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Treatment of scapular winging with modified Eden-Lange procedure in patient with pre-existing glenohumeral instability

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Primary scapular winging typically results from palsies of the serratus anterior, trapezius, and rhomboid muscles, which are caused by injury to the long thoracic nerve, spinal accessory nerve, and dorsal scapular nerve, respectively.[11-13] The Eden-Lange procedure has become the surgical treatment of choice for scapular winging from trapezius palsy[7,16] because other surgical procedures have high failure rates.[11] In this procedure the levator scapulae muscle is transferred laterally to the scapular spine, and the rhomboid minor and major are both transferred laterally to the infraspinous fossa. The modification of this procedure by Bigliani and coworkers[3,7] includes transfer of the levator scapulae muscle laterally to the scapular spine and lateral transfer of the rhomboid minor and major to the supraspinous and infraspinous fossae, respectively. The modified and standard Eden-Lange procedures have been shown to be successful in eliminating scapular winging by restoring the major actions of the trapezius muscle.[3,4,7,8,16-18]

Our review of the English-language literature revealed only one report of a patient who had an Eden-Lange procedure for scapular winging performed in the setting of glenohumeral instability.[7] The purpose of this case report is to describe the use of the Eden-Lange procedure to treat a patient with scapular winging who had pre-existing multidirectional glenohumeral instability. The scapular winging resulted from a blow to the patient's neck from a lacrosse stick. The winging exacerbated the underlying instability and pain, which had previously been minimally symptomatic. Consequently, the patient's symptoms limited participation in physical therapy and prohibited any possible improvement in stability. Therefore, the modified Eden-Lange procedure was performed, and postoperatively, the patient had fewer symptoms of instability after a proper physical therapy program.

Case report

A 21-year-old right hand–dominant man (weight, 69.4 kg; height, 172.7 cm; body mass index, 23.3) presented to our clinic with a chief complaint of right shoulder pain and instability. The patient related underlying instability that worsened after being struck with a lacrosse stick across the neck while playing 4 years ago. His pain was currently 6 of 10 on a visual analog scale with attempts at lifting objects over chest level and reaching over his head and behind his back. He had impairment with many other activities of daily living including the inability to sleep on his side, wash his back, lift 10 lb overhead, reach high to a shelf, throw a ball overhead, or participate in sports.

The patient further reported a sense of instability beginning around the age of 12 years. The opposite shoulder was also loose but less pronounced than the right side. By the time the patient was aged 15 years, he was able to spontaneously dislocate and relocate his right shoulder. In the following year, this condition began to interfere with some activities of daily living, especially in sports requiring throwing and overhead catching motions. There was no discrete injury that caused the shoulder instability. The patient managed the instability by routinely performing isometric exercises at home as taught by his primary care physician.

Ethical review committee statement: Each author certifies that his institution has approved the reporting of this case, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Table I Preoperative and postoperative measures of shoulder pain and function

Pain and function questionnaires	Preoperative clinic visit	33-mo follow-up after Eden-Lange procedure
10-cm VAS score on typical day (best possible score, 0)	6.0	2.1
ASES score (best possible score, 100)	38.3	72.8
WORC score (best possible score, 0 [100%])	827 (61%)	543 (74%)
Simple Shoulder Test* (No. of yes responses)	12/12	10/12
DASH score (possible score, 0)	31	13
Short form 36†		
Physical functioning	75.0	95.0
Role limitations because of physical health	25.0	100.0
Role limitations because of emotional problems	33.3	100.0
Energy/fatigue	75.0	75.0
Emotional well-being	68.0	68.0
Social functioning	100.0	100.0
Pain	57.5	77.5

ASES, American Shoulder and Elbow Surgeons; *DASH*, disabilities of the arm, shoulder and hand; *VAS*, visual analog scale; *WORC*, Western Ontario rotator cuff.

* Number of yes responses/number of questions ("yes" responses correlate with better shoulder function than "no" responses).

† All questions are scored from 0 to 100, with 100 representing the highest level of functioning possible. Aggregate scores are compiled as a percentage of the total points possible.

After the lacrosse injury that occurred at age 17 years, the patient's shoulder dysfunction became more problematic and his subluxation was so great that he had to make a constant effort to position his shoulder to prevent dislocation. He could no longer play lacrosse because of the shoulder dysfunction, and the isometric exercises became insufficient for managing the instability. He had never participated in a formal physical therapy program for these symptoms, which he now attributed to worsening of his underlying multidirectional instability by what he described as the relatively more recent ''shoulder winging.''

