EUROPEAN SOCIETY OF THORACIC IMAGING

THESES OF INVITED SPEAKERS LECTURES
FINAL PROGRAMME / BOOK OF ABSTRACTS
EUROPEAN SOCIETY OF THORACIC IMAGING

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FINAL PROGRAMME / BOOK OF ABSTRACTS
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Dear Colleagues and Friends,
On behalf of the Local Organising Committee and on behalf of the European Society of Thoracic Imaging I would like to warmly welcome you on the 14th Annual Meeting of the ESTI in Prague, Czech Republic.
We are delighted to announce a programme that covers the wide range of the topics. It includes diagnoses of diseases of pulmonary parenchyma, great vessel of thorax, mediastinal diseases and diseases of the heart.
One aim of the conference is to stimulate exchange of information among scientists and clinical specialists. And we are very successful in this respect. This ESTI meeting has two weeks before opening over 500 registered participants and it means it is the largest ESTI meeting ever held. We have among participants also more than 100 pneumologists.
The meeting features basic and advanced postgraduate courses, delivered by renowned and outstanding speakers from Europe and distinguished colleagues from the USA. Selected proffered papers will provide an overview of the current trends in research.
We have the pleasure to organize the Joint workshop “Basics of cardiac imaging by CT and MR”. For the first time ESTI and ESCR (The European Society of Cardiac Radiology) join together to discuss the latest developments within the enormous progress made in the field of imaging technologies and their clinical applications. The Joint workshop starts on Sunday afternoon.
The technical exhibit will provide an up to date overview of the state of art of different imaging modalities and their latest technical developments. Besides all this, we invite you to see old friends and meet new colleagues in the historic atmosphere of Prague, a great city of charm and culture.
I hope you all will enjoy your stay in Prague during the 14th ESTI Annual Meeting.

Friendly regards,
Jiří Neuwirth
President of ESTI 2006
COMMITTEES

ESTI 2005/2006 COUNCIL

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Past president: D. Hansell
President elect: K. Malagari
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Second vice president: J. Vilar
Secretary: D. Tack
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            F. Laurent

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                M. Prokop
                A. Mester

Jury committee: S. Desai
               E. Coche

Programme committee: F. Gleeson
                    T. Franquet
                    M. Storto

Electronic media committee: A. Bankier
                           S. Desai
                          B. Ghaye

Committee for industry relationship: P. Schnyder
                                     J. Verschakelen
                                     L. Bonomo
                                     C. Beigelman

Strategic committee: L. Bonomo
                    J. Mata
                    C. Herold
                    S. Diederich

Training and educational committee: J. Verschakelen
                                    A. Bankier
                                   D. Hansell
                                  H. U. Kauzcor
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# Programme at a Glance

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<tr>
<th>Day</th>
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<td>8:00 – 9:00</td>
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<td>Honorary Lecture</td>
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<td>Scientific session:</td>
<td>Pulmonary Nodules</td>
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<td>Cardiac and Vascular Imaging</td>
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<td>14:00 – 16:00</td>
<td>Scientific proffered</td>
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<td>Interstitial Lung</td>
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<tr>
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<td>Disease</td>
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<td></td>
<td>Belveder Hall</td>
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<td>14:00 – 14:48</td>
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<tr>
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<td>Pulmonary Embolism</td>
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<td>New examination’s</td>
<td>techniques</td>
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<td>15:00 - 15:48</td>
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<td></td>
<td>Intervention</td>
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<tr>
<td>16:00 – 16:30</td>
<td>Coffee</td>
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<td>16:30 – 18:00</td>
<td>Parallel scientific</td>
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<td>16:00 – 17:40</td>
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<td>Mediasitonal and Pleural Disease</td>
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<td></td>
<td>17:00 – 17:40</td>
<td>Thoracic Manifestations of Extrathoracic Disease</td>
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</table>

| **Saturday – June 10, 2006:** |                    |                                                                                 |
| 8:00 – 9:20    | Scientific session:| HRTC of Interstitial Lung Disease                                               |
| 9:20 – 9:50    | Coffee              |                                                                                  |
| 9:50 – 10:50   | Scientific session:| Pulmonary Embolic Disease                                                        |
| 10:50 – 11:50  | Film reading session|                                                                                  |
| 12:00 – 13:30  | Lunch               |                                                                                  |
| 13:30 – 15:30  | Scientific proffered| papers in two parallel sessions:                                                 |
|                | Main Hall           |                                                                                  |
|                | 13:30 – 14:54       |                                                                                  |
|                | Computer Aided Dia-| nosis/Nodules                                                                     |
|                | gnosis/Nodules      |                                                                                  |
|                | Belveder Hall       |                                                                                  |
|                | 13:30 – 14:42       |                                                                                  |
|                | Miscellaneous       |                                                                                  |
|                | 14:42 – 15:18       |                                                                                  |
|                | Lung Cancer         |                                                                                  |
| 15:30 – 16:00  | Coffee              |                                                                                  |
| 16:00 – 17:40  | Parallel scientific | sessions:                                                                        |
|                | 16:00 – 17:00       | Smoking Related Lung Disease                                                     |
|                | 16:00 – 17:00       | Mediasitonal and Pleural Disease                                                 |
|                | 17:00 – 17:40       | Thoracic Manifestations of Extrathoracic Disease                                 |

| **Sunday – June 11, 2006:** |                    |                                                                                 |
| 8:00 – 9:00    | Scientific session:| Multislice CT                                                                    |
| 9:00 – 10:00   | Scientific sessions:| Functional Lung Imaging                                                          |
| 10:00 – 10:30  | Coffee              |                                                                                  |
| 10:30 – 11:30  | ESTI business meeting|                                                                                  |
| 12:00 – 13:30  | Lunch               |                                                                                  |
| 13:30 – 15:30  | Cardiac and Coronary| Anatomy and Physiology                                                            |
|                | Disease             |                                                                                  |
| 14:00 – 15:30  | Coffee              |                                                                                  |
| 16:00 – 18:00  | Optimisation and Standards of Cardiac imaging (MRI, MDCT)                        |

| **Monday – June 12, 2006:** |                    |                                                                                 |
| 8:00 – 10:00  | Cardiac Pathology I:| Non-ischemic Myocardial Disease                                                  |
| 10:00 – 10:30 | Coffee              |                                                                                  |
| 10:30 – 12:00 | Cardiac Pathology II:| Coronary Atheroslerosis, Ischemic Heart Disease                                 |
| 12:00 – 13:00 | Lunch               |                                                                                  |
| 13:00 – 13:20 | Pros and Cons of invasive and noninvasive cardiac imaging                       |
| 13:30 – 16:00 | Case Analysis, Clinical Reporting, Communication with Cardiologist             |

**WORKSHOP**
The Slide Preview Room is located in the meeting room Vienna I. All technical equipment will be available for final checking of your presentation. To avoid any later problems it is highly recommended that you check the compatibility of your system with the conference projection system. Our technical staff will be glad to assist you.

IT IS ESSENTIAL FOR THE SMOOTH RUNNING OF THE MEETING THAT ALL SPEAKERS HAND IN THEIR POWERPOINT PRESENTATION AT LEAST ONE HOUR BEFORE THE BEGINNING OF THEIR SESSION. Enough time must be allowed to check the presentations carefully and for the staff to enter the data into the system.
Friday June 9, 2006

Lung Cancer – Moderator – B. Ghaye
• 8:00 – 8:20 Lung Cancer Screening, current European status ................................. S. Diederich
• 8:20 – 8:40 CT and MRI in Lung Cancer staging .......................................................... J. Vilar
• 8:40 – 9:00 PET-CT in Lung Cancer Staging ................................................................. J. Prior

Coffee

9:30 – 9:40 Welcome address – J. Neuwirth & C. Herold

Presidential Award
9:40 – 10:00 Honorary Lecture – L. Bonomo

Pulmonary Nodules – Moderator – S. Padley
• 10:00 – 10:20 The Use of CAD in Chest CT ................................................................. M. – P. Revel
• 10:20 – 10:40 What to do with Incidentally Found Pulmonary nodules ......................... C. Herold
• 10:40 – 11:00 Lung Nodules in Patients with Extrathoracic Malignancy ....................... S. Desai

Cardiac and Vascular Imaging – Moderator – E. van Beek
• 11:00 – 11:20 CT of the Heart from Electron Beam to Multislice CT ............................ R. Riemmuller, J. Mata
• 11:20 – 11:40 From Science to Practice in Cardiovascular CT ..................................... J. Schoepf
• 11:40 – 12:00 The Current Role of MRI in Cardiovascular Imaging ................................. J. Bogart
• 12:00 – 12:20 The use of Contrast Media in Cardiovascular Imaging ................................. M. Prokop

Lunch 12:30 – 14:00

Scientific preferred papers in two parallel sessions
Main Hall – Moderator – E. van Beek, M. Prokop
• 14:00 – 15:12 Cardiac Disease .......................................................... A. Gholamrezanezhad, M. Zagrodzka, S. Ley, P. Vock, G. Masselli
• 15:12 – 15:24 Infection .............................................................................. M. Eichinger
• 15:24 – 15:48 Interstitial Lung Disease ......................................................... M. Vasakova, E. Magkanas

Belveder Hall – Moderator – P. Grenier, T. Franquet
• 14:00 – 14:48 Pulmonary Embolism .......................................................... N. Karabulut, Z. Metaforati, M. Das, J. Belfield
• 14:48 – 15:00 New examination’s techniques ......................................................... J. Zaporozhan,
• 15:00 – 15:48 Intervention ........................................................................... Ch. Hohls, L. Menchini, H. Prosch, A. Magnusson

Coffee

Parallel Sessions with Invited Speakers
Thoracic Intervention – Moderator – S. Copley
• 16:30 – 16:50 Lung biopsy ........................................................................ N. Howarth
• 16:50 – 17:10 Pleural intervention ................................................................. F. Gleeson
• 17:10 – 17:30 Radiofrequency Ablation of thoracic tumours ......................... K. Steinke

Imaging of the Critically Ill Patient – Moderator – S. Diederich
• 16:30 – 16:50 Imaging of chest trauma ................................................................. P. Schnyder
• 16:50 – 17:30 Imaging of acute chest pain ....................................................... J. Ferda, P. Costello
• 17:30 – 18:00 Imaging of the ICU patient .............................................................. M. Hehrman
Saturday  June 10, 2006

Scientific session – Invited Speakers

HRCT of Interstitial Lung Disease – Moderator – S. Desai
• 8:00 – 8:20 The Use of the Reticular Pattern in Diagnosis  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . M. Storto
• 8:20 – 8:40 The Use of the Nodular Pattern in Diagnosis  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . C. Beigelman
• 8:40 – 9:00 Borderlands of normal  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . D. Hansell
• 9:00 – 9:20 Differentiating the interstitial pneumonias  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . N. Muller

Coffee

Pulmonary Embolic Disease – Moderator – P. Schnyder
• 9:50 – 10:10 When to image  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . B. Ghaye
• 10:10 – 10:30 Imaging of suspected acute pulmonary embolism  . . . . . . . . . . . . . . . . . . . . . . . . . . . . L. Goodman
• 10:30 – 10:50 Imaging of chronic thromboembolic disease  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . P. Eliáš

Film Reading Session – Moderator – F. Gleeson, J. Verschakelen
• 10:50 – 11:50 N. Muller, L. Goodman, M. Maffesanti, S. Ellis

Lunch  12:30 – 13:30 GE Satellite symposium

Scientific proffered papers in two parallel sessions

Main Hall – Moderator – S. Diederich, C. Herold
• 13:30 – 14:54 Computer Aided Diagnosis/Nodules  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . J. Zaporozhan, M. Eichinger, F. Gilbert, M. Das, M. Polovičák, A. Larici, M. Roddie

Belveder Hall – Moderator – A. Bankier, P. Vock
• 14:00 – 14:42 Miscellaneous  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . H. Gietema, Å. Johnsson, A. Grgic, S. Ley, J. Zaporozhan, N. Griffin
• 14:42 – 15:18 Lung Cancer  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . W. De Wever, Ch. Hintze, N. Qureshi

Coffee

Parallel sessions with Invited Speakers

Smoking related lung disease – Moderator – D. Hansell
• 16:00 – 16:20 Airway Disease in Smokers  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . J. Verschakelen
• 16:20 – 16:40 Whats’ new in Emphysema – Perspectives and Challenges  . . . . . . . . . . . . . . . . . . . . . . . . . . . . A. Bankier
• 16:40 – 17:00 Smoking related interstitial lung disease  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . A. Oikonomou

Infection – Moderator – A. Bankier
• 16:00 – 16:20 Viral Infection in the Lungs: Radiologic-Pathologic Correlation  . . . . . . . . . . . . . . . . . . . . . . . . . . . T. Franquet
• 16:20 – 16:40 Infection in AIDS and the immunocompromised patient  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. Padley
• 16:40 – 17:00 Community acquired and nosocomial infection  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . H. Mírka

Mediastinal and Pleural disease – Moderator – D. Wormanns
• 17:00 – 17:20 Investigation of suspected mediastinal tumours  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . K. Malagari
• 17:20 – 17:40 Investigation of suspected pleural malignancy  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. Copley

Thoracic Manifestations of Extrathoracic disease – Moderator – P. Vock
• 17:00 – 17:20 Pulmonary Manifestations of Vasculitis and Connective Diseases  . . . . . . . . . . . . . . . . . . . . . . . . E. Coche
• 17:20 – 17:40 Drug induced lung disease  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . C. Schaefer-Prokop
Sunday  June 11, 2006

Scientific session – Invited Speakers

Multislice CT – Moderator – C. Herold, A. Mester

• 8:00 – 8:20  Protocol optimisation ........................................ D. Wormanns
• 8:20 – 8:40  Dose reduction ................................................... D. Tack
• 8:40 – 9:00  The clinical utility of post-processing ....................... P. Vock

Functional Lung Imaging – Moderator – M. Prokop

• 9:00 – 9:20  Functional Insights into Pulmonary Function using CT ....... P. Grenier
• 9:20 – 9:40  Perfusion MRI of the Lungs ................................... S. Ley
• 9:40 – 10:00 Clinical Hyperpolarised 3-Helium MRI of the Lung .......... E. van Beek

Coffee

ESTI Business Meeting

End of Meeting

Joint workshop ESTI/ESCR

14:00–15:30  Cardiac and Coronary Anatomy and Physiology
              3 x 30 minutes
                     Cardiac anatomy in all modalities ................................. J. Bogaert
                     Coronary anatomy ...................................................... Ch. Herzog
                     Physiology .............................................................. R. Rienmüller

Coffee

16:00–18:00  Optimisation and Standards of Cardiac Imaging (MR, MDCT)
              2 x 45 minutes
                     CT ................................................................. M. Gutberlet
                     MRI .............................................................. Ch. Herzog

Monday  June 12, 2006

08:00–10:00  Cardiac Pathology I: Non-ischemic Myocardial Diseases, Valvular Disease
              3 x 40 minutes
                     Congenital heart disease ........................................ M. Gutberlet
                     Cardiomyopathy ................................................ M. Gutberlet
                     Valvular disease MR ............................................... L. Natale

Coffee

10:30–12:00  Cardiac Pathology II: Coronary Atherosclerosis, Ischemic Heart Disease
              3 x 30 minutes
                     Coronary calcifications ................................................ Ch. Herzog
                     Coronary stenosis .................................................... M. Oudkerk
                     Acute chest pain ..................................................... J. Schoepf

Lunch

13:00–15:00  Case Analysis, Clinical Reporting, Communication with Cardiologists
              ................................................................. R. Rienmüller, J. Neuwirth, J. Ferda, J. Žížka, M. Heřman
Invited speakers for ESTI Meeting

A. Bankier
C. Beigelmann-Aubry
J. Bogaert
L. Bonorno
E. Coche
S. Copley
P. Costello
S. Desai
S. Diederich
P. Eliáš
S. Ellis
J. Ferda
T. Franquet
B. Ghaye
F. Gleeson
L. Goodman
P. Grenier
D. Hansell
M. Heřman
C. Herold
N. Howarth
S. Ley
M. Maffessanti
K. Malagari
H. Mirka
N. Muller
A. Oikonomou
S. Padley
J. Prior
M. Prokop
R. Reinmüller
M. P. Revel
C. Schaefer-Prokop
P. Schnyder
J. Schoepf
K. Steinke
M. Storto
D. Tack
E. Van Beek
J. Verschakelen
J. Vilar
P. Vock
D. Wormanns

Austria
France
Belgium
Italy
Belgium
United Kingdom
USA
United Kingdom
Germany
Czech Republic
United Kingdom
Czech Republic
Spain
Belgium
United Kingdom
USA
France
United Kingdom
Czech Republic
Italy
Canada
Canada
UK
USA
Holland
Austria
France
Holland
Switzerland
USA
Switzerland
Italy
Belgium
United Kingdom
Belgium
Spain
Switzerland

Invited speakers for Joint Workshop

J. Bogaert
J. Ferda
M. Gutberlet
M. Heřman
Ch. Herzog
L. Natale
J. Neuwirth
M. Oudkerk
J. Schoepf
R. Rienmüller
J. Žižka

Belgium
Czech Republic
Germany
Czech Republic
Germany
Italy
Italy
Czech Republic
Holland
USA
Austria
Czech Republic
Lung Cancer Screening: Current European Status

Lung cancer is the leading cause of death from malignancy in Europe and worldwide. Overall survival is < 15%. As there are no early symptoms and prognosis is far better when detected at early (e.g. stage IA: 5-year survival > 60 %) than at advanced (e.g. stage IV: 5-year survival 1%) it is hoped that screening a population at risk could reduce mortality from lung cancer. Low-dose unenhanced spiral computed tomography (low-dose CT), particularly when using multidetector technology (MDCT) has the potential of identifying cancers smaller than 10 mm. Several feasibility studies have demonstrated that low-dose CT can identify small cancers, stages of detected tumors are much lower, resectability is higher and 5-year survival better than in than in symptomatic patients. The proportion of invasive procedures for benign lesions is small. However, no study to date has demonstrated a reduction in mortality from lung cancer through screening due to the one-arm non-randomized design of all trials. Before general recommendations for low-dose CT screening or lung cancer can be made most European health authorities will require demonstration of mortality reduction through prospective randomized controlled trials comparing mortality from lung cancer in a screening arm and a control arm. A large scale trial of > 50,000 individuals is currently performed in the US and has finalized enrollment in 2004. Results are anticipated after 2010. A Dutch/Belgian trial (NELSON-Trial) is underway, planning to recruit some 20,000 individuals. To my knowledge there are no other large randomized controlled trials in Europe. However, several smaller trials are under way to address specific aspects such as risk population, inclusion criteria and diagnostic algorithms in detected nodules.

Take home points:
1. Prognosis in Lung cancer is much better at early than at advanced stages
2. Low-dose spiral CT is sensitive in detecting small, resectable lung cancers with favourable prognosis
3. Prospective controlled randomized trials are under way to assess potential mortality reduction through screening

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. The National Lung Screening Trial (NLST) has recruited over 50,000 subjects in the US in 2004
2. A Dutch/belgian NELSON trial is the only large scale European randomized trial under way.
3. Results concerning mortality reduction can not be expected before the year 2010
CT and MRI in lung cancer staging

Lung cancer is the most common cause of cancer mortality in the developed countries. Despite new therapies and a great improvement in diagnosis, the survival rate has not improved significantly in the last 15 years. Nevertheless a better selection of patients for surgery, radiotherapy, chemotherapy or combined treatments can be achieved by means of imaging.

CT is considered the basic tool for staging of Lung Cancer (LC). Multislice CT offers an improved anatomic and temporal resolution and an add value to the standard CT examination by offering a better resolution in different planes, virtual endoscopy and excellent vascular display. The main advantages of CT over other imaging methods are; 1) availability, 2) cost, 3) anatomic resolution and, 4) Allows guided interventional procedures, especially needle aspiration biopsy of tumour and lymph nodes. Main disadvantages are; radiation and the need in many cases of intravenous contrast.

MRI has similar sensitivity and specificity as CT for TNM staging, but still remains a second line technique, due to its inferior availability. Despite this, MRI is being used more frequently for special situations such as Pancoast tumours, tumours invading the diaphragm and mediastinal invasion. Adrenal metastases are better evaluated with MRI when CT is unable to distinguish an adenoma from a tumour. Total body MRI in some places has replaced nuclear medicine for M staging in lung carcinoma.

The three main points to stress in this lecture will be related to:

A – How to do it: (Proper technique): Adequate technical protocols in CT and MRI that unable the radiologist to visualize the structures that can be involved in staging of LC.

B – What to look for: T, N, M has to be interpreted by looking at specific features of the tumour, the surrounding structures, the lymph nodes and distant usual metastatic foci. Knowledge of what the oncologist and surgeon need to know is mandatory.

C – How to combine different techniques. CT, MRI and PET should be used wisely following protocols intended to save time and costs to the patient and achieve the most accurate diagnosis.

Take home points:
1. Multislice CT should be utilized as a first step in Staging Lung Cancer
2. TNM knowledge by radiologists is mandatory, especially regarding the surgeons and oncologists perspective.
3. MRI is an alternative or a complement to CT for TNM staging.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. CT is mandatory in lung cancer staging
2. PET/CT should be performed in lung cancer surgical candidates.
3. MRI is used in specific situations either as complementary or a substitute for CT or Nuclear Medicine.
4. Each institution should define specific protocols for staging lung cancer.
PET/CT in Lung Cancer Staging

Computed tomography (CT) has been the mainstay of lung cancer staging for over two decades. A new era of functional imaging with positron emission tomography (PET) combined with morphological CT information has begun. New integrated PET/CT scanners are increasingly available and constitute the fastest growing imaging technology on the market, offering shorter imaging time than PET alone and increased patient convenience with both scans performed in a single session. The PET component provides unique information about tumour biology and gives additional information on both nodal and metastatic staging, while the CT component best delineates local tumour spread. Several non-randomised studies have shown PET/CT to be more accurate than PET or CT alone for TNM staging in non-small cell lung cancer (NSCLC), increasing observer confidence and diminishing equivocal findings. With more accurate staging come more appropriate treatments and less invasive unnecessary interventions. PET/CT has the power to improve patient management and clinical pathways. For instance, the inclusion of PET up-front instead of the traditional NSCLC staging was shown in a multisite study to lead to less mediastinoscopies without changing overall costs.

PET/CT probes tumour aggressiveness and metabolic activity and predicts patient outcome and survival independently of the TNM stage. Similarly, PET assesses metabolic response to preoperative chemotherapy as early as after the first cycle. Another emerging application of PET is the restaging after neoadjuvant preoperative chemotherapy, where significant correlations exist between tumour metabolic activity response and survival. Finally, PET/CT has great potential in radiation therapy planning for defining more precisely the margins of biologically active tumour.

Accounting for 15–20% of all lung tumours, small-cell lung cancer may benefit from PET/CT with superior staging accuracy, and prognostic information independent of disease stage. Likewise in mesothelioma (< 2% of all lung cancers), PET/CT may offer improved staging leading to patient upstaging and decreased rate of unneeded surgery.

Take home points:
1. PET/CT outperforms PET or CT alone in accuracy for staging patients with non-small cell lung cancer and may become the preferred imaging test in lung cancer.
2. PET measurement of tumour activity with standardized uptake value (SUV) is a predictor of patient outcome and survival independent of the TNM stage.
3. Emerging applications of PET/CT are early assessment of chemotherapy, restaging of neoadjuvant radiochemotherapy and radiation therapy planning.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. PET/CT is more accurate than PET or CT alone in staging NSCLC. Visual correlation of PET and CT is the next best solution when integrated PET/CT is not available (De Wever M. et al., Eur Radiol 2006; in press DOI: 10.1007/s00330-006-0284-4).
2. Standardized uptake value (SUV) on preoperative PET predicts NSCLC stage, recurrence and survival (Cerfolio RJ. et al., J Thorac Cardiovasc Surg 2005;130:151) and SUV change from two serial PET studies before and after chemotherapy predicts histopathological response in primary NSCLC and mediastinal lymph nodes (Pöttgen C. et al., Clin Cancer Res 2006;12:97).
4. Randomised study of traditional vs. up-front PET staging in patients with suspected NSCLC shows similar overall costs with the use of less invasive surgery (Herder GJM. et al., J Clin Oncol 2006;24:1800).
Pulmonary circulation: From old to new imaging modalities

The lung is the only organ where vessels (arteries and veins) are visualized without contrast administration. Since the advent of spiral CT and MR the chest radiograph has been the only non-invasive imaging modality for evaluating the pulmonary vessels. The gravitational distribution of pulmonary blood flow, a fundamental observation made in 1927 by Bjure and Laurell, represented and still represents the fundamentals of functional radiology. Computed tomography and magnetic resonance, thanks to angiographic and functional techniques, have increased the potentials of non-invasive imaging of the pulmonary vessels. Rapid technical developments of CT and MR allow the radiologist to achieve a qualitative morphologic and quantitative functional evaluation of pulmonary perfusion so that the role of angiography and V/Q scintigraphy can be significantly reduced.

Take home points:
1. To get familiar with the different imaging modalities available for evaluating the pulmonary circulation.
2. To learn about the different roles of chest radiography, CTA, MRA in the diagnosis of pulmonary vascular diseases.
The use of CAD in thoracic imaging

The basic concept of Computer-Assisted-Diagnosis (CAD) is to provide a computer output as a second opinion to improve the accuracy and consistency of radiologists’ interpretation. Another objective is to reduce the image reading time. The aim of this lecture is to present some CAD systems currently available for lung nodule evaluation on CT examinations, and to discuss future developments and perspectives. The currently available CAD systems generally include different functions, such as: lung nodule automated detection (1), lung nodule segmentation and volume measurement (2), and lung nodule growth estimation based on comparative volumetric evaluation (3). They mainly concern the evaluation of small solid lung nodules. The most recent software versions make also possible the evaluation of non-solid nodules and large solid lesions. Some CAD systems are also tested to allow an automated differentiation between benign and malignant nodules, based on shape recognition. Concerning lung nodule detection, it has been reported that the use of a CAD system improves the radiologists’ detection of pulmonary nodules at chest CT and that sensitivity is substantially higher than with conventional double reading. However, it has also the potential to increase the number of false positives. Moreover, CAD systems have not been compared to cine-mode reviews of MIP-reconstructed images, in terms of accuracy and image reading time. Lastly, the impact on patients management has not been evaluated. Other publications concern lung nodule volumetric measurements. Volume measurement is deeply influenced by the scanning parameters, especially the slice thickness. Software measurements have been found repeatable, when performed on the same CT acquisition. CAD systems allowing volumetric evaluation could improve lung nodules monitoring of growth, especially because two-dimensional measurements were proved inaccurate for detecting growth in small nodules, less than 10 mm in diameter. Only few data are available on morphological automated differentiation between benign and malignant nodules.

The exact impact of CAD for lung nodules evaluation on CT examinations still needs to be evaluated.

Take home points:
1. The use of CAD systems improves the radiologists’ detection of pulmonary nodules at chest CT and has the potential to improve radiologists’ diagnostic accuracy in distinguishing small benign nodules from malignant ones on HRCT
2. Manual measurements are inaccurate for evaluating small lung nodule growth
3. Monitoring of small lung nodule growth is improved by the use of CAD systems based on volumetry

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. 3D-surface reconstructed images provided by CAD systems may help recognize intrapulmonary lymph nodes, which have a specific shape.
2. The use of CAD systems should be compared to cinemode reviews of MIP-reconstructed images done by radiologists.
3. Evaluation of reading time with and without using a CAD system should be performed.
4. Computed lung nodule volume measurements are influenced by the level of inspiration during CT acquisitions.
Management Approach to Incidentally found Pulmonary Nodules

Patients with pulmonary nodules are not a homogenous group of individuals. Clearly, lung nodules in a smoker have a different significance compared to those detected in an oncologic patient, or those seen in a young non-smoker with no risk factors for malignant disease. Furthermore, there is increasing evidence that apart from pretest probability, the traditional morphologic criteria, nodule size and patient age are important factors in the construction of a management model for patients with pulmonary nodules.

Current management strategies for indeterminant small pulmonary nodules have raised serious concerns, because they are partly flawed or, partly outdated. For example, existing recommendations involve several follow-up CT examinations for every indeterminant nodule, regardless of its size. Such elaborate follow-up protocols are not required for very small nodules, and particularly, not when such nodules are found incidentally in young non-smokers without a history of cancer. Furthermore, in young patients, the risk from radiation must be weighted against the risk of missing a malignant disorder, or the risk arising from an invasive diagnostic approach. As the risk of malignancy increases with nodule size, focal abnormalities with a diameter of more than 8 mm require a more aggressive and potentially invasive diagnostic approach to confirm or rule out cancer.

The aim of this presentation is to provide the audience with a practical approach to the management of incidentally detected pulmonary nodules of various sizes in patients with different risk profiles for a malignant pulmonary disorder, such as lung cancer.

Take home points:
1. Incidentally found pulmonary nodules need to be managed according to morphology, size and the individual’s risk situation.
2. Nodules smaller than 4 mm in diameter do not need follow-up in low risk individuals.
3. Nodules larger than 8 mm in diameter need a rigorous and sometimes invasive diagnostic approach.

The most important articles published in the period 2003 – 2006:
3. Winer-Muram HT. The solitary pulmonary nodule. Radiology 2006; 239:34–49
Lung Nodules in Patients with Extrathoracic Malignancy

In patients with a known primary extrathoracic malignancy staging investigations will commonly include an examination of the chest. Whilst, most patients will be referred for a plain chest radiograph, there is a limit to the size (typically around 1 cm diameter) of pulmonary nodules detectable by conventional radiography. Because the contrast resolution of computed tomography (CT) is higher and there is no anatomical superimposition, small intrapulmonary nodules will frequently be identified; this is particularly true since the advent of spiral and now multidetector row CT machines. However, determining the significance of focal intrapulmonary nodules, in patients with a known malignancy, remains a vexing problem for the radiologist and clinician. The significance of imaging findings (specifically at CT) in patients with underlying malignancy will be discussed. The potential importance of the clinical data, multiplicity and size of pulmonary nodules will be reviewed.

Take home points:
1. Incidental lung nodules are commonly seen in patients undergoing staging tests for extrathoracic malignancy.
2. Determining the significance and best management of such nodules is problematic.
3. The multiplicity of nodules, knowledge of the biological behaviour of the underlying malignancy and a smoking history are amongst the important factors in determining the clinical significance of such nodules.

The most important article(s) published in the period 2003–2006:
3. Libby DM. Managing the small pulmonary nodule discovered by CT Chest 2004; 125:1522–1529
CT of the heart from electron beam to multi slice CT

The synonyms of EBT are Cardiac-CT, Cardiovascular CT, Cine CT and Ultrafast CT. The history of these fastest and oldest multi-slice and multi-detector imaging CT technology is closely related to following names of whom some are mentioned: D. Boyd, M. Peschmann, A. Agatson, B. Brundage, G. Houndsfield, M. Lippton, M. Marcus, A. Margulis, H. Ringetz, J. Rumberger, P. Sheedy, W. Stanford.

