Introduction The BTS Pulmonary Nodule Guidelines recommend the use of nodule volumetry as a biomarker of malignancy in pulmonary nodules (PNs). Unfortunately, there is significant inter-scan volumetry measurement variability not representing true growth, of up to 25% (Gietema et al., 2007), with reliable growth detection requiring a scan time interval of up to 12 months. CT Texture analysis (CTTA) does not require volumetry detectable growth to detect change and may be a useful biomarker of malignancy.

Aims and objectives To assess the repeatability of texture features extracted from PNs and compare this to the inter-scan variability of volume measurements.

Materials and methods 40 patients, (20 with an indeterminate PN and 20 with pulmonary metastases) underwent two Low Dose Volumetric CT scans within a 60 minute period.

20 texture features previously used in combination to predict nodule probability of malignancy (BTS 2015) were extracted from each automatic contoured region surrounding the PN.

The variability of texture measurements within individual nodules was assessed by computing the relative differences between baseline and validation scans. Mean and standard deviation (sd) were estimated from the relative differences. Lower and upper limits of repeatability (LLR and ULR) were calculated as mean ± 1.96 × sd. The intra-class correlation coefficient (ICC) was also used to assess the repeatability of the image features for this group of patients.

Results Nodule volumes ranged from 76 to 8130 mm^3, (mean 2D diameter 8.7 mm; sd 3.2) and were not statistically different between baseline and validation scans (p = 0.92, Wilcoxon rank sum test).

The mean difference in volume between the two scans was 37.4 mm^3 (6.2%, sd 30.4).

18 out of 20 textural features displayed ULR and LLR below ± 26.2% (sd ≤ 12.3%). These were less variable than nodule volume (mean = 1.2%; sd = 14.4%; LLR = −27.0%; ULR = 29.5%). All features had high repeatability (0.87 ≤ ICC ≤ 0.99), see Figure 1.

Conclusion The repeatability of CTTA was comparable to automatic volumetric measurements that are currently recommended for use in clinical practice. To our knowledge this is the first study to assess CTTA repeatability, a promising biomarker of malignancy.

P22 APPLICATION OF THE RECENT BTS GUIDELINES TO A POPULATION OF NODULE PATIENTS

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The BTS nodule guidelines utilise morphological features, volume measurement, and risk modelling to stratify nodule management-potentially time consuming methods which may be offset by the possibility of early discharge

Our aim was to identify patients who may be suitable for immediate (volume <80mm^3 or 5mm) or early discharge (stable interval volumetry or VDT >800 days) from our previous Fleischner driven follow-up, and to estimate reduction in future CTs –'scans saved', by noting the number of CTs that would have remained in their original schedule.

118 patients were identified. 22 patients had nodules <5 mm, discharge would save 28 future scans. Of 12 patients with 5–5.9mm nodules, 6 patients were dischargeable (4 volume <80 mm^3, 2 benign morphology), saving 10 future CT scans.

Abstract P22 Table 1

	<5 mm	5–5.9mm	6–7.9mm	>8 mm
n	22	12	44	40
Volume < 80mm3	22	4	1	
Benign features		2	2	
Static volume at 1 year			8	8
VDT > 800 days at 1 year			4	
Total discharge	22	6	15	8
Scans saved	28	10	15	8

For patients with larger nodules and CT scans at least a year apart, serial volumetry identified 17 patients with nodules 6–7.9mm of which 15 were either morphologically benign, <80 mm^3, static in volume or VDT >800 days, and thus dischargeable saving 15 future CT scans; and 9 patients with >8 mm nodules of which static volumetry was noted in 6, saving 8 future scans.

All patients with a CT follow up period of between 3 months and 1 year (n = 44) had static linear measurements and volumetry was not retrospectively performed on these.

Total discharges were 51 (see table), with a saving of 61 scans compared to historical protocol. Discharge of patients with nodules < 5 mm is a one off gain as these will not enter follow up in the future. Excluding these, results in an ongoing saving of 33 scans if 34 patients undergo either paired or one off volume measurements, taking an average of 5 minutes to perform. Additional volumetry at 3 months would add a further 5minutes to analysis of these patients CTs. We believe the 'trade off' between time for volumetry versus reduced CTs (radiology time, radiation exposure and patient inconvenience) is favourable and should provide an incentive for units to offer volume measurements, performed as in this study by either chest radiologist or trained chest physician, if they are not already doing so.

P23 A REVIEW OF ADVICE GIVEN FOR FOLLOW UP OF LUNG NODULES DETECTED ON CT IMAGING

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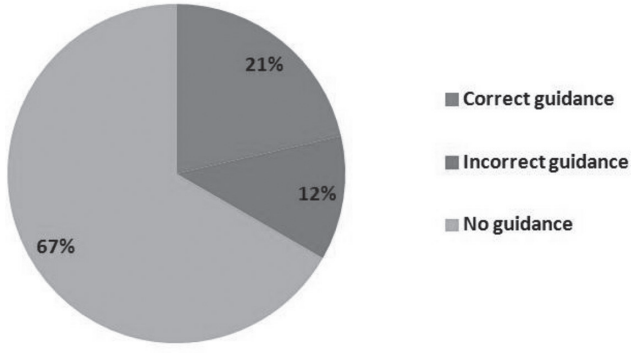
Introduction and objectives Pulmonary nodules detected on computed tomography (CT) scanning should be followed-up appropriately, particularly to ensure cases of malignancy are not missed. Direction for this comes through British Thoracic Society (BTS)[1] and Fleischner Society guidelines.[2] We sought to assess whether appropriate advice was provided for follow-up of lung nodules identified on CT images.

