

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.e-fjs.com

CASE REPORT

Brachial plexus injury during axillary thoracotomy

Chou-Ming Yeh ^{a,b}, Chia-Man Chou ^{c,*}^a Division of Thoracic Surgery, Taichung Hospital, Department of Health, Executive Yuan, Taichung, Taiwan^b Department of Veterinary Medicine, National Chung Hsing University, Taichung, Taiwan^c Department of Surgery, Taichung Veterans General Hospital, Taichung, Taiwan

Received 25 December 2010; received in revised form 7 March 2011; accepted 16 October 2011

Available online 16 March 2012

KEYWORDSaxillary thoracotomy;
brachial plexus
injury;
mediastinal tumor;
rehabilitation

Summary Brachial plexus injury is a severe neurologic injury that results in functional impairment of the affected upper limb, and it can be difficult to diagnose and manage. We report a woman aged 51 years who developed brachial plexus injury of the right arm after axillary thoracotomy with removal of a mediastinal tumor. Aggressive rehabilitation was promptly neurologic instituted, and the impairment of her arm recovered completely 69 days after surgery. Copyright © 2012, Taiwan Surgical Association. Published by Elsevier Taiwan LLC. All rights reserved.

1. Introduction

Brachial plexus injury in adults is usually a closed injury resulting from considerable traction to the shoulder and is difficult to diagnose and manage.^{1,2} An integration of injury history, physical examination, radiologic findings, and electrodiagnostics can help the diagnosis.² Most brachial plexus lesions are due to traction sustained during birth, but in adults they are usually caused by traffic accidents or following a fall.^{3,4} There is usually a long-term neurologic dysfunction, which results in considerable socioeconomic problems.^{5,6}

Axillary thoracotomy is a simple and rapid approach for treatment of pulmonary and mediastinal lesions with minimal muscular transections and mild postoperative pain.^{7,8} Axillary thoracotomy, like other thoracic surgery procedures, has complications that may include bleeding and infection⁷; however, brachial plexus injury after axillary thoracotomy has never been reported in the literature.

We hereby report a woman aged 51 years who developed right brachial plexus injury after axillary thoracotomy with removal of a mediastinal tumor, and pertinent articles in the literature are reviewed.

2. Case report

A woman aged 51 years had undergone partial cervical thyroidectomy for nodular goiter 5 years previously. A mediastinal tumor was incidentally found by a routine chest radiograph. Chest computed tomography (CT) showed

* Corresponding author. Department of Surgery, Taichung Veterans General Hospital 160, Section 3, Taichung Port Rd., Taichung 40705, Taiwan.

E-mail address: cmchou@vghtc.gov.tw (C.-M. Chou).

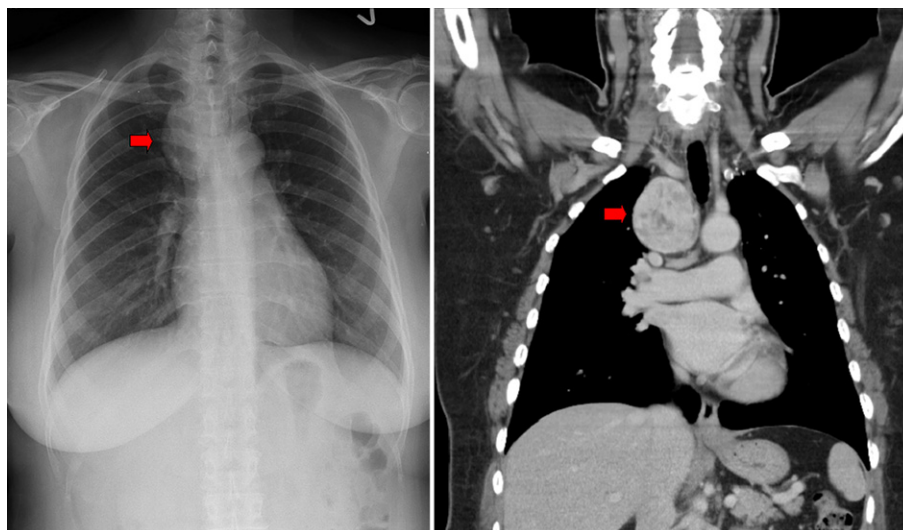


Figure 1 Chest radiography (left) showing a right mediastinal mass (arrow) with tracheal compression. Chest computed tomography (right) showing a well-enhanced lesion (arrow) in the right paratracheal region.

