149. Solitary pulmonary nodules in the age of lung cancer screening: up and coming endoscopic options

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Use of radial endobronchial ultrasound for diagnosing peripheral lung lesions – A tertiary centre experience

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Introduction: Small peripheral lung lesions continue to pose a diagnostic dilemma for pulmonologists. Flexible bronchoscopy with fluoroscopy has a limited diagnostic sensitivity (31-56%) for such lesions. Radial endobronchial ultrasound (EBUS) is a relatively new technique that has been used to improve yield, although diagnostic performance has been reported to vary considerably. We describe the characteristics of patients who underwent radial EBUS and outcomes in our centre.
Methods: Retrospective review was performed for 123 patients from Singapore General Hospital with peripheral lung lesions who underwent brochoscopic evaluation with radial EBUS guidance from August 2008 to December 2011.
Results: Median patient age was 64 years. Overall diagnostic yield was 68.3% with no difference for malignant (68.5%) or non-malignant (68%) lesions (p=0.954). Year-on-year diagnostic yield generally improved with increasing experience: in 2008, yield was 42.9% as compared to 2011 (80%). Data for ultrasound probe location was available for 93 patients. Yield was higher if the probe was within the lesion (78.3%) than when the probe was adjacent to the lesion (40%) (p=0.001). Data for lesion size was available for 118 patients. 40 patients had lesions less than 20mm diameter. Diagnostic yield of such lesions (77.5%) was higher than for larger lesions (64.1%), although this did not reach statistical significance (p=0.169).
Conclusion: Radial EBUS is useful for evaluating peripheral lesions of less than 20mm diameter. Training and experience is important to improve diagnostic yield. We recommend that the ultrasound probe be positioned within the lesion before attempting bronchoscopic biopies.

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Optical coherence tomography for increasing the diagnostic yield of TBNA

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Introduction: Bronchial biopsy techniques of peripheral nodules are associated with poor diagnostic yields. Optical coherence tomography (OCT) can be used to assess tissue microstructure in vivo, however is typically restricted to airway or pleural-based approaches. The aim of this study was to develop a transbronchial OCT catheter, and to investigate the potential of OCT to differentiate nodules from parenchyma with the goal of increasing the TBNA diagnostic yield of peripheral nodules.
Methods: We developed a narrow diameter OCT catheter compatible with standard 21-guage TBNA needles. Safety and feasibility was demonstrated in 3 swine, in vivo. To determine the accuracy of OCT for differentiating nodules from surrounding parenchyma, OCT was conducted in 55 surgically resected tissue specimens. 2 OCT experts, 2 pathologists, and 2 pulmonologists interpreted the OCT data offline.
Results: Successful imaging was conducted in all swine. Image criteria for differentiating parenchyma from nodule included signal void spaces corresponding to alveoli, and linear regularly spaced specular reflections representing collapsed alveoli. Nodules were found to have a generalized homogeneous appearance. Blinded readers diagnosed the OCT images as nodule or parenchyma with an average accuracy of 95.6%.
Conclusions: We have developed the first transbronchial OCT catheter that is compatible with standard 21-gauge TBNA needles, and have demonstrated that OCT can accurately differentiate nodules from surrounding parenchyma. We anticipate that transbronchial OCT may be useful in increasing the diagnostic yield of TBNA by confirming the needle placement within the target nodule prior to biopsy.

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Qualitative and economical analysis of transbronchial lung biopsy with the cryoprobe

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Objective: To analyze the histological quality of transbronchial lung cryobiopsy in patients with interstitial or malignant lung diseases in which a previous transbronchial lung biopsy (TBB) with conventional forceps was no diagnostic. A second objective was to analyze the cost of TBB with the flexible cryoprobe compared with surgical lung biopsy.
Patients and methods: From 01.02.2011 until 31.01.2012, 19 TBB with the flexible cryoprobe were performed. Afterwards, we analyze the cost of a TBB with the flexible cryosonde compared with surgical lung biopsy.
Results: We obtained representative material in 18/19 (95%) patients. Cryobiopsies total specimen area was 20-60 mm^2 compared to TBB with forceps which was 0.5-8 mm^2. Cryobiopsies did not show crush artifact in any case. In 15/19 (79%) patients we obtained a definitive diagnosis: 2 malignant tumors and 13 benign disease: 6 usual interstitial pneumonia, 1nonspecific interstitial pneumonia,1desquamative interstitial pneumonia, 1diffuse panbronchiolitis, 1 follicular bronchiolitis, 1 rheumatoid nodules, 1 respiratory bronchiolitis and 1 organizing pneumonia. In 3 patients we found some pathological findings but a definitive diagnosis was not achieved. The cost of TBB with cryobiopsy was 351€ against the cost of surgical lung biopsy which was 1189€.
Conclusions: Transbronchial cryobiopsies are larger than TBB with conventional forceps with a preserved sample because of the absence of crush artifact. Moreover, cryobiopsy is 3 times cheaper than surgical lung biopsy. Hence, transbronchial cryobiopsies could be considered as a prior step or a potentially replacing tool for the open lung biopsy.

