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Thoracoscopic microsurgical excision of a thoracic schwannoma

Case report

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A 6-cm-diameter schwannoma located at T-2 was resected completely by using transthoracic microsurgical endoscopy. The partially cystic tumor widened the neural foramen and extended into the apex of the right thoracic cavity but did not extend intradurally. The tumor was accessed by means of three 15-mm incisions made in the intercostal spaces. The operative blood loss was only 200 ml, and there were no complications. The patient was discharged on the 2nd postoperative day and returned to full activity 1 week after surgery.

Thoracoscopy provides an excellent alternative to thoracotomy for peripheral thoracic nerve sheath tumors that originate within the neural foramen or more distally along the intercostal nerves within the thorax. An anterior approach is required for intrathoracic tumors but is not suited for intradural tumors. An open posterior or posterolateral approach to the thoracic spine is required for intradural tumors to allow the dura to be closed adequately.

Key Words * thoracoscopy * microsurgery * endoscopy * schwannoma * neurofibroma * thoracic spine * spinal tumors * video-assisted thoracoscopic surgery

The use of thoracoscopy has rapidly increased during the past decade and has been used to treat a wide array of pathological processes involving the thorax and mediastinum.[1,15,17] Thoracoscopy has also been applied successfully to a variety of spinal applications: sympathectomies, thoracic discectomies, corpectomies, spinal reconstructions and internal fixations, anterior releases to correct spinal deformities, decompressions of the spinal cord and nerve roots, stabilization of the thoracic spine, and to obtain biopsies of vertebral lesions.[3-6,10,11,18,19,22,23,24,26] We report a patient with a thoracic schwannoma that was resected by means of thoracoscopy in which microsurgical endoscopic techniques were used.

CASE REPORT

Examination. This 52-year-old woman presented for routine chest radiography to evaluate dyspnea and a productive cough and was found to have a right upper lobe mass. She had no neurological symptoms or signs, and the results of both her neurological and physical examinations were normal. There were no

stigmata of neurofibromatosis.

Neuroimaging. A magnetic resonance (MR) imaging study of the thoracic spine (Fig. 1) demonstrated an enhancing, 6-cm-diameter cystic lesion arising from the right neural foramen of T-2. The tumor widened the neural foramen and extended widely into the apex of the right hemithorax. The tumor extended to the lateral edge of the dura but did not extend intradurally.

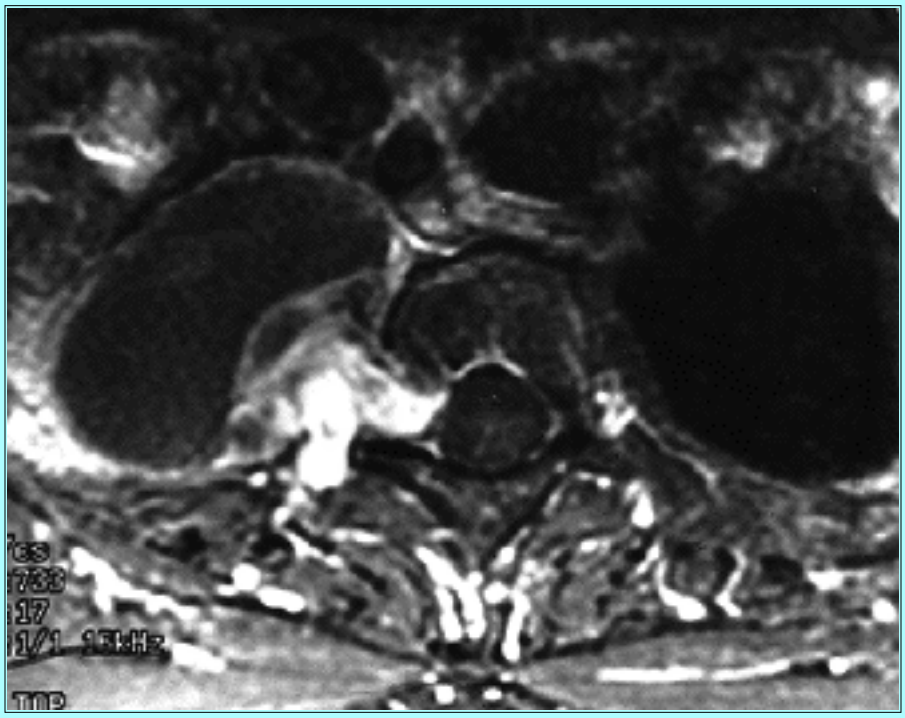

Fig. 1. Gadolinium-enhanced axial MR image showing that an enhancing tumor has widened the neural foramen at T-2 and extended into the chest. A 6 X 6-cm spherical cyst extends into the chest, but the tumor does not extend intradurally.