In contrast to conventional CT machines EBT has no rotating tubes or detectors. The X-rays are emitted from one of the 4 target rings after they were met by an electron beam. The electrons are emitted from a cathode (gun) electromagnetically accelerated and focussed to swip along the above mentioned target rings (210 deg.). The stationary detectors placed above the patients receive the transmitted fans of radiation. Single slice more with an exposure time of 100, 200, 300 until 2000 ms and variable slice thickness of 1,5, 3, 6, 8 and 10 mm are available. The so called multi slice mode with exposure time of 15 ms enables until 2 x 17 images per sec to be used for functional and perfusion studies.

Any method used for diagnostic evaluation of the heart must be reviewed under the aspect which and by which quality the essential parameters of cardiac function may be determined. It is well known that the cardiac function depends on the state of peri- myo-, epicardium, of coronary artery walls, of cardiac valves and configuration of cardiac cavities. These morphological parameters interfere with functional parameters as preload, afterload, contractility and heart rate. These again interfere with coronary blood flow, myocardial perfusion and metabolism. Additionally non cardiac features as mediastinal and thoracic changes, systematic diseases as anemia, hyper- and hypothyriosis, changes of blood viscosity and neuro-humoral factors interfere with functional parameters as well.

For early recognition and staging of coronary heart disease and its differentiation from primary cardiomyopathies as inflammatory myocarditis and complete definition of all these functional determinants is absolutely necessary. Until recently the main limitation in the diagnostic imaging of the heart was its wide range of mostly unpredictable changes of the speed of cardiac movements caused by the heart rate as well as by movement of the thoracic organs inclusively the diaphragm.

The upcoming Multi Slice CT systems offer by continuous shortening of the exposure time and by applying the approach of imaging segmentation essential improvements in the visualization and determination of the functional parameters of the heart coming close to electron-beam computed tomography.

Take home points:
1. Higher the spatial and temporal resolution of CT technology, higher the quality of cardiac information.
2. Keep in mind that image quality is related to signal noise ratio and that way to dose.
3. For optimal study interpretation all morphological and functional determinants of the heart must be evaluated.

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. The advanced Multi Slice CT technology is approaching a quality by which diagnostic coronary angiography may be replaced.
2. New algorithm in evaluating coronary artery disease are upcoming.
3. Close collaboration of all involved and interested in cardiac diseases is necessary.
From Science to Practice in Cardiovascular CT

In recent years, CT has positioned itself as the premier modality for cardiovascular imaging. Current generation multidetector-row CT (MDCT) enables high-resolution, motion free imaging of the heart within a single, short breath-hold. Gross cardiovascular morphology and pathology can be assessed in a straightforward, fast and robust manner. At contrast enhanced MDCT coronary angiography, coronary arteries can be visualized with unprecedented detail. With increasing accuracy, MDCT enables non-invasive patency evaluation of coronary artery bypass grafts and coronary stents. Most importantly, the accuracy for non-invasive assessment of the presence and degree of coronary artery stenosis has continuously improved. There are some remaining limitations for stenosis detection and grading on a segmental and vascular level. However, the extremely high negative predictive value of this test for ruling out significant stenosis on a per-patient basis positions CT as a powerful test for triaging patients prior to catheter angiography. The cross-sectional nature of contrast enhanced MDCT coronary angiography allows assessment of the vessel wall and may permit more accurate quantification of total atherosclerotic plaque burden than measuring calcified components alone. For a limited time, future technical improvement will be pursued mainly by accelerated gantry rotation speed and additional detector rows. However, novel concepts of CT image acquisition are already under investigation and may bring about yet another quantum leap for medical CT.

Take home points:
1. MDCT is the premier modality for cardiovascular imaging.
2. The most important current clinical role of coronary CTA is the reliable non-invasive exclusion of significant coronary artery disease.
3. Technical developments will further improve the utility of this test.

Most important articles published in the period 2003–2006:

Most important statements concerning the subject of the lecture in the year 2005/2006:
1. Global utilization of coronary CTA will rapidly expand.
2. The scientific communities are called upon to identify suitable indications and curb overutilization.
The Current Role of MRI in Cardiovascular Imaging

While in recent years, spotlights in cardiac imaging were mainly focused on the fast progress in multidetector-row computed tomography technology, magnetic resonance imaging (MRI), in contrast, has slowly matured over the last two decades toward a fully integrated clinical imaging modality, offering the clinician valuable and often unique information for patient treatment and follow-up. Since its introduction in the early 1980s, it can be said that this technique has evolved from a time-consuming, static technique, toward an almost real-time, dynamic imaging modality, competing with the noninvasive reference technique, i.e. echocardiography. Within an acceptable imaging time, i.e., 30 to 45 minutes, accurate information can be obtained on cardiac and pericardial and great vessel anatomy, ventricular and valvular function, myocardial perfusion patterns, flow quantification, and tissue characterization (e.g. assessment of myocardial necrosis, myocardial scarring, pericardial inflammation, …). This comprehensive approach in a completely noninvasive manner is definitely the strongest point in favor of MRI. Speaking in a simplified way, two-types of cardiac MR images are obtained: dark-blood and bright-blood images. Dark-blood images are obtained with spin-echo MRI sequences and provide morphologic information. Bright-blood images are gradient-echo based, and are used for dynamic (functional) imaging, myocardial first-pass perfusion imaging, infarct and viability imaging, and coronary artery imaging. Usually, cardiac MRI is performed along the cardiac axes (ie. short, vertical- and horizontal long-axis). For functional cardiac imaging, a volumetric, multislice approach is used offering accurate and reproducible data on global and regional function of both ventricles. Moreover, cine MRI can be used to evaluate motion of valve leaflets, and to visualize valve regurgitation as well as stenosis. Tagging techniques can be applied to quantify the myocardial strain. Velocity-encoded cine MRI using the phase information allows to quantify flow volumes and velocities, valvular regurgitation, pressure gradients, and to calculate valve orifices. Paramagnetic contrast agents are used to evaluate myocardial perfusion, to increase contrast between pathologic (e.g. necrotic, scar, inflamed tissues) and normal tissue. Submillimeter spatial resolution three-dimensional techniques are available to study the coronary arteries. To provide the most accurate information, this arsenal of available MRI techniques should be used and fine-tuned toward the clinical question.

Take home points:
1. Cardiac MRI has evolved toward an almost real-time examination, competing with echocardiography, therefore it is necessary to think dynamically, functionally and not statically when approaching the heart
2. Noninvasiveness, accuracy and versatility are the strong points in favor of MRI
3. Use the arsenal of available MRI techniques as appropriate as possible, this means, fine-tuned to each clinical question.

The most important article(s) published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. Cardiovascular MRI has become a preferred imaging modality for studying cardiovascular diseases
2. Cardiac MRI is the best technique to study patients with myocardial infarction and viability and has important potential to study patients with ischemic heart disease (angor pectoris).
3. Also for non-ischemic myocardial diseases, pericardial diseases and cardiac masses, cardiac MRI can offer unique information regarding morphology, tissue characterization, and impact on diastolic and systolic cardiac function
4. Cardiac MRI is the preferred technique to follow-up patients with congenital heart disease.
The Use of Contrast Agents in Cardiovascular Imaging

Vascular imaging with CTA or MRA at present relies on high vascular contrast enhancement during the first pass of the contrast agent. Knowledge of contrast dynamics is essential for optimizing enhancement. Contrast dynamics depends on the duration of the injection, the flow rate of the agent, the enhancement per ml agent (depending on contrast concentration in CT and relaxivity in MR) and various patient factors such as circulation time, blood volume and cardiac output. The basic mechanisms are similar for CTA and MRA. Timing of the scan, however, varies: in CTA, the scan is timed so that enhancement is high through the duration of the scan (which can vary between 3 and 30 s, depending on the scanner technology); in MRA, the scan is timed so that enhancement is high during acquisition of the center of k-space (which may be substantially shorter than the total scan duration). Individual timing by test bolus or bolus tracking techniques is mandatory for CTA as well as MRA. The same holds true for the use of a saline chaser bolus that is used to push the contrast material forward and improve contrast utilization. Techniques for optimizing contrast injection for CTA and MRA will be presented.

For cardiac imaging with CT, the scan can be timed so that there is washout of the right ventricle. Biphasic injections can be used to provide residual enhancement of the right ventricle to facilitate automated evaluation of cardiac function. Late enhancement of the myocardium can provide information about myocardial viability. In CT, such scan require a sufficient amount of contrast material to be injected (100-150ml). MR is much more sensitive for studying late enhancement effects.

Newer developments include higher concentration contrast agents for CT, contrast agents with higher relaxivity (and sometimes higher concentration) for MR and bloodpool agents for MR. Specific advantages and potential disadvantages of such agents will be discussed.

Take home points:
1. Knowledge of contrast dynamics is mandatory for optimum results in CTA and MRA with modern scanners.
2. Timing of the scan has to be adapted to scan duration and scanner technology.
3. New CT and MR contrast agents of better enhancement of the cardiovascular system.
4. Right ventricular enhancement on cardiac CTA can be predefined by appropriate choice of injection parameters.

The most important article(s) published in the period 2003–2006:
2. Bae KT. Test bolus versus bolus tracking techniques for CT angiographic timing. Radiology 2005;236: 369
3. Bae KT, Tran HQ, Heiken JP. Uniform vascular contrast enhancement and reduced contrast medium volume achieved by using exponentially deceleration contrast material injection method. Radiology 2004;231 (3): 732

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. Cardiovascular MRI has become a preferred imaging modality for studying cardiovascular diseases
2. Cardiac MRI is the best technique to study patients with myocardial infarction and viability and has important potential to study patients with ischemic heart disease (angor pectoris).
3. Also for non-ischemic myocardial diseases, pericardial diseases and cardiac masses, cardiac MRI can offer unique information regarding morphology, tissue characterization, and impact on diastolic and systolic cardiac function.
4. Cardiac MRI is the preferred technique to follow-up patients with congenital heart disease.
Lung biopsy

Transbronchial image guided lung biopsies are increasingly used to obtain well tolerated tissue sampling. When planning a procedure, a valid indication is mandatory. Recognized indications include the diagnosis of an indeterminate pulmonary nodule, an undiagnosed mediastinal mass, a hilar mass when bronchoscopy is negative, single or multiple nodules when metastases are suspected and probable infectious lesions presenting as nodules or masses.

Almost every imaging technique has been used over the years for guiding needles when performing percutaneous biopsies. Today, CT is the major technique in use for lung biopsy. Fluoroscopy, ultrasound and MRI may still be helpful in exceptional circumstances. The most simple, accurate, safest and fastest approach will be chosen. In most cases, CT fulfills these criteria.

A number of techniques are described about how to perform CT guided lung biopsy, with varying needle type and size, from freehand technique to CT fluoroscopy and assistance of an on-site cytopathologist. The choice between the different methods will depend on the location and size of the target lesion, its relation to adjacent structures but also on personal preference and experience. In general, accuracy and complication rates improve when one is familiar with the method. The strengths and limitations of different CT guidance techniques will be discussed.

The most frequent complication of CT guided lung biopsy is a pneumothorax, which usually resolves spontaneously or can be treated by the radiologist. Serious complications are rare.

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Learning objectives:
1. When to use CT guidance
2. How to perform a CT guided biopsy

Take home points:
1. Learn to establish a valid indication to lung biopsy
2. Learn how to plan and perform the procedure
3. Learn how to manage the complications of the procedure
Pleural Intervention

This presentation will discuss the indications for pleural intervention, including biopsy and drainage. The different imaging techniques and needles available for biopsy and the expected diagnostic accuracy and incidence of complications will be reviewed. Data on drain size and efficacy will be presented, and the role of fibrinolytic therapy in patients with malignant and infected effusions will be discussed.

Take home points:
1. Image guided pleural biopsy is accurate in the diagnosis of pleural malignancy
2. Small bore chest drains are as efficacious as large bore drains
3. The routine use of fibrinolytic therapy in all patients with empyema does not currently appear warranted

The most important article(s) published in the period 2003–2006:
2. BTS guidelines for the management of pleural infection. Thorax 2003;58:Suppl 2:i1–7
3. UK MRC/BTS MIST1 trial of intrapleural streptokinase in pleural infection. NEJM 2005;352(9):865–874
Radiofrequency Ablation of thoracic tumors

Percutaneous RFA of lung lesions is an evolving minimally invasive therapy, both for metastases and for primary lung tumors (NSCLC).

Lung metastases occur frequently in the course of malignant disease, are identified in up to 40% of patients dying of malignant tumors, and are often the only site of disease progression despite local control of the primary tumor. Site, number and size of the metastases are often the limiting factor for surgery of a sometimes potentially still curative disease.

Bronchial carcinoma is worldwide the leading cause of death from malignant disease, both in men and in women. 80% are NSCLC and only 1/5 of the tumors qualify for a surgical approach with curative intent. Radiotherapy and Chemotherapy are of modest and often only short lasting success with local recurrence and overall poor survival rates. Not few of the resectable patients are not amenable to surgery because of their limited cardiorespiratory function and other comorbidities.

From our experience with the ablation of well over 70 patients so far we can state that percutaneous CT-guided lung RFA is a safe intervention with ignorable mortality, modest morbidity, and good short term results.

Lung metastases especially from colorectal primaries, but also from renal cell carcinoma (RCC), sarcoma and thyroid carcinoma qualify for this procedure. Data for metastases from breast cancer and melanoma are too scarce to allow a proper indication. Up to 5 metastases per hemithorax and tumor diameters smaller than 5 cm (ideally less than 3.5 cm) are amenable for this procedure.

Palliative ablations for pain control of circumscribed chest wall tumors or lung tumors invading into the chest wall are upcoming.

Pneumothorax and pulmonary parenchymal hemorrhage are the most frequent complications.

By means of representative examples indications, limitations and complications of this minimally invasive therapeutic option are discussed and clarified.

Take home points:
1. Lung RFA is a new and good therapeutic means for local tumor control
2. Primary (NSCLC) and secondary lung malignancies suitable
3. Careful indication evaluation and joint tumor bord decision is mandatory Wrong philosophy: “If you have a hammer everything looks like a nail”

The most important publication published in the period 2003–2006:

The most important statements arising during scientific work:
1. Standardized inclusion criteria, follow-up scheme and terminology necessary
2. Combination therapies (e.g. RFA + external beam radiation for NSCLC) to be evaluated
3. Prognostic factors to be determined
Imaging of chest trauma

The aim of this presentation is to provide emergency radiologists with some usual pathological conditions, regularly met in chest trauma patients. This topic will also focus on less commonly known life threatening lesions. Clinical features and radiological patterns (plain films and CT) of a flail chests, closed forequarter amputations will be discussed.

Among pneumothoraces, the topic will focus on the importance to recognize occult pneumothoraces only displayed by CT, including apical, postero-lateral and fissural ones.

Pneumomediastinum arising from tracheo-bronchial ruptures will be considered.

Finally, the topic will deal with cardiovascular lesions, easily detectable by 16/64 row MDCT, including aorta lesions, cardiac ruptures and coronary lesions.

Take home points:
1. Flail chests and thoracic cardiovascular lesions are always associated with severe thoracic and abdominal damages.
2. Occult pneumothoraces must be readily diagnosed and reported, particularly in patients under mechanical ventilation.
3. Any pneumomediastinum displayed by CT urges realization of bronchoscopy.
4. Whole body survey protocols must be adapted to patient’s stoutness and condition and type of equipment.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. Evaluation of chest wall trauma requires the use of cine-mode viewing of axial sections, cine-mode MIP-MPR and 3D volume rendering images.
2. In 80 % of complete brachial plexus tear, a lesion of the subclavian artery or its branches will occur.
3. Tracheo-bronchial lesions occur within 2.5 cm around the carina.
4. Angiography to detect or rule out an aorta lesion has been completely replaced by MDCT and transoesophageal echocardiography.
Imaging of acute chest pain (Part A)

Myocardial infarction or angina is 1,000 times more common than acute aortic dissection (AD) as cause of chest pain. However, acute aortic dissection, acute intramural hematoma and acute penetrating ulcer are all life threatening disorders. It is estimated that the incidence of acute dissection is 20 cases per million people per year. Both the accuracy and availability of multi-detector row CT for emergent patients with suspected AD make it the examination of choice.

A delayed or missed diagnosis of AD and left untreated is associated with a mortality rate of 1% per hour during the first 24 hours. CT has a sensitivity, specificity, PPV, NPV, and accuracy of 99%, 100%, 100%, 99.7%, and 99.5% respectively.

We will describe the spectrum of AD, intramural hematoma (IMH) and penetrating ulcer, analyzing the imaging findings and clinical implications.

Take home points:
1. Non-enhanced CT images are essential to diagnose acute blood within the aortic wall.
2. ECG gating can eliminate motion artifacts that may cause a false positive diagnosis of AD.
3. Interactive 3-D display techniques provide improved display of both anatomic relationships and disease extent.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in year 2005/2006:
1. Variants of aortic dissection include acute intramural hematoma and penetrating aortic ulcer.
2. MDCT can rapidly and accurately differentiate acute aortic syndromes.
3. Interactive 3-D techniques readily demonstrate complications of AD including vascular compromise and thrombosis.
4. Careful attention to technique, including contrast delivery and ECG gating, improve the diagnostic accuracy of CT.
Coronary ECG-gated CT-angiography in patients with acute chest pain

When the 64-detector row CT scanner is installed within the emergency suite, it should be used in general management of the patients with acute chest pain. The initial 12-lead ECG is most important diagnostic tool to select patients between cathlab and the CT suite. Patients with ST elevation (suspected acute STEMI) are admitted to the cathlab to undergo direct PTCA. All other possible causes of the chest pain could be assessed by chest ECG-gated CTA.

The fastest gantry rotation and fastest table feed is recommended. The useful imaging parameters are collimation 64 x 0.6 mm, gantry rotation 330 ms. 100 ml of the no-ionic iodinated contrast agent is injected with flow rate 4 ml/s follow saline flush with amount of 50 ml. Data acquisition start using bolus tracking in aortal root level. Images are reconstructed with different parameters to obtain data sets for evaluation coronary arteries, myocardium, pulmonary artery, thoracic aorta and lung parenchyma. We recommend following parameters: 1,5 mm axial images with HR convolution algorithm for lung parenchyma, 3 mm axial images with soft tissue convolution algorithm for mediastinum and myocardium and multiphase reconstruction of 0.6 mm images every 10 % of the whole R-R interval with smaller field of view only for coronaries and heart. Images are viewed not only in static 3D-space using MPR, MIP or VRT , but also using dynamic cine-evaluation of the beating heart.

The most important coronary related findings are occluded coronary artery's branch corresponding with akinetic hypoperfused myocardial segment in acute myocardial infarction; high grade coronary (or bypass) stenosis with enlarged soft plaque (own coronaries) in patients with unstable-angina; coronary artery dissection; or anomalous coronary artery origin (especially in young individuals). Assessment of the pulmonary artery, thoracic aorta and lung parenchyma is needed to prevent the false negative conclusions in patients with non-coronary related chest pain.

Take home points:
1. ECG-gated coronary MDCTA should be used as a primary imaging tool in patients with chest pain without ST elevations.
2. Evaluation of thoracic aorta, pulmonary artery and adjacent organs is needed.

The most important articles published in the period 2003 – 2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. ECG-gated coronary MDCTA should be used as a primary imaging tool in patients with chest pain without ST elevations.
2. Contrast-enhanced 64-slice CT is a clinically robust modality that allows the identification of proximal coronary lesions with excellent accuracy. Measurements of plaque and lumen areas derived by CT correlated well with IVUS.
Imaging of the ICU patient

Intensive care unit (ICU) patients are critically ill, suffering from intricate and complex medical problems. They are monitored and supported by various medical devices that make transport of the patient to the radiology department difficult or impossible. Bedside radiographs, and in a specific cases bedside ultrasound, remain the most accessible imaging tools for their daily monitoring. Chest films are most frequent. When transport of the patient is possible, CT can add important information.

Several technical problems must be overcome to obtain good quality and standardized bedside radiographs. Digital bedside chest radiographs proved to increase quality as compared with conventional ones. Radiologist reporting such films needs to know not only clinical status and type of therapy of the patient, but also position in which radiograph was obtained. Report of ICU patient radiograph must contain also information on the position of inserted tubes, catheters or electrodes. When possible, comparison with previous films is mandatory.

Adult respiratory distress syndrome (ARDS) represents frequent and severe condition in ICU patients. ARDS is a clinical diagnosis of acute respiratory failure characterized by (1) tachypnea, dyspnea, cough, and the physical findings of airspace consolidation, (2) diffuse airspace disease on chest radiograph, (3) severe arterial desaturation that is resistant to even high concentrations of inhaled oxygen, and (4) pulmonary function evidence of increased pulmonary vascular pressures and resistance and decreased lung compliance. More than 50% of cases are fatal, and survivors may have chronic lung disease. Radiographic manifestation can change fast and does not need to correlate with clinical status. Radiographically bilateral, patchy, ill-defined opacities appear in the first 24 hours. The appearance is similar to that of airspace oedema of cardiac origin, except that the heart size is usually normal and the oedema tends to show a more peripheral distribution. Opacities become more extensive over the next few days. Pleural effusions are unusual.

Take home points:
1. Good quality bedside chest radiograph is the most accessible imaging method for daily monitoring of ICU patient.
2. ARDS is clinical diagnosis supported by radiographic findings.
3. Bilateral, patchy, ill-defined opacities located more peripherally represent typical radiographic appearance of ARDS.

The most important articles published in the period 2003 – 2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. Placing patients with acute lung injury in the prone position has been shown to improve oxygenation.
2. Dynamic CT imaging adds promising functional information for the respiratory treatment of early ARDS.
3. Although physiologic imaging has been well explored in the laboratory, recent advances in clinical CT technology have provided a new opportunity for patient care.
4. Digital radiography markedly improves quality of the portable radiograph in the evaluation of the critically ill patient.
The use of the reticular pattern in diagnosis

On HRCT, the finding of numerous and interlacing lines resembling a mesh is indicated as reticular pattern and is usually associated with interstitial lung disease. It may result from interlobular and/or intralobular interstitial thickening by fluid, fibrous tissue, or infiltration by cell or other material.

Although a reticular pattern can be found in a variety of diseases, the HRCT appearance of reticulation and the distribution of abnormalities are important key-findings in the differential diagnosis. A course reticular pattern associated with severe distortion of lobular architecture, traction bronchiectasis and bronchiolectasis is indicative of fibrosis and can be observed in idiopathic pulmonary fibrosis or other causes of UIP. Similarly, a reticular pattern characterized by irregular cystic spaces and honeycombing is almost typical of end-stage pulmonary fibrosis. A smooth reticular pattern characterized by interlobular septal thickening and a normal lobular architecture can be found in pulmonary edema or hemorrhage, sarcoïdosis, lymphangitic spread of cancer, and amiloidosis. In patients with lymphangitic spread of cancer or lymphoma, sarcoïdosis, silicosis or coal worker's pneumoconiosis, a nodular appearance of thickened interlobular septa can be observed.

Intralobular interstitial thickening can also be seen in the absence of significant fibrosis. When this is the case, traction bronchiectasis or other manifestations of fibrosis are absent.

The most important articles published in the period 2003–2006:
3. Souza CA, Muller NL, Flint J, Wright JL, Churg A. Idiopathic pulmonary fibrosis: spectrum of high-resolution CT findings. AJR 2005; 185:1531–1539
The use of the nodular pattern in diagnosis

The diagnostic approach of a nodular pattern on HRCT is based on the consideration of the size, appearance and distribution of the nodules. The analysis of the distribution of the nodules with respect of the landmarks of the secondary pulmonary lobule is the most useful in order to contribute to the differential diagnosis.

In perilymphatic distribution, the nodules are predominantly located in relation to the parahilar peribronchovascular interstitium and/or within the centrilobular interstitium, along the septa and/or in a subpleural location. The differential diagnosis includes sarcoidosis, lymphangitis carcinomatosis, silicosis and coal workers pneumoconiosis.

Distribution at random has no topographic predominance. The differential diagnosis includes hematogeneous metastases, miliary tuberculosis, histoplasmosis, and viral infection in immunocompromised patients including CMV and herpes virus.

Centrilobular distribution is defined by the presence of multiple small nodules often ill-defined grouped within the center of the secondary pulmonary lobule. They are located at least 3 mm from the pleura. Sometimes, the small nodules are associated with branching linear opacities providing the “tree in bud” appearance characteristic of infectious or inflammatory bronchiolitis.

Diffuse ill-defined centrilobular nodules homogeneously distributed is highly suggestive of hypersensitivity pneumonitis or vascular disease. Centrilobular nodules having a patchy distribution within the lobule and inhomogeneously distributed within the lungs may be encountered in bronchiolitis but also at the early phase of interstitial lung disease.

The caveats that may occur are easily resolved by use of maximum intensity projection on volumetric isotropic high resolution CT data set.

Take home points:
1. The most useful way to correctly diagnose a nodular pattern is based on the analysis of the distribution of the nodules with respect of the landmarks of the secondary pulmonary lobule.
2. The absence of any nodule along the pleura interface is characteristic of a centrilobular distribution.
3. Maximum intensity projection is the best post-processing procedure in order to detect and characterize whatever the type and aspect of the nodular pattern.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
Multidetector CT generate isotropic volumetric high resolution data; this allows an excellent assessment of the nodular pattern by using the maximum intensity projection technique, which is the best post-processing tool to detect and characterize a nodular pattern.
Borderlands of Normal

A fundamental role for HRCT is to confirm or refute the presence of interstitial lung disease. Although there has been much meticulous work detailing findings in pathologically defined entities, HRCT appearances in apparently healthy individuals have been less intensively scrutinised. This discrepancy is partly related to the attraction of studying disease states and the difficulties in obtaining histological material from normal subjects. The concept of normality is often considered in terms of Gaussian distribution, however such analysis cannot readily be applied to qualitative non-numerical HRCT image descriptions. An “abnormality” referred to in a radiological report is usually regarded as synonymous with the presence of disease. However, there are several caveats because findings considered abnormal in one group may not be of any clinical significance in another; for example, ill-defined centrilobular nodules and patchy ground glass opacity seen on HRCT in a 65 year old cigarette smoker may be within the range of expected findings, whereas in a 25 year old non-smoker these features would be regarded as likely to represent early, but important, interstitial lung disease. In the elderly, HRCT findings consistent with limited interstitial fibrosis (“presbyterian lung”) are quite frequent. In addition, some findings on HRCT (for example, focal areas of decreased attenuation) do not have an obvious pathological correlate. Whether, such abnormalities represent early pathological changes or are insignificant is often unclear. The spectrum of HRCT in this borderland will be illustrated and discussed.

Take home points:
Over-sensitivity of HRCT for clinically unimportant “abnormalities”, or false positive diagnoses, needs to be appreciated
Expected age and smoking-related changes on HRCT should not be over-reported
For apparently diffuse abnormalities on HRCT, e.g. questionable ground glass opacification, pulmonary function testing, in particular DLco, is an important arbitrator
Differentiating the interstitial pneumonias

The aim of this presentation is to present a practical approach to the differential diagnosis of the most common interstitial pneumonias.

Usual Interstitial Pneumonia (UIP)/IPF

The characteristic high-resolution CT findings of UIP consist of irregular linear opacities (reticulation) and honeycombing. The reticular pattern and honeycombing typically have a patchy distribution, involve all lobes, and is most severe in subpleural lung regions and lower lung zones. Lack of predominantly subpleural fibrosis on CT should suggest an alternative diagnosis. Ground-glass opacities may be present in UIP but are usually less extensive than the reticulation.

UIP has a poor prognosis the majority of patients having a progressive downhill course with a median survival of 2–4 years. Recent studies suggest that up to 10 % of patients may develop acute exacerbation each year. Acute exacerbation is characterized by rapid clinical deterioration and development of superimposed diffuse alveolar damage or acute organizing pneumonia of unknown etiology. The main differential diagnosis includes infection (particularly Pneumocystis) and acute drug reaction.

Nonspecific Interstitial Pneumonia/Fibrosis (NSIP)

The most common HRCT manifestation of NSIP consists of symmetric bilateral ground-glass opacities. The majority of patients have a fine reticular pattern superimposed on the ground-glass opacities, traction bronchiectasis, and traction bronchiolectasis. Honeycombing is uncommon at presentation and tends to be mild. The abnormalities in NSIP may be diffuse but in 60–90 % of cases involve mainly the lower lung zones and in 50–70 % of patients involve predominantly the peripheral lung regions.

The prognosis of predominately cellular NSIP is considerably better than that of UIP and the prognosis of fibrotic NSIP slightly better than that of UIP.

Cryptogenic Organizing Pneumonia (COP)

The most common high-resolution CT findings in BOOP consist of bilateral areas of consolidation, which in 60 to 80 % of cases have a fine reticular pattern superimposed on the ground-glass opacities, traction bronchiectasis, and traction broncholectasis. Honeycombing is uncommon at presentation and tends to be mild. The abnormalities in NSIP may be diffuse but in 60–90 % of cases involve mainly the lower lung zones and in 50–70 % of patients involve predominantly the peripheral lung regions.

Cryptogenic organizing pneumonia has a good prognosis, the vast majority of patients responding to corticosteroids.

Take home points:

1. The characteristic distribution of the reticulation with associated honeycombing of UIP allows a specific diagnosis on CT in the majority of cases.
2. Acute exacerbation of UIP is more common than previously recognized.
3. NSIP and organizing pneumonia are a common reaction pattern to various drugs and are commonly associated with collagen vascular diseases.

The most important articles published in the period 2003 – 2006:


The most important statements concerning the subject of the lecture in the year 2005/2006:

1. Acute exacerbation of UIP is more common than previously recognized.
2. In approximately 50% of cases NSIP has a characteristic pattern of presentation on high-resolution CT.
3. In approximately 50% of patients high-resolution CT results in a change in first-choice diagnosis of interstitial lung diseases by pulmonologists.
4. The request rate for surgical lung biopsy in patients in suspected idiopathic pulmonary fibrosis decreases significantly after high-resolution CT.
Pulmonary Embolic Disease – When to image

Diagnosis of VTE is challenging as signs and symptoms are non-specific. Therefore diagnostic tests are necessary to establish the presence or absence of PE. The prevalence of PE in clinical studies has linearly decreased from 30-40% in the 1970–1980’s to less than 10% in the most recent studies. Therefore diagnostic strategies based on sequential non-invasive tests are necessary to identify patients in whom anticoagulation can be safely withheld and limit the number of patients requiring more-invasive or more expensive tests. Two kinds of pretest clinical prediction for patients suspected of PE are found in the literature: first, the empiric or implicit clinical prediction for which prediction of a diagnosis is certainly linked to the experience of the clinician and to cognitive bias linked to his past experience of patients with PE. Second the clinical scores or prediction rules that are elements that allow to quantify the respective contributions of medical history, clinical examination and laboratory tests to a diagnosis or a prognosis in a given patient. Scores are intended to have a better inter-observer agreement than empiric evaluation and to be didactic and accessible to less experience clinicians. These scores include the Wells score, the Geneva score and the revised Geneva scores. All have advantages and limitations. These scores categorize patients as low, intermediate or high clinical probability of PE. ELISA D-dimer tests may be used to rule out VTE in all non-high clinical probability patients, whereas whole blood agglutination assays may be used for that purpose only in low-clinical probability patients. Management studies have demonstrated that PE can be safely ruled out in patients based on clinical probability and normal D-dimer test result, which occur in 20-40% of the patients. Others non-invasive tests, such as alveolar dead space measurement are currently investigated to further limit the number of patients requiring imaging for suspicion of PE. The large multicentric Christopher study showed that a diagnostic algorithm based on dichotomous clinical probability of PE, D-dimer test and CT was effective for treatment decision with a low 1.3% 3-month VTE risk in patients with negative CT.

