Modified Eden-Lange Procedure for Trapezius Paralysis with Ipsilateral Rotator Cuff-Tear Arthropathy

A Case Report

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Scapular winging typically results from serratus anterior dysfunction caused by injury to the long thoracic nerve or from trapezius dysfunction caused by injury to the spinal accessory nerve[1,2]. The surgical treatment of choice for scapular winging caused by trapezius palsy is the Eden-Lange procedure[3,4]. This procedure, as modified by Bigliani et al.[3,5], includes transfer of the levator scapulae muscle laterally to the scapular spine, and lateral transfer of the rhomboid minor and major muscles to the supraspinatus and infraspinatus fossae, respectively. (In the "standard" procedure, the rhomboid minor and major muscles are both transferred to the infraspinatus fossa.) Many studies have documented the success of the modified and standard Eden-Lange procedures in eliminating scapular winging by restoring the major actions of a flaccid trapezius[3-9]. However, to our knowledge, there are no reports of patients who had an Eden-Lange procedure performed in the setting of a concurrent chronic, large rotator cuff tear with glenohumeral arthritis (rotator cuff-tear arthropathy [RCTA]). We report on a patient with RCTA that evolved from minimally symptomatic to substantially symptomatic after he developed ipsilateral trapezius palsy as the result of a radical neck dissection for thyroid cancer; we describe the use of the Eden-Lange procedure in this patient with advanced rotator cuff disease. The patient was informed that data concerning his case would be submitted for publication, and he provided his consent.

Case Report

A sixty-six-year-old right-hand-dominant man (weight, 108 kg; height, 178 cm; body-mass index, 34.4 kg/m^2) presented to our clinic with right shoulder pain and weakness three months after having undergone radical neck dissection for thyroid cancer that had spread to nearby lymph nodes. During the neck surgery, a segment of the spinal accessory

Fig. 1

Preoperative anteroposterior radiograph of the shoulder showing humeral head elevation with narrowing of the subacromial space as well as glenohumeral arthritis in the superior aspect of the joint.

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nerve (cranial nerve XI) with enveloping cancerous tissue had been resected, subsequently resulting in scapular winging. The patient also had received postsurgical radiation.

The patient reported substantial pain with routine activities, which he rated 5 of 10 on a 10-cm visual analogue scale (VAS). Other preoperative measures of his general health as well as the shoulder pain and function are listed in Table I. Six years previously, he had undergone an open repair of a massive rotator cuff tear with an acromioplasty on the same shoulder. He stated that "my right shoulder was only mildly painful and weak last year, but now it is killing me." He also reported an increased "grinding sensation" with shoulder use. He deliberately limited his shoulder motion and avoided lifting. He was taking ibuprofen and acetaminophen for the pain, which still occurred with minimal use of the shoulder. Additional medications included lisinopril and hydrochlorothiazide for hypertension, and levothyroxine for postsurgical hypothyroidism. He did not have a history of alcohol consumption, and he had quit smoking cigarettes in 1991. The surgical history included bilateral total knee replacement and a left rotator cuff repair.

Physical examination showed that the right trapezius was flaccid and did not exhibit any palpable contractions. The trapezius palsy resulted in obvious lateral scapular winging with prominence of the superior border of the scapula, as expected[2]. Active forward flexion of the right shoulder was 70° and active abduction was 45°, and both were notably painful. Passive shoulder flexion was 130° and passive abduction was 110°. A positive drop-arm sign was associated with subacromial crepitance, and moderate pain was elicited with impingement (Neer) and impingement reinforcement (Hawkins-Kennedy) maneuvers[10-12]. Mild pain and glenohumeral crepitance were also noted with shoulder external rotation with the elbow at the patient's side. Manual muscle testing showed 4+/5 shoulder external rotation strength, and the deltoid muscle contraction was robust. There was no evidence of subscapularis weakness or shoulder instability or of other neurological impairment.

