Editorial

Editorial on Totally endoscopic (VATS) first rib resection for thoracic outlet syndrome

H. Volkan Kara

Department of Thoracic Surgery, Istanbul University, Cerrahpasa Medical Faculty, Istanbul, Turkey

Correspondence to: H. Volkan Kara, MD, MSc. Department of Thoracic Surgery, Istanbul University, Cerrahpasa Medical Faculty, Istanbul, Turkey. Email: volkan_kara@yahoo.com.

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Thoracic outlet syndrome (TOS) is defined as compression of neural and vascular structures passing through the superior aperture of the chest 'Thoracic Outlet'. The involved anatomical structures are brachial plexus, subclavian artery and vein, and they are at risk of compression on their course between neck and axilla. The classification of TOS referred to the compressed structure so named as neurogenic TOS (nTOS) and vascular TOS (vTOS) sub-grouped: arterial and venous (1,2). According to the current literature 95% of TOS cases are nTOS, 4% venous and 1% arterial. Some cases may be combined compressed more than one structure (2,3). The first line treatment approach for TOS is conservative. This is composed of physiotherapy, orthotics, plus pharmacological therapy. The next step should be surgical treatment if no successful improvement is achieved with the mentioned conservative treatment (4).

Surgical therapy for TOS is based on decompression of the thoracic outlet to give free room for the compressed structures. Decompression may be achieved by resection of the first rib, freeing of scalene attachment, and resection of the cervical rib (if exists) (5,6). Starting from 1910 by Thomas Murphy (7), there had been several surgical approach variations (8) including posterior approach by Clagett (9), transaxillary approach by Roos (10) supraclavicular, axillary conventional approach by Hempel and Sanders (11).

The 2 well-known and commonly used techniques for first rib resection for TOS are supraclavicular and transaxillary approaches (4).

Video-assisted thoracoscopic surgery (VATS) has become popular in thoracic surgery starting from 1990's. This popularity brought the pioneering for excision of the first rib for TOS by Ohtsuka and Wolfe in 1998 (12). The technique has been described as using the video camera system for resecting the first rib in TOS patients (12). The use of VATS in TOS surgery had been described in different with or without using the pleural cavity (1,6,13).

The long-term results and outcomes of common surgical modalities (supraclavicular and transaxillary approach) has been compared few times and still does not have a clear agreement (14,15). The supraclavicular approach has been reported to be giving a good view of the topographic anatomy and promoted to have the advantage of diminishing the risk for nerve damage. The incision site for thus visible scar formation seems to be a negative factor. Transaxillary approach has a potential of better cosmetic outcome due to the incision site but pointed for higher risk for brachial plexus injury (1). The surgical outcomes comparing 2 common approaches do not show a significant difference (15,16). Both methods may have operative complications including long thoracic nerve injury during dissection of middle scalenus muscle, brachial plexus injury, phrenic nerve injury (17) and Horner syndrome which has been addressed to occur in supraclavicular approach more (17). There is a potential risk for opening for parietal pleura during the intervention and cause persistent pneumothorax which may require chest tube insertion. Having a chest X-ray

in the operating room to decide for the chest tube insertion is a good method to manage this (1,18). Damage to subclavian vessels and thoracic duct are potential complications during dissection and resection of the first rib (6).

On the other hand, superiority of the transaxillary approach for better outcomes compared with supraclavicular approach has been documented (19). This varying knowledge confirms that there is still big room to field of surgical treatment of TOS. So, the need for new ideas and approaches are still needed.

Recently, George and colleagues published 'Totally Endoscopic (VATS) First Rib Resection for Thoracic Outlet Syndrome' in *Ann Thorac Surg* 2017;103:241-5 (2). This paper describes a new modified VATS technique for first rib resection

All the basic, well-known and approved principles about VATS procedures as: selective double tube intubation, patient positioning, preparation, surgical team's distribution is clearly mentioned. The authors describe their technique by using 3 port incisions, which have been marked before starting. The authors also mark another extra incision place for a potential risk for unexpected situation that may require conversion to open surgery. The use of newly designed or modified surgical instrumentation differs and makes the technique unique from previously published video assisted approaches (1,12). VATS instruments and all the surgical maneuvers are performed within the thoracic cavity through the ports. Endoscopic (thoracoscopic) periosteum elevator, Rongeurs, endoscopic rib cutter with a 10-mm jaw which is capable of between the blade and distal edge capable of cutting ribs are used in the procedure their additive support to prevent injuries to the adjacent vascular and neural structures is clearly underlined. The parietal pleura's dissection from the first rib, excising the rib anteriorly from the costochondral junction to posteriorly as close to the transverse process by using the modified endoscopic rib cutter is mentioned both in the written in the text and demonstrated by the figures .The pitfalls of the technique as paying attention not to harm the neurovascular bundle by retracting the area with care mostly where the 1st rib is wide, trimming the rib stump by using Rongeurs carefully and insertion of a chest tube before closure are explained. The availability of the technique for cervical rib excisions is mentioned. The surgical results showed the technique is safe and very promising in the future treatment of TOS in the daily practice.

Few comments about the technique are as follows: The maneuver for scalenotomy might be hard to perform from the inner site of the thoracic cavity. Avoiding any harm to the vascular and neural structures will definitely need experience as the tearing of the vascular structures generally occur during the excision of the rib in all documented surgical methods. Unexpected bleeding from the subclavian vessels during the demonstrated approach might be catastrophic and may be hard to manage and for any emergent repair. The emergency plan for conversion to either open method for repair and compressing on the vessels meanwhile to earn time and securing the patient's situation might be difficult. Managing risks depends on the expertise and the speed of the team in emergent situations. The authors mention about their emergency plan through marked and prepared incision marking to use to do an emergency bleeding situation as the position of the injury site might be blind and hard to compress.

Even one is for 5 mm video camera; this technique uses 3 port sides. The involvement of each intercostal space may be blamed to negative effect on pain scores post operatively. The need for chest tube insertion adds to hospitalization time and may individually increase postoperative pain.

The 3 surgical port sides may be cosmetically a weak side mostly by the female patients when compared to the axillary approach. The 6th month follow up results are so promising but long term results for the technique and the recurrence rates would be great to comment on. These are so important which would be additive to the knowledge and should be considered carefully for the future studies.

Video assisted surgery has been proven to be safe with having the advantage of easier dissection in the surgical working area with direct clear vision using the magnification opportunities of the camera systems. This might be more valuable for using VATS in TOS cases for not harming the neural structures.

The need for education and teaching opportunities are so important in thoracic surgery including. It so important to create a teachable and transmittable surgical technique in medical knowledge. VATS systems gives this opportunity both demonstrating on site of the patient and giving opportunity to the junior thoracic surgery team members practice according to their level by the help of an instructor, also recording. The procedure and watch again.

Benefit of the patient from surgery depends on the successful intervention by using a proven operative technique. Complication management mostly damage or tearing of vascular structures which may require repair should always kept in mind. The brachial plexus may also be damaged directly or axonal damage due to traction during

the intervention. The surgeon must feel comfortable about the position for the patient safety. Either approach should be capable of handling any problem.

We still need higher number of patients with long-term follow up. The more prospectively designed studies for these innovative new techniques would lighten our way for safer and successful surgical treatment of TOS.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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