

Research Article

Transmanubrial Approach for Removing a Head and Neck Tumor Located at the Upper Lateral Mediastinum

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What Is It about?

The transmanubrial approach is an excellent method for removing tumors located at the upper lateral mediastinum due to its functional and cosmetic benefits. However, only limited application of this method to head and neck tumors has been reported so far. We describe the utility of this technique when combined with head and neck surgery through our experience from 2 cases.

Keywords

Approach for the mediastinum · Venous angle · Functional surgery

Abstract

Background: When a head and neck tumor invades the upper lateral mediastinum, the transmanubrial approach (TMA), in which the sternoclavicular joint is temporarily mobilized and replaced back to the physiological position, appears to be an excellent method. However, there have been only a few reports about the application of this approach to head and neck tumors. **Materials and Methods:** We recently adopted this technique for the removal of 2 head and neck tumors that required handling of the subclavian and innominate veins around the venous angle. **Results:** We could safely remove the tumors under good surgical view and obtained excellent cosmetic and functional results. **Conclusions:** TMA is a useful technique for the removal of head and neck tumors, which invade the upper lateral mediastinum. More frequent applications of this method are encouraged in combination with head and neck tumor surgery.

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Introduction

When head and neck tumors extend to the mediastinum, appropriate approaches for this challenging region are required. The bony thorax, particularly the sternum, obstructs this procedure, and thus, handling this barrier is a critical point when safely conducting mediastinum surgery. In general, partial (L-shape) or total midline sternotomy, or removal of the bony structures, including the parts of the manubrium, sternum, clavicle, and ribs, appears to be the mainstay of surgical treatments, and provides a relatively good surgical view of the mediastinum [1–4]. However, when a tumor is located at a relatively limited area of the upper lateral mediastinum or the thoracic inlet, sternotomy is insufficient to gain a good exposure of this area. Conversely, removing a part of the sternum and clavicle appears to be too invasive, resulting in postoperative deformity and malfunction of the shoulder, although with a good surgical view [5]. To address these problems, Grunenwald and Spaggiari [6] first applied a transmanubrial osteomuscular sparing approach (TMA) to tumors of the apical chest in which the sternoclavicular joint was temporally mobilized following a minimal osteotomy and was placed back to and fixed in the physiological position. Because of its functional and cosmetic benefits, the application of this approach has been extended to the surgeries of various diseases, including Pancoast tumors, brachial plexus tumors, chondrosarcoma of the first rib, T1 vertebral tumors, and the thoracic inlet syndrome [7]. However, on the basis of a PubMed search in the English medical literature, to date there have been few reports that have adopted TMA in combination with head and neck tumor surgery [5]. We recently resected head and neck tumors using TMA from 2 patients: a recurrent desmoid tumor and a massive internal jugular vein thrombus that was caused by a metastatic cervical lymph node. In this report, we describe the surgical technique and utility of TMA for treating head and neck tumors.

Patients and Methods

Patients

Case 1

A 39-year-old male underwent the first removal of a desmoid tumor in the right side of his neck at a local hospital. The tumor recurred approximately 1 year after the surgery. He then underwent a second surgery and 50 Gy of postoperative irradiation. However, a second recurrence occurred 15 months later, and then he visited our department. The recurrent tumor was mainly located around the venous angle of the right internal jugular vein (IJV) and subclavian vein (SCV) (Pirogoff angle) and the lower part of the tumor was tightly sandwiched between the right clavicle and SCV (Fig. 1). We planned a second-stage surgery, initially to attempt to remove the tumor without osteotomy, and if this was not feasible, then utilize TMA.

