Lateral intramuscular planar approach to the lumbar spine and sacrum

Technical note

EDGAR NEWMAN WEAVER JR., M.D.

Neurosurgery Center of Southwest Virginia, Roanoke, Virginia

The goal of this study was to establish a much less invasive method for access to the lateral lumbar spine for posterolateral fusion and pedicle screw (PS) placement.

The technique was developed through knowledge of the anatomy literature and the author’s clinical experience in more than 90 completed cases.

The lateral intramuscular planar approach provides a much less invasive access to the lateral aspect of the lumbar spine and sacrum. An invariant intramuscular plane, poorly described in the anatomical literature, is ideal for posterolateral fusion and/or PS placement from L-3 caudally. The approach requires essentially no resection of the multifidus muscle, or of the pars thoracis of the erector spinae. (DOI: 10.3171/SPI-07/08/270)

KEY WORDS • erector spinae • multifidus muscle • pars lumborum • pars thoracis

In the 1960s, Wiltse and colleagues described the sacrospinalis-splitting approach to the lumbar spine. This procedure was accomplished by making a paraspinous incision through the deep fascia, approximately 2 cm from the midline, and developing the plane between the multifidus and the longissimus muscles (Fig. 1).

In a later publication, Wiltse and Spencer described how this approach could be implemented to undertake central and far-lateral discectomy, central decompression even across the midline, and PS insertion. Thus the longissimus muscle is retracted laterally and the multifidus muscle can be resected from the osseous elements medial to the facet joints.

In 1953 Watkins described a far-lateral approach, a route between the erector spinae (iliocostalis) and the quadratus lumborum, which requires some resection of the ilium for proper muscle reflection.

In this report I will describe an intermediately lateral approach directed obliquely to the area of the pedicle via a natural plane existing within the longissimus–iliocostalis muscle complex. This lateral intramuscular planar approach is essentially a bloodless dissection along a well-defined layer of adipose tissue, requiring minimal detachment of muscle from bone (Fig. 1).

Abbreviations used in this paper: ESA = erector spinae aponeurosis; PS = pedicle screw.

The Lateral Intramuscular Planar Approach

Anatomical Review

The multifidus is the largest and most medial of the three main paraspinous muscle groups. It arises from the vertebral laminae, especially the spinous processes, in a series of overlapping fascicles that insert on the lower vertebrae (mammillary processes and facet capsules), the iliac crest, and the sacrum. The major surgery-related anatomical feature is that this muscle is essentially contained medial to the facet joints above the sacrum. Its most caudal fibers, however, fan laterally over the sacrum and attach to the ilium in an almost perpendicular fashion (Fig. 2). Of significance, the lateral edge of the multifidus is enveloped by a thin, shiny fascia. At its attachment to the ilium, this fascia is represented by a distinct fibrous band.

Lateral to the multifidus, the lumbar erector spinae is traditionally described as consisting of the longissimus thoracis (medial) and the iliocostalis lumborum (lateral). Each of these muscles has two parts: a pars lumborum and a pars thoracis. The pars thoracis component of the longissimus–iliocostalis complex arises from the thorax and spans the lumbar vertebrae, attaching to them only medially at the tips of the spinous processes. This longer component acts primarily in stabilizing the thorax to the iliosacrum. Importantly, this attachment is created by a broad sheet of their long tendons that constitutes the ESA. Therefore, below L-4, there is a relatively meager fleshy representa-
tion of these muscles. It is conceptually preferable to refer to these long muscles as the “pars thoracis of the erector spinae” without reference to the two anatomical muscles as traditionally described.

The underlying pars lumborum components of the two muscles arise from the transverse processes, and they course obliquely dorsolaterally to attach to the ilium, lateral to the multifidus—with the pars lumborum of the longissimus being more medial (Fig. 2). Again, it is less confusing to consider this component of both muscles as the “pars lumborum of the erector spinae,” which stabilizes the lumbar vertebrae to the ilium. Thus, the erector spinae can be understood to consist of two functional components: the long and superficial fibers of the pars thoracis (and its ESA) overlying the deeper, shorter fibers of the pars lumborum.

