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Concomitant rotator cuff repair and instability surgery provide good patient-reported functional outcomes in patients aged 40 years or older with shoulder dislocation

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Background: Recurrent anterior shoulder dislocation in patients aged ≥ 40 years is not as rare as once thought. The mechanism of instability in this patient population is different—more likely to be attributed to rotator cuff pathology—compared with that in younger individuals. With an increasingly aging active population, surgical management has a rising role in preventing morbidity associated with recurrent instability. Our purpose was to evaluate outcomes of anterior shoulder instability repair (ie, Bankart or bony Bankart repair) with and without rotator cuff repair (RCR) in patients aged ≥ 40 years.

Methods: We conducted a retrospective chart review of all patients aged ≥ 40 years who underwent surgical repair for anterior shoulder instability from 2008–2016. Patients were categorized into 4 cohorts: Bankart repair only, bony Bankart repair only, Bankart repair with concomitant RCR, and bony Bankart repair with concomitant RCR. Demographic and history-of-instability data were collected. Clinical and functional outcomes assessed included the Single Assessment Numeric Evaluation score, American Shoulder and Elbow Surgeons score, Penn Shoulder Score, visual analog scale score for pain, Western Ontario Shoulder Instability Index score, and patient satisfaction score.

Results: A total of 146 patients were included in this study, with 103 patients (71%) having ≥ 2 -year outcome scores. Outcome scores were not significantly different among groups. For patients who underwent Bankart repair only, bony Bankart repair only, Bankart repair with RCR, and bony Bankart repair with RCR, the Single Assessment Numeric Evaluation scores were 80.8 ± 19.7 , 90.0 ± 10.7 , 79.3 ± 29.4 , and 87.2 ± 10.6 , respectively ($P = .284$); American Shoulder and Elbow Surgeons scores, 83.8 ± 19.7 , 92.4 ± 17.4 , 82.5 ± 25.6 , and 85.6 ± 12.7 , respectively ($P = .114$); Penn Shoulder Scores for function, 84.5 ± 17.9 , 90.9 ± 15.3 , 83.6 ± 25.1 , and 95.7 ± 13.0 , respectively ($P = .286$); and Western Ontario Shoulder Instability Index scores, 481.0 ± 519.5 , 292.1 ± 414.3 , 548.9 ± 690.5 , and 320.6 ± 258.7 , respectively ($P = .713$). Age at the time of surgery significantly differed between cohorts ($P < .001$). No patients had recurrence of instability during the study period.

Conclusion: Similar functional outcomes can be achieved in the surgical management of anterior instability in patients aged ≥ 40 years. Rotator cuff tears should be suspected and repaired in patients with anterior instability, especially those aged ≥ 50 years.

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This study was approved by the Institutional Review Board at Thomas Jefferson University.

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The incidence of primary, traumatic anterior shoulder instability and dislocation after the age of 40 years is less common than that in younger patients.^{18,33} However, with an increasingly active aging population, a rise in traumatic shoulder instability events is seen.^{13,24} When a traumatic dislocation occurs, these patients can often have constant pain, disability, and recurrent instability.^{4,15,24,26,28} Recurrent anterior shoulder dislocation in older patients is not as rare as

once thought. Rowe and Sakellarides²⁰ reported recurrence rates of 24% and 14% in patients aged 41–50 years and 51–60 years, respectively, whereas Walch et al³⁰ noted an 11% rate of recurrence in patients aged > 60 years in their study.¹⁰

The rotator cuff provides significant dynamic stability to the glenohumeral joint via a concavity-compression mechanism.^{6,7} Cadaveric studies have shown that a 50% decrease in rotator cuff integrity leads to a 50% increase in the occurrence of dislocations.¹⁶ Additionally, in comparison to rotator cuff-intact shoulders, a smaller capsuloligamentous lesion induces instability in a rotator cuff-deficient cadaveric model.¹⁶ Given that the prevalence of rotator cuff tears (RCTs) increases with age, with 40%–50% of individuals aged ≥ 50 years having cuff pathology,^{27,32} it is not surprising to find significant literature showing the concurrent incidence of RCTs with shoulder dislocations in older patients.^{4,5,19,23,24,26,29}

Despite extensive literature on anterior shoulder instability surgical management focused on the young and active individual, there is a paucity of literature regarding outcomes of shoulder instability repair in patients aged ≥ 40 years. Given the high incidence of concurrent RCTs in older patients with instability, our purpose was to evaluate outcomes of anterior shoulder instability repair with and without rotator cuff repair (RCR) in patients aged ≥ 40 years.