Radiographs showed moderate arthritic changes at the superior aspect of the glenohumeral joint and a high-riding (superiorly subluxated) humeral head (Fig. 1). Electromyography and nerve conduction studies confirmed the presence of severe right spinal accessory nerve injury with ongoing denervation of the trapezius muscle.

To restore the dynamic actions of the trapezius muscle, a modified Eden-Lange procedure was performed in accordance with the description by Galano et al.[3]. The only revision from the modified technique reported by Bigliani et al.[5] was the use of a suture anchor in the scapular spine for the levator scapulae

TABLE I Data Before and After Modified Eden-Lange Procedure*

		After Eden-Lange Procedure			
	1st Clinic Visit (Before Eden-Lange Procedure)	6-Mo Follow-up	9.5-Mo Follow-up (with Stress Fracture)	12-Mo Follow-up	24-Mo Follow-up
Active forward flexion *(deg)*	70	155	145	150	150
10-cm VAS score on typical day (best = 0)	5.3	1.5		0.1	0.4
ASES score (best = 100)	40			90	95
WORC score (best = 0 [100%])	1471 (30%)	580 (72%)		751 (64%)	162 (92%)
Simple Shoulder Test†		12/12		9/12	10/12
DASH score (best = 0)	55	15		14	5
Short Form-36†					
Physical functioning	60	60		75	75
Role limitations due to physical health	0	0		25	25
Role limitations due to emotional problems	0	0		66.6	66.6
Energy/fatigue	10	30		50	60
Emotional well-being	68	72		80	92
Social functioning	37.5	75		85	100
Pain	32.5	45		55	77.5
General health	45	45		55	35

*ASES = American Shoulder and Elbow Surgeons, WORC = Western Ontario Rotator Cuff Index, and DASH = Disabilities of the Arm, Shoulder and Hand. †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, with use of the RAND scoring table.

