Brachial Plexus Injuries Complicating Video-Assisted Thoracic Surgery

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Key words
- Brachial plexus injury
- Minimally invasive surgery
- Video-assisted thoracic surgery

Abbreviations and Acronyms
- EBM: Evidence-based medicine
- NAPS: Nerve action potentials
- VATS: Video-assisted thoracic surgery

BACKGROUND
Minimally invasive surgery is mostly associated with decreased morbidity or accelerated recovery (5, 11, 12, 22). Video-assisted thoracoscopic surgery (VATS) has been replacing open thoracotomy for the treatment of pneumothorax, lung resection, and hyphidrosis with better results and lower complication rates compared with thoracotomy (10, 21). The negative results of any procedure are typically underreported, leading to distorted evidence. It was proposed that encouraging more surgeons to submit and more journals to publish negative results for minimally invasive surgery might better determine safety and efficiency of these procedures (4). We present two patients who sustained a brachial plexus injury during VATS procedure.

CASE DESCRIPTION
Case I. A 21-year-old woman underwent VATS for the treatment of pneumothorax on July 27, 2004. Severe bleeding during VATS procedure from the pleural dome occurred. Repeatedly, the surgeon attempted to stop bleeding by coagulation. As his endeavors were unsuccessful, conversion to an open procedure was unavoidable. During the open procedure, brachial plexus was visualized and found to be injured during the VATS procedure. Exact hemostasis was accomplished via open approach. Total sensorimotor deficit in both patients on the side where surgery was performed was noticed postoperatively. After 3½ months in patient 1, nerve roots C5 and C6 were neurolyzed. Neuramas of middle and lower trunks and posterior and medial cords were resected and graft repair with sural nerves was performed. In the second patient, 1 month after VATS the entire plexus was neurolyzed because of severe fibrosis. Following neurolysis, positive nerve action potentials (NAPs) were recorded. Patient 1 after the 6-year follow-up has full range of motion of the shoulder and elbow. Extension and flexion in the wrist and fingers recovered to M4/5. Pain sensation and two-point discrimination recovered. Patient 2 after 2½-year follow-up recovered full range of motion of the shoulder, elbow, and forearm. Pain sensation recovered in dermatomes C5 and C6.

CONCLUSIONS: The two presented cases show that VATS is not without severe complications, as evidence-based medicine methodology suggests. Surgical findings in our patients imply that if this type of complication happens, early surgical exploration could be the best option for the patients.
dome occurred. After being unable to entirely stop bleeding by coagulation, the surgeon converted VATS to an open procedure. As the lesion of subclavian artery was severe, the surgeon ligated the artery. Total sensorimotor deficit of the right arm was noticed postoperatively. The surgeon who performed VATS presented the case to the senior author. As he was not sure which type of brachial plexus injury occurred, both surgeons agreed to perform brachial plexus exploration after minimal time delay. After 1 month, a lesion in continuity of the entire right plexus was shown, with thinner fibrosis surrounding the upper portion and thicker fibrosis round its lower part. Following external neurolysis or epineurotomy, NAPs were recorded across the lesions. At 2 1/2-year follow-up, full range of motion of the shoulder and elbow occurred. Extension and flexion in the wrist joint were graded M5/5. Flexor digitorum profundus returned to M5/5, flexor digitorum superficialis M5/5, flexor pollicis M5/5, flexor digiti minimi M4/5, finger abduction returned to M4/5, finger adduction returned to M4/5, and adductor pollicis returned to M4/5 (Figures 2A and B). Sensation recovered to S4.

DISCUSSION
To our knowledge, this is the first publication of brachial plexus injury complicating VATS with functional recovery following surgical treatment. Brachial plexus injuries are one of the worst complications after thoracoscopic sympathectomies (2, 7, 15). Rare brachial plexus injuries that were sustained during VATS procedures were successfully treated nonsurgically (14). Gossot et al. (6) reported one subclavian artery tear out of 940 thoracic endoscopic sympathectomies, without additional nerve injury. Lange (13) reported brachial plexus injury during thoracoscopic sympathectomy. Lower plexus was erroneously excised instead of the upper thoracic sympathetic ganglia. The present author did not notice any neurologic recovery following graft-repair of inferior brachial plexus. The optimal time to decide for or against surgery has been the subject of much controversy. The period between trauma and the time of operation has varied from 1 to 6 months (8). Some authors favor an aggressive approach as early as possible (1). In the second case, we used a more aggressive approach because of suggestion of possible

Figure 1. (A) Lesions without continuity between middle and lower trunks and posterior and medial cords are shown. (B) Schematic drawing of graft repair following resection of traumatic neuromas of middle and lower trunks and gliomas of posterior and medial cords. Nerve roots C7, C8, and T1 are indirectly coapted with 10 autologous 7- to 8-cm-long nerve grafts with posterior and medial cords. L, upper trunk; μ, middle trunk; λ, lower trunk; L, lateral cord; P, posterior cord; M, medial cord.

Figure 2. (A) One year postoperatively flexion of fingers is shown. (B) One year postoperatively wrist and fingers extension is shown.
laceration of the brachial plexus during VATS.

The course of surgical treatment in both patients suggested that iatrogenic injuries were sustained during endoscopic procedure. In the first patient, brachial plexus sustained direct structural damage as well as thermocoagulation damage. Operative findings in the second case suggested that mechanisms of injury were thermocoagulation, physical manipulation, and significant postoperative hematoma. Retrospective analysis of patient 2 raises concern as to whether spontaneous regeneration would have occurred if we had not neurolyzed it.

Following graft repair, functional recovery has been achieved in the first case, although several negative prognostic factors (the high level of injury and an iatrogenically incurred injury mostly by thermocoagulation) threatened the final outcome (17). Positive perioperative factors included the short interval between the injury and the final so-called 3-month surgery (9). Microscope-assisted interfascicular autologous nerve grafting proved to be the optimal technique for reconstruction of gaps longer than 3 cm (16-18). Intraoperative NAP recordings were helpful in the surgeon’s decision to perform neurolysis only of lesions less than 3 cm (16-18). NAP recordings were helpful in the surgeon’s decision to perform neurolysis only of lesions less than 3 cm (16-18). NAP recordings were helpful in the surgeon’s decision to perform neurolysis only of lesions less than 3 cm (16-18).

CONCLUSION

The two presented cases show that VATS is not without severe complications as EMB methodology suggests. Surgical findings of our patients imply that if this type of complication happens, early surgical exploration could be the best option for the patients.

REFERENCES