a well-defined mass 4.5 cm in diameter in the right paratracheal region, apparently not connected with the thyroid (Fig. 1). During the operation, she was placed in a left decubitus position with hyper-abduction of the right arm (Fig. 2). Axillary thoracotomy with removal of the mediastinal tumor was performed via the right second intercostal space and the operation lasted for 130 minutes. The pathology report showed an ectopic goiter. Postoperatively, the patient experienced right arm numbness and weakness. On postoperative Day 14, neurologic examinations, including nerve conduction studies (NCS), electromyography (EMG) and magnetic resonance imaging (MRI) of the cervical spine were performed and demonstrated right brachial plexus injury. As shown in Fig. 3A, motor NCS of

the right axillary and musculocutaneous nerves showed severely reduced amplitude of action potential (AP), prolonged distance, and latency. The right radial and median nerves showed mildly reduced AP amplitude. Both ulnar nerves and the left median, radial, axillary, and musculocutaneous nerves, including nerve conduction velocity and F waves, were normal. Sensory NCS of the median and ulnar nerves were normal on both sides. Needle EMG of the right deltoid and biceps muscles showed presence of positive sharp waves and fibrillation potential with no volitional activity. The right triceps and brachioradialis muscles showed mildly reduced recruitment, and the right rhomboid major muscle was normal. MRI of the C-spine revealed no evidence of root lesions. A rehabilitation program,

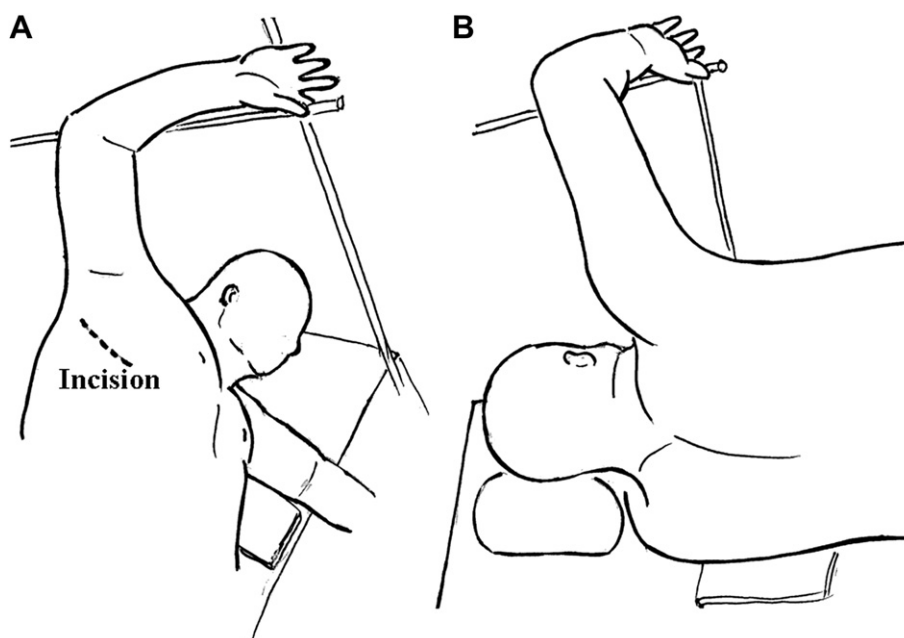


Figure 2 Schematic drawings of the patient's position during the operation: (A) anterolateral view; (B) posterior view.

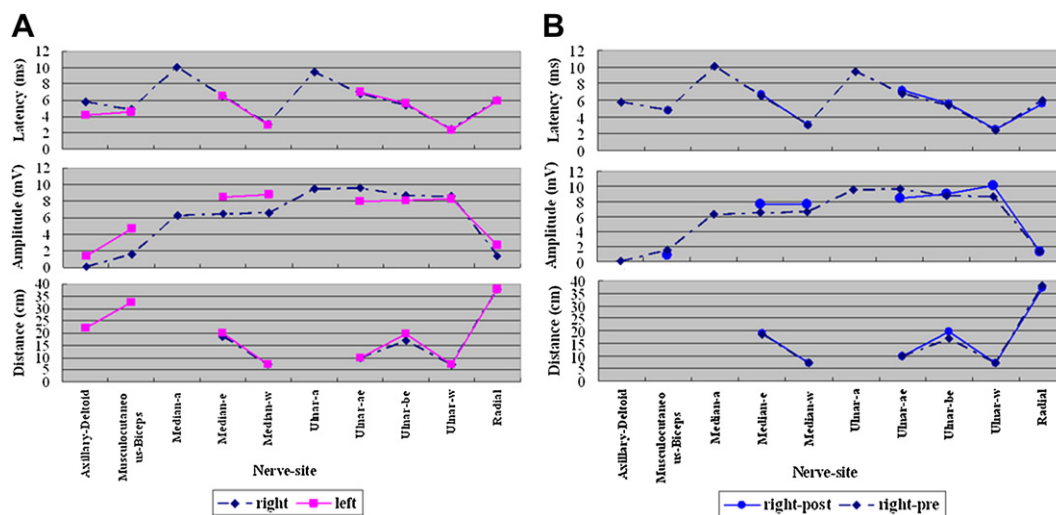


Figure 3 Results of motor nerve conduction studies for both upper limbs before the rehabilitation program: (A) results of motor nerve conduction studies of right upper limbs before rehabilitation; (B) 3 weeks after the rehabilitation program. a = axillary; ae = above elbow; be = below elbow; w = wrist.

including hot packing, muscle stimulation, and strengthening treatment, was scheduled. Repeated NCS on postoperative Day 36 (Fig. 3B) still showed no motor conduction response of the right axillary nerve, although there was a mild improvement in the AP amplitude of the right median nerve. Needle EMG of the right biceps and brachioradialis muscles demonstrated severe denervation without volitional activity, and the right deltoid muscle showed severe denervation with single motor unit potential. The right triceps and rhomboid major muscles were normal. The rehabilitation program was continued. By postoperative Day 69, the patient had completely recovered without symptoms of right upper limb weakness or numbness.

