

Surgical Technique Guide-Debulking of Thoracic Tumor

Metastatic spine tumors are rare (put article here). Metastatic spine tumors causing spinal cord compression and paralysis are almost non-existent (put article here). These are complex problems to manage and require a team approach involving spine surgeons, intensive care specialist, oncologist, radiation oncologist and pathologist to name a few.

We present a 60 year old female that experienced some base of her neck pain in seven months prior to her presentation. She self treated herself with over the counter anti-inflammatory medications. Her symptoms waxed and waned for about five months upon which she finally presented to a pain management physician. She was treated with conservative management including both physical therapy and tramadol (r) for two months.

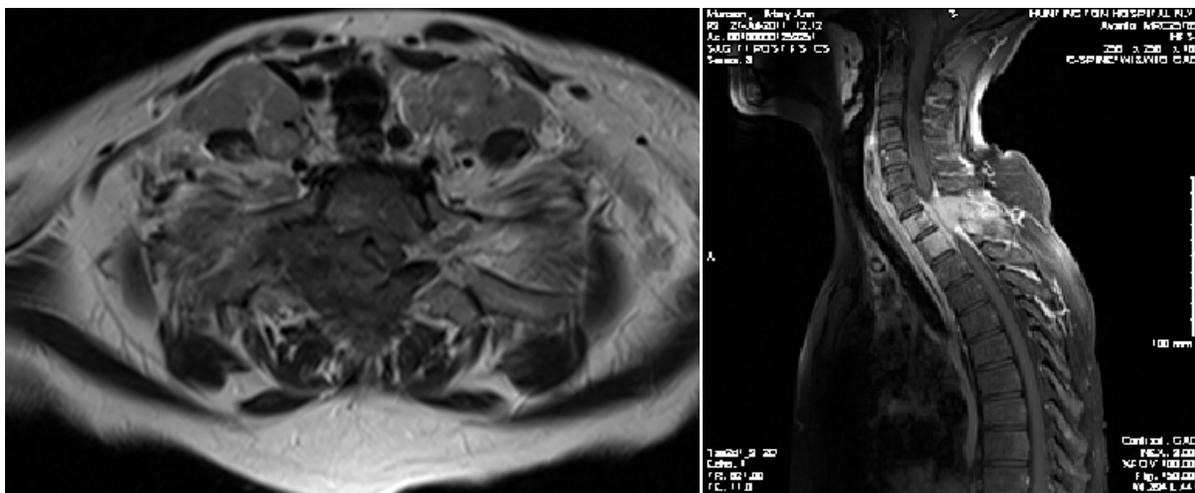
She awoke on a Friday morning with some difficulty with walking. She called her insurance company nurse line and was told that her symptoms did not sound emergent and that she needed to be seen by an outpatient neurologist. The next Tuesday morning she awoke with inability to ambulate and severe weakness in her legs. She was taken by ambulance to her emergency room.

Her past medical history was non-significant. She never had surgery, had no history or family history of cancer and was a nonsmoker.

Physical examination was revealing for global left lower extremity weakness from L2-S1 was 4/5 and her right lower extremity was more profound with L2-S1 being 3/5. She had an equivocal Babinski and no clonus bilaterally. Sensation was intact to light touch in the thorax and to bilateral legs, including inner thighs. Reflexes were +1 to bilateral knees and ankles. Her bilateral upper extremity examination was normal with normal strength, sensation and reflexes. She was unable to walk due to her profound weakness.

Radiographs:

Cat scan showed extensive bony destruction of T1 and T2 with an additional lesion at the right pelvis.



Axial and Sagittal Pre-operative MRI showing extensive destruction and significant compression of the spinal cord at the T1 and T2 levels. (Caption)

MRI show massive spinal cord compression at both her T1 and T2 levels extending both anterior and posterior, mostly from the right side.

She was placed on 10 mg of decadron every 6 hours. She was medically optimized, however, she continued to rapidly deteriorate and 36 hours after admission, she underwent decompressive tumor debulking, laminectomy and posterior spinal instrumentation with fusion.

Surgical Technique:

The patient is intubated with fiber-optic intubation if there is ever any concern for spinal stability. Neuromonitoring, including motor evoked potentials is mandatory to assess spinal integrity during the debulking and instrumentation portions of the surgery. Baseline neuromonitoring is recommended. This patient was gently transferred over to a Jackson Spine Table keeping the neck neutral at all times. The eyes and abdomen should be evaluated to ensure freedom from pressure. The ulnar nerve should be free of pressure and sequential stocking are recommended on the calves for deep vein thrombosis prophylaxis.

