Is it safe to include octogenarians at the start of a video-assisted thoracic surgery lobectomy programme?†

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Abstract

OBJECTIVE: The study aimed to investigate the safety of including patients ≥80 years of age at the start of a video-assisted thoracic surgery major pulmonary resection (VMPR) programme.

METHODS: Patients were considered for VMPR if the computed tomography/positron emission tomography (CT/PET) was suggestive of T1–3, N0–1 and M0 lesion. Age was not a criterion for exclusion at the very start of the programme. Data were collected prospectively and comparison made between two groups, (A) <80 years of age and (B) ≥80 years, in terms of preoperative risk factors, oncological and functional data, operative results, postoperative complications and survival.

RESULTS: Between April 2005 and January 2011, 200 consecutive patients were considered for VMPR. A total of 160 had non-small-cell lung cancer, of whom 136 were in group A, with a median age of 66.5 (range: 42.8–79.4 years) and 24 in group B with a median age of 82 (range: 80–85.5 years). In group B, 13 were men and 11 were women. Rate of conversion to thoracotomy was similar (3 (12.5%) in group B vs 17 (12.5%) in group A, p = 0.65), and so was the mean hospital stay (5.8 ± 3.3 days in group B vs 5.9 ± 4.6 days in group A, p = 0.899). Admission to intensive care unit and atrial fibrillation were significantly higher in octogenarians (six (25%) and six (25%) in group B vs eight (5.9%) and nine (6.6%) in group A, p = 0.008 and p = 0.012, respectively). There was significantly less mean days of air leak in octogenarians (0.06 ± 0.3 days in group B vs 2.8 ± 5.6 days in group A, p = 0.000). Otherwise, there were no age-related differences in relation to morbidity, mortality and the 3-year survival rate.

CONCLUSION: Octogenarians undergoing VMPR have a higher incidence of atrial fibrillation and admission to the intensive care unit for cardiopulmonary support but otherwise are no different from younger age groups when it comes to rate of conversion to thoracotomy, hospital stay, morbidity and mortality. Age should not be an excuse to deny the elderly curative VATS resection. In our experience, accepting octogenarians early in the VMPR programme did not compromise the outcome results.

Keywords: Video-assisted thoracic surgery • Lobectomy • Non-small-cell lung cancer • Systematic nodal dissection • Octogenarians

INTRODUCTION

In the United Kingdom, the fastest population increase has been in the number of those aged 85 and over, the ‘oldest old’ [1]. In 1983, there were just over 600 000 people in the UK aged 85 and over. By 2031, the number is projected to more than double to reach 2.5 million and to account for 4% of the total population (Dini, E. (2008). Estimating the changing population of the oldest old. (Available: http://www.ons.gov.uk/ons/rel/population-trends-rd/population-trends/no-132-summer-2008/estimating-the-changing-population-of-the-oldest-old-.pdf last accessed 5 December 2011.) As a result of improved diagnostic techniques and preoperative interventions to enhance the safety of surgical management, anaesthetic and intensive-care advancements, increasing numbers of elderly patients will present for pulmonary resection. Consequently, interest has been revived in video-assisted thoracic surgery (VATS) as a minimally invasive surgical technique in this age group due to the belief that this approach will improve outcome. We were concerned at the start of our VATS lobectomy programme that inclusion of octogenarians might jeopardise the programme and had to ask the question: is it justified to include these patients at the beginning or after acquiring some experience to smooth the learning curve? To answer this question, we retrospectively compared octogenarians to younger age groups in terms of risk factors, oncological and functional data, operative, postoperative events and survival.

