Primary malignant tracheal tumors are rare diseases. Complete resection should be obtained because of correction of associated airway obstruction and cure is achieved in early or low-grade malignant tumors. Surgical resection is associated with better long-term survival for primary malignant tracheal tumors compared to the non surgical patients.\(^1,5\) ACC and squamous cell carcinoma are the most common malignant tracheal tumor.\(^2,9\) ACC is characteristically a low grade malignant tumor usually associated with prolonged survival. However, the survival is shorter in the tumor, associated with local or distant metastases.\(^2,5,7\) ACC involving the tracheal carina and main bronchus is extremely rare disease and it is a challenging problem in terms of surgical technique and airway management during the surgical resection. ACC are infiltrative tumours with microscopic invasion along the submucosal or peritracheo-bronchial plane of greater than gross appearance and complete resection may be difficult to achieve.\(^1,4\) Current surgical techniques included carina pneumonectomy or carina upper lobe lobectomy.\(^3\) According to the relative immobility of the left main bronchus, which is limited to dissect and migrate by the aortic arch, the earlier reports of carinal surgery suggested that the extent of airway resection should be restricted to 4 cm to lower the risk of an anastomotic complication.\(^1,3,8\) The capacity to obtain tumor-free margins is limited by the size, location of the tumors and other patient-related factors such as old age, stocky body habitus, deformed thoracic spine and short neck. Most of the centers with significant patient numbers had reported long-term outcomes for resected ACC tumors bearing microscopic tracheo-bronchial transected margins.\(^1,3\) The principles of resection and reconstruction of the tracheal cancers included dissection of the airway which is limited to the region to be resected, preservation of tracheobronchial blood supply and complete resection to normal airway. In addition, a variety of
release maneuvers are used to allow a tension-free anastomosis. Patients with lung cancer or low-grade tracheo-bronchial tumors may also benefit from the pulmonary preservation procedures. For patients with head and neck carcinomas, most authorities accept the adequate surgical margin >5 mm. Deslauriers et al recommended that the surgical margins should be 1 cm for lung cancer and 5 mm for low-grade malignancy. Following the recommendations and a previous report which suggested that the surgical resection margin should be 1 cm from the tumor, it is feasible and reasonable for a selected patient who has an ACC of the tracheal carina invading into the main bronchus to resect and reconstruct the tracheo-bronchial tree without pulmonary resection.

CASE REPORT

A 41 year old Thai female, coming to the hospital with a history of progressive dyspnea on exertion for 2 months. She had stridor and respiratory rhonchi in both lungs - predominantly on the right side. CXR revealed hyperaeration of the lung mostly on the right side with a bulging of the right side of the superior mediastinum at the carina level. CT scan demonstrated a round mass size 3 cm at the right side of the carina which involved the main bronchus. (Fig 1) FOB showed a carina mass which nearly completely occluded the right main bronchus and a biopsy specimen of the mass was adenoid cystic carcinoma. The patient underwent carina and right main bronchial resection. (Fig 2)

Anesthetic view points

The main anesthetic problem in this case was intra-thoracic tracheal obstruction. Based on the CT scan, the carinal mass was fixed, sessile and obstructed about $\frac{3}{4}$ of the luminal diameter. However, the image was not correlated with clinical signs. The patient had neither dyspnea nor orthopnea. As we were concerned about the possibility of difficult ventilation after general anesthesia with tracheal intubation or muscle relaxant induced mass collapse and further airway obstruction, the right groin was prepared for a femoro-femoral cardiopulmonary bypass. After full monitoring and intravenous line insertion, the patient was premedicated with intravenous fentanyl 50 mcg, midazolam 1 mg and atropine 0.6 mg. Then 10% lidocaine was sprayed in the oropharyngeal cavity to reduce airway reflex during the endotracheal intubation. General anesthesia was conducted via inhalation induction with oxygen and sevoflurane. The endotracheal tube was inserted when the patient was deeply anesthetized. As we found no problem in ventilation, then ventilation was controlled and anesthesia was maintained with oxygen, air, sevoflurane, fentanyl and vecuronium. Then, the patient was placed on the left lateral decubitus for right posterolateral thoracotomy.

