Laminotomy outcomes in pediatric patients


We commend the authors for reporting this first of its kind study in the pediatric population, although it is well reported in adults. The use of developmentally appropriate pain scores and the rate of change in paraspinal muscle (PSM) fat infiltration rather than absolute value in order to account for growth are positive points. However, we would like to seek clarifications on some of the shortcomings that we found in the study.

The reason for the development of the split laminotomy technique is to minimize muscle dissection, thereby leading to a lower incidence of chronic pain, spinal instability, and deformity.4 This study had a relatively short follow-up duration (2 weeks to 4 years), and tended to focus on short-term outcomes such as postoperative pain control and PSM volume and fat atrophy. Only 37 patients underwent postoperative imaging, which could have led to bias in the results. A study with a longer follow-up duration considering the abovementioned outcome would serve a better purpose.

The split laminotomy approach is suited for midline spinal pathology, spanning single or multiple levels at various sites (cervical, thoracic, and lumbar).2 However, in this study, only patients who underwent primary surgery for filum lipoma, spanning less than or equal to two levels, were considered in the statistical analysis. This is a very limited indication, and the results cannot be generalized to different spinal levels or pathologies, thus limiting the applicability of the technique. The authors also fail to report the incidence of conversion to conventional laminectomy and the factors associated with it.

Filar lipoma is usually associated with spinal dysraphism.3 In such cases, laminotomy or laminar distraction would not be possible and split laminotomy is thus not feasible. There was no report of the incidence of spinal dysraphism in either group.

The feasibility of the use of nonpenetrating titanium clips for dural closure and technical difficulty with dural approximation with suture also need to be accounted for.

Finally, we would like to congratulate the authors on reporting the largest series of this technique in a pediatric population. This article lays the foundation for a larger study spanning various spinal levels for different indications with a longer follow-up duration.

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References

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Response
We would like to thank the authors of the Letter to the Editor for their valuable comments and critiques. As stated in our discussion, our study has several limitations, some of which are inherent of a retrospective study. Our follow-up times were variable, ranging from 2 weeks to 4 years, as many patients were lost to follow-up after their initial wound check appointment at 2 weeks. Only a minority of the patients had postoperative imaging available as we do not routinely obtain these studies on all patients.
We obtain postoperative imaging on patients with specific follow-up needs, whenever there is concern for symptom persistence or recurrence, or when there is concern for possible complications. This creates a potential bias, because presumably the patients with better outcomes (i.e., those with symptom resolution, normal wound healing, and no concern for complications) are those who would not otherwise follow up past their initial wound check evaluation. Given the obvious limitation in follow-up and available postoperative imaging studies, which precluded direct assessment of the development of spinal instability, spinal deformity, and chronic pain, we focused on the assessment of PSM fat infiltration and muscle atrophy,\textsuperscript{5,8–12} as this has been linked to the incidence of chronic back pain and is believed to predispose to spinal instability and progressive dysfunction.\textsuperscript{9,10,12}

Postlaminectomy spinal deformity is more prevalent in the pediatric population than in adults. Risk factors associated with iatrogenic spinal deformity include the use of adjuvant radiation, multilevel exposure, and the particular level of surgery (incidence is higher for cervical > thoracic > lumbar cases);\textsuperscript{1} hence we sought to compare equivalent-level surgeries. The statistical analysis was limited to lumbar cases for filum terminale sectioning as this group had a sufficient number of patients to reach statistical significance and represented a more homogeneous population for comparison. Unfortunately, the number of controlled thoracic-level cases was minimal, with only 4 cases for each surgical group and a disproportionally higher number of tumor cases in the conventional group (Table 1 in our paper), thus carrying additional confounding risk factors for the development of spinal instability and spinal deformity. Although we previously demonstrated the applicability of the technique at various spinal levels in the case report of an extensive multilevel exposure for debulking of a cervicothoracolumbar spinal cord lipoma,\textsuperscript{2} there were no isolated cervical-level cases for comparison in the current series.

As mentioned in our discussion, the split laminotomy affords sufficient exposure for dorsal/midline approaches such as filum sectioning, and we encountered no iatrogenic laminar fractures with the use of the laminar distractors; hence there was no need for conversion to conventional laminectomy in any of the split laminotomy procedures.

It is unclear to us what is meant by the statement “filar lipoma is usually associated with spinal dysraphism.” A lipoma of the filum terminale is a form of spinal dysraphism.\textsuperscript{12} If the authors refer to an association between filum lipomas and spina bifida, our experience has been similar to that noted in the excellent paper by Morota and colleagues\textsuperscript{6} that was referenced:

Indeed, the presence of a lipoma in the filum terminale, the final product of secondary neurulation, is increasingly being acknowledged. The availability of MRI has made the discovery of caudally located lipomas, which do not penetrate the dorsal aspect of the dura mater or fascia, and are unassociated with spina bifida, more common. It should be remembered that spina bifida diagnosed in such patients does not constitute true “pathological” spina bifida, but merely “physiological” spina bifida formed by the cartilaginous part of the lamina in the course of normal development.

Our findings are consistent with this statement, i.e., that the only spina bifida associated regularly in patients with filum lipomas is of the physiological form, a cartilaginous midline in the infant patients. The split laminotomy procedure remains the same in these patients. We should note that we choose lumbar levels below the conus rather than sacral levels for filum sectioning as this keeps the incision farther away from the diaper area and lessens the risk of stool contamination during the postoperative period.

In our experience, the width of exposure of the split laminotomy reaches approximately 1 cm (Fig. 9 in our paper), which limits its application to mostly dorsal/midline approaches and creates a practical challenge when using sutures for dural closure. As it was not an intended outcome of the study, we did not quantify the frequency with which nonpenetrating titanium clips were used. However, nonpenetrating titanium clips are routinely used for dural closure in our split laminotomy cases as it requires less exposure than do conventional suturing techniques.\textsuperscript{4}

The results of our study reinforced the short-term benefits of the split laminotomy in minimizing acute postoperative pain and the longer-term benefits of decreasing muscle atrophy and fatty degeneration, which are known to be associated with the development of chronic pain and spinal instability. However, we agree that larger studies including various spinal levels, broader indications, and longer-term follow-up would be ideal.

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