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Trans-parenchymal nodule access (TPNA) – Real-time image-guided approach to pulmonary nodules

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Background: Currently, pulmonary nodules (PN) are accessed by Transthoracic Needle Aspiration (TTNA) or Transbronchial Needle Aspiration (TBNA). There is a clinical need for improvement of bronchoscopic access to small (<10mm) intraparenchymal PNs such that the high yield of TTNA and the safety of TBNA is achieved.
Objective: To assess the safety and yield of Trans-Parenchymal Nodule Access (TPNA).
Methods: In a healthy canine model, multiple 0.25cc calcium hydroxylapatite injections were implanted to represent ≤8mm diameter PNs in the upper and lower lobes. CT scans were acquired and plans were generated to prescribe a vessel-free, straight-line path from a central airway location directly to the target using an image guidance system (LungPoint®). Access through the airway wall was initiated with a TBNA needle followed by balloon dilation and sheath insertion. Advancement of the sheath was guided by overlaying CT-defined targets and tunnels onto the live fluoroscopy images using the system. The sheath enabled target sampling with 2.0mm biopsy forceps through the lumen.
Results: In 10 canines, 31 targets averaging 34mm (21mm – 50mm) from the airway wall and 7.6mm (0.1mm – 21mm) from the pleura, were accessed via TPNA and sampled. Sampling results indicated a yield of 90.4% with no pneumothoraces and minimal bleeding (<2ml).
Conclusions: These canine studies demonstrate that TPNA has the potential to achieve the high yield of TTNA with the low complication profile associated with TBNA.

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Combination of CT-guided core biopsy with rapid-on-site-evaluation of imprint cytology enables time and cost savings in diagnosis of peripheral lung tumors

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Aim: Pathologic sampling is essential for the diagnosis of peripheral lung tumors. In our study we examined a combination of CT-guided core-biopsies with rapid evaluation of imprint cytology with regard to diagnostic and cost efficiency.
Material and methods: Biopsy of a peripheral lung nodule was performed as core biopsy in local anesthesia under CT-guidance. Imprint cytology of the core biopsy specimen was used for rapid evaluation. The report times of the zytologic and histologic reports documented in the hospital information system were used for cost analysis.
Results: 91 patients received CT-guided biopsy for tumor diagnosis. In addition to core imprint cytology was performed for rapid evaluation biopsy in 58 cases. In 45/58 cases the cytological diagnosis was received in less than 60 minutes (mean 7:30h, median 48 min). The mean time to histological report was 52:30 h. The combination of core biopsy and imprint cytology enabled a correct diagnosis in all cases (11 benign nodules, 47 malignancies). In two cases the imprint cytology was false negative resulting in 96% sensitivity and 96,5% accuracy. There were 12 major complications: 11 chest tubes for pneumothorax, 1 bleeding requiring bronchoscopy.
The calculated costs for a core biopsy alone were documented with 54,30 Euro. The additional imprint cytology was calculated with another 21,07 Euro. The reduced time to diagnosis allowed for cost savings of 890 Euro.
Conclusion: The combination of CT-guided core biopsy and imprint cytology enables a fast and very reliable tumor diagnosis and can save costs in the diagnostic work up of patients with peripheral lung nodules.

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Prospective international trial of endobronchial implantation of electromagnetic fiducials for real-time tracking of lung tumors during radiotherapy (RT)

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Introduction: Technologic advance in RT delivery has resulted in dramatic improvement in lung cancer tumor control, but respiratory motion of these tumors still complicate RT. We present our results implanting novel anchored electromagnetic transponders (Varian Medical, Palo Alto, CA) which provide real-time localization and tracking of tumor position during RT.
Methods: 31 patients (pts) underwent bronchoscopic implantation of 3 transponders (93 total) in small airways in or near the tumor under fluoroscopy ± superDimension electromagnetic navigation or EBUS. Transponder positions were determined from serial CTs to assess positional stability. Localization and tracking of transponders and tumor was performed using the Calypso System during RT.
Results: There were 14 males/17 females, ages 43-79 (med. 63), with 10/31 tumors in the LUL and 21 in the other lobes. Follow-up was 0-12 mos (med. 2 mos). No unique skills or tools were required for implantation, and satisfaction with the procedure was high. 29 pts had no significant problems associated with the transponder or procedure. One pt with an apical pleural-based tumor developed a pneumothorax, resolving overnight after chest tube placement. Migration of 1 transponder at appx 1 wk was attributed to implantation in a larger airway; pt was asymptomatic. Positional stability of 74/75 transponders was confirmed in the 25 pts completing RT to date. Localization and tracking was achieved in all pts in whom this was attempted.
Conclusions: Implantation of electromagnetic anchored transponders is feasible and safe. This technology should enable highly accurate delivery of radiotherapy.