Materials and methods

Patient selection

We conducted a retrospective chart review of all patients aged ≥ 40 years who underwent surgical repair for anterior shoulder instability with a minimum of 2 years' clinical follow-up. Patients aged < 40 years and/or with < 2 years' clinical follow-up were excluded from this study. The indications for surgery included primary and recurrent instability due to labral and/or rotator cuff pathology. Patients were categorized into 4 cohorts: Bankart repair only, bony Bankart repair only, Bankart repair with concomitant RCR, and bony Bankart repair with concomitant RCR. Procedures were performed from 2008–2016 by 6 shoulder and elbow fellowship-trained surgeons; all were performed arthroscopically.

Data collection

Patient data were obtained via a retrospective chart review. Relevant data included age, sex, handedness, medical comorbidities, age at first dislocation, number of dislocations, traumatic vs. atraumatic mechanism of injury, and time between first diagnosis and repair. Arthritis was noted by the presence of joint space narrowing and/or bone spurs on preoperative radiographic films. Patients were also queried about the postoperative recurrence of instability episodes including frank dislocations and subluxations, complications, and need for revision procedures.

Clinical and functional outcomes were assessed at the time of the retrospective review by using the American Shoulder and Elbow Surgeons (ASES) score,¹² Single Assessment Numeric Evaluation (SANE) score,³¹ Penn Shoulder Score (PENN),⁹ visual analog scale (VAS) score for pain, Western Ontario Shoulder Instability Index (WOSI) score,⁸ and patient satisfaction score. Clinical outcome scores were obtained through chart review, telephone interview, or mail correspondence.

Statistical design

Nonparametric tests were used to compare clinical outcomes across groups. A Kruskal-Wallis nonparametric test was implemented for the 4 cohorts (Bankart repair and bony Bankart repair

with and without RCR), and a Mann-Whitney nonparametric test was used for 2 larger groups (repair with RCR and repair without RCR). Spearman nonparametric correlations were used to examine the correlation between patient outcomes and background variables such as age at first diagnosis and number of dislocations. Analysis of variance and *t* tests were used to compare the cohorts (all 4 cohorts and 2 cohorts, respectively) regarding continuous demographic characteristics (eg, age at first diagnosis). We used χ^2 tests to compare groups regarding categorical variables (arthritis and so on). All analyses were performed using SPSS software (version 23; IBM, Armonk, NY, USA).

Results

Demographic characteristics

After application of the inclusion and exclusion criteria, 146 patients were included. Of these 146 patients, 103 (71%) had ≥ 2 -year outcome scores: 58 of 88 patients in the Bankart repair cohort, 13 of 22 in the bony Bankart repair cohort, 23 of 26 in the Bankart repair-RCR cohort, and 9 of 10 in the bony Bankart repair-RCR cohort. Demographic data are detailed in [Table I](#).

There were no significant differences in sex, number of dislocations, or anchors used in the RCR groups. [Table II](#) shows the distribution of tendons torn and mean number of dislocations, which were not significantly different based on tear location. Patients in the Bankart repair-only group received significantly more labral anchors than those in both RCR groups. The prevalence of arthritis at the time of surgery was nonsignificant between groups ($P = .065$) ([Table I](#)).

Age at the time of surgery significantly differed between cohorts ($P < .001$). The Bankart repair-only cohort was significantly younger than the Bankart repair-RCR cohort ($P < .001$), as well as the bony Bankart repair-RCR cohort ($P < .001$). The patients in the bony Bankart repair-only group were significantly younger than those in the bony Bankart repair-RCR cohort ($P < .001$). Furthermore, there appeared to be a progression in pathology as patients aged. The average age at first diagnosis for each cohort was as follows: 37.9 years for Bankart repair, 46.1 years for bony Bankart repair, 49.5 years for Bankart repair with RCR, and 63.1 years for bony Bankart repair with RCR. Comparison of all cohorts, with the exception of the bony Bankart repair-only vs. Bankart repair-RCR cohort, showed a significant difference in age at first diagnosis ([Table I](#)). Additionally, patients who underwent a Bankart repair (without an RCR) had a significantly longer period from diagnosis until this surgical procedure than patients who underwent a bony Bankart repair—both without and with an RCR (10.6 ± 13.7 years vs. 2.7 ± 6.7 years [$P < .001$] and 6.6 ± 20.9 years [$P < .001$], respectively). Patients who underwent a prior surgical procedure were excluded from this analysis.