The patient was in good overall health and had no personal or family history of hypertension, heart disease, or muscle disease. He did not have a history of smoking, and he drank about 2 alcoholic beverages per week. Physical examination showed very prominent rhomboids, but the trapezius was flaccid. The trapezius palsy resulted in obvious lateral scapular winging as would be expected with this condition.[11,13]

There was pain and high-grade subluxation with crank and jerk maneuvers, as well as a moderate sulcus sign. Right shoulder active forward flexion was 160° and abduction was 130°, but the patient showed pain and guarding. For comparison, the left shoulder had full range of motion (active forward flexion was 180° and abduction was 180°), mild subluxations, and a mild sulcus sign. Manual muscle testing showed 5 of 5 strength in all planes of shoulder motion, and the deltoid strength was also normal. The patient scored 0 of 9 on the Beighton scale, suggesting no significant generalized joint hyperlaxity.[2] Radiographic examination showed no abnormalities. Electromyography and nerve conduction studies confirmed the presence of right spinal accessory nerve injury with no evidence of trapezius innervation.

The treatment plan was to correct the scapular winging with surgery and then institute a physical therapy program for the underlying multidirectional glenohumeral instability. If the therapy program failed, then surgery to correct the instability was the next step. This approach was based on the unpublished experience of a colleague, who has noted that (1) it is difficult for patients to rehabilitate their shoulder when both procedures are performed and (2) it is important to achieve scapular stabilization first; then subsequent procedures that are aimed at glenohumeral stabilization are less likely to fail (L. Bigliani, written communication, October 2008).

To restore the dynamic actions of the trapezius, the senior author (J.G.S.) performed a modified Eden-Lange procedure in accordance with the description of Galano et al.[7] With the patient under general anesthesia and in the left lateral decubitus position with the head of the bed elevated 15°, an incision was made along the length of the medial border of the scapula. The rhomboid major and minor muscles were transferred to the infraspinous and supraspinous fossae, respectively. A second incision was made over the middle portion of the scapular spine for the transfer of the levator scapulae muscle to the scapular spine. A sling and swathe with a small abduction pillow were used postoperatively for 6 weeks. A detailed description of the postoperative rehabilitation and restrictions can be found in the article of Galano et al. Preoperative and postoperative scores of shoulder pain and function are listed in Table I. At 6 weeks after surgery, the patient started physical therapy that emphasized glenohumeral strengthening in addition to periscapular muscle strengthening.[21]

At final follow-up at 33 months after surgery, the patient's scapular winging was eliminated, and his shoulder was now stable even though he had a sensation that it was permanently sitting more forward than before surgery. However, a final axillary-lateral radiograph did not show evidence of subluxation, even though he sensed the forward placement in the position in which the radiograph was taken (Fig. 1). Physical examination showed flaccidity of the upper trapezius and hypertrophy of the levator scapulae, rhomboids, and latissimus dorsi muscles (Fig. 2).

At this final follow-up, the patient was finishing college and worked part time at a boat dealership, where he detailed boats without significant shoulder discomfort. He was able to play lacrosse more effectively than before surgery; however, overhead throwing was avoided as much as possible because of persistent pain with this motion. Although the patient stated that he was very satisfied with his outcome, results from postoperative pain and function questionnaires show residual pain and reduced function. In fact, pain with overhead throwing explained why the Simple

Figure 1 Postoperative axillary-lateral radiograph showing normal glenohumeral anatomy.

Shoulder Test, American Shoulder and Elbow Surgeons, and Western Ontario Rotator Cuff scores at final follow-up were lower than what were expected when compared with his verbal reports of very good to excellent shoulder function. It was surmised that this pain with throwing resulted from impingement symptoms caused during fatigue-induced malposition of the scapula with subsequent reduction in arm abduction.[18] Nevertheless, he did not take medications for pain. He also stated that he avoided lifting anything heavier than 10 lb straight off of the ground because of reduced strength in the axial direction. This was attributed to residual weakness in addition to inferior subluxability of the glenohumeral joint that occurred only with this activity.

Discussion

Paralysis of the trapezius muscle is usually caused by injury to the spinal accessory nerve,[7,11,13] which is at risk of trauma because it courses superficially through the posterior triangle of the neck.[13] Blunt trauma resulting from a direct blow from a hockey or lacrosse stick, which is what happened to our patient, has been associated with spinal accessory nerve palsy.[4,7,13] Neck dissections and other types of injuries such as blunt trauma, football tackles, gunshot wounds, stabbings, and bite injuries have also been described as causes of spinal accessory nerve injury and subsequent trapezius palsy.[4,7,13,17]

Treatments for spinal accessory nerve injury, such as nerve exploration with neurolysis, direct nerve repair, or nerve grafting, might be successful if performed within

