



Original Article

Evaluation of functional results from shoulders after arthroscopic repair of complete rotator cuff tears associated with traumatic anterior dislocation



Glaydson Gomes Godinho^{a,b,c,*}, José Márcio Alves Freitas^{a,b,c},
Flávio de Oliveira França^{a,b,c}, Flávio Márcio Lago Santos^{a,b,c},
Leandro Furtado de Simoni^{a,b,c}, Pedro Couto Godinho^{a,b,c}

^a Hospital Ortopédico, Belo Horizonte, MG, Brazil

^b Hospital Lifecenter, Belo Horizonte, MG, Brazil

^c Hospital Belo Horizonte, Belo Horizonte, MG, Brazil

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ABSTRACT

Objective: To evaluate the clinical outcome of arthroscopic rotator cuff fixation and, when present, simultaneous repair of the Bankart lesion caused by traumatic dislocation; and to assess whether the size of the rotator cuff injury caused by traumatic dislocation has any influence on the postoperative clinical outcomes.

Methods: Thirty-three patients with traumatic shoulder dislocation and complete rotator cuff injury, with at least two years of follow up, were retrospectively evaluated. For analysis purposes, the patients were divided into groups: presence of fixed Bankart lesion or absence of this lesion, and rotator cuff lesions smaller than 3.0 cm (group A) or greater than or equal to 3.0 cm (group B). All the patients underwent arthroscopic repair of the lesions and were evaluated postoperatively by means of the UCLA (University of California at Los Angeles) score and strength measurements.

Results: The group with Bankart lesion repair had a postoperative UCLA score of 33.96, while the score of the group without Bankart lesion was 33.7, without statistical significance ($p=0.743$). Group A had a postoperative UCLA score of 34.35 and group B, 33.15, without statistical significance ($p=0.416$).

Conclusion: The functional outcomes of the patients who only presented complete rotator cuff tearing after traumatic shoulder dislocation, which underwent arthroscopic repair, were similar to the outcomes of those who presented an associated with a Bankart lesion that was corrected simultaneously with the rotator cuff injury. The extent of the original rotator cuff injury did not alter the functional results in the postoperative evaluation.

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* Corresponding author.

E-mail: glaydsongg@gmail.com (G.G. Godinho).

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Avaliação dos resultados funcionais dos ombros submetidos ao reparo artroscópico de roturas completas do manguito rotador associadas a luxações traumáticas anteriores

R E S U M O

Palavras-chave:

Ombro
Artroscopia
Ruptura
Manguito rotador
Luxação do ombro

Objetivo: Avaliar o desfecho clínico da fixação artroscópica do manguito rotador (MR) e, quando presente, a correção simultânea da lesão de Bankart, causadas por luxação traumática. Avaliar se a dimensão da lesão do MR causada por luxação traumática influenciou nos resultados clínicos pós-operatórios.

Métodos: Foram avaliados retrospectivamente 33 pacientes com luxação traumática do ombro e lesão completa do manguito rotador e seguimento mínimo de dois anos. Para fins de análise, os pacientes foram divididos em grupos: presença de lesão de Bankart fixada ou ausência da lesão e lesões do MR menores do que 3 cm (grupo A) ou iguais a ou maiores do que 3 cm (grupo B). Todos foram submetidos a reparo artroscópico das lesões e avaliados, pós-operatoriamente, pelo escore da UCLA (University of California at Los Angeles) e medida da força.

Resultados: O grupo em que houve o reparo da lesão de Bankart apresentou UCLA pós-operatório de 33,96, em relação ao grupo em que essa lesão não estava presente 33,7, sem significância estatística ($p=0,743$). O grupo A apresentou resultado de UCLA pós-operatório de 34,35 e grupo B 33,15, sem significância estatística ($p=0,416$).