Clinical outcomes

There were no statistically significant differences in the following clinical outcome scores among the 4 cohorts of patients: SANE score ($P = .284$), ASES score ($P = .114$), PENN ($P = .286$), VAS pain score ($P = .283$), satisfaction score ($P = .614$), WOSI score ($P = .713$), and WOSI percentage ($P = .610$) ([Table III](#)). Similarly, there were no statistically significant differences in these clinical outcome scores when patients were combined into 2 cohorts: SANE score ($P = .288$), ASES score ($P = .796$), PENN ($P = .644$), VAS pain score ($P = .920$), satisfaction score ($P = .456$), WOSI score ($P = .845$), and WOSI percentage ($P = .730$) ([Table IV](#)).

No patients in any of the groups had a recurrent instability event in our study period. However, 7 patients (4.8%) had complications

Table I
Demographic data

	Bankart repair (n = 88)	Bony Bankart repair (n = 22)	Bankart repair and RCR (n = 26)	Bony Bankart repair and RCR (n = 10)	P value
Age at surgery, yr	46.4 ± 6.7	48.8 ± 6.9	54.4 ± 10.0	63.1 ± 5.3	<.001
Age at first diagnosis, yr	37.9 ± 12.5	46.1 ± 11.2	49.5 ± 12.8	63.1 ± 5.3	<.001
Sex, n	56 M/32 F	13 M/9 F	21 M/5 F	6 M/4 F	.339
BMI, kg/m ²	27.1 ± 5.9	31.2 ± 4.6	27.9 ± 5.3	32.2 ± 6.8	.003
Arthritis at time of surgery, n (%)	38 (43.2)	3 (13.6)	8 (30.8)	3 (30.0)	.065
Mean No. of dislocations	5.1 ± 8.6	4.6 ± 12.8	2.4 ± 2.1	1.0 ± 0.5	.468
No. with prior shoulder surgery (%)	3 (3.4)	0 (0)	8 (29.6)	0 (0)	
No. of labral anchors	4.2 ± 1.7	3.2 ± 1.2	3.0 ± 0.8	2.4 ± 1.0	<.001
No. of RCR anchors	—	—	1.9 ± 1.1	2.1 ± 0.8	.564

RCR, rotator cuff repair; M, male; F, female; BMI, body mass index. Continuous variables are presented as mean ± standard deviation.

Table II
Rotator cuff tendons involved in tear (ie, partial or full) based on postoperative and/or MRI report and mean number of dislocations based on tear location

Tendons involved	n (%)	No. of dislocations, mean ± SD
SST	16 (48.5)	2.2 ± 2.2
SST and IST	3 (9.1)	2.0 ± 1.0
SST, IST, and TM	1 (3.0)	4.0 ± 1.0
SBC	2 (6.1)	2.5 ± 2.1
SBC and SST	6 (18.2)	2.5 ± 1.4
SBC, SST, and IST	5 (15.2)	1.2 ± 0.4

MRI, magnetic resonance imaging; SD, standard deviation; SST, supraspinatus tendon; IST, infraspinatus tendon; TM, teres minor tendon; SBC, subscapularis tendon.

during the 2-year postoperative period. In the Bankart repair–only group, 1 patient had continued pain, 1 had a retear of the labrum, 1 had continued weakness and crepitation, and 1 had an RCT. In the Bankart repair–RCR group, continued pain was noted in 1 patient whereas post-traumatic arthritis developed in 1. In the bony Bankart repair–RCR group, 1 patient had continued pain and underwent revision to an anatomic shoulder replacement. No complications were reported in the bony Bankart repair–only group.