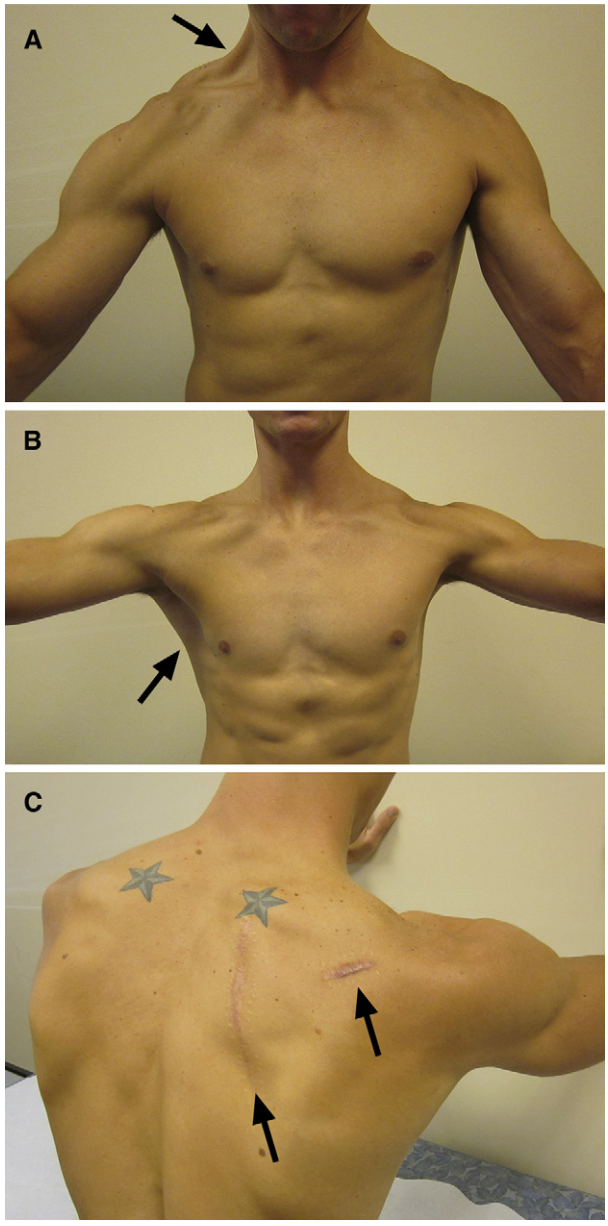

Figure 2 Postoperative photographs showing muscle hypertrophy of right (**A**) levator scapulae and (**B**) latissimus dorsi, obtained while the patient elevated his arms against resistance. (**C**) Photograph showing surgical scars from modified Eden-Lange procedure, as well as correction of scapular winging, obtained while the patient pushed against a wall.

6 months of some injuries.[1,7,9,14,18,20] However, our patient was injured 4 years before surgery, which made primary repair options or nerve grafting unfeasible. Conservative treatment and physical therapy for spinal accessory nerve injuries have been shown to be unsuccessful because of the inability to adequately strengthen adjacent muscle groups to compensate for the trapezius palsy.[3,4,6,10,12,15,18,19]

Therefore, the modified Eden-Lange procedure was chosen as the surgical treatment for our patient's lateral scapular winging. This procedure allowed him to achieve

good results in terms of pain relief, strength, and stability after a routine physical therapy program (Table I). The outcomes surveys showed some residual dysfunction that the patient tended to minimize in his discussions with us. This is similar to the experience of Bodack et al,[5] who noted that patients who had this surgery often deny shoulder dysfunction because they are using compensatory techniques.

Our review of the English-language literature showed one case of a patient with underlying glenohumeral instability, which also was addressed at the time of the Eden-Lange procedure. As described by Galano et al,[7] this previous patient was an 18-year-old football player who also had concomitant suprascapular nerve palsy, glenohumeral instability, and a subscapularis tear in addition to trapezius palsy. In contrast to our patient, the instability resulted from a discrete traumatic event. This patient underwent the modified Eden-Lange procedure, as well as concurrent pectoralis major transfer. No additional glenohumeral stabilization procedure was required (W. Levine, written communication, October 2011).

Conclusions

Our patient's shoulder pain and instability attributed to dysfunctional scapulothoracic kinematics and stability that were caused by trapezius palsy were significantly improved with the modified Eden-Lange procedure. Correction of the scapular winging allowed him to participate in physical therapy for his underlying atraumatic multidirectional glenohumeral instability, which strengthened the shoulder muscles sufficiently to gain adequate stability for his daily activities and athletic participation. As a result, he no longer complained of shoulder instability, and improvement in terms of pain relief, stability, and strength was shown with the American Shoulder and Elbow Surgeons score (increasing from 38.3 to 78.2) and other outcome measures (Table I) with no requirement for a stabilization procedure.

Disclaimer

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