81. Vascular and parenchymal imaging

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Late-breaking abstract: Point-of-care chest sonography: A prospective observational study on 88 patients. Preliminary data

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Background: Bedside lung ultrasonography (BLU) is a technique performed and interpreted by the clinician who is in charge of the patient treatment. Even if recent studies show that BLU is theoretically useful in several diseases, the impact of this technique in clinical practice is still unknown. The primary aim of the present study was to analyze BLU indications in a respiratory medicine setting. The secondary aim was to describe the actual methodological application of BLU in the clinical practice.
Methods: Prospective observational analysis of consecutive BLU performed by pulmonologists at a University Hospital from April to May 2011. After each examination indication, methods and clinical consequences were recorded on a web-database.
Results: To date 88 exams on 88 patients (aged 42±34 years, mean±sd, 32 females, 32 pediatrics, 16 outpatients) were performed by 7 experienced operators. The quality of the examination was judged adequate in all patients. The most frequent indications were: lung consolidation (40%, of exams), pleural effusion (27%), guidance for thoracentesis (17%), acute respiratory failure (8%), and pneumothorax (3%). The mean duration of the exam was 10±4 minutes. As a result of BLU, in only 8% of the cases chest x-ray or CT were needed. Bedside clinician reported that in 73% of the cases BLU had a significant clinical impact on patient management.
Conclusions: Our preliminary results suggest that lung ultrasonography performed by pulmonologist is a feasible procedure, widely used in clinical practice for many indications. Further studies are needed to evaluate the impact of BLU on patients management.

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Incidental abnormalities found on CT pulmonary angiograms performed for suspected acute pulmonary embolism

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A CT pulmonary angiogram (CTPA) is performed commonly in the investigation of suspected pulmonary embolism (PE). Other lung, mediastinal and pleural pathologies of clinical importance may be found incidentally, not suspected from the chest X-ray (CXR). We studied 500 sequential CTPA scans done for suspected PE in a community hospital to assess the nature and frequency of any pulmonary pathology first suggested by the CTPA, with particular reference to pneumonia not diagnosed on the CXR. All CXR and scans were reviewed by a radiologist as well as the treating clinicians.

Retrospective observational study of CTPA for incidental pulmonary pathology

	CTPA	Pneumonia	Others
PE +ve	123 (24.6%)	27 (5.4%)	23 (4.6%)
PE –ve	377 (75.4%)	83 (16.6%)	122 (24.4%)
Total	500	110 (22%)	145 (29%)

PE was found in 123 of 500 (24.6%) scans. 110 of 500 (22%) scans showed evidence of pneumonia. Out of these 110 scans, 55 had no evidence of pneumonia on the CXR (of which 63% had been taken within 48 hours of the CTPA). Other pathologies were seen on 145 of 500 scans (29%).

Other pathologies seen on CTPA (n=145)

Pleural Effusion	63 (43.45%)
Lymphadenopathy	15 (10.34%)
Pulmonary nodules	14 (9.65%)
Metastatic lesions	12 (8.27%)
Others	41 (28.27%)

Conclusion: This study is suggestive of a high incidence of pneumonia in patients scanned for suspected PE, half of whom had no consolidation in the initial CXR. This raises questions concerning the reliability of clinical decisions that rule out pneumonia when there is no consolidation on a CXR.

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Management of incidental lung parenchymal lesions found on CT pulmonary angiograms

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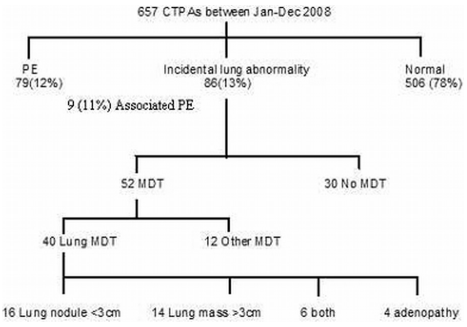
Introduction: Incidental findings of lung parenchymal lesions are common. Many studies have described what these alternative diagnoses are, but few have looked at their management. We aim to investigate how these are managed in a UK district general hospital.
Methods: We retrospectively analysed all CTPAs undertaken in 2008. We used Picture Archiving and Communication System (PACS) for CTPA reports, Pathweb for biopsy results and multidisciplinary team (MDT) database and patient case notes for the final clinical outcome.
Results:



As a result 15 had a PET scan of which 9 were FDG-avid and 7 proceeded to a tissue biopsy. Ten patients (11.6%) had positive histology. 5 had locally advanced or metastatic non-small cell lung cancer, 3 had squamous cell carcinoma, two had other metastatic carcinomas. Time from CTPA to histological diagnosis was more than 21 days for 7 patients. Three patients were referred for curative surgery (lobectomy/VATS), four patients to oncology (palliative radiotherapy/chemotherapy), three patients referred for palliative care.
Conclusion: Incidental findings on CTPAs have generated additional work for the respiratory department and lung multidisciplinary team. Patients with positive histology had advanced carcinoma and the incidental finding of lung cancer was associated with a poor prognosis. Incidental findings of these lesions require standardised follow-up and management plans in order to avoid delays.