Case 2

A 64-year-old male was referred to our department with a right lower neck mass. Magnetic resonance imaging (MRI) and contrast-enhanced computed tomography (CT) revealed a large cystic lymph node (4 × 3 cm) and a massive thrombus in the right IJV, extending from the level near the jugular foramen to the slightly lower level of the Pirogoff angle, entering into the right innominate vein (IV) (Fig. 2). Fine-needle aspiration cytology demonstrated a class V squamous cell carcinoma. No apparent primary tumor was detected through an extent-of-disease workup. The patient was diagnosed with lymph node metastases from a squamous cell carcinoma (SCC) tumor of an unknown origin. Given the extent

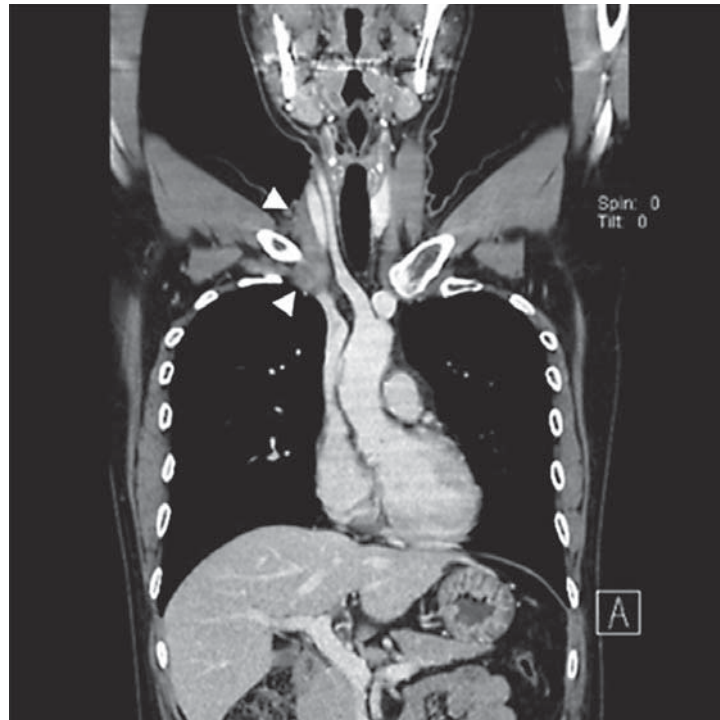


Fig. 1. Computed tomography image with enhancement. White arrowheads indicate the recurrent desmoid tumor.

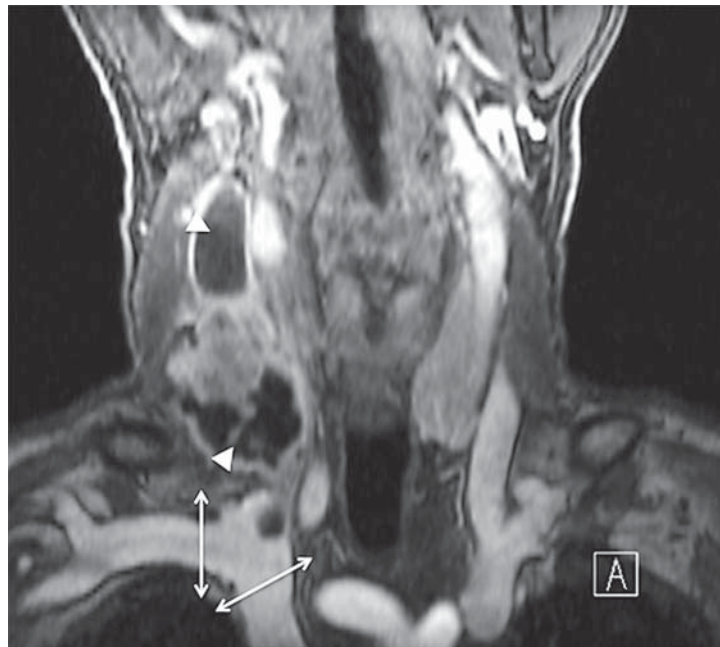


Fig. 2. Magnetic resonance image with enhancement. The double-sided arrows indicate the planned resection lines of the subclavian vein and innominate vein. White arrowheads indicate the thrombus.

of the lymph node and tumor thrombus, a conventional radical neck dissection (RND) plus resection of the Pirogoff angle at the cut lines, demonstrated in Figure 2, appeared to be mandatory to prevent the possible dissemination of tumor cells and thrombus. We decided to adopt TMA to obtain sufficient exposure of the Pirogoff angle and safely handle the SCV and IV.

