

**Society of Thoracic Radiology
Oral Presentations
Scientific Session II
Tuesday, March 4, 2008**

Moderators: Drs. T. Mohammed and S. Bhalla

- 8 2:00 PM Beth Israel Deaconess Medical Center, **Tracheal Replacement Graft in an Animal Model: Preliminary MDCT Findings**, LITMANOVICH D, Tsukada H, Gangadharan S, Ernst A, Ashiku S, Garland R, DeCamp M, Boiselle P
Diana Litmanovich, MD
- 9 2:08 PM Beth Israel Deaconess Medical Center, **Measuring Post-intubation Tracheal Stenoses: Comparison of Standard Axial and True Perpendicular Reformatted Cross-sectional CT Images**, LITMANOVICH D, Ernst A, Raptopoulos V, O'Donnell C, DeCamp M, Boiselle P
Diane Litmanovich, MD
- 10 2:16 PM Cleveland Clinic, **Predicting Therapeutic Response by CT in Thoracic Metastatic Renal Cell Carcinoma**, SMITH AS, Shah SN
Andrew Smith, MD, PhD
- 11 2:24 PM MD Anderson Cancer Center, **When Does the Hemithorax Opacify After Pneumonectomy? Digital Radiographic Analysis of the Pleural Fluid Opacification in the Post-pneumonectomy Patient**, O'SULLIVAN P, Vaporciyan A, Munden R
Paul John Patrick O'Sullivan, MRCPI, FFR RCSI
- 12 2:32 PM University of California, Los Angeles, **Effects of Fissural Anatomy on Treatment Outcome of Emphysema Patients Receiving Endobronchial Valve**, ABTIN F, Goldin J, Brown M, Rao A, Kim H, Ahmad S, Roback D, Jiang A, Pais R, Irani Z, Brown K, Suh R
Fereidoun Abtin, MD
- 13 2:40 PM National Jewish Medical & Research Center, **Impact of Chest CT on Medical Decisions in MDRTB**, DYER D, Huitt G, Levin A
Debra S. Dyer, MD
- 14 2:48 PM Vanderbilt University, **Potentially Unnecessary Surgical Lung Biopsies in Patients with UIP**, RAGLE AN, Donnelly EF, Lancaster LH
Amanda Ragle, MD

Tracheal Replacement Graft in an Animal Model: Preliminary MDCT Findings

LITMANOVICH D, Tsukada H, Gangadharan S, Ernst A, Ashiku S, Garland R, DeCamp M, Boiselle P

Purpose: Tracheal transplantation has been an elusive goal for treating patients with diffuse tracheal diseases; however, partial tracheal replacement with an allogenic aortic graft offers a potential viable option. Our purpose is to determine evolution of MDCT findings following this procedure in an animal model.

Material and Methods: Between January 2007 and October 2007, 10 sheep each underwent resection of 8 cm of the proximal trachea, replaced by an 8 cm aortic allograft attached by end-to-end anastomosis. All animals were serially imaged between 2 wks and 6 mos after surgery using a 64-MDCT scanner (kVp120, mA 320, collimation 0.5 mm) pre- and post-contrast. Aortic graft length, diameter, wall width, density, enhancement and vascularization pattern were evaluated by a second-year thoracic imaging fellow. Mean serial measurements were compared to determine changes between 2 wks and 6 mos following surgery. CT results were compared to bronchoscopy findings in all cases and to necropsy in selected animals.

Results: Progressive graft contraction was observed with decrease in graft length from 80 mm (2 wks) to 19 mm (6 mos). Peri-graft inflammatory tissue decreased from 13 mm (2 wks) to 6 mm (6 mos). Grafts were homogeneous soft-tissue density on C- scans, with marked diffuse enhancement on C+ scans. MDCT and bronchoscopy findings were concordant in all cases, but MDCT led to improved recognition of graft contraction. Necropsy of 4 animals confirmed MDCT findings of graft contraction and necrosis.

Conclusion: MDCT provides important complementary information to bronchoscopy following tracheal replacement with an aortic graft and has the potential to improve understanding of anatomical and pathological changes following this innovative surgery.

Measuring Post-intubation Tracheal Stenoses: Comparison of Standard Axial and True Perpendicular Reformatted Cross-Sectional CT Images

LITMANOVICH D, A. Ernst, V. Raptopoulos, C. O'Donnell, M. DeCamp, P. Boiselle

Purpose: Routine axial CT images are not truly perpendicular to the tracheal long axis. The impact upon the accuracy of measuring focal tracheal stenoses is uncertain. Our purpose is to compare tracheal luminal measurements using standard axial CT images with reformatted axial images that are perpendicular to the tracheal long axis.

