Transmandibular Approach for the Treatment of Upper Cervical Spine Metastatic Tumors

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abstract

The transmandibular tongue-splitting approach is a useful and safe procedure for treating secondary lesions of the upper cervical spine, with only minor cosmetic and functional impairment. This method requires a team approach and has the advantage of enhancing the surgical exposure, thus allowing for resection and stabilization on more levels. Two patients with metastases in the upper cervical spine were treated using this approach. In view of a relatively long life expectancy, a marginal resection was performed. The residual instability required a combined approach and internal fixation. Both patients were ambulant, neurologically intact, and pain free 24 and 26 months postoperatively.

Two patients who had metastatic lesion of the upper cervical spine were treated at our institution. A preoperative evaluation included the scoring system proposed by Tokuhashi et al for the prognostic assessment of patients with vertebral metastases. The treatment goal for each patient was determined according to the Tomita prognostic scoring system. This strategy provides appropriate guidelines for treatment in patients with spinal metastases. In both patients, we used a transmandibular approach followed by a second stage for the craniocervical stabilization. Tracheostomy and gastrostomy were performed in both patients.

Case Reports

Case 1

A 59-year-old man with thyroid follicular adenocarcinoma was simultaneously diagnosed with a secondary lesion at the right side of the atlas. He reported severe pain and experienced difficulty in supporting his head in the upright position. Frequently, he was obliged to hold his head with his hands.

In vertebral thyroid metastatic lesions, excising single metastases has provided good results. Pain and neurological impairment characterize the clinical picture. Preoperative Tokuhashi score was 10. Preoperative Tomita score was 2. A multiple-stage procedure was planned.

Total thyroidectomy, elective tracheostomy, and endoscopic gastrostomy were performed. Shortly after, the metastatic lesion was approached through a transmandibular tongue-splitting approach (Figure 1). The secondary lesion was resected. Immediate stabilization was achieved by anterior screw-plate fixation (condyles-C2).

Postoperatively, the patient was immobilized in a halo vest for 20 days. The postoperative period was uneventful with no complications. Definitive stabilization consisted of craniocervical internal fixation (cranial claw by hooks) by an additional posterior approach (Figure 2). The patient recovered in one month. One year postoperatively, a right femoral pathological fracture occurred, requiring nail fixation. Two years postoperatively, the patient was ambulating, pain free, and neurologically intact.

Case 2

A 63-year-old woman presented with neck pain. No further neurologic deficits were noted. Physical examination revealed a severe spinal cord compression of the upper cervical region (C2).

She was diagnosed simultaneously with a primary tumor and a metastatic lesion. Cancer of the left breast and a secondary lesion in C2 with severe spinal cord compression were identified (Figure 3).

Bone scan showed no other skeletal localization. Preoperative Tokuhashi score was 11. Preoperative Tomita score was 2. Resection of both the primary and secondary lesion were

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performed in a single-stage procedure. After elective tracheostomy, a transmandible tongue-splitting approach was performed and spinal cord decompression was achieved (Figure 4).

Stabilization consisted of anterior vertebral body reconstruction (Harms mesh) and screw-plate fixation. Endoscopic gastrostomy was also performed. No neurovascular complications were reported.

Postoperatively, the patient was immobilized in a halo vest for 20 days. Craniofacial internal fixation (cranial claw by hooks) was performed during a second surgical stage. The patient recovered in 15 days with only minor cosmetic and functional impairment and excellent pain relief. During the most recent follow-up examination, 26 months postoperatively, the patient reported no symptoms and was neurologically intact. She was ambulant and pain free.

**Surgical Technique**

Patients are positioned in a supine position. The head is not fixed in position, thus allowing for intraoperative manipulation for improved exposure. Tracheostomy initially is performed to provide a good view of the posterior oropharynx and to provide a secure airway postoperatively, avoiding complications secondary to significant lingual and oropharyngeal edema.

A midline incision from the lower lip to the hyoid bone is made, zigzagging in the inferior part and curving around the chin pad. After the lip split, the vestibular mucosa is incised and the periosteum is elevated at the mandibular symphysis, medially to the mental nerve. Mini plates are positioned before performing the osteotomy following a paramedian line and preserving the central incisors root, with a reciprocating air-powered microsagittal saw. Retention sutures are then placed on either side of the tongue to retract it.

An electrocautery incision is made along the median raphe to the midline epiglottic fold posteriorly. The mandibular lingual halves are spread laterally and held in place by a Dingman retractor. The soft palate is divided along the midline in the cranial part and inferiorly around the uvula and stay sutures are placed to hold the halves of the soft palate apart to expose the high nasopharynx. The posterior pharyngeal wall is infiltrated and incised along the median raphe, then the pharyngeal flaps are swept away to either side to

**Figure 1:** Case 1. A 59-year-old man with a metastatic lesion in Cl secondary to thyroid cancer underwent a transmandible tongue-splitting procedure (A, B).

