SHORT PAPER SESSION E2

E2.1 A novel educational tool to optimise lung cancer screening in Australia

Dr Miranda Siemienowicz[1], Dr Sally Ayesa[2], Dr. Moe Suleiman[3,4], Mr. Mu'ath Ibrahim[3,4], Professor Patrick Brennan[1], Dr Catherine Jones[3,4,5]
[1]Northern Imaging Victoria, Melbourne, Australia, [2]University of Sydney Medical School, Sydney, Australia, [3]University of Sydney, Sydney, Australia, [4]DetectedX, University of Sydney, Australia, [5]Royal Brisbane and Women's Hospital, Brisbane, Australia

In Australia, 15,000 newly diagnosed cases of lung cancer occur each year and whilst age-standardised rates are declining for males, for females the reverse is happening, with incidence increasing by about 30% since 2004. The National Lung Cancer Screening Program (NLCSP) in Australia will commence in mid-2025 and with approximately 5%[1] of radiologists in Australia being chest subspecialists, a rapid and effective educational intervention is required.
This current multi-State work involves thoracic radiologists and physicians, radiographers, biomedical engineers and physicists across clinical, academic, professional college and industrial domains and will deliver a regimen that incorporates on-line delivery, latest educational innovations and artificial intelligence (AI).
There are three strands: interactive on-line modules; a webinar series delivered by experts; a novel image viewing platform available 24/7 to clinicians wherever they are located.
The viewing platform will be configured to accept both 2D and 3D images of the lungs to enable real-life case interactions using the clinicoradiological Nodule Management Protocol derived for the NLCSP and full image processing facilities. The educational platform features AI-powered tools to tailor training pathways based on user profiles, learning behaviour, deep learning based radiomic signatures as well as first-order statistical measures and second-order Haralick texture descriptors.
The platform features robust reporting capabilities for clinical leads and screening managers, providing insights into individual and group performance. The solution facilitates the most effective and rapid learning experience for all diagnosticians involved in the Australian NLCSP with outputs relevant across all radiologic specialties and geographic locations.

1. https://www.ranzcr.com/college/document-library/2020-workforce-census-report-australia

E2.2 Evaluating the effectiveness of a gamification simulation in enhancing chest X-Ray interpretation proficiency among third-year radiography students

Kacper Budyn[1], Mrs Emma Edwards[1]
[1]Keele University, Newcastle Under Lyme, United Kingdom

Background
Chest X-rays (CXR's) are the most frequently performed imaging examinations in the UK, requiring radiographers to develop strong interpretation skills ensuring accurate diagnosis (Gefter et al,. 2023). Gamification in education has shown promise in enhancing engagement and achieving learning outcomes (D'Amore et al., 2012). This study evaluates the effectiveness of gamification in improving CXR proficiency amongst third-year radiography students.
Methods
This study involved the development and implementation of CXR RadPath, a gamified education tool designed to enhance CXR interpretation. The game structured six key categories related to CXR interpretation. Participants completed a baseline assessment before the gamification, followed by a post-intervention assessment to measure improvements in proficiency and confidence. Data was collected both quantitatively and qualitatively to assess students' perceptions of gamification as a learning tool and it's effectiveness in supporting radiographic education. Quantitative results were compared to measure changes in competency, whilst qualitative responses were thematically analysed to identify themes in student experience.
Results
Student's demonstrated a significant improvement in CXR interpretation proficiency after engaging with a gamified simulation. Confidence levels increased notably, 83% of students progressed from ''Moderately Confident'' to ''Very Confident'' in their ability to interpret CXR's. Similarly, 67% of students improved in identifying abnormalities on CXR's. Quantitative results showed an improvement in mean scores by 31%. Pathology identification also improved. The simulation was deemed engaging, effective and beneficial for enhancing systematic radiographic analysis skills.
Conclusion
Gamification as an educational tool significantly improved students' confidence and accuracy in CXR interpretation, demonstrating the effectiveness of gamification.

