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Research Article

Outcomes of the Latarjet Procedure in Recurrent Anterior Shoulder Instability Due to Tramadol-Induced Seizure

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Abstract

Background: This study was aimed to evaluate the final results of surgical treatment (Latarjet procedure) in the recurrent anterior shoulder instability following episodes of tramadol-induced seizure.
Methods: From January 2005 to March 2013, 47 patients with recurrent anterior shoulder dislocation after suffering a seizure episode following tramadol use underwent surgical procedure. There were 53 shoulders in 47 male patients (six had bilateral recurrent dislocations). The mean age of the patients at the time of operation was 24.7 years (ranging from 20 to 44 years). The average number of episodes of anterior shoulder dislocation before surgery was 16.
Results: External rotation with the elbow at the side improved from 45.8 ± 9.3° (30°-60°) pre-operatively to 61.5 ± 7.8° (45°-90°) post-operatively ($P < 0.001$). Forward elevation also increased significantly post-operatively ($P = 0.002$). Mean pre-operative Rowe score was 28.41 ± 4.30 (30-85) which increased to 73.57 ± 8.40 post-operatively. The Western Ontario Shoulder Instability Index (WOSI) score decreased from 1352 ± 74 to 618 ± 46 ($P < 0.0001$).
Conclusion: Correcting glenoid bone loss by Latarjet procedure combined, if necessary, with humeral head defect reconstruction could be a proper treatment method in patients experiencing recurrent anterior shoulder dislocation after idiosyncratic seizure reaction of tramadol.

Keywords: Seizure; Shoulder Dislocation; Tramadol

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Background

Tramadol is a synthetic opioid-like analgesic which acts centrally with weak mu (μ)-opioid agonist properties. It is a weak inhibitor of norepinephrine and serotonin reuptake, often prescribed for cancer or postoperative pain. It acts through both opioid and non-opioid mechanisms that can cause physical and psychological addiction (1, 2). Tramadol has been reported to have adverse effects including headache, dizziness, dysphoria, central nervous system (CNS) stimulation, and seizures (3, 4). Tramadol overdose has been found to induce respiratory depression, bradycardia, seizure, and coma. At common clinically effective doses, tramadol has been reported to mildly decrease the severity of seizures (5). However, at comparatively higher doses, tramadol has paradoxically been shown to cause seizures (5). Prescription of selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants, monoamine oxidase (MAO) inhibitors, or other drugs that decrease the seizure threshold could enhance the neurotoxic effects of tramadol. Alcohol ingestion, epilepsy, and head trauma have been reported as predisposing factors for tramadol-induced seizure (6). Standard doses of tramadol are 50 mg orally, 50-100 mg parenterally, and 100 mg rectally. The suggested maximum dose of tramadol is 400 mg/day (7, 8). According to the result of two surveys, the minimum dose that causes seizure is 200 mg (9, 10).

During recent years, due to the availability of tramadol as a pain killer in our country, its abuse has dramatically increased (11, 12). Shoulder dislocation is considered as an important issue in epileptic patients (13, 14). It can be the consequence of forceful muscle contractions during the seizure. While most cases of posterior dislocation of the humeral head have been reported in these patients, anterior dislocation also is still the most likely pattern. Common secondary bony injuries to the anterior rim of glenoid and posterior humeral head make anterior dislocation susceptible to becoming recurrent. Treatment options for anterior shoulder instability include arthroscopic or open soft-tissue repair, arthroscopic or open bone block procedures augmenting the anteroinferior glenoid rim, and/or filling the humeral head. In patients with seizure episodes, it has been shown that bony defects, either on the glenoid or humeral side or both, are so large that classic arthroscopic Bankart repair has a high failure rate (15). Therefore, bony procedures such as Bristow, Latarjet, and Hill-Sachs repair either by arthroscopic remplissage or allograft reconstruction seem to be more efficient surgical options. The aim of this study was to evaluate the final result of Latarjet procedure in recurrent anterior shoulder instability due to tramadol-induced seizure.