Take home points:
1. As PE prevalence is decreasing in routine practice, patients requiring PE imaging should be selected by other tests.
2. Non-invasive diagnostic strategies are necessary to identify patients in whom anticoagulation can be safely withheld.
3. Management studies have demonstrated that diagnostic algorithm based on clinical probability of PE, D-dimer test and CT is effective for treatment decision with a low 3-month VTE risk.

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
PIOPED II: Lessons for the Radiologist

PIOPED II was an eight-institution prospective trial in the use of MDCT angiography (CTA) and venography (CTV) for the detection of venous thromboembolism (VTE). CT results were compared with several composite reference standards and Wells assessment of pretest probability.

Results

Sensitivity and specificity for CTA were 83%/96% and for CTA/CTV were 90%/95%. When sensitivity and specificity were adjusted for inherent flaws in the reference standards, sensitivity rose by 1-3% and specificity fell 1%.

Lessons

1. If pretest probability is low and D-dimer (ELISA) is negative, imaging is not required.
2. CTA alone was inadequately sensitive to exclude PE.
3. CTA + CTV or CTA + Wells scoring achieved satisfactory sensitivity and specificity.
4. CTV of the inferior vena cava and iliac veins added little information.
5. CTV contributed most in centers where CTA results were below average.
6. When clinical probability and CT results were discordant (e.g. high Wells/negative CT or vice versa), CT results were correct in < 50% of cases.
7. PIOPED II results are at odds with numerous clinical outcome studies of withholding anticoagulation with a negative CT.
8. In a post study review of discordant CTA and PAgrams, an expert panel indicated that CTA was correct in the majority of cases.

Conclusion

CTA is the study of choice for pulmonary embolism but should be paired with objective pretest clinical assessment or imaging of the lower extremities.

Take home points:

1. CTA alone may be inadequate to diagnose or exclude PE.
2. Concomitant studies of the lower extremities or objective pretest scoring makes CTA the imaging test of choice.
3. Discordant clinical and CTA results require further imaging.

The most important articles published in the period 2003–2006:


The most important statements concerning the subject of the lecture in the year 2005/2006:

1. D-dimer and low-clinical probability eliminates the need for imaging.
2. Clinical outcome studies of CTA negative patients show excellent results without anticoagulation.
3. Isolated small pulmonary emboli, in the absence of DVT, may not require anticoagulation.
Imaging of chronic tromboembolic disease

Chronic tromboembolic pulmonary hypertension (CTEPH) represents a consequence of one or multiple episodes of acute pulmonary embolism (PE). The condition is relatively rare (1–5 % of patients with PE), but usually has a poor prognosis due to the right heart failure. In appropriately selected group of patients, pulmonary trombendarterectomy is effective treatment of choice. The aim of this presentation is to familiarize the audience with the current issues concerning the utility of various imaging methods for evaluation of patients with suspected pulmonary hypertension (PH, consequently CTEPH), with the emphasis on CT and, to some degree, MR. Imaging plays the important role in the primary detection of PH, differentiation of various causes of PH and, finally, selection of patients for surgical treatment of CTEPH. Spiral CTA is generally accepted as an effective tool for depiction of acute PE. Recently published European evidence based guidelines for management of patients with suspected chronic PH recommend to perform besides V/Q scan and catheter angiography (AG) also HRCT and CTA. The rationale for keeping AG as a gold standard for statement of definitive diagnosis and selection of patients with CTEPH for surgical treatment is based on the fact that, among others, direct measurements of arterial pressure and pulmonary vascular resistance, even with the possibility to separate the downstream component caused by surgically untreatable small vessel vasculopathy, can be performed at the same setting. Current MDCT is capable to bring direct angiographic informations which are at least comparable with AG (changes of diameter and shape of the vessels, asymmetrical filling defects, intraluminal clots, occlusions, webbing, calcifications etc.). Additional informations about lung parenchyma (mosaic attenuation, infarctions, bronchiectases, additional/alternative parenchymal changes) and other structures (mediastinum, bronchial collateral circulation etc., heart) are of very important value not only for diagnosis statement, but also for establishing the need for surgical intervention. It can be anticipated that in the near future MDCT can play even more important role in the diagnostic algorithm of suspected chronic PH. There is also a growing evidence that state of the art contrast enhanced MR examination reveals sufficient capability to provide detailed angiographic as well as functional (lung perfusion, cardiac morphology and function) data for the evaluation of patients with suspected PH.

Take home points:
1. The direct signs of CTEPH depictable on invasive or noninvasive pulmonary angiographic studies comprise variable central arterial dilatation, eccentric or longitudinal filling defects, intraluminal defects, webs, calcifications, occlusions and marked caliber reduction of central and peripheral vessels in irregular distribution.
2. Parenchymal changes accompanying CTEPH are best appreciated on HRCT and include mosaic pattern in irregular distribution (low attenuation areas containing narrow vessels, no evidence of air trapping on expiratory scans), marked variation in the size of segmental vessels (more specific for CTEPH), peripheral wedge shaped opacities and bands, cylindrical bronchiectases along the stenotic or obstructed arterial segments.
3. Dilated bronchial arteries (diameter more than 1.5 mm on CTA) support the diagnosis of CTEPH against idiopathic PH and can serve as a predictor of positive outcome after tromboendarterectomy

The most important articles published in the period 2003 – 2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. CT can bring additional information for selecting candidates for operative treatment of CTEPH
2. State of the art MR shows promising role in differentiation between idiopathic PH and CTEPH
Smoking Related Lung Disease: Airway Disease in Smokers

Smoking can be responsible for the development of chronic bronchitis, constrictive bronchiolitis, emphysema, respiratory tract infections, pneumonia, and interstitial lung disease and lung cancer. This presentation will concentrate on the pathological and radiological features of smoking induced large and small airway abnormalities, on the possible effect of these abnormalities on the lung function and on the use of computed tomography to quantify these lung function changes. Chronic bronchitis is characterised by the inflammatory thickening of the wall of the bronchi and the presence of an excess of mucus on the surface of the lumen. These changes can become visible on a (HR)CT scan of the lungs and present predominantly as bronchial wall thickening and bronchial dilatation. Constrictive bronchiolitis is due to obstruction of the peripheral small airways as a result of inflammation with excess mucus and of fibrotic remodelling. Loss of alveolar attachments and elastic recoil are believed to contribute also to this obstruction. These small airways abnormalities can be seen directly on a (HR)CT as ground-glass opacity, centrilobular nodules and branching lines and can cause mosaic perfusion and air-trapping which are indirect signs of small airways narrowing. Some patients with airway abnormalities develop airflow limitation. Inflammation of the airways is indeed one of the pathological hallmarks of chronic obstructive pulmonary disease (COPD). The other hallmark is destruction of lung parenchyma (emphysema) which interacts in a complex fashion with these airway abnormalities in the development of airflow limitation. The presence of emphysema also complicates the use of CT for the quantification of airflow limitation. Nevertheless several studies have shown good correlations between pulmonary function test indicators of airflow limitation on one hand and bronchial (wall-thickness, airway dimensions) and bronchiolar (air-trapping) changes on the other hand.

Take home points:
1. Smoking can be responsible for the development of chronic bronchitis and constrictive bronchiolitis that are together with emphysema the pathological hallmarks of chronic obstructive pulmonary disease (COPD).
2. (HR)CT features can be divided into direct signs when inflammation of the bronchial and bronchiolar wall and accompanying exudates develop causing directly visible lung changes and indirect signs that are the result of obstruction of the small airways causing regional underventilation and reduced perfusion (mosaic pattern) and that indirectly indicate the presence of small airway abnormalities.
3. Significant correlations between airway abnormalities and functional measurements were found.

Suggested reading:

Important statements concerning the subject of the lecture in the year 2005/2006:
1. CT is important to differentiate patients with predominantly emphysema disease from those with airway wall remodelling. (reference 3)
2. The important additional CT abnormalities in individuals with emphysema that influence FEV1 and DLCO are bronchial wall thickness and core-rind heterogeneity, respectively. (reference 2)
What’s new in emphysema – perspectives and challenges

Pulmonary emphysema is defined as an “abnormal permanent enlargement of the air spaces distal to the terminal bronchioles, accompanied by destruction of the alveolar walls, and without obvious fibrosis”. In the western world, pulmonary emphysema is among the most common respiratory disorders. Although essentially linked to tobacco smoking, a variety of other agents can contribute to the development of emphysema. Emphysema thereby became a substantial public health problem. As emphasized by G.L. Snider “in many ways, emphysema is the pneumologist of the last half of the twentieth century what tuberculosis was to the pneumologist in the first half of the twentieth century.” Pulmonary emphysema is a chronic disorder. Patients suffer from emphysema for years, sometimes for decades. This creates high costs for care and rehabilitation. Depending on epidemiological factors, these costs may vary. In virtually all countries of the western world, however, emphysema is among the “top five” diseases in terms of morbidity associated health care costs. Most studies investigating the development of emphysema, notably in the early stages of disease, have been conducted in animals. Also, many long-term studies are based on animal experiments. It therefore remains unknown whether data obtained from those studies will remain valid in the context of human emphysema. This issue urges for a technology that allows to detect and follow human emphysema in-vivo. CT fulfills most of requirements that such a technology should have. This substantially stimulated the interest of researchers in CT as a modality used for the longitudinal follow-up of patients with emphysema.

This lecture will summarize basic knowledge about the CT imaging of emphysema, present novel quantitative approaches about the work-up of this disease, and show how these approaches can be used in the assessment of chronic obstructive lung disorders in a broader context.

Learning objectives:
At the end of this lecture, the participants will
• be aware of the epidemiological and socioeconomic importance of pulmonary emphysema;
• be familiar with the basic technical tools and parameter used and required to accurately quantify emphysema on CT;
• have learned about the emerging role of functional imaging and the use of advanced techniques in the quantification of pulmonary emphysema on CT.
Smoking related interstitial lung diseases

This lecture is focused on the various forms of interstitial lung disorders related to smoking (smoking related interstitial lung diseases – SRILDs), on HRCT analysis, radiologic – pathologic correlation and differential diagnosis.

There is increasing awareness that smoking may cause lung diseases other than bronchogenic carcinoma, chronic bronchitis and emphysema including Pulmonary Langerhans cell histiocytosis (PLCH), respiratory bronchiolitis interstitial lung disease (RBILD) and desquamative interstitial pneumonia (DIP). In addition a subset of smokers with fibrosing interstitial pneumonias may have a pattern that fits better to Nonspecific Interstitial Pneumonia (NSIP) rather than Usual Interstitial Pneumonia (UIP).

RBILD and DIP are characterized histologically by accumulation of alveolar macrophages within respiratory bronchioles, with bronchocentric distribution in RBILD as opposed to diffuse distribution in DIP. HRCT in RBILD demonstrates ground glass opacification superimposed by ill-defined nodules, while DIP exhibits diffuse ground glass opacification. PLCH is manifested by nodular sclerosing lesions containing Langerhans cells that may undergo cavitation, depicted by combination of cysts and nodules on HRCT. UIP is characterized histologically by temporal inhomogeneity of fibrosis as opposed to the temporal homogeneity of NSIP. NSIP may be differentiated from UIP by the presence of subpleural ground glass opacities rather than honeycombing prominent on UIP. Overlapping of HRCT findings and coexistence of emphysema may occasionally confuse the differential diagnosis.

HRCT discloses and delineates the various forms of smoking related interstitial lung diseases – a rare group of disorders that may have good prognosis with smoking cessation.

Take home points:

1. The various forms of SRILDs may present with similar clinical symptoms and occasionally with good prognosis especially after cessation of smoking.
2. The histopathology varies among the various forms of SRILDs although considerable overlap between them and with emphysema may occur.
3. HRCT can differentiate SRILDs in most of the cases but occasionally biopsy may be required to determine their different prognosis due to considerable overlap.

The most important articles published in the period 2003 – 2006:


The most important statements concerning the subject of the lecture in the year 2005/2006:

1. RBILD, DIP and PLCH share a common cellular line as origin: the macrophage.
2. UIP and NSIP are fibrosing interstitial pneumonias that also may be associated with smoking.
3. Due to considerable overlap of histopathology in the spectrum of SRILDs, biopsy from one site may not be representative and establishing the principal diagnosis may be problematic.
4. Present data supprt that RBILD progresses to emphysema while DIP may progress to NSIP.
Viral Infection in the Lungs: Radiologic-Pathologic Correlation

Pulmonary viral infection is relatively common and a major cause of morbidity and mortality particularly in immunocompromised patients. The most important pathogen in immunocompromised patients is Cytomegalovirus. Other pulmonary viral infections include herpes simplex virus, varicella-zoster, adenovirus, syncytial-respiratory virus, Epstein-Barr virus, Hantavirus, metapneumovirus and H5N1. The radiologic manifestations of pulmonary viral infections are protean and include ground-glass opacities, air-space consolidation, nodular opacities, bronchial wall thickening, tree-in-bud appearance and small pleural effusions. The differential diagnosis is based on the clinical history and the pattern and distribution of findings on high resolution CT.

Take home points:
1. Accurate clinical information is essential to narrow the differential diagnosis of viral infections in the immunocompromised patient.
2. The radiologic manifestations of pulmonary viral infections include small nodular opacities, tree-in-bud appearance, ground-glass opacities, air-space consolidation, and bronchial wall thickening.
3. Combination of pattern recognition with knowledge of the clinical setting is the best approach to pulmonary infectious processes.
Infection in AIDS and the Immunocompromised patient

General
The role of the radiologist in contributing to the diagnosis and care of patients who are immunocompromised, either with AIDS or non-AIDS, is greatly enhanced by knowledge of the clinical scenario. It is important to know the cause of immunocompromise, in the HIV patient if the CD4 count is significantly suppressed, and if the patient is taking anti-retroviral therapy or chemotherapy. This information should be available in addition to the usual salient clinical findings such as the acuteness of the patient’s symptoms, the degree of hypoxia and the results of any previous imaging. The use of this systematic approach greatly enhances the ability of the radiologist to issue a clinically useful opinion on any particular imaging test.

HIV
There have been profound changes in the clinical spectrum of presentation in patients who are immunocompromised as a result of significant advances in treatment and prophylaxis. Furthermore the demographics of the HIV positive population, as presenting to a European metropolitan centre, have also fundamentally altered over the last 20 years.

Radiology
Whilst there is a broad range of potential pathogens in this patient group, this presentation will concentrate on the radiological findings of the more commonly encountered organisms. There is considerable overlap in radiological appearances produced by distinct organisms. Whilst certain patterns are considered typical, and will be illustrated, this variation in radiological manifestation will also be illustrated. It is important to remember that non-infectious causes are also common and of varied radiological appearance.

Take home points:
1. Clinical background is essential
2. Radiological appearances are frequently non-specific
3. Non infectious causes should be considered

Most important articles published in the period 2003 – 2006:

The most important statements on this subject concerning the subject of the lecture in the year 2005/2006:
1. Clinical dialogue is essential for meaningful radiology
2. Diagnosis is usually made on microbiology
3. Radiology identifies pathology, guides diagnostic sampling and assesses response to therapy
4. HIV demographics and presentation have changed profoundly in the past ten years.
Community acquired and nosocomial infection.

Pneumonia is one of the most frequent causes of morbidity and mortality through the world. Classification is based on the etiology (bacterial, viral, fungal, protozoal), morphology (lobar pneumonia, bronchopneumonia, interstitial pneumonia), clinical course (acute, recurrent, chronic) and relation to other disease (primary, secondary). For clinical practice is the most significant epidemiological classification into community-acquired (CAP) and nosocomial pneumonia (NP). Even if both entities have many similar features (include radiologic patterns), they should be regarded separately. They are caused by different spectrum of pathogens, affect different groups of individuals and require different diagnostic and therapeutic approach.

CAP arise in patients out of the hospital. The most frequent pathogens in this group are bacteria Steptococcus pneumoniae, Mycoplasma pneumoniae, Haemophilus influenzae and virus Influenza A. Overall mortality rate is ranging from 5 to 10 %. Diagnostics of CAP is usually not difficult. It is frequently based on clinical and radiological finding alone. Microbiological diagnosis is made only in 10 – 50 % of cases. NP is defined as pneumonia occuring after admission to the hospital, which was neither present nor in a period at the time of admission. It is the most frequent hospital acquired infection with an incidence ranging from 0.4 to 5 % and mortality between 25 and 41 %. Most often is caused by Gramm-negative bacteria. Patients do not always present with typical symptoms and microbiological identification of causative pathogen is only in 30 – 70 % of cases successful, therefore it can be difficult to make the diagnose. Imaging methods play crucial role not only in the detection of pneumonia and its complications, but also in assessment of the differential diagnosis, follow-up and navigation of interventional procedures. It is usually not possible to set specific diagnosis, but in accordance to radiologic pattern and clinical entries are imaging methods able to narrow the spectrum of potential pathogens and appropriately route following diagnostic proceeding. Chest radiography is a method of the first choice for detection of pneumonia and monitoring of response to therapy. Computed tomography is recommended in patients with unclear and nondiagnostic radiographic findings. It is also very helpful in management of patients with imunodeficiency.

Take home points:
1. Despite CAP and NP have some similar features they should be regarded as separate clinical entities.
2. It is usually not possible to set specific diagnosis, but in accordance to radiologic pattern and clinical entries are imaging methods able to narrow the spectrum of potential pathogens and appropriately route following diagnostic proceeding.
3. Chest radiography is a method of the first choice. Computed tomography is recommended in patients with unclear and nondiagnostic radiographic findings and in management of patients with imunodeficiency.

The most important articles published in the period 2003–2006:

Most important statements concerning the subject of the lecture in the year 2005/2006:
1. HRCT is helpful in patients with respiratory symptoms and negative or unclear x-ray finding.
2. A pattern of pulmonary involvement may suggest potential group of pathogens, but only rarely are imaging methods able to set the specific diagnosis.
Mediastinal Neoplasms: Imaging Concepts

In this presentation, the most common mediastinal space occupying lesions of all mediastinal compartments will be discussed. The imaging diagnostic approach is based on morphometric features, location, and densitometry or signal intensity basically obtained by CT or MRI.

The features of each lesion at chest x-rays, CT and MRI will be presented as well as pitfalls in imaging diagnosis. The features of superior mediastinal lesions including thymic tumors and cysts, thyroid masses (goiter of malignancies), thymic cyst lymphomas, parathyroid adenomas, lymphangiomas, parathyroid adenomas as well as lymphomas will be discussed. Anterior mediastinal lesions such as thymic tumors/cysts, lymphomas, aneurysms, germ cell tumors, large thyroid goiters with intrathoracic invagination, pericardial cysts, lymphangioma, hemangiomas as well as lipomas/liposarcomas will be described.

The majority of middle mediastinal lesions include lymphomas, bronchogenic cysts, pericardial cysts, aneurysms, while the differential diagnosis can be further focused as in any mediastinal lesion with the use of epidemiologic information.

Posterior mediastinal lesions include neurogenic tumors, meningoceles, esophageal space occupying lesions (hernias/masses/esophageal duplication cysts and neuroenteric cysts).

Take home points:

1. Computed Tomography (CT) remains the procedure of choice for mediastinal pathology since it allows both exact localization and density characterization including vascularity (contrast enhancement information). In addition, CT is the modality of choice to diagnose vascular causes of mediastinal enlargement, and if the latter are excluded, CT is the ideal guide and for percutaneous biopsy in many cases.

2. Signal characteristics obtained by Magnetic Resonance Imaging (MRI) also allow the evaluation of the texture of the lesion. MRI is advantageous for the demonstration of the vascular relations of a lesion without the need for intravenous contrast medium, and it is the modality of choice for the discrimination of cardiac from pericardiac lesions and in the evaluation of neurogenic tumors allowing excellent visualisation of the intraspinal component compared to CT. It is particularly useful for confirming hemorrhage or the cystic nature of a mass, as well as chest wall invasion.

The most important articles published in the period 2003–2006:

1. Ichiro Hasegawa, Phillip M. Boiselle, and Hiroto Hatabu Bronchial Artery Dilatation on MDCT Scans of Patients with Acute Pulmonary Embolism: Comparison with Chronic or Recurrent Pulmonary Embolism Am. J. Roentgenol., 2004; 182: 67–72.


The most important statements concerning the subject of the lecture in the year 2005/2006:

1. The location, morphologic characteristics, signals and density information obtained by CT, MRI, and scintigraphy often give complete presurgical information for treatment planning.

2. The knowledge of epidemiologic characteristics however is crucial to correctly focus the diagnostic differential.

3. Common pitfalls regarding density/ signal information include the presence of high protein content, or milk of calcium within a lesion.

4. The use of contrast is mandatory for both CT and MRI to reveal vascularity and soft tissue component within a lesion. Complete absence of enhancement within a lesion confirms the cystic nature.
Investigation of suspected pleural malignancy

Whilst malignant pleural mesothelioma is still a relatively rare intrathoracic tumour by comparison with lung cancer, the incidence is still rising and is expected to peak in European men by the year 2020. Asbestos exposure is still a major factor in the development of malignant mesothelioma, and there is a long latency of up to 40 years between exposure and development of the disease. The diagnosis is often not straightforward, even histopathologically. Various imaging modalities such as radiography, ultrasound and CT are useful in the investigation of suspected pleural malignancy. The radiographic features include pleural effusion which may be small or large, encasement of the lung with volume loss of the affected hemithorax and lobulated pleural masses. Intravenous contrast CT may show nodular pleural thickening, circumferential pleural thickening, parietal pleural thickening greater than 1cm thick and mediastinal pleural involvement. Ultrasound and CT may be used to guide biopsy. MR and PET may also have a role in the investigation and staging of disease. The imaging features of malignant mesothelioma on these different modalities will be described, typical features and potential pitfalls will also be highlighted. The prognosis is usually poor as patients often present late with irresectable disease. Radiological staging is performed using contrast-enhanced CT, MR and PET, and is important to guide treatment and suitability for surgical resection. As yet, there is no clearly defined role for imaging in screening for malignant mesothelioma, however, there may be an emerging role for serum tumour markers.

Take home points:
1. The incidence of mesothelioma is still rising in the developed world
2. The diagnosis of mesothelioma may not be straightforward, both radiologically and histopathologically
3. There may be an emerging role for serum tumour markers in the detection of mesothelioma.

The most important articles published in the period 2003 – 2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. There have been advances in the diagnosis and treatment of mesothelioma in the last 10 years.
2. However, malignant mesothelioma still remains a difficult disease to detect early and treat successfully.
3. Imaging is important in the detection of disease, as a guide to percutaneous biopsy and in staging and treatment assessment.
Pulmonary manifestations of vasculitis and connective tissue diseases

This presentation summarizes the radiological and computed tomographic pulmonary manifestations of vasculitis and connective tissue diseases. These include Wegener's granulomatosis, giant cell arteritis, Behcet's syndrome, Goodpasture syndrome, rheumatoid disease, systemic lupus erythematosus, systemic sclerosis, Sjögren's syndrome and some other rare disorders. The radiological and CT findings however are often non-specific and need to be interpreted together with the clinical findings. Although conventional chest radiography is commonly used for initial assessment, spiral computed tomography can demonstrate the entire spectrum of thoracic manifestations of vasculitis and connective tissue diseases, including abnormalities of the vessel lumen and wall, perivascular tissues, lung parenchyma, pleura and mediastinal structures. New generations of multi-slice CT, with sub-millimetric slices and isotropic imaging appear as a significant improvement in the non-invasive diagnosis of such disease by demonstrating in one acquisition small or great vessel abnormalities combined with fine analysis of interstitium. The characteristic imaging manifestations of the various entities are reviewed and illustrated.

Take home points:
1. Imaging plays an important role in the initial evaluation and follow-up of patients with connective tissue diseases and vasculitis
2. The radiological findings are variable and non-specific and need to be interpreted together with the clinical and laboratory findings.
3. Multislice CT appears as an interesting imaging modality to assess in one acquisition small vessels, airways and interstitium in patients with connective tissue disease or vasculitis.

The most important article(s) published in the period 2003–2006:
3. Multislice CT appears as an interesting imaging modality to assess in one acquisition small vessels, airways and interstitium in patients with connective tissue disease or vasculitis.
Drug Induced Lung Disease

Multiple cytotoxic and non-cytotoxic drugs (e.g., antiarrhythmic drugs or anti-inflammatory drugs, etc.) potentially induce lung disease. The prevalence of drug induced lung disease is likely to be considerably underestimated in clinical routine. Dependant on the pathological mechanism and course, acute and chronic lung diseases are differentiated. Mostly, the diagnosis is rather difficult because clinical symptoms and morphologic findings are non-specific. They may simulate the findings seen in the lung after radiation, caused by an infection or mimic the pulmonary lesions of the underlying disease. A prompt diagnosis, however, is important, since continuation of the medication and thus of the lung injury may cause irreversible parenchymal damages with a fatal course at the worst. Cessation of the medication and appropriate therapy, however, mostly yield rapid improvement.

Take home points
1. To become acquainted with the specific context which drugs may cause lung disease under which conditions
2. To become familiar with typical morphological patterns of drug induced lung disease
3. To learn which other lung diseases have to be considered in the differential diagnosis or may be mimicked by drug induced lung damage.

The most important articles published in the period 2003–2006:
1. Silva CL, Muller NL. Drug induced diseases: most important reaction patterns and corresponding HRCT manifestations. Semin Ultrasound CT MR 2006, 27(2): 111–6

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. At present more than 350 drugs are known to cause injury of the lung parenchyma, upper and lower airways, pulmonary vasculature, lymph nodes, mediastinum, pleura and the neuromuscular system.
2. The diagnosis is based on clinical history and consistent radiological findings, lung biopsy is performed rarely.
3. Knowledge of the most common HRCT patterns is important for early recognition and proper management of drug induced lung disease.
4. Pneumotox (www.pneumotox.com) provides updated information on drug induced respiratory disease.
Multislice CT – protocol optimisation

Multislice CT protocol recommendations have to cover a wide range of different scanners from four up to 64 or more detector rows with very different scan speed. Several aspects have to be taken into account:

1. **Slice thickness (detector configuration) and reconstruction increment:**
   Thin slice imaging of the chest has become standard with the widespread availability of MSCT scanners. While the scan duration does not cause any problem with a 64-detector-row CT, with four-detector-row scanners the required breath-hold duration may still be an issue for severely ill patients. Inability to hold the breath for a thin slice scan may jeopardize image quality. Appropriate breathing training prior to the scan and “customized” breathing commands are useful to reduce this problem.

   The optimal reconstruction increment is a trade-off between the clinical questions to be answered (e.g. nodule volumetry) and computer, network and storage media capacity and cost; it depends on the expected case mix.

2. **Radiation dose**
   Necessary radiation exposure varies in a wide dose range depending on the clinical situation. Typical questions and consequences for the radiation dose will be discussed.

3. **Contrast media**
   The faster a CT scanner is the more important is the correct timing of the contrast media (CM) bolus. Depending on the clinical question, different CM timing may be useful. Optimal vessel opacification is mandatory for CT angiography, either for pulmonary angiography to detect pulmonary emboli or for depiction of aortic pathology. Oncological imaging requires optimal depiction of the tumour extent into other structures, e.g. chest wall. This requires a certain amount of CM and some time for enhancement of tumour tissue for best discrimination. Consequences for an optimal scan delay will be discussed.

4. **Additional scans**
   In some situations the standard MSCT scan acquired in supine position in deep inspiration is not the best way to answer the most important clinical questions. Optimal detection of air trapping as a sign of bronchiolitis obliterans (e.g. in patients after bone marrow or lung transplantation) requires additional scans in expiration. Detection of subtle fibrosis (e.g. for diagnosis of asbestos related lung disease) is best done with CT scans in prone position.

**Take home points:**

1. Scan parameters should be adapted to the clinical question for best image quality. A certain diversity of scan protocols for chest CT should be prestored on the scanner and should be well-known to the radiologist.

2. Additional scans in expiration or in prone position can be helpful or even necessary in certain situations.

3. Amount of contrast media and timing of the CT scan should not considered constant when answering different clinical questions.
Dose reduction in thoracic CT

D. Tack

Brussels/BE

Dose reduction in thoracic CT

The assertion that any radiation dose, no matter how small, can cause cancer is the basis for the linear no-threshold theory of radiation carcinogenesis. However, some health scientists consider the cancer risk from low-dose radiations as used in clinical practice for diagnostic procedures as being grossly exaggerated or even negligible. The European Commission has published precautionary measures in order to limit the radiation dose, in particular from CT, because the dose by a chest CT may be 100 times higher than that by a CRX. The influence of CT parameters (number of detector-rows, beam collimation, KVp, mAs, pitch, CTDIw), of patients parameters (height, weight, body mass index, age, gender, and underlying conditions) as well as of radiologist-dependant parameters on the effective dose are presented. Radiation dose levels from typical standard CT protocols with single and multislice technique are compared to those of a CRX. Low-dose HRCT and multislice CT protocols enable to reduce the radiation per examination by a factor of 10 as compared to standard acquisitions, mainly by decreasing the mAs or by increasing the pitch. Potential benefit in dose reduction by the use of low KVp is presented. Newly developed automatic dose reduction systems are promising because they adapt the tube conditions to the patient’s geometry. Distinction has to be made between the radiation dose delivered to one single individual and the collective radiation dose because the effect of diagnostic strategies on the individual and the collective doses may be opposite.

Take home points:

1. To understand the characteristics and limitations of the linear no threshold theory for calculation of cancer risks from low dose radiations, and to become familiar with the resulting EC for chest CT.
2. To learn how CT and biometric parameters influence the effective radiation dose; to compare the radiation dose of standard multislice CT and low-dose multislice CT protocols with the doses delivered by other imaging modalities of the chest.
3. To learn how to decrease the radiation dose with multislice CT; to point out unsolved questions regarding the optimization of CT protocols and parameters for reducing the radiation dose.
Multislice CT – The clinical utility of post-processing

Problem: Increased z-axis resolution with near-isotropic 3D data causes enormous amounts of data. To manage the huge amount of information, reading techniques must be used to simplify the understanding both for the radiologist and the referring clinician.

2D approach: The basic principle is to scan once, producing high-noise small voxels (<=1mm) that are then used to get the information for all needs, such as HRCT, thicker low-noise soft tissue slices of 5 mm (and for any type of postprocessing). Beside axial views, multiplanar reconstruction (MPR) is used to show any oblique/curved planes. Viewing by fast/cine tile and/or stack presentation is more and more replacing the single image analysis.

