Brief communication - Thoracic oncologic

Peroperative fiducial placement for postoperative stereotactic Cyberknife radiosurgery

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Abstract

Radiotherapy is often the treatment used for inoperable early-stage lung cancer as well as pulmonary metastases. In the last decade, efforts were done to increase local control with high-dose radiation without excessive collateral damage. Initially used for cranial lesions, stereotactic radiosurgery enlarged extracranial indications; the Cyberknife radiosurgery system needs metal (gold) markers for image guidance. For lung tumours, fiducials are inserted computed tomography (CT)-guided or bronchoscopy-guided. We describe four patients where fiducial placement was done during surgery.

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Keywords: Fiducial marker; Cyberknife; Radiotherapy

1. Introduction

Surgery remains the standard of care for early-stage lung cancer as well as certain pulmonary metastases. In the case of inoperable patients, radiotherapy is often chosen [1]. Recently, efforts were made to increase local control with high-dose radiation without excessive collateral damage. Stereotactic radiosurgery used for cranial lesions, enlarged its indications [2, 3]. The Cyberknife radiosurgery system needs metal markers (gold markers), placed in or near the tumour, for image guidance. For lung tumours, fiducials are inserted computed tomography (CT)-guided or bronchoscopy-guided [4, 5]. We describe the fiducial placement we use during surgery.

2. Case reports

Four patients were admitted to our department. Surgery was decided by the multidisciplinary staff. Table 1 shows the patients’ data.

2.1. Patient no. 1

A 61-year-old woman had Hodgkin disease (radiotherapy + chemotherapy, 39 years before), adenocarcinoma of the left breast (surgery + chemotherapy, 16 years before), adenocarcinoma of the left lung lower lobe (pT2N1M0: surgery + chemotherapy, four years before), local recurrence of breast cancer (surgery, one year before). Last check-up showed two nodules in the right lung lower lobe. During surgery, two wedge resections were done. A fiducial was placed near each resection, sutured inside the visceral pleura. Histology showed broncho-alveolar adenocarcinoma. No complementary treatment was decided. Local recurrence appeared 14 months later. Radiosurgery and chemotherapy was decided.

2.2. Patient no. 2

A 53-year-old woman had a left colectomy for cancer. One year later, bilateral lung metastases appeared and were treated with chemotherapy. At last check-up, only three were left. First, she underwent a lower left lobectomy. Then, on the right side, she had a lower lobectomy combined with upper lobe dorsal segmentectomy; a fiducial was placed near to the resection edges of the upper lobe. Histology showed microscopic incomplete resection. Radiosurgery and chemotherapy was decided.

2.3. Patient no. 3

A 67-year-old woman had osteosarcoma on the right thigh. One year later, bilateral lung metastases appeared and were treated with chemotherapy. At last check-up, only one nodule was left. She underwent a right upper sleeve lobectomy. Fiducial was placed near bronchial anastomosis (Fig. 1). Histology found a supplementary parenchymal lesion. Six months later, multiple recurrences appeared. Chemotherapy was decided.
Table 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Age/sex</th>
<th>Lesion</th>
<th>FEV₁ (l)</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61/F</td>
<td>RLL</td>
<td>1.49/62</td>
<td>20 AWD</td>
</tr>
<tr>
<td>2</td>
<td>53/F</td>
<td>RUL + RLL + LLL</td>
<td>2.40/104</td>
<td>19 AWD</td>
</tr>
<tr>
<td>3</td>
<td>67/F</td>
<td>RUL</td>
<td>2.11/84</td>
<td>16 AED</td>
</tr>
<tr>
<td>4</td>
<td>73/M</td>
<td>LUL</td>
<td>1.72/61</td>
<td>2 AWD</td>
</tr>
<tr>
<td>5</td>
<td>74/M</td>
<td>LyLL</td>
<td>3.00/90</td>
<td>1 AWD</td>
</tr>
</tbody>
</table>

FEV₁, in liter and percentage from theoretic volumes; RLL, right lower lobe; AWD, alive without disease; RUL, right upper lobe; LLL, left lower lobe; AED, alive with evidence of disease; LUL, left upper lobe; Ly, Interlobar lymph node of the left lung.

Cyberknife radiosurgery system arrived in our University Centre in 2007. Since then, we think that the limited resections, with potential risk or local recurrences, can benefit from fiducial marker placement during surgery. Complementary stereotactic radiotherapy can be delivered in the postoperative period or distantly. In our four cases, we placed ‘preventively’ these fiducial markers. In the 1st case, adjuvant Cyberknife radiosurgery was realised because of invaded microscopic surgical limits. In the 2nd case, radiosurgery was realised one year after the thoracic surgery. In the 3rd case, radiotherapy was not necessary because local recurrence appeared with other metastatic foci. Finally, in the 4th case, a fiducial marker was placed because the frozen section of the bronchus was not reassuring but definitive histology showed negative margins. Three months later, the fiducial marker is still in place and no recurrence was noted in the follow-up chest CT-scan.

Technically, the Cyberknife radiosurgery system needed a gold marker (‘Golden Grains’, ARPLAY Medical Company) for image guidance [6, 7]. This fiducial is placed peroperatively either in the visceral pleura or directly placed in the suture near to surgical borders. The price for the gold marker is €50. Actually, we have a permanent stock in the operating theatre. This ‘preventive’ strategy for particular cases has several advantages, it is more economical and lower risk than percutaneous or bronchoscopic insertion.

Last but not least, this procedure must not compromise the oncologic quality of our surgical treatment. It can really help the therapeutic management for very selected patients. Further experience will certainly clarify the effectiveness of the procedure.

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References