It is crucial to the understanding of the lateral intramuscular planar approach to realize that the pars lumborum, as stated by Bogduk: “does not gain any attachment to the erector spinae aponeurosis, which is the implication of all modern textbook descriptions that deal with the erector spinae...Indeed, the aponeurosis is free to move over the surface of the underlying lumbar fibers, and this suggests that the lumbar fibers, which form the bulk of the lumbar back musculature, can act independently from the rest of the erector spinae.” It should also be noted that, at the caudal-most (sacral) level, some of the fibers of the pars lumborum are overlapped slightly by the lateral-most fibers of the multifidus.

In my surgical experience, the separation of the pars lumborum and pars thoracis components of the erector spinae is consistently anatomical up to L-3, where the aponeurosis of the erector spinae transitions into more muscle bulk. Above this level, the two functional components become interdigitated and gradually less separable. Caudal to the third transverse process, however, the well-defined fatty plane separating the two components can be developed, leading at its bottom to the junctional angle of the transverse process and the facet joint. This plane proceeds along the same line up the sacrum lateral to the lumbosacral joint, although at this level it may run slightly under the caudal fibers of the multifidus as they fan laterally.

**Surgical Dissection**

With a midline skin incision, a subcutaneous dissection is extended laterally enough to expose the iliac crest. Separate paraspinous incisions have also been used, but the length of the requisite midline incision is surprisingly short. Thus, the only real advantage of using two skin incisions is to avoid a significant subcutaneous dead space, and this can be effectively obliterated during closure, as noted below.

Deep Gelpi retractors are anchored into the medial fascia to hold the skin flap back. An incision of the aponeurosis is made with the cautery medial and parallel to the iliac crest at a sufficient distance to allow easy reattachment of the aponeurosis to its remaining iliac leaf. Where the ilium falls away ventrally, the incision is extended cephalad through the two layers of thoracolumbar fascia and curved medially at its upper end (Fig. 3). This is usually 4 to 5 cm from the midline. The bulky fibers of the multifidus muscle, caudally, are noted running parallel transversely over the sacrum. Those of the pars lumborum can be differentiated by the structure’s slightly more ventrally oblique direction and

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**Fig. 1.** Artist’s drawing. Axial view of spine and muscles demonstrating the angle of entry for the lateral intramuscular planar (LIMP) approach, which is directed to the junctional area of the transverse process and the facet joint. The Wiltse approach is provided for comparison.

**Fig. 2.** Artist’s drawing. Dorsal view of the multifidus and pars lumborum exposed after the overlying pars thoracis/ESA has been removed.
by the cross-hatching appearance of its muscle bundles. The surgeon may also confirm this suspected line of demarcation by palpation, feeling the distinct fibrous band representing the attachment of the lateral fascia of the multifidus (Fig. 4). Fluoroscopically, this band lies horizontally lateral at the level of the posterior aspect of L-5.

Two dissectors are used to probe the lateral/cephalad edge of this fibrous band, confirming the proper plane by identifying the adipose tissue in its depth, and then gently developing this plane medially. The lateral fascia of the multifidus will have a distinct shiny appearance as the muscle curves mediocephalad. The plane is obliquely oriented under the pars thoracis/ESA, the muscle tissue of which is against the multifidus superiorly. The surgeon can then develop this plane, either abruptly with finger dissection or with a more careful dissection between the pars thoracis/ESA superomedially and the pars lumborum inferolaterally. The Gelpi retractors are then repositioned deeply to hold the planar dissection open. In its depth the adipose tissue line is coagulated/aspirated to expose the junctional area of the transverse processes of L-4 and L-5. With blunt finger pressure, the merging and interdigitating fleshy fibers of the pars thoracis and pars lumborum can be separated at the rostral end of the dissection to expose the L-3 transverse process and sometimes also that of L-2. Caudally, the fatty plane dissection is extended up the sacrum. This dissection may proceed slightly under the multifidus along the lateral aspect of the lumbosacral joint; sometimes a few of the lateral-most fibers of the multifidus are dissected from the sacroiliac to establish access to the S-1 pedicle. With a little experience this initial dissection can be accomplished within 15 to 20 minutes, at most, and with minimal blood loss.

