Tips & Tricks: Lateral Lumbar Interbody Fusion: Preoperative Positioning for Success

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Background

Lateral Lumbar Interbody Fusion (LLIF) is a newer technique addressing lumbar spinal pathology which has the advantage of requiring a less invasive retroperitoneal dissection compared to more traditional approaches to the lumbar spine. This technique also allows for indirect decompression, restoring disc height and alignment while tensioning the surrounding ligamentous structures.[1] Furthermore, LLIF allows insertion of a large footprint cage which can span the more dense apophyseal ring of the vertebral body.[2] Initial descriptions recommended a left-sided approach to avoid the inferior vena cava, but either side can be utilized safely considering various anatomic considerations. The technique was described initially in 2006 via a two-incision technique but has been adapted to a single incision technique along the flank region.[3,4] Patient positioning is essential to safely accomplishing the goals of LLIF surgery. There are a multitude of positioning considerations entirely unique to the lateral position compared to supine or prone positioning.[2] This necessitates appropriate and rigid positioning to ensure the patient does not move throughout the procedure, as reliable orthogonal fluoroscopic imaging is essential. Like many newer procedures, LLIF presents a learning curve which is not limited to positioning but begins with understanding the nuances of patient positioning.[4]

Example Case

A 63-year-old female presented to our outpatient offices with a one-year history of progressive low back and radiating buttock and anterior thigh neurogenic claudication and pain as well as lower extremity numbness and weakness. She also had a history of a previous L4-L5 fusion without complication. MRI lumbar spine revealed severe central and lateral recess stenosis at the adjacent L3-L4 level. After failing appropriate conservative management, she was deemed a candidate for L3-L4 LLIF with anterolateral instrumentation via a left-sided lateral retroperitoneal approach.

Positioning

Supplies

Axillary roll—An axillary roll is placed to protect the shoulder joint. It will be placed 3-4 inches caudal to the axilla to avoid brachial plexopathy.

Overhead Armboard—An overhead armboard is placed slightly more cephalad than normal to minimize obstruction with the fluoroscope.

OR Table—A Skytron 6600 or equivalent OR table is reversed 180˚ and the head extension attached to the former foot of the bed. This allows for appropriate clearance of intra-operative fluoroscopy from the base of the table (Figure 1).

Sticky Rolls—Two Sticky Rolls are created to stabilize the patient's torso. These are made by

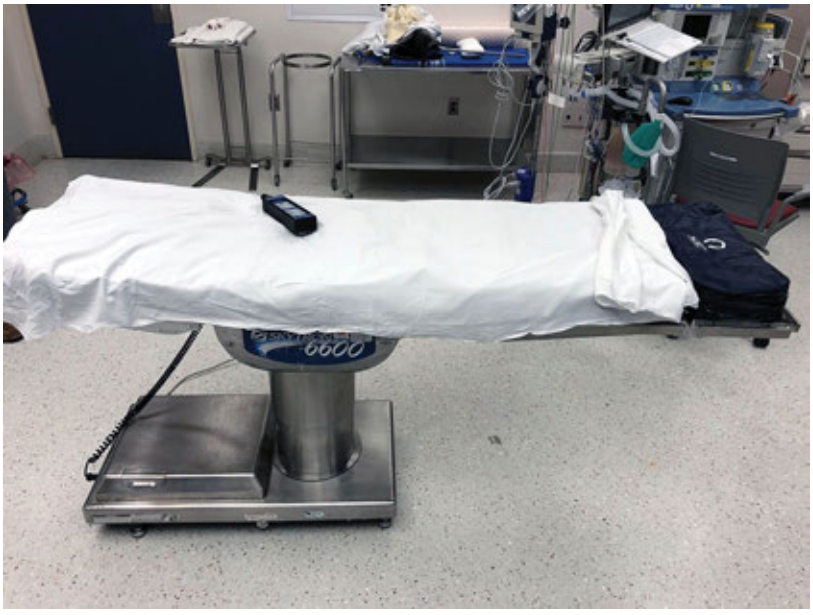

Figure 1. A Skytron 6600 bed reversed with headboard attached at the former foot of the bed.

rolling an OR blanket into a bump and wrapping with 3" tape. The first wrap of tape is down at one end circumferentially to hold the roll together, then the tape is twisted to expose the sticky side and wrapped from one end to the other (Figure 2).

