Minimally Invasive Thoracic Corpectomy and Anterior Fusion in a Patient with Metastatic Disease: Case Report and Review of the Literature

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- XLIF
- transthoracic corpectomy
- minimally invasive

Abstract

For patients with metastatic disease to the spine there are numerous surgical approaches for decompression of neural elements and maintenance of mechanical stability. The challenge is to accomplish this while minimizing patient morbidity. Here we report on the feasibility and utility of a minimally invasive extreme lateral approach to the mid to high thoracic spine for anterior decompression and fusion.

Introduction

With 5–10 % of all cancer patients diagnosed with metastatic spine disease and nearly 40 % of cancer patients having evidence of spinal metastases at autopsy, the spine is a common site for metastasis [1–4]. Of the patients with metastatic disease to the boney spine, 10–20 % become symptomatic from spinal cord compression [5–7]. In 70 % of spinal metastasis the metastatic emboli seed the vertebral body, and any cord compression that may result is ventral. There are various challenges to ventral decompression and reconstruction, especially in the thoracic spine, and many approaches have been described that attempt to address these issues [1–3, 8–11]. Here we describe a minimally invasive extreme lateral approach that was utilized for anterior decompression and stabilization.

Bibliography
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Case Report

History, physical and imaging

The patient is a 63-year-old male with a history of metastatic non-small cell lung cancer to the T6 vertabrae (Fig. 1). He presented to the emergency room complaining of back pain, acute onset of urinary retention and bowel incontinence. On exam he had decreased rectal tone, hyperreflexia and diffuse weakness in his bilateral lower extremities. He was taken to the operating room for an emergency laminectomy from T5 to T7 with posterior resection of the tumor. He was later referred to our spine service at University of California San Diego for anterior decompression and stabilization. Eight weeks after his original laminectomy he was taken back to the operating room for an elective T6 corpectomy and fusion from T5 to T7.

Operative procedure

After the patient was placed under general anesthesia and was intubated he was positioned in a true 90° left lateral decubitus position and taped to the bed. The right arm was rotated forward and the scapula out of the way to allow access to the mid to high thoracic cavity in the midaxillary line. A cross-table anterior-posterior (AP) image confirmed that our incision and thoracotomy would be directly over the T6 vertebrae. An incision was made and the underlying rib resected creating a corridor for our atraumatic tissue dilators and expandable retractors. For this approach there is no need to intubate the patient with a double lumen endotracheal tube or to let down a lung. This minimally invasive extreme lateral approach and use of atraumatic tissue dilators and expandable retractors have previously been described by Ozgur et al. [12]. Under fluoroscopy a series of dilators (MaXcess System, NuVasive, Inc.) were placed centered over the T6 vertebrae and the MaXcess retractor was placed over the final dilator. A rigid articulating arm was attached to both the retractor and the surgical table to provide hands-free retraction. The retractor blades were expanded in a cranio-caudal direction to the aperture and the bifurcating light cables illuminated the operating corridor allowing maximum visualization (▶ **Fig. 2**). Under direct visualization the superior and inferior diskectomy was performed using an up-biting curette, pituitary rongeur and various scrapers. Using a high powered drill the vertebrae was drilled away. A depth measurement tool was used to determine the width of the vertebral body above and below the corpectomy to determine the length of our screws. A 16-mm diameter expandable cage was placed (▶ **Fig. 2**) (Ulrich Medical, USA). With the MaXcess retractor in place a small superior staple was placed in T5 and a small inferior staple (NuVasive, Inc.) was placed in T7 (▶ **Fig. 3**). The staples were secured into places seating into the vertebral body with fixation spikes on the underside of the staple. In each staple a 5.5 × 30 mm screw was placed anteriorly and a 6.5 × 30 mm screw was placed posteriorly. Rods were appropriately placed, locked down with locking caps and two anterior fixed connectors were placed between the rods (▶ **Figs. 4, 5**).

Post-operative clinical and radiographic follow-up

The patient suffered no surgical complications. He was ambulating by post-operative day two and was discharged home on post-operative day three. With six-month follow-up there is no sign of progressive deformity or failure of instrumentation (▶ **Fig. 6**).