The operative technique

The right posterolateral thoracotomy was performed and entered the right pleural cavity through the 5th intercostal space. The trachea and main bronchi were dissected as much as possible keeping the dissecting plane on the anterior and posterior wall to preserve the lateral blood supplies. The left main bronchus was transected first about 1 cm from the carina (Fig 3). Two traction sutures were placed to the cartilaginous ring of the distal bronchial end pulling the bronchus up for further anastomosis. The right bronchus was transected at the upper lobe and intermediated bronchus 1.0 cm from the tumor margin (Fig 3). Finally the trachea was transected 1 cm above the tumor margin. During tumor resection at the carina, the tracheal tube was slightly withdrawn and the left lung was ventilated via a sterile endotracheal tube inserted into the left main bronchus connected with a breathing circuit and under intermittent ventilation of the left lung. The proximal end of the trachea was anastomosed end to end to the distal left main bronchus using 30 PDS (polydioxanone) continuous sutures on the posterior wall and interrupted suture on the anterior wall (Fig 3). Then the tracheal tube was pushed further down to the left bronchus in order to ventilate the left lung during further tracheo-bronchial anastomosis. The intermediate bronchus was incised vertically and 2/3 of the circumferential distal end of the upper lobe bronchus was anastomosed end to side to the incisional line of the intermediate bronchus using 40 PDS continuous sutures (Fig 3). Then the neo-bronchial orifice of the right bronchus was anastomosed end to side to the lateral wall of the trachea 1 cm above the previous tracheal anastomosis using 40 PDS continuous sutures (Fig 3). Finally, the tracheal tube was withdrawn to ventilate bilateral lungs. Before surgical closure, an intraoperative right paravertebral catheter was placed for postoperative pain control. Following muscle reversal with atrope 1.2 mg and prostigmin 2.5 mg, the patient was able to be extubated uneventfully. Then, postoperative multimodal analgesia was provided by 0.2% bupivacaine for continuous paravertebral block, intravenous parecoxib bid and inter-

Fig 1. CT scan demonstrated a carina mass size 3 cm, involving right main bronchus

Fig 2. The carina tumor involved orifice of the RUL bronchus
mittent morphine as needed on the first day after surgery. On the second and third postoperative day, oral cox-2 inhibitor, weak opioid and paracetamol were given on an around the clock basis combined with paravertebral infusion. The patient recovered with an acceptable minimal pain score (VAS < 3) and no complication.

RESULTS

The patient recovered well from the operation and was discharged within 2 weeks after the operation. The histopathologic finding was ACC, size 5x4.5x3 cm. the tracheal margin was free of tumor, the right and left main bronchial margins were involved by tumor and metastatic carcinoma in 1 out of 8 resected regional lymph nodes. She had transient harseness of voice, postoperative bronchitis, bronchospasm and needed oral antibiotics and a bronchodilator for a month. Early postoperative fiberoptic bronchoscopy revealed adequate anastomotic bronchial lumens and a minimal granulation tissue at the left bronchial anastomosis (Fig 4).

DISCUSSION

Carinal resection for ACC provides acceptable results in terms of operative mortality and long-term survival rates for carefully selected patients. Concerning surgical margin, several reports recommended 5-10 mm free margin from the tumors. Whenever the cut surface of the trachea is grossly normal the local control with postoperative radiation is acceptable for second local therapy. Currently surgical options for the carina tumors that involve the main bronchus include carina pneumonectomy and carina plus upper lobectomy. Porhanov et al reported a large number of sleeve carina resection. He concluded that preservation even of a part of the lung is likely to improve functional stability of the patients when complications arise. This patient had a 3 cm carina tumor that it was quite a large tumor for complete removal. The resection gap, after carina resection should be less than 4 cm for safely tracheo-left bronchial anastomosis. Following the previous surgical margin recommendation, to resect the tumor and reconstruct without excessive tension and oncologic compromise, the transection lines of the patient should be carefully selected, keeping 1 cm away from the gross tumor. The tumor margin of the patient was close to the orifice of the right upper lobe bronchus. Therefore, we had to transect the upper lobe bronchus and proximal portion of the intermediate bronchus. Using the continuous running monofilament sutures making partial end to side joins of the upper lobe and intermediate bronchus to form the neo-bronchial orifice was simplified. Since, the neo-bronchial lumen was very short, it was easier to connect the right neo-bronchial orifice to the side of the trachea using the continuous running suture as well. For selected patients without oncologic compromise, combined carina and main bronchial resection with pulmonary sparing should be done instead of carina pneumonectomy or carina sleeve lobectomy, which may reduce pulmonary complications and morbidity and mortality.
REFERENCES


