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Radiographer screening for incidental pulmonary emboli on routine contrast-enhanced computerised tomography scans at a cancer centre

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AIM: To introduce and assess effectiveness of a radiographer-led screening programme for the detection of unsuspected pulmonary emboli on routine contrast-enhanced computed tomography (CT), and to evaluate radiographer response to this extended role.

MATERIALS AND METHODS: A training programme was devised for all radiographic staff working in CT. The screening service was introduced and monthly quality assurance performed with cumulative analysis of the first 2 years. Clinical effectiveness before and after screening was evaluated by comparing the time interval between the scan and the start of a clinical consultation for anticoagulant prescription. A satisfaction survey was sent to all participating staff.

RESULTS: Thirty-two radiographers completed the training. During the training period, the radiographer detection rate of incidental pulmonary emboli was 89%. Main, lobar, segmental, and subsegmental emboli were detected. The overall detection rate after full introduction of the programme was 92% for the first 2 years. The time interval between the scan and clinical consultation for anticoagulant prescription dropped from a mean of 1.5 days to a mean of 26 minutes and ensured that treatment was commenced at the same patient attendance. Eighty-four percent of staff completed the satisfaction survey and all were satisfied with the extended role.

CONCLUSION: Radiographer screening for incidental pulmonary emboli was effective and accurate. It resulted in immediate communication with the responsible physician and commencement of anticoagulation therapy at the same hospital attendance, creating a "one-stop" service. Radiographer satisfaction with the extended role was high.

Introduction

The incidence of pulmonary emboli is four- to six-times greater in an oncology population than the general medical population,[1] and the diagnosis of an incidental pulmonary embolus is associated with the same adverse survival in cancer patients as in patients with symptomatic pulmonary emboli.[2] Technological advances in computed tomography (CT) image quality have resulted in increased recognition of incidental pulmonary emboli on routine intravenous contrast-enhanced thoracic CT.[3] The main aim of the present study was to introduce a radiographer-led

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screening programme for the detection of unsuspected pulmonary emboli and to assess its effectiveness in terms of detection and time to patient treatment. To the authors' knowledge, this is the first study to assess training efficacy across a large cohort of radiographers working in CT on a rotational basis, and to document the change in time taken to institute treatment. A secondary aim was to assess staff satisfaction with the extended role.

Materials and methods

The purpose of the training programme was to provide a fast and effective radiographer-led screening programme for incidental pulmonary embolism detection using routine contrast-enhanced CT. As the responsibility for confirming and reporting the presence of a pulmonary embolism remained with the radiologist, there was no requirement for formal ethics approval.

The intention was to integrate the screening programme into the normal working practices of the CT service with radiographer screening taking place at the point of care in the CT control room. CT lists included patients with all histological types of cancer and were undertaken for staging, treatment response or follow-up. Apart from CT pulmonary angiograms (CTPAs) and unenhanced studies, every inpatient and outpatient contrast-enhanced CT thorax was assessed, including patients with poor venous access or suboptimal contrast enhancement. A flow-chart illustrating the proposed patient journey through CT following a contrast-enhanced thorax scan is included in Fig 1.

A pilot cohort of six cross-sectional radiographers underwent training. They read relevant literature on pulmonary embolism prevalence, imaging criteria for detection, and clinical management. They attended a series of prepared lectures on the epidemiology and pathophysiology of pulmonary embolism, normal intravenous contrast-enhanced thoracic CT anatomy, the CT appearance of acute and chronic pulmonary emboli, and potential reasons for misdiagnosis. The radiographers then reviewed 20 cases individually, followed by a group discussion. Thereafter, each radiographer completed a log book of 100 cases, which were all reviewed by the training radiologist. A post-training standard of 90% detection was decided upon and audit of the pilot cohort confirmed that the standard had been met. The same training programme was then extended to include all radiographic staff working in and rotating through the CT department, irrespective of seniority and extent of previous CT experience and the post-training standard was met by all. Training of the entire radiographic staff took 2 years 4 months before full implementation of the screening programme was possible. Before that time, trained staff screened all the patients they scanned. Several posters were designed and placed in the CT control room to remind staff of key CT imaging features of pulmonary emboli.

CT acquisition and review

CT images were acquired on all three CT systems including a 16-multidetector CT system and two 64-multidetector CT systems (Somatom Sensation 16 and Somatom AS Definition 64, Siemens, Erlangen Germany). Imaging parameters on the 16 section system were standardised for all routine protocols with 1.5 mm beam collimation, pitch 0.75, 0.5 second rotation time, and 3 mm reconstructed section thickness. On the 64-section system, the imaging parameters were 0.6 mm beam collimation, pitch 1.2, 0.5 second rotation time, and 3 mm reconstructed section thickness.

According to body weight, 70 or 85 ml of an iodinated intravenous contrast medium iopamidol (300 mg iodine/ml; Niopam 300, Bracco imaging Germany) was administered at a rate of 1–3 ml/s depending on venous access. Scans were performed using a bolus-tracking technique with a trigger threshold of 120 HU units. The imaging protocol was standardised for all patients who had an arterial phase contrast-enhanced thorax scan. All images were screened immediately following scan acquisition by the radiographer performing the scan using the scanner workstations (Wizard, Navigator and Syngo Acquisition Workplace, Siemens, Erlangen Germany).

Implementation of screening programme

Prior to full implementation of the screening programme, a standard operating procedure (SOP) was developed to support and integrate the screening programme into the daily work of the CT department. This outlined governance arrangements and detailed the roles and responsibilities of all staff groups, pathways of communication, quality assurance and continued radiographer training and audit. Procedures were also introduced for training new employees and for management of an incidentally discovered pulmonary embolus when no radiologist was immediately available, for example, at weekends. Signs were produced for waiting areas to inform the patients that the screening programme was in operation and that there might be an additional wait if a pulmonary embolus was detected.

Robust lines of communication were essential for the success of the screening programme. Radiographers and radiologists had to understand and adhere to the standardised management of incidental pulmonary emboli (see Figs 2–3). This included:

Radiographers asking the attending radiologist to confirm a pulmonary embolus, informing the patient that the scan was being reviewed and then informing the patient when a pulmonary embolus was confirmed by the radiologist. They also told the patient where to go and who would assess them for anticoagulant prescription.

Radiologists contacting the clinical team when a pulmonary embolus was detected and making a note on the picture archiving communication system (PACS) about the pulmonary embolus if they were not responsible for issuing the final CT report (to ensure that the finding was included in the written report).

Quality assurance for the screening programme

All screen-detected pulmonary emboli were recorded on the Computerised Radiology Information System (CRIS) and

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