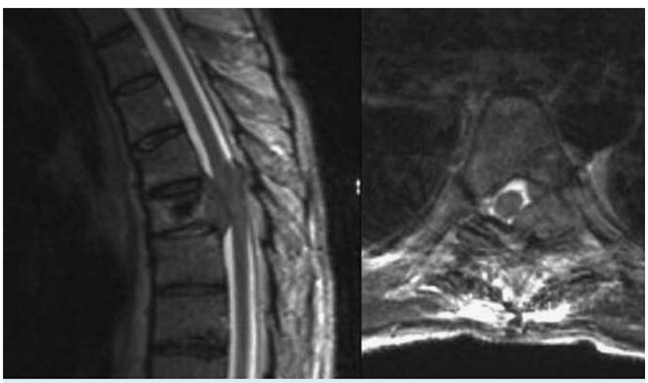

Fig. 1 MRI demonstrates a metastatic lesion involving the T6 vertebrae, invading the central canal, resulting in severe stenosis and cord compression.

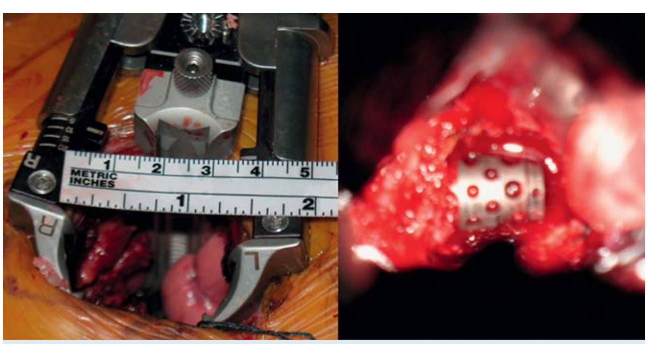

Fig. 2 Intraoperative photos: with the patient in the lateral decubitus position with the retractor system in place (left), and after the corpectomy and insertion of the expandable cage (right).

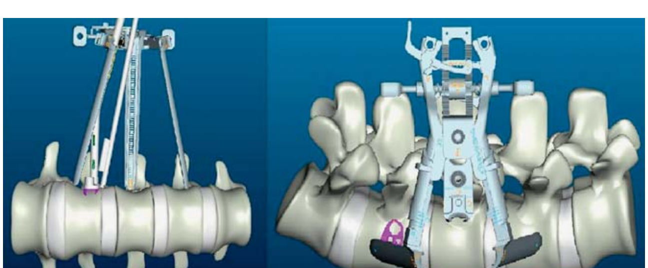

Fig. 3 Schematic drawing demonstrating placement of inferior staple (left) and the view through the retractor system in place (right).

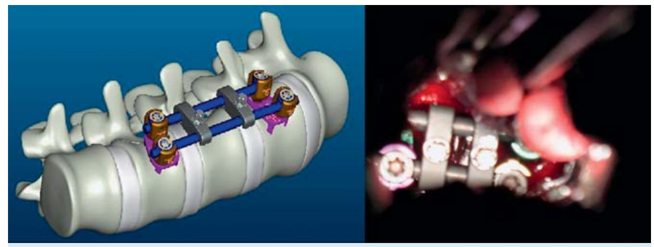

Fig. 4 Schematic drawing (left) and intraoperative photo (right) with superior/inferior staples, four screws and two anterior fixed connectors in place.

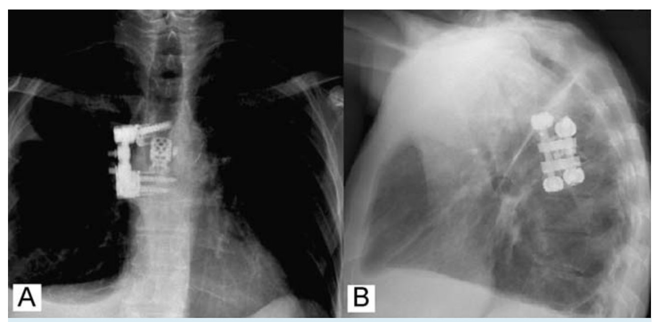

Fig. 5 Postoperative images demonstrating the cage and anterior instrumentation in place.