**Figure 2:** Case 1. Combined approach. Resection, craniofacial stabilization (cranial-hooks).
insertion of a cuffed endotracheal tube, a bulky neck dressing is applied. Tracheotomy is maintained for 15 days.

DISCUSSION
In 12%–20% of cases, vertebral metastases are the first sign of the malignant disease. Metastatic lesions of C1 and C2 most frequently present with severe pain and only rarely with neurologic involvement due to the dimension of the spinal canal at this level. The lesions are poorly visualized on plain radiographs and most often require bone scan or axial CT for definitive diagnosis. Delay in diagnosis is frequent in these patients.

Numerous internal fixation techniques exist for the craniocervical junction, some of which involve screw-plate fixation. Screw-plate fixation by Roy-Camille and developments of the Luque’s procedure (ie, sublaminar wiring) led to the Harms technique and a modification, the Ransford loop and the posterior occipitocervical fusion at C0-C2 using a “Y” plate as described by Grob.

We designed a craniocervical fixation procedure using a cranial claw by hooks, which counteracts flexion/extension, lateral bending, axial rotation, and shear forces. This metal construct is indicated in severe cases with significant bone destruction and high instability, such as tumoral osteolytic lesions. An in vitro biomechanical study was performed to assess the primary stability provided by our occipitocervical fixation device (cranial hooks). The surgical resection of spine tumors is characterized by peculiar approaches. In fact, tumors are frequently located in the vertebral body and often near junctions. Therefore, it frequently is necessary to use an anterior approach and often a combined anteroposterior approach to perform the tumoral resection in 50% of patients.

Junctional lesions require “ad hoc” procedures, which may be difficult to perform. The craniocervical junction is difficult to access surgically, due to the anterior position of the face and posterior nonhomogeneous structures, such as the skull and the cervical spine.

Many tumors involving the upper cervical spine require approaches that are not

expose the clivus and the upper three cervical vertebrae. A self-retaining retractor provides the exposure and allows for surgical resection of the lesion.

Anterior internal fixation using a titanium implant is performed. The paraspinal musculature and prevertebral fascia are reapproximated. The pharyngeal walls are closed in two layers along the midline using 3.0 Vycril interrupted sutures. The soft palate is then closed in layers with 3.0 Vycril sutures. Reconstruction of the dorsum of the tongue is started from posterior to anterior using 3.0 Vycril interrupted sutures. The intrinsic lingual musculature is brought together in a similar way with 2.0 Vycril interrupted sutures. The ventral surface of the tongue and the floor of the mouth are closed in this order. The mandibular osteotomy is repositioned and the same mini plates and screws are used for osteosynthesis. The soft tissue of the lip, chin, and mental region are closed in layers, and a drain is placed at the base of the tongue and brought out to the inferior part of the suture line. The skin is closed using interrupted 5-0 nylon sutures. After the

Figure 3: Case 2. A 63-year-old woman with breast cancer and a secondary lesion in C2 associated with spinal cord compression.

Figure 4: Case 2. Combined approach. Anterior decompression using a transmandibular approach and craniocervical anterior and posterior stabilization.

Reconstructive surgery has a primary role in the treatment of spinal tumors. The anterior and posterior stabilization at the C0-C3 levels has specific requirements with respect to other spinal segments and has many indications, ie, the use of anterior support in the upper cervical spine and different types of craniovertebral fixation.
commonly used for other diseases, such as the transoral approach. 14 When combined with a posterior approach, it is useful in the treatment of local aggressive primary tumors. This technique 15 has been associated with a series of severe complications, ie, infections. However, morbidity has significantly decreased over time. 16,17 Transoral surgery has since been accepted as the natural anterior approach to the upper cervical spine. This approach, especially in tumors, offers a very small surgical field. It must be stressed, however, that natural obstacles, such as the tongue and mandible, exist that prevent exposure proximally and distally. Small, fine, precise movements are needed due to space restrictions. Experience and adequate technical equipment are necessary to overcome these limitations. Another limitation involves the impossibility of checking on lesions distal to C2 under normal conditions. In fact, correct tumor resection can be difficult to perform. The transmandibular approach, which extends the surgical exposure, is anatomically invasive; the face is involved and requires a team approach. 20,21 However, with respect to the transoral approach, it enhances the surgical exposure, thus allowing for resection and stabilization on more levels. When the reconstruction is correctly performed, the functional recovery is relatively rapid with limited cosmetic damage. The surgical aggressiveness is proportional to the severity of the disease.

**CONCLUSION**

The objectives of surgical treatment of metastatic spinal lesions are to suppress pain, restore or maintain neurological function, and stabilize the spine. The improvement of diagnostic modalities, the development of new surgical approaches and more adequate fixation devices for anterior and posterior stabilization of the spine have led to a more radical approach to spinal metastatic tumors. The transmandibular tongue-splitting approach is a useful procedure for treating secondary lesions at the upper cervical spine, with minor cosmetic and functional impairment.

**REFERENCES**