MATERIALS AND METHODS

VMPR was introduced at Southampton General Hospital – UK in April 2005, inspired by the work of W. Walker (Edinburgh Royal
In accordance with recent publications [9,10], chemotherapy was considered for patients with suspected non-small-cell lung cancer (NSCLC), first-time operation and stage T1–2 peripheral tumour, N0–1 and M0 (TNM 6th edition classification) [3]. Age was not an exclusion criterion for either the VMPR or the routine systematic nodal dissection (SND) part of the operation. All presumed lung cancer cases were discussed in a multidisciplinary meeting, and decision to operate conformed to the British Thoracic Society (BTS) guidelines [4,5]. Informed consent was obtained from all patients by a consultant surgeon. Patients had full pulmonary function tests including estimation of transfer factor for carbon monoxide ($T_l^{LCO}$) and calculated predicted postoperative forced expiratory volume in 1s ($FEV_1$) ($PPOFEV_1$) expressed as % predicted and predicted postoperative $T_l^{LCO}$ ($PPO_l^{LCO}$) expressed as % predicted, using an anatomical equation for lobectomy [6]. Preoperative investigations included computed tomography (CT) chest and abdomen, fusion positron emission tomography computed tomography (PET/CT) and CT or magnetic resonance imaging (MRI) of brain. Flexible bronchoscopy would have been performed by the chest physician and possible histological diagnosis obtained. N2 disease suggested by PET/CT was excluded from this series; however, cases of N1 were included, as they were deemed removable during the VATS procedure.

All cases were performed under general anaesthesia, using single-lung ventilation. Three ports were fashioned, two 1 cm and a utility port 3–4 cm long at the midaxillary line over the 5th or 6th intercostal space. Suitability to proceed to VATS resection was decided after initial videoscopic assessment of the mass and pleural cavity. Resection was performed by individual anatomic dissection of hilar structures, without rib spreading. All lung specimens were extracted within a polythene bag but not the nodes. The bronchial stump was tested under water for air leak. An epidural fine-bore catheter was inserted under videoscopic guidance into the paravertebral extrapleural space for postoperative analgesia. A single 28-F chest tube with extra holes was positioned, and wounds closed in layers.

SND was added routinely in the last consecutive 106 patients, after acquiring adequate expertise in this technique. It took some time to strictly adhere to the guidelines of the European Thoracic Society and the recently published update from the American College of Surgeons Oncology Group (ACOSOG) Z0030 trial [7,8]. We harvest nodes en bloc, stations 2–4, 7, 8, 9, 10 and 11 on the right and 4, 5–6, 7, 8, 9, 10, 11 and 3, when indicated, on the left side. The azygos vein and ligamentum arteriosum were always preserved.

Patients were recovered according to a standard protocol in the theatre recovery room for 2 h before being transferred to the ward. Postoperative pain relief was provided by a continuous 0.25% bupivacaine infusion supplemented by patient-controlled analgesia (PCA) using morphine continuous intravenous infusion and non-steroidal anti-inflammatory oral analgesics.

Follow-up of patients was scheduled at 4 weeks and 3 months after surgery and yearly thereafter, with chest X-ray on each visit. All patients referred to chemo- or radiotherapy had a screening CT before and after such treatment. Any new symptoms on follow-up were discussed in a multidisciplinary team setting and requisition of a CT scan was made on clinical grounds. Collection of postoperative events and complications covered the postoperative clinic visits, and the figures reflect that. Stage Ila and higher NSCLC patients were referred for adjuvant chemotherapy in accordance with recent publications [9,10].

Long-term survival information was obtained from the family doctor or Central Registry of Deaths.

**STATISTICAL METHODS**

The main aim of the study was to compare two age groups, group A <80 and group B ≥80 years of age in terms of preoperative risk factors, oncological and functional data, perioperative events, postoperative complications and outcome. Statistical analysis was performed using Statistical Package for the Social Science Programme, PASW Statistics 18 (IBM Corporation, Somers, NY, USA). Data were expressed as percentage, mean ± standard deviation (SD) or as median and range, where indicated. The relationships between different categorical variables and the two age groups were assessed with the χ² test and Student's t-test for continuous data. If any of the expected frequencies cells of a contingency table was <5, Fisher's exact test was used for categorical variables. Product-limit method of Kaplan–Meier survival analysis was used to evaluate time-dependent events in survival. Log-rank tests and Wilcoxon regression models were used for crude and adjusted survival analyses. A p value <0.05 was considered statistically significant.

