

Peer Review File

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Review Comments

Reviewer A

Comment 1: The topic of this paper study is quite important. The authors summarized all current issues for management of TOS. This study is clear and easy to read. I really enjoyed this paper.

I congratulate their work for TOS.

Reply 1: Thank you for your review of our manuscript.

Changes in the text: No changes made in the manuscript.

Reviewer B

The authors provide an excellent review of the TOS diagnoses and operative approaches. Overall, the manuscript should be published, I offer just a few suggestions on how to strengthen the manuscript

Comment 1. Figure 3 is an excellent photographic representation of a transaxillary approach. If possible, additional photos pertaining to transaxillary, supraclavicular, and paraclavicular approaches would add to the strength of the manuscript.

Reply 1: Unfortunately, we do not have any unpublished material available at the moment.

Changes in the text:

Comment 2. Page 7, line 142, diagnose should be changed to diagnosis

Page 8, lines 167-168, I presume the authors mean an anterior scalene muscle block?

Reply 2: We agree with the reviewer that diagnose should be changed to diagnosis. We perform a scalene muscle block in the anterior and medial scalene muscle.

Changes in the text: Page 7, sentence 175: Changed diagnose to diagnosis. Page 8, sentence 202: changed to scalene muscle block (SMB) in the anterior and medial scalene muscle is performed.

Comment 3. Does patient's body habitus or BMI affect the decision to proceed with supra or paraclavicular approaches over transaxillary?

Reply 3: In our TOS center we primarily choose for the transaxillary approach, also in patients with a higher BMI. However, in some extreme cases (BMI >40) we decide to use the supraclavicular approach. A study performed by Thompson et al. shows that BMI does not influence the outcome for SC operations. This approach has the benefit of an easier access and better visibility in these cases. A paraclavicular approach is only used for venous or arterial reconstructions in our center.

Changes in the text: Page 12, sentence 309-312: added However, the transaxillary

approach is considered less preferable in patients with a Body Mass Index (BMI) higher as 40. A study performed by Thompson et al. concluded that BMI has no impact on the outcome of surgery via the supraclavicular approach (52).

Comment 4. The authors could consider summarizing the pros and cons of each approach in a table

Reply 4: In page 12-13, line 313-353 we describe the pros and cons of the transaxillary and supraclavicular approach in detail. Therefore, we do not think it is necessary to add such a table to the text.

Changes in the text: No changes were made in the text.

Comment 5. Are there any differences in postoperative pain or recovery between the 3 approaches?

Reply 5: So far the current literature shows no significant differences in postoperative pain or recovery between the different approaches for thoracic outlet decompression. We don't see differences in postoperative pain or opioid use between the transaxillary and supraclavicular approaches in our own data.

Changes in the text: No changes were made in the text.

Reviewer C

I would like to raise the following points:

Comment 1. The axillary approach requires lateral traction on the operated arm, which may lead to brachial plexus palsy. To avoid this, release of traction is recommended to be performed in regular intervals during the operation (personal communication with the reviewer). Could the authors comment on this with respect to their personal experience as well as their strategy to avoid this complication.

Reply 1: During surgery we use the Trimano (Arthrex, Naples, FL) arm holder to immobilize the arm. Height can be easily adjusted. Furthermore the head is tilted to the affected side with a high pillow, providing relaxation of the brachial plexus. Finally we estimate tension on the inferior trunc of the brachial plexus (that is freed for approx. 5-6 cm's) with the use of a forceps pushing sideways against the inferior trunc. It should be possible to move the inferior trunc a couple of mm's ensuring there is not much tension. This combination, in our experience of over 1000 cases in the last 7 years, does not make it necessary to pause the procedure or reduce tension otherwise.

Changes in the text: No changes were made in the text.

Comment 2. Unfavorable postoperative results as well as recurrences are the result of either incomplete decompression or of postoperative scarring. With respect to the radicality of bony decompression, a costovertebral exarticulation of the posterior segment of the first rib is now advocated by several authors (Illig 2013, Goeteyn, personal communication), an approach that had been previously discredited as too radical. The authors of this paper do support the radical approach (line 257), which is in line with the strategy of the reviewer, and we can provide clinical data to prove this

point. We have recently published a retrospective study that supports the radical approach of bony dissection and I would recommend including our study in the list of references (Lassner, F.; Becker, M.; Prescher, A. Relevance of Costovertebral Exarticulation of the First Rib in Neurogenic Thoracic Outlet Syndrome: A Retrospective Clinical Study. J. Pers. Med. 2023, 13, 144.)

Reply 2: We agree with the reviewer and have decided to add the suggested reference along with a reference of Thompson et al.

Changes in the text: page 10, sentence 259: added 2 references 33 and 34.