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Diffuse pulmonary ossification (DPO) in the absence of interstitial fibrosis: CT findings and clinical correlates

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Introduction: Diffuse pulmonary ossification (DPO), or "dendriform" ossification, occurs in the setting of chronic lung disases, particularly usual interstitial pneumonitis (UIP). It also can occur in assocation with severe emphysema or chronic lung infections. We have observed DPO on chest CT in the absence of chronic lung disease.
Objectives: We attempt to identify a cohort of individuals with CT findings of DPO in isolation in order to a) characterize the imaging appearance and b) assess potential clinical factors that may be associated with the development of DPO.
Methods: We performed an elctronic search of chest CT reports between 2000-2011 at our institution for the word "dendriform" The CT studies were then reviewed by 3 thoracic imaging subspecialists who characterized the findings. Electronic medical records were reviewed for demographic and clinical information and follow-up data.
Results: 25 patients with CT findings of DPO in isolation were identified. DPO showed dense and soft tissue nodularity involving the peripheral interstitium (interlobular septae and subpleural space) especially in the posterior and lateral lower lungs with a costophrenic angle predominance. Patients were male, over age 70, and had few if any pulmonary symptoms. Smoking history was variable. Many had a history of or risk factors for aspiration. Serial scans, when available, showed progression of DPO over many years with minimal clinical change.
Conclusions: DPO can occur in isolation with a characteristic CT appearance, particularly in elderly men. It may indicate recurrent chronic aspiration in some cases. The findings progress over time with minimal clinical symptoms.

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Ventilation – Perfusion scan outcome when the chest radiograph is abnormal

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Introduction: Guidelines recommend isotope lung scanning (V/Q) may be considered as first line investigation for suspected pulmonary embolism (PE) provided there are facilities on site and a chest radiograph (CXR) is normal. Occasionally, V/Q scans are performed in the presence of an abnormal CXR.
Aim: To study the diagnostic yield of V/Q scans in patients with suspected PE and an abnormal CXR.
Method: All patients who had a V/Q scan for suspected PE over a period of 12 months from February 2008 were included in the study. The CXR and V/Q scan reports were recorded.
Results: 1041 V/Q scans were performed at our institution with a preceding CXR. Of these, 345 CXRs were reported as abnormal.

Effusion	72	Plaques	6
Consolidation	71	Scarring	6
COPD	68	Cardiomegaly	5
Atelectasis	48	Post Op	5
Pulmonary Oedema	37	Pleural Thickening	4
Nodules	8	Scoliosis	1
Fibrosis	8	Other	5

Of the 345 patients with an abnormal CXR that had a V/Q scan, 275 (80%) were reported as Low, 25 (7%) Moderate and 40 (12%) as High probability of PE. 5 patients scans were not formally reported.
Of those in the Low Probability group, 9 had a subsequent CTPA with 1 (0.004%) being positive for PE, in the Moderate Probability group 20 had a subsequent CTPA with 5 (20%) being positive for PE and in the High Probability group 6 had a subsequent CTPA with 2 (5%) being positive for PE.
Discussion: One third of the patients that had a V/Q scan to investigate suspected PE had an abnormal CXR. Despite this, 275 (80%) of these patients had a low probability scan, 9 of these patients went on to have a CTPA and only 1 was positive for PE.
A low probability V/Q scan may prevent unnecessary radiation exposure and adequately exclude PE, even in the presence of an abnormal CXR.