Conclusão: Os resultados funcionais dos pacientes que apresentaram apenas rotura completa do manguito rotador após luxação traumática do ombro, submetidos ao reparo artroscópico, mostrou-se semelhante àqueles que apresentaram associação da lesão de Bankart, corrigida simultaneamente com a lesão do manguito rotador. A extensão da lesão inicial do manguito rotador não alterou os resultados funcionais na avaliação pós-operatória.

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Introduction

The shoulder is the joint with greatest mobility and instability in the human body, and for this reason it is the one most liable to dislocate.¹

Glenohumeral dislocation may cause tearing of the rotator cuff. This is relatively rare among patients under the age of 40 years but more frequent among patients over this age.²⁻⁴ Rotator cuff injuries are the main complication documented after shoulder dislocation among patients over the age of 40 years.⁵ This is due to the different injury patterns presented by the static and dynamic stabilizers in these groups.

Capsuloligamentous anterior static stabilizers, which were described by McLaughlin et al.,⁶ have a fundamental role in young individuals' shoulders, but not in patients over the age of 40 years. When they are injured, this is expressed in the form of Bankart lesions.⁷ After this age, the function of the rotator cuff as a dynamic stabilizer has fundamental importance and, when injured, this generates what Debiski et al.⁸ and Craig et al.⁹ described as posterior instability, with consequently increased anterior translation due to loss of the posterosuperior blockage that the rotator cuff provides.

Combined repair of Bankart lesions and rotator cuff injuries, when present, is still a matter of controversy in the literature. Few studies have been published, and these have all been retrospective. With the advent of arthroscopy for treating rotator cuff injuries, instead of open surgery, the biggest issue

today is whether associated repair of Bankart lesions is necessary or not. It is better established that in these situations, rotator cuff injuries should always be repaired.

The objectives of this study were to evaluate the clinical outcomes from arthroscopic fixation of the rotator cuff and, when present, simultaneous correction of Bankart lesions caused by traumatic anterior dislocation of the shoulder; and to evaluate whether the magnitude of rotator cuff injuries caused by traumatic dislocation influenced the postoperative clinical results.

Material and methods

This was a retrospective study covering the period from September 1998 to March 2012. Over this period, 36 patients with traumatic anterior dislocation of the shoulder in association with complete tearing of the rotator cuff underwent surgical treatment by means of videoarthroscopy. The patients were operated by the four titular surgeons of the group.

The inclusion criteria were that the patients needed to have a clinical and radiographic diagnosis of traumatic anterior glenohumeral dislocation in association with complete tearing of the rotator cuff and that their cases were reevaluated by means of magnetic resonance imaging and clinical examination after a minimum follow-up of two years.

Patients presenting the following were excluded from the study: previous surgery on the shoulder, glenohumeral

arthrosis, incomplete documentation, not located for evaluation, fracture associated with the scapular belt, previous neurological lesions and Bankart lesions with bone loss from the glenoid greater than 20% of the anteroposterior diameter, with injury to the anteroinferior capsule alone.

This study was approved by the ethics committee of the orthopedics hospital.

Thirty-three patients fulfilled the prerequisites for participation in the study: 22 males (67%) and 11 females (33%). Their mean age was 56 years (range: 34–81).

All the patients were right-handed. Twenty-four were affected in the right shoulder (72%) and nine in the left shoulder (28%).

The minimum length of follow-up was 24 months and the maximum was 108 months; the mean was 39 months.

The traumatic cause was the reason for coming to the initial consultation, in the cases of all the patients.

The number of dislocations ranged from one to more than 20 episodes: 18 patients (54%) presented only one episode; 13 (40%) from two to ten; and two (6%), more than 20 dislocations.

Twenty-two patients (66%) presented Bankart lesions in association with complete tearing of the tendons of the rotator cuff. Eleven patients (33%) presented shoulder instability, with complete tearing of the tendons of the rotator cuff but without the presence of Bankart lesions.

To classify the injuries, the criteria of Cofield¹⁰ were used. For the purposes of statistical analysis, the small and medium-sized injuries were put together into group A and the large and extensive injuries into group B. Thus, 20 patients (60%)

presented rotator cuff injuries smaller than 3 cm (small and medium-sized group) and 13 (40%) had injuries greater than or equal to 3 cm (large and extensive group), in the anteroposterior dimension of the injuries.