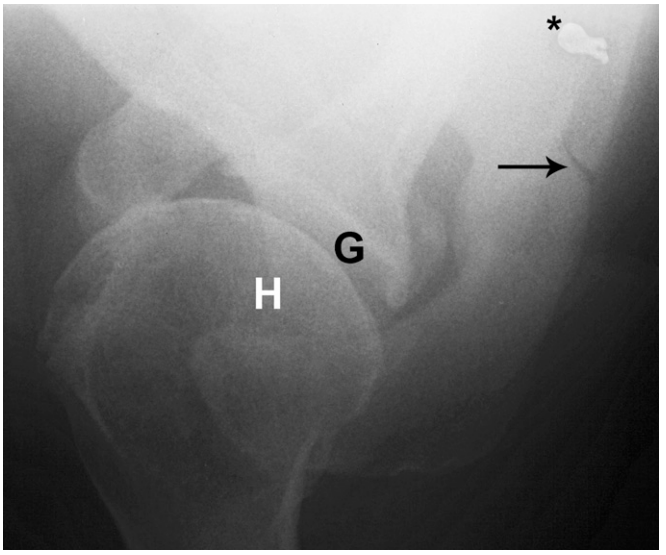

Fig. 2-A

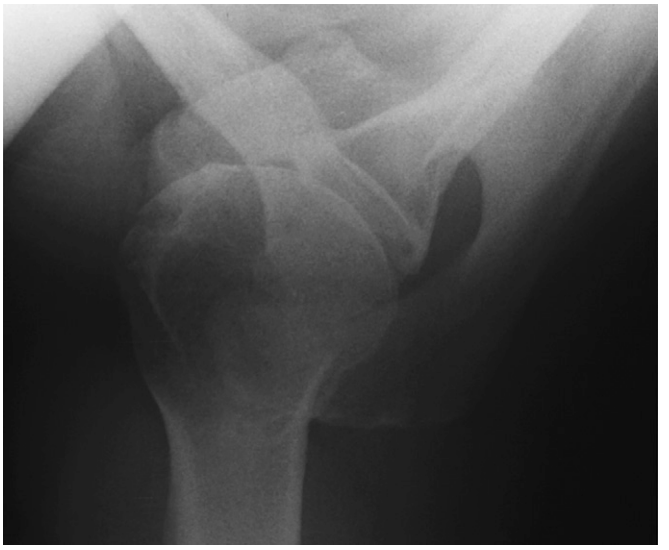

Fig. 2-B

Fig. 2-A Axillary lateral radiograph showing the lateral portion of the scapular spine, the humeral head (H), and the glenoid (G). The object in the scapular spine is the suture anchor (asterisk), which was used to facilitate reattachment of the transferred levator scapulae muscle. Lateral to the suture anchor is the linear lucency (arrow, pointing to the left edge of the lucency) that appeared to be a stress fracture, which developed in the ninth postoperative month. This stress fracture fully resolved (see Fig. 3-A). **Fig. 2-B** Axillary lateral radiograph of the contralateral shoulder for comparison.

muscle transfer. This use of a suture anchor, which is not routine, was employed in this case to firmly apply the lateral-most portion of the transferred levator scapulae muscle while limiting lateral extension of the incision.

Postoperative scores for shoulder pain and function are listed in Table I. The patient had four months of supervised physical therapy postoperatively. The only untoward event occurred approximately nine and a half months after surgery, when

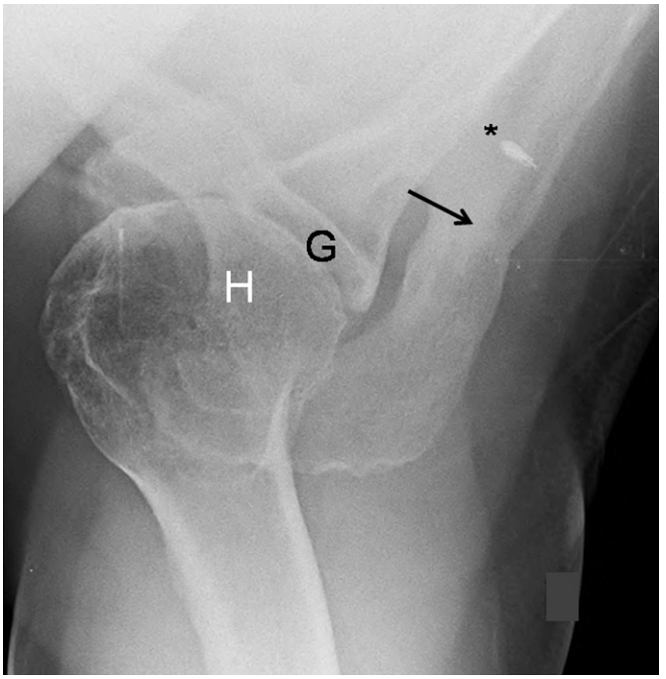

Fig. 3-A

Fig. 3-B

Fig. 3-A Axillary lateral radiograph showing the location of the healed scapular spine stress fracture (arrow), which is lateral to, but in close proximity of, the suture anchor (asterisk). Arthritic changes in the glenohumeral joint are apparent. H = humeral head and G = glenoid. **Fig. 3-B** Anteroposterior radiograph made twenty-six months after surgery shows arthritic changes and the persistence of the humeral head elevation. Acromioclavicular arthritis is also notable.

he reported increasing pain following six weeks of substantially increased shoulder use and strengthening exercises. The pain was localized over the lateral portion of the scapular spine; a radiograph revealed a stress fracture in this area (Figs. 2-A and 2-B). The stress fracture was approximately 3 cm lateral to the suture anchor, and this proximity may have been a factor in the occurrence of the stress fracture. The pain subsided after a two-month cessation of active shoulder motion (only passive-assisted motion was allowed during this time), and it did not recur.