After 6 months of monitoring, the patient decided to undergo surgical removal of the tumor to prevent its further growth within the chest or into the spinal canal.

Operation. A double-lumen endotracheal tube was placed to allow intraoperative single-lung ventilation. The patient was placed in a left lateral decubitus position. Her right arm was abducted, elevated, padded, and secured to an ether screen to provide access to the axilla and anterolateral thorax. Three flexible 15-mm-diameter thoracoscopic portals were inserted into the third, fourth, and fifth intercostal spaces. One portal was used to insert a three-dimensional rod-lens endoscope; the other two portals were used to insert tools with which to perform the dissection.

The ventilation of the right lung was stopped and the lung became atelectatic, providing exposure of the chest wall, spine, and tumor within the thoracic cavity. The patient was rotated ventrally to allow gravity to retract the lung away from the spine.

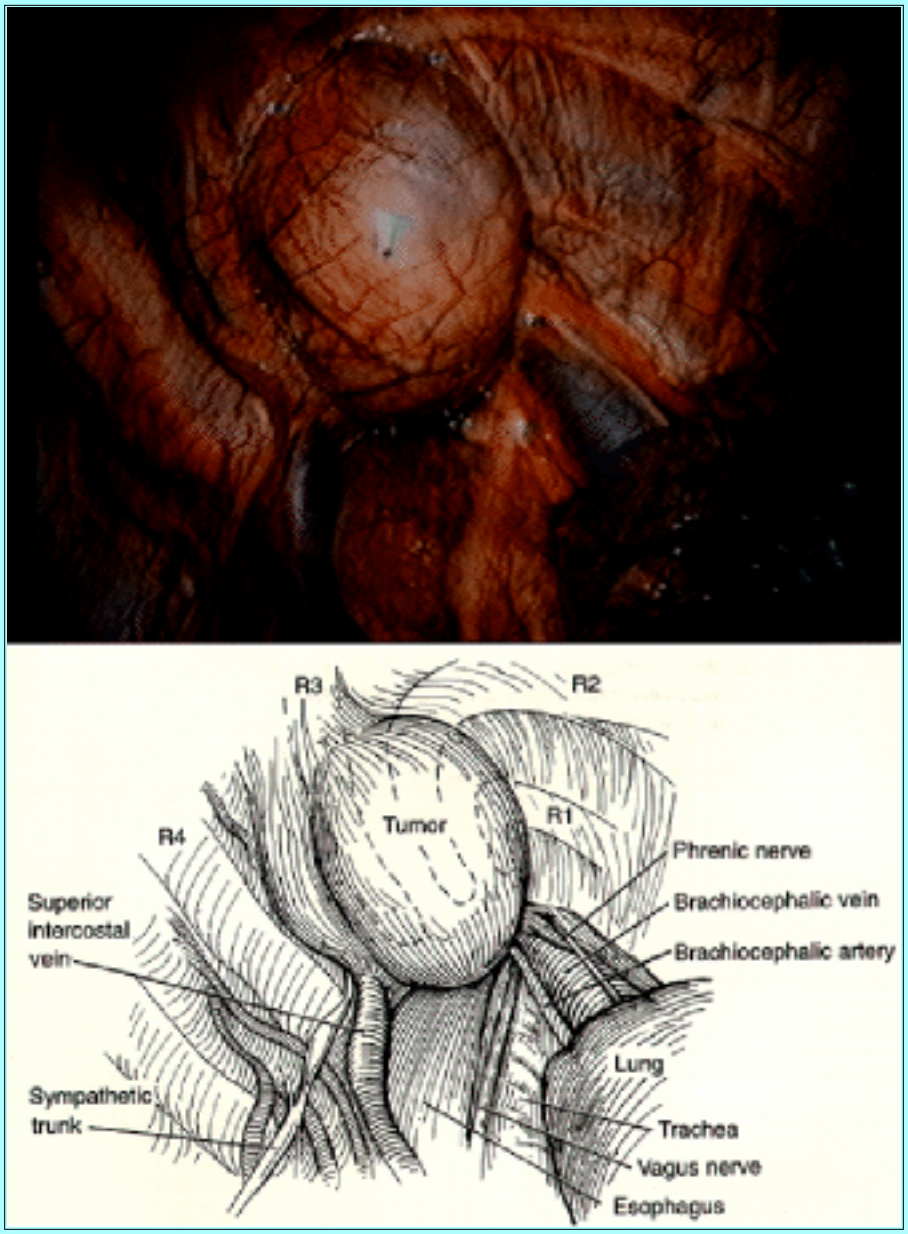

Fig. 2. Intraoperative photograph (A) and corresponding illustration (B) showing an endoscopic view of the tumor and the anatomy of the thoracic cavity from a right-sided thoracoscopic approach. The large cystic tumor, which extends from the T-2 neural foramen into the apex of the chest, is adjacent to the spine, chest wall, trachea, esophagus, brachycephalic and subclavian vessels, and the phrenic and vagus nerves. Top = rostral; bottom = caudal; left = lateral; and right = medial.

The tumor and the adjacent vascular and visceral and musculoskeletal structures were clearly identified (Fig. 2). A needle was inserted into the cystic component of the tumor and 30 ml of thin translucent xanthochromic fluid was aspirated from the tumor. The internal decompression of the tumor facilitated mobilization of the mass (Fig. 3).