Two patients presented three-way associations between dislocation, rotator cuff injury and axillary nerve injury (“unfortunate triad”).

After the operation, the functional evaluation was made using the UCLA score.¹¹ Strength was evaluated using a domestic spring balance with a maximum load of 12 kg (Performance Plus[®]), with the patient positioned in accordance with the Jobe test, i.e. at abduction of 90° and frontal-plane flexion of 30°, in an upright standing position (Fig. 1). The elbow was kept extended, with maximum pronation of the forearm.¹² With one of the extremities of the strength measurement device fixed to the patient’s foot and the other to the limb that was to be examined, the patient was asked to maintain maximum distension of the system for five seconds and the force attained was recorded.¹³

All the patients were evaluated using radiographic images in views that comprised a trauma series¹⁴: neutral anteroposterior view, with the patient inclined at 30° on the side examined; “true anteroposterior view”; lateral view of the scapula; and simple lateral view of the axilla. In addition, the lateral view of the acromion (outlet view)¹⁴ and strict lateral view of the glenoid (Bernageau view)¹⁵ were used.

Surgical technique

The surgical position used for all the patients who underwent arthroscopic repair was lateral decubitus, with longitudinal and vertical traction on the limb.

The procedure was started with joint inspection,¹⁶ by means of a posterior portal. When a lesion of the anterior labroligamentous complex was present, an anterosuperior portal and an anteroinferior portal were added.¹⁷

Two or three threaded metal anchors of diameter 4 mm were inserted in accordance with the extent of the labral deinsertion. Non-absorbable no. 2 threads were attached to the anchors, and these were used for capsulolabral reconstruction, with retensioning of the anteroinferior labroligamentous complex (capsular shift effect) (Fig. 2).¹⁸

Tenotomy of the biceps was performed when there was evidence of advanced degeneration or instability.

After the procedure on the joint, bursectomy was performed, with debridement of the borders of the lesion. Measurements were made along its anteroposterior and lateromedial axes using a millimeter ruler.¹⁹

Threaded anchors of diameter 5 mm were inserted in the greater tubercle, with non-absorbable no. 2 thread attached to them. The synthesis on the lesion was performed using tendon-bone sutures and modified Mason-Allen stitches²⁰ and/or side-to-side stitches, depending on the elasticity and shape of the lesion (Figs. 3 and 4).

Acromioplasty was performed when signs of subacromial friction were seen during bursoscopic investigation.

Excision of the inferior acromioclavicular osteophyte (partial Munford procedure) was indicated when this was presented exuberantly and when it was seen to have participated in the impact as an coadjuvant. Complete excision of 1 cm



Fig. 1 – Positioning method and measurement of strength using a domestic spring balance, in accordance with the position of the Jobe test.

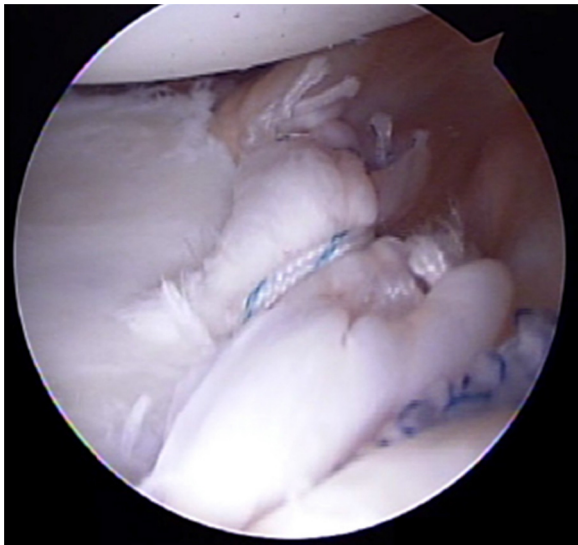


Fig. 2 – Suturing and retensioning of the capsulolabral complex using anchors and high-tension thread.

