

Open anterior approaches for lumbar spine procedures

Andrew A. Gumbs, M.D.^a, Norman D. Bloom, M.D.^a, Fabian D. Bitan, M.D.^b,
Scott H. Hanan, M.D.^{a,*}

^aDepartment of Surgery, Lenox Hill Hospital, 100 East 77th Street, New York, NY 10021, USA

^bDepartment of Orthopedic Surgery, Lenox Hill Hospital, 100 East 77th Street, New York, NY 10021, USA

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Abstract

With the advent of anterior lumbar interbody fusion (ALIF) and artificial discs as common procedures for the treatment many spinal problems such as pseudoarthrosis, degenerative disc disease and internal disc disruption from trauma, anterior exposure has become an increasingly popular procedure for the general, thoracic, urologic and vascular surgeon. Despite this, the body of literature describing this procedure is lacking. Dividing the approach for anterior spinal surgery into the thoracolumbar, mid-lumbar, and lumbosacral regions, we describe the basic techniques and anatomy needed to perform these open approaches, specifically, repairs of disc spaces T12–L2, L2–5, and L5–S1, respectively. The technique for the retroperitoneal approach will be discussed in detail; however, issues involved with indications for transperitoneal approach and technical “pearls” will also be discussed. © 2007 Excerpta Medica Inc. All rights reserved.

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With the advent of anterior lumbar interbody fusion (ALIF) as a common procedure for the treatment of many spinal problems such as pseudoarthrosis, degenerative disc disease, and internal disc disruption from trauma, anterior exposure has become an increasingly popular procedure for general, thoracic, urologic, and vascular surgeons [1]. Despite this, the body of literature describing this procedure is lacking, especially in the general and vascular surgery literature. Dividing the approach for anterior spinal surgery into the thoracolumbar, mid-lumbar, and lumbosacral regions, we describe the basic techniques and anatomy needed to perform these open approaches, specifically, repairs of disc spaces T12–L2, L2–5, and L5–S1, respectively. The technique for the retroperitoneal approach will be discussed in detail, and issues involved with indications for the transperitoneal approach will also be described. The techniques for thoracic and cervical approaches and laparoscopic procedures will not be addressed here.

Technique

Thoracolumbar region (T12–L2)

The patient is placed in the lateral decubitus position and secured using either a bean-bag or sand bags. Typically, the approach is via the left side; however, the right chest and retroperitoneum may be approached if need be. A thoraco-abdominal incision is made, generally directly over the 10th or 11th rib depending on the patient's anatomy and the levels to be exposed. The incision is oriented in an oblique fashion and is carried down onto the abdominal wall for a few centimeters. The subcutaneous tissues, the serratus anterior, and latissimus dorsi muscles, are divided to expose the intercostals muscles directly over the desired rib. These muscles are divided to expose the superior border of the intended rib. The rib is dissected free from its bed in a standard fashion, being careful to avoid the neurovascular border below. Anteriorly, the costal margin or the rib is identified and divided. At this point the abdominal wall musculature can be divided. The external and internal obliques are split for a variable distance. It is best to limit this to the bare minimum to prevent postoperative muscular dysfunction. Immediately below the split costal margin is the transversalis layer, which can now be divided.

Once this is complete, the peritoneum is dissected off of the overlying diaphragm and the psoas muscle, which opens the retroperitoneal space. The diaphragm can now be taken

* Corresponding author. Department of General Surgery, Lenox Hill Hospital, 130 E. 77th St., Seventh Floor, New York, NY 10021. Tel.: +1-212-614-6770; fax: +1-212-598-9181.

E-mail address: drhanan@optonline.net

down under direct visualization leaving a distal cuff for repair and staying clear of the more central region to avoid phrenic nerve injury. A self-retaining retractor is placed to obtain exposure within the thoracic and retroperitoneal space. The lung can be gently compressed cranially with a moist lap pad and a minimal decrease in tidal volume; single-lung ventilation is not necessary. The parietal pleura over the lower thoracic spine is now opened and the thoraco-lumbar junction exposed. The segmental vessels to the vertebral bodies are dissected and divided to gain anterior access to the disk spaces. Specific care must be paid to the segmental arteries because of the potential for serious hemorrhage. These arteries are paired at each vertebral level and supply extra-spinal and intra-spinal structures. These vessels need to be controlled and ligated on the side, which the exposure is undertaken. This should be done close to the aorta to ensure that the collateral blood supply to the spinal cord is preserved to protect against cord ischemia [2].