3D approach: These techniques show 3D information in 2D images, i.e. they present data that are not available in one real plane. The principles of maximal intensity projection (MIP), minimal intensity projection (mIP), surface shaded display (SSD), volume rendering (VR), virtual endoscopy (VE) and of perspective stereoscopic viewing (PSV) will be explained and their application in the chest will be demonstrated.

Quantitative methods: The most important methods to evaluate morphologic and functional aspects of chest disease quantitatively will be presented.

Take home points:
1. There is a paradigm shift from 2D to 3D, from film reading to interactive workstation analysis
2. Use 2D and 3D postprocessing to overcome the enormous amount of data
3. An adequate scanning protocol is the prerequisite for clinically useful postprocessing

The most important articles published in the period 2003–2006:

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. CT imaging in 2006 means 3D analysis
2. Scan small voxels, analyse thicker ones
Functional insights into lung and airway diseases using CT

The single figures of individual PFT results do not reflect regional differences in disease severity, and pathologic processes that tend to counteract each other are not reflected. Blood gases do not detect regional impairment of lung perfusion or ventilation that induces compensatory changes on oxymetric uptake. FEV1 is affected by many factors including the size and elastic properties of the lung, bronchial calibre and collapsibility of the airway wall. MDCT provides an accurate high resolution assessment of airway and lung disease at a regional level. Development of new postprocessing techniques contributes to quantitative assessment of lung volumes, airway dimensions, and extent of lung disease. Isotropic data sets offer the advantage to provide multiplanar reformation of high quality and accurate assessment of the airways. Using low dose over the entire thorax during continuous forced expiratory maneuver, MDCT provides an exhaustive assessment of air trapping and airway collapse. Precise volumetric measurements of the lung parenchyma are obtained by combining lung extraction software techniques with spirometrically controlled CT acquisition, such that the exact physiologic state of lung inflation is known at the time of the CT volume acquisition. Objective quantification of emphysema and air trapping is obtained by density thresholding techniques to volumetric data with a regional mapping on 2D and 3D images. Quantitative assessment of the airways, segmentation and measures of airway lumen and wall areas are obtained automatically on airway cross section in a plane perpendicular its central axis.

In asthma, the ability to follow up bronchial reactivity and lung attenuation at expiration over time in cohorts of patients receiving different treatments can provide an independent tool to assess and monitoring current and new therapies. Bronchial wall area measured at CT is related to the duration and severity of the disease, and reflects the degree of smooth muscle hypertrophy and hyperplasia (airway wall remodelling). Irreversible air trapping reflects remodelling in small airways.

In COPD patients, MDCT provides ability to separate airway predominant from parenchymal predominant pathology. In patients with sarcoidosis and airflow obstruction, MDCT may characterize airway wall involvement that is related to further therapeutic response.

Take home points:
1. CT analysis of airway dimension in asthmatics provides additional data that derived from traditional measures of lung function.
2. CT may be a more sensitive input in clinical trials, and ultimately in a clinical management of individual asthmatic or COPD patients.
3. Because important questions remain to be answered in obstructive lung diseases, the use of CT in such setting seems justified.

The most important articles published in the period 2003–2006:
2. de Jong PA, Muller NL, Pare PD, Coxson HO. Computed tomographic imaging of the airways: relationship to structure and function. Eur Respir J 2005; 26:140–152

The most important statements concerning the subject of the lecture in the year 2005/2006:
1. Technical advances in computed tomography allow the assessment of airway wall dimensions, and are ideally suited for the noninvasive investigation of the pathogenesis of airway wall remodelling and the evaluation of new therapeutic interventions.
2. Relative lung areas with attenuation coefficients lower than –960 or –970 HU and 1st percentile are valid indexes to quantify pulmonary emphysema on multidetector row CT scans.
3. CT measurements of airway dimensions at CT could be used to estimate the dimensions of the small conducting airways, which are the site of airway obstruction in COPD.
4. Excess of tissue inhibitor of metalloproteinase-1 may have a pathogenic role in airway wall thickening in asthmatic patients which may result in chronic airflow obstruction.
MR-Perfusion of the Lungs

Background
Pulmonary perfusion is one of the fundamental parameter of lung function. There are several motivations for a better knowledge of the regional perfusion of the lung including a better understanding of the physiological and pathophysiological processes involved in gas exchange as well as additional functional information for the diagnosis, treatment planning and monitoring of lung diseases.

Technique
Latest hard- and software of MR scanners allows for fast 3D data acquisition of the pulmonary perfusion. With these improvements MRI facilitates a higher spatial and temporal resolution than radionuclide methods. The basic principle of contrast-enhanced perfusion MRI is a dynamic MR image acquisition following an intravenous bolus injection of a paramagnetic contrast agent to visualize the peak enhancement of the lung parenchyma. Post processing is done by subtraction or correlation analysis. Quantification is feasible by applying single value deconvolution (SVD) analysis and the indicator dilution theory.

Physiological and clinical applications
Perfusion MRI demonstrates physiological differences of regional lung perfusion between inspiration and expiration, normoxia and hypoxia as well as a gravity dependent gradient. Clinically, vascular diseases such as pulmonary embolism, lead to perfusion defects which are easily detected by visual analysis. Airway diseases, such as COPD, asthma or cystic fibrosis, result in perfusion defects due to hypoxic vasoconstriction or distortion of the lung parenchyma. Perfusion MRI is an important complement to MR angiography for the detection of pulmonary embolism as well as the differential diagnosis of pulmonary arterial hypertension. Perfusion MRI is also useful in the clinical assessment of lung function using perfusion as a surrogate, especially to predict the postoperative lung function. Quantification of pulmonary perfusion is possible and results in different parameters like pulmonary blood flow, blood volume and mean transit time. Those parameters can be used for the follow-up and monitoring of therapeutic effects in various lung diseases (like effectiveness of inhalation therapy).

Conclusions
Contrast-enhanced perfusion MRI is a simple and robust technique providing 3D images of lung perfusion. In addition to the analysis of physiological and pathophysiological processes quantitative perfusion MRI offers valuable information for the diagnosis, follow-up and treatment monitoring of various lung diseases.

Take home points:
1. Assessment of contrast-enhanced 3D MR perfusion datasets of the lung is feasible
2. Typical perfusion pattern allow for comprehensive diagnosis of pulmonary disease
3. Quantification of MR perfusion offers valuable information for follow-up and treatment monitoring

The most important articles published in the period 2003 – 2006:
Clinical Hyperpolarized 3-Helium MR Imaging of the Lung

Lung imaging has traditionally relied on morphologic imaging, and computed tomography has been the main modality in this respect.

Since 1994, hyperpolarized noble gas MR imaging has been developed with an aim of increasing functional information of the lung, without the need for ionizing radiation. This has resulted in several techniques that are being applied in clinical studies: ventilation distribution imaging, imaging of small airspaces using diffusion imaging (ADC), imaging of gas flow into the lungs (dynamic, spirometric MRI) and imaging of partial oxygen pressures and oxygen uptake in the lung regions (derived V/Q).

Several studies have now shown where these techniques may be helpful, including imaging of emphysema, asthma and various genetic diseases, such as alpha-1-antitrypsin deficiency and cystic fibrosis. Others areas, such as the use of this information for planning of radiotherapy in lung cancer, are also being investigated.

This presentation will demonstrate the background of the techniques and their clinical application thus far.

Take home points:
1. To learn the physical backgrounds of hyperpolarized 3-Helium MRI.
2. To learn the four basic techniques and their derived information.
3. To learn about potential clinical applications of these techniques in relation to other imaging modalities.
EUROPEAN SOCIETY OF THORACIC IMAGING
14th Annual Meeting, Prague, June 9–11, 2006

FILM READING SESSION

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Case 1

Mario Maffessanti
Case 7

Lawrence R. Goodman
Case 8

Day 1

Nestor Müller
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The relationship between target heart rate and ischemia in myocardial perfusion imaging using stress protocol of Treadmill exercise

Background: Treadmill exercise (ETT) is one of the most helpful diagnostic tools in the field of cardiology. It has been used frequently as one of the main stress protocols and the best physiological stress technique for scintigraphic assessment of ischemia and myocardial perfusion imaging (MPI). However, it has been postulated that if patients fail to achieve their age-predicted target heart rate (THR), the electrocardiographic changes following ETT stress and also scintigraphic results of this stress protocol for MPI are unreliable. We decided to assess the ability of submaximal ETT in provoking ischemia as determined by MPI.

Methodology: One hundred and nine patients (60 F, 49 M) were prospectively assessed with MPI after stress protocol of ETT. Patients were advised to discontinue Beta blockers and nitrates before test. 49 patients failed to attain THR (due to fatigue, breathlessness or other causes). MPI was performed based on the 1-day protocol, using Tc-sestamibi.

Results: 60 patients attained THR, of which 28 patients (46.7%) had normal myocardial perfusion pattern and 32 patients (53.3%) had scintigraphic evidences of ischemia. The remaining 49 patients had submaximal ETT, of which 15 patients (30.6%) had normal MPI and 34 patients (69.4%) had scintigraphic evidences of ischemia. The prevalence of ischemia was significantly higher in those patients with submaximal ETT (P < 0.01).

Conclusion: Based on our study results, ischemia was more common in patients who had performed a sub-maximal ETT. It could be a logical hypothesis that ischemic heart disease limits the ability of patients to complete ETT and therefore, it would not be judged that submaximal ETT is always insufficient for MPI. In these settings, it could be possible to administer the radiopharmaceutical in the peak heart rate even if the patient fails to attain their THR.
**Value of MR-phase-contrast flow measurements for functional assessment of pulmonary arterial hypertension**

**Objective:** The goals of our study were to compare the pulmonary hemodynamics between healthy volunteers and patients with pulmonary arterial hypertension (PAH) and to correlate MR phase-contrast flow measurements with echocardiography.

**Material and Methods:** 25 patients with PAH and 25 healthy volunteers were examined at 1.5T MRI (Magnetom Symphony, Siemens). Phase-contrast flow measurements were performed in the ascending aorta, pulmonary trunk, left and right pulmonary artery resulting in the following parameters: peak velocity [cm/sec], average blood flow [L/min], velocity rise gradient, time to peak velocity [msec], velocity rise gradient, and the pulmonary distensibility [cm²]. The bronchosystemic shunt was calculated. In PAH patients echocardiography served as gold standard.

**Results:** In comparison to the volunteers the PAH patients showed significantly reduced pulmonary velocities (p = 0.002), blood flow (p = 0.002) and pulmonary distensibility (p = 0.008). In patients the time to peak velocity was shorter (p < 0.001), and the velocity rise gradient was steeper (p = 0.002) than in volunteers. While in volunteers the peak velocity in the aorta was reached earlier, it was reverse in patients. Patients showed a significant bronchosystemic shunt (p = 0.014). No correlations could be established between MRI measurements and echocardiography.

**Conclusion:** MRI is a feasible technique for differentiation between PAH and volunteers. Further studies have to be conducted for absolute calculation of pressure estimates.

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**Noninvasive estimation of pulmonary vascular resistance (PVR) and pulmonary arterial pressure (PAP) in pulmonary arterial hypertension (PAH) by MRI**

**Objectives:** To estimate non-invasively functional and prognostic parameters of the pulmonary circulation in PAH by MRI

**Methods:** We report our initial experience of 9 patients (6 female, 3 male, median age 49 years, range 25-68) with PAH: median PVR was 826 dyne*s/cm⁵ (range 300-1403 dyne*s/cm⁵), median PAP was 51 mmHg (range 36-63 mmHg). All patients were studied by both right heart catheterisation and MRI. MRI included morphologic imaging (HASTE dark blood), TRUFISP cine sequences, pulmonary flow quantification by phase contrast MRI, and 3D-MR contrast-enhanced angiography. The MRI results obtained by a blinded reader were correlated with PVR and mean PAP values obtained by invasive measurement.

**Results:** Cardiac output based on pulmonary flow measurements correlated with PVR (r = 0.79) and with PAP (r = 0.81). Cardiac output based on right ventricular volume measurements (CORV) correlated with PVR (r = 0.85; CORV = -0.0032 PVR + 6.265) and with PAP (r = 0.71).

**Conclusion:** Non-invasive MRI estimation of PVR and PAP in patients with PAH is feasible. Two different and independent semi-quantitative MRI techniques correlate with clinically important prognostic parameters of the pulmonary circulation; this may mean robustness of the MRI technique. Further consolidation of these results is needed.
Assessment of Pulmonary perfusion by MR in patients suffering from pulmonary arterial hypertension (PAH) in comparison to healthy volunteers

**Purpose:** The peripheral pulmonary arteries are pathologically changed in patients suffering from PAH. Aim of this study was to evaluate if these changes can be assessed by quantitative 3D-MR-perfusion techniques.

**Material and Methods:** 5 volunteers and 20 PAH patients (NYHA class 3-4) were examined using a 1.5T MRI. Measurement of pulmonary perfusion was done in inspiratory breathhold (FLASH3D; 3.5 x 1.9 x 4 mm³; each TA 1.5 s). Injection of contrast media (0.1 mmol Gd-DTPA/kg BW) and image acquisition were started simultaneously. Evaluation of 3D-perfusion was done using single-value-decomposition technique (in-house written software). Lung borders were outlined manually. Each lung volume was divided into 3 regions (ventral, middle, dorsal), and the following parameters were assessed: Time-to-Peak, blood-flow, blood-volume, mean-transit-time.

**Results:** In both populations, a ventral to dorsal gradient was present with higher blood-flow and volume in the dorsal regions of the lung. A significant difference (p < 0.05) between volunteers and patients was found for time-to-peak (12 vs. 16 s) and mean-transit-time (4 vs. 6 s) in the dorsal regions. Blood-flow and volume were lower in patients than in volunteers (i.e. dorsal regions: 180 vs. 124 ml/100 ml/min and 12 vs. 10 ml/100 ml), but failed to be significantly different. The relation between blood-flow and volume in the dorsal regions compared to the middle and ventral regions showed no difference between both groups.

**Conclusion:** PAH leads to a significant increase of the mean transit time of blood through the pulmonary vascular bed. However, significant differences were neither observed for blood-flow and volume nor a vertical shift in pulmonary blood distribution.

16-MDCT angiography coronary artery in the emergency department for patients with acute coronary syndrome (NSTEMI-UA)

**Aim:** The diagnosis of acute coronary syndrome (ACS), especially non-ST-elevation myocardial infarction and unstable angina (NSTEMI and UA) in the emergency department (ED) still remains a challenge. The aim of our prospected study was to investigate the image quality and the diagnostic accuracy of 16-MDCT coronary angiography in detecting coronary artery lesion in patients with suspected ACS (NSTEMI-UA) presented in ED.

**Material and Methods:** We studied with 16-MDCT (Sensation 16, Siemens, Forchheim, Germany) and coronary angiography 37 patients with the following inclusion criteria: (1) chest pain compatible with myocardial ischemia, (2) normal or no-diagnostic ECG changes, (3) and initial concentrations of serum troponin-I < 1 ng/ml. The 16-MDCT was performed with electrocardiographically-gated technique after the intravenous administration of 90–100 ml of iodinated contrast material followed by a saline bolus. The scan parameters were: 120 kV, 650-720 mAs, 16x0.75mm collimation, 0.42 s rotation time, 3mm (pitch 0.25) feed/rot, B30f kernel. We evaluated for each patient: (1) image quality and different type of artefacts, (2) plaques identification and characterization; we considered hard, mixt and soft plaques when the CT density of the plaques were > 85HU, between 85 and 40HU and < 40HU, respectively.

**Results:** The data evaluation of the image quality was based on a total of 453 segments, of which 415 segments (92.2 %) were considered to have diagnostic image quality. MDCT correctly detected 15 patients with at least 1 stenosis > 50% and correctly ruled out significant coronary artery disease in 19 patients with 1 FP and 2 FN; sensitivity 88 %, specificity 95 %, PPV 94 %, NPV 90 %. The plaques were hard in 6 cases, mixt in 16 cases and soft in 14 cases, respectively.

**Conclusion:** Our results point-out that 16-MDCT in ED has the real ability to detect and ruled out significant coronary stenoses in patients with ACS (NSTEMI-UA).
Assessment of a new MRI-Scoring-System for Pulmonary Changes in Patients with Cystic Fibrosis (CF) – Comparison to established CT- and Chest-X-Ray-Scoring-Systems

**Objectives:** CF patients need repeated chest imaging for follow up and therapy control. Chest-x-ray is the standard modality complemented by CT if required. CF patients show a continuously rising life expectancy. Consequently, MRI as a radiation free imaging modality also providing functional imaging data is attractive. The value of a MRI–scoring-system for pulmonary changes in comparison to established CT- and chest-x-ray-scoring-systems is assessed.

**Methods:** 31 CF patients (18f, 12m; mean age 16.9 years) with stable lung disease were examined by morphological MRI (31 pat.): HASTE, coronal and transversal orientation (TR/TE/TA: 600 ms/28 ms/18 s, slice thickness 6 mm, inspiratory breath hold); CT (29 pat.): 120 kV, dose modulated mAs, 1 mm collimation, pitch 1, 0.5 s rot. time, inspiratory breath hold, 1 mm reconstruction; chest-x-ray (21 pat.) within 4 weeks from the MRI. The images were evaluated by 4 experienced chest radiologists in consensus using a modified Chrispin Norman-Score for chest-x-ray, and a modified Helbich-Score for CT and MRI. For data analysis the median scores as well as Pearson correlation coefficients were calculated.

**Results:** The maximal possible score for MRI and CT was 25. The median MRI and CT scores were 13 (min 3, max 21) respectively 14 (min 6, max 20). The maximal possible score for chest-x-ray was 34. The median chest-x-ray score was 14 (min 5, max 32).

Pearson correlation coefficient: MRI and CT = 0.84; MRI and chest-x-ray = 0.62; chest-x-ray and CT = 0.72.

**Conclusion:** Morphological MRI of the lung in CF patients shows comparable results to volumetric CT. It is a highly promising radiation free method for the initial assessment of CF lung changes as well as for follow-up studies. Furthermore MRI is capable of functional lung imaging, making it even more important.

Correlation of IL-1, IL-4, IL-12, IL-1RA and IL-4RA cytokine gene polymorphisms and HRCT score in patients with idiopathic pulmonary fibrosis

**Objectives:** Idiopathic pulmonary fibrosis (IPF) is a serious disease with unknown etiology. An influence of cytokine gene polymorphisms in etiology and pathogenesis of the disease is supposed. We have used high resolution computed tomography (HRCT) as a marker of disease stage and progressibility and compared the alveolar and interstitial score with IL-1, IL-4, IL-12, IL-1RA and IL-4RA cytokine gene polymorphisms.

**Methods:** The IPF patients were all Caucasians from the Czech Republic and consisted of 20 female and 10 male, with a mean age of 65.4 years, range 36-85. The HRCT results were evaluated by experienced viewer using the interstitial and alveolar score scales, which were based on the IPF HRCT description system of Gay et al. We evaluated the polymorphisms of cytokine genes utilizing a PCR with sequence-specific primers method.

**Results:** The HRCT alveolar score was more pronounced in IL-4 RA (+1902) AG heterozygotes. The HRCT interstitial score was less severe in the IL-12 (-1188) AA homozygotes. According to progressibility of HRCT interstitial score, the CC homozygosity at IL-1 RA (mspa 1 11100), the AA homozygosity at IL-4 RA (+1902) and CC homozygosity at IL-4(+33) positions were more frequent in patients with stable disease compared to that with progressive disease.

**Conclusion:** We suppose that the polymorphisms of IL-4, IL-4RA, IL-1RA and IL-12 genes (genes with regulatory activity) could influence the phenotype of the Idiopathic pulmonary fibrosis represented by the measurable HRCT extention scores.
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Pulmonary Wegener’s Granulomatosis: Airways involvement on Inspiratory and Expiratory HRCT

Objectives: To examine possible involvement of the airways in Pulmonary Wegener’s Granulomatosis (PWG) employing inspiratory and expiratory HRCT.

Material and Methods: The study comprised eleven consecutive patients (6F/5M) with histologically proven Wegener’s Granulomatosis undergoing HRCT, at inspiration and expiration. Two patients were former smokers.

Results: Bronchial and/or bronchiolar involvement was detected in 6 pt in the form of wall thickening (n = 3), bronchiectasis (n = 2), bronchiolectasis (n = 2), tree-in-bud (n = 3). Air-trapping (AT) was present in 5/11pt. In one patient (no smoker), with no abnormalities on inspiration, AT was the only finding on expiration. Other imaging findings included: cavitary masses (n = 5), cavitary nodules (n = 3), solitary nodules (n = 7), consolidations (n = 4), ground-glass opacities (n = 6), honeycombing (n = 2), thickening of interlobular septa (n = 2), vascular thickening (n = 2), parenchymal bands (n = 5), pleural effusion (n = 2) and reduction of lung volume (n = 3). The lesions were mainly distributed in middle (6/11) and lower (10/11) lung fields with sparing of ventral lung areas (10/11) and the upper lung fields (10/11).

Conclusion: AT should be added in the spectrum of HRCT findings in PWG. HRCT imaging findings including AT, bronchial wall thickening, bronchiectasis, bronchiolectasis and tree-in-bud, suggested involvement of the airways in PWG.

BELVEDERE HALL

PULMONARY EMBOLISM 14:00 – 14:48

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Relationship of parenchymal and pleural abnormalities with the presence and severity of acute pulmonary embolism: comparison with findings in patients without embolism

Objective: To compare the frequencies of pleural and parenchymal abnormalities in patients with and without acute pulmonary embolism (PE) detected at helical computed tomography (CT), and to investigate whether the pleuroparenchymal findings correlate with the severity of PE.

Methods: We reviewed contrast-enhanced dual-slice helical CT scans acquired in 100 patients suspected of having acute PE. The presence of filling defects consistent with central or peripheral PE was recorded. In patients with PE, the CT severity index was calculated using Qanadli and Mastora scores. The parenchymal abnormalities were recorded using bronchopulmonary nomenclature. The number of wedge-shaped opacities, nodules and masses were counted. The severity of atelectasis, consolidation and ground glass attenuation was assessed based on the percentage of involvement. The presence, size and location of pleural effusions were recorded.

Results: Thirty-eight (38 %) patients had CT evidence of PE. The mean degree of obstruction of the pulmonary arterial bed was 25.1 ± 19.8 %, and 16.2 ± 15 % according to Qanadli and Mastora scores respectively. Pleural effusions were seen in 23 (60.5 %) patients with PE and 33 (52.6 %) patients without PE (p > 0.05). Parenchymal abnormalities were seen in 36 (94.7 %) patients with PE and 52 (83.9 %) patients without PE (p > 0.05). Atelectasis, the most common finding, was present in 21 (60 %) patients with PE and 31 (54.4 %) patients without PE (p > 0.05). The peripheral wedge-shaped opacity and consolidation observed in 14 (36.8 %) and 16 (42 %) patients with PE respectively, and both achieved a statistical significance (p = 0.001). No parenchymal abnormalities showed significant correlation with the severity of PE.

Conclusion: Wedge-shaped opacities and consolidation are significantly associated with PE. Other parenchymal and pleural findings at CT do not correlate with the presence and severity of PE.
**Prognostic factors in the resolution of acute pulmonary embolism**

**Objective:** To evaluate the effect of several potential factors on the resolution of pulmonary emboli, in patients with acute pulmonary embolism (APE), during the first two weeks.

**Methods:** Submassive APE was identified with spiral Computed Tomographic Pulmonary Angiography (CTPA) in 43 patients. Seventeen patients underwent a repeat CTPA at 2 weeks follow-up after the initiation of anticoagulant therapy. Potential parameters studied were: initial CTPA obstruction index (CTPAOI) derived on the basis of embolus size and location, initial blood gas values (BGVs) including PaO₂, PaCO₂, SaO₂ and P(A-a)O₂, age, sex and other laboratory data. Interval changes of these variables between the initial and the follow-up CTPA were analyzed using a t-paired test with a statistical significant at p<0.05. Linear regression analysis was performed, in order to develop a mathematical model to predict the 15 days CTPAOI.

**Results:**

The initial CTPAOI (mean ± SD, 55.7 ± 24%) vs CTPAOI at 15 days (23.0 ± 20.8%, t = 8.7) and initial BGVs (PaO₂: 63.8 ± 15.7 mmHg, PaCO₂: 32.3 ± 5.7 mmHg, SaO₂: 90 ± 10.7 % and P(A-a)O₂: 45.7 ± 19.6) vs the values at 15th day (PaO₂: 76.8 ± 9.9 mmHg, PaCO₂: 37 ± 3.8 mmHg, SaO₂: 95.3 ± 1.8 % and P(A-a)O₂: 26.4 ± 8) were statistically significant (p < 0.05). Furthermore, we found that the initial CTPAOI and sex are the variables that can predict the 15 days CTPAOI in our patients with a satisfactory correlation (r = 0.87 and p < 0.05).

**Conclusion:** Both the CTPAOI and the BGVs were significantly improved at the 15 days follow-up study. The CTPAOI at 15 days is influenced mainly by the initial CTPAOI and sex.

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**Computer-aided detection of pulmonary embolism. Assessment of sensitivity with regard to vessel segments.**

**Objectives:** To assess the sensitivity of a CAD software prototype for the detection of pulmonary embolism in routinely acquired MDCT chest examination with regard to vessel level.

**Methods:** 35 patients were included who were referred to the radiology department for suspected pulmonary embolism. MDCT chest examinations of the thorax were acquired at a 16-slice MDCT (Sensation 16, Siemens Medical Solutions, Forchheim, Germany) scanner to rule out PE. A standard PE protocol was applied 120 kV, 100 mAseff., 16 x 0.75 mm collimation, 1 mm slice thickness with 0.8 mm increment, 100 ml i.v. contrast media with a bolus tracking at pulmonary trunk was applied. All cases were read by two radiologists to assess the standard of reference. All thrombi were marked at each vessel level. A CAD prototype software (Siemens Medical, Malvern, PA, US) was applied to the datasets and each marker of the software was analyzed with regard to vessel segment (lobar, segmental, subsegmental) and judged as true positive or false positive findings. Sensitivity for the different vessel levels was assessed.

**Results:** 22 patients were positive for PE. 13 patients did not have PE. In 22 patients a total number of 177 thrombi were found by the consensus panel. The CAD software had an overall sensitivity of 81 %. The median false positive rate per case was 3. At the subsegmental level sensitivity was 68 % per case and 82 % overall. At the segmental level sensitivity was 84 % per case and overall 85 %. At the lobar level the sensitivity was 100 %.

**Conclusion:** Computer-aided detection of pulmonary embolism reveals a very high sensitivity with regard to vessel level and a very low false positive rate. Especially at the subsegmental level a high sensitivity is mandatory as small subtle emboli could be missed by the radiologist during daily routine work.
Audit of investigation of pulmonary embolism: Final diagnoses after CT pulmonary angiogram

Objectives
1. Verify new hospital imaging pathway for pulmonary embolism after the introduction of CT pulmonary angiography.
2. Determine the frequency of alternative chest pathology at CTPA that would explain the patients’ presenting symptoms.

Method:
Data was collected on all patients being investigated for acute pulmonary embolism at our hospital from 01/02/2004 until 12/07/2005.
Pre-test probability, first line investigation (perfusion scan or CTPA) and final diagnosis on CTPA were recorded. Final diagnosis was categorised into normal, infection, cardiac failure and other.

Results:
782 CTPA scans were performed during the specified time and 206/782 (26%) patients were found to have PE. 576/782 (74%) were negative for PE and included in the audit. Of these, 336/576 (58%) had perfusion scan, 240/576 (42%) had CTPA as first line investigation.
In patients without PE, CTPA was normal in 113/336 (39.5%) with an initial perfusion scan, 35/240 (14.5%) with initial CTPA.
The commonest alternative diagnoses were infection (96/336 [29%] with initial perfusion scan and 102/240 [42%] with initial CTPA) and cardiac failure (18/336 [5%] perfusion scan and 35/240 [14.5%] CTPA as first line investigation).
33/576 (6%) patients were found to have primary or secondary lung malignancy; 10/336 (3%) with perfusion and 23/240 (9.5%) with CTPA as initial investigation. 11 % of patients with normal chest x-ray had emphysema on CTPA.
The frequency of alternative diagnoses was not affected by the pre-test probability of PE.

Conclusion:
CTPA is valuable not only in excluding PE but in diagnosing alternative pathologies. Perfusion scan only excludes patients from further imaging on the basis of a normal scan. An abnormal perfusion scan is a poor predictor of PE and requires further investigation.

MDCT of the Lung Using Prospective and Retrospective Respiratory Gating in an Animal Experiment

Purpose:
Investigation of prospective (3D) and retrospective (4D) respiratory gating for CT of the lung using two prototype non-contact gating devices in a large animal experiment.

Material and Methods:
Five anesthetized and ventilated healthy pigs underwent 1mm-MDCT with prospective and then with retrospective respiratory gating using two non-contact gating devices – CCD camera and laser sensor device. The output signal of both gating devices was connected to the scanner instead of the ECG gating unit. [1] Quality of inspiratory and expiratory prospective gated CT images was analyzed for sharpness using a 4-point-score (1 - excellent to 4 - severe artifacts). [2] Retrospective gated CT images were reconstructed at every 10 % of the respiratory cycle. Semiautomatic segmentation of all datasets provided lung volume (LV) and MLD.

Results:
[1] While working perfectly well in all cases using CCD, only 60 % of expiratory scans could be performed using laser. All images showed excellent sharpness (CCD vs. laser) for bronchi (1 vs. 1.6), lung fissures (1 vs. 1.1), parenchyma (1 vs. 1.4) and diaphragm (1.4 vs. 1.9), the pericardial lung structures showed minor artifacts (1.8 vs. 2.3). [2] The mean difference of LV between maximum inspiration and expiration was 240 ml vs. 246 ml. The mean difference of MLD between maximum inspiration and expiration was 67 HU vs. 70 HU. The lowest MLD was found at the beginning of the respiratory cycle (0 %) for laser, and at 90 % for CCD.

Conclusion:
[1] "Free-breathing" 3D-CT of the lung using prospective respiratory gating is feasible providing better results for CCD. [2] Retrospective gated 4D-CT acquisition over time allows for retrospective reconstruction of raw data at any point of the respiratory cycle. No differences were found for calculated LV and MLD, while the respiratory cycle was more precisely detected by laser.
Online dose-reduction during CT-fluoroscopy guided chest interventions

**Purpose:** To evaluate the effectiveness of an online dose-reduction system (HandCare™) during CT-fluoroscopy guided interventions.

**Method and Materials:** HandCare™ automatically switches off the X-ray beam at user-selectable scan projections, thus minimizing direct radiation exposure of the patient and the radiologist’s hand during CT-fluoroscopy guided interventions.