Surgical Setup

Positioning

The patient is positioned so the anterior superior iliac spine is just caudal to the break in the bed. This is critical to optimize the operative retroperitoneal corridor between the ilium and the 12th rib when the bed is flexed (Figure 3).

The hips and knees are flexed to ensure the patient can be centered on the table while also relieving tension on the psoas musculature and the lumbosacral plexus to reduce the risk of traction neuropraxia during operative exposure.

The down arm is placed into the lateral arm board with the elbow extended to allow for IV access and blood pressure monitoring. The upper arm is placed into an overhead armboard with a mild flexion through the elbow to allow for both arm boards to remain as cephalad as possible while still providing physiologic positioning. This again minimizes risk of the arm boards obstructing the fluoroscopic imaging during surgery (Figure 4).

Two pillows are placed between the legs and the fibular head and lateral ankles are padded bilaterally. Sequential compression devices should be attached and plugged in throughout the surgery.

Sticky rolls are utilized to stabilize the patient in a manner similar to a beanbag positioner, while maintaining a lower profile for operative considerations. The first roll is wedged posteriorly along the back, the second is wedged anteriorly against the abdomen (Figure 5). These provided

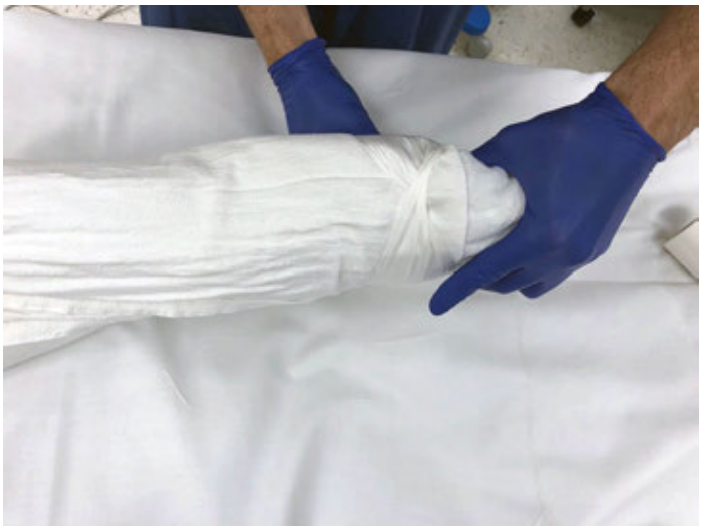

Figure 2. One of the two "sticky rolls" composed of tape and blankets that will assist with stabilization.

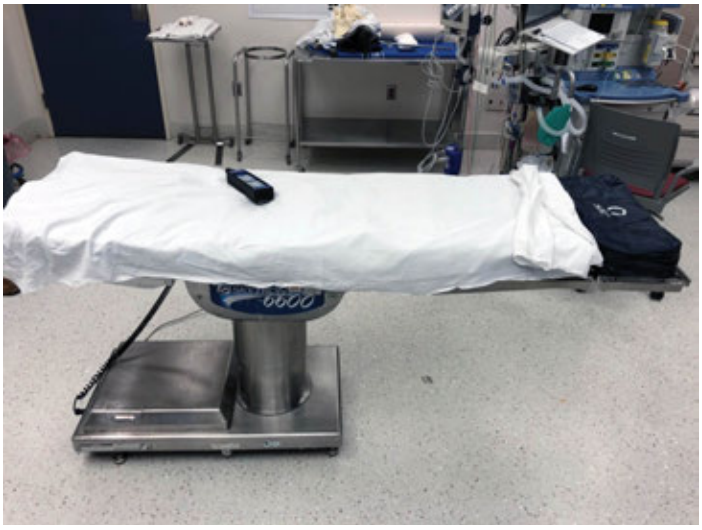

Figure 3. Posterior view of patient positioning with demonstration of ASIS below table break.