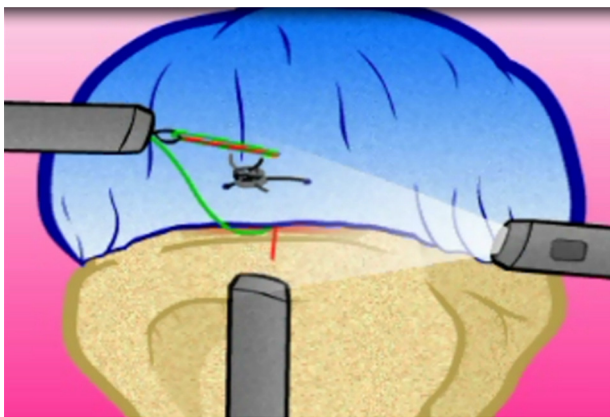


Fig. 3 – Method for performing Mason-Allen stitches, with passage of a simple stitch through the U-shaped stitch (mattress) that serves as an anchor.



Fig. 4 – Final view of the Mason-Allen stitch.

of the acromial extremity of the clavicle (total Mumford procedure) was indicated when there were radiographic signs of joint degeneration, in association with a well-defined clinical condition of local pain.

The patients were instructed to use an abduction sling with an auxiliary pad for a minimum of three weeks in cases of rotator cuff injuries of up to 2 cm in diameter and for six weeks in cases of injuries greater than 2 cm.

After the sling had been withdrawn, a rehabilitation program was started, consisting of analgesia, hydrotherapy, rehabilitation of the passive and autopassive ranges of motion (ROM). Strengthening of the rotator cuff muscles, initially by means of isometric exercises, was started 60 days after the operation in cases of lesions smaller than 2 cm and 90 days after the operation in cases of lesions larger than 2 cm, provided that the passive ROM had been recovered. Isotonic strengthening was introduced 90 days after the operation for the lesions smaller than 2 cm and 120 days after the operation for the lesions larger than 2 cm. Patients were allowed to return to sports six months after the operation. For contact sports, the return was delayed until eight months after the operation.

Evaluation of the patients

The patients were evaluated clinically after the operation by means of the UCLA score. Their strength was measured with the aid of a domestic spring balance, as mentioned earlier.

Statistical analysis

To evaluate differences in UCLA scores after the operation between the patient groups, the Mann-Whitney test was used.

The data from this study were processed using the Statistical Package for the Social Sciences (SPSS), version 17.0. The significance level was taken to be $p < 0.05$, for all the statistical measurements made.

Results

The UCLA variable was evaluated statistically with the variable of presence of Bankart lesions and with the variable of absence of Bankart lesions, and no statistical difference was seen between them (Table 1).

In evaluating the variable of postoperative UCLA score in relation to groups A and B of the rotator cuff injuries (respectively, lesions smaller than 3 cm and greater than or equal to 3 cm), no statistical difference was observed (Table 1).

Discussion

Dislocation of the shoulder associated with rotator cuff injury is greatly studied today. However, although this is a relatively frequent occurrence, few studies on this topic have been published.

The consequences of anterior dislocation among patients over the age of 45 years are markedly different from those in younger populations.²¹⁻²³ Reves and Itoi reported that the incidence of rotator cuff injuries was 30% among patients presenting dislocation who were over the age of 40 years and 57% among those over the age of 50 years. In the present study, one

Table 1 – Patient distribution according to UCLA score and the variables of repair or non-repair of the Bankart lesion and extent of the rotator cuff injury.

Variable	Group	N	Mean	SD	Median	p-Value
UCLA after operation	Bankart repaired	23	33.96	1.77	35.00	0.743
	Absence of Bankart	10	33.7	3.13	35.00	
UCLA after operation	Rotator cuff injury < 3 cm (Group A)	20	34.35	1.09	35.00	0.416
	Rotator cuff injury ≥ 3 cm (Group B)	13	33.15	3.21	35.00	

Note: The probabilities of significance (p-values) relate to the Mann-Whitney test.

patient (3%) under the age of 40 years presented rotator cuff injuries in association with dislocation.