To calculate the effective dose, a female Alderson-Rando-Phantom was equipped with thermoluminescent dosimeters (TLD) in 41 different positions with 3 TLD placed in each position. Radiation exposure was performed on a 16-row-MSCT scanner in the CT-fluoroscopy mode (120 kV, 30mA, 1.2x1.2mm collimation), simulating a CT-guided chest intervention. Additionally, the local dose was assessed in 22 locations above the phantom to estimate the radiation exposure to the radiologist’s hand. Effective doses, breast doses, and doses to the radiologist’s hand during CT-fluoroscopy were compared with and without the online dose-reduction. Statistical significance was tested using the student t-test.

**Results:** Using the online dose-reduction the effective dose during CT-fluoroscopy was reduced from 0.249 mSv/s to 0.162 mSv/s (35 %) with a breast-dose reduction from 2.32 mSv/s to 1.22 mSv/s (47 %). The dose to the radiologist’s hand was reduced from 40 mSv/s to 14 mSv/s (65 %). The achieved dose reductions were statistically significant (p < 0.05).

**Conclusions:** Online dose-reduction significantly decreases radiation dose of the patient and the radiologist during CT-fluoroscopy guided interventions.


**Objectives:** To evaluate angiographic and therapeutic aspects of hemoptysis in chronic obstructive pulmonary disease (COPD) patients (pts).

**Methods:** Thirty five pts (33 M, 2 F, age, 34-76 yrs; mean, 57 yrs) with COPD (Gold score: score 0 n = 16; score 1: n = 12; score 2 n = 7), not associated with any other risk factor, have been evaluated for bronchial artery embolization for mild (n = 6), moderate (n = 14) or severe (n = 15) hemoptysis. With exception of one pt showing endobronchial vascular abnormalities, fibroscopy found only inflammation of the mucosa. Active bleeding was documented at fibroscopy on the right lung (n = 20), issuing from the upper (n = 15), middle (n =2) and lower (n = 3) lobe, on the left lung (n = 11), issuing from the upper (n = 7), lower (n = 3) lobe or from the lingula (n = 1) or bilateral (n = 4).

**Results:** Bronchial artery angiography of the bleeding site depicted signs of moderate (n = 18) or severe (n = 10) hypervascularisation in 28 (80 %) pts, and normal bronchial arteries in 7 (20 %), with evidence of abnormal nonbronchial systemic arteries in 5 (14 %). Pts with moderate or severe hypervascularization had one (n = 22) or two (n = 6) dilated bronchial arteries. Dilatation was depicted in ectopic (n = 7) or orthotopic (n = 26) bronchial arteries. No statistical correlation was found between the degree of hypervascularisation and the severity of the COPD. Bleeding was stopped, independently from the severity of hypervascularization, with (a) bronchial artery embolization (n=28) and nonbronchial artery embolization (n = 1) in 29 pts, (b) surgery (n = 3) or vasoconstricting drugs (n = 3), in case of endovascular treatment failure.

**Conclusions:** Asymptomatic smokers (Gold score = 0) have the same probability as pts with severe COPD to suffer from hemoptysis, and endovascular treatment success does not statistically correlate with the degree of the COPD or with the severity of bronchial artery hypervascularization.
Breathe to Needle Tip – A Novel Approach to Biopsy Small Subpleural Pulmonary Lesions

Purpose: Small subpleural pulmonary lesions are difficult to biopsy. While the direct, short needle path has been reported to have a lower rate of pneumothorax, the indirect path traversing more healthy lung provides higher diagnostic yield. We evaluated a novel CT-fluoroscopy guided direct approach to these lesions.

Material and Methods: Between 01/2005 and 03/2006 CT-fluoroscopy guided core biopsies were performed in 22 patients in an ongoing prospective study. The tip of the coaxial needle remains outside the visceral pleura (17 G coaxial needle, 18G Biopsy-gun, 15 or 22 mm needle path). The position of the lesion relative to the needle tip is optimised using CT-fluoroscopy by adjusting the breathing position of the patient. The Biopsy-gun is fired with the needle tip still outside the pleural space. Thus, only the cutting needle is penetrating the pleura and the lesion. Cytological smears are analyzed by a cytopathologist on-site and biopsies are repeated as indicated with the coaxial needle still outside the pleura.

Results: All biopsies were performed by 7 radiologists. A definitive diagnosis was obtained in 20 patients by histology and/or cytology (10 malignant, 10 benign). In one patient only necrotic material could be obtained. In another patient cytology revealed suspicious cells, a definitive diagnosis, however could not be obtained. Median nodule size was 1.6 cm (0.9 cm to 3 cm). A small pneumothorax was in 9 patients, chest tube placement was not required.

Conclusion: The presented approach has a high diagnostic yield. This approach seems to be especially advantageous for biopsies of subpleural lesions in the lower lobes.

CT guided punctures performed with a freehand technique and when using a new needle guiding device – A comparative phantom study.

Purpose: In order to simplify CT guided biopsies and to increase the certainty of reaching the target, a simple device, guiding and supporting the needle, has been constructed. The aim was to evaluate if the new device improves the procedure.

Materials and Methods: The phantom consisted of a ham into which a spherical target, 10 mm in diameter, was implanted. Two different puncturing techniques were used, a freehand technique and punctures performed using the needle guide. Punctures were performed by nine radiologist, 3 experienced CT interventionists, 3 experienced interventionists and 3 young radiologists. All radiologists performed 9 punctures with each technique. The number of needle manipulations necessary as well as the number of control scans during the procedure were recorded.

Results: The number of needle manipulations were significantly less when using the needle guide, 0.15 vs 3.68 manipulations. The number of control scans was almost equal for the two techniques. However, when using a free hand technique the majority of control scans were conducted after the initial puncture while when using the needle guide the majority was before puncture.

Conclusion: When using the needle guide the target was hit with a minimum of needle manipulations.
Purpose: Quantitative evaluation of the lung parenchyma might be impaired or unreliable by use of reduced dose CT protocols. Aim of the study was to define the threshold where reduced dose has significant impact on quantitative emphysema parameters.

Material and Methods: 30 patients suffering from severe centrilobular emphysema underwent MDCT (120 kV, 150 mAs, 1 mm). Original CT raw data were simulated using ten mAs settings (10–100 SIMmAs). Quantitative analysis provided lung volume, emphysema volume (EV), emphysema index (EI), MLD and four emphysema volume classes (class 1-4). Simulated low dose results were compared to original acquisition, given as percent variation. For statistical evaluation between different mAs levels the Sign-Test was used. A variance of EI less than 2 % was defined as "not clinical relevant".

Results: MLD was equal down to 20 SIMmAs. Mean EV was 3.8 ± 1.4 L and differ only up to 3.5 ± 3.2 % from original data. Mean EI was 52 ± 10 % and showed variation up to 3.4 ± 3.4 %. EI showed no clinical relevant variation down to 30 SIMmAs. The large emphysema volume class was significantly different below 50 SIMmAs. The intermediate and small classes showed an over-proportional variation below 50 SIMmAs.

Conclusion: Dose reduction down to 30 SIMmAs is possible for clinical routine. Settings below 50 SIMmAs significantly alter the in-detailed 3D emphysema quantification.

Objectives: The imaging gold standard for the assessment of structural lung changes in patients with Cystic Fibrosis (CF) is CT, scored by different qualitative scoring systems. We investigated whether an automated approach for quantitative evaluation of volumetric CT data sets offers additional information for determination of disease severity.

Methods: 14 CF-patients (7 m, 7 f, median (med) 13 years, range 8–21) underwent volumetric high resolution CT performed for clinical indication and scored by a modified Helbich-Score. Self written software was used for automated detection and segmentation of bronchi. Lumen diameter (LD) and wall thickness (WT) were measured for each bronchial generation.

Results: All 14 volumetric data sets were eligible for automated segmentation and measurement. LD and WT were detected down to the 12th bronchial division. Two patient groups were defined: A: 7 patients, med FEV1 =102 %, MEF25 = 103 %, Helbich score < 9; B: 7 patients med FEV1 = 64 %, MEF25 = 30 %, Helbich score > 9. In group A no correlation was found between CT-score, lung function and LD or WT. In group B a correlation between LD of small generations (5–10) and FEV1 (r = -0.66) and MEF25 (r = 0.56) was found. No significant difference in LD and WT was found between the two groups.

Conclusion: Patients showed comparable LD or WT not reflected by lung function tests or visual CT-score. While lung function assesses forced air flow, the CT-score gives a qualitative but subjective analysis of lung morphology. Thus, complementary aspects of the disease are evaluated. Quantitative assessment might prevent underestimation of disease severity.
Pulmonary nodule detection: evaluation of diagnostic performance using thin axial images, MIP, and CAD

**Purpose:** This study aimed at evaluating the potential diagnostic benefits of MIP images and a commercially available CAD for the detection of small pulmonary nodules as compared with standard 1-mm images, on an early lung cancer screening material.

**Material and methods:** CT were acquired with a 16-row MDCT using 1-mm slices. Thirty subjects were randomly selected from our database. Three radiologists independently reviewed in a random order on a workstation 3 types of images: axial 1-mm images, axial MIP slabs (6-mm); CAD detections (LungCare, NEV VB 10, Siemens). Two independent experienced chest radiologists decided by consensus which were true positive nodules.

**Results:** 285 nodules ≤ 1 mm were identified as true positive. The detection rates of the three independent observers with 1-mm axial images were 22% ± 4.8%, 30% ± 5.3%, and 47% ± 2.8%; with MIP slabs: 33% ± 5.4%, 39% ± 5.7%, and 45% ± 5.8%; and with CAD: 35% ± 5.6%, 36% ± 5.6%, and 36% ± 5.6%. When taking into account the reader effect, sensitivity of MIP images was higher (Two-way ANOVA, p = 0.046). Similar results were obtained for nodules ≤ 3-mm (p < 0.0001). When MIP images were added to 1-mm images, these rates increased to 43% ± 5.8%, 49% ± 9.3%, and 71% ± 9.2% (p < 0.0001). When CAD was added to 1-mm images, these rates were 50% ± 5.8%, 53% ± 5.8%, and 66% ± 5.2% (p < 0.0001).

**Conclusion:** MIP and CAD reduced the number of overlooked small nodules. At least one of these reading techniques should be added to the visualisation of thin axial images for the detection of pulmonary nodules on thin collimation thoracic CT.

Computer-aided volumetry of pulmonary nodules: Accuracy across different scanner technologies: from single-slice spiral CT to 64-slice multidetector-row CT

**Objectives:** To compare the accuracy of computer-aided volumetry of phantom pulmonary nodules across different CT scanner generations from single-slice spiral CT to 64-slice multidetector-row CT (MDCT).

**Methods:** A lung phantom with five different categories of nodules (intraparenchymal, around a vessel, attached to a vessel, pleural, attached to the pleura) was scanned at a single-slice spiral CT (Somatom Emotion), 4-slice MDCT (Somatom Volume Zoom), 16-slice MDCT (Somatom Sensation 16) and 64-slice MDCT (Somatom Sensation 64). Each category comprised of 7–9 nodules each (total nodules: 40) with different sizes (3–10 mm, 13.24 mm³–524.97 mm³). A routine standard dose protocol was performed using the thinnest collimation feasible on each scanner. Image data were reconstructed at the thinnest slice thickness with a reasonable reconstruction increment. Data sets were analyzed with dedicated volumetry software (LungCARE; Siemens). Volumes of all nodules were calculated and compared for different scanners.

**Results:** Using single-slice technology, the smallest nodule in the phantom attached to a vessel (13.24 mm³) could not be evaluated at all. Average relative volume error for all other nodules was 8.4% (SD 7.3%). Average relative volume error was 8.9% (SD 7.2%) for the 4-slice MDCT protocol, 6.6% (SD 9.9%) for the 16-slice MDCT protocol, and 7.4% (SD 8.3%) for the 64-slice MDCT protocol, respectively.

**Conclusion:** Computer-aided volumetry is technically feasible for all scanner types, as volumetry of phantom nodules did not vary significantly for different CT scanners. This offers the potential for follow-up of pulmonary nodules, despite ongoing technical developments.
Detection of metastatic nodules in lungs of the young people by means of low-dose spiral CT (LDSCT).

Objectives: The aim of this study was to evaluate possibility to detect metastatic nodules in young oncological patients with respect to reduce collective dose of radiation by means of LDSCT.

Methods: The study included 67 patients (33 females), average age 12.25 (5 to 24 years), with a suspicion of metastatic nodules of prime tumor in the lungs. For 98 examinations the one-row spiral CT (Somatom AR.Star Siemens, Erlangen, Germany) was used with following parameters: 110 kVp, 63 mAs, 5 mm collimation, 7,0–20,0 mm table feed per rotation, and a 5 mm reconstruction interval. All the CT studies were evaluated by two radiologists independently. Comparatively the morphological taxonomy of the nodules was applied by means of the CAD. The dose of ionizing radiation was determined by the standard whole-body fantom and the integrated metering system Radcal 9010 with collecting tube 10X5-3CT.

Results: Metastatic tumorous lung nodules were depicted in 17 patients. There were 50 patients without nodules in the lungs, 8 with one nodule and 9 with two or more nodules with diameter more than 3 mm. The results were reproducible, accurate, confirmed by the next clinical results. The algorithm trying to detect nodules by the automatic detector demonstrated the 100 % sensitivity, but low specificity. CT dose index 100 (CTDI 100) was for our LDSCT protocol 4,128 mGy for standard CT of lung is average 6,033 mGy).

Conclusion: The technique of the one-row LDSCT could reduce the collective dose of ionizing radiation without reduce of the quality of examination. Therefore this technique seems to be acceptable for the routine examination. The automatic detection and classification of nodules should be improved in the next steps of the study.

The study was supported by the the Internal Grant Agency of the Ministry of Health of the Czech Republic No.NR/8314-3.

Computer-aided detection system in the identification of lung nodules: performance at different threshold values

Objectives: To test out the performance of a computer-aided detection system (CAD) in the identification of lung nodules using different threshold values.

Methods: 20 Multidetector CT scans of the chest (slice thickness 0.6 mm, pitch 13.75, 50 mAs and 120 kV) in a screening population were retrospectively reviewed by a thoracic radiologist using a CAD system (LungVCAR, GE Healthcare). The reader identified lung nodules among all positive findings automatically marked at two different threshold values of nodule minimum size (2 and 4 mm) and registered each nodule diameter.

A second blinded session of reading was performed by two chest-radiologists who reviewed all images in consensus with CAD without setting any threshold and represented the standard of reference.

Results: 56 lung nodules were identified by the standard of reference. At threshold value of 2 mm 63 nodules were detected, with 47 findings correctly recognized as lung nodules, 16 false positive and 9 false negative results (sensitivity 83 %). At 4 mm 21 findings were correctly identified as lung nodules with no false positive and 35 false negative results (sensitivity 37.5 %). Mean diameters of nodules identified at 2 mm and 4 mm were respectively 3.9 mm and 5 mm. 26 of 35 false negative (74 %) not marked at 4 mm had a diameter less or equal than 4 mm.

Conclusions: Using a CAD system with a lower threshold set, the sensitivity resulted good but the false positive nodules seems to increase. At higher threshold set most of the missed lung nodules had a diameter less or equal than 4 mm, which could be significant in patients with neoplastic risk or known neoplasm. In these clinical settings a lower threshold value should be used.
CAD detection of early lung cancer – performance in conventional dose CT compared with low dose CT of the thorax

**Purpose:** Assessment of computer-aided detection (CAD) software performance in detection of small, biopsy proven lung cancers from a lung cancer-screening program compared with those found on conventional, diagnostic MDCT of the thorax.

**Methods and Materials:** Twenty-seven multi-detector row CTs of the thorax with small biopsy proven lung cancers were collected; 16 cases from a low-dose CT lung cancer screening program (size range 7–19 mm, median diameter 15.5 mm, 10/16 solid) and 11 detected as indeterminate or suspicious nodules on conventional body CT (size range 7–23 mm, median diameter 18 mm, 11/11 solid). Donor institutions provided reference truth coordinates and histological reports for the cancers and the CTs were analysed with commercially available CAD software optimised for detection of spherical, solid nodules 5–20 mm diameter (LungCAD, Medicsight plc, London) using 12 different CAD filter settings.

**Results:** For conventional dose thoracic CT (mA 100–200) CAD detected between 8–9/11 (73–82 %) of cancers while on low-dose CT (mA 40–60) only 3–5/16 (19–31 %) of cancers were detected (p < 0.001). Removal of the non-solid and part-solid cancers in the screening group from the analysis reduced CAD lung cancer detection to 1/9 (11 %) indicating that the CAD algorithm was more affected by mA and noise than by cancer density.

**Conclusion:** The performance of a CAD algorithm for detection of small lung cancers on conventional diagnostic CT varies when applied to low-dose lung screening CT suggesting that optimized algorithms differ according to the clinical scenario.

Impact of massive image noise on emphysema scores provided by the density mask method on multi-slice computed tomography

**Purpose:** To demonstrate the impact of image noise on results of emphysema quantification at multidetector-row computed tomography (CT) scans and to show feasibility of calculating reliable emphysema scores on low-dose scans when applying a noise reduction filter first.

**Material and Methods:** Between March 2003 and May 2004, we enrolled 31 patients (17 men, 14 women; mean age 54 y, range 19–74 y) from the outpatient department of pulmonology referred for non-contrast-enhanced chest CT. All patients underwent standard-dose chest CT (SDCT) (120 kVp, 130 mAs, 16 x 0.75 mm collimation, reconstructed at 1.0 mm) followed by low-dose chest CT (LDCT) (90 kVp, 20 mAs). An automated program calculated emphysema scores (ES) as long volume without a prefixed attenuation threshold as percentage of total lung volume for three thresholds: -910 HU, -930 HU and -950 HU. ES for SDCT and LDCT were compared by paired-samples t-tests. Secondly, ES were performed after applying a noise reduction filter. Results were again compared to results from SDCT using paired-samples t-tests.

**Results:** Mean ES were for LDCTs were significantly higher compared to SDCTs (p < 0.05 for all thresholds). Results for both scans became similar (p > 0.05) after filtering LDCT for image noise.
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**CT esophagography for evaluation of esophageal perforation or rupture**

**Objectives:** To evaluate the usefulness of CT with oral contrast to detect or exclude leakage in patients with suspected esophageal perforation.

**Methods:** Between 2002 and 2005 30 examinations in 20 consecutive patients with suspected esophageal perforations were performed using helical CT with oral contrast. Twelve examinations were performed after endoscopical or surgical treatment of perforation.

The scanning protocol included contiguous 5 mm slices through the thorax before and after intake of oral contrast. All patients received 20-40 ml of an aqueous solution consisting of 20 ml iohexol 140 mg/ml diluted in 20 ml of water.

Findings at endoscopy, surgical exploration or in case of negative CT-findings uneventful clinical follow up was used as reference. 14 patients had perforation or rupture, 2 had persistent leakage after treatment.

4 consultant radiologists and 2 residents in a random order without clinical information reviewed the anonymous examinations. Sensitivity, specificity and influence of radiological training were analysed.

**Results:** The clinical radiological report was correct regarding detection or exclusion of leakage in all cases. The perforation site was located correctly in 15 of the 16 cases with leakage. With knowledge of findings at surgical exploration even the perforation site for the last case could be located on the CT. When excluding the least experienced resident, the pooled sensitivity and specificity was 89 % and 76 % respectively. Positive and negative predictive value was 81 % and 85 % respectively. The most experienced thoracic radiologist diagnosed all 16 perforations and was correct regarding negative findings in 11 of 14 cases. The least experienced resident missed leakage in 6 out of 16 cases.

**Conclusion:** CT esophagography is useful for the evaluation of esophageal perforation both pre- and postoperatively and diagnostic accuracy is improved by training and experience.

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**Feasibility of low-dose computed tomography in follow up of patients with severe emphysema after airway bypass procedure**

**Background and aim:** Lung volume reduction (LVR) surgery is a therapeutic option which has been developed to treat patients with severe emphysema. However, significant morbidity and mortality offsets the advantages of this method. By creating an extraanatomic airway bypass via transbronchial fenestration airway bypass procedure has been shown to improve expiratory flow and reduce dynamic hyperinflation in explanted human lungs and thus could potentially replicate the benefit of LVR surgery. The aim of this study was to evaluate the feasibility of thin-section low-dose multislice computed tomography (MSCT) in the radiological monitoring of patients after the placement of the bronchial stents for airway bypass.

**Methods and Patients:** In a prospective setting, 7 patients (5f, 54–76 years) were examined before (up to 2 weeks) and after (1 day and 1 month) stent placement with low-dose protocol at maximal inspiration in a multrow CT scanner (Philips Mx8000). The exact position of the stents in bronchi was analysed and compared with the bronchoscopic findings, which served as the gold standard.

**Results:** 35 from initially bronchoscopically placed 36 stents were accurately depicted by means of MSCT. In the first postprocedure CT examination 1 stent was dislodged in the main bronchus, 1 was lost in the lung parenchyma. In total, another 3 stents showed inappropriate position in a MSCT and within a few days, they were dislodged. During control bronchoscopy after one month 5 stents could not be identified, but they were in regular position in MSCT. There were 3 occluded stents bronchoscopically, from which two were characterized correctly in MSCT. There were three instances of minor bleeding and one small pneumothorax, which resolved spontaneously.

**Conclusion:** In this preliminary study low-dose MSCT proved useful in monitoring airway bypass procedure and should be routinely performed as additional tool to bronchoscopy.
Impact of oxygen inhalation on pulmonary perfusion: Assessment by MR-Perfusion and – Flow measurements

Purpose: In dyspnoic patients oxygen supply is sometimes needed during MRI studies of the chest. Oxygen enhanced MR-Ventilation imaging of the lung is based on the inhalation of oxygen. However, the effect of oxygen on the pulmonary circulation is unknown. Therefore, the goal of this study was to evaluate the influence of oxygen on the pulmonary perfusion.

Material and Methods: 10 healthy volunteers were examined (1.5T) with contrast enhanced 2D inversion-recovery Turboflash perfusion of the lung parenchyma and phase-contrast flow measurements in the pulmonary trunc. Both measurements were performed breathing room air (RA) and 100 % oxygen (O2).

Results: The perfusion measurements showed a significant difference between the pulmonary blood flow (181 vs. 257 ml/min/100ml, p = 0.02) and blood volume (14 vs. 21 ml/100ml, p = 0.007) between RA and O2. The mean transit time of the contrast bolus was not changed (p = 0.2).

The mean heart rate during flow measurements breathing RA (67 ± 11 beats/min) and O2 (61 ± 12 beats/min) were significant different (p = 0.01).

The average blood flow (pulmonary trunc) was significant lower while breathing O2 (RA: 5.9 vs O2: 5.5 l/min, p = 0.047).

Conclusion: The administration of oxygen during MRI of the lung causes a significant change of the pulmonary blood flow and perfusion. Thus for MR-Perfusion and MR-Flow measurements oxygen should be avoided. In the context of oxygen enhanced MR-Ventilation imaging of the lung the contribution of this effect needs to be further evaluated.

Influence of different ventilation settings in the lung using retrospective respiratory gated 4D-CT in an animal experiment

Purpose: The effect of different ventilation parameters onto the lung parenchyma regarding change of lung volume (LV) and mean lung density (MLD) for the whole lung are not yet investigated. Therefore different ventilation settings in an animal experiment were applied. 4D quantification of LV and MLD was performed using retrospective respiratory gated 4D-CT.

Material and Methods: Five ventilated healthy pigs underwent 1mm 16-row MDCT with retrospective respiratory gating using a non-contact CCD camera as gating device. The device was connected to the scanner instead of the ECG gating unit. All animals were scanned with two tidal volumes of [1] 300 and [2] 450 ml. For each tidal volume 3 different PEEP levels were applied: 0, 5 and 10 cmH2O. All raw data were reconstructed throughout the respiratory cycle in increments of 10%. Semiautomatic segmentation of all 300 datasets provided LV and MLD.

Results: [1] At the tidal volume of 300 ml the inspiratory LV was 1.18, 1.38 and 1.59 L and expiratory LV 0.89, 1.1 and 1.33 L (PEEP 0, 5 and 10).

Between maximum inspiration and expiration the difference of LV was 295, 270 and 255 ml and the difference of MLD was 83, 67 and 47 HU (PEEP 0, 5, 10).

[2] At the tidal volume of 450 ml the inspiratory LV was 1.36, 1.56 and 1.8 l and expiratory LV 0.92, 1.16 and 1.43 L (PEEP 0, 5, 10).

Between maximum inspiration and expiration the difference of LV was 435, 400 and 370 ml and the difference of MLD was 112, 88 and 63 HU (PEEP 0, 5, 10).

Conclusion: The detected tidal volume within the lung is conversely proportional to the adjusted PEEP level. Respiratory gated 4D-CT acquisition using different ventilation setting allows for an in-depth analysis of the effect of mechanical ventilation parameters over time.
Centrilobular ground glass nodules on CT and their significance in pulmonary artery hypertension

Objective: Three recent publications have described the presence of centrilobular glass nodules on thin section CT in patients with pulmonary artery hypertension. The aim of this study was to determine whether the presence and distribution of centrilobular nodules on CT depended on the aetiology of the pulmonary artery hypertension or its severity.

Methods: From the National Pulmonary Hypertension Service database, we identified 8 patients with idiopathic pulmonary arterial hypertension and 20 patients with Eisenmenger syndrome who had also undergone contrast enhanced thin section CT. CT studies were reviewed for the presence of centrilobular ground glass nodules and other pulmonary vascular changes. Haemodynamic data were also reviewed.

Results: Both patients with Eisenmenger syndrome and idiopathic pulmonary arterial hypertension showed the presence of centrilobular ground glass nodules with no significant difference between the 2 patient groups in terms of frequency or distribution. There was no correlation between the frequency of nodules and pulmonary artery pressures.

Conclusion: Patients with Eisenmenger syndrome and idiopathic pulmonary arterial hypertension demonstrate similar pulmonary vascular changes on CT. Centrilobular ground glass nodules are a characteristic feature but their presence do not predict the underlying cause of pulmonary hypertension or its severity.

Prospective comparative study of integrated PET-CT scan versus re-mediastinoscopy in the assessment of residual mediastinal lymph node disease after induction chemotherapy for mediastinoscopy provens

Objective: Mediastinal restaging after induction therapy for non-small cell lung cancer remains a difficult and controversial issue. The goal of this prospective study was to compare the performance of integrated PET-CT and re-mediastinoscopy in the evaluation of mediastinal lymph node metastasis after induction chemotherapy.

Patients and methods: 30 consecutive stage IIIa-N2 NSCLC patients surgically treated at our institution were entered in this prospective study. N2 disease was proven by cervical mediastinoscopy. After completion of induction chemotherapy, the mediastinum was reassessed by integrated PET-CT and re-mediastinoscopy. All patients underwent thoracotomy with attempted complete resection and systematic nodal dissection.

Results: Integrated PET-CT showed no evidence of nodal disease (N0) in 13 patients, N1 disease in 3 patients and residual mediastinal disease (N2) in 14 patients. Re-mediastinoscopy was positive in only 5 patients. In 17 patients, persistent N2 disease was found at thoracotomy. The sensitivity, the specificity and accuracy of integrated PET-CT was 77 %, 92 % and 83 %. For re-mediastinoscopy, the figures were 29 %, 100 % and 60 %. The results for CT alone and PET alone were respectively 59 %, 62 %, 60 % and 71 %, 69 %, 70 %. Sensitivity (P < 0.0001) and accuracy (P = 0.012) were significantly better for integrated PET-CT in comparison with re-mediastinoscopy.

Conclusion: After a thorough staging mediastinoscopy, post induction re-mediastinoscopy had a disappointing sensitivity due to adhesions and fibrosis. Integrated PET-CT yielded a better result than obtained in previous studies with side by side PET and CT images.
Quantitative perfusion measurement in lung cancer: initial experience using a hybrid breath hold and navigator triggered 3D MR sequence

Purpose: MRI provides significant morphological information in the staging of lung cancer. Recently, the treatment has started to focus on anti-angiogenesis therapies. With the advent of motion controlled and fast dynamic sequences, MRI may become a powerful tool for the evaluation of tumor perfusion (TP) in lung cancer. We describe our initial experiences regarding the feasibility of MR lung TP measurements in a clinical setting.

Method and Materials: 53 Patients with suspected lung cancer were examined with morphological and dynamic contrast-enhanced MR. TP was measured with a navigator triggered 3D-FLASH sequence (TR 2.32 ms, TE 0.76 ms, FA 15°). The sequence was initiated in expiratory breath hold with 2.8 s per volume. After 30 s free breathing continued for 3.5 min, being triggered during expiration. ROI-based analysis of TP was performed. Bolus Arrival Time (BAT), Max. relative peak intensity (MPI), Time to Peak (TTP), Max. Slope (MS) and exponential function parameters were computed. Correlation with histology was analyzed with the Student’s-t-test.

Results: This technique allowed for continuous and stable measurements in intrapulmonary lesions over 4 min. with adequate coverage of the washout period. First phase parameters such as BAT showed only moderate correlation to lesion dignity (p < 0.01). MPI and TTP did not differ significantly between benign and malignant lesions. The second phase contributed valuable information. 13/16 cases of adenocarcinoma showed a fast increase in intensity and wash-out. Only 3/16 adenocarcinomas showed accumulation curves, as found in other solid tumors.

Conclusion: The feasibility of lung TP studies with motion triggered 3D-FLASH sequences is demonstrated. Our first results suggest that it can be a valuable addition to morphological imaging based on a multi criteria evaluation, but it cannot predict the dignity of a lesion on its own. The potential of a hybrid 3D perfusion study for monitoring TP in follow-up exams appears to be very high. Corresponding data will be demonstrated.

The clinical utility of ultrasound in detecting malignant pleural disease in the presence of a pleural effusion.

Aim: To prospectively assess the role of ultrasound in demonstrating malignant pleural thickening and differentiating malignant from benign pleural disease in the presence of a pleural effusion.

Method and Materials: 39 consecutive patients referred to radiology for further investigation of a pleural effusion of unknown aetiology were recruited. All patients had a chest ultrasound followed by a contrast enhanced CT. Two independent observers (consultant chest radiologist and fellow in chest radiology) assessed the pleural surfaces on ultrasound using the above mentioned established CT criteria for malignant pleural thickening. Additionally, diaphragmatic thickness/nodularity, pleural effusion size and liver echotexture for hepatic metastasis was recorded. An ultrasound and CT based diagnosis of malignant or benign pleural disease was made. Definitive diagnosis was based on histological/cytological analysis for malignant disease and clinical follow up in benign disease.

Results: Pleural effusions were malignant in 23 patients and benign in 16 patients. Ultrasound correctly diagnosed malignant pleural disease in 18 of the 23 patients (sensitivity 78 %, specificity 94 %, Positive Predictive Value 95 % and Negative Predictive Value 75 %). Benign pleural disease was correctly diagnosed in 15 of the 16 patients (sensitivity 93 %, specificity 78 %, PPV 75 %, NPV 94 %).