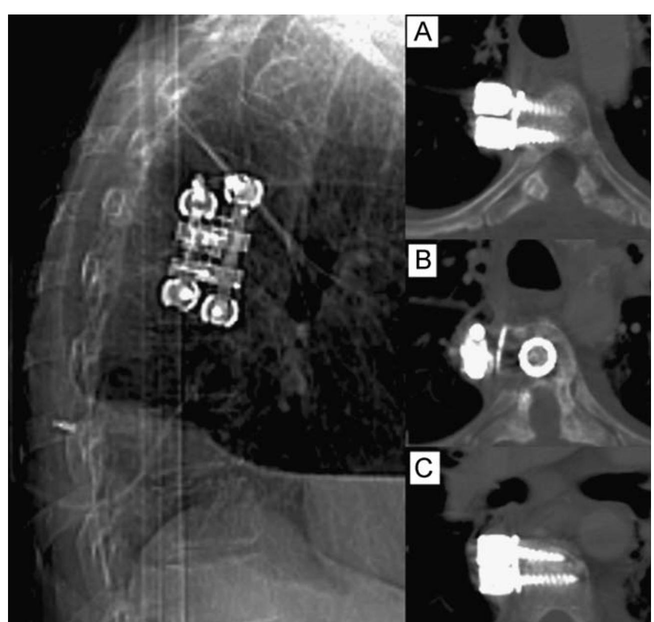

Fig. 6 Follow-up X-ray and CT (A: top, B: middle and C: bottom of construct) at 6 months demonstrate maintenance of sagittal alignment and no indication of failure of the instrumentation.

Discussion

Metastasis disease to the boney spine may result in mechanical destabilization, neurological injury or pain. Surgical intervention is directed at local disease control, decompression of neural elements, mechanical stabilization/restoration of anatomic alignment and pain control [13].

Surgeons attempting to resect spine tumors have a multitude of options for their approach [1–3,8]. The choice of approach is dictated by tumor location, the number of levels involved, the necessity of total excision, desired methods of resection and reconstruction, and the medical condition of the patient [1,2,14]. Anterior, posterior, anterolateral, posterolateral (including lateral extracavitary), combined anterior and posterior, staged anterior and posterior, and minimally invasive approaches have all been described [1,9–11].

Access for anterior decompression in the thoracic spine is challenging. The manubrium, clavicle and ribs are anterior boney obstructions [13]. The heart, major vessels, esophagus, trachea and recurrent laryngeal nerve all limit the anterior approach [13]. Other elements of the patient's anatomy that may limit the approach include junctional kyphosis, short neck or a congentially high sternum [15–17]. The scapula and shoulder girdle limit how high in the thoracic spine the surgeon can access through a lateral approach. Taking all these anatomic elements and the patient's body habitués into consideration, the surgeon may be limited to a very narrow working corridor in the transthoracic or far lateral approach.

A posterior extracavitary approach is employed by many surgeons, an approach limited by the degree of ventral access available to the surgeon. For many surgeons the destabilization resulting from destruction of the posterior elements mandates the need for long posterior constructs to restore stability [15,16,18,19]. A disadvantage to this approach is that it involves a great deal of tissue manipulation and destruction resulting in the need for medical management and pain control.

Here we describe a minimally invasive extreme lateral approach that allows decompression and fusion through a single approach with little morbidity to the patient. As metastases preferentially go to the pedicles, the most vascular part of the vertebra, in many patients the tumor extends posterior or far lateral to the cord. For these patients a far lateral approach may not be enough. However, when appropriate and utilized as a single approach the advantage of this technique is the option to accomplish decompression and stabilization through a single approach. Many of these patients will have to undergo radiation and chemotherapy, and eliminating the need for a posterior approach will limit the risk of wound dehiscence, infection and need for further surgery. In a large proportion the purpose of surgery is to provide adequate mechanical stability. The biomechanics of a lateral rather than a posterior instrumented fusion differ in their ability to limit flexion, extension or rotation. However, the relatively fixed and rigid anatomy of the thoracic spine and the life expectancy of a patient with metastatic disease may mean that for many patients a purely anterior construct is more than adequate.

Conclusion

There are a multitude of surgical approaches that are available to surgeons as they tailor their surgical strategy to the patient's disease. Here we present one approach that may have no utility for some, but which may complement or be utilized as a single approach for other patients, especially those with single level ventral cord compression. This is an approach that is safe and permits both decompression and fusion to be accomplished through a single approach with little morbidity and a fairly benign post-operative course.

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