the outcome of patients with NSCLC, with symptom-oriented follow-up. There was no clinically significant difference in median survival after recurrence ($p = 0.219$).

Chiu *et al.* [7] followed up 43 patients with a complete resection of NSCLC, which included low-dose CT every 3 months in the first 2 years post-operatively until tumour recurrence. Low-dose CT detected 79% of cases with tumour recurrence and 58% of all tumour recurrence sites. This study did not comment on survival.

Korst *et al.* [8] showed that surveillance CT is frequently abnormal post-resection but the majority of the abnormalities are not suspicious for recurrence. A retrospective analysis showed 105 abnormal CT findings in 92 patients 6 months or 1 year or yearly post-resection. Of these, 32 scans of 32 patients were suspicious for recurrence and further work-up showed recurrence or new malignancy in 16 of 32 patients. Of the 73 abnormal but unsuspicious scans, five patients had recurrence. Nine patients had interval lung cancers detected independently of surveillance CT scanning.

Korst *et al.* [9] then followed up the previously identified 92 patients for an average of 3.2 years. Of the 60 patients with the 73 abnormal but unsuspicious scans, 7 developed recurrent lung cancer during the follow-up period. Of the 16 patients with abnormal CT scans that were deemed suspicious but were found to have no further malignancy, 3 developed a recurrence during this follow-up period. The surgeon utilizing surveillance CT rarely missed recurrent NSCLC but a low-positive predictive value generated a significant number of negative and sometimes invasive investigations.

CLINICAL BOTTOM LINE

From the limited number of papers that address the effect of CT follow-up on survival following lobectomy for NSCLC, three [2, 4, 5] showed that CT scanning may improve the survival of patients by detecting local and distant recurrences at an earlier stage when the patient is asymptomatic, therefore allowing earlier interventions to take place. However, this may also require CT head in addition to CT chest [4] and we must also take into account lead-time bias when interpreting these results. Furthermore, it is important for doctors to explain the radiation implications of CT scanning to their patients.

Two papers [3, 6] broadly showed that follow-up with CT does not improve survival outcomes regardless of the site of recurrence. Owing to the limited and contradictory evidence, an randomized controlled trial to assess the survival outcomes of patients followed up with a CT screening protocol vs a symptom-based follow-up would be required to definitively comment on whether a survival benefit is present. The remaining papers [7–9] supported the use of CT as a screening tool for recurrence, although they did not directly comment on survival. It should be noted that ongoing studies are looking at the role of CT scanning in detecting lung cancers in high-risk individuals (current or former smokers) who have not had lung cancer. Two prominent trials [10, 11] have shown that CT screening for lung cancer increases the detection of early stage lung cancer but no reduction in mortality has been observed.

Conflict of interest: none declared.

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eComment. Computed tomography surveillance of lung cancer survivors: The jury is still out

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Srikantharajah et al.'s review of five single centre studies concludes that the existing evidence for a survival benefit from routine computed tomography (CT) surveillance of non-small cell lung (NSCLC) cancer survivors following an anatomical resection is equivocal and conflicting. Hence they plead for a randomized control trial [1]. In fact this patient subgroup have been largely excluded from prospective analysis by most trial designs.

The multi-centre prospective phase III North American National Lung Screening Trial (NLST) reported a lung cancer-specific 20% mortality risk reduction with (three annual) low-dose (LD) CT scans for lung cancer screening in 'at risk' individuals (aged 55-74 years with a minimum 30 pack year history of tobacco exposure), although two other contemporary trials failed to demonstrate a similar survival benefit [2–4].

More recently, the American Association for Thoracic Surgery (AATS) published guidelines recommending annual LDCT be performed each year from such individuals age 55-79 years and not just three screening scans in the lifetime of the patient [5]. This is based in part on the peak age of incidence of lung cancer in the USA and average life expectancy, at 70 years and 78.6 years respectively, and the age-related linear increase in NSCLC incidence. Additionally, the AATS has issued a recommendation for annual LDCT screening to be offered to all surgically treated NSCLC survivors who have completed 4 years of radiologic surveillance without evidence of recurrence. Such patients should be initially followed-up with a high

resolution CT for 4 years following resection for NSCLC (stage 1A- IIIA) and thereafter with LDCT screening from post-resection year 5 onwards [5].

LDCT surveillance should persist for the duration of the lung cancer survivor's life unless or until a reduction in functional status or pulmonary reserve precludes treatment of a new NSCLC. The AATS suggests screening should commence 6 months following lobectomy initially at 6 monthly intervals due to the peak incidence of recurrence in the first 2-3 years. The rationale for this is based on the knowledge that individuals who have had lung cancer are at the highest risk (3% annual risk) of developing a recurrence or a second primary tumour.

In evaluating the potential role of CT scanning as a screening or surveillance tool for NSCLC, one has to be cognizant of several important considerations. Firstly, does an increased CT screening/surveillance rate translate into a survival benefit or is the former due to over-diagnosis, the detection of biologically insignificant tumours and lead time bias. Does the new lesion if malignant, represent a likely recurrence or a second metachronous primary tumour? This distinction is important both in terms of prognosis and treatment offered. Additionally, the role of a concomitant PET scan in the monitoring of such patients needs to be defined. Given the preponderance of both symptomatic and incidental extra thoracic recurrent disease (e.g. brain metastases) with NSCLC survivors, should a surveillance CT protocol be confined only to the thorax? The potential benefits of follow-up with serial CT imaging are evidently immense but must be balanced against the false positive (low specificity) rate, which can increase patient anxiety, stimulate unnecessary invasive investigations and the small inherent risk of radiation induced malignancy. The AATS recommendations are largely based on the NLST findings but simply extrapolating the North American data to formulate local guidelines may be ill advised and instead clinicians need to carefully evaluate their own local cancer demographics and the cost implications of CT surveillance.

Conflict of interest: none declared

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