VIDEO OF ORTHOPAEDIC TECHNIQUE

Modified Resection Technique for Ventrally-located Subdural Thoracic Extramedullary Schwannoma

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Introduction

The incidence of intraspinal tumors is 0.25 per million per year, most being in the thoracic segment. Routine laminectomy via a median posterior approach can expose laterally and dorsally located tumors. However, it can be difficult to expose a median ventrally located tumor via a median posterior approach. For schwannomas, a median posterior approach is also appropriate because it is simple and less time-consuming. If necessary, the spinal cord can be rotated to expose the tumor; however, such rotation may cause spinal cord injury. During surgery, the tumor should be resected piecemeal. After decreasing the tumor size by piecemeal resection, it is easy to dissect the border between the tumor and the spinal cord; this technique minimizes spinal cord injury.

Case Presentation and Surgical Technique

A 71-year-old woman presented with lower back pain, along with numbness in the soles of both feet for 1 month. There was no pain or numbness elsewhere. She also had intermittent claudication after walking 100 m at most, which was alleviated by resting. She had a history of hypertension, which was well controlled by medication. There was no history of surgery or injury. MRI showed an intraspinal tumor located in the ventral side of the spinal cord at the level of T₁₀. No areas of decreased sensation were detected. She had 5/5 strength in all upper and lower musculature with the exception of the iliopsoas, quadriceps and both biceps femoris muscles, which were 4/5. She had normal reflexes and no pathological signs.

She underwent tumor resection and T₉₋₁₀ fixation surgery. After she had been positioned prone on the operation table, general anesthesia was administered. C-arm fluoroscopy was performed to locate the T₁₁ vertebra and surgery initiated through a posterior approach. A single incision was made to expose the diseased segments and the adjacent upper and lower lamina. C-arm fluoroscopy was then performed again to verify the involved segments. A pedicle screw trajectory was prepared. The spinous process of T₁₁ and the supraspinous

ligament were severed vertically along the midline of the process, after which the spinous processes of T₉ and T₁₀ were severed at their bases and turned cephalically. Ultrasonic bone curettes and Kerrison rongeur were used to perform a laminectomy from T₉ to T₁₀. Using ultrasonic bone curettes, the medial part of the facet joint was removed to expand the spinal canal. The spinal dura was opened vertically and the initial small incision slowly extended. The dura was retracted bilaterally with stay sutures and the tumor carefully isolated. Nerve fibers attached to the tumor were carefully isolated along their upper and lower poles. The tumor was then removed piecemeal. A 5-0 atraumatic suture silk (Ethicon, Cincinnati, OH, USA) was used to suture the dural incision by the interlocking suture method, the stitch length being 1.5 mm and edge distance 2 mm, until no leakage was detectable. A gelatin sponge was trimmed to the shape of the removed lamina and firmly placed so as to cover the seam and the adjacent area. A second layer of medical adhesive was sprayed over the gelatin sponge and its edges. We call this procedure the "sandwich" method¹. A figure of eight suture was then used to osculate the broken spinal process of T₁₁ and the supraspinous ligament. A pedicle screw system was used in combination with an inter-transverse autologous bone graft. Positive pressure drainage tubes were put in place and the water-stop method used to seal the incision layer by layer.

The patient's numbness had resolved postoperatively. MRI showed no evidence of spinal cerebral fluid leakage and that the tumor had been resected completely. The pathological diagnosis was extramedullary schwannoma. She was discharged on the eighth postoperative day.

Discussion

Ultrasonic Surgical Aspirators (Piezosurgery)

Ultrasonic surgical aspirators, which have mainly been used to remove soft-tissue tumors, now come with a longitudinal and torsional (LT) tip that has vertical and twisted vibrations and

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can be used in skull base and spinal surgeries to cut and scrape bony structures. Nakagawa reported using an ultrasonic surgical aspirator system (Sonopet OST-2001; Stryker, Kalamazoo, MI, USA) with LT tips and lightweight handpieces in 36 cases of various spinal surgeries such as anterior approaches and laminoplasty for cervical spondylosis and ossification of posterior longitudinal ligament, and partial laminectomy for lumbar stenosis². We used an ultrasonic surgical aspirator system “XD806A” made in China by SMTP Technology (Zhangjiagang Jiangsu, China) to perform the laminectomy and expand the spinal canal. We have found that the piezosurgery is a safe and effective alternative to burrs when working near the dura, nerves and vessels because it does not have the risk of kicking, which could damage nearby soft tissues.

Reconstruction of Posterior Structure of Spine by Bony Union of Spinous Process of T₁₁

Biomechanics research has shown that lumbar range of motion increases and strength of anti-tension bend decreases when more posterior complex is removed: preservation of the lumbar posterior complex provides better strength of anti-tension bend and lumbar stability of flexion than does laminectomy³. Asano *et al.* found that the posterior ligaments have a statistically significant effect on the tensile stiffness of the L₄₋₅ functional spinal unit, providing 12%–16% of the tensile stiffness⁴. The posterior ligaments may have the most important role in the condition of anteflexion of the lumbar spine.

At present, there is general agreement that disturbing the stability of the lumbar region should be kept to a minimum when seeking to achieve complete decompression. Surgical procedures should be improved according to biomechanical research results in restoring the posterior structures of spine and maintain stability.

We reconstruct the posterior structure of the spine by achieving bony union of the spinous process of T₁₁; this

is more reliable than fibrous union of the interspinous and supraspinous ligaments.

Dural Repair

Although a number of materials, such as fibrin glue, collagen biomatrix, hydrogels and autologous tissue, alone or in combination, have been developed to prevent cerebrospinal fluid leakage, these materials have various limitations⁵⁻¹¹.

In our former study, use of the “sandwich” complex for the damaged spinal dura reduced the volume of drainage post-operatively and significantly reduced the incidence of cerebrospinal fluid leakage compared with conventionally managed patients¹. The “sandwich” group patients had a significantly smaller total volume of drainage on the day of surgery and on the first, second and third postoperative days than did the conventionally managed patients.

As described above, the “sandwich” technique involves a sponge that adheres to the trauma surface, absorbing a large amount of blood and facilitating hemagglutination. Fibrin glue, a biological protein, is then used as a sealant for spinal dural repair. Within a week, during which time the local tissues inside the incision adhere together, leakage diminishes, providing an ideal repair.

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Video Image

Additional video images may be found in the online version of this article.

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