Berbig et al.⁵ evaluated 167 patients after dislocation of the shoulder. Among patients with anterior dislocation of the shoulder who were under the age of 60 years, the incidence of rotator cuff injuries was 8.2%. Among those over the age of 60 years, the incidence of associated rotator cuff lesions was 56%. In our study, 42% of the rotator cuff injuries were present among patients over the age of 60 years and 58% below this age.

Most of the studies have only addressed repair of rotator cuff injuries and have not evaluated Bankart lesions, regarding their presence or absence or regarding their repair or non-repair. In relation to Bankart lesions, authors such as Porcellini et al.²⁴ have proposed that they are present in all cases. They argued that rotator cuff injuries were inconsistent and therefore treatment of Bankart lesions should be considered to be essential for these patients. They found a mean postoperative Constant score for combined repair of the rotator cuff and Bankart lesions of 69.4. Other authors, such as Gumina et al.,²⁵ were able to report results that were even more satisfactory. In three out of five patients with dislocation and rotator cuff injuries, in whom Bankart lesions were present and were repaired, the mean postoperative Constant score was 77. Lastly, in a retrospective study, Voos et al.²⁶ analyzed the results from repairs to rotator cuff injuries that were associated with Bankart lesions, without discriminating between partial and complete rotator cuff tears. They found that 16 patients presented a mean postoperative ASES score of 95.8. In our study, we found that 10 patients with dislocation presented rotator cuff injuries without any Bankart lesion. Repair of these cases of rotator cuff injury alone did not present any statistically significant difference in UCLA scores, in relation to the group of 23 patients in whom Bankart lesions were also present and were repaired (33.7 vs 33.96, respectively).

Taking into consideration the extent of the rotator cuff injury and the clinical repercussions of its surgical repair among the patients with traumatic dislocation and rotator cuff injury, there is an even greater scarcity of studies in the literature. Gumina et al.²⁵ obtained a mean postoperative Constant score of 80 points, for five patients with large injuries who underwent repair of the rotator cuff alone, with a minimum follow-up of two years. For three patients with small or medium-sized injuries, the result was a score of 78 points for the same procedure. For three patients with extensive

injuries, simultaneous repair produced a postoperative Constant score of 77 points. Thus, these scores were very similar and did not show any significant difference. Their study was concordant with our results, in which the patients in group A obtained a postoperative UCLA score of 34.35, while group B had a postoperative score of 33.15, which was also not a statistically significant difference. In a retrospective analysis on 150 patients between the ages of 40 and 60 years, with the same diagnosis, Porcellini et al.²⁴ also did not find any statistically significant associations between patients with complete tears of the subscapularis tendon, extensive tears of the rotator cuff and tears of the supraspinatus tendon alone, which is also concordant with the data found in our study.

Sang-Jin Shin et al.²⁷ showed that there is still no consensus regarding the structures that should be repaired: rotator cuff injuries, Bankart lesions, or both. These authors showed that only through repairing both structures could shoulder stability be restored without losing range of motion. They also reported that when both structures were repaired, attention was given to taking care to avoid excessive tensioning of the suture, so as to avoid the risk of stiffness and secondary arthrosis.

With advances in arthroscopy and better knowledge of the anatomy and physiology of the shoulder joint, the concept of instability has become more wide-ranging and has ceased to mean only dislocations and subluxation. This concept has come to include dysfunctions of the shoulder caused by microinstability, which especially in this context, may be caused by the existence of an uncorrected Bankart lesion. This may originate clinical manifestations of pain and functional deficit, especially among patients in the age group of over 40 years who practice sports that involve throwing.²⁸

We did not observe any cases of recurrence of dislocation, subluxation or painful trapping after the operation among the patients evaluated, either in group A or in group B. This shows that the treatment was effective, and that there was no correlation with the extent of the initial injury to the rotator cuff.