Radiography is helpful to identify landmarks prior to skin incision. Occasionally, preoperative marking can be done with the help of interventional radiology using CAT scan technology. Preoperative antibiotics are provided and an incision is made giving adequate cephalad and caudal exposure for both tumor debulking and instrumentation allowing for stability and decompression. Subperiosteal dissection is performed out to the tips of the transverse process and deep retractors are placed.

At this point it is imperative to localize the level of the tumor that needs to be debulked. Fluoroscopy may be helpful at this point, however, if soft tissue becomes an obstacle, then spot X-ray may be more beneficial for identifying landmarks. At this point, attention should focus on identifying landmarks for instrumentation to stabilize the spine two to three levels above and two to three levels below the lesion. Typically, if spanning a junction, serious consideration should be given to three levels of instrumentation due to the high stresses at these levels.

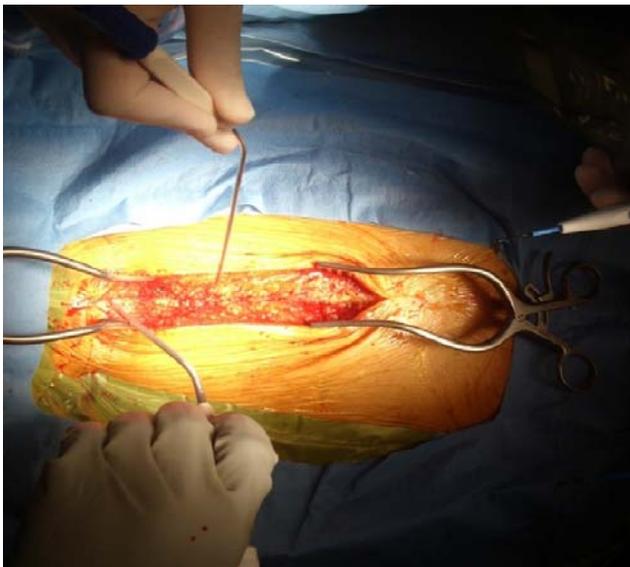
With any concern for instability, after all pedicle or lateral mass screws are placed, a temporary rod may be placed on the contralateral side of the lesion. Using a combination of rongeur and burr, the spinous process and lamina are thinned down to the far cortex or down to the tumor depending on the extent of the tumor. All posterior bony architecture should be removed from the level above and the level below the lesion prior to debulking the tumor. Also, prior to debulking, neuromonitoring should be checked to ensure that all chemical paralysis is off. Ensure that the patients mean arterial pressure is around 80 mm/mg (check this) and give consideration for 10 mg of IV decadron. Consider obtaining a hematocrit keeping in mind that perfusion to the spinal cord is of utmost importance at this time in the surgery.

To debulk the tumor, roton curettes are helpful to develop a plane between the tumor and the spinal cord. Occasionally, the rib may have to be removed with a Gigly saw, a sagittal saw or a Midas rex burr. Three to four centimeters of rib removal is usually adequate, and can be used for autograft later in the surgery. A bovie can be used to remove the subperiosteal layer back to the superior and inferior edges of the rib and a freer and woodson can be used to perform subperiosteal dissection anteriorly. Take care

not to enter the pleural cavity, however, if a small breach is performed, there is usually no long term consequence. Additionally, if cephalad and caudal access are needed, the superior and inferior facets may be sacrificed. Caudally, the pedicle may be entered with a gear shift, then the pedicles is expanded with a tap, then use a Kerrison to march cephalad until tumor is appreciated. If more cephalad exposure is need, the inferior facet can be removed using a 3 mm straight osteotome.

The tumor is removed in piecemeal fashion. During this process, make sure the blood pressure remains adequate and the motor potentials are occasional checked. If the exiting nerve root needs to be sacrificed at the thoracic level, there is usually minimal consequence to the patient's outcome. A Smith-Peterson Osteotomy can be performed by removing the entire facet at this time. After the foramen is unroofed, isolate the nerve root and tie off the nerve root with two 2-0 Nylon stitches. Sacrifice the nerve root in between the Nylon stitches. This will sometimes give greater lateral access to the tumor.

After the tumor is gently debulked off of the spinal cord and removed from the spinal bony architecture, a rod is placed and secured with end caps. The temporary rod on the contralateral side is replaced with a final rod and secured with end caps. Duragen and eveseal may be placed as need to protect thin dura or to seal any leaks that may have been caused during the decompression and tumor debulking.