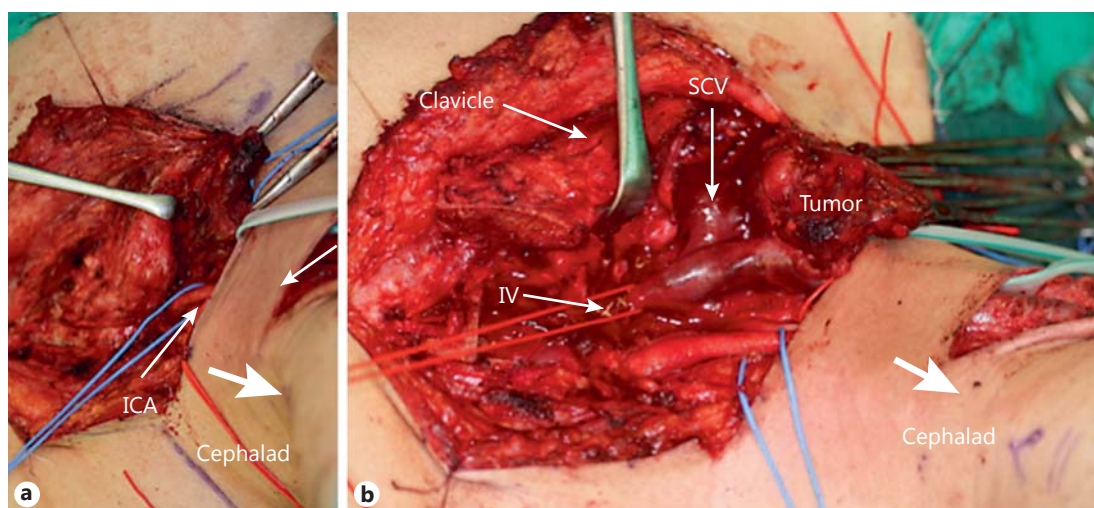


Fig. 3. Intraoperative photos during surgery: before (a) and after employing the transmanubrial approach (b). ICA, internal carotid artery; SCV, subclavian vein; IV, innominate vein.

Surgical Technique of TMA

TMA is clearly and self-evidently explained with beautiful illustrations by Grunenwald and Spaggiari [6]. Thus, here we briefly summarize the procedures. After skin flap elevation, sternocleidomastoid muscle (SCM) dissection, and IJV exposure, 25% of the superoexternal part of the manubrium is sectioned in an L-shape, sparing the connection of the sternoclavicular joint. Then, the first costal cartilage and connective tissues between the clavicle and first rib are resected. These maneuvers enable the elevation of the clavicle with the sternoclavicular joint and the exposure of the upper lateral mediastinum. After the planned surgery, the retracted bony part is placed back and fixed with wires.

Application of TMA to Our Two Cases

Case 1

Following skin incision and flap elevation, the internal carotid artery and the vagus nerve were identified and isolated. We then resected SCM from the sternum and clavicle, which is not recommended in the original TMA because the tumor densely adhered to the lower part of SCM and we expected that the visualization of the positional association between the tumor and SCV might be achieved. However, this was not feasible, as shown Figure 3a, and TMA was adopted according to our planned second-stage surgery. This procedure greatly enlarged the surgical view, and the tumor was safely dissected from the SCV and the Pirogoff angle (Fig. 3b). However, the tumor was densely adhered to the lateral wall of the IJV and therefore the lower part of the IJV was removed with the tumor. The resected and elevated bone was placed back and fixed with surgical wires.

Case 2

Here, TMA was applied first to safely ligate the SCV and IV. We resected SCM on the plane of the sternum and clavicle, as performed in case 1, because RND was required. Following this modified TMA, the IV and SCV were safely isolated and resected as planned (Fig. 2, 4a). Subsequently, we proceeded to RND, wherein the upper IJV was ligated approximately 3 cm below the jugular foramen, and the massive tumor was safely removed with the thrombus. Figure 4b demonstrates the surgical view after right RND plus TMA. Of note, the SCV and the brachial plexus were well visualized, which is not usually feasible with RND alone.