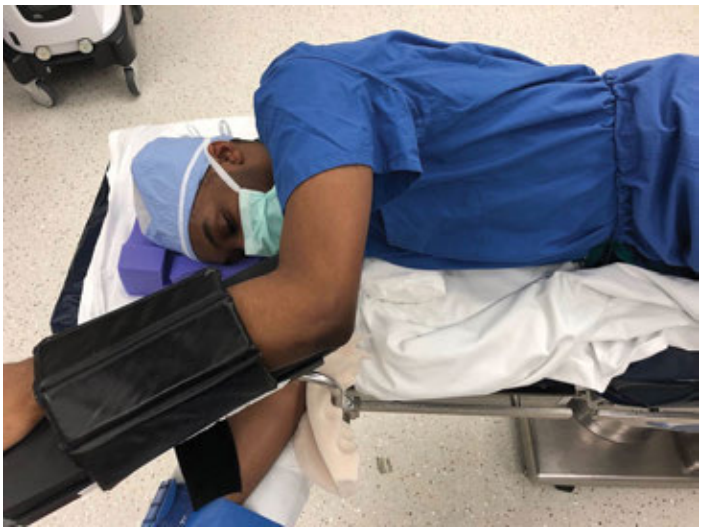

Figure 4. Armboard positioning demonstrated as Dr. Osemwengie simulates patient positioning.

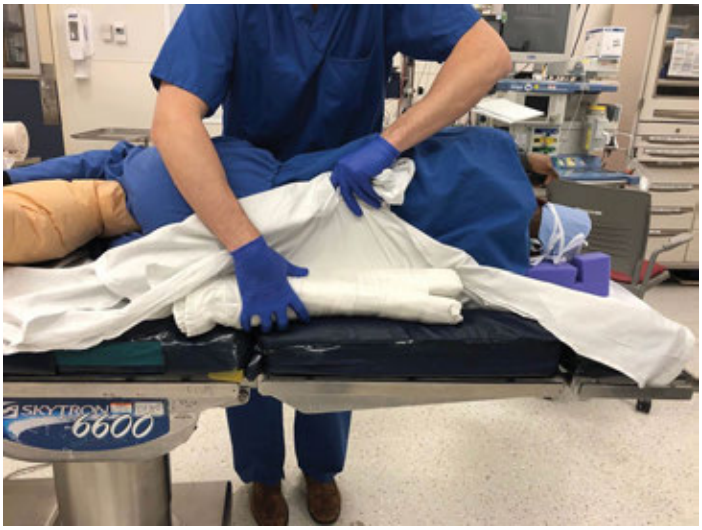

Figure 5. Placement of the posterior sticky roll which will be wrapped in the table blanket.

additional stability to prevent rotational movement during instrumentation. This can be particularly helpful in more obese patients.

Taping

#1—Begin with 3" tape at the level of the greater trochanter / ASIS, wrap circumferentially around the patient and under the bed twice (Figure 6).

#2—Wrap around the thighs and legs. Start at the greater trochanter and wrap down the thigh toward the knee with foam crate along the fibular head (Figure 7). Continue taping below the bed aimed toward the feet, then circumferentially around the ankle, ensure the lateral malleolus is padded. Above the bed, continue the tape along the leg toward the knee and continue under the bed ending at the starting point for this roll of tape: the greater trochanter (Figure 8).

#3—Start another roll of tape along the rib cage, wrap circumferentially around ensuring the wrap allows for a wide surgical field for sterilization and draping (Figure 9). This provides stability to the proximal torso while allowing a wide field during the procedure.

Bed Angle

With the patient positioned appropriately, now break the bed approximately 10 degrees at the flank region to optimize access to the retroperitoneal space without abutting the ilium or rib cage. Given the bed is reversed 180˚, the operator will need to (1) Trendelenburg the bed and (2) reflex the bed (Figure 10).

Additional Reinforcement

Additional tape may be required to reinforce along the patient's hips and ribs once the bed is positioned at the appropriate angle.

