

Peer Review File

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Reviewer A

This is a well-written technical note describing step-by-step procedure of transforaminal endoscopic thoracic approach. Although there's little new technical aspect in this paper, it is worthwhile to reader to understand the "step-by-step" procedure and detailed nuance of the advanced endoscopic surgery.

I think it's good to publish as it is.

Reply: Thank you for your kind remarks.

Changes in the text: None.

Reviewer B

The article gives us a good demonstration of the transforaminal endoscopic thoracic discectomy. The figures and video as well as the descriptions are a good guidance to those willing to perform the technique, although is an already well-established procedure.

The introduction shows us the difficulties in dealing with thoracic diseases with the interlaminar and the transthoracic approaches but gave me the impression that the transforaminal approach is the best approach to thoracic disease and the main barrier might be the shallower learning curve. I think it should be clearer to the readers that besides the learning curve, the most important is to decide the approach based on the location of the compression and the anatomy. The inter laminar and the transthoracic approaches have their role and should be considered along with the other approaches when facing a thoracic disc herniation, even though "posterior approaches are dangerous and ventral and lateral approaches require dealing with pleural contents".

The Discussion bring us good topics on the difficulties surgeons will face along their own learning curve if they are willing to perform endoscopic spine surgery. The discussion on money and time investment is very important, since some good surgeons still hesitate to understand this barrier in endoscopic spine surgery and limit their own development. Very interesting article.

Some points to be worked:

Comment: Video is very well explained but could be better edited, there are moments that there is not much going on that could be excluded or fastened up.

Reply: The video has been edited and shortened by several minutes. Thank you.

Changes in text: The video has been edited and shortened by several minutes.

Comment: No references are cited in the introduction where statements should be linked to references. No references also in “the key steps”, even though there are phrases where it cannot be absent such as: “There are established more invasive approaches”, “This is the “trans SAP approach.””.

Reply: We have now added appropriate references in the introduction (thoracic approaches & learning curve) and in the key steps (more invasive approaches & trans SAP)

Changes in text: At the end of the first paragraph of the introduction, regarding the learning curve, we have added the following references:

Lewandrowski KU, Telfeian AE, Hellinger S, Jorge Felipe Ramírez León, Paulo Sérgio Teixeira de Carvalho, Ramos MRF, Kim HS, Hanson DW, Salari N, Yeung A. Difficulties, Challenges, and the Learning Curve of Avoiding Complications in Lumbar Endoscopic Spine Surgery. *Int J Spine Surg.* 2021 Dec;15(suppl 3):S21-S37. doi: 10.14444/8161. PMID: 34974418; PMCID: PMC9421222.

Wang H, Huang B, Li C, Zhang Z, Wang J, Zheng W, Zhou Y. Learning curve for percutaneous endoscopic lumbar discectomy depending on the surgeon's training level of minimally invasive spine surgery. *Clin Neurol Neurosurg.* 2013 Oct;115(10):1987-91. doi: 10.1016/j.clineuro.2013.06.008. Epub 2013 Jul 2. PMID: 23830496.

Regarding thoracic approaches we have added:

Kerezoudis P, Rajjoub KR, Goncalves S, Alvi MA, Elminawy M, Alamoudi A, Nassr A, Habermann EB, Bydon M. Anterior versus posterior approaches for thoracic disc herniation: Association with postoperative complications. *Clin Neurol Neurosurg.* 2018 Apr;167:17-23. doi: 10.1016/j.clineuro.2018.02.009. Epub 2018 Feb 6. PMID: 29428625.

In the key steps section, regarding more invasive approaches, we have added the following reference:

Kerezoudis P, Rajjoub KR, Goncalves S, Alvi MA, Elminawy M, Alamoudi A, Nassr A, Habermann EB, Bydon M. Anterior versus posterior approaches for thoracic disc herniation: Association with postoperative complications. *Clin Neurol Neurosurg.* 2018 Apr;167:17-23. doi: 10.1016/j.clineuro.2018.02.009. Epub 2018 Feb 6. PMID: 29428625.

In the key steps section, regarding the trans SAP approach, we have added the following reference:

Hasan S, White-Dzuro B, Barber JK, Wagner R, Hofstetter CP. The Endoscopic Trans-Superior Articular Process Approach: A Novel Minimally Invasive Surgical Corridor to the Lateral Recess. *Oper Neurosurg (Hagerstown)*. 2020 Jul 1;19(1):E1-E10. doi: 10.1093/ons/opaa054. PMID: 32281629.

Comment: “an entry point 7.5 cm off the midline (Fig. 2)” - that is actually in figure 1.

Reply: Changed to (Fig. 1)

Changes in text: Changed to (Fig. 1)

Comment: Review the topic 8. Durotomy.

Reply: Changed to “Durotomy can be treated...” and the following reference has been added: Telfeian AE, Shen J, Ali R, Oyelese A, Fridley J, Gokaslan ZL. Incidence and Implications of Incidental Durotomy in Transforaminal Endoscopic Spine Surgery: Case Series. *World Neurosurg*. 2020 Feb;134:e951-e955. doi: 10.1016/j.wneu.2019.11.045. Epub 2019 Nov 15. PMID: 31734429.