In our study, two case of the terrible triad of the shoulder were observed: shoulder dislocation in association with rotator cuff injury and axillary nerve injury. In the first case, complete recovery was achieved, with an UCLA score after the rotator cuff repair of 35, after two years of follow-up. The nerve injury was treated conservatively. However, in the second case, the result was not so satisfactory, with an UCLA score after the rotator cuff repair of 25 points. The nerve injury was again treated conservatively. Rockwood and Groh²⁹ were the

first to describe the terrible triad, which was presented in two patients. Although one of their patients presented incomplete neurological recovery at the end of two years, the functional recovery of both of their patients was complete. However, differing from our study, the rotator cuff injury was treated conservatively in both of their case. Likewise, other authors such as Gonzales and Lopez³⁰ and Simonich and Wright,³¹ who took the same approach as in our study, obtained good clinical results at the end of two years of follow-up.

The present study had the limitations of being retrospective and not having a control group formed by patients with Bankart lesions who did not undergo surgical repair.

Conclusion

The functional results from the patients who presented complete tearing of the rotator cuff alone, subsequent to traumatic dislocation of the shoulder, and who underwent arthroscopic repair, were shown to be similar to the results from the patients who presented associated Bankart lesions that were corrected simultaneously with the rotator cuff injuries.

The extent of the initial injury to the rotator cuff did not alter the functional results in the postoperative evaluation.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

