S74 ASSESSING THE DIAGNOSTIC ACCURACY OF THE BRITISH THORACIC SOCIETY ALGORITHM FOR INVESTIGATION OF SOLID PULMONARY NODULES

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Background The British Thoracic Society guidelines (2015) on the investigation and management of pulmonary nodules recommend the use of two risk prediction tools to assess the likelihood of malignancy in solid pulmonary nodules (Brock model following initial CT and the model described by Herder *et al*. following PET-CT). Management strategies are suggested on the basis of these risk assessments. The aim of this study was to assess the performance of this algorithm in patients with solid pulmonary nodules recruited from a UK teaching hospital.

Method Patients with solid pulmonary nodules (4–30 mm) were retrospectively identified from the lung cancer MDT and a nodule follow-up clinic (n = 221). All patients had a final diagnosis confirmed by histology or radiological stability on 2-year follow up.

Results The median age was 69 years. The prevalence of malignancy was 37.1% (29.9% primary lung cancer, 7.2% metastatic disease). 25 patients where PET-CT was recommended by the guideline but did not occur were excluded from subsequent analysis.

Ten patients had nodules <5 mm and therefore would have been immediately discharged. All these nodules were benign.

CT surveillance was recommended for 106 patients (37 with nodule <8 mm, 45 with malignant risk of <10% following initial CT, and 24 with malignant risk of <10% following PET-CT). 94% of these 106 patients had benign disease, 2% had primary lung cancer and 4% had metastatic disease.

Surgical/non-surgical treatment was recommended for 58 patients where the malignant risk was >70% following PET-CT. 81% of these patients had primary lung cancer, 10% had metastatic disease and 9% were benign.

For nodules with a malignant risk of between 10 and 70% following PET-CT, the guidelines recommend consideration of biopsy with alternatives of CT surveillance or surgical resection depending on patient preference and fitness. Of the 22 patients with nodules in this range, 36% were benign, 55% primary lung cancer and 9% metastatic disease.

Conclusion The solid nodule algorithm from the BTS guidelines shows good accuracy in discriminating benign from malignant nodules, recommending appropriate management in a high proportion of cases. Further studies should evaluate this and the other management algorithms with prospectively collected data.

S75 A CLINICAL MODEL TO ESTIMATE THE PROBABILITY OF PULMONARY NODULE MALIGNANCY IN A POPULATION OF ONCOLOGY FOLLOW-UP PATIENTS

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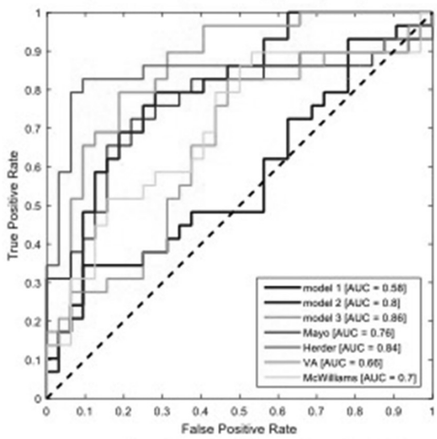
Introduction The new BTS Pulmonary Nodule Guidelines 2015 recommend the use of composite prediction models to assess the pre-test probability of malignancy in patients presenting with pulmonary nodules (PNs). These models were not developed for use in patients with a history of malignancy within five years of presentation with a PN.

In order to assist in the diagnosis of PNs, CT texture analysis has been proposed as a potential biomarker in tumour characterisation.[1] Image texture refers to the statistical analysis of spatial intensity variations of the pixels within an image to produce a CT texture score.[2]



ROC analyses for the different clinical models
Model 1: clinical characteristics + diameter
Model 2: clinical characteristics + texture score
Model 3: texture score

1. Mayo et al 1997. Arch Int Med 157:849-855
2. Herder et al 2005. Chest 128;2490-2496
3. Gould et al 2007. Chest 131:383-388
4. McWilliams et al 2013. NEJM 369:910-919

Performance for the different clinical models
AUC is Area under the ROC curve, N is the number of subjects

Model	AUC	N	Estimation of model parameters
Model 1 (clinical char + diameter)	0.58	61	Leave-one-out
Model 2 (clinical char + texture score)	0.80	61	Leave-one-out
Model 3 (texture score)	**0.86**	61	Leave-one-out
Mayo[1]	0.76	61	Published weights
Herder[2]	0.84	61	Published weights
VA[3]	0.66	61	Published weights
McWilliams[4]	0.70	61	Published weights

Patient Demographics and Nodule Characteristics

Variable, N= 61	Benign N=32	Pulmonary Metastases N= 20	Primary Lung Cancer N=9	Total N= 61
Age: (Mean, SD)	62.0 ± 13.1	63.3± 13.8	73.2± 7.6	64.1± 13.1
Sex: M= male F= female	20M: 12F	11M: 9F	3M: 6F	34M: 27F
Smoking Status: Current/ Ex-smoker	18	12	8	38
Never Smoker	14	8	1	23
Emphysema : Yes	4	2	5	11
No	28	18	4	50
Mean Nodule Size: mm (Mean, SD)	5.8±2.7	7.7±3.6	10.9±7.6	7.1±4.3
Nodule Type: Solid	27/32	20/20	5/9	52/61
Perifissural	5/32	0/20	0/9	5/61
Sub-solid	0/32	0/20	4/9	4/61

Abstract S75 Figure 1 Comparison of own models to published clinical models for probability of malignancy of pulmonary nodules

Aims and objectives

1. To evaluate four existing models for the probability of malignancy in the target population.
2. To create and validate prediction models for probability of malignancy for patients undergoing oncology follow-up for an indeterminate PN.