Conclusion: Ultrasound is safe, easily accessible and is a reliable test for demonstrating malignant pleural disease. In patients presenting with a pleural effusion ultrasound should be considered the first line investigation of choice with CT reserved for problematic cases where ultrasound has been inconclusive.
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**Cardiac disease**

1. **Left ventricular long axis orientation: a quantitative evaluation using chest X rays, CT and ECG**

   **Purpose:** To quantify the heart rotation in the left chronic overload in comparison with the right chronic overload.
   **Material and methods:** Seventy-five patients (54 women and 21 men) underwent follow up CT examination (16 slices, Siemens Medical Solution). Exclusion criteria were the TEP, acute pulmonary oedema and a density in the pulmonary artery lower than 150 HU. The inclusion criteria were the presence of two of three major criteria for each kind of overload. The major criteria for the right overload were: right/left ventricular short axis ratio > 1; pulmonary artery > 29 mm; pulmonary arteriole/bronchi ratio > 1; whereas for the left overload were: RV/LV ratio < 0.6; ventricular wall thickness > 14 mm; ascending aorta > 40 mm. The axis was defined by the line drawn from the mitral valve, perpendicular to the atrio-ventricular plane, through the apex and a sagittal line. Cardiac anatomical axis was compared electric axis on ECG and with cardiothoracic ratio and aortic knob width on the chest radiograph.
   **Results:** A significant difference was observed between the group of the left (twenty two patients with mean cardiac axis 63°) and the group of right cardiac overload (twentyfour with mean cardiac axis 35°). Twenty nine patients were excluded. All the patients with left cardiac overload presented a significant left deviation of the electric cardiac axis (range 15/-55°) and an increased cardiothoracic index (mean value 0.6). We did not identify a correlation between the electric and anatomical axis in the right overload.
   **Conclusions:** Left cardiac overload induces a rotation that can be observed on ECG, X rays and CT. Right cardiac overload gives important indirect signs on CT examination but not significant anatomical changes of the cardiac axis.

**Infection**

2. **Computed Tomography for Pulmonary Tuberculosis in AIDS Patients: 2 years experience**

   **Purpose:** To determine the radiological features of newly diagnosed pulmonary tuberculosis in human immunodeficiency virus (HIV)-infected patients.
   **Materials and Methods:** 67 HIV-infected patients (eight women, fifty-nine men; age range, 26–56 years; mean age, 38 years) with newly diagnosed tuberculosis between 2000 and 2001 were retrospectively evaluated. Chest radiographs (n = 67) and computed tomography (CT) scans (n = 65) were assessed for lymphadenopathy, pulmonary nodules, focal consolidation, reticular opacities, cavities, and fibrosis. Correlations were solved by SPSS program.
Results: When tuberculosis was diagnosed, 60 patients had pulmonary signs or symptoms — cough and/or shortness of breath, but 17—night sweating and loss of weight. At the time tuberculosis was diagnosed, chest radiographs and chest CT revealed pulmonary signs or symptoms, as follows: reticular opacities (n = 32), pulmonary nodules (n = 58), cavities (n = 12), and focal consolidations (n = 58). Chest CT scans not revealed lymphadenopathy.

Conclusion: The radiological features of newly diagnosed tuberculosis in HIV-infected patients resemble the findings of tuberculosis in non-HIV-infected patients, but the dissimilarities had been finding – focal consolidations were found more frequently on lower lobes (especially 10th segment), pulmonary nodules were found on fibrotic changes, but cavities incidence correlate with previous pulmonary pathologies.

Pulmonary tuberculosis in children: CT findings and indications

Objective: Describe CT findings of pulmonary TB in infected or sick children, and define the CT indications in relation to the thoracic X-ray and PPD results.

Materials and Methods: We performed thoracic CT on 25 under five year-old children who had been in contact with a bacilliferic adult in a day care center. Of the 25, seven were PPD positives with equivocal plain film findings, four PPD negatives with equivocal plain film findings, and 14 PPD positives with normal plain film. A low dosage helical CT with IV contrast was given to all, and they were evaluated by a thoracic radiologist.

Results: Of the 11 children with equivocal plain film findings, the CT results were compatible with TB in eight, two of which were PPD negatives. Of the 14 children with normal plain film and PPD positives, the CT was pathological in eight. The majority of the CT findings were subcarinal, right paratracheal and hilar lymph nodes which were either normal-sized or enlarged, and/or hipodenses with or without peripheral contrast enhancement. Other findings were: lung nodule, lung infiltrated, and mosaic pattern. In 10 of the patients, the diagnosis of TB was suspected only because of the CT.

Conclusion: Affected mediastinal lymph nodes is the most common finding in pulmonary tuberculosis in children, whether they are enlarged or normal-sized, and/or hipodenses with or without peripheral contrast enhancement. A thoracic CT would be advisable for children under five years-old when TB or some of its complications is suspected and thoracic plain film is normal or equivocal.

Complicated pulmonary hydatid cysts: clinical and radiologic findings

Objective: The purpose of this study was to evaluate the clinical and radiologic findings of complicated pulmonary hydatid cyst.

Methods: During a period of about 17 years, from 1988 to 2005, a total of 110 patients with 140 complicated pulmonary hydatid cyst was studied. The study group included 63 women and 47 men with a mean age 37 years (range, 6 to 80 years). Chest radiography and CT were performed in all patients. MRI was also performed in 15 patients. The mainly used operative method was cystotomy (75 %). The segmentectomy and lobectomy were performed in low rates. All patients received antihelmintic treatment in the postoperative periods. Mean follow-up period was 24 months.

Results: Complications of pulmonary hydatid cyst such as rupture (n = 115), infection (n = 35), abscess (n = 8), complex mass simulating necrotic tumor (n = 8), and pleural involvement (n = 7) were presented. 57 patients presented only ruptured pulmonary hydatid cyst, while the remaining 18 were found to have both intact and ruptured cyst. Moreover, 30 patients (31 %) presented hydatid cysts in the liver, spleen and/or kidney. The radiologic and clinic diagnosis of complicated pulmonary hydatid cyst was incorrect in 9 of the 110 patients (8 %). Postoperative complication occurred in 10 patients. One patient died during the surgery due to anaphylactic reaction.

Conclusion: Despite the advances in diagnostic methods, the problems associated with the diagnosis and treatment of complicated pulmonary hydatid cyst are still challenging. Our findings suggested that ruptured pulmonary hydatid cyst should be diagnosed preoperatively to avoid any unnecessary delay in prompt surgical treatment of these complications.

Pulmonary Aspergillosis: The Spectrum of the disease – A Pictorial Review of the Radiology

Objectives: To present a pictorial review of the imaging features of the spectrum of pulmonary aspergillosis

Method: The imaging features of pulmonary aspergillosis are presented with an educational text and the relevant differential diagnoses. Modalities including plain film and CT are used to illustrate the key radiological findings.

Results: Aspergillus is a ubiquitous fungus in soil and is often found in the sputum of healthy individuals. Pathological infection usually occurs in patients with chronic lung disease or immunosuppression and is a spectrum of disease. Pulmonary aspergillosis can take one of the following forms:
• Allergic bronchopulmonary aspergillosis (ABPA) is a hypersensitivity reaction to the fungus, usually occurring in patients with bronchial asthma.
• Aspergilloma is the commonest form. In this condition a pre-existing cavity is colonised by the organism and results in the formation of a "fungal ball".
• Semi-invasive and airway-invasive aspergillosis are often grouped together as chronic necrotising aspergillosis, but are regarded by some as separate entities. The hallmark of these conditions is pneumatic consolidation with or without cavitation and is usually seen in patients with chronic lung disease, other chronic debilitating conditions or impaired immunity.
• Angioinvasive aspergillosis affects immunosuppressed patients with severe neutropaenia and has a high mortality.

Conclusion: Pathological aspergillosis infection generally occurs in patients with pre-existing lung disease or immunosuppression and is a spectrum of mycotic disease caused usually by Aspergillus Fumigatus. This pictorial review aims to familiarise radiologists with the imaging appearances of the spectrum of the disease.

Role of MDCT in a very rare case of tracheal mucocutaneous leishmaniasis.

Objectives: Describe the CT features of a very rare case of tracheal mucocutaneous leishmaniasis underlying the role of this technique within diagnostic procedures.

Methods: a 68 years old man who presented severe obstructive respiratory symptoms (dyspnoea, tirage, cough) has undergone to MDCT examinations during a follow-up for G2-G3 bladder cancer. Complete triphasic CT studies of chest, abdomen and pelvis have been performed using a GE “Lightspeed Plus” 4 detector row scanner.

Results: the first CT examination showed an unusual finding: a well-enhanced tracheal wall thickening thought to be responsible of the acute symptoms. A little nodular lesion was also seen in the apical region of right lung. 18-FDG-PET showed a relevant uptake in both lesions. Bronchoscopy with biopsies put in evidence the presence of leishmania donovanii protozoa within the tracheal lesion. Another MDCT examination has been performed at the end of the antimonials based chemotherapy. Both tracheal thickening and pulmonary nodule have then become unrecognisable while all respiratory symptoms gradually disappeared.

Conclusions: A restricted number of pathological conditions could be responsible of a tracheal wall thickening and not any leishmaniasis tracheal localization is reported in literature. A well performed MDCT examination is, in our opinion, useful in early detecting, evaluating and follow up of several infectious diseases such as leishmaniasis that are become more frequent in travellers and in immunodepressed patients and which could be potentially dangerous if not immediately treated.

HRCT findings of usual interstitial pneumonia:our experience

Title: HRCT findings of usual interstitial pneumonia (UIP):our experience

Purpose: To demonstrate HRCT findings of pathologically proven UIP.

Method and Materials: Serial HRCT scans were retrospectively analyzed in 26 patients with pathologically proven UIP over a 3-year period of time. Two independent observers assessed the presence and extent of various patterns of parenchymal abnormalities on HRCT.

Results: Of the 26 cases evaluated 23 (89 %) presented ground-glass opacities (mostly correlated with presence of disease activity-alveolitis), 22 patients (85 %) presented a fine reticular pattern (mostlly affecting the subpleural regions), tracheobronchietasis in 20 patients (79 %), emphysema in 21 (80 %), honeycombing in 20 patients (79 %) mostly in the subpleural region of the mediolateral and lower lung zones, loss of lung volume in 4 patients (16 %), consolidation in 1 (5 %) and no cases with nodular opacities.

Conclusion: UIP is characterized on HRCT imaging by ground-glass opacities, a fine reticular pattern with traction bronchiectasis, emphysema and honeycombing of the subpleural regions.
The radiological spectrum of sarcoidosis: a review of the typical and atypical thoracic manifestations

Objectives: To review and illustrate the typical and atypical appearances of pulmonary sarcoidosis.

Methods: We reviewed the imaging findings of the 86 sarcoidosis patients (29 men and 57 women) diagnosed in the last 10 years in our hospital. Medical records, imaging studies and pathological findings were analyzed.

Results: Sixty seven patients had thoracic lymphadenopathy in various locations. Parenchymal lung involvement included ground glass opacities (n = 36), small lung nodules (n = 36), large nodules (n = 10) and cavitary nodules (n = 2). Pleural involvement was observed in 17 patients.

Conclusion: Radiological findings in sarcoidosis are common and variable. Radiologists should be acquainted with the variable appearances and be able to concise differential diagnosis for the findings.

Herb Medicine Induced Interstitial Pneumonitis in 3 Patients: HRCT and Histopathologic Correlation

Purpose: To evaluate HRCT features of herb medicine induced interstitial pneumonitis and correlate with histopathologic findings.

Material and Methods: All patients were women (31, 33 and 58 years old) having dyspnea and coughing. Younger two women had taken herb medicine (not identified) for weight control before 2 weeks and 1 month in each. The other older woman had taken herb medicine (kampap and ssangwha tang) for bronchitis 1 week ago. All patients performed HRCT, after that fluoroguided cutting needle biopsy using 16G Ace-cut needle.

Result: Two younger patients demonstrated mostly ground glass opacities (GGO) in entire lung zone more prominent in both lower lobes on HRCT which pathology turned out to be hypersensitivity pneumonitis and chronic inflammation with interstitial fibrosis, respectively. The older patient showed axial peribronchovascular consolidation and GGO, which confirmed to be diffuse organizing pneumonia. Initially all patients had restrictive lung pattern with decreased FEV1 (31 ~ 63 %) in pulmonary function test. They were all improved clinically and radiologically after steroid treatment within one month.

Conclusion: HRCT findings of herb medicine induced interstitial pneumonitis were diffuse ground glass opacities in all cases with different histopathologic findings. The pattern of GGO was more homogenous in cases with herb medicine for diet, in contrast to heterogenous GGO and additional axial peribronchial consolidation on HRCT in case with herb medicine for bronchitis. All patients with herb medicine induced interstitial pneumonitis were quite well recovered after steroid therapy.

Smoke related lung disease: overlap of imaging findings

Objectives: The purpose of this work is to describe high-resolution CT (HRCT) findings and analyze the overlap in smoking-related lung diseases.

Methods: We selected 14 patients with diagnosis of smoking-related lung disease made at our institution (n = 14, 12 man and 2 woman, mean aged 48.2 ± 3.8). We reviewed their HRCT images and medical histories. The images were obtained using a 4-slice multidetector CT. We assessed the presence, extension and distribution of the following radiological findings: emphysema, air trapping, tree-in bud, ground-glass, centrilobular nodules, cysts, septal lines, reticular densities, bronchiectasis, loss volume and honeycombing.

Results: 10 patients were current smokers and 4 patients were ex-smokers. The mean cigarette consumption was 50.4 ± 9.2 pack-years. Most of them (50 %) were asymptomatic but in other cases the onset symptom was dyspnea, cough or hemoptysis. Pulmonary function was abnormal in 3 patients (21 %). The diagnosis were based on clinical features and HRCT findings. 7 patients (50 %) were diagnosed with pulmonary Langerhans’ Histiocytosis (PLCH), 4 patients with respiratory bronchiolitis-associated interstitial lung disease (RB-ILD), 2 patients with desquamative interstitial pneumonia (NID) and 1 with idiopathic pulmonary fibrosis (IPF). The most common radiographic findings were ground-glass in NID (100 %), centrilobular nodules in RB-ILD (100 %), honeycomb in FPI (100 %) and cystic lesions in PLCH (85.7 %).

A high percentage of patients had emphysema areas (77.5 %). The patients with RB-ILD had also radiographic findings of all 3 diseases (ground glass, cystic lesions and honeycombing).

Conclusion: There is a clear relation between cigarette smoking and interstitial lung diseases developed in this research, with numerous similarities in demographic, radiological and clinical profile. In this group of interstitial diseases we have shown that there is an overlap of radiological signs obtained by HRCT.
**10 Extrinsic allergic alveolitis: correlation between quantitative CT histogram analysis, bronchoalveolar lavage flow cytometry, and pulmonary function tests**

**Objectives:** Comparison of results of quantitative CT histogram analysis (QCT) derived from HRCT scans and PULMO CT with those from bronchoalveolar lavage flow cytometry (BAL/FC) and pulmonary function tests (PFT) in extrinsic allergic alveolitis.

**Methods:** 15 patients with diagnosis of extrinsic allergic alveolitis were included in the study. The diagnosis was established by clinical examination, chest-X-ray, and PFT. All 15 patients underwent HRCT examination. After a visual qualitative analysis, the PULMO CT evaluation package (Siemens, Medical Systems) was used providing determination of mean lung density and histogram analysis. PFT and BAL/FC were afterwards applied to 13 patients.

**Results:** The criteria for diagnosis of extrinsic allergic alveolitis were fulfilled with QCT mean lung density > -779 HU at least at one of the representative anatomical levels of the right lung, and BAL lymphocytosis CD4 : CD8 < 1.0. With 8 of 15 patients we found agreement of HRCT/QCT and BAL/FC findings. QCT mean lung densities for three levels of right lung were -756 HU, -749 HU, and -737 HU, respectively. BAL/FC lymphocytosis CD4 : CD8 mean was 0.5 ± 0.3. The mean values of C index for the three levels were 32.8 ± 9.3%, 30.3 ± 7.5%, and 27.7 ± 5.6%, respectively. Those for D index were 20.2 ± 10.5%, 23.3 ± 10.7%, and 25.7 ± 14.1%. We found a good linear correlation between QCT histogram analysis for C index and BAL lymphocytosis CD4 : CD8 (r = 0.72). The correlation in the case of D index was much lower (r = 0.35). The HRCT/QCT and PFT correlate only partially.

**Conclusion:** HRCT/QCT histogram analysis is a very good method for quantitative evaluation of the lung density in an early stage of alveolitis and fibrosis. HRCT/QCT combined with BAL/FC, PFT, clinical and other noninvasive methods is a sufficiently accurate and reliable diagnostic tool for extrinsic allergic alveolitis. The direct implication is that a surgical biopsy is not necessary to diagnose extrinsic allergic alveolitis.

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**11 Perilymphatic Nodules - Differential Diagnosis in HRCT**

**Objectives:** To discuss an approach to the differential diagnosis of the diseases that have a predominant distribution along the lymphatics, based on their distribution within the lung, the appearance of the abnormalities and associate findings.

**Methods:** We retrospectively revised the imaging findings of patients with a nodular pattern in HRCT with a perilymphatic distribution, from our radiological data base of thoracic pathology.

**Results:** Several diseases are characteristically associated with nodules occurring predominantly in relation to pulmonary lymphatics. By carefully analysis of the pattern of involvement of the perilymphatic interstitium in HRCT and by the identification of associated findings we can make a confident diagnosis of the disease.

**Conclusion:** The perilymphatic nodules tend to be prevalent in the perilobular and subpleural interstitium, and they are more common in diseases that spread along the lymphatics. By showing the distribution of those nodules and associated findings, HRCT enables the narrowing of the differential diagnosis.

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**12 Cystic Lung Diseases: High-resolution CT Findings with Pathologic Correlation**

**Objective:** To present a clinical-radiological-pathological review of a wide spectrum of cystic lung diseases emphasizing important diagnostic and discriminatory features.

**Methods:** We retrospectively revised, from our radiological data base, the imaging findings of patients with cystic lung diseases lung cysts are well defined, thin walled (< 3 mm), round parenchymal lined spaces (> 1 cm) filled with air or fluid. Afterwards we revised the radiographic findings of the several cystic lung diseases with emphasis in the pathologic-radiological correlation.

**Results:** Cysts may be seen, among others, in infections (tuberculosis, staphylococcal, tracheobronchial papillomatosis, and pneumocystis carinii pneumonia), bronchial dilatation (cystic bronchiectasis), interstitial lung diseases (UIP, LIP), emphysema, lymphangioleiomyomatosis, tubercous sclerosis, Langerhans cell histiocytosis, neurofibromatosis, and neoplasms. Most of the time, the anatomic distribution of cysts, the associated CT findings and the appropriate clinical setting may allow a confident diagnosis. However, in some cases, a lung biopsy will be often required for a definitive diagnosis.

**Conclusion:** The differential diagnosis of cystic lung diseases is based not only on the number, size, shape and distribution of cysts but also on the assessment other parenchymal findings. In some disorders, the definitive diagnosis requires a histopathological confirmation.
Intervention

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Is the combined US-guided pleural biopsy with thoracentesis helpful in diagnosis of pleural tuberculosis

Objectives: To determine if additional pleural biopsy is helpful following ultrasound (US)-guided thoracentesis in diagnosis of pleural tuberculosis.

Methods: One hundred pleural biopsies with thoracentesis were performed with US-guidance for diagnostic or therapeutic purpose over a 2-year period in every patient presenting with pleural effusion suspected to be associated with tuberculosis. The diagnosis of pleural tuberculosis was confirmed in any patient presenting with positive culture findings of Mycobacterium tuberculosis, either on the pleural fluid or other biological material, or the presence of histopathologic findings suggestive of pleural tuberculosis on pleural biopsy, and also, in the absence of negative laboratory results, those patients with clinical improvement after empirical treatment.

Results: Of these, 58 patients met the diagnosis of pleural tuberculosis by our case definition. Chronic granulomatous inflammation was positive in 27 pleural biopsies. A pleural exudate with a high ADA concentration and a majority of lymphocytes among its leukocytes was considered positive in 64 pleural fluid analyses. ADA activity is also elevated in 6 patients whose diagnosis was empyema and pleural metastasis. The combined use of pleural biopsy with thoracentesis confirmed pleural tuberculosis in 58 patients. Procedure related pneumothorax was documented in 10 patients.

Conclusion: ADA is a highly sensitive diagnostic marker, the most sensitive diagnostic criterion was the caseating granulomas in biopsy tissue samples, but the joint sensitivity of this criterion was significantly higher. The combined use of US-guided pleural biopsy with thoracentesis is a relatively safe, helpful diagnostic approach to achieve a rapid and precise diagnosis in the cases of pleural tuberculosis.

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Lung tumor radiofrequency ablation with two types of electrode: our experience

Objectives: To compare the effectiveness of two different types of RFA electrode (multitined expandable electrode -E1- and spiral expandable electrode -E2-), in malignant lung tumors.

Methods: During a three-year period 65 CT-guided RFA sessions were performed on 35 patients with 48 pulmonary lesions (25 metastatic and 23 inoperable primaries). Lesion diameter ranged from 1.6 to 5 cm. In 22 lesions (with diameter < 2.5 cm) an E1 type of electrode was used while in 26 lesion diameter > 2.5 cm an E2 type was used. The mean ablation time was 17 min. Follow-up was performed after IV administration of contrast media with dual phase CT scan immediately after the procedure and at 1-, 6-, and 12-month intervals, in all patients.

Results: Total tumor necrosis was achieved with E1 electrode in 21/22 lesions (95.5 %) while with E2 in 20/26 patients (77 %). Partial necrosis was revealed in 1/22 malignancies with E1 RFA, and in 6/26 with E2 RFA (26.3 %), which required a second RFA session. The 6-month follow-up revealed recurrence rate 4 % for E1, and 7 % for E2 sessions. Higher rate was observed to the E2 type of electrode due to larger treated lesions. Three self-limited pneumothoraces (4.6 %) occurred during the sessions.

Conclusion: Whereas future studies with greater patient series are needed, expandable multitined and spiral electrodes have equivalent effectiveness in the management of inoperable lung tumors.

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The accuracy of percutaneous biopsy under CT-guidance in cases of mediastinal abnormalities

Objectives: To evaluate the diagnostic accuracy and the complication rate of core needle biopsy (CNB) in patients with mediastinal abnormalities.

Methods: Two hundred and forty-five percutaneous needle biopsies were performed during 6-years under CT guidance, in patients with mediastinal masses for diagnosis of their disease. All biopsies were performed with an automated gun of 18 Gauge/10 cm, receiving 2–4 specimens, according to clinical and CT findings. The procedures were applied under local anesthesia.

Results: The diagnostic accuracy was 93.5 %. Final diagnosis was lymphoma (Hodgkin or Non Hodgkin) in 105 cases, benign tumors in 40 cases, inflammation in 29 cases, and other malignancies in 55 cases. Specimens were inadequate and biopsy was repeated in 16 cases. Histopathologic results were positive for lymphoma in 10 patients, while the final diagnosis of the other 6 cases was confirmed after open surgery.

Conclusion: According to our experience percutaneous CT-guided biopsy is a safe, accurate, low cost, minimal invasive method for the diagnosis of mediastinal abnormalities.
**16 Our experience with needle biopsy of thoracic tumours**

Differential diagnosis of lung lesions can be complicated, if common diagnostic methods are inefficient. The fine needle biopsy (FNB) or core biopsy (CB) are used if radical treatment or surgical way are impossible. In our paper we deal with our own experience with FNB or CB in differential diagnosis of lung lesions of unknown origin.

**Aim of study:** Efficacy and complication of FNB or CB for lung lesion diagnosis.

**Cohort of patients (pts):** We analyzed 72 pts, mean age of 67.3 ± 7.45 years (yrs), minimal 54 yrs and maximal 83 yrs. Pts were unable to undergo surgical treatment or surgical diagnostic examinations.

**Methods:** The appropriate site of needle biopsy was determined via CT or fluoroscopy. The fine needle (Chiba) or core biopsy (Tru-Cut, Cook) biopsy was performed with local anaesthesia trough a small cutaneous incision. During biopsy 1–6 samples were taken. After 24 hours the radiograph of chest was performed.

**Results:** From 1999 to 2002 58 pts underwent fine needle biopsy and between 2003–2005 in 32 pts core biopsy was preferred. Fine needle biopsy was successful in 33 pts (58.6 %) and core biopsy in 26 pts (81.25 %). The most common site was the right upper lobe (28.1 %).

In 38 pts was confirmed carcinoma (90.5 %), in 4 pts non-specific inflammation. Pneumothorax after biopsy was in 5 pts (6.9 %), haemoptysis in 2 pts (2.8 %) and 1 death (1.4 %). Exitus was after core biopsy.

**Conclusions:** Fine needle biopsy or core biopsy are methods used for diagnosis if the other methods are unable to use. Our own better experiences and results are better with core biopsy.

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**Lung cancer**

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**17 Lung cancer: reporting practices and “MISSED LESIONS”**

**Introduction:** Approximately 20 % of lung cancers are “missed” on CXR. When a cancer is detected our departmental guidelines recommend that appropriate management is advised in the radiology report. Alert mechanisms for unexpected findings are advised to optimise the patient pathway. A standard of 75 % for the detection of lung cancer from CXR is recommended.

**Objectives:**
1. Identify “missed” lung cancer rates.
2. Determine delay in patient management created by “missed” cancer.
3. Determine adherence to department guidelines for including advice on referral to appropriate clinical team in radiology report.

**Method:** The radiological reports and radiographs performed in the year prior to lung cancer diagnosis of 50 consecutive patients were reviewed. Note was made of “missed” lesions detected by retrospective CXR analysis, time from CXR to diagnosis and adequacy of advice in radiology report.

**Results:** 5 cases excluded as data incomplete. Lung cancer suspected from CXR in 40 patients, 2 unreported by radiologist, and from CT thorax in 5. 20/45 patients had not had a CXR in the year preceding diagnosis. There were 3 “missed” cancers in 20 patients with previous CXRs. In 36/38 cases detected on CXR by Radiologist, correct management was suggested whereas correct management was not suggested in any of the 5 cases detected by CT. The time from CXR to diagnosis was 24 days. This increased to 10 months for patients with “missed” cancers. One patient was not reviewed by lung cancer specialist for 8 months despite appropriate radiology advice.

**Conclusion:** 85 % CXR detection rate for lung cancer surpassing recognised standard. Missed lesions and communication errors create delays in patient management. 90 % reports offered advice re-patient management. Tendency to omit advice if malignancy detected on CT.

**Recommendation:** Radiologist to use alert mechanism to highlight potential malignancy when reporting all imaging modalities, not just plain films.

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**18 Audit of urgent lung cancer clinic referrals recommended by radiologist reporting chest x-ray**

**Objectives:** A policy was introduced to recommend urgent lung cancer clinic referral in the radiology report if a mass lesion, lobar atelectasis or non-resolving infection was found on chest x-ray. This audit aimed to assess referral criteria and the effect on waiting times of both clinic appointments and staging CT scan.

**Method:** The chest x-ray appearances, source of request and final diagnosis of consecutive patients referred during the first 6 months of policy were recorded and compared to those referred in the 3 months prior to policy.

**Results:** Chest x-rays of 60/62 patients [29 Hospital (47 %); 33 GP patients (53 %)] referred as per protocol were reviewed. Two chest x-rays were unavailable. 55 patients attended clinic: 44 had a mass lesion, 2 lobar atelectasis, 9 non-resolving infection. Malignancy was detected in 31/55 (56 %); 29/44 (66 %) with mass lesion/1 (50 %) lobar atelectasis and 1/9 (11 %) non-resolving infection (7/9 were referred before treatment starting time in 50% of cases).
the follow-up film). Pre-protocol 37 patients (8 Hospital (22 %); 29 GP patients (78 %)) x-rayed in our department were referred. 16/37 (43 %) had a final diagnosis of malignancy. The mean time from chest x-ray to clinic appointment increased (13 days pre-protocol, 24 days post-protocol) but reduced from clinic to staging CT scan (24 days pre-protocol, 5.5 days post-protocol).

**Conclusion:** A mass lesion of lobar atelectasis on chest x-ray is associated with a high rate of malignancy. Non-resolving infection is a poor discriminator in the absence of appropriate x-ray follow-up. Adequate follow-up should be enforced. The policy has increased hospital clinician referrals to the lung cancer clinic, the main reason for the increased delay to clinic appointment.

**Additional value of integrated PET-CT in the detection of clinical relevant extrathoracic findings in patients with a lung tumour: comparison with CT and PET alone.**

**Objective:** The aim of our study was to assess retrospectively the additional value of integrated PET-CT (PET-CT) in the detection of clinical relevant extrathoracic findings (CRF) in the staging of patients with a suspect or malignant proven pulmonary lesion in comparison with computed tomography (CT) and positron emission tomography (PET) alone.

**Additional value of PET-CT in the staging of lung cancer: comparison with CT alone, PET alone and visual correlation of PET and CT**

**Objective:** Integrated-PET-CT is the most recent approach to post hoc image fusion of PET and CT images. It combines these image modalities into one scanner that acquires accurately aligned anatomical and functional images in the same scanning session.

**Purpose:** The purpose of our study was to evaluate retrospectively the accuracy of integrated PET-CT in the staging of patients with a suggestive lung lesion and to compare this accuracy with the accuracy of CT alone, PET alone and visually-correlated-PET-CT.

**Methods:** Fifty patients undergoing an integrated PET-CT for staging of a suspicious lung lesion were studied. TNM-statuses were determined with CT, PET, visually-correlated-PET-CT and integrated PET-CT. These TNM-stages were compared with the surgical TNM-status.

**Results:** Integrated PET-CT was the most accurate imaging technique in the assessment of the TNM-status. Integrated PET-CT predicted correctly the T-status, N-status, M-status and TNM-status in respectively 86 %, 80 %, 98 % and 70 % versus 68 %, 66 %, 88 %, 46 % with CT, 46 %, 70 %, 96 %, 50 % with PET and 72 %, 68 %, 96 %, 54 % with visually-correlated-PET-CT. T-status and M-status were overstaged respectively in 8 % and 16 % with integrated PET-CT, in 20 % and 28 % with CT, in 16 % and 20 % with PET, in 12 % and 20 % with visually-correlated-PET-CT and understaged in 6 % and 4 % with integrated PET-CT, versus 12 % and 6 % with CT, 38 % and 10 % with PET and 12 % with visually-correlated-PET-CT.

**Conclusion:** Integrated PET-CT improves the staging of lung cancer through a better anatomic localization and characterization of lesions and is superior to CT alone and PET alone. If this technique is not available, visual correlation of PET and CT side by side can be an alternative.

**Detection of pulmonary metastatic nodules: Usefulness of low-dose multidetector CT in comparison with chest radiograph.**

**Purpose:** To evaluate the usefulness of low-dose multi-detector CT in detection and follow-up of pulmonary metastatic nodules in patients with malignancy.

**Materials and Methods:** We retrospectively reviewed conventional chest radiographs and low-dose multi-detector CT(low-dose CT) scans in 81 patients, who had been under the diagnosis of malignancy. We reviewed the detection for pulmonary nodules and counted the number of nodule in each modalities. The nodules were confirmed by surgical operation and by radiologic criteria. The sensitivity, specificity and accuracy were compared between two modalities.