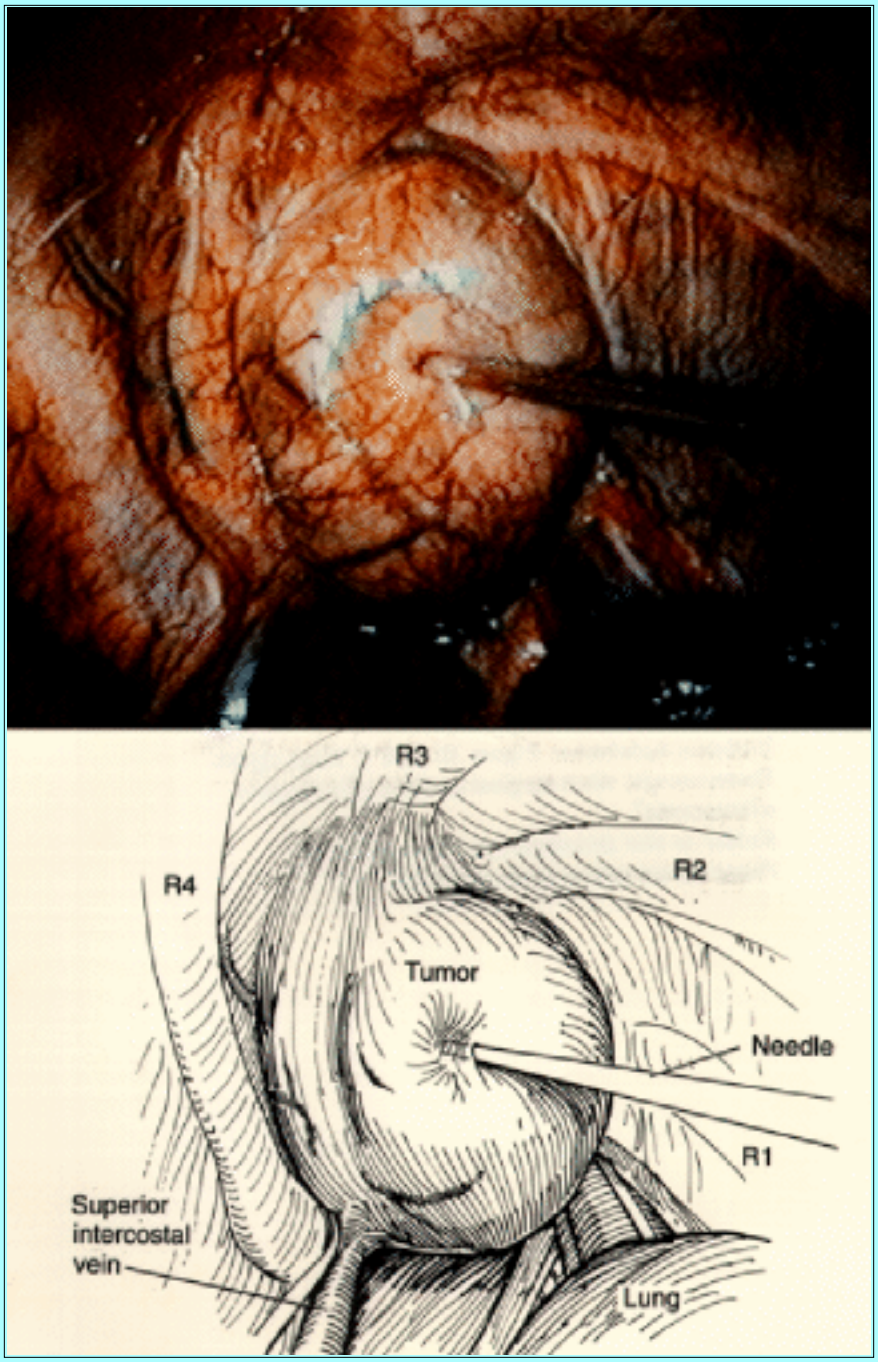

Fig. 3. Intraoperative photograph (A) and corresponding illustration (B) showing how the tumor cyst is decompressed by inserting a long needle into it and withdrawing 20 ml of xanthochromic fluid.

The pleura overlaying the tumor was incised using an endoscopic microscissor and opened widely to mobilize the pleural margins from the tumor. The vascular supply to the tumor was coagulated with bipolar cauterization.

The tumor capsule was separated from the chest wall, adjacent vessels, and the mediastinum by using sharp and blunt dissection with endoscopic soft-tissue dissection tools (Fig. 4). The tumor was mobilized and followed to the surface of the spine and to the neural foramen. The intrathoracic tumor tissue was then excised in several pieces, which were removed from the chest through the endoscopic portal. The stump of tumor entering the neural foramen was shrunk with endoscopic bipolar cauterization to mobilize the foraminal component of the tumor.