Fluoroscopy

Position the C-arm on the ventral side of the patient, with the bed and patient appropriately positioned, the machine

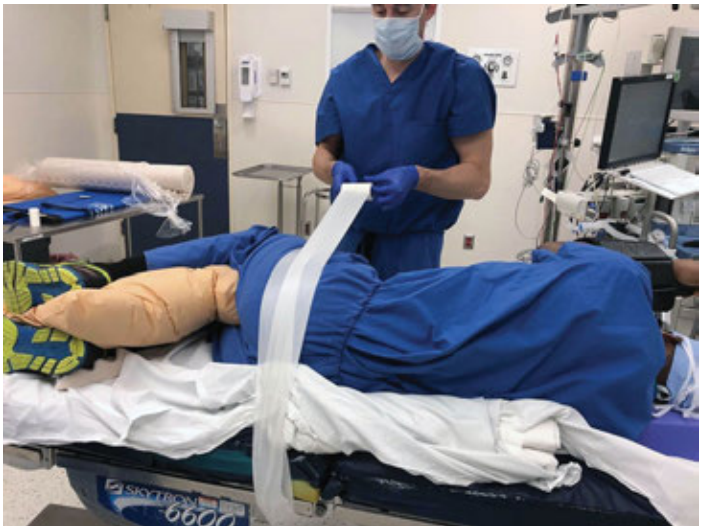

Figure 6. Dr. Khalsa demonstrates wrapping the first band of tape at the pelvis.

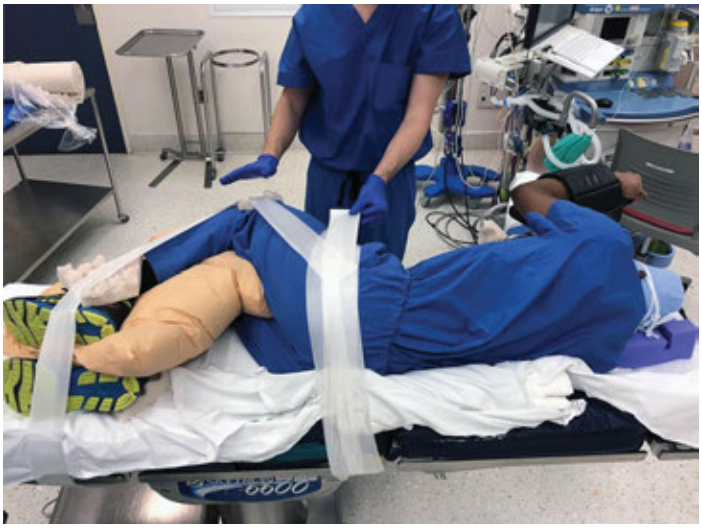

Figure 8. The second roll of tape after including feet, legs with appropriate padding.

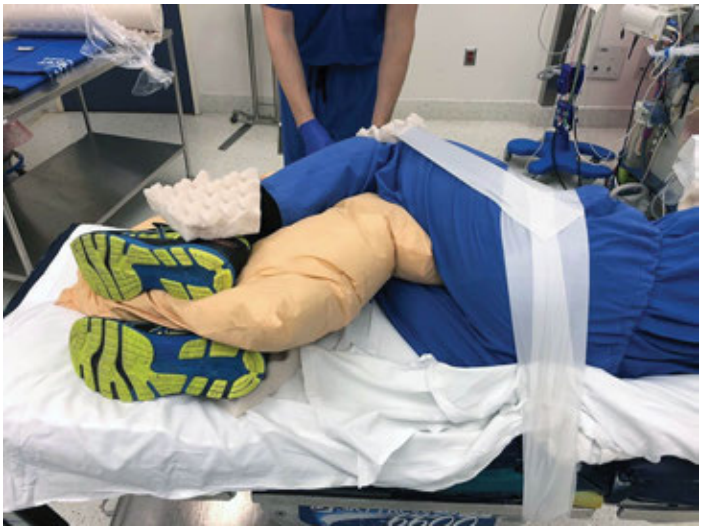

Figure 7. The second roll of tape starts at the greater trochanter and wraps around the table.