Methods All CT scans undertaken at Wexham Park and Heatherwood Hospitals between July and October of 2015 were searched for the term 'lung nodule'. This search yielded 152 matches. Scans were subsequently excluded if they were reported as showing 'no lung nodule(s)', a nodule in the context of known or metastatic malignancy, and nodules reported as calcified granulomas. The remaining 42 scans were assessed to determine whether advice on follow-up was provided in the radiological report, and whether this was in keeping with existing guidance.

Results Of the 42 reports included, only fourteen of these (33%) provided any guidance on follow-up. Of these, nine (21% of reports) complied with BTS or Fleischner Society recommendations. The reasons for non-compliance with guidelines when advice was provided were no timescales or follow-up modalities suggested (four of five) and incorrect follow-up time (one of five). Results are summarised in Figure 1.

Conclusions From our results it is evident that no or incorrect follow-up advice is being given, based on radiological appearances, for the majority (79%) of pulmonary nodules seen on CT imaging. Clearly the potential consequences of this may include malignancy not being detected and managed in a timely fashion. It is therefore fundamental that each unit has a system, based on existing guidelines, to ensure correct advice is provided based on radiological findings.



Abstract P23 Figure 1 Guidance given for lung nodules reported on CT imaging

REFERENCES

1 Callister MEJ, Baldwin DR, Akram AR, *et al*. British thoracic society guidelines for the investigation and management of pulmonary nodules. *Thorax* 2015;**70**(Suppl 2):ii1–ii54.

2 Macmahon H, Austin JH, Gamsu G, *et al*. Guidelines for the management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. *Radiology* 2005;**237**(2):395–400.

Clinical Aspects of Pulmonary Vascular Disease

P24 SHORT TERM OUTCOME OF PATIENTS WITH ACUTE PULMONARY EMBOLISM AND HIGH LACTATE AT A DISTRICT GENERAL HOSPITAL

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Introduction The risk stratification of haemodynamically stable patients presenting with pulmonary embolism (PE) is currently focussed on evidence of right ventricular (RV) dysfunction and myocardial necrosis (elevated Troponin). However these single markers have insufficient evidence to definitively guide treatment decision making. Plasma lactate has been shown to be potentially useful in identifying normotensive PE patients at high risk of PE related adverse events. The aim of this retrospective cross sectional study is to assess the role of serum lactate in the risk assessment of patients presenting with acute PE in a "real world" setting.

Methods We reviewed the cases of all patients with a radiologically confirmed PE on CTPA from Royal Wolverhampton Hospital between June 2014 and June 2015. The primary outcome was PE related complications within 7 days of diagnosis. This comprised of shock (systolic blood pressure <90 mmHg or pressure drop of ≥40 mmHg for ≥15 min), RV dysfunction, or need for cardiopulmonary resuscitation/mechanical ventilation.

Results 172 patients were diagnosed with acute PE during this time. 169 cases were analysed (insufficient information recorded in 3). Serum lactate was recorded in 92 (54.4%). Out of the 92 patients, 38 (41.3%) had a PE related complication with a higher average lactate (2.40 mmol/L) than the 54 (58.7%) who did not (lactate of 1.73 mmol/L) ($p < 0.018$ using the unpaired t test). PE related complications occurred in 33 (38.8%) of the 85 normotensive patients that had a lactate recorded. These patients also had a higher average lactate (2.24 mmol/L) than the 52 (61.2%) patients without complications (lactate 1.72 mmol/L) ($p < 0.05$). The positive predictive value of lactate as a single marker for a PE related complication is 53.1%. However the combination of a lactate ≥2, evidence of RV dysfunction and positive Troponin had a positive predictive value of 100%.

Conclusions This study adds to the evidence that a high serum lactate used in combination with a positive troponin and RV dysfunction can be a useful predictor of early adverse PE related events and may aid treatment decision making.

P25 RETROSPECTIVE ANALYSIS OF PATIENTS PRESENTING WITH ACUTE PULMONARY EMBOLISM (PE) AS THE FIRST MANIFESTATION OF MALIGNANCY

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Introduction A link between development of PE and presence of malignancy has long been established. NICE recommends patients presenting with PE should be offered: history, examination, chest x-ray and urinalysis. Further investigation for cancer with abdomino-pelvic CT (CT A/P) scan in patients over 40 with a first unprovoked PE should be considered.[1] CT screening has not been shown to improve occult cancer diagnosis or mortality from cancer.[2]

	Total presenting with PE	Total with established cancer (all cancers) prior to diagnosis of PE	Total with new cancer (all cancer) diagnosis	Total with cancer diagnosis on CT A/P	1 year mortality in cancer diagnosed on CT A/P
Number of Patients	177	47	10	5	4

Abstract P25 Figure 1 Number of patients presenting with PE depending on cancer diagnosis