Initial Exposure



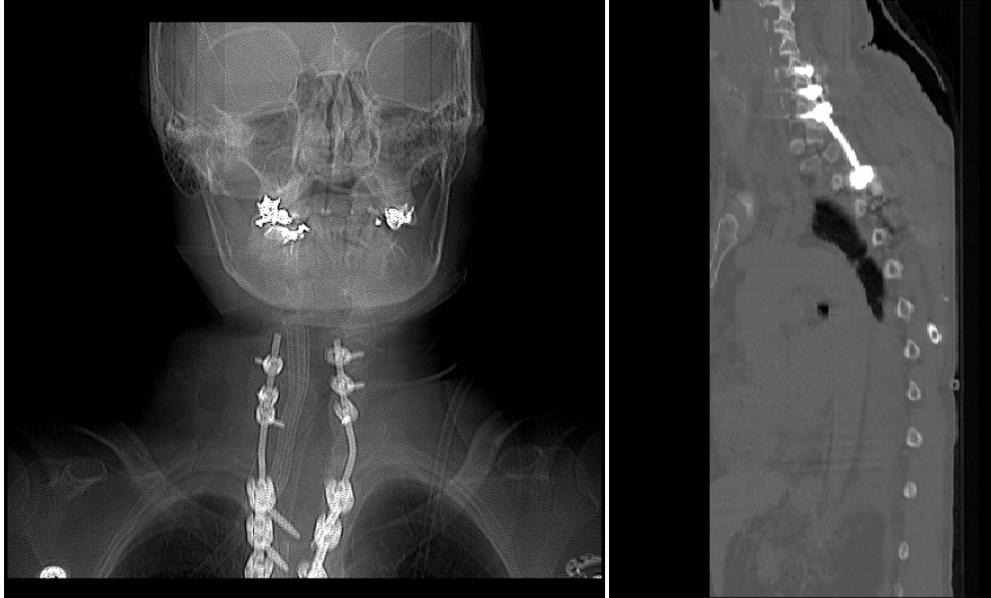
Pedicle screws are in place and the decompression has begun.



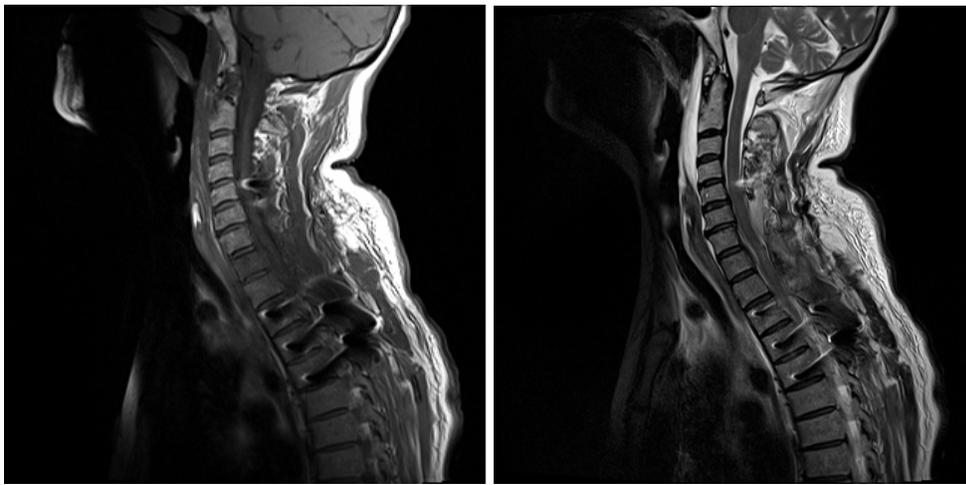
Debulking of the tumor continues with freeing of the spinal nerve roots.



Adequate decompression of the spinal cord without need to sacrifice the nerve roots and placement of final rods.



Post operative CAT scan revealing the extent of the instrumentation needed to stabilize her spine. (Caption)



Post operative MRI showing the posterior elements have been removed with posterior decompression of the spinal cord with adequate preservation of lordosis. (Caption)

Pathology:

Poorly differentiated adenocarcinoma consisting with lung tissue with TTF-1 Positive, CK-7 Positive, CEA Positive, CDX2 negative, and Melan A Negative.

Outcomes:

Post operatively she had some worsening of function in her left lower extremity that ultimately returned over the next two weeks. Her hospital course was otherwise unremarkable. She went to rehab on post op day 15 and started chemotherapy two months after her surgery. Functionally she has regained the ability to ambulate with a walker and continues to improve, now 5 months post operative.

Discussion:

Patient with complex extramedullary spinal tumors require a team approach. Knowledge of longevity is of paramount importance. The stability of the spine needs to be assessed with decision making based on two