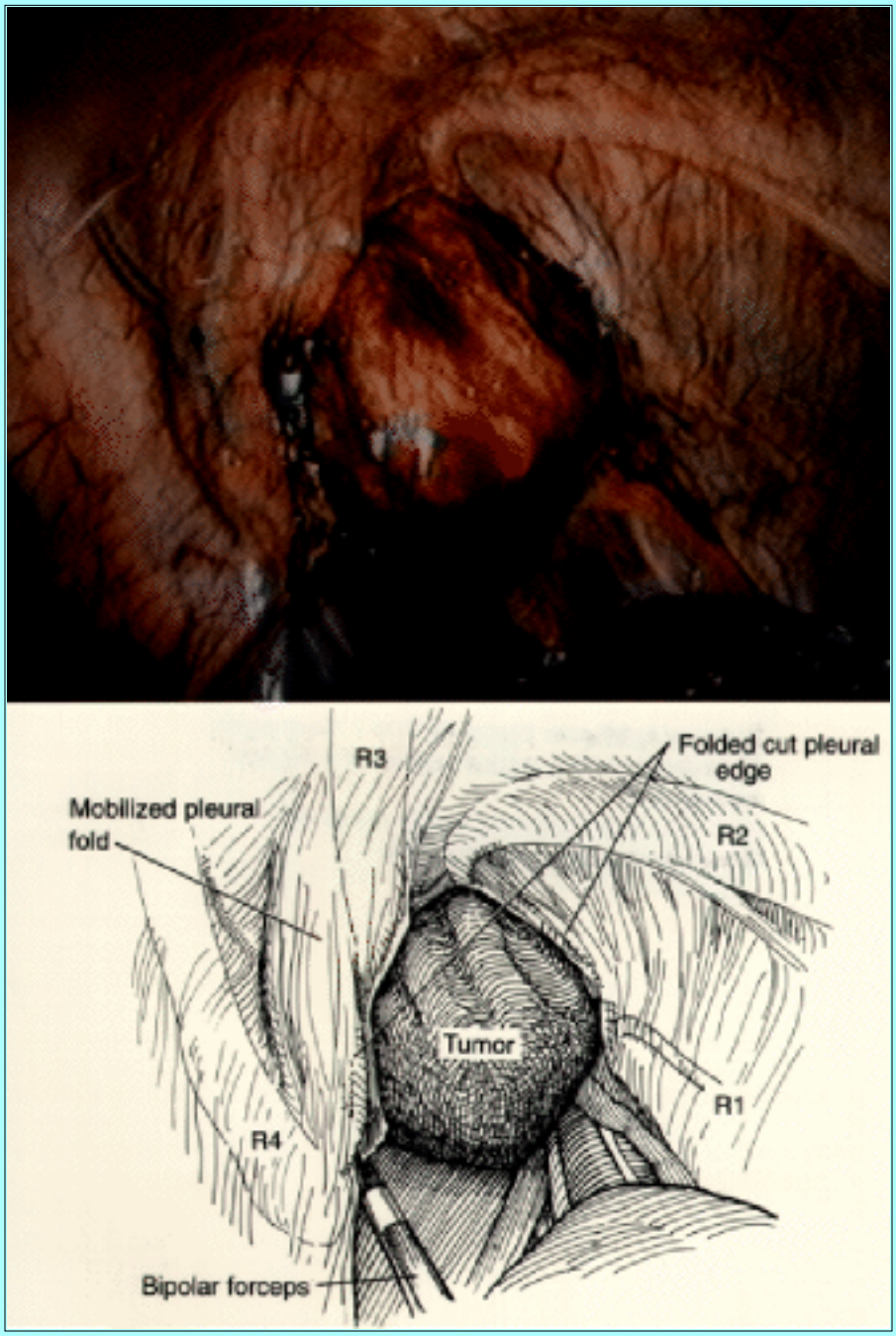

Fig. 4. Intraoperative photograph (A) and corresponding illustration (B) showing how the pleura is incised and dissected from the surface of the tumor to expose the tumor surface completely. The tumor is carefully separated from the adjacent vascular and visceral structures by using sharp and blunt dissection.

The epidural space and proximal nerve root sleeve adjacent to the tumor were identified by removing the head of the T-3 rib and the T-3 pedicle caudal to the tumor. This dissection was achieved with endoscopic rib dissectors, curettes, periosteal elevators, Kerrison rongeurs, and a pneumatic drill.

After the dura and proximal nerve root were identified, the root sleeve was ligated at its junction with the dura by using an endoscopic suture ligature (Fig. 5). The root was sectioned distal to the ligature, and the residual foraminal tumor was removed as a single piece. Hemostasis was achieved with bipolar cauterization and Avitene. A Valsalva maneuver was performed to verify that there was no cerebrospinal fluid (CSF) leak.