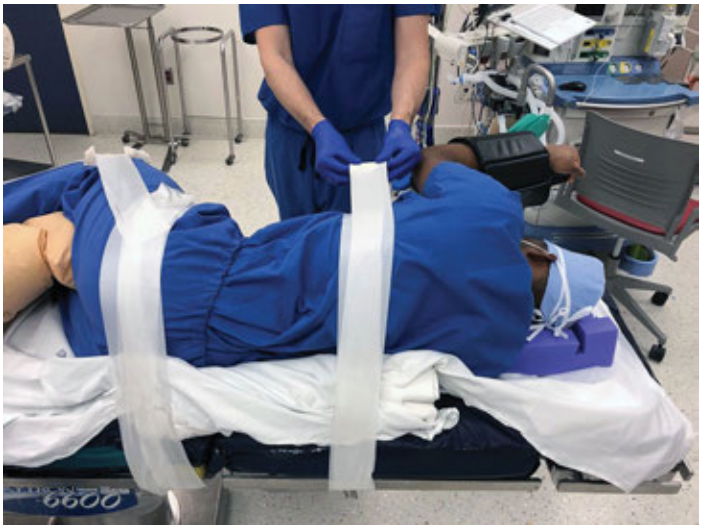

Figure 9. The third roll of tape wrapped around the torso, will allow access below the 12th rib.

should be orthogonal to the patient and maneuver from AP and lateral radiographs without any further adjustments of the fluoroscope and with the bed in a stationary position (Figures 11, 12). The C-arm will be placed parallel to the vertebral endplates of the planned surgical site in order to allow for achieving a true lateral and AP radiograph prior to surgery.

Assessment of true AP and lateral radiographs is important prior to preparation and draping. AP assessment includes assuring the spinous process in midline, the pedicles are symmetric and reside in the upper third of the vertebral body, and vertebral endplates are crisp and without double density. Lateral assessment includes assuring pedicles are completely overlapped and minimizing double density of the endplates in this plane.

Next, with the use of a T-tool, the posterior aspect of vertebral body is identified on a true lateral radiograph of the spine. Here we show an example of appropriate use of the T-tool at the L3-4 level, marking the posterior aspect of the operative disc space (Figure 13). This is marked with a permanent surgical marker on the patient's flank prior to prepping and draping. The eventual incision will completely parallel the operative disc space. After prepping and draping and surgical dissection, the appropriate start point allows for expedient insertion of instrumentation at the appropriate disc space and the final construct on lateral radiograph (Figure 14, 15).

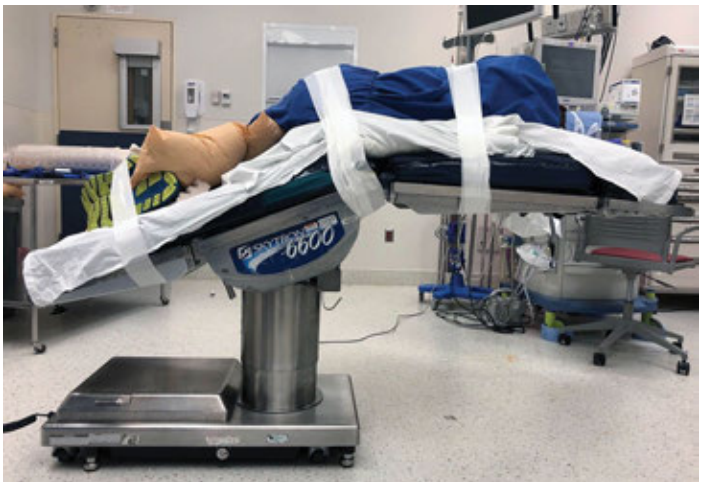

Figure 10. With the bed flexed, appropriate patient positioning demonstrated with access to the operative corridor.