Methods

From January 2005 to March 2013, 64 adult patients with shoulder dislocations after a seizure episode due to tramadol abuse were admitted in Imam Khomeini Hospital Complex institute. Five cases had acute posterior dislocation or fracture-dislocation, three cases came with acute anterior fracture-dislocation, and three cases

experienced only one episode of shoulder dislocation. These 14 patients have been excluded from the study. The other 50 cases that underwent surgery for recurrent anterior dislocation (more than one episode of dislocation) were included in our study (another three patients were excluded because of loss to follow-up after the surgery). None of them had any history of previous shoulder surgery. All of them had confirmed history of seizure episode due to tramadol abuse. All patients were examined by neurologists in order to exclude other causes of seizures. Preoperative clinical examination involved active affected shoulder range of motion (ROM) using a goniometer, apprehension test, posterior instability test, relocation test, and the Rowe and Western Ontario Shoulder Instability Index (WOSI) scores. Radiographic investigations including true anteroposterior (AP) view in internal rotation and computed tomography (CT) including 3-dimensional reconstruction and humeral head subtraction (en face view) were requested for all patients. 53 shoulders in 47 male patients were studied (six had bilateral recurrent dislocations). A detailed history of drug abuse by our patients during their preoperative visits was taken. In all cases, the first dislocation happened during the seizure due to tramadol abuse, whereas the other episodes of shoulder dislocation occurred during daily activities or playing sports and we have found no signs of trauma during post seizure physical examination by reviewing their medical records. The study was done in Tehran University of Medical Sciences, Tehran, Iran. All of the patients were informed about all aspects of the study and signed the informed consent before the surgery.

Surgical Technique: In all cases except one, surgical technique was the modified Latarjet according to Burkhart et al. (16). All the procedures were performed by single surgeon (first author). Surgery was performed in the semi-sitting position through a limited deltopectoral approach. The coracoacromial ligament (CAL) was incised about 1 cm from its coracoid attachment and after release of pectoralis minor, coracoid osteotomy was conducted. Preparation of coracoid graft was done by flattening of inferior surface using an oscillating saw and two 2.5mm drill holes were made perpendicular to this surface approximately 1 cm apart. The subscapularis muscle was split alongside the line of its fibers at the interval between its superior 2/3 and the inferior 1/3. At the level of the joint line, the joint capsule was incised vertically. The bone bed of anterior glenoid surface was prepared by high-speed burr after excision of labrum and medial capsule. Two or three suture anchors were placed to reattach capsule to the anterior rim just beneath the bone block. The position of the coracoid was checked as the 4.5mm cancellous screws were tightened to prevent any lateral overhanging. The anterior capsule was augmented by suturing CAL over it. In a 27-year-old patient with more than fifty dislocations and several episodes of seizure, almost 50% of anterior glenoid bone loss was found on CT scan. The coracoid process thickness was considered insufficient to compensate for glenoid bone loss and osteochondral scapular allograft was used for glenoid reconstruction. The mean follow-up period was 48.2 months (ranging from 34 to 58 months). Pre- and post-operative apprehension sign, active shoulder ROM, Rowe score, and subjective WOSI score were documented. Standard AP and axillary views were done at the latest follow-up to determine union of coracoid graft and the presence and stage of possible osteoarthritis (OA) based on the method of Samilson and Prieto (17). Sling and swathe was prescribed for three weeks after the operation. Activities of daily living were permitted at six weeks and complete return to sports activities after achievement of healing of the coracoid graft by clinical and radiological evaluation at about 6 months (Figure 1).

Figure 1. Final follow-up radiograph of one of our patients undergoing Latarjet procedure

Statistical analysis was carried out by means of SPSS software (version 18.0, SPSS Inc., Chicago, IL, USA). The numerical results are expressed as mean ± standard deviation (SD) and student t-test analysis was performed for their comparison. Probability values of less than 0.05 were considered significant. Ethics Committee of Research and Development Department of Tehran University of Medical Sciences approved all the procedures.

Results

Baseline characteristics of study population including age, sex, side of involvement, follow-up time, and tramadol dose of usage are summarized in table 1.

Table 1. Baseline characteristics of the patients

Parameters	Value (percent)
Patients (number of shoulders)	47 (53)
Site [n (%)]	22 (41.6)
Right	19 (35.9)
Left	6 (11.5)
Bilateral	27 (50.9)
Dominant shoulder	26 (33.3)
Non-dominant shoulder	22 (41.6)
Sex [n (%)]	
Male	47 (100)
Mean age (year) (range)	24.7 (20 to 44)
Mean tramadol consumption (mg) (range)	800 (400 to 2000)
Mean number of dislocation before the surgery (range)	16 (3 to 63)
Mean follow-up time (month) (range)	48.2 (34 to 58)