- Bahk M, Keyurapan E, Tasaki A, Sauers EL, McFarland EG. Laxity testing of the shoulder: a review. *Am J Sports Med.* 2007;35(1):131-44.
- Reeves B. Arthrography of the shoulder. *J Bone Joint Surg Br.* 1966;48(3):424-35.
- Taylor DC, Arciero RA. Pathologic changes associated with shoulder dislocations. Arthroscopic and physical examination findings in first-time, traumatic anterior dislocations. *Am J Sports Med.* 1997;25(3):306-11.
- Hawkins RJ, Morin WD, Bonutti PM. Surgical treatment of full-thickness rotator cuff tears in patients 40 years of age or younger. *J Shoulder Elbow Surg.* 1999;8(3):259-65.
- Berbig R, Weishaupt D, Prim J, Shahin O. Primary anterior shoulder dislocation and rotator cuff tears. *J Shoulder Elbow Surg.* 1999;8(3):220-5.
- McLaughlin HL. Injuries of the shoulder and arm. In: McLaughlin HL, Harrison L, editors. *Trauma.* Philadelphia: Saunders; 1959. p. 233-96.
- Neviaser RJ, Neviaser TJ, Neviaser JS. Concurrent rupture of the rotator cuff and anterior dislocation of the shoulder in the older patient. *J Bone Joint Surg Am.* 1988;70(9):1308-11.
- Debski RE, Sakone M, Woo SL, Wong EK, Fu FH, Warner JJ. Contribution of the passive properties of the rotator cuff to glenohumeral stability during anterior-posterior loading. *J Shoulder Elbow Surg.* 1999;8(4):324-9.
- Craig EV. The posterior mechanism of acute anterior shoulder dislocations. *Clin Orthop Relat Res.* 1984;(190):212-6.
- Cofield RH. Subscapular muscle transposition for repair of chronic rotator cuff tears. *Surg Gynecol Obstet.* 1982;154(5):667-72.
- Amstutz HC, Sew Hoy AL, Clarke IC. UCLA anatomic total shoulder arthroplasty. *Clin Orthop Relat Res.* 1981;(155):7-20.
- Jobe FW, Moynes DR, Brewster CE. Rehabilitation of shoulder joint instabilities. *Orthop Clin North Am.* 1987;18(3):473-82.
- Godinho GG, Santos FM, Freitas JM. Avaliação da força muscular e da função do ombro, após reparo do manguito rotador. *Rev Bras Ortop.* 1994;29(9):643-6.
- Rockwood CA Jr, Szalay EA, Curtis RJ, Young DC, Kay SP. X-ray evaluation of shoulder problems. In: Rocwood CA Jr, Matsen FA, editors. *The shoulder.* Philadelphia: Saunders; 1990. p. 178-200.
- Bernageau J, Patte D, Debeyre J, Ferrane J. Intérêt du profil glénoidien dans le luxation récidivantes de l'épaule. *Rev Chir Orthop.* 1976; Suppl. 2:62.
- Godinho GG, Souza JM, Oliveira AC, Freitas JM. Artroscopia cirúrgica no tratamento da síndrome do impacto: nossa experiência em 100 casos cirúrgicos. *Rev Bras Ortop.* 1995;30(3):540-6.
- Godinho GG, Souza JM, Freitas JM, Santos FM, Vieira AW, João FM. Tratamento da instabilidade anterior do ombro - Experiência com a técnica de Morgan. *Rev Bras Ortop.* 1997;32(4):261-5.
- Godinho GG. Tratamento cirúrgico da instabilidade anterior do ombro pela técnica artroscópica. In: Pardini Junior AG, editor. *Clínica ortopédica.* Rio de Janeiro: Medisi; 2004.
- Godinho GG. Reparo das lesões do manguito rotador por via artroscópica. In: Pardini Junior AG, editor. *Clínica ortopédica.* Rio de Janeiro: Medisi; 2000.
- Schlegel TF, Hawkins RJ, Lewis CW, Turner AS. An in vivo comparison of the modified Mason-Allen suture technique versus an inclined horizontal mattress suture technique with regard to tendon-to-bone healing: a biomechanical and histologic study in sheep. *J Shoulder Elbow Surg.* 2007;16(1):115-21.
- Rowe CR. Prognosis in dislocations of the shoulder. *J Bone Joint Surg Am.* 1956;38-A(5):957-77.
- Reeves B. Acute anterior dislocation of the shoulder. Clinical and experimental studies. *Ann R Coll Surg Engl.* 1969;44(5):255-73.
- Itoi E, Tabata S. Rotator cuff tears in anterior dislocation of the shoulder. *Int Orthop.* 1992;16(3):240-4.
- Porcellini G, Paladini P, Campi F, Paganelli M. Shoulder instability and related rotator cuff tears: arthroscopic findings and treatment in patients aged 40 to 60 years. *Arthroscopy.* 2006;22(3):270-6.
- Gumina S, Postacchini F. Anterior dislocation of the shoulder in elderly patients. *J Bone Joint Surg Br.* 1997;79(4):540-3.
- Voos JE, Pearle AD, Mattern CJ, Cordasco FA, Allen AA, Warren RF. Outcomes of combined arthroscopic rotator cuff and labral repair. *Am J Sports Med.* 2007;35(7):1174-9.
- Shin SJ, Yoo JC, McGarry MH, Jun BJ, Lee TQ. Anterior capsulolabral lesions combined with supraspinatus tendon tears: biomechanical effects of the pathologic condition and repair in human cadaveric shoulders. *Arthroscopy.* 2013;29(9):1492-7.
- Boileau P, Zumstein M, Balg F, Penington S, Bicknell RT. The unstable painful shoulder (UPS) as a cause of pain from unrecognized anteroinferior instability in the young athlete. *J Shoulder Elbow Surg.* 2011;20(1):98-106.
- Groh GI, Rockwood CA Jr. The terrible triad: anterior dislocation of the shoulder associated with rupture of the rotator cuff and injury to the brachial plexus. *J Shoulder Elbow Surg.* 1995;4 1 Pt 1:51-3.
- Gonzalez D, Lopez R. Concurrent rotator-cuff tear and brachial plexus palsy associated with anterior dislocation of the shoulder. A report of two cases. *J Bone Joint Surg Am.* 1991;73(4):620-1.
- Simonich SD, Wright TW. Terrible triad of the shoulder. *J Shoulder Elbow Surg.* 2003;12(6):566-8.