**Results:** Low-dose CT depicted more nodules than chest radiograph, and indeterminate nodules at chest radiograph may be clearly benign at low-dose CT (eg. calcified granulomas or bony lesions). The accuracy of low-dose CT (75.3 %) was significantly higher than that of chest radiograph (49.4 %) in detection for pulmonary nodules (p < 0.05).

**Conclusion:** Low-dose CT may provide better information than does chest radiograph in diagnosis and follow-up of pulmonary metastasis. Low-dose CT may be useful when chest radiograph is inconclusive, or when surgery is considered as treatment for pulmonary metastasis.
Assessment of tumor vascularity in patients with non-small cell lung cancer: dynamic contrast-enhanced CT and pathologic correlation

**Purpose:** To correlate the findings at dynamic CT of NSCLC with pathologic findings and to compare contrast enhancement of central and peripheral portions of NSCLC.

**Materials and Methods:** Nineteen patients with NSCLC underwent dynamic MDCT scans and the scans were obtained prior to and at 20, 50, 90, 180, 240, 300 seconds after bolus contrast injection. CT densities of the central and peripheral portions of tumor were measured on circular ROIs. After resection of the tumors, the site of CT scan area was stained with H-E, CD34, and VEGF. The maximal enhancement ratio (MER), the slope value, and the point of maximum signal intensity (Tmax) of time-attenuation curve at both central and peripheral portions of the tumor were obtained.

**Results:** MER was correlated positively with MVCs and VEGF staining in both central and peripheral portions (Spearman rank test, p < 0.05) of the tumor, respectively. The MER, the slope value, and Tmax of time-attenuation curve of the peripheral portion were significantly higher than those of the central portion of the tumor (Wilcoxon signed rank test, p < 0.05). In central portions, MER was significantly correlated with slope value (p < 0.05). But in peripheral portions, there was no correlation between MER and slope (p > 0.05).

**Conclusion:** Dynamic contrast enhancement using MDCT provides a useful tool in assessment of tumor vascularity in patients with NSCLC. The degree of dynamic contrast enhancement of NSCLC on CT is correlated with the tumor vascularity and showed significantly different pattern between central and peripheral portions of NSCLC. The peripheral portion of NSCLC may show stronger, faster contrast enhancement than central portion of NSCLC.

Inflammatory pseudotumor: a confusing diagnosis

**Objectives:** CT features, evolution and pathologic correlation in three cases of pulmonary inflammatory pseudotumor (IPT)

**Methods:** We reviewed CT and pathologic findings of three patients with confirmed diagnosis of surgically resected IPT

**Results:**

- **Case 1.** 30 year old man with history of cough and expectoration five months before. CT showed a stenotic endobronchial lesion in inferior lobe bronchus and associated lower lobe atelectasis with bronchiectasis. Biopsy showed non specific inflammatory reaction. Right inferior lobectomy was performed and histopathologic examination revealed IPT.

- **Case 2.** 51 old man year with history of recurrent pneumonia presented a 9cm spiculated right hilar mass with pleural retraction causing slight compression of the middle lobe bronchus. Retrotracheal lymph nodes were enlarged. Biopsy was non specific. Patient underwent pneumonectomy. Nine months later, an ill defined mass in left superior lobe was detected corresponding to recurrence and was controlled with corticoid.

- **Case 3.** 53 year old women with previous uterine leiomiosarcoma. CT revealed a 5cm round well defined peripheral mass in right upper lobe. Transthoracic FNA demonstrated malignant cells. Lobectomy of right upper lobe was performed and microscopic findings showed IPT.

**Conclusion:** Preoperative diagnosis of IPT is difficult because of the wide range of CT findings and the low diagnostic accuracy of cytology and biopsy. Patients are usually misdiagnosed as benign tumours or cancer. Resection is recommended for both diagnosis and treatment. Although this tumor has a benign behaviour, recurrence and lymph node involvement can occur and can be detected by radiologic monitoring after resection.

Radiological-histological correlation in lung lesions false positive from FDG-PET

**Objective:** To show a number of benign focal lung lesions with CT malignancy-mimicking findings and increased PET activity

**Materials and Methods:** We reviewed 7 patients from our center treated for lung lesions. All were given thoracic CT with IV contrast and PET. 6 of them underwent thoracic CT with IV contrast and PET. 6 of them underwent thoracic CT with IV contrast and PET. 6 of them underwent thoracic CT with IV contrast and PET. Of them 1 of the patients showed improvement.

**Results:**

- **CT findings:** Maxiimun right lobe(LLL), URL infiltrate related to bronchial narrowing, nodule in Lower right lobe(LRR), spiculate nodule in URL, mass in LLL with pleural effusion and 1 nodule in Middel Righ lobe. 2 of them patients showed mediastinal lymph nodes in the CT and PET uptake. Histological findings were: 2 cryptogenic organizing pneumonia one of them with associated Acynemicos, anthracosis and sinus histology. Costenman disease and residual fibrosis.

**Conclusion:** The combination of clinical history, CT morphologic findings and metabolic PET activity is very useful to predict malignancy or benignity.-However some benign lesions present radiological findings that suggest malignancy and also present metabolic activity in the PET.
Comparative quantitative perfusion analysis of suspected lung cancer with dynamic contrast enhanced MRI and ultrasound (CEUS) - Initial experience.

Aim: To assess the intermodality utility of contrast enhanced MR and CEUS in distinguishing between malignant and benign lesions, by means of quantitative perfusion and morphological analysis.

Materials and Methods: 10 patients with suspected lung cancer and/or atelectasis were prospectively examined with MR (pre/post VIBE, STIR and navigator triggered 3D FLASH perfusion sequences) and US (grey scale and dynamic low MI contrast imaging). Morphological features and perfusion characteristics were assessed and a provisional diagnosis of malignant or benign disease established. For perfusion quantification ROI based time intensity curves were generated. From these the bolus arrival time (BAT), time to maximum intensity (TTP) and wash in slope were then calculated. These parameters and curve profile were then correlated with the final diagnosis by performing a Student t test. Definitive diagnosis was based on histological and microbial analysis.

Results: The lesions measured 2-7cm in size. 5 were primary adenocarcinomas, 4 were atelectasis secondary to a proximal tumour and 1 was a case of TB. Both imaging modalities showed different subjective patterns of enhancement on morphological imaging that readily distinguished between atelectasis and tumour. Also on US, all the generated curve profiles associated with malignancy showed a characteristic fast wash in and definite washout period. This contrasted with MR where a few profiles demonstrated accumulation, usually suggestive of benignity in cases of known malignancy. We found no significant correlation between the final diagnosis and the calculated parameters from the perfusion curves on either MR or US.

Conclusion: Our initial experiences suggest that both dynamic CEMRI and US can offer additional useful information in certain clinical settings such as in oncological staging and radiotherapy planning where differentiating atelectasis from tumour is important and frequently poorly delineated on routine CT staging.

Pleural Tumours and Pseudo-tumours: Pictorial Review

Objectives: Review of the imaging characteristics of pleural tumours, benign and malign, and their main differential diagnosis in chest x-ray and in chest CT.

Methods: We retrospectively reviewed the imaging findings of patients with pleural tumours, and pleural pathology that could mimic pleural tumours, from our radiological data base of thoracic pathology, selecting those with pathologic material in order to allow us to do radiological and pathologic correlation.

Results: Our review includes benign pleural tumours as lipoma and solitary pleural tumour, and malignant tumours as metastasis, lymphoma, mesothelioma and malignant solitary fibrous tumour. The pathologies that can mimic pleural tumours as round atelectasis, pleural amiloidosis, loculated pleural effusion and pulmonary abscess are also revised.

Conclusion: Pleural tumours are a rare pathology and most of them have non specific radiological signs. A large number of benign and more common pleural pathology may mimic pleural tumours and prevent the correct and precocious diagnosis and treatment. With this work we hope to review some of the signs that permit the diagnosis of pleural pathology, particularly tumoral, and their differential diagnosis.

CT evaluation of the pleura in patients with idiopathic pleural effusions referred for Video Assisted Thoracoscopic Surgery (VATS): correlation with thoracoscopic findings and final diagnosis.

Objectives: To evaluate CT findings in patients with idiopathic pleural effusion (PE) referred for diagnostic VATS and correlate them with thoracoscopic findings and final diagnosis of effusions.

Methods: Fifty-eight patients with idiopathic PE were evaluated with VATS in this prospective study. CT scans were evaluated for the presence and extent of pleural thickening and nodules and classified as non-specific, exudate or malignant effusions. These data were compared with visual diagnosis on VATS and with final diagnosis of PE.

Results: Final diagnoses of PE were malignant in 27, and benign in 31 patients. Eighteen PE were classified as malignant by CT (sensitivity 48%, specificity 84%), and 12 were considered malignant by surgeon’s impression (sensitivity 41%, specificity 97%). Ten malignant effusions exhibited nodules and 18 pleural thickening on CT scans. Eighteen of the 24 PE not showing pleural thickening or nodules on CT were benign.

Diagnosis suggested by CT and the corresponding VATS and final diagnoses are shown in the following table.
**Conclusions:** CT findings and visual assessment of the pleura by the surgeon on VATS had similar sensitivities for diagnosing malignant effusions. Although some overlap exists, most malignant pleural effusions referred for diagnostic thoracoscopy showed either pleural thickening or nodules on CT, and most effusions lacking those findings were benign.

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28 **Quantitative analysis of airway abnormalities in infants and young children with non cystic fibrosis bronchiectasis**

**Purpose:** The purpose of this study was to quantify airway dimensions in infants and young children with non cystic fibrosis (CF) bronchiectasis, and to determine whether the airway structure of this group differs from that of normal children by using HRCT.

**Methods and Materials:** HRCT images of the lungs were obtained from 26 infants and young children with non_CF bronchiectasis between the ages 0 and 12, and from 15 control subjects. On cross-sectional cut airway-artery pairs, airway outer diameter (AOD), airway lumen diameter (ALD), vessel diameter (VD) were measured by two observers. By this measurements airway wall thickness (AWT) was derived AWT = [AOD-ALD] / 2.

**Results:** Mean AOD, ALD, AWT values and ALD/VD and AWT/VD ratios were grater in children with non_CF bronchiectasis than in normal subjects (p < 0.001). AWT/VD ratio of nonbronchiectatic segments in children with non_CF bronchiectasis was grater than in control subjects (p < 0.001).

**Conclusion:** The airways of infant and young children with non-CF bronchiectasis have thicker wall and more dilated than those of normal infants and children. The bronchial wall thickening in bronchiectatic but also in non-bronchiectatic airways segments suggest that there may be ongoing airway inflammation and airway remodeling.

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30 **Radiologic findings in metabolic lung diseases**

The aim of the study is to present imaging findings in metabolic lung diseases. Metabolic lung diseases includes a heterogenous group of diseases. All these diseases have a biochemical abnormality in pathogenesis. These diseases includes, pulmonary alveolar proteinosis, metastatic pulmonary calcifications, pulmonary amyloidosis, pulmonary alveolar microlithiasis and storage diseases. Although these diseases are clinically rare, they have typical radiologic findings. Knowledge of the different patterns of pulmonary involvement in these diseases provides a useful tool for establishing the etiology.

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31 **CT findings in pulmonary alveolar proteinosis**

**Objectives:** To describe the CT and chest X ray findings in pulmonary alveolar proteinosis.

**Material and Methods:** A retrospective review of HRCT scans of 6 patients with pathologically proven PAP was performed.

**Results:** HRCT scans have a crazy paving pattern of ground-glass opacities or air-space opacities on a background of smooth interlobular thickening in a diffuse geographic distribution. This crazy paving pattern has been described as part of a characteristic appearance of pulmonary alveolar proteinosis.

**Conclusion:** Pulmonary alveolar proteinosis is often a diagnostic dilemma. When patients with this condition present, the clinical differential diagnosis can be broad. But the classical radiologic findings helps in differential diagnosis.
Conclusion: The detection of CREF is necessary for correct staging of lung tumour and to avoid unnecessary interventions. Integrated PET-CT is the best imaging procedure for this purpose and is better than CT and PET alone.

Results: Among 515 lymphomas (Oct. 1997–Jan. 2006), we identified 91 Hodgkin lymphomas -HD- (17.67 %) and 424 non-Hodgkin’s lymphomas -NHL- (82.33 %). Rather than present the usual thoracic forms, with lymph node with or without contiguous pulmonary involvement, we focus on unusual types of lymphomas which may be of interest when morphological findings make diagnosis doubtful.

Methods: Among the HD, we identified 8 lymphomas with extranodal involvement (8.79 %): 4 with pulmonary nodules (4.40 %), some of which had cavities. One of these had pleural effusion, and another pleural and pericardial effusion. In another patient (1.10 %), the nodule corresponded to an intrapulmonary adenopathy, recognized by its relationship to the bronchovascular axes. Two cases (2.20 %) had thymic cyst, another (1.10 %) presented a thymic cystic lesion. Spontaneous presentation of this form is very rare in untreated patients, and it can be indistinguishable from a congenital thymic cyst.

Among the NHL, we identified 21 patients (4.95 %) with an extranodal lesion: 10 (2.36 %) with pulmonary involvement, and 7 (1.65 %) with a pleural lesion. In two of these, the lesion was associated with pericardial involvement (one with transdiaphragmatic infiltration), and in another with parietal (costovertebral) infiltration. There was 1 case (0.24 %) of polyloid endobronchial lesion. This is a highly unusual presentation (only 50–55 cases described). We found two cases (0.47 %) of MALT (Mucosa-Associated Lymphoid Tissue) lymphoma, one associated with lymphocytic interstitial pneumonia (LIP), and one exceptional case of primary cardiac lymphoma (0.24 %).

Conclusion: As well as the usual, widely recognized nodal form of thoracic lymphoma, with or without neighboring pulmonary involvement, we need to be able to diagnose this condition when faced with less frequent extranodal forms, such as those described.

Materials and Methods: 400 consecutive patients (group I) underwent an integrated PET-CT for staging a suspicious lung lesion. 220 of these patients had a pathological proven lung tumour and underwent a PET-CT with intravenous contrast administration (group II). CT, PET and PET-CT were evaluated on the detection of CREF. These abnormalities were compared with the final diagnosis obtained from the medical records, including pathological reports. Statistical analysis was done by measuring sensitivity, specificity, accuracy and Mc Nemar test.

Results: In group I CREF were revealed with CT, PET and PET-CT in respectively 44 %, 25 % and 21 % of the patients. In group II these figures were 49 %, 26 % and 24 %. In group I the sensitivity, specificity and accuracy for detection of CREF with CT were respectively 44 %, 94 % and 89 %. These figures were respectively 57 %, 96 % and 91 % for PET and 89 %, 98 % and 97 % for PET-CT. In group II the sensitivity, specificity and accuracy were respectively 51 %, 96 % and 89 % for CT, 65 %, 96 % and 91 % for PET and 88 %, 98 % and 96 % for PET-CT.

Conclusion: The detection of CREF is necessary for correct staging of lung tumour and to avoid unnecessary interventions. Integrated PET-CT is the best imaging procedure for this purpose and is better than CT and PET alone.
Spectrum of normal variants-congenital thoracic anomalies diagnosed by CXR and CT in adults

Objectives: Normal variants and specially congenital thoracic anomalies are usually diagnosed during the childhood. Asymptomatic lesions may be diagnosed in early adulthood. Most of them are easily depicted because they are relatively frequent, but others can be misdiagnosed because of their bizarre radiological aspect or because of their unusual presentation in the adult life.

We will present our experience in diagnosing normal variants-congenital thoracic anomalies in adults in a county hospital during a 6 years follow-up.

Methods: This is a retrospective review including adult patients having a normal variant or a congenital thoracic anomaly in CXR without any specific thoracic related symptom which further underwent a CT examination to confirm the diagnosis.

Results: We will show CXR and CT of different normal variants-congenital anomalies including some infrequent ones such as bronquial atresia with broncocele, lobar atresia, two cases of congenital absence of pericardium (one of them associated with congenital diaphragmatic hernia), aberrant origin of segmental posterior LUL bronchus from LUL bronchus with associated vein coursing partially trough the mediastinum, venous anomalous pulmonary drainage (including two rare cases of combined venous anomalous drainage from RUL and RML to superior vena cava and one case of venous anomalous drainage from RLL associated to intrathoracic inferior vena cava agenesis). We will also include a rare case of mediastinal various secondary to portal hypertension presenting as multiple mediastinal masses.

Conclusion: Normal variants and congenital thoracic anomalies in adults may be a diagnostic challenge in normal practice because of their CXR aspect or because of their unusual presentation at that age. CT is a known helpful technique to get the final correct diagnosis.

Thymic Shadow on Frontal Chest Radiographs of Normal Adults

Objectives: To determine which structures contribute the aorticopulmonary interface (API) extending from the aortic arch (AA) to the left lower heart border, obliteration of the proximal descending aorta (PDA) above the left pulmonary artery, and the right upper mediastinal interface (RUMI) above the heart and their morphologic variations on frontal chest radiographs of normal adults.

Methods: We reviewed frontal chest radiographs of 113 adults in whom CT scans excluded pathologic processes affecting the mediastinum.

Chest radiographs were analyzed noting shapes of the API and the RUMI, sharpness of the PDA, and the incidence of such findings in each decade of patient’s age. Chest PA and CT scans were correlated to determine which structure(s) contributed these features.

Results: Five patterns of the API were recognized; type 1 (no API), types 2–4 (the API passing across the AA, which is concave, straight, or convex to the left, respectively), and type 5 (the API running tangential or lateral to the AA). Types 4 and 5 were more common in subjects under age 40 than older subjects (14/47 vs 2/66; P < .005). Obliteration of the PDA was seen only in subjects under age 30 (7/25, 28%). The laterally convex RUMI was seen in 12% (3/25) of subjects under age 30 and 9% (11/88) of subjects over age 30 (P > .50). The normal thymus with variable degree of fatty change was responsible for types 4 and 5 of the API, obliteration of the PDA, and the laterally convex RUMI in subjects under age 30.

Conclusion: The API, the RUMI, and the PDA may appear different according to the patient’s age, and patients under age 30 may normally show type 4 or 5 of the API, obliteration of the PDA, and the laterally convex RUMI on frontal chest radiographs due to the normal thymus.

Radiographic Appearances of Posterior Diaphragmatic Defect Associated with Aging

Objectives: Posterior diaphragmatic defect is considered associated with aging. We investigated radiographic features of posterior diaphragmatic defects that have hardly been known.

Methods: Among 2156 consecutive chest CT scans, 78 patients (age range, 34–87; mean age, 61) who met the following criteria were included in the study: presence of posterior diaphragmatic defect, no peridhiaphragmatic disease which might impair evaluation of the diaphragm on CT, and presence of lateral chest radiographs obtained within a week of CT. Their 78 CT scans were retrospectively analyzed for location of posterior diaphragmatic defect (medial, middle, or lateral one third) and contents herniated through the defect. Lateral chest radiographs were analyzed for shape of the posterior diaphragm and posterior costophrenic sinus. Two chest radiologists reviewed images together and decisions were reached by consensus.

Results: Chest CT showed 72 posterior diaphragmatic defects in the left side and 31 in the right (total, 103) in the 78 patients. The defect involved, in decreasing order of frequency, both medial and middle one thirds (n = 49, 50.4%), middle one third (n = 36, 37%), medial one third (n = 10, 9.4%), both middle and lateral one thirds (n = 7, 7.2%), or lateral one third (n = 15, 15%), of the posterior diaphragmatic leaflet.

On CT, the retroperitoneal fat was herniated into the thorax through the defect in all patients, sometimes with the kidney (n = 8).

Lateral chest radiographs showed normal contour (n = 51, 49.5%) or focal humping (n = 7, 6.8%) of the posterior diaphragm, or blunting (n = 41, 39.8%) or upward convexity (n = 4, 3.9%) of the posterior costophrenic sulcus on the affected side.

Conclusion: In patients without a history of pleural disease, focal humping of the posterior diaphragm or blunting or upward convexity of the posterior costophrenic sulcus on a lateral chest radiograph may be a finding of posterior diaphragmatic defect associated with aging.
Pulmonary hamartoma

**Objectives:** Pulmonary hamartomas are the most common benign neoplasms of the lung. The population incidence is 2.5/1000. In most cases the diagnosis is based on computed tomography (CT) and fine needle aspiration cytology (FNAC). Objective of our study was to review diagnostic procedures (cytologic and radiographic features) in patients with pulmonary hamartoma in our hospital.

**Methods:** All 35 consecutive cases diagnosed as pulmonary hamartoma at Golnik Hospital in the last eight years were studied. We reviewed medical records, the cytologic smears and CT scans.

**Results:** There were 21 females and 14 males, the average age was 60.5 years. The average diameter size of hamartoma was 21.7 mm. For diagnosing hamartoma we used CT and FNAC in 16 (45.7 %) patients, only FNAC in 15 (42.9 %) and only CT in 4 (11.4 %) patients. Cytologic diagnosis based on recognition of different mesenchymal components. Cytologic smears of all 31 patients contained chondroid extracellular substance or mature cartilage, fibromyxoid material was present in 29 (93.5 %), adipose tissue fragments or adipocytes in 24 (77.4 %) and cuboidal epithelial cells in 28 (90.3 %) aspirates. CT scans showed peripherally located round or oval nodular mass with sharp edges. Characteristic CT scan picture consisted of heterogeneous structure with speckled, low density areas (fat, cartilage) and calcifications. Over this period 6 (17.1 %) patients underwent surgery, the definitive histologic diagnosis in all cases was hamartoma. Follow-up for the rest of the patients was unremarkable.

**Conclusions:** In some cases of pulmonary hamartomas the definitive diagnosis can be made only by CT without invasive diagnostic procedures. Many times CT does not yield a definitive diagnosis and in these cases we recommend transthoracic FNAC. We also feel that the majority of patients with hamartomas can be followed clinically rather than undergoing surgical procedure.

Bony thorax: Spectrum of Radiologic Features of Various Etiologies

We retrospectively collected the cases of abnormalities in bony thorax in our hospital for recent 5 years. The purpose of this exhibit is to demonstrate chest radiography and CT findings of bony thorax of various etiologies. Trauma-related lesions usually occur in isolated but can alert the radiologist to other injuries. Infection include acute and chronic osteomyelitis, and secondary change from adjacent chest wall infection. Benign bone tumors include osteochondroma(exostosis), enchondroma, fibrous dysplasia, Langerhans cell histiocytosis. Malignant tumors have metastasis and primary tumor of bony thorax. A variety of pathologic conditions of the bony thorax may be overlooked at chest radiography. CT is an excellent imaging modality for depicting bony thorax. The acknowledgement of these entities is helpful to make specific diagnosis and avoid mistake in clinical practice.

Mediastinal cystic lesions: radiologic spectrum

**Objective:** We present the characteristic radiographic, computed tomographic (CT), and magnetic resonance (MR) findings in major congenital and acquired mediastinal cystic masses.

**Methods:** The prospective study included 30 patients (26 adults and 4 children) with mediastinal masses. All patients were surgical treated.

**Results:** In our study, there were 7 cystic teratoma, 5 bronchogenic cyst, 5 mediastinal hydatid cyst, 4 thymic cyst, 2 pericardial cyst, 2 lymphangioma, 2 gastric duplication cyst, 2 left ventricular aneurysm, and 1 cystic goitre. Lesions were located in the anterior mediastinum (n = 13), right paratracheal (n = 6), the posterior mediastinum (n = 4), the middle mediastinum (n = 2), subcarinal (n = 2), aortopulmonic window (n = 2) areas, and below the right hilum extending into the posterior mediastinum (n = 1). On chest radiographs, benign mediastinal cysts appear as a sharply margined, round or oval area of increased opacity. Cross-sectional imaging with CT and/or MRI allowed narrowing of the differential diagnosis of mediastinal cystic masses substantially by defining the origin and tissue characteristics.

**Conclusion:** Radiological evaluation of a mediastinal cystic masses is an important challenge in chest radiology. Whereas chest radiograph gives limited results, cross-sectional techniques, especially CT and MR, play a powerful role in evaluating the mediastinum.
**40 Pneumothorax, Pneumomediastinum and Pneumopericardium: Pictorial Review**

**Objectives:** Review the embryology and the anatomy of the pleural and pericardial reflections in the thorax. To describe the pathophysiology, the various radiographic signs and the diagnostic pitfalls of pneumothorax, pneumomediastinum and pneumopericardium on chest radiographs their correlation with chest CT.

**Methods:** A retrospective review was carried out on 20 patients of the ICU unit with the clinical and radiological diagnosis of pneumothorax, pneumomediastinum and pneumopericardium. The chest X-Rays and CT scans were revised by two independent observers without knowledge of the clinical data. The observers recorded the abnormalities and the most likely diagnosis.

**Results:** In the radiological diagnosis of pneumothorax, pneumomediastinum and pneumopericardium, chest radiography is the primary modality but is not as sensitive and specific as CT that can allow the earlier diagnosis of them and detecting associated abnormalities.

**Conclusion:** Pneumothorax, pneumomediastinum and pneumopericardium usually develop during emergency situations and these conditions may result in cardiopulmonary compromise. An early and accurate diagnosis is crucial for proper treatment.

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**41 Confused uptake of FDG-PET in benign and malignant lesions of the chest**

**Purpose:** To correlate the computed tomographic (CT) findings with FDG-PET findings in various lesions of the chest and to evaluate the benefit for adequate diagnosis and treatment with chest lesions.

**Materials and Method:** Twenty consecutive patients with chest lesions suspicious for malignancy or benign underwent FDG-PET scanning and chest CT. All findings were confirmed by histologic examination or response to medication. FDG-PET scan was evaluated by using peak standardized uptake values. Computed tomographic (CT) and histopathologic findings also were reviewed.

**Results:** The mean age of patients was 48 years (range, 8-72 years). They had various chest lesions, which included benign (tuberculous granuloma, active tuberculosis, bacterial infection, organizing pneumonia, fungal infection, hamartoma, hemangioma, and post-operative change), malignant lesions (BAC, lung metastasis from other organs, and metastatic lymphadenopathy) and normal structure showing intense uptake. The mean SUV of these lesions was 3.1.

**Conclusion:** Although FDG-PET is an accurate imaging modality to differentiate malignant from benign lesions with a high sensitivity and negative predictive value, high FDG uptake in some benign or inflammatory lesions can cause false-positive results and low FDG uptake in some malignant lesions can also cause. Therefore, radiologists should be familiar with these appearances of chest lesions so that such chest lesions are not misdiagnosed ...

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**51 CT appearances of talc pleurodesis**

**Aim:** Talc pleurodesis has been used for many years in the management of patients with pleural effusions and spontaneous pneumothorax but the CT appearances following talc pleurodesis have not been widely reported.

**Material And Methods:** The post pleurodesis CT studies of 16 patients obtained over a 5 year period were reviewed. The mean age was 63 years (Range 41–79). 10 patients were male. 9 patients had a single post pleurodesis CT scan of the chest performed and 7 had more than one post procedure chest CT scan. The patients underlying pathology which led to their pleurodesis was: mesothelioma (7), spontaneous pneumothorax (4), metastatic adenocarcinoma (2), lung carcinoma (2) and lymphoma (1).

**Results:** The characteristic finding observed in all patients except one was the presence of high density deposits in the posterior basal regions of the pleural space. These were typically linear in 7 patients, nodular in two and a combination of linear and nodular in six. In one patient, the only abnormality was mild soft tissue density pleural thickening posteriorly. In five patients talc deposits were present on both visceral and parietal pleura separated by an effusion (a variant of the split pleura sign). Talc deposits extended into an interlobar fissure with associated fissural thickening in five patients. In patients who had more than one CT study, the appearances remained stable.

**Conclusions:** The typical finding was the presence of high attenuation areas in the posterior basal regions of the pleural space. Two new appearances were observed; extension of talc deposits in to the fissure and the presence of a variant of the split pleura sign. It is important to recognise these CT appearances so as not to confuse them with other pathologies such as asbestos exposure.
Right inferior pulmonary vein pericardial recess: a potential pitfall. Morphological and densitometric analysis with Multidetector CT

Objective: To evaluate morphological and densitometric features of right inferior pulmonary vein pericardial recess (RIPVPR), that could be misinterpreted as adenopathy or pulmonary nodule.

Methods: 265 consecutive patients underwent CT of the chest with a Multidetector CT (LightSpeed Pro 16, GE Medical System) before and after contrast medium injection, using a collimation of 16 x 1.25 mm. Axial images and 2D sagittal and coronal reconstructions were retrospectively reviewed, evaluating dimensional, morphological and densitometric features of RIPVPR, if identified. Location, size and shape as well as attenuation and enhancement of RIPVPR were systematically reported.

Results: RIPVPR has been identified in 30/265 patients (11 %). The inferior portion of the recess, usually round shaped, resulted most frequently identified (73 %), because of its greater diameter. Anterior and posterior portions of this recess have small dimensions and spindle shape. The mean density of the recess resulted of 20 H.U. and a frequent finding were areas with negative density values. An enhancement of RIPVPR has never been identified after contrast medium and an effect mass on the right inferior pulmonary vein never identified.

Conclusion: RIPVPR is a frequent finding on Multidetector CT of the chest. Morphological and densitometric features are typical and, if known, allow an easy differential diagnosis from hilar adenopathies or pulmonary nodules.

Three cases of lymphangioma of the mediastinum in a children

Introduction: Lymphangiomas are developmental anomalies of vasculo-lymphatic origin. They can arise anywhere along the lymphatic system; however, they are usually located in the neck, upper mediastinum or groin, and in most cases (80–90 %) appear by the age of 2 years. They can be of simple capillary, cavernous or cystic types. Enlargement of these cystic lesions is common and may compress the adjacent organs, causing respiratory distress, feeding difficulties, or vascular compromise. The aim of our study was to assess the CT appearance of mediastinal thoracic lymphangioma and to define the nature, extent, and anatomic relationships of these lesions.

Materials and Methods: Three patients (mean age 1 year) with mediastinal and cervicomedial lymphangioma. Chest CT was performed in all the cases. Two cases had symptoms such as dyspnea and superior vena cava syndrome.

Results: One patient had cystic lesion located in the posterior mediastinum extending over the vertebral column to both hemi thoraces, the lesion was unilocular and smoothly marginated with water attenuation inside. Two patients had a giant multicycstic and multiseptated non-enhancing mass of soft tissue attenuation, the lesions were located in the upper and middle mediastinum and right hemi thoraces. The lesions extended into the posterior mediastinum, to the anterior right neck region, to the right paravertebral sulcus, with displacing and compressing mediastinal structures. The lesions in the upper mediastinum enveloped the great vessels. Pathologic examination identified two cases of cystic type, and one cavernous type.

Conclusion: The CT appearance of mediastinal thoracic lymphangioma is variable depending on the pathologic type. CT gives a more accurate assessment of relationship to neighbouring organs. Typically at CT, the lesion displaces solid organs, has uniform septa which slightly enhance and has contents of attenuation near that of water.