3. Discussion

Surgical approaches for removal of a mediastinal tumor include median sternotomy, thoracotomy, and a minimally invasive approach (video-assisted mediastinoscopy or thoracoscopy). Median sternotomy and traditional thoracotomy provide good exposure of the thoracic cavity and thus facilitate effective and safe resection of the mediastinal tumor, especially a large one.⁹ Compared with mediastinal sternotomy and traditional thoracotomy, osteomuscular sparing axillary thoracotomy allows adequate exposure of the pleural cavity without any resection of chest wall structures. In addition, it is easy to perform, faster to repair, and decreases postoperative pain.^{7,8} Minimally invasive surgery, of course, provides less postoperative pain and shorter hospital stay with smaller incisions, but must be used to treat smaller mediastinal tumors. No matter what kind of procedure is considered, the most important point is to perform a smooth and safe operation in a reasonably short amount of time.¹⁰ In this case, the tumor was adjacent to the superior vena cava and right common carotid artery. We chose axillary thoracotomy rather than video-assisted thoracoscopic surgery

because axillary thoracotomy allows excellent exposure to avoid vascular injury and bleeding.

Postoperative brachial plexus injuries have been reported in some surgeries, such as coronary artery bypass grafting, especially during internal mammary artery harvesting, and thoracoscopic sympathectomy for axillary hyperhidrosis, but it is rare in thoracotomy.^{11–13} The injury should not be caused by the procedure itself, but sternal retraction may result in injurious compression of the brachial plexus or dorsal overextension of the abducted arm during the operation.^{11,12} Brachial plexus injury in this patient probably resulted from limited exposure with hyper-abduction of the right arm during the operation.

Treatment varies depending on the mechanism and the length of time after the injury.^{4,13} In those with closed injury, the nerve is probably still in continuity, and the patient may be followed clinically for 2 to 5 months.¹³ Nerve regeneration can occur if the nerve tissue components are preserved.³ The majority of injuries will heal in days or months; however, residual deficits may persist.^{3,11} If there is no reversal of the neurologic deficit by that time, surgical intervention is warranted.¹³ Moreover, an aggressive rehabilitation program is essential in the treatment of brachial plexus injuries, even those occurring postoperatively.⁶

In this case, postoperative brachial plexus injury was noted and was successfully treated after an early and intensive rehabilitation program. Surgeons should be aware of the possibility of this type of injury during operation.

References

1. Yoshikawa T, Hayashi N, Yamamoto S, et al. Brachial plexus injury: clinical manifestations, conventional imaging findings, and the latest imaging techniques. *Radiographics*. 2006;26: S133–S143.
2. Rovak JM, Tung TH. Traumatic brachial plexus injuries. *Mo Med*. 2006;103:632–636.

3. Benjamin K. Part 1. Injuries to the brachial plexus: mechanisms of injury and identification of risk factors. *Adv Neonatal Care*. 2005;5:181–189.
4. Desai DC, Uribe A, Lachman T. Brachial plexus injury due to compression: an alternate mechanism of injury: case report and review of the literature. *Am Surg*. 1997;63:487–489.
5. Shin AY, Spinner RJ, Steinmann SP, Bishop AT. Adult traumatic brachial plexus injuries. *J Am Acad Orthop Surg*. 2005;13:382–396.
6. Ramos LE, Zell JP. Rehabilitation program for children with brachial plexus and peripheral nerve injury. *Semin Pediatr Neurol*. 2000;7:52–57.
7. Dürreleman N, Massard G. Axillary thoracotomy. MMCTS, doi:10.1510/mmcts.2006.001834.
8. Shu Q, Zhang Z, Zhu X, et al. Transaxillary minithoracostomy in intrathoracic surgery for 316 infants and children. *Chin Med J*. 2003;116:1008–1010.
9. Koga H, Yamataka A, Kobayashi H, Miyamoto H, Lane GJ, Miyano T. Median sternotomy provides exposure for excising anterior mediastinal tumors in children. *Pediatr Surg Int*. 2005; 21:864–867.
10. Kaneko K. Thoracoscopic surgery. *Kyobu Geka*. 2009;62(8 suppl):718–722.
11. Chong AY, Clarke CE, Dimitri WR, Lip GY. Brachial plexus injury as an unusual complication of coronary artery bypass graft surgery. *Postgrad Med J*. 2003;79:84–86.
12. Lee PH, Hsieh LF, Hong CZ. Unilateral brachial plexus injury as a complication of thoracoscopic sympathectomy for hyperhidrosis: a case report. *Arch Phys Med Rehabil*. 2003;84: 1395–1398.
13. Blaauw G, Muhlig RS, Vredevelde JW. Management of brachial plexus injuries. *Adv Tech Stand Neurosurg*. 2008;33: 201–231.