Discussion

The principal finding in this study is that strong functional outcomes can be achieved with Bankart or bony Bankart repair with or without RCR in patients aged ≥ 40 years. To our knowledge, this is the largest cohort study to evaluate 2-year functional outcomes of 4 surgical management options for instability in older patients. The functional and pain scores were not significantly different among the 4 groups, nor were they different when the

groups were separated into concomitant RCR vs. no RCR. Patients in the groups were heterogeneous in terms of age, age at first diagnosis, years between diagnosis and surgery, number of labral anchors placed, and body mass index, making it difficult to draw comparisons between groups and directly evaluate the impact of each specific treatment. However, we did find improved functional outcomes with no recurrences and a low risk of complications across all 4 groups during the 2-year study period. Although we additionally show that RCR provides strong functional gains and restores stability, further investigations should be geared at ascertaining the true value of concomitant cuff repair in these older patients.

Patients who underwent an RCR, whether with Bankart or bony Bankart repair, were significantly older at the time of surgery than those in the Bankart repair–only group. This finding suggests that older patients are more likely to present with RCTs for which they may benefit from concomitant RCR to restore function, relieve pain, and achieve the strong functional and pain outcomes observed at 2 years in our study. Patients undergoing RCR with Bankart repair and bony Bankart repair were found to have delays of 4.8 years and 6.6 years, respectively, from the time of diagnosis to treatment, likely attributed to the perception that instability is rare in the older patient. This is underscored by the Bankart repair–only cohort averaging 10.6 years from the time of diagnosis to surgery, highlighting a possible perception that instability in the absence of an RCT or bony Bankart lesion should be treated conservatively.

The findings of our study are consistent with those in the literature. The mechanism of instability is different in older patients; it is more likely to be due to rotator cuff pathology.^{1,11,14} The reported incidence of RCTs in patients aged > 40 years with a primary, traumatic anterior glenohumeral dislocation is 35%–100%.¹ Neviasser et al¹⁴ evaluated 37 patients aged > 40 years of age (mean age, 59.8 years) with primary anterior dislocation. They reported missed RCTs in all patients, with the development of recurrent instability that was

Table III
Outcome score details comparing all 4 cohorts

Score	Bankart repair (n = 58)	Bony Bankart repair (n = 13)	Bankart repair and RCR (n = 23)	Bony Bankart repair and RCR (n = 9)	P value
SANE	80.8 ± 19.7	90.0 ± 10.7	79.3 ± 29.4	87.2 ± 10.6	.284
ASES	83.8 ± 19.7	92.4 ± 17.4	82.5 ± 25.6	85.6 ± 12.7	.114
PENN	84.5 ± 17.9	90.9 ± 15.3	83.6 ± 25.1	85.7 ± 13.0	.286
VAS	1.3 ± 2.9	0.7 ± 2.2	1.3 ± 2.9	0.9 ± 0.9	.283
WOSI					
Score	481.0 ± 519.5	292.1 ± 414.3	548.9 ± 690.5	320.6 ± 258.7	.713
%	27.5 ± 42.8	14.0 ± 19.8	26.1 ± 32.9	15.3 ± 12.3	.610
Satisfaction	8.0 ± 2.9	8.5 ± 2.5	8.3 ± 3.1	8.2 ± 2.9	.614

RCR, rotator cuff repair; SANE, Single Assessment Numeric Evaluation; ASES, American Shoulder and Elbow Surgeons score; PENN, Penn Shoulder Score; VAS, visual analog scale score for pain; WOSI, Western Ontario Shoulder Instability Index.

Table IV
Outcome score details comparing Bankart repair (including bony repair) with and without RCR

Score	Bankart repair (including bony repair) without RCR (n = 71)	Bankart repair (including bony repair) with RCR (n = 32)	P value
SANE	82.5 ± 18.7	81.5 ± 25.2	.288
ASES	85.4 ± 19.5	83.4 ± 22.5	.796
PENN	85.7 ± 17.5	84.2 ± 22.2	.644
VAS	1.2 ± 2.3	1.2 ± 2.5	.920
WOSI			
Score	446.42 ± 504.6	484.7 ± 605.4	.845
%	25.0 ± 39.8	23.0 ± 28.8	.730
Satisfaction	8.1 ± 2.8	8.3 ± 3.0	.456

RCR, rotator cuff repair; SANE, Single Assessment Numeric Evaluation; ASES, American Shoulder and Elbow Surgeons; PENN, Penn Shoulder Score; VAS, visual analog scale for pain; WOSI, Western Ontario Shoulder Instability Index.

successfully treated with capsular and subscapularis repair in 11 of these patients. Furthermore, they showed that shoulder weakness in older patients following shoulder dislocation was more likely attributed to RCT than neuropathy. Sonnabend²⁴ looked at 53 patients aged > 40 years (mean age, 58 years) who had primary dislocation. Of the 40 patients who did not have a fracture, 13 had weakness or pain at 3 weeks. All 13 had associated RCTs, in whom pain and weakness were successfully treated with RCR.