NEW EXAMINATION’S TECHNIQUES
(e.g. CR, DR, double source CT, molecular imaging)

Capability of multidetector CT to study of the bronchial arterial.

Objectives: the aim of this study is to assess the capability of multidetector CT to study of the small arteries as the bronchial arterial.

Methods: from October 2005 to January 2006 20 patients are underwent to thorax multidetector TC with clinical suspicious of pulmonary nodules or follow-up for anamnestic cancer or for bronchial stenosis. MDCt scanning was performed with a spiral scanners (Lightspeed Advantage, GE Medical Systems, Milwaukee, Wis.). In all patients, we injected iopromide (370 mg/ml, 2 ml/kg) (Ultravist 370; Schering, Berlin, Germany) into an antecubital vein with a power injector at a rate of 3.5 ml/sec.

Results: 17 right bronchial arterials and 15 left bronchial arterials are individuated. We could analyzed also 10 inter-rib-bronchial trunks and the presence of 4 bronchial arterials at the emergences.

Conclusion: this study demonstrate the capability of multidetector TC to study of small arteries with minor cost and risk of the angiography study.
**HRCT findings and severity of asthma**

**Objectives:** The aim of this study was to clarify the distinction among HRCT findings according to asthma severity.

**Methods:** We evaluated 80 patients with asthma and 21 healthy subjects. 28 out of the 80 asthmatic patients had mild asthma (group 1), 20 had moderate to severe asthma (group 2) and 32 had severe persistent asthma (group 3). All patients underwent HRCT scans at full inspiration and full expiration. HRCT scans were evaluated for:

- Bronchial wall thickening (using bronchial wall index, BWI)
- Prominence of centrilobular structures
- Air trapping on expiratory scan
- Bronchiectasis
- Emphysema
- Ground glass opacities

The lung was divided into six zones, each of these zones was evaluated and scored separately for the presence and/or extent of the HRCT features. Prominence of centrilobular structures and air trapping were scored according to the cross-sectional area of lung involved in each zone. The total score ranged from 0 to 24. Grade 1 was defined for a total score of < 6, grade 2, 3, 4, were defined for total scores 6 to 12, 13 to 18 and >18 respectively.

**Results:**
- The mean BWI values were: group 1: 0.46 ± 0.03, group 2: 0.53 ± 0.01, group 3: 0.55 ± 0.02, all of which were higher than the control subjects (0.4 ± 0.08).
- Prominence of centrilobular structures was observed in all patients with severe persistent asthma (100 %), in 38 % of group 1, 72 % in group 2, but in none of the control group.
- The frequency of air trapping was 75 % in group 1, 80 % in group 2, 84.3 % in group 3 and 0 % in the control group.
- Bronchiectasis was present in one case in group 1, 1 case in group 2 and 3 cases in group 3.
- Ground glass opacities were found in one case in group 1.

**Conclusion:** Abnormalities revealed by HRCT are more intensive in all the groups of asthmatic patients compared to all healthy subjects, regardless of the severity of the disease.

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**MDCT lung volumes evaluation: comparison to clinical findings**

**Objectives:** To compare quantitative MDCT evaluation of pulmonary gas volume, FRC (functional residual capacity) volume, pulmonary tissue volume, to clinical findings in ARF (Acute Respiratory Failure) patients.

**Methods:** Twenty-eight ARF (Acute Respiratory Failure) patients admitted to Emergency Department because of polytrauma or pneumonia or cardiogenic edema or suspected pulmonary embolism or an unknown dyspnea-air hunger. Systemic arterial blood samples were withdrawn 10 min before the CT scan: arterial pH, Pao2, Paco2, haemoglobin concentration and arterial oxygen saturation. Functional respiratory parameters were measured in mechanically ventilated patients using Servo Ventilator.

GE 16 MDCT scan was performed during continuous respiration or PCV mode (pressure-constant ventilation); a volumetric acquisition from apex to diaphragma in 7 sec was obtained. Data were analysed by an Advantage Workstation with 3D-Reformat Imaging, Volume Density masks, Volume Density Histograms.

**Statistical analysis:** Gaussian distribution Linear Regression model, ANOVA table. Correlation (Pearson r) assume Gaussian distribution; Spearman non parametric correlation.

**Results:**
- Significant correlations (P < 0.05) between systemic arterial blood gas parameters, functional respiratory measurements and MDCT lung volumes data.

**Conclusion:** Multi-slice scanners allow image acquisition with high temporal resolution and reduction of image artefacts; high technology workstations can yield complex visualization post processing (VR, Air-way Navigator, MPR) and in the same time quantitative analysis from raw data to measure lung volumes and to quantify lung aeration. In this study we found significant correlation between MDCT data and clinical findings.

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**Quantitative perfusion MR in patients with chronic obstructive lung disease: Correlation of perfusion parameters with pulmonary function test and quantitative CT**

**Purpose:** The purpose of this study is to evaluate the correlation of perfusion parameters of three-dimensional, contrast-enhanced MR imaging (3DCEMRI) with pulmonary function test (PFT) and quantitative CT parameters.

**Materials and Methods:** Eight patients with chronic obstructive lung disease (COPD) and nine patients with solitary pulmonary nodule were included. 3DCEMRI covering the whole lung was performed with a temporal resolution 1.0 s and 35 dynamic phases. From the signal intensity-time curves, pulmonary blood flow (PBF), mean transit time (MTT) and pulmonary blood volume (PBV) of each pixels were calculated by using in-house software. In all patients, volumetric CT was done with 0.75 mm collimation. Quantitative parameters assessed were the volume fraction of the lung below -950HU (V1) and mean lung density (MLD). Parameters from PFT included FVC, FEV1, FEV1/FVC and DLCO. Statistical analysis was performed with Spearman correlation analysis and stepwise regression.
Results: The calculated mean PBF, MTT, and PBV were 104.66 ± 75.62 mL/100 mL/min (mean ± SD), 4.04 ± 0.74 sec, and 7.83 ± 5.54 mL/100mL, respectively. Spearman correlation test showed that the decrease in PBF and PBV correlated with the decrease in FEV1/FVC and increase in V950 (all test, p < 0.05). Decrease in MTT correlated with decreased in FEV1 and FEV1/FVC (p < 0.05). Stepwise regression analysis revealed that V950, DLCO and MLD were independent determinants of PBF; V950, determinant of PBV; and FEV1/FVC determinant of MTT (all test, p < 0.05).

Conclusion: This study shows that deterioration in perfusion parameters measured on MR in patients with COPD correlates strongly with the severity of impairment of ventilation function and parenchymal destruction.

061296145
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Acute COPD exacerbation: MRI evaluation of regional pulmonary perfusion -preliminary experience

Objective: Aim of our study was to evaluate regional semi-quantitative pulmonary perfusion differences in the lung in COPD patients under acute exacerbation.

Material and Methods: 23 Moderate Chronic Obstructive Pulmonary Disease (COPD) patients 13 of which underwent a COPD exacerbation, were studied. Two-dimensional contrast-enhanced, first-pass dynamic MR perfusion imaging was performed in all the Patients under clinical stable conditions and under exacerbations. All the examinations were performed on a a 3T magnet operating MR unit, having 80mT/m gradients (Achieva 3T – Philips Medical Systems) using a body coil.Dynamic images (TR 3.5 ms ; TE 1.4 ms; NSA: 2; matrix 256 x 256; reconstructed matrix 512 x 512; FOV 35–40 x 35–40 cm; total scan time 14 sec; scan delay, 6 sec.) were acquired with a 2D breath hold 11 TSE sequence.

Results: During acute exacerbation all patients have shown pulmonary hypertension as assessed by the catheterization of the pulmonary artery, with no evidence of pulmonary embolism as assess by CT examination.

The MR perfusion study showed no significant difference in IAUC values between clinically stable COPD patients and COPD patients under acute exacerbation was observed (mean AUC values:pre-exacerbation 1650 ± 188 Is/t; during exacerbation 1550 ± 176 Is/t,P < 0.001).

Decreased wash-in rates (mean value pre-exacerbation 73 ± 33Is/t;mean value during exacerbation 9 ± 3s) and wash-out rates (mean value pre-exacerbation 75 ± 33Is/t; mean value during exacerbation 10 ± 3s) were observed during exacerbation as compared to pre-exacerbation values.

Conclusion: Our preliminary data have shown that the pulmonary hemodynamic abnormality in COPD patients under acute exacerbation may be due to vasoconstriction and/or pulmonary micro embolism as expressed by pulmonary peripheral decreased wash-in and wash-out rates.

061299246
Woo Jeongjoo (Korea) jjblue@eulji.or.kr
Usefulness of Coronal and Sagittal Image Reconstruction for Detection of Small Apical Blebs in Patients with Spontaneous Pneumothorax using Multidetector CT

Objective: Primary spontaneous pneumothorax is nearly always the result of rupture of an apical blebs. To assess the usefulness of coronal & sagittal image reconstruction for detection of small apical blebs as compared with 2mm reconstruction axial images revealed by 16 channel MDCT.

Methods: A retrospective study was performed with 55 patients with primary spontaneous pneumothorax who underwent MDCT (120 kVp, 1mm collimation, pitch of 6) of lung apex (4–5 cm caudad from apex)was performed as follows. Axial images were made with 2mm reconstruction intervals and coronal, sagittal reformat images were made with 2mm reconstruction intervals. Axial images and coronal, sagittal images were interpreted by two radiologists. Presence, location, sharpness of apical blebs were recorded.

Results: Apical blebs were detected in 48 of 55 patients (87 %) with 2mm reconstruction axial images and 53 of 55 patients (96 %) with 2mm interval coronal reformat images, 54 of 55 patients (98 %) with sagittal reformat images. 17 small apical blebs in 6 patients were detected only in coronal or sagittal reformat images. These blebs were very small (<5mm) and located at the top of the apex. 2 subpleural blebs are noted only in sagittal reformat images. Sagittal reformat image has superior resolution to coronal reformat image. Distribution of the blebs were more clearly visualized on coronal and sagittal images than axial image in 50 patients (90 %). Sharpness of the blebs were mostly not dependen t to image reconstruction tool but the size and location of the blebs.

Conclusion: MDCT scans with coronal and sagittal image reconstruction is significantly useful in detecting small, far apical blebs in patients with primary spontaneous pneumothorax. Coronal and sagittal image reconstruction is recommended for routine process in addition to axial reconstruction in patients with primary spontaneous pneumothorax.
Pulmonary embolism

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Parenchymal and pleural findings on CT angiography: differences between patients with and without pulmonary embolism and relationship with the presenting syndrome.

Objectives: To evaluate parenchymal and pleural findings on CT angiography, and to compare their frequencies in patients with and without pulmonary embolism (PE) and in the different presenting syndromes of patients with PE.

Methods: CT angiograms of 235 patients with clinical suspicion of acute PE were retrospectively evaluated for the presence of parenchymal and pleural findings. The final diagnosis of PE was clinically established by using a validated algorithm. Patients with pulmonary embolism were classified according to their presenting syndrome in 4 groups: pulmonary hemorrhagic or infarction, isolated dysnea, circulatory collapse and asymptomatic. Differences between patients with or without PE and among different presenting syndromes were evaluated calculating odds ratio (OR) with 95% confidence intervals (CI).

Results: Seventy-six patients had PE. Thirty-seven of them presented with the pulmonary hemorrhage or infarction syndrome. The only parenchymal abnormality significantly associated with PE was peripheral wedge-shaped opacity, which was seen in 10 (13.2%) patients with PE and 3 (1.9%) without PE (OR, 7.8; CI = 2.1, 29.5). Bilateral pleural effusions were significantly more frequent in patients without PE (23.9% vs 7.9%; OR, 0.27; CI= 0.11, 0.68).

When patients with PE were evaluated according to their presenting syndrome, atelectasis was significantly more frequent in patients with hemorrhagic or infarction syndrome than in the other presenting syndromes (19% vs 8%; OR = 3.77; CI = 1.06, 14.16). Peripheral wedge-shaped opacity was similarly distributed in patients with different presenting syndrome.

Conclusions: Parenchymal and pleural findings at CT are of limited value for differentiating patients with or without PE. Peripheral wedge-shaped opacity was more frequent in patients with PE having the hemorrhagic or infarction syndrome than with other presenting syndromes.

Chronic thromboembolic pulmonary hypertension (CTEPH): CT measurements and correlation with pulmonary artery pressures

Pozek Igor (Slovenia) igor.pozek@klinika-golnik.si

Objectives: To correlate pulmonary artery (PA) diameter and sizes of heart chambers on CT angiography with pulmonary artery pressures in patients with CTEPH and in patients with other causes of pulmonary hypertension.

Methods: Measurements of max. PA diameter, max. right ventricle diastolic diameter (RV) and right/left ventricle diastolic minor axis ratio was calculated (RV/LV) on thoracic CT angiography of seven patients with CTEPH and ten patients with other causes of PH (1 COPD, 4 Sistemic Sclerosis, 3 Primary Pulmonary Hypertension, 1 Veno Occlusive Disease, 1 Hepato Pulmonary Hypertension). Catheter measurements of mean PA pressure (mPAP) were performed. Pressure gradient between pulmonary artery diastolic pressure and mean wedge pressure (Pad-mwp) was calculated. Linear regression analysis was made between CT measurements and PA pressures.

Results: Significant correlation of PA diameter with mPAP and Pad-mwp for the whole group of 17 patients was found ($r = 0.64$ and 0.62). For the group of 7 patients with CTEPH correlation was better ($r = 0.75$) and for the other group with PH it was statistically not significant ($r = 0.43$). Even better correlation of PA diameter and Pad-mwp was found for CTEPH patients ($r = 0.94$). Measurements of RV and RV/LV minor axis ratio didn’t correlate significantly with PA pressures.

Conclusion: In patients with CTEPH PA diameter correlates with mPAP and even better with pressure gradient between pulmonary artery diastolic pressure and mean wedge pressure.
Cardiac Physiology by Tomographic Imaging

Simultaneously. It means nowadays we can answer cardiac questions like in an ONE-STOP-SHOP replacing in part previous diagnostic methods and improving the quality of information.

**Goal:** The goal of the presentation is to demonstrate and to discuss the basic control mechanisms of cardiac function (sympathicus and parasympathicus) and the direct (heart rate, ventricular contractility, arteriolar resistance, venous tone) and derived (cardiac output, rate pressure product, aortic pressure, wall tension) determinants of myocardial perfusion.

**Methods:** More than 4.000 patients were studied by CT and above 1000 by MRI using standardized protocols evaluating the coronary end myo-, peri- and endocardial morphology, myocardial perfusion (ml/100g/min) and cardiac functional parameters as EDV, ESV, EF, LVMM, contractility and aortic compliance. Additionally in all patients the heart rate and the blood pressure were measured and the rate pressure product calculated.

The studied group of patients consisted of: healthy volunteers, coronary heart disease (before and after bypass surgery or dilatation), congenital and acquired cardiac diseases, valvular diseases (before and after surgery), cardiomyopathies, hypertension, diabetes mellitus, renal failure with haemodialysis, pericardial disease and cardiophobia.

**Results:** Myocardial perfusion was (as hypothesized) closely related to the heart rate, cardiac output, rate pressure product and blood pressure. Myocardial perfusion may be in normal range in spite of several coronary stenotic lesions above 50 %, when tachycardia and/or high blood pressure are present; may decrease without stenotic lesions above 50 % when bradycardia and/or low cardiac output and/or low blood pressure are present.

**Conclusion:** Our results show that it is possible to measure myocardial perfusion quantitatively on daily basis. For the individual clinical interpretation of the measured myocardial perfusion values it is necessary to evaluate simultaneously its direct and derived determinants and to take in consideration the role of the neuro-humoral system.

**Take home points:**

1. For optimal study interpretation all morphological and functional determinants of the heart must be evaluated.
2. Myocardial perfusion is mainly determined by rate pressure product.
3. The regulation of myocardial perfusion is a multifactorial process.

**The most important articles published in the period 2003–2006:**
Clinical indications for cardiovascular magnetic resonance (CMR); consensus panel report. Eur Heart J 2004; 25:1940–1965

**The most important statements concerning the subject of the lecture in the year 2005/2006:**
1. The advanced Multi Slice CT technology is approaching a quality by which diagnostic coronary angiography may be replaced.
2. New algorithm in evaluating coronary artery disease are upcoming.
3. Close collaboration of all involved and interested in cardiac diseases is necessary.
MRI of Valvular Heart Diseases (VHD)

MRI has a unique role in cardiac imaging, based on the capability of giving morphology, function, flow and perfusion data in the same examination.

Valvular heart diseases are a topic in which the competition of echocardiography is extremely powerful; in fact, Echo gives superb anatomic details, and doppler completes flow velocity information. For these reasons Echo remains the first choice and usually unique imaging method. Nevertheless MRI can be useful as it has some advantages, such as independency from patient habit, higher reproducibility, flow quantification.

There are several MRI techniques to investigate valve diseases: black blood imaging to assess morphology, cine-MRI to evaluate valve function and chambers function, cine-phase contrast to quantify absolute flow and flow velocity.

Concerning morphology, Echo is superior in the evaluation of leaflets and sub-valvular apparatus.

In functional assessment, MRI is the gold standard technique for global ventricular function evaluation; in valve function qualitative assessment is based on size measurement of anterograde or retrograde flow voids, but the correlation with echo-doppler is relatively good because of high variability of signal voids due to echo time dependency.

Flow and velocity quantification with cine-PC is accurate. In single valve regurgitation, the technique is considered the gold standard for regurgitant volume and fraction measurement. In valvular stenosis pressure gradient evaluation is accurate but an important issue is the exact setting of the encoding velocity. Furthermore, different methods to calculate the area of stenotic valve are available.

Finally, contrast-enhanced MRI is very useful in post-operative complications assessment, such as para-valvular leakage and abscess.

Take home points:
1. Echo > MRI in morphology
2. Absolute flow quantification is peculiar of MRI
3. Cine-PC is the gold standard for quantification of valve regurgitation

The most important articles published in the period 2003–2006:
## ESTI HISTORY

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<td>2006</td>
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BASIC INFORMATION

Official Meeting Language
The official meeting language is English. There will be no interpretation provided.

Slide Preview Room
The Slide Preview Room is located in the meeting room Vienna I. All technical equipment will be available for final checking of your presentation. To avoid any later problems it is highly recommended that you check the compatibility of your system with the conference projection system. Our technical staff will be glad to assist you.

IT IS ESSENTIAL FOR THE SMOOTH RUNNING OF THE MEETING THAT ALL SPEAKERS HAND IN THEIR POWERPOINT PRESENTATION AT LEAST ONE HOUR BEFORE THE BEGINNING OF THEIR SESSION. Enough time must be allowed to check the presentations carefully and for the staff to enter the data into the system.

Poster Presentation
The poster presentation will be held from Friday June 9, 2006 until Sunday June 11, 2006. The number of your poster can be found in this programme book and will also be displayed at the entrance to the Poster Area.

Mounting hours:
- Thursday, June 8, 2006: 16:00 – 20:00
- Friday, June 9, 2006: 8:00 – 12:00

Opening hours:
- Friday, June 9, 2006: 12:00 – 18:00
- Saturday, June 10, 2006: 8:00 – 18:00
- Sunday, June 11, 2006: 8:00 – 12:00

All poster authors are kindly asked to display at their posters time when they will be available for poster discussion. Pins for mounting posters will be available at the Poster desk.

Abstracts
Abstract book is included in the Final Programme. Abstracts are printed as they were received by on-line electronic submission without editing. The organisers are not responsible for any errors in English or missing information.
Exhibiton
The meeting exhibition takes place in the Belveder Foyer (Level 01).

Set-up hours:
- Thursday: June 8, 2006 12:00 – 19:00
- Friday: June 9, 2006 8:00 – 12:00

Opening hours:
- Friday: June 9, 2006 8:00 – 18:00
- Saturday: June 10, 2006 8:00 – 18:00
- Sunday: June 11, 2006 8:00 – 12:00

Break-down hours:
- Sunday: June 11, 2006 12:00 – 19:00

Internet Corner
Four internet terminals will be available in the Vienna II.

Messages board / Information desk
The message board is located at the Registration Area as well as Information Desk. Our staff at the Registration Desk will be more than pleased to help delegates with their queries.

Coffee breaks and Lunches
Two coffee breaks are organised during each day. Coffee breaks will be served in the exhibiton area. Lunches are not included in your registration. If you would like to order lunch boxes, please ask for at the Registration desk. Lunch boxes can be ordered one day in advance for 10 €.

Business Centre
The business centre is located at level 0 near the reception desk. Hotel staff will be glad to assist you sending faxes, making copies etc…

Useful telephone numbers:
- Prague Information Service: 221 714 444
- Reception Desk hotel Diplomat: 296 559 111
- Meeting Secretariat: 777 791 173
- Emergency (police, firemen, first aid): 112
- Prague International Airport (operator): 220 111 111
Meeting Venue

Diplomat**** Prague hotel:
The four-star Golden Tulip Diplomat Hotel is located on the very edge of Prague’s historic centre, only 10 minutes from the city airport. Close to the Prague Castle it is surrounded mainly by diplomatic residences. It offers 398 standard to superior rooms and suites. Three floors have been arranged for non-smokers. Specially equipped rooms for the disabled are also available. The spacious newly renovated Conference Centre with its sixteen rooms can accommodate up to 820 persons and provides state-of-the-art audio-visual technology, multimedia equipment and facilities for simultaneous interpreting. Other services include restaurants, hairdressers’, a newspaper & souvenir shop, an antique shop, a car and limousine rental, a car park service, a business centre, a fitness and health centre and a room service. The business centre is located on the 2nd floor. There are 16 types of rooms tailored for every client’s requirements. All conference premises are fully air-conditioned.

http://www.diplomatpraha.cz

Venue Accessibility:

Prague Ruzyně International Airport is located approximately 20 km north-west of the city centre (30 min. by taxi). The airport is served either by taxi or public transport. The Diplomat hotel is located at the final station of the public bus No. 119 which goes from the airport.

From the Airport to the Diplomat hotel:
From the airport take the bus no.119 (which runs every 10-15 minutes) to Dejvická station – final station. The Diplomat hotel is situated there. By bus the journey takes approx. 30 min.

By taxi to the Diplomat hotel:
By taxi the Diplomat hotel is approx. 20 minutes away from the airport. The price for a taxi should not be higher than approx. 700 CZK (22 EUR). Credit cards are not accepted. Cash is the only means of payment. The airport is served either by airport taxis or by private taxis.

By train to the Diplomat hotel:
Most of the international trains arrive at the Main station – Hlavní Nádraží. From the Hlavní Nádraží station take metro line C to the station Muzeum than you have to change the line C for line A and the Diplomat hotel is situated at the terminate station Dejvická.

Travel from the city centre:
From Prague city centre (Wenceslas square) the Diplomat hotel can be reached by the subway. Take metro line A from the Muzeum station to the terminate station Dejvická. The Diplomat hotel is next the station. The Diplomat hotel can be also easily reached by trams from the city centre (e.g. trams No. 20, 26 or night tram No.51)
Prague and Czech Republic

Prague:
Prague, the capital city of the Czech Republic, lies in the heart of Europe and ranks amongst the most impressive historical cities in the world. The city has always played an important part in the history of the nation, country and Europe. Prague is not only a centre of cultural movements dating back for centuries (Art from every period in history can be found here), it also exhibits a unique collection of historical monuments, dominated by Prague Castle. In 1992, the historical core of the city (866 hectares) was listed in the UNESCO World Cultural and Natural Heritage Register as a town with a unique and lively blend of Roman, Gothic, Renaissance, Baroque, Art Nouveau and Cubist architecture. Prague was one of nine European cities awarded the title European City of Culture in 2000. Prague has around 1.2 million inhabitants. For more information, visit the website www.pis.cz.

About Czech Republic
The Czech Republic is a small country in the heart of Europe, which has an appeal for visitors. Thanks to it’s location at the crossroads of various cultures, the Czech Republic has countless cultural and historical points of interest, these destinations attracted a relatively high number of foreign tourists even before the velvet revolution. The physical land area puts into a category of smaller countries. Aside from the Czechs: Moravians, Silesians, Slovaks, Germans, Polish, Gipsies and other nationalities also inhabit the culturally diverse country. The Czech Republic is a country of great historical and cultural importance, a country where historic monuments and entire towns have been included on the World Heritage List. Czech Republic also has good venues available for congress, cultural, market, incentive and spa tourism. Czech Republic has much to offer to tourists from all around the world. There is something for everyone here. Since May 1, 2004 Czech Reublic has become a member of EU.

Time difference
The Czech Republic is in Central European Time Zone. Central European Time (CET) is 1 hour ahead of Greenwich Mean Time (GMT+1). After last Sunday in March the time in the Czech Republic is shifted back by 1 hour to Central European Time and this lasts until the end of September.

Weather
Temperature: Prague is a city with a mixture of oceanic and continental, average winter temperature is 5 degrees of Celsius, average summer temperature is 20 degrees of Celsius. Annual precipitation: 500 – 700 mm.
For actual weather goes to www.novinky.cz/pocasi.

Currency
The Czech currency is called the Czech crown. In circulation is in the form of banknotes of the following value: 5,000, 2,000, 1,000, 500, 200, 100 and 50 crowns and coins of the following value: 50, 20, 10, 5, 2, 1 crowns and 50 halers. Exchange offices and ATM machines are easily available throughout the town and at Prague International Airport. It is advisable to exchange money in banks rather than in the high street exchange offices. The approximate exchange rate as per May 2006: 1 € = 28,2 CZK. For actual course go to www.crb.cz.
Prague Transportation
A public transport ticket from 8th until 12th June was arranged for every participant. Tickets will be delivered at a registration desk.

Metro
The Prague Metro network consists of 3 lines designated by letters and differentiated in colour: A – green colour (Skalka station – Dejvická station), B – yellow colour (Černý most station – Zličín station), C – red colour (Ládví station – Háje station), with transfers possible at Museum station (lines A and C), Můstek station (lines A and B), Florenc station (lines B and C). Metro operates daily from 5 a.m. to 12 p.m.

Trams
Daytime operation is from 4:30 a.m. to 24:00 a.m. Night time operation is from 0:30 a.m. to 4:30 a.m. and is provided by tram No. 51 to 58 with traffic intervals 30 minutes. The central transfer-station for night time lines is Lazarská stop. Tram schedules are located at individual stops.

Buses
The daytime and night time operation of buses is similar to tram operation. Night time service is provided by bus No. 501 to 514. Bus schedules are located at individual stops.

Taxi
When taking a taxi, be sure that the taxi is equipped with a permanently installed yellow roof lamp with the TAXI sign in black letters. The registration number, company name and price list including the base rate, rate per kilometre and one-minute-waiting rate must be displayed on both front doors of the cab. These prices must correspond with the prices set on the meter in the cab. Customers are recommended to order a taxi with non-stop dispatching offices where the information on fares is available in advance.

Visa
All foreign visitors to the Czech Republic must possess a passport valid for at least the next 3 months. Participants who require a visa should apply in advance to the consular offices of the Czech Republic or diplomatic mission in their country in order to avoid delays in travel arrangements to the meeting. Please note that the Visa application procedure can take up to 2 months. For more information about Visa requirements please visit www.mzv.cz. For more information about Czech Republic please visit website www.czech.cz.

Participants can change money as well as use a bank machine in the hotel Diplomat.

Restaurant – Czech cuisine
Czech cuisine is typical of Middle European gastronomy, yet clearly reflects a number of Czech elements – e.g. bread or fruit dumplings, various kind of soups, sauces, numerous potato dishes, cake and wide range of festive dishes. In general Czech gastronomy means roasted pork with dumplings and sauerkraut, potato pancakes, plum dumplings and bilberry cakes... and of course Czech drinks – primarily beer and first-rate wines from South Moravia, not to mention “Slivovice”, a clear Czech plum brandy and Becherovka a delicious herbal elixir.

Tipping: Services is almost always included in hotel and restaurant bills. A further tip of a few coins is appropriate. Some typical percentages for tipping are: restaurants – 5–10 %...
MAP OF PRAGUE

- Prague Castle
- Subway
- City Centre
- Ruzyně Airport

1. Diplomat Hotel – Conference Venue
2. Krystal Hotel
3. Masaryk College Dorms

Prague Castle
Subway
City Centre
Ruzyně Airport
SOCIAL PROGRAMME

CONFERENCE DINNER:
June 9, 2006 – 20:00: Jazz boat
Meeting participants are welcome to enjoy the evening that offers the opportunity to explore enchanted Prague from the deck of the Jazz boat. The river cruise will allow you to discover some of the city's major monuments and sights, such as the National Theatre, Prague Castle and Charles Bridge. Great food, drinks and Jazz music included. Entertainment guaranteed!

Price:
Delegates — Included in the registration fee.
Accompanying persons — 50 €.
Reserve your ticket soon, number of places limited.
Radiologists in training — 50 € (will be available onsite ONLY as per occupancy)
Transportation from the hotel Diplomat to the boat departure station will not be provided.

WORKSHOP CONCERT:
June 11, 2006:
For participant of Joint workshop of ESTI and ESCR will be organised a rock pop concert in Baracnicka Rychta club at a Lesser Town. Everyone is sincerely invited to relax over listening and dancing and to enjoy a music of a group Brati v Triku and an evening with a refreshment. A transfer will be provided from hotel Diplomat at 19:15 for every participant.

GUIDED TOURS

A number of interesting guided tours have been prepared for all delegates and accompanying persons. Please find the respective schedules and short description below. All participants are kindly asked to meet at the registration area in the Diplomat hotel at the scheduled times with exception of the evening events and post-congress tours. The organiser reserves the right to cancel any tour in case there are less than 15 registered persons. On-site request for guided tours are welcome but can not be guaranteed.

GRAND TOUR OF PRAGUE:
This insightful historical tour lets you enjoy the city’s most famous sights. Starting at The Prague castle, follows the “Royal Route”, winding down to the Lesser Town and picturesque Kampa island, you will cross the Charles bridge and continue to discover remarkable monuments of the Old town area.

Price: 37 €
The price includes A/R coach transportation. English speaking guide and entrance fees.
Dates: June 9, 2006 11:00
       June 10, 2006 13:00
Duration 4 hours
JEWISH TOWN: (Tour for accompanying persons)
You will discover an astonishing history of the Jewish community in Prague. Which can be traced back to the middle of the 10th century. Miraculously many outstanding documents have remained intact through the WWII. The visit includes the Old Jewish cemetery, the main synagogues (Old-New Synagogue…) as well as the Jewish Museum that stores a heartbreaking collection of children’s art from the Nazi concentration camp – Terezin.

Price: 43 €
The price includes A/R coach transportation. English speaking guide and entrance fees.
Dates: June 9, 2006 11:00
Duration 4 hours

DON GIOVANNI: NATIONAL THEATRE OF MARIONETTE
Unique marionette theatre in Art deco style presents it’s most famous performance Don Giovanni by Mozart. Mozart compounded his opera for Prague and he also conducted world premier of Don Giovanni in Prague… In case of interest we are able to reserve tickets for you… Just add your preferred date to the registration form… Programme of performances is to be announced…
# LIST OF PARTICIPANTS

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