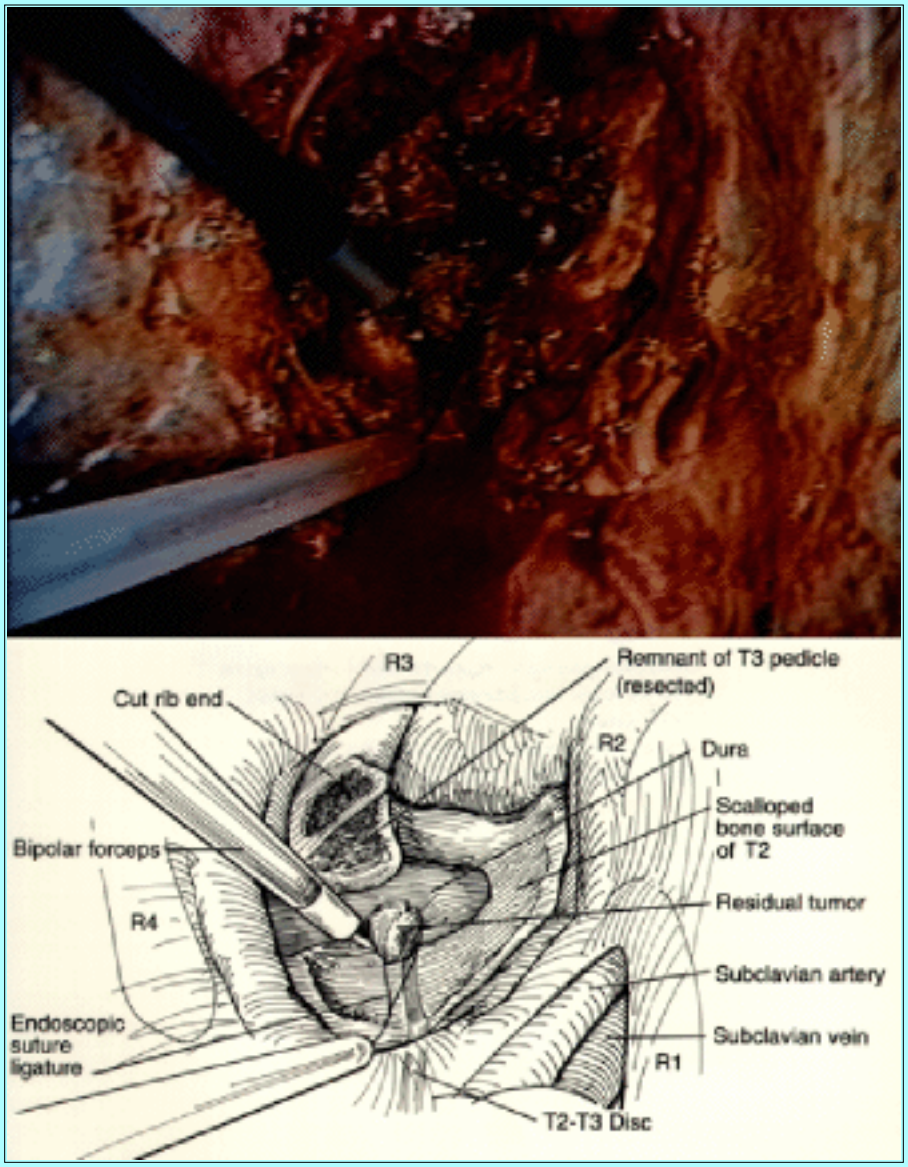

Fig. 5. Intraoperative photograph (A) and corresponding illustration (B) showing that the tumor has been resected. The foraminal component of the tumor was resected after the dura and proximal T-2 root sleeve was exposed by removing the T-3 rib head and T-3 pedicle. Once the dura and proximal nerve root were identified, the proximal root was ligated with an endoscopic suture loop and the root was divided distal to the ligature. The distal nerve root and the residual tumor were then removed completely by using sharp dissection. Left = inferior; right = cephalad; top = lateral; and bottom = medial.

Intraoperatively, a chest tube was placed through one of the endoscopic portals. The lung was inspected and reinflated under direct endoscopic visualization. The portals were removed and the three 15-mm incisions were closed with absorbable sutures. The duration of the procedure was 4 hours (from skin incision to closure) and the patient lost 200 ml of blood.

Postoperative Course. Postoperatively, the patient remained neurologically intact. Her chest tube was removed on the 2nd postoperative day (total fluid drainage was 300 ml). She had no postoperative complications and returned to full activity 7 days after the procedure.

DISCUSSION

Thoracoscopy provides an excellent alternative to a thoracotomy for resecting intrathoracic schwannomas or neurofibromas with large components within the chest cavity. Only four other cases in which thoracoscopy has been used to resect an intrathoracic nerve sheath tumor have been reported.[13,16,20,28] Thoracoscopy has also been used to resect mediastinal and vertebral body tumors.[6,12,25]

The tumors most amenable to thoracoscopic resection are those located peripherally within the intercostal nerves or that extend from the neural foramen into the chest. Presently, however, thoracoscopic resection is not advised for intradural extensions of tumor (for example, dumbbell tumors) because it is technically difficult to achieve a watertight dural closure by using endoscopic techniques. Intradural tumors should be resected through an open posterior or posterolateral approach to allow dural closure. If an anterior