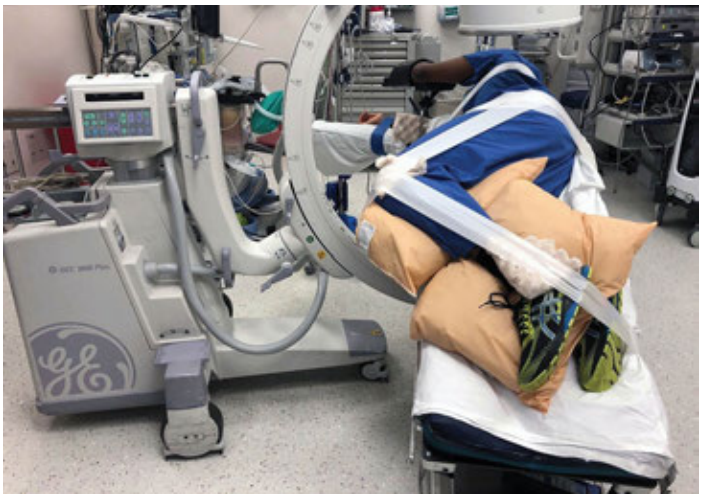

Figure 11. C-arm positioning is demonstrated for a lateral radiograph.

Figure 12. C-arm positioning is demonstrated for an AP radiograph.

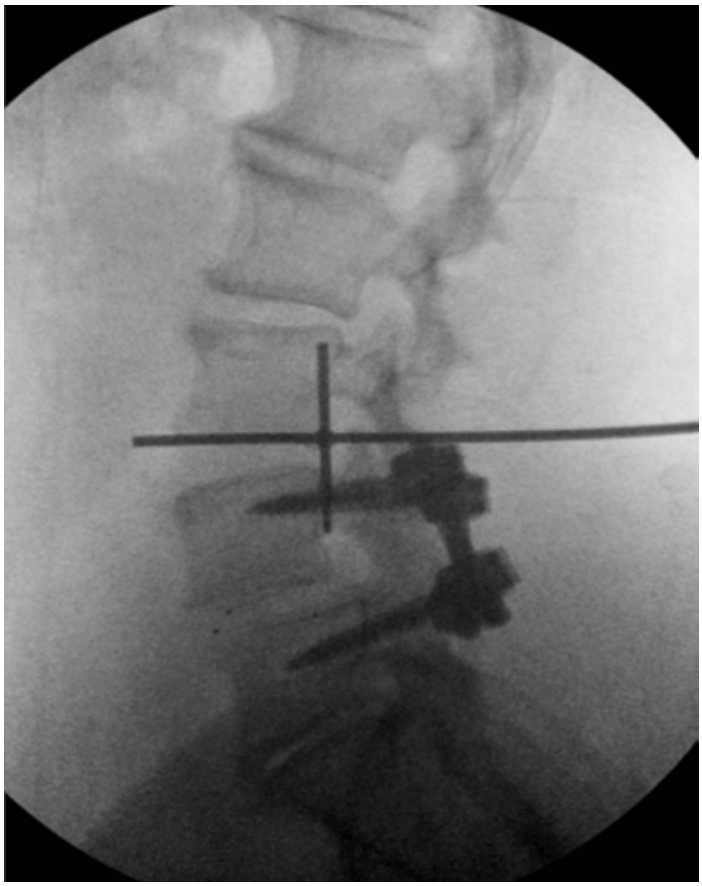

Figure 13. T-tool is aligned to the posterior aspect of the vertebral body on a true lateral radiograph.