We found that some of them experienced seizure episode by only single dose of tramadol abuse, while varying amounts of drug abused have been reported (from 800 mg to 1600 mg at one session of drug abuse). On the other hand, some of them were addicted to daily use of this drug by different doses. In all cases, tramadol was used orally. The average duration of tramadol consumption before the seizure was 10 months (ranging from 3 to 25 months). The mean age of the patients at the time of operation was 24.7 years (ranging from 20 to 44 years). The dominant and the non-dominant shoulders were similarly affected. The mean interval between the first episode of shoulder dislocation and operation was 20.5 months (ranging from 8 to 31 months) and the average number of episodes of anterior shoulder dislocations before surgery in our patient group was 16 (ranging from 3 to 63). The mean percentage of glenoid defects, Hill-Sachs defects, and their association with WOSI has been shown in table 2.

Table 2. Correlation of number of dislocation episodes, Hill-Sachs, and glenoid defects percentages with Western Ontario Shoulder Instability Index (WOSI)

Parameters	WOSI	P-value
Number of dislocations (n)	18 ± 8	0.01
Hill-Sachs size (%)	24 ± 8	0.15
Glenoid loss (%)	23 ± 7	0.17

WOSI: Western Ontario Shoulder Instability Index

Before the operations, all patients showed a positive apprehension test at 45 degrees of abduction (so called bony apprehension test), whereas at the final follow-up, only three patients had a positive test at 90° of abduction. External rotation with the elbow at the side improved from 45.8 ± 9.3° (30°-60°) pre-operatively to 61.5 ± 7.8° (45°-90°) post-operatively (P < 0.0001). Forward elevation also increased from 149.3 ± 11.2 to 155.3 ± 8.7 post-operatively (P = 0.002). The increment in abduction and internal rotation also has been shown in table 3.

Table 3. Comparison of the pre-operative versus final follow-up of range of motion (ROM), Western Ontario Shoulder Instability Index (WOSI), and Rowe score

ROM	Mean ± SD	P-value
Abduction (°)		< 0.0001
Pre-operative	135.60 ± 11.30	
Final follow-up	165.80 ± 8.40	
External rotation (°)		< 0.0001
Pre-operative	45.80 ± 9.30	
Final follow-up	61.50 ± 7.80	
Internal rotation (°)		< 0.0001
Pre-operative	45.70 ± 6.30	
Final follow-up	62.40 ± 3.10	
Forward elevation (°)		0.0020
Pre-operative	149.30 ± 11.20	
Final follow-up	155.30 ± 8.70	
WOSI		< 0.0001
Pre-operative	1352.00 ± 74.00	
Final follow-up	618.00 ± 46.00	
Rowe score		< 0.0001
Pre-operative	28.41 ± 4.30	
Final follow-up	73.57 ± 8.40	

ROM: Range of motion; WOSI: Western Ontario Shoulder Instability Index; SD: Standard deviation

The mean pre-operative Rowe score was 28.41 ± 4.30 (16-47). The mean scores for the Rowe subgroups were 22 points (10-32), 12 points (0-14), and 16 points (0-23) for stability, motion, and function, respectively, while at final follow-up, the mean Rowe scores was 73.57 ± 8.40 points (43-96) (P < 0.001). Mean scores for the Rowe subgroups were as follow: 36 points for stability (ranging from 15 to 53), 15 points for motion (ranging from 7 to 20), and 23 points for function (ranging from 9 to 29) (P < 0.0001). The WOSI score decreased from 1352 ± 74 to 618 ± 46 postoperatively (P < 0.001). 10% of the patients (6 patients) experienced postoperative seizures because of relapse of the tramadol usage, but only in one patient (2%), re-dislocation has been diagnosed with breakage of the graft that underwent revision surgery. Signs of OA were detected in four patients (7.5%): three cases were considered as mild; all of them had more than 50 episodes of dislocation. The glenoid defect (using 3-dimensional CT en face view) in these patients was 23%, 27%, and 27%, respectively. One patient had moderate OA. He was the patient in whom the large glenoid defect was reconstructed by osteoarticular allograft.