approach is also required to resect a large intrathoracic extension of a dumbbell tumor, the operative procedures can be staged. The intradural tumor is removed first and the dura is closed by means of a dorsal approach. The ventral approach (thoracoscopy or thoracotomy) is performed next to remove any intrathoracic portions of the tumor that are unaccessible by means of the posterior or posterolateral approach.

The surgical indications for the resection of an intrathoracic nerve sheath tumor include the need to obtain a tissue biopsy specimen for diagnosis, to prevent a malignant transformation, to relieve mass effect within the chest (for example, when pulmonary function is impaired), or to prevent the tumor from extending through the foramen into the spinal canal.[8,21,27]

The surgical techniques to resect these tumors are relatively simple. Careful mobilization of the tumor from the adjacent vascular and mediastinal structures is very impotant. Traction placed on the proximal tumor can cause avulsion of the nerve root, a CSF leak, or spinal cord damage, and this should be avoided. Once the tumor is fully mobilized, the bulk should be sharply resected. When the tumor extends into the neural foramen, bone dissection (rib and pedicle removal) is required to identify the epidural space and root sleeve clearly, to ligate the root and excise proximal tumor within the foramen, and to prevent a CSF leak.

The practice of thoracoscopic surgery requires dedication and training to learn the new psychomotor skills that are needed to perform these techniques safely. We strongly recommend that surgeons attend training courses and practice the surgical techniques in a laboratory setting, using animal and cadaveric models before attempting to use any of these techniques clinically.

Compared with thoracotomy, thoracoscopy requires much smaller incisions and is associated with better cosmetic results, less postoperative pain, fewer pulmonary complications, shorter hospitalizations, and an earlier return to activity.[2,3,6,7,9,14,19,22,24] Thoracoscopy is a viable alternative to thoracotomy for the resection of intrathoracic nerve sheath tumors.

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