Changes in text: Changed to “Durotomy can be treated...” and the following reference has been added:

Telfeian AE, Shen J, Ali R, Oyelese A, Fridley J, Gokaslan ZL. Incidence and Implications of Incidental Durotomy in Transforaminal Endoscopic Spine Surgery: Case Series. *World Neurosurg*. 2020 Feb;134:e951-e955. doi: 10.1016/j.wneu.2019.11.045. Epub 2019 Nov 15. PMID: 31734429.

Reviewer C

Even though there have been previous publications on the TETD, I do find your work interesting and of added value. Please see my comments:

Comment:- line 31: typo; add of.

Reply: changed

Change in text: added “of.” Changed sentence to: “attractive because of advantages that include that the procedure can be performed...”

Comment: - line 32: how big is the incision? Is awake always advantageous? What is awake?
- Line 35-38: do you have a citation for this?

Reply: Incision is 6 to 8 mm. The principal advantage to awake surgery is avoiding the complications associated with general anesthesia, especially in the elderly. The authors also appreciate the real-time neuromonitoring that a responsive patient provides. The authors use the term “awake” to mean that the patient is able to converse during the procedure. The following citations have been added regarding the learning curve:

Lewandrowski KU, Telfeian AE, Hellinger S, Jorge Felipe Ramírez León, Paulo Sérgio Teixeira de Carvalho, Ramos MRF, Kim HS, Hanson DW, Salari N, Yeung A. Difficulties, Challenges, and the Learning Curve of Avoiding Complications in Lumbar Endoscopic Spine Surgery. *Int J Spine Surg.* 2021 Dec;15(suppl 3):S21-S37. doi: 10.14444/8161. PMID: 34974418; PMCID: PMC9421222.

Wang H, Huang B, Li C, Zhang Z, Wang J, Zheng W, Zhou Y. Learning curve for percutaneous endoscopic lumbar discectomy depending on the surgeon's training level of minimally invasive spine surgery. *Clin Neurol Neurosurg.* 2013 Oct;115(10):1987-91. doi: 10.1016/j.clineuro.2013.06.008. Epub 2013 Jul 2. PMID: 23830496.

Change in text:

For surgeons looking to expand their minimally invasive arsenal of techniques, endoscopic spine surgery is particularly attractive because of advantages that include that the procedure can be performed: 1) through a tiny incision (6-8 mm), 2) in awake patients (patient able to converse during procedure), and 3) in an outpatient setting.

Transforaminal surgery has a higher barrier to adoption and probably a shallower learning curve (many cases over a long period before mastery is achieved) chiefly due to 2 challenges: 1) Needle targeting, and 2) Understanding endoscopic visual anatomy (1-2).

Comment: Case 1:

How long were symptoms present?

How was decided what procedure patients would undergo?

What was the indication for the CT-scan? This study?

Reply: Symptoms were present for 1 year prior to surgery. The patient had researched procedures for his thoracic radiculopathy and requested a consultation with a surgeon who specialized in endoscopic spine surgery. He had already seen other surgeons for opinions regarding more invasive procedures. The CT myelogram was ordered by another physician for evaluation of a possible upper lumbar disc herniation.

Changes in text:

A 32-year-old male presented with a right-sided T7-T8 foraminal disc herniation (Fig. 1). He suffered from thoracic back pain and radicular pain despite 1 year of conservative treatment and reported dramatic benefit from a T7-8 selective nerve root block.

Comment: Case 2:

- what was the reason for the discogram?

- What was the indication for the MRI?

line 150 has a typo

Reply: Discogram dye can be used as an adjunct in endoscopic spine surgery to stain the disc and help better distinguish disc material from non-disc material. The MRI was performed post-operatively at the patient's request. The patient was anxious about the success of the procedure and wanted reassurance.

The typo on line 150 has been fixed.

Changes in text: The following has been added to Case 2, “Discogram dye is sometimes used to help distinguish disc material from non-disc material in endoscopic spine procedures.”

Line 150 now has “Understanding,” spelt correctly.

Comment: Discussion

- lines 171-180: also discuss

Gadjradj PS, Broulikova HM, van Dongen JM, Rubinstein SM, Depauw PR, Vleggeert C, Seiger A, Peul WC, van Susante JL, van Tulder MW, Harhangi BS. Cost-effectiveness of full endoscopic versus open discectomy for sciatica. *Br J Sports Med.* 2022 Feb 20;56(18):1018–25.

Even though surgery may be more costly, it can still pay out in societal costs. Also discuss the potential cost savings due to reducing the need for fusions.

Reply: I am embarrassed that I was not aware of this brilliant paper. I am very grateful for the reviewer sharing this with us and have added the reference and a discussion of its implications to the Discussion section.

Changes in text: A multicenter randomized controlled trial was published by Gadjradj et al (x) on the cost-effectiveness of full endoscopic versus open discectomy for sciatica. The results suggest that endoscopic discectomy is more cost-effective from the societal perspective (principally due to expediting getting the patient back to work and back to life).

Comment: I have a bit an issue with calling it a truly MISS in the final sentences. What is MISS? A small scar? Less Creatinephosphokinase? Maybe just remove " truly" as you have shown no data to back that up except for two cases but no comparison.

Reply: Agreed

Changes in text: “The cases and video presented here demonstrate a step-by-step technique that makes it possible to perform a thoracic discectomy in an awake patient, in an outpatient setting, in a minimally invasive fashion.”