Discussion

Shoulder dislocation can be a consequence in the epileptic patients, especially during grand mal seizures (13-15). The incidence of posterior shoulder dislocation, including fracture dislocations and locked posterior dislocations, has been documented (13, 15, 18-23). On the other hand, anterior shoulder dislocation in epileptic patients is also frequently reported, but choosing the best treatment option is controversy (14, 15). While satisfactory outcomes are reported for posterior dislocation, the outcomes of anterior dislocation treatment are less favorable (15). Good acceptable long-term outcomes, with low rates of recurrence, have been previously reported in two studies by Hovelius et al. (24, 25) and a study by Lunn et al. (26). Patients with dislocation induced by seizure are thought to be at high risk for recurrence, and so the outcomes of soft tissue-related surgeries are less favorable in comparison with bony reconstructive operations (14, 15, 27). Small case series showed 100 percent failure rate following soft-tissue surgeries such as the Putti-Platt procedure (n = 3) and the capsular shift alone (n = 1) (15). In addition to high risk of recurrent seizures, these group of patients usually have significant humeral and glenoid bone loss (15%-40% and 15%-35%, respectively, in this study). Therefore, the Latarjet procedure is a suitable technique for treatment of such patients, because it addresses both glenoid and humeral head bone defects.

In 1995, Hutchinson et al. (14) reported their results in epileptic patients after bone-buttress procedures. They documented the results of 15 operations in 13 patients with a mean age of 29 years at the time of procedure. Ten dislocations occurred during seizures, three were traumatic and two without any detectable cause. All patients were managed with a bone augmentation to the anterior glenoid using either femoral head allograft or iliac crest autograft. They found outstanding clinical outcomes in terms of the Constant-Murley score (mean 91 points) with no case of re-dislocations, while eight patients continued suffering from seizures. No OA changes of the shoulder joint were found in radiographic investigations at the end of a mean follow-up of 2.7 years. In our study, pre-operative OA changes were more than Hutchinson et al.'s study (14) which affected the glenohumeral joints. Comparatively long delay between the initial dislocation and index surgery, the extent of bone loss on the humeral and glenoid sides, and the significant number of dislocations in our cases could explain this finding.

10% of the patients (6 patients) experienced postoperative seizures, but only in one patient (2%) re-dislocation has been diagnosed with breakage of the graft that underwent revision surgery. The incidence of re-dislocation in patients without seizure who have been operated with this technique was between 0% and 15% (28-31). In one case with the failure of the Latarjet procedure, we conducted revision surgery, by means of a large iliac crest autograft similar to that introduced by Hutchinson et al. (14). We thought that the vigorous muscle contractions during a seizure episode might cause recurrent dislocation irrespective of the method of bone reconstruction applied.

In Buhler and Gerber study of a series of 17 anterior and 17 posterior dislocations in patients with seizure, they found high percentage of re-dislocation after bone block reconstruction with a mean follow-up of ten years (15). Their overall incidence rate of recurrence was 47%; five of the eight recurrent dislocations were happened following seizure episodes. Raiss et al. (32) reported the outcomes of Latarjet procedure in 12 patients (14 shoulders) with anterior recurrent shoulder dislocation as a consequence of seizure episodes. All patients experienced their first dislocation during a seizure. With mean follow-up period of 8.3 years, the mean postoperative Rowe score was 76, while re-dislocation happened in 6 cases and recurrent seizure episodes were found in 8 of them. The mean age of

our patients was 24 years, which is younger than the patients analyzed by Raiss et al. (32). On the other hand, all of our cases were stated to have seizure episodes exclusively due to tramadol abuse, that was reconfirmed by physical examination by a single neurologist.

In published reports by Hutchinson et al. (14), Buhler and Gerber (15), and Raiss et al. (32) patients were seizure-free for a minimum of 2 months before operation, but still, recurrence of seizures was found in all of these studies and was considered as the main cause of complications.

In our study, as reported with an acceptable sample size (47 patients) the re-dislocation rate was the same as study of Hutchinson et al. (14) and was lower than studies of Buhler and Gerber (15), and Raiss et al. (32) with smaller sample sizes (0%, 40%, and 43%, respectively). This may be attributable to the statement that our patients were seizure-free after cessation of the tramadol abuse, while other studies were unable to control seizure episodes effectively. In order to better evaluate the outcomes of this procedure in this specific patient group, we need to do a multicenter study with long-term follow-up, so we can find uncommon complications related to the procedure; and on the other hand, comparative studies related to either open or arthroscopic Latarjet and Bankart procedure may be necessary.

Conclusion

Tramadol abuse can induce seizure causing severe bony damages in the shoulder joint that may result in recurrent anterior shoulder dislocation. Correcting glenoid bone loss by Latarjet procedure combined, if necessary, with humeral head defect reconstruction, after control of addiction might be a successful treatment method in these patients.

Conflict of Interest

The authors declare no conflict of interest in this study.

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