At the time of final follow-up thirty months postsurgery, the patient stated "my shoulder is doing great." The scapular winging was eliminated, the pain was negligible, and the subacromial crepitation was greatly reduced. The only problems that he noted were mildly reduced strength and fatigue with repetitive overhead reaching. The stress fracture had completely healed (Fig. 3-A). Although the humeral head remained high-riding (Fig. 3-B), no additional surgery for the underlying RCTA was warranted.

Discussion

Restoring a stable scapulothoracic articulation was the key to achieving a very good result after a modified Eden-Lange procedure for trapezius palsy in our patient with preexisting RCTA. In a study of the surgical management of trapezius palsy, Teboul et al.[9] found that patients over the age of fifty and/or those who had undergone a previous radical neck dissection were most likely to experience poor outcomes following an Eden-Lange procedure. In contrast, our patient, who was sixty-six years old, had underlying RCTA, and had undergone a previous radical neck dissection, had a good outcome.

In many cases of spinal accessory nerve injury, a prolonged period of observation (for a minimum of twelve months) is warranted when the injury is not the result of neurotmesis[7,13]. However, Martin and Fish[1] noted that, in contrast to serratus anterior dysfunction from a long thoracic nerve injury, a trapezius muscle that is dysfunctional due to spinal accessory nerve injury does not consistently recover function with conservative management[5,7,8,14-17]. One reason for the failure of conservative treatment is the inability of a physical therapy exercise program to adequately strengthen adjacent muscle groups to compensate for the flaccid trapezius[5,7,8]. Although some treatments for spinal accessory nerve injury, including nerve exploration with neurolysis, direct nerve repair, or nerve grafting, may be beneficial if performed within six months after injury[7,18-21], the fact that our patient had had a portion of the nerve resected and subsequent regional radiation therapy made nonoperative options or nerve grafting unfeasible. We speculate that, in addition to the "good shoulder function" before neck surgery, the relatively short duration (four months) between the spinal accessory nerve injury and the modified Eden-Lange procedure might have contributed to the overall very good outcome. This short duration may have minimized disuse atrophy of the deltoid and rotator cuff muscles.

Besides the development of a stress fracture of the scapular spine, the coexistence of two major shoulder diagnoses made our case novel. Increased pain attributable to the exacerbation of the preexisting RCTA may be explained by the altered scapular stability and the mechanics that resulted from scapular winging. Specifically, in conditions of scapular winging, the scapular muscles cannot properly rotate the acromion away from the humerus as the arm is elevated, likely contributing to impingement of the rotator cuff and secondary tendinopathy[22]. Subluxation of the humeral head upward through the large rotator cuff tear was indicative of poor glenohumeral kinematics, and the scapular destabilization further compromised the already weak rotator cuff and mechanically disadvantaged deltoid muscle. Restoration of a stable scapular base allowed the patient to regain overhead motion even though the radiographic finding of a high-riding humeral head persisted (Fig. 3-B).

To our knowledge, the development of a stress fracture of the lateral portion of the scapular spine as a complication of an Eden-Lange procedure has not been previously reported. Stress fractures of the scapular spine and acromion have been reported in the setting of RCTA, and they probably result from increased stresses and/or acromial erosion associated with humeral head elevation[23,24]. In our case, the proximity to the suture anchor may have contributed to the stress fracture. Following a period of rest with subsequent overall reduced shoulder exercise and use, this fracture completely resolved.

We located only a few reported cases of patients who had an underlying full-thickness rotator cuff tear that had not been surgically repaired at the time of an Eden-Lange procedure. Galano et al.[3] described a patient who, in addition to having a modified Eden-Lange procedure for trapezius palsy, had concomitant suprascapular nerve palsy, glenohumeral instability, and a subscapularis tear; this patient also underwent concurrent pectoralis major transfer.

In conclusion, our patient's shoulder pain and weakness from RCTA substantially worsened as a result of a dysfunctional scapulothoracic articulation that was caused by a trapezius palsy. The modified Eden-Lange procedure yielded an excellent result in terms of pain relief and a very good result in terms of strength. Additional surgery for the preexisting RCTA was not needed through thirty months of follow-up. ■

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