**RESULTS**

Between April 2005 and January 2011, 200 consecutive patients were considered suitable for first-time VMPR at our institution. The final histological results revealed NSCLC in 160 patients, who constitute our study group. We compared two age groups (A <80 years and B ≥80 years). Patients 80 years or older accounted for 15% of NSCLC patients (24/160).

Table 1 compares the risk factors between the two groups. There was no age-related statistical difference in terms of gender, smoking, diabetes, hypertension, ischaemic heart disease, cerebrovascular disease, chronic obstructive pulmonary

**Table 1:** Risk factors compared between two age groups (A) <80 years and (B) ≥80 years undergoing VMPR-SND for lung cancer

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Group (A) &lt;80 years (136)</th>
<th>Group (B) ≥80 years (24)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>78 (57.4%)</td>
<td>11 (45.8%)</td>
<td>0.295</td>
</tr>
<tr>
<td>Smoking</td>
<td>92 (67.6%)</td>
<td>20 (83.3%)</td>
<td>0.122</td>
</tr>
<tr>
<td>BMI (mean)</td>
<td>27.3</td>
<td>23.8</td>
<td>0.012</td>
</tr>
<tr>
<td>Diabetes</td>
<td>13 (9.6%)</td>
<td>1 (4.2%)</td>
<td>0.696</td>
</tr>
<tr>
<td>Hypertension</td>
<td>35 (25.7%)</td>
<td>4 (16.7%)</td>
<td>0.340</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>18 (13.2%)</td>
<td>4 (16.7%)</td>
<td>0.747</td>
</tr>
<tr>
<td>CVA/TIA</td>
<td>9 (6.6%)</td>
<td>4 (16.7%)</td>
<td>0.109</td>
</tr>
<tr>
<td>Pulmonary functions:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$PPOFEV_1$%</td>
<td>63.6 ± 15.5</td>
<td>66.3 ± 23.9</td>
<td>0.549</td>
</tr>
<tr>
<td>$PPO_l^{LCO}$%</td>
<td>58.7 ± 20.8</td>
<td>52.9 ± 2</td>
<td>0.436</td>
</tr>
<tr>
<td>WHO performance status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1</td>
<td>81 (78.6%)</td>
<td>16 (72.7%)</td>
<td>0.577</td>
</tr>
<tr>
<td>≥ 0</td>
<td>22 (21.4%)</td>
<td>6 (27.3%)</td>
<td>0.577</td>
</tr>
<tr>
<td>COPD, asthma, emphysema</td>
<td>27 (19.9%)</td>
<td>8 (33.3%)</td>
<td>0.141</td>
</tr>
<tr>
<td>Second malignancy (treated)</td>
<td>27 (19.9%)</td>
<td>4 (16.7%)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

* Indicates statistical significance, p < 0.05.
disease (COPD), WHO performance status or the presence of previously treated malignancy. Further, there were no differences in pulmonary function as gauged by predicted postoperative FEV1% and predicted postoperative FVC%. Group B had significantly lower body mass index (BMI): 23.8 kg m$^{-2}$ compared to 27.3 kg m$^{-2}$ in the younger group (p = 0.012).