D'AMORE, A., JAMES, S. and MITCHELL, E.K.L., 2012. Learning styles of first-year undergraduate nursing and midwifery students: A cross-sectional survey utilising the Kolb Learning Style Inventory. Nurse education today, 32(5), pp. 506–515.
GEFTER, W.B., POST, B.A. and HATABU, H., 2023. Commonly Missed Findings on Chest Radiographs: Causes and Consequences. Chest, 163(3), pp. 650–661.

E2.3 The RADICAL study: A large mixed-methods study evaluating whether CXR algorithms can assist in the detection of urgent suspicion of cancer (USC)

Dr Sean Duncan[1]
[1]University Of Glasgow, Glasgow, United Kingdom

Diagnosing and treating lung cancer in early stages is essential for survival outcomes [1]. Image analysis by machine-learning software has the potential to support radiology workflows with a focus on immediate triage of suspicious X-rays. Based in NHS Greater Glasgow and Clyde, the RADICAL study is a stepped-wedge cluster-randomised study consisting of a retrospective technical evaluation and prospective clinical effectiveness study alongside the assessment of acceptability via qualitative work and evaluation of cost-effectiveness via a cost utility analysis. The primary objective is to assess the clinical effectiveness of qXR software to prioritise patients with suspected lung cancer on CXR for follow-up CT. Secondary objectives look at the utility, safety, technical performance, health economics and acceptability of the intervention. Early results for 80,000 CXRs interpreted over 12 months will be presented alongside a retrospective technical evaluation.

Link to BMJopen study protocol: https://bmjopen.bmj.com/content/14/9/e081062#ref-2

1. Tsai C-H, Kung P-T, Kuo W-Y, et al. Effect of time interval from diagnosis to treatment for non-small cell lung cancer on survival: a national cohort study in Taiwan. BMJ Open 2020;10:e034351. doi:10.1136/bmjopen-2019-034351

E2.4 The significance of breast lesions identified incidentally on lung health check CT

Andrew Chai[2], Dr Gillian Hutchison[1]
[1]Manchester Foundation Trust, Manchester, United Kingdom, [2]Shrewsbury and Telford Hospital NHS Trust, United Kingdom

Background

The Targeted Lung Health Check Programme is a screening initiative offering low-dose CT (LDCT) scans to populations at higher risk of lung cancer. Like other forms of cross-sectional imaging, this can produce incidental findings, resulting in increased patient anxiety due to further investigations. We investigated the frequency of incidental breast lesions found through this programme and their outcomes.

Method

A retrospective review of all patients with breast findings detected by LDCT from November 2019 and July 2024 (n=52). Their referral method for breast assessment at one-stop clinic (OSC), findings on breast imaging, and biopsy results were recorded.

Results

52 patients had breast findings at LDCT. 41 patients triaged by breast radiologist. 24 required no further investigation. 17 patients required referral to One Stop Breast Clinic. 13 patients have completed the pathway and 5 malignancies were identified. 11 cases were referred without discussion with a breast radiologist. None of these cases identified a malignancy.

Conclusion

Discussion with the breast radiologist for triage resulted in almost half of potential breast clinic referrals to be avoided thus avoiding undue anxiety for patients and freeing capacity in the clinics to enable 2 week wait targets to be met. All the malignancies identified had been triaged by a breast radiologist. With the expansion of Lung Health Check Screening there is a rise in the number of incidental findings and it is essential to avoid unnecessary cases overloading already stretched resources in breast clinics. Example cases with pertinent distinguishing features will be presented.

E2.5 What is the significance of IVC contrast reflux on CTPA? A direct comparison with echocardiogram

Liam Martin[1], Palina Piankova[1], Kenneth Chan[1], Dr Cheng Xie[1]
[1]Oxford University Hospitals, Oxford, United Kingdom

Objective

Reflux of contrast into the inferior vena cava (IVC) is frequently seen on CT pulmonary angiogram (CTPA), but there is a lack of evidence to prove its significance. This project aims to investigate whether IVC contrast reflux is an accurate indicator of tricuspid regurgitation (TR).