Materials and Methods: Consecutive patients with bronchoscopically-proven, post-intubation tracheal stenoses who also underwent MDCT evaluation between February 2003 and May 2004 were evaluated. All patients were imaged at end-inspiration with a MDCT scanner with a standard protocol (170 mAs, 120 kVp, 2.5 mm collimation). Standard axial images were reconstructed at 2.5 mm collimation. Additionally, a series of reformatted 2 mm collimation axial images were obtained perpendicular to the long axis of the trachea at an imaging workstation. For each case, at the point of maximal stenosis, luminal area and coronal and sagittal diameters were electronically measured by a thoracic radiologist. Statistical analysis was performed using the paired t-test.

Results: Study cohort was comprised of 24 patients (48 ± 18.1 years, 26-88 years range; 15 men, 9 women). Compared to reformatted images, standard axial images underestimated the degree of narrowing in 23 (96%) of 24 patients and were equivalent in 1 patient. Mean luminal area at the site of stenosis obtained on reformation images (80 mm²) was significantly smaller than that obtained on standard axial images (101 mm²) ($p < 0.0001$). Mean percentage difference in luminal area was $22.7\% \pm 15.8$.

Conclusion: Standard axial CT images significantly underestimate the magnitude, clinical severity of tracheal stenoses as compared to reformatted axial images perpendicular to the tracheal long axis

Predicting Therapeutic Response by CT in Thoracic Metastatic Renal Cell Carcinoma

SMITH AS and Shah SN

Intro: Response to biologic therapy such as tyrosine kinase inhibitors (TKIs) for thoracic metastatic renal cell carcinoma (mRCC) has traditionally been assessed by CT size measurements using RECIST (Response Evaluation Criteria In Solid Tumors). No standardized method of post-therapy tumor evaluation incorporates the complex morphologic changes seen on CT. We correlate clinical disease progression with CT changes in morphology, volume and size to assess therapeutic response.

Mat/Meth: In this IRB approved HIPAA compliant retrospective study, we searched our electronic record database (Jan 2000 to April 2007) and found 43 pts with mRCC to the chest treated with TKI therapy who had >1 cm chest metastases (osseous lesions excluded). Tumor density, volume and size were evaluated on pre- and post-TKI therapy contrast enhanced CT chest exams and correlated with clinical disease progression on serial follow up exams. Patients were categorized as having new mets (19), increased size of existing lesions (11), or stable disease (13).

Results: Following TKI therapy, decreased mean and central attenuation of non-parenchymal thoracic metastases correlated better with favorable treatment response than changes in tumor size alone; whereas changes in density in parenchymal mets occurred less frequently. Increased tumor density as well as increased lesion size correlated with disease progression.

Conclusions: In nonparenchymal mets, changes in tumor morphology are more predictive of early therapeutic response of thoracic mRCC following TKI therapy than tumor size alone (i.e. using RECIST only). Decreased tumor density more accurately correlates with a favorable response than decreased lesion size. Increased tumor density is an independent factor suggesting disease progression.

When Does the Hemithorax Opacify after Pneumonectomy? Digital Radiographic Analysis of the Pleural Fluid Opacification in the Post-Pneumonectomy patient.

O'SULLIVAN P, Vaporciyan A, Munden R

Purpose: The radiographic appearance of the hemithorax in patients post pneumonectomy was reviewed to define normal radiographic features. Images were evaluated for timing of hemithorax opacification. Also, when this did not occur complications and the radiographic features were noted.

Method and Materials: A retrospective review was performed of 154 oncology patients who underwent intra or extrapleural pneumonectomy over 3 years. The radiographic appearance, amount of hemithorax opacification, and complications were recorded. Assessment of % opacification was performed on upright posterior-anterior chest radiographs. Medical records were reviewed for type of surgery and relevant history.

Results: A progressive rise in air-fluid level was seen in 110 patients. The median time to 70% opacification was 4 days, and time complete opacification was 2.37 months.

The patients post intrapleural pneumonectomy, took 4 days to achieve 70% opacification, those post extrapleural pneumonectomy took 8 days. Time to complete opacification was 2.14 months for the intrapleural group, and 2.92 months for extrapleural patients. The left hemithorax achieved complete opacification twice as fast as the right side, at 1.74 months vs. 3.35 months.

In 59 patients with complications, there were 19 pneumonias, 9 empyema/pleural space infections, 8 ARDS, 7 bronchopleural fistulas, 7 wound sepsis, 4 gortex graft failure, 2 chylothorax, 2 pulmonary emboli and 1 pulmonary hemorrhage.

Conclusion: The median time to complete hemithorax opacification post chest tube removal is 2.37 months post pneumonectomy. This process is faster on the left side. A decreasing air-fluid level, new multiple air-fluid levels or delayed opacification raises suspicion for complications.