Table 2 compares the operative and postoperative data between the two groups. There was no age-related difference in mean operative time (group B 03:28 ± 01:00 hh:mm vs group A 03:40 ± 00:55 hh:mm, p = 0.385). One patient in group B was found to have pleural deposits on initial videoscopic inspection and did not proceed to curative resection; all other 23 patients proceeded to VATS lobectomy–SND, which was not different from the type of operation performed for younger age groups (p = 1.000). There were three conversions to thoracotomy in group B (12.5%) for bad vision, bleeding and accidental transection of left-main bronchus during VATS left-upper lobectomy. This was not significantly different from group A with a conversion rate of 17 (12.5%) (p = 0.650). Radical SND was performed significantly less in the octogenarians (group B 9 (37.5%) vs group A 87 (64%), p = 0.015). Whereas there was no difference between age groups in terms of operative bleeding, there was significantly less postoperative tube drainage after operation (group B 420 ± 246 ml vs group A 633 ± 473 ml, p = 0.022). There was no difference between groups in mean hospital stay (group B 5.8 ± 3.3 days vs group A 5.9 ± 4.6 days, p = 0.899), re-admission within 2 weeks (group B 1 (4.2%) vs group A 1 (8.1%), p = 0.695) or 30 days’ mortality (group B 1 (4.2%) vs group A 1 (0.7%), p = 0.278).

Table 3 compares the complications between the two groups. There was no difference in occurrence of at least one postoperative surgical or non-surgical event (group B 15 (62.5%) and 12 (50%) compared with group A 73 (53.7%) and 85 (62.5%), p = 0.423 and p = 0.248, respectively). There was a significantly lower incidence of pneumothorax and surgical emphysema (p = 0.046) and subsequently less mean days of air leak in octogenarians (group B 0.06 ± 0.3 days vs group A 2.8 ± 5.6 days, p = 0.000). Atrial fibrillation in the postoperative period was experienced significantly more by octogenarians (group B six (25%) vs group A nine (6.6%), p = 0.012). Postoperative admission to intensive therapy unit (ITU) or high-dependency unit (HDU) was significantly higher in the octogenarians (group B six (25%) vs group A eight (5.9%), p = 0.008); however, this was not due to mechanical ventilation (group B three (12.5%) vs group A four (2.9%), p = 0.069). The reasons for admitting six octogenarians to the ITU/HDU were:

1. lung collapse/consolidation requiring continuous positive airway pressure (CPAP) or biphasic intermittent positive airway pressure (BIPAP), atrial fibrillation and mild renal impairment;
2. lung collapse/consolidation requiring mechanical ventilation and inotropic support for 1 day;
3. intra-operative atrial fibrillation requiring inotropic support and ITU observation for 1 day;
4. bronchopleural fistula requiring re-operation within 24 h from initial VATS lobectomy, VATS stitching of bronchus and mechanical ventilation for 2 days;
5. postoperative bleeding and lung collapse requiring thoracotomy 24 h after VATS lobectomy, admitted to ITU for observation; and
6. accidental transection of left-main bronchus during VATS left-upper lobectomy, requiring thoracotomy and reanastomosis of lower lobe bronchus to left-main bronchus – admitted to ITU for observation for 1 day.

Table 4 compares the final histology between octogenarians and younger age groups. There was no statistical difference either in the presenting stage of lung cancer or in the dimension (p = 0.965) and subsequently less mean days of air leak in octogenarians (group B 0.06 ± 0.3 days vs group A 2.8 ± 5.6 days, p = 0.000). Atrial fibrillation in the postoperative period was experienced significantly more by octogenarians (group B six (25%) vs group A nine (6.6%), p = 0.012). Postoperative admission to intensive therapy unit (ITU) or high-dependency unit (HDU) was significantly higher in the octogenarians (group B six (25%) vs group A eight (5.9%), p = 0.008); however, this was not due to mechanical ventilation (group B three (12.5%) vs group A four (2.9%), p = 0.069). The reasons for admitting six octogenarians to the ITU/HDU were:

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of the primary tumour \( p = 0.176 \) and \( p = 0.608 \), respectively. The frequency of early clinical stage I and II disease increased with age, from 70% in group A to 83% in the most elderly group B, however; this did not reach the significance level \( p = 0.176 \). Likewise, there was a tendency for octogenarians to present with early stages (Ia and Ib) for which chemotherapy was not indicated (group B 567 ± 202 vs group A 597 ± 490, \( p = 0.916 \)). Again, presenting with an earlier stage of the disease is no longer a privilege of group B (stage Ia–Ila: group B seven (77.8%) vs group A 55 (63.2%), \( p = 0.485 \)). The trend for presenting with very early stages not requiring adjuvant chemotherapy is not observed in the octogenarian group (group B seven (77.8%) vs group A 44 (50.6%), \( p = 0.167 \)). These results corroborate the value of SND as a gold standard in staging the mediastinum in lung cancer.