Method

A retrospective cohort study with consecutive patients who had a CTPA from Jan-Oct 2022, and an echocardiogram within 1 year of the CTPA. Arm 1 consisted of CTPAs without IVC reflux (control group). Arm 2 included CTPAs with IVC contrast reflux. Severity of TR was recorded from corresponding echocardiogram reports (none, trace, mild, moderate, severe).

Results

217 patients were included. Arm 1 consisted of 100 patients' CTPAs (average age 68 years) and echocardiograms (37 with no TR, 43 trace, 15 mild, 5 moderate, 0 severe). Arm 2 consisted of 117 patients' CTPAs (average age 75 years) and

echocardiograms (15 with no TR, 34 trace, 26 mild, 28 moderate, 13 severe). Having TR or no TR on echocardiogram was significantly different compared to CTPAs of each Arm (P<0.05). However, exclusive analysis of patients with moderate/severe TR (46/217) on echocardiogram were not significantly different compared to corresponding CTPA (P>0.05). There were 5/46 false positives (no IVC reflux on CTPA, but moderate/severe TR on echocardiogram). Therefore when TR is moderate/severe, IVC reflux on CTPA has 89% (41/46) TR detection accuracy.

Conclusions

IVC reflux on CTPA could detect moderate/severe TR as observed on corresponding echocardiograms. These patients would benefit from early cardiology input for further investigation.

E2.6 Internal target volumes of lung tumours can be more accurately localised with pre-fraction 4D-MRI than with 4D-MRI captured at radiotherapy planning

Mr Mark Warren[1], *Lynn Bell, Dr Neeraj Bhalla, David Cobben, Abhishek Mahajan, Miss Louise Turtle, John Fenwick*

[1]*The University Of Liverpool, Liverpool, United Kingdom*

Background

MR-linacs could allow daily adaption of the Internal target volume (ITV) at each treatment fraction. This would require capturing a pre-fraction 4D-MRI, followed by a roughly ten-minute adaption period before treatment delivery.
This study investigated if the ITV observed on a pre-fraction rather than a planning 4D-MRI would provide a more accurate representation of the ITV during treatment delivery.

Method

Fourteen lung cancer patients underwent repeat respiratory-correlated 4D-MRI, using a 2D T2-weighted HASTE sequence.
For each patient, repeat 4D-MRI were used to form three types of ITV, representing timepoints analogous to: daily pre-fraction verification (ITVpre); treatment delivery ten minutes later (ITVpost); and treatment delivery around two weeks later (ITV~2weeks). Changes to the extent of the ITV between planning and treatment were determined using the Hausdorff Distance HD. The 90th percentile of the maximum distances that ITVpost and ITV~2weeks extended outside ITVpre were also calculated.

Results

Table one shows that after correction for centroid drift, mean HD between ITVpre and ITVpost was smaller than between ITVpre and ITV~2weeks (7.6mm vs 11.1mm, p<0.01). The 90th percentile of the maximum distances that ITVpost extended outside ITVpre was smaller than that for ITV~2weeks (9.5mm vs 17.3mm).

Conclusion

The HD of ITVs defined on repeated 4D-MRI datasets collected ten minutes apart were more similar than those collected weeks apart. For 90% of patients, the margin required to encompass changes to the ITV observed over ten minutes is ~7mm smaller than that needed to encompass changes observed over two weeks.

Table 1. Values of *HD* between ITVs captured at ten minute and two-weekly intervals

	HD (mm)	
Patient	ITV_{pre}/ITV_{post}	$ITV_{\sim 2weeks}/ITV_{pre}$
1	9.8	10.6
2	10.8	18.8
3	7.6	6.1
4	6.7	8.7
5	10.2	10.2
6	3.5	9.4
7	2.3	22.6
8	8.1	9.2
9	10.7	12.6
10	8.5	13.8
11	4.0	6.7
12	8.7	12.5
13	6.5	7.7
14	8.4	6.7
Mean	7.6*	11.1
Median	8.3*	9.8

Key. *- paired differences of HD are significantly lower between ITVs delineated on 4D-MRI collected at 10-minute intervals, than between ITVs delineated on 4D-MRI collected at two-week intervals (p<0.01).