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Ex vivo lung sonography: Morphological-ultrasound relationships

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The nature of lung ultrasound "artifacts" (B-lines, White Lung) has not yet been determined. We need to know what pathological structure and what physical mechanism create artifacts. We believe that lung ultrasonographic imaging is the acoustic behavior of ultrasounds crossing substrates of variable porosity or density. Each of 5 New Zeeland white rabbit right lungs was sequentially inserted in cylindrical, rigid, hermetically sealed containers, with different volumes of 50 mL, 30 mL, 20 mL and 15 mL. Both lung and internal space of each container communicated with external air through a cork cap: the former through a cannula connected to trachea lumen and the latter through a tube connected to an aspiration system. Each system underwent negative pressure to get different known degrees of lung inflation. Densities were obtained for each lung at each level of inflation. Every lung was studied through ultrasonography and then sectioned and analyzed to correlate images with histological appearance.
In normal lung the variation of the pleural plane from specular reflector to generator of acoustic interference recognizes a mechanism which is related to values of tissue density. Artifacts described in lung ultrasonography as B-lines and White Lung appear in the normal lung through air dependent or weight dependent increases in density.
Conclusion: Ultrasound lung artifacts are density or porosity related. B-Lines and white lung (as in pathological conditions) can be reproduced in normal lungs that are deflated (ie denser or less porous) to levels of density which are not realizable under in vivo physiological conditions (< 0,45 g/mL). This mechanism is at the base of the genesis of artifacts also in the pathologic lung.

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Agreement between clinical and HRCT diagnoses in the evaluation of patients with respiratory diseases

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Aim: HRCT scans have been widely used in the diagnostic algorithm of respiratory diseases. In this study we aim to find out the agreement between clinical and HRCT diagnosis in such workup.
Methods: A retrospective study analysing 100 consequetive patients who had HRCT scans between July and September2008. Data of scans and clinical information were obtained from electronic patients records.
Results: Total number of patients who had HRCT was 100. The average age patients was 65.3. Males constituted 61%. 76% of referrals were made by respiratory physician (RP), the rest from other specialities. The commonest presenting symptom was SOB (61%). Overall 54% of HRCT diagnosis correlated with clinical diagnosis. 76 request were made by RP of which 29 (38%) correlated with clinical diagnosis. A total of 38 patients had clinical sign on examination, 37 (97%) of these had HRCT findings consistent with clinical diagnosis but only 40 of the 62 patients (64%) with no clinical signs had clinicoradiological correlation. 52 of the 56 patients (92%) who had prior chest X-ray abnormality which was later confirmed on a HRCT. The remaining 42 patients who had normal X-ray, only 20 (47%) had HRCT abnormality. The correlation increased to 96% when it was referred by a RP who had identified clinical signs and this further improved to a 100% when there was an associated CXR findings.
Conclusion: In this study only 54% of the patients had clinicoradiological correlation. This correlation improved significantly to 100% when requested by RP who had identified prior clinical signs and chest X-ray abnormalities. Routine request for an HRCT scans are unyielding and should not be encouraged.

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Can D-dimer assay, together with clinical probability predict computed tomography pulmonary angiogram (CTPA) outcomes for pulmonary embolism (PE)?

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Introduction: Annual incidence of PE is estimated at 60-70/100 000. Current National Guidelines recommend patients presenting with suspected PE should be risk-assessed according to presenting symptoms, risk factors, clinical findings, and investigation results. Fear of missing potentially life-threatening PE likely results in over-investigation.
Aims: To assess if we are identifying patients correctly based upon pre-imaging risk scores and whether there is a D-dimer level most consistent with the diagnosis.
Method: A retrospective review of patients attending for CTPA in a one month period. Clinical indicators were documented and patients were divided into risk groups.
Results: 38 patients had a CTPA. 20 (52%) male. Age range 20-99years (median 62). 6 (15%) did not have a D-dimer. 22 (58%) had a major risk factor for PE, and 16 had a minor risk factor. 32 (84%) patients had a positive D-dimer (>200 ng/mL). In the high risk group 8/22 had a positive CTPA with median D-dimer of 1552ng/mL. 14/22 were negative for PE with median D-dimer of 345ng/mL. The remaining 16 patients who were low risk were all negative for PE on CTPA, median D-dimer 570ng/mL.
Conclusion: The results show that improvements can be made in investigating patients with suspected PE. A D-dimer level higher than that classed as positive in our hospital trust may be more appropriate from this small sample size. Further review with a larger number of patients is required.
This may reduce the financial costs but more importantly will provide patients with appropriate directed care and reduced risk from radiological exposure.