Table 6 shows the clinical and pathological staging of the 24 octogenarians in group B. The PET scan failed to demonstrate pleural metastatic deposits in one patient with c-stage Ia, who after initial videoscopic inspection and frozen-section histology did not proceed to resectional operation. Another patient with preoperative c-stage IV due to multiple lesions in different lobes was proven by frozen section not to have metastatic disease and had a successful VATS lobectomy. No patient in group B required preoperative staging mediastinoscopy.

Fig. 1 shows the Kaplan–Meier survival curves for the two groups. There is no statistical difference in survival between octogenarians and younger groups for at least the first 4 years of follow-up (log-rank 0.048, \( p = 0.826 \), Wilcoxon 0.144, \( p = 0.704 \). Statistical difference starts to appear after 4 years of follow-up and can partly be explained by the higher probability of dying from non-related competing causes.

### DISCUSSION

The incidence of lung cancer in the general population in the UK is 69 per 100,000, at a peak age between 75 and 80 years, but in men over 75 years of age it rose to 751 per 100,000 [11].

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**Table 4: Pathology and recurrence compared between two age groups (A) <80 years and (B) ≥80 years undergoing VMPR–SND for lung cancer**

<table>
<thead>
<tr>
<th>Pathological stage</th>
<th>Group (A) &lt;80 years (136)</th>
<th>Group (B) ≥80 years (24)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenocarcinoma</td>
<td>96 (70.6%)</td>
<td>13 (54.2%)</td>
<td>0.111</td>
</tr>
<tr>
<td>Squamous cell</td>
<td>24 (17.6%)</td>
<td>11 (45.8%)</td>
<td>0.021</td>
</tr>
<tr>
<td>Pathological stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ia–Ila</td>
<td>95 (69.9%)</td>
<td>20 (83.3%)</td>
<td>0.176</td>
</tr>
<tr>
<td>Ib and higher</td>
<td>41 (30.1%)</td>
<td>4 (16.7%)</td>
<td>0.176</td>
</tr>
<tr>
<td>Tumour dimension (mm)</td>
<td>31 ± 16</td>
<td>33 ± 14</td>
<td>0.167</td>
</tr>
<tr>
<td>Local recurrence</td>
<td>9 (6.6%)</td>
<td>0 (0%)</td>
<td>0.357</td>
</tr>
<tr>
<td>Distant metastases</td>
<td>15 (11%)</td>
<td>2 (8.3%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Chemotherapy not indicated (Ia, Ib)</td>
<td>73 (53.7%)</td>
<td>19 (79%)</td>
<td>0.052</td>
</tr>
<tr>
<td>Chemotherapy initiated</td>
<td>32 (23.5%)</td>
<td>2 (8.3%)</td>
<td>0.093</td>
</tr>
</tbody>
</table>