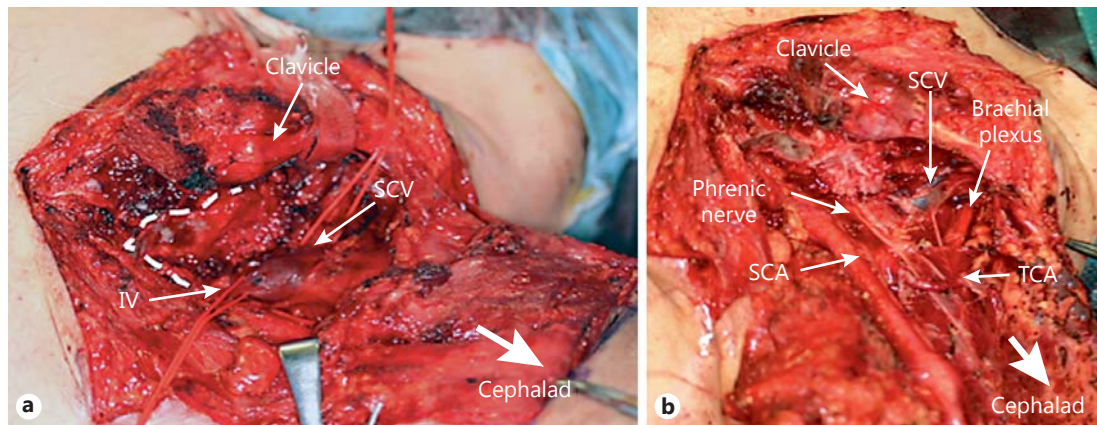


Fig. 4. a Intraoperative view of the transcervical approach. **b** View after tumor removal. Dotted line indicates the line of osteotomy. SCV, subclavian vein; IV, innominate vein; SCA, subclavian artery; TCA, transcervical artery.

Results

The postoperative courses of the two cases were uneventful. According to the final histological examination, the nodal metastases of case 2 contained both SCC and papillary carcinoma components. As the patient had a history of receiving a right thyroid lobectomy for papillary carcinoma 29 years ago, the metastatic lymph node was suspected to be a collision state of SCC and papillary carcinoma derived from the thyroid carcinoma. Because there was no apparent tumor in his remaining left thyroid gland, he was treated with 60 Gy of postoperative chemoradiation with 2 cycles of 80 mg/m² cisplatin. Case 1 was free of tumor recurrence 3 years after surgery. Case 2 developed mediastinal lymph node metastases 6 months after surgery and is alive with tumors. In both cases, favorable shoulder articulation was obtained, and no apparent limitation of the shoulder movement was observed.

Discussion

In this study, we could safely remove 2 cases of head and neck tumors that extended to the upper lateral space of the mediastinum using TMA. This surgical maneuver provided sufficient visualization and working space, and greatly facilitated the handling of the great vessels, particularly the SCV. In contrast to the conventional methods of sternotomy or removal of the bony structures, the exposure of the upper lateral mediastinum is feasible without impairing the shoulder function and cosmetic outcome with this minimally invasive surgical technique. In our two cases, we sacrificed SCM because of the extension of the tumor, thus partly modifying TMA, which was originally proposed as an “osteomuscular sparing” approach [6]. However, with respect to the current trend, SCM is preserved in the majority of head and neck tumor surgeries (e.g., modified neck dissection) [8], and thus integrating the original TMA to head and neck surgery is expected to further contribute to functional and cosmetic benefits of patients. Altogether, it is quite puzzling why TMA has not prevailed in the field of head and neck surgery for removing tumors involving the upper lateral mediastinum. We hope that this study will evoke the attention of head and neck surgeons to this excellent surgical procedure.

Conclusions

We applied TMA for removing the head and neck tumors that extended to the upper lateral mediastinum. Because of the good exposure and favorable functional and cosmetic results, utility of this technique was confirmed. Further use of this method in patients is encouraged.

Ethics Statement

Patients gave their informed consent for the publication of their clinical records.

Disclosure Statement

The authors declare no conflicts of interest.

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