P583

Early signs of hemoptysis, the advance CT approach

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Hemoptysis, the act of coughing up blood, is an important symptom since it frequently reflects serious underlying lung disease. If the hemoptysis is substantial, persistent, or recurrent then further evaluation is indicated, particularly since patients with chronic bronchitis related to smoking are at high risk for lung cancer. The aim of the study is to incorporate advance CT procedures in determining the right cause of hemoptysis and finding the right area of bleeding.
Material and methods: All patients were examined of 16 or 64 MDCT. We use standard lung procedure and all advanced MDCT methods, like 3D virtual bronchoscopy, nodule check, MDCT pulmonary angiography, very slow infusion injection of contrast agent, very fast bolus injection of contrast agent and wide specter of filters.
Results: We examined 1536 patients with coughing up blood and compared results on the most common causes with standard methods. Male patients were 917 and female 619, middle age of patients were 56.4 years. Our first aim was to find lung cancers in patients with recurrent hemoptysis where standard methods were insufficient. We found 18.76% more lung carcinomas in compare with standard procedures. Our second aim was to find right place of bleeding. In compare with standard methods we found the right place of bleeding in 21.54% more patients that with standard methods.
Conclusion: Improvements with advanced technics are significant. Important is to notice that advanced technics are not invasive and in any case danger to patients health.

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Abnormal chest radiographs preceding VQ scans: Does the type of abnormality matter?

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Introduction: Abnormal chest radiographs (CXR) have been considered to affect the interpretation of Ventilation/Perfusion scans (V/Q) for the investigation of suspected Pulmonary Embolism (PE). Recommendations suggest a V/Q scan only if a contemporaneous CXR is normal. Impact of individual CXR abnormalities on the outcome of V/Q scan has not been fully explored.
Aim: To study the impact of individual CXR abnormalities suggestive of a range of cardiopulmonary diseases on V/Q scan results for the investigation of suspected PE.
Method: All V/Q scan and preceding CXR reports from February '08-January '09 at our 960 bed teaching hospital were included in the study.
Results: Data for a total of 1041 subjects who had a CXR prior to V/Q was collected. Total number of V/Q done on those with abnormal CXR findings was 345. The CXR abnormalities were classified as per the underlying cardiopulmonary pathology suggested by the report.

	Low probability V/Q	Intermediate probability V/Q	High probability V/Q	Total
Normal CXR-Number (%)	590 (85%)	41 (6%)	65 (9%)	696
COPD-Number (%)	55 (81%)	2 (3%)	11 (16%)	68
Atelectasis-Number (%)	34 (71%)	5 (10%)	9 (19%)	48
Effusion-Number (%)	57 (79%)	9 (13%)	6 (8%)	72
Pulmonary Oedema-Number (%)	35 (95%)	2 (5%)	0 (0%)	37
Infection-Number (%)	57 (80%)	7 (10%)	7 (10%)	71

Discussion: Regardless of whether the CXR report preceding the VQ scan was suggestive of infection, effusion, congestion or "COPD", the proportion of low probability VQ scans was high (71-95%). This proportion was particularly high at 95% (and with no high probability scans) in those with CXRs suggestive of pulmonary oedema/congestion.
When used in the correct clinical context a V/Q scan can be used with a high degree of accuracy despite certain CXR abnormalities.

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Limits of normality of quantitative thoracic CT analysis

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Introduction: Quantitative CT scan analysis has been widely studied in ARDS patients, while, data on healthy population are scanty. Reference values, however, would be of clinical relevance when assessing, i.e., the excess lung weight or edema, or whatever change in CT anatomy/physiology induced by disease.
Methods: We retrospectively included patients who underwent a spiral CT scan for clinical reasons and whose images were considered normal by radiologists. Lungs were outlined on each CT image with a dedicated software; lung weight, volume and tissue fraction were computed with a dedicated software.
Results: We enrolled 52 patients (25 males), age 65±12 years, height 1.67±0.09 m, BMI 26±4 kg/m^2. The table summarizes the main CT scan characteristics of patients, with CT taken at near total lung capacity.
While the gas values are dependent on inflation, the lung weight is not. Therefore, of particular note the significant correlation between height and total lung

Lung CT scan characteristics

	Whole population	Females	Males	p
Total lung weight (g)	921±174	833±157	1016±140	<0.001
Total lung volume (mL)	4790±1413	4030±1037	5611±1314	<0.001
Gas volume (mL)	3869±1312	3197±1006	4595±1225	<0.001
Mean CT number (HU)	–792±61	–775±73	–811±38	0.03
Not inflated tissue (%)	9±7	10±9	8±5	NS
Poorly inflated tissue (%)	19±3	18±3	19±3	NS
Well inflated tissue (%)	61±9	62±10	60±9	NS
Over inflated tissue (%)	11±8	9±9	13±7	NS

weight ($p<0.001$, $r^2=0.40$) according to the equation: total lung weight = -1268 + height∗1311. The correlation between height and total lung volume is statistically significant ($p<0.001$, $r^2=0.51$) according to the equation: total lung volume = -15250 + height∗12001.
Conclusions: Lung weight and volume are related to height in a healthy population.