Methods Retrospective data on clinical and radiological characteristics were collected from the medical records of 61 patients with a PN (mean diameter 7 mm, SD 4 mm) that had an active or previous history (within 5 years) of primary lung or extra-thoracic malignancy. The gold standard diagnosis of the nodules was established by histology or 2-year stable follow-up.

Three multivariable logistic regression models were evaluated using a leave-one-out cross-validation strategy:

Model 1: Age, Sex, Smoking status, Emphysema, Nodule diameter.

Model 2: Age, Sex, Smoking status, Emphysema, CT Texture score.

Model 3: CT Texture score only.

The models' performance, measured using the area under the ROC curve (AUC), were reported and further compared to existing clinical models.

Results The highest AUC, 0.86, was obtained from Model 3 (texture score only). Utilising clinical parameters (Model 2) did not improve performance.

In comparison, AUCs for previously published clinical models were 0.76(Mayo), 0.84(Herder), 0.66(VA) and 0.70(McWilliams) (Figure.1).

Conclusion This texture feature model is successful at discriminating benign from malignant nodules in a population of patients undergoing oncology follow-up.

While not significantly better than the Herder model (which incorporates PET avidity), this model offers improved risk stratification for PNs in the absence of PET in this patient group.

REFERENCES

1 RSNA 2014, SSC03-05
2 IEEE International Conference doi: 10.1109/SMC.2013.663

S76 "STRAIGHT TO CT" IN PRIMARY CARE – IMPROVING THE LUNG CANCER PATIENT JOURNEY

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Although the advent of rapid access secondary care services has shortened the wait to timely diagnosis in lung cancer, significant delays and congestion can still occur through patients needing to attend clinic before appropriate investigations are organised.

To circumvent this, with primary care colleagues we designed a "straight to CT" system where if a general practitioner is concerned about a patient, or a chest X-ray in the community or emergency department shows suspicious changes, the radiology department automatically offers the patient a CT scan to be performed within 72 h with a same day report. This allows the primary care clinician to reassure patients with normal scans, or where necessary direct appropriately patients with scans showing non-malignant abnormalities. Patients with scans showing possible malignancy are intercepted by the lung cancer team who then organise appropriate further management.

We replaced our one stop rapid access lung cancer clinic with this new service in January 2014 and have now reviewed its use one year on.

468 patients from the local community were eligible for the "straight to CT" service. Of the 246 with a coded X-ray, 222 underwent a 72-hour CT scan (18 of the reminder declined or were not contactable), and of these 127 (57%) showed suspicious abnormalities and were intercepted by the lung cancer team. Of the 222 referred by a concerned clinician, 177 underwent a 72-hour scan (of the remainder 19 were not contactable or declined and the rest were deemed inappropriate) and 60 of these (34%) showed suspicious changes and were intercepted by the lung cancer team. Overall, 401 72-hour scans were performed in 2014: this is similar to the number of scans performed (402) in 2013 using the traditional rapid access clinic model.

As well as empowering primary care, by preventing unnecessary clinic attendance this innovative service has significantly reduced costs and by bringing forward investigations has reduced the lead time to diagnosis (to a mean of 19 days) in our patients. Furthermore, fears that such a service might increase unnecessarily the number of CT scans performed have proved groundless.

We recommend the use of such a service to colleagues to aid timely and economical investigation of patients with a suspected diagnosis of lung cancer.

The smoking gun

S77 PROCESSING OF CIGARETTE GRAPHIC HEALTH WARNING LABELS DECREASE WITH PROLONGED EXPOSURE

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Introduction Cigarette package graphic health warning labels (GHWL) remain an important means of communicating serious smoking risks. There were significant delays in implementing them in different countries around the world, partly due to tobacco company resistance; additionally, the messages used differ considerably. We expected a reduced cognitive processing of the messages based on the duration since launch. In order to address this question we compared a London (4 years) vs Singapore (8 years exposed) cohort.

Methods We used a 50-item structured interview; after recording demographics and smoking history, 10 country-specific warning labels were shown. In addition to the emotional response and impact on smoking cessation/prevention, cognitive processing was assessed on a scale from '1' ('not at all/never') to '5' ('all the time/a lot'). Smoking-risk knowledge and their importance in terms of prevention and treatment were elicited.

Results 266 participants were recruited, 163 from London (52 ± 18 years, 54% male, 35% smokers) and 103 from Singapore (58 ± 15 years, $p = 0.012$; 78% male, $p < 0.001$; 53% smokers, $p = 0.003$). Londoners read the labels more carefully and more often; they talked and thought more about them, even with no warning labels were in sight, and they kept packages more often as a reminder about their messages (overall, 2.0 ± 1.3 *vs* 1.5 ± 1.0, $p < 0.001$). The processing differences