Comment 3. With respect to the topic of postoperative scarring, critical factors are inflammation, hemorrhage, lymph leakage, and the extent of tissue resection. From this background, it is debatable whether and to which extent muscular resection is necessary (omohyoid muscle (line 412), and anterior and medial scalene muscle (line 415). Does the complete resection of the anterior and medial scalene muscle provide the best results, as the authors believe (Line 246), and is this supported by clinical data? The authors should address this topic, especially whether release of the medial scalene muscle may be sufficient in terms of decompression when performed in combination with a radical rib resection.

Reply 3: We agree with the reviewer that the prevention of extensive postoperative scarring is essential for a good result in TOD surgery. In supraclavicular (redo) cases we perform a fat pad wrap to limit the postoperative adhesions/scarring to the brachial plexus. This technique does not include muscle resection (other than the omohyoid) but only splitting the scalene fat pad at the level of the omohyoid muscle (that is resected). A partial (as high as possible) resection of the anterior and medial (and minimus in many cases) scalene muscle is part of a TOD, since both muscles insert (at least partially) on the first rib (and Sibson's fascia). Therefore, partial resection is necessary to perform a first rib resection. Besides, we resect these muscles as proximal as possible (with attention for the phrenic and long thoracic nerve) to avoid regrowth/scarring near the brachial plexus, as can be seen in redo cases after previous transection instead of removal of the scalene muscles.

In our experience TOS can not be attributed to a certain cause. A huge variety of causes can only be addressed if a complete TOD is performed (as described).

Changes in the text: No changes were made in the text.

Comment 4. Lymph leakage is easily provoked when handling the supraclavicular scalene fat pad, certain patients are more prone to this complication due to anatomical variations of lymph vessels. This may cause serious complications when performing the dissection of the scalene fat pad (line 447).

Reply 4: In our experience we have not seen extensive lymph leakage so far, other than two thoracic duct lesions that responded well to conservative (MCT diet) measures. Based on the 16 procedures performed over the last 2 years using this technique we have not seen lymph leakage or seroma. Freeing of the fatpad is done with the use of a ligasure device.

Changes in the text: No changes were made in the text.

Comment 5. What do the authors mean by “bone nipper”? The correct term might be “Kerrison rongeur”.

Reply 5: We apologize, we mean a 8 or 5mm straight bone rongeur. A Kerrison is not possible to use in a transaxillary approach.

Changes in the text: page 17, sentence 436 and 442 added 8 mm straight bone rongeur.

Reviewer D

Thank you for this overview of the topic of TOS.

Comment 1. Unfortunately, it is not a comprehensive overview since you obviously completely neglect the existence and the development of minimally invasive techniques such as VATS and especially the RATS approach to the first rib.

Reply 1: In page 10, sentence 265 of the manuscript, we stated that VATS and RATS approach for TOS surgery show promising results. We expanded the text as follows.

Changes in the text: Page 10/11, sentence 265-273: Recent publications of video-assisted thoracoscopic (VATS) and robotic (RATS) approach for TOS surgery show promising results. (45, 50, 51) However, in VATS and RATS most authors perform a partial rib resection, which is a known cause of recurrence (as in any approach) as previously stated, transect the scalene muscle (not resect), and do not perform a complete neurolysis of at least the lower brachial plexus. Another difference is that a pectoral minor tenotomy (or tenectomy) is only possible with an extra incision. Albeit promising results in single center reports, we already performed several redo-surgeries for recurrent and persistent NTOS in patients that previously had a VATS or RATS-TOD. To our opinion both approaches might be promising in the hands of skilled thoracoscopic or robotic surgeons, though the clinical advantages and (midterm) results must be validated.

Comment 2. Furthermore you simply state: most authors perform a partial rib resection, which is a known cause of recurrence'.

This is simply not true - rather transaxillary approaches have been shown to sometimes result in incomplete resections of the anterior as well as the posterior end of the first rib, resulting in recurrence. In addition, most 'open' techniques have been shown to sometimes lead to traction or pressure damage of nerves, since the nerve roots and/or brachial plexus need to be 'held away' for exposure of the rib.

Reply 2: We agree with the reviewer, any approach is prone for incomplete resections. In SC, TA, VATS and RATS TOD-surgery this always remains operator depended.

Changes in the text: Page 11, sentence 266-267: Which is a known cause of recurrence (as in any approach) as previously stated

Comment 3. In our series of RATS first rib resections, I have not seen a single patient complaining of temporary or even permanent nerve affection and not one single patient with recurrence.

Reply 1: We congratulate the reviewer with these outstanding results.

Changes in the text: We made no changes to the text.

If not for the missing part of RATS and VATS techniques, you present a very well-written and exhaustive overview - congratulations.