Effects of Fissural Anatomy on Treatment Outcome of Emphysema Patients Receiving Endobronchial Valve

ABTIN F, J. Goldin, M. Brown, A. Rao, H. Kim, S. Ahmad, D. Roback, A. Jiang, R. Pais, Z. Irani, K. Brown, R. Suh

Purpose: Currently, Endobronchial valves (EBV) are being investigated as an alternative to lung volume reduction surgery (LVRS). Incomplete fissures can affect collateral flow and hence treatment response. The purpose of this study is to evaluate the prevalence of complete fissures adjoining the target lobe treated with EBV in patients with total lobar collapse as compared to patients with no significant change in volume.

Methods: From Data set of 285 patients treated for heterogeneous emphysema with Emphasys Medical Inc. endobronchial valve, 34 subjects were selected. 17 cases having volume change of more than 90% and a matched cohort of 17 individuals with volume change of less than 10%. Pre-treatment CT scan were read by six readers which scored the fissures using a linear scale of 0 to 4 with 0 being completely absent fissure, 1= trace fissure present, 2=Incomplete fissure, 3= trace fissure absent, and 4 completely intact fissures.

Results: The mean score on fissural integrity in a group with complete collapse included 3.27, 2.82, and 3.54 for right major, right minor, and left major fissure and for group with no collapse included 2.73, 1.99 and 2.95 respectively. The fissures had significantly higher score in patients with complete collapse as compared to the cohort with no collapse ($p < 0.001$).

Conclusions: Anatomy of fissures adjacent to a target lobe receiving treatment with EBV needs to be considered and included into the protocols in selection of patients and target lobe.

Impact of Chest CT on Medical Decisions in MDRTB

DYER D, Huitt G, Levin A

Purpose: The early recognition and treatment of multi-drug resistant tuberculosis (MDRTB) is essential. Along with medical therapy, patients are often treated with surgery to eradicate the infection as quickly as possible. The goal of this study was to evaluate the impact of chest CT on medical decision making, particularly surgical planning.

Methods: The CTs and medical records of 18 patients referred over a six year period to a quaternary referral center for MDRTB were reviewed. The chest CTs were reviewed by a thoracic radiologist. The medical records were reviewed by an infectious disease physician who was part of the team caring for these patients, to determine how the CTs influenced therapy.

Results: All 18 patients had at least one CT. The chest CT findings included macronodules, centrilobular nodules, bronchiectasis, consolidation, cavity formation and lung destruction. The CT scans showed more extensive disease than expected in 8 patients, less extensive disease in 7 patients and the expected extent of disease in 3 patients. 7 patients were treated with medical therapy only. 11 patients had surgeries including pneumonectomy, lobectomy and thoracoplasty. All the surgical patients had cavitary disease. Their CTs showed 1 to 5 cavities, ranging in size from 1 to 10 cm. CT confirmed the initial surgical plan in 3 patients and revised the surgical plan in 8 patients. Information from the CT led to an increased area of resection in 3 patients and a decreased area of resection in 2 patients. The surgical plans were refined to include thoracoplasties in 3 patients.

Conclusion: Chest CT is a valuable tool in assessing extent of mycobacterial disease and can alter surgical management.

Potentially Unnecessary Surgical Lung Biopsies in Patients with UIP

RAGLE AN, EF Donnelly, LH Lancaster

PURPOSE

To determine if surgical lung biopsies are being performed in patients where the diagnosis of UIP was or could have been diagnosed confidently with HRCT.

METHODS

The database of patients with interstitial lung disease referred to Vanderbilt University Medical Center over an 18 month period was reviewed to select patients diagnosed with UIP by surgical lung biopsy. Patients' CT scans and their reports were reviewed to determine if adequate HRCT was performed and to determine if the findings to make a confident diagnosis of UIP were present and adequately reported.

RESULTS

There were 62 patients with UIP proven by surgical biopsy in the database. Of those 62 patients, 27 were excluded because a CT performed prior to biopsy was not available for review. Of the remaining 35 patients, 17 (48.6%) had HRCT findings sufficiently characteristic to make a confident diagnosis of UIP. Of those 17 patients, the HRCT interpretations were inadequate in 11 patients (65%). The remaining 6 patients (35%) had adequate HRCT interpretations, but subsequent biopsies were still performed. Twelve of 35 patients (34.3%) with UIP proven by biopsy had adequate HRCT but not characteristic findings of UIP, therefore biopsy was necessary to make the diagnosis of UIP. The remaining 6 patients (17%) did not have an adequate HRCT prior to biopsy, therefore biopsy may or may not have been necessary.

CONCLUSION

Although a diagnosis of UIP can be made with confidence in many cases using clinical assessment and HRCT, a large number of patients are still getting surgical biopsies. In most cases it appears that the radiology report failed to indicate that the findings were characteristic of UIP. It is possible that, with more specific reporting, many biopsies for suspected UIP may not be necessary.