* Indicates statistical significance, \( p < 0.05 \).
Pulmonary resection is still considered the optimal treatment for NSCLC, and this is especially true in the early stage. Published evidence suggests that elderly patients are denied potentially curative surgery solely because of chronological age and because of the physician perception that they are too frail to withstand treatment. Mery et al. reported 30% of elderly patients either were denied surgery or were offered only palliative surgery, in contrast with 8% among the youngest patients [12]. Chambers et al. examined the published evidence to address the question of whether lung resection in patients ≥70 years of age with lung cancer is justified when compared with non-surgical treatment in terms of postoperative morbidity, mortality and quality of life (QoL) [13]. They report a unanimous verdict from several prospective and large population studies that patients ≥70 years of age respond as well as younger patients in all outcome measures pertaining to morbidity, mortality and QoL postoperatively and should receive aggressive surgical management if considered fit for surgery. In 2010, The BTS and Society for Cardiothoracic Surgeons of Great Britain and Ireland Working Party published an update to the 2001 detailed recommendations for the selection and management of patients with potentially operable lung cancer [4,5]. As far as age is concerned, the recommendations were:

1. Elderly patients undergoing lung resection are more likely to require intensive perioperative support. Preoperatively, a careful assessment of co-morbidity needs to be made.
2. Surgery for clinically stage I and II disease can be as effective in patients over 70 years as in younger patients. Such patients should be considered for surgical treatment, regardless of age.
3. Age over 80 years alone is not a contraindication to lobectomy or wedge resection for clinically stage I disease.
4. Pneumonectomy is associated with a higher mortality risk in the elderly. Age should be a factor in deciding suitability for pneumonectomy.

Our experience of moving from open to VATS lobectomy mirrors that of Walker et al. and Seder et al. [2,14]. However, the experience of radical SND was established 2 years after the start of the programme. Age was not a criterion to decide against either VMPR or SND and the series was consecutive without selection. Our results corroborate the BTS guidelines for VATS as a minimal-access approach to resect early lung cancer in octogenarians and are in full agreement of its recommendations. Recently, Fanucchi et al. reported 2.4% operative mortality and 30% overall morbidity [15]. Despite the absence of mortality in our series, it is expected to reach these figures when the series is large enough. However, our rate of surgical events at 62.5% and non-surgical events at 50% is slightly more than published data. Partly, this is explained by the fact that surveillance of complications extended to the follow-up period, and the figure reflects occurrence of at least one minor or major complication. This did not have a major impact on the mean LOS (group B 5.8 ± 3.3 days, group A 5.9 ± 4.6, p = 0.899).

Pooled analysis of the two groups with disregard to nodal dissection created a bias factor. Despite all patients being subject to one set of rules, our figures revealed a significant reduction in performing SND in octogenarians. This is an inherent limitation to explaining few findings, such as the less operative bleeding, less tube drainage and presenting with earlier stages of the disease. These could easily be justified by reduced incidence of performing SND in the older group. We therefore compared the two groups in Table 5 including only patients who underwent SND. The advantage of less air leak remained with octogenarians; however, the trend and advantage for postoperative bleeding, tube drainage and presenting with earlier disease stage had disappeared. This highlights the importance of SND in proper staging of lung cancer, even when mediastinal nodal involvement is not suspected.

Burfeind et al. published the largest prospective series of QoL in elderly patients undergoing pulmonary resection. Patients ≥70 years of age experienced transient decreases in all QoL domains at 3 months, which returned to baseline at 12 months [16]. Furthermore, the mean survival was equivalent when matched for cancer stage to patients <70 years of age. The 5-year survival rate decreased with increasing age, as shown by Owonikoko et al., who conducted a retrospective study of 316 682 patients undergoing different modality treatment for lung cancer [17]. Patients 80 years or older account for 14% of all lung cancers and have inferior outcomes when compared with younger patients (<70, 70–79 or >80 years was 15.5%, 12.3% and 7.4%, respectively, p = 0.0001). Local therapy (radiation or surgery) was offered to the elderly far less frequently. In those offered surgery, 5-year survival rates were comparable (63.2%, 58.4% and 61.4%, respectively). For patients 80 years or older who received single-modality, less than lobectomy surgery, the outcome was statistically inferior [12,17,18].