The junctional area for PS placement at each level is cleared with the cautery. With fluoroscopic guidance the PS can be placed from this position without disrupting the

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**Fig. 3.** Artist’s representation of where the incision is made in the ESA and thoracolumbar fascia relative to the ilium and transverse processes.

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**Fig. 4.** Artist’s drawing showing the initial opening of the ESA with the multifidus and pars lumborum exposed. The blow-up illustration reveals the line of demarcation between these muscles, as represented by a distinct fibrous band that is the attachment of the lateral fascia of the multifidus to the ilium. m. = muscle.
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Facet joints. For grafting preparation and/or manipulation of hardware, the pars lumborum can be completely and easily dissected from the transverse processes with the cautery. Similarly, a relatively minimal resection of muscle off the sacrum is needed for graft preparation. Thus PS and graft placement are readily accomplished via the lateral intramuscular planar approach; moreover, the multifidus, the pars thoracis, and the facet joints are essentially completely spared (Fig. 5 left).

Closure of the aponeurosis and thoracolumbar fascia is conducted using interrupted sutures. The dead space is then closed, similarly, using heavy tacking sutures. The total blood loss can be negligible for bilateral placement of screws and allograft; most bleeding comes from the pedicles during their preparation. The lumbar muscular arteries can bleed briskly if violated as they enter into the surgical field at the junctional region. As they vascularize the pars lumborum, however, they can be visualized and cauterized as the muscle is detached from its origins medially. Additionally, the ascending lumbar vein, running longitudinally beneath the junctional area, can bleed profusely if the dissection is taken too deeply between the transverse processes.

Discussion

The lateral intramuscular planar approach is ideal for access to the pedicles up to L-3. I use it exclusively for PS placement at these lower levels. The approach allows a junctional screw placement that is directed more medially down the pedicle. There is complete sparing of the facet joints along this orientation (Fig. 5 right). Even when a midline exposure has been taken laterally for a transforaminal lumbar interbody fusion, it is still easier and less traumatic in cases of PS placement to proceed with the lateral intramuscular planar approach rather than continue additional resection of the entire paraspinal musculature laterally.

The lateral intramuscular planar approach is applicable for all pedicle fixation systems. Also, an in situ lateral fusion can be undertaken with remarkable ease and rapidity, and with minimal disruption of muscle the graft environment is ideal.

A disadvantage of the lateral intramuscular planar approach for instrumentation-augmented fusion is that it is not suited for cross-strutting. In contrast to the Wiltse approach, the surgeon has no access to the spine medial to the facet joints for neural decompression. However, as noted previously, even with a separate midline dissection for such a purpose, the lateral intramuscular planar approach remains significantly less invasive for PS placement and/or graft-assisted posterolateral fusion than lateral resection/retraction of the entire paraspinal musculature from the spine.

Conclusions

The anatomy and details of an approach to the lateral lumbar vertebrae and sacrum are described for PS placement and/or fusion. The lateral intramuscular planar approach is directed along an intramuscular plane that has been poorly appreciated in the anatomy literature. Compared with the standard approach in which muscle is retracted and resected from the midline, this plane provides a much less invasive access to the lateral spine from L-3 to S-2. If the surgeon understands the muscular anatomy and makes the appropriate effort, the plane can be found and developed with relative ease.

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References


Address reprint requests to: Edgar Newman Weaver Jr., M.D., Neurosurgery Center of Southwest Virginia, Roanoke, Virginia 24014. email: Americophl@aol.com.