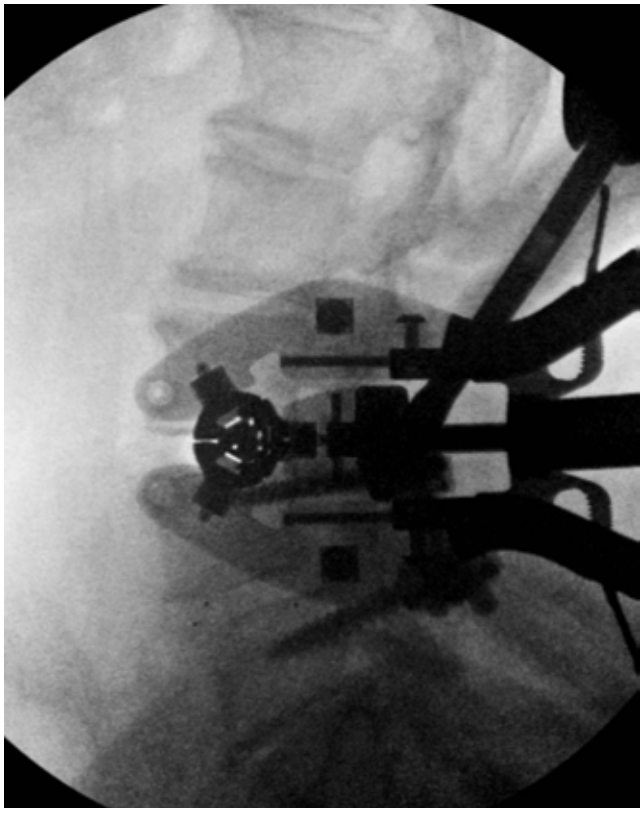

Figure 14. Radiograph demonstrating instrumentation insertion on a lateral radiograph.

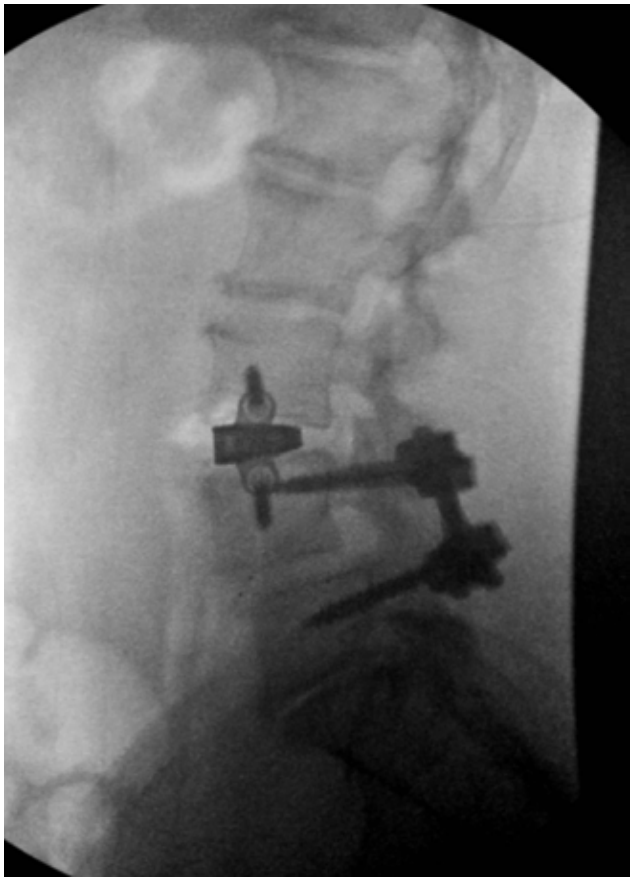

Figure 15. Final construct demonstrated on a lateral radiograph.

Additional Tips

Surgical stools should be readily available for the surgeon and assistant's use regardless of his/her height as the operative field is often higher given the position.

Discussion

Lateral lumbar interbody fusion is a newer technique gaining popularity in orthopaedic spinal surgery to address lumbar spine pathology. Effective use of the technique to help patients requires an understanding of how-to setup the operating table in a manner which maximizes patient stability and minimizes adjustment after the insertion of instruments. The process starts with proper bed selection and appropriate use of padding and support to stabilize bony prominences to position the patient with access to relevant lines while also allowing access to the surgical field. Positioning the pelvic girdle and shoulder appropriately aligned will minimize the need for adjustment while taping the patient to the bed. Stable, reliable positioning is absolutely essential to safely accomplishing the goals of this surgery. Here we demonstrate the method utilized by one of our senior spine surgeons which has been utilized with good success to allow efficient use of operating room time and to maximize intra-operative stability during instrumentation.

Please note that the patient fluoroscopic images have been anonymized and are used in conjunction with the photos of the physician modeling patient positioning for educational purposes.

References

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