In our series, octogenarians represent 15%, but the proportion is expected to rise. There was no statistical difference between patients <80 and ≥80 years in terms of risk factors. Octogenarians had significantly more benign arrhythmias and admissions to ITU/HDU after the operation. The significance of preponderance of squamous cell carcinoma in the octogenarians over younger age groups seems to indicate a different pathology with age extremes. In our study, the probability of a tumour being of squamous histology increased from 17% among younger patients <80 years old to 45.8% for patients ≥80 years old (p = 0.002). Squamous cell tumours are known to have lower recurrence rates and portend longer survival times than adenocarcinoma [19].

![Figure 1: Kaplan-Meier estimated survival in 160 patients undergoing VMPR-SND for all stages NSCLC, comparing two age groups, group A <80 years and group B ≥80 years.](image-url)
Several authors have investigated the safety of sublobar resections in older population to reduce postoperative mortality and morbidity [12]. Berry et al. performed a study to identify specific risk factors for complications after lung resection in octogenarians [20]. A total of 147 (77%) patients of their series underwent VATS resection. The authors clearly identified a resection greater than wedge as a specific risk factor for complications. Okami et al. investigated the outcome of early stage NSCLC resection in elderly population comparing lobar versus sublobar resections [21]. They showed no overall or disease-free survival benefit for lobectomy compared with sublobar resection in this age group. In the same context, Aoki et al. suggested that lobectomy without radical SND appears to be a satisfactory surgical procedure for octogenarians with clinical stage I NSCLC because the risk of postoperative pulmonary morbidity may increase and mitigate against prolonging survival [22]. Our results show that VATS–SND neither imparts an extra risk or complications for this cohort of patients nor does it prolong hospital stay. However, radical harvesting of mediastinal nodes on the right chest added 30 extra min to the planned VATS resection, whereas left-sided harvesting added 45–60 min. We admit that introduction of SND to VMPR in our programme was phased, due to a prolonged learning curve and difficulty with harvesting #7L. This explains why there was no statistical difference between the two age groups in systematic nodal sampling (p = 0.561), while the chance of octogenarians to undergo radical SND was significantly less (group B 9 (37.5%) vs group A 87 (67%), p = 0.015). If the subcarinal #7 nodes were not harvested, the case was not counted as SND, irrespective of the number of harvested nodes. Other reasons for reluctance to perform radical SND might be theatre-time pressure, anaesthetic advice and prohibitive adhesions. However, in our opinion, the added information obtained by SND is invaluable in terms of appropriate staging, avoiding stage migration and guiding the correct multidisciplinary adjuvant therapy. With regard to the extent of resection; in our opinion surgeons should not bail out to limited sublobar resection in low-to-moderate risk octogenarians, due to high rate of local recurrence and compromise of cure. Octogenarians seem to benefit from the same standards of management as their younger counterparts. Patient selection, aggressive postoperative treatment of complication and intensive monitoring can minimise postoperative events.

The literature evaluating the evolving role of VATS lung resection in octogenarians is scarce but seems to suggest that minimally invasive techniques might have a better outcome than thoracotomy in this age group [23,24]. Although our data do not directly support it, it is possible that VATS as a minimal access approach may have a positive impact on outcome in the octogenarians. Randomised controlled trials are required in this age group, to compare VATS to thoracotomy to better understand the impact of minimal access on outcome. In a review of lung cancer management in the elderly in UK, Booton et al. concluded that denying the elderly important advances in the treatment of lung cancer on prejudice alone is no longer justified [25]. Fit elderly persons should ideally be included in randomised trials to provide an evidence base.

**CONCLUSIONS**

It is safe and justified to include octogenarians right at the start of a VATS lobectomy programme. Apart from higher incidence of benign arrhythmias and admission to ITU/HDU, there were no age-related complications (rate of conversion, hospital stay, morbidity, mortality and 3-year survival). Age should not be an excuse to deny the elderly important advances in treatment of lung cancer, as long as a careful preoperative assessment is performed to appropriately select surgical candidates.

**Conflict of interest:** none declared.

**REFERENCES**


