Cerebral Infarction After Lobectomy for Lung Cancer

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Abstract: Background and objective: The left upper lobectomy as treatment for lung cancer has been identified as a risk factor for cerebral infarction. We analyzed cases of surgery for lung cancer to clarify factors that increase the risk for postoperative cerebral infarction. Methods: This study included patients with primary lung cancer who underwent lobectomy or segmentectomy with >ND1 lymph node dissection from 2008 to 2014 at Hachioji Medical Center of Tokyo Medical University. In total, 479 patients (294 males and 157 females) were examined. Cases of cerebral infarction occurring within 30 days of surgery were retrospectively studied. All surgeries were performed under mini-thoracotomy with thoracoscopy support. Vessels >7 mm in diameter were amputated using a linear stapler. Results: Cerebral infarction occurred in four male patients, representing 0.8% (4/479) of all lung cancers and 1.4% (4/294) of all male patients. Of these four patients, three were in their 60s (1.4% of 157 patients in their 60s) and one was in his 70s (0.5% of 215 patients in their 70s). Two cases involved adenocarcinomas, and two involved squamous cell carcinomas. One patient underwent right upper lobectomy, two underwent right lower lobectomy, and one underwent left upper lobectomy. The cerebral infarctions occurred in a branch of the vertebral artery. The pons was impaired in three cases, and the cerebellum was impaired in one. Three patients had p12 disease, and one patient had p13 disease. Operative time was 4–5 h in two cases, 5–6 h in one, and >6 h in one. Only pl factor significantly differed between patients with and without postoperative cerebral infarction. Conclusions: To prevent cerebral infarction, the following factors should be considered: preoperative smoking cessation, operative positioning to protect the vertebral artery, shortening of operative time, and stronger anticoagulant therapy for high-risk patients, such as those with past history of transient ischemic attack.

Keywords: Cerebral Infarction, Lobectomy, Lung Cancer, Lymph Node Dissection, Pulmonary Vein Thrombosis

1. Introduction

Cerebral infarction occurs at a high frequency in patients undergoing left upper lobectomy (LUL) for lung cancer [1-6]. Thrombus caused by a long pulmonary vein (PV) stump is associated with an increased risk of cerebral infarction [1, 4-9]. In our clinical experience, cerebral infarction is not more frequent after LUL compared with other operative methods. We analyzed cases of surgery for lung cancer to identify factors that increase the risk of postoperative cerebral infarction.

2. Methods

Among patients with primary lung cancer who underwent lobectomy or segmentectomy with >ND1 lymph node dissection from 2008 to 2014, excluding preoperative chemotherapy cases, 479 patients were examined. There were 294 male and 157 female patients. Cerebral infarction cases occurring within 30 days after surgery were retrospectively studied. All surgeries were performed under mini-thoracotomy with thoracoscopy support. Vessels >7 mm in diameter were amputated using a linear stapler.

Data were collected from medical records of patients at the
Statistical analysis

Differences in clinical factors between patients with and without postoperative cerebral infarction were examined using analysis of variance. P values < 0.05 were accepted as statistically significant.

3. Results

Cerebral infarction occurred in four male patients, representing 0.8% (4/479) of all lung cancers and 1.4% (4/294) of all male patients. Of these four patients, three were in their 60s (1.4% of 157 patients in their 60s) and one was in his 70s (0.5% of 215 patients in their 70s) (Figure 1). Two of these cases involved adenocarcinomas (0.6% of 347 adenocarcinomas), and the remaining two involved squamous cell carcinomas (2.1% of 95 squamous cell carcinomas). One patient underwent right upper lobectomy (RUL, 0.7% of 144 RULs); two underwent right lower lobectomy (RLL, 1.9% of all RLLs), and one underwent left upper lobectomy (LUL, 1.0% of 96 LULs) (Figure 2). Two patients were diagnosed with stage IB disease (1.3% of all 153 with stage IB), one with stage IIA disease (2.0% of all 51 with stage IIA), and one with stage IIB disease (3.0% of all 33 with stage IIB). In terms of tumor size, one was 10–20 mm in diameter (0.8%), two were 20–30 mm in diameter (1.5%), and one was >70 mm in diameter (7.1%). Three patients had pl2 disease (2.5%), and one had pl3 disease (3.7%) (Figure 3). Operative time was 4–5 h in two cases (1.4%), 5–6 h in one (1.4%), and >6 h in one (2.0%) (Figure 4). Only pl factor significantly differed between patients with and without postoperative cerebral infarction (Table 1).
Two cases had a past history of malignant disease. Despite being a nonsmoker, one case had a past history of transient ischemic attack (TIA), angina pectoris, and subdural hematoma. Therefore, heparinization was perioperatively performed for this patient. One patient died 2.2 months after surgery, and one died 9.1 months after surgery. One patient completely recovered without complications, and the other was alive 21.2 months after surgery with loss of consciousness.

4. Discussion

Thrombosis in the PV stump can cause cerebral infarction and/or thrombosis in other vital organs [10-11]. Ohtaka et al. [7] reported that among 193 patients with primary lung cancer who underwent lobectomy, thrombus developed in the PV stump in seven (3.6%) patients. Amazingly, all patients with thrombus had undergone LUL; this group of patients accounted for 13.5% of all LULs. These findings suggest that the length of the left superior PV stump is involved in thrombus formation. After lobectomy, the length of the left superior PV stump is longer than that of any other PV stump. Yamamoto et al. [1] reported six cases of cerebral infarction after lobectomy despite using anticoagulant therapy. Nakano et al. [12] also reported cases with postoperative cerebral infarction after lobectomy using anticoagulant therapy.
increased operative time indicates increased time in the lateral position, thereby increasing the risk of cerebral infarction. Pleural invasion and adhesion to the chest wall also lead to excessive operative time. Cerebral infarction developed after 2013 in three of four cases. The surgical wound decreases in size every year. The angle at which the automatic stapler was used on the PV may also have increased the risk of cerebral infarction. The PV may be ligated at the bottom via traditional ligation methods. However, in the context of video-assisted thoracic surgery, the PV can be amputated only at a certain angle and position. Although ligation is performed in the same plane as the surface of the vascular intima, the stapler penetrates through the vascular intima. These factors may also contribute to thrombus formation.

We recommend that physicians seeking to prevent cerebral infarction should consider the following factors: preoperative smoking cessation, use of an operative position that protects the vertebral artery, shortening operative time, and use of stronger anticoagulant therapy for high-risk patients, such as those with a past history of TIA.

5. Conclusions

To prevent cerebral infarction, the following factors should be considered: preoperative smoking cessation, operative positioning to protect the vertebral artery, shortening of operative time, and stronger anticoagulant therapy for high-risk patients, such as those with past history of transient ischemic attack.

Disclosure Statement

All the authors do not have any possible conflicts of interest.

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