Older patients who have an RCT after a dislocation have improved function and pain following surgical intervention compared with those who opt for nonoperative management.³ In a study performed by Hawkins et al,⁴ in which 61 patients aged > 40 years were evaluated following an anterior dislocation, 14 patients had persistent pain and weakness following physical therapy (PT). Of these patients, 7 underwent acromioplasty and RCR whereas the other 7 opted for PT. None of the 7 patients treated nonoperatively achieved pain relief or recovery of adequate function, whereas 4 of the 7 who underwent surgery saw improvement. Additionally, there were 39 patients who sustained anterior dislocations but did not yet receive PT. RCTs were found on physical examination and/or arthrogram in 35 of these patients. Of these patients, 30 remained symptomatic with night pain and impaired motion and 4 went on to recurrent dislocation. Similarly, Simank et al²² found successful surgical management of associated RCTs with anterior dislocation in patients aged > 40 years. Of the 33 patients (mean age, 59 years) included in the study, 18 opted for therapy and 15 opted for RCR. Recurrent dislocations were found in 3 patients in the nonoperative group and none in the RCR group. Pevny et al¹⁵ reviewed 52 traumatic, first-time shoulder dislocators aged > 40 years (mean age, 56 years). Of the 12 patients with isolated RCTs, 84% achieved excellent or good results with surgical treatment compared with only 50% of patients in the nonoperative group. Pevny et al concluded that prolonged morbidity due to RCT is more predominant in the older population. These results suggest that RCR in older patients presenting with instability plays a beneficial role in restoring function.

Arthroscopic stabilization for recurrent anterior instability in older patients has also been shown to be effective in achieving functional improvements. Ro et al¹⁷ evaluated 50 such patients and found significant improvements in VAS, Constant, and Rowe scores. It is interesting to note that RCTs were found in 28% of the patients, with 8% undergoing a single-anchor repair. Sperling et al²⁵ looked at 11 patients aged ≥ 50 years treated with Bankart repair. At 3 years, no patients had recurrent instability; moreover, the patients achieved strong functional outcomes (range of motion, ASES score, and Simple Shoulder Test score). In this study, no patients had concurrent RCTs, however.

A fear in patients aged ≥ 40 years undergoing surgery for labral pathology is increased risk of postoperative stiffness.² Shields et al²¹ found that the 13 patients in their study (mean age, 58.8 years) who underwent simultaneous Bankart repair and RCR after shoulder dislocation had similar functional outcomes at an average of 3 years' follow-up compared with the patients' uninjured extremity. Even in those patients who had recurrent tears, functional outcomes were not affected. In our cohort, 3 patients (2.1%) had continued pain following surgery.

Our study is not without limitations. First, given the retrospective nature of our study design, the surgical techniques and indications may have varied based on the treating surgeon. We were unable to control for older patients presenting with more advanced pathology. It is difficult to determine the exact effect of RCR on the older patient because those patients who did not undergo an RCR were generally younger and likely had milder pathology at presentation. However, we did show that concomitant RCR in older patients is able to restore function and provide pain relief. Second, incomplete functional follow-up at 2 years leads to potential selection bias that could influence our findings. Third, a 2-year follow-up period might be inadequate to evaluate recurrent instability, and thus, no strong conclusions can be drawn. Finally, inconsistent imaging precludes us from presenting the severity of pathology (ie, size of bony lesions).

Conclusion

Similar functional outcomes can be achieved in the surgical management of anterior instability in patients aged ≥ 40 years. RCTs should be suspected and repaired in patients with anterior instability, especially those aged ≥ 50 years. Bankart repair and bony Bankart repair with and without additional RCR are effective means to restore function and relieve pain. Further investigation is needed to determine the true effect of concomitant RCR and the exact age at which an RCR would be beneficial in the setting of capsulolabral repair.

Disclaimer

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References

1. Araghi A, Prasarn M, St Clair S, Zuckerman JD. Recurrent anterior glenohumeral instability with onset after