Because the artery of Adamkiewicz is fundamental in supplying blood flow to the anterior and posterior spinal arteries in the thoraco-lumbar area, selective angiography of the artery of Adamkiewicz has been advocated in the pre-operative work-up of patients to aid in choosing surgical approach in the hopes of minimizing risks for paraplegia. Large segmentals can also be individually occluded temporarily with vascular clamps while spinal monitoring takes place. If no changes are identified, these vessels can be divided. This artery usually arises on the left between T8–10, but its origin can vary between T7 and L4; as a result, special care must be taken when dissecting out vertebral bodies at these levels [2]. At this region care should be taken to avoid injury to the retroperitoneal lymphatics (cisterna chyli/thoracic duct) as large lymphoceles can develop. Should an injury occur, oversewing the lymphatic chain with a non-absorbable suture (2-0 silk) should remedy the situation.

If the diaphragm was incised, a large bore chest tube is placed and the diaphragm is repaired with a non-absorbable stitch after the orthopedic procedure is completed. The thoracic cavity is closed by first placing rib approximating sutures and then repairing the intercostals musculature. The serratus anterior and latissimus dorsi muscles are reapproximated with running non-absorbable stitches and the anterior abdominal wall is reconstructed layer by layer with this technique as well.

Mid-lumbar region (L2–L5)

A left paramedian incision is made to avoid the more prominent common iliac vein on the right and carried down through the subcutaneous tissue until the external oblique fascia is identified. This layer is incised at its medial extent, where it is still aponeurotic. At this point, the rectus sheath is opened and the rectus muscle is mobilized to identify the posterior rectus sheath and semilunar line. Mobilization of the rectus can be toward the midline or toward lateral; we prefer mobilization from medial to lateral to avoid disruption of the segmental innervation to the abdominal wall. At the level of the semilunar line, the retroperitoneal space can be developed by bluntly dissecting the peritoneum in a lateral to medial direction and off of the overlying posterior

rectus sheath. This layer can then be divided in a vertical direction to allow for muscle sparing and to facilitate closure. The peritoneal sac is now bluntly dissected off of the psoas muscle, taking care to identify the ipsilateral ureter, until the left iliac artery and vein are identified. This incision can usually be used to expose L2–S1.

At this point the exposure is aided by the use of a self-retaining retractor. We use both the Balfour Retractor (Spectrum, Stow, OH) and the Omni-Retractor (Omni, St. Paul, MN). The multiple varied blades available in both of these systems assist in the actual dissection. Multiple repeated adjustments of these blades can complete the exposure. The left iliac artery and vein are retracted medially, and any segmental vessels are divided laterally. Care must again be taken at this stage to control any segmental branches that may affect the orthopedic surgeon's exposure. At this region care must again be used to avoid injury to the retroperitoneal lymphatics and lumbar sympathetics. More important is the need to avoid injury to the vascular structures. The ileolumbar or ascending vein is generally a large branch overlying the L5 body. This vessel can tether the iliac vein and prevent adequate exposure of the L4/5 disk space. We generally dissect this vessel and divide it (Fig. 1). The L5 root, which often runs in close proximity to this branch, should be located. When the ascending branch is left intact, undue traction on the left iliac vein should be avoided, because minor tears can lead to major hemorrhaging.

At this point the orthopedic portion of the procedure is undertaken (Fig. 2). After vigorous hemostasis is confirmed, the blades are removed one by one to assure a dry field. The wound is irrigated and the abdominal wall is reconstructed in a layered fashion.

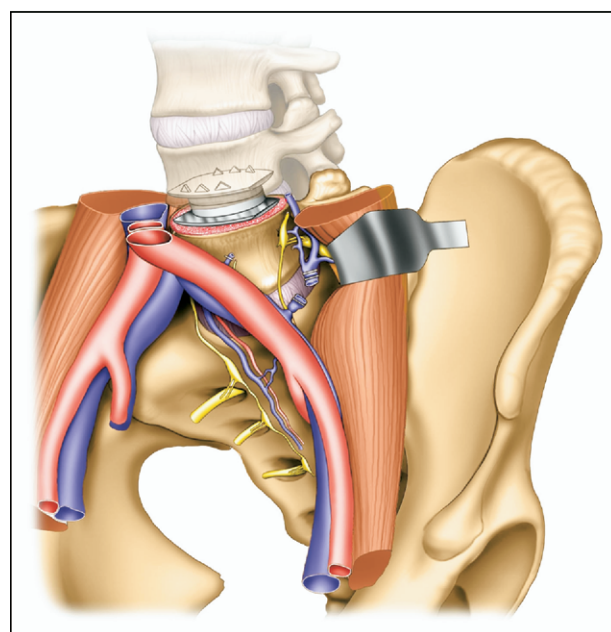


Fig. 1. Division of ileo-lumbar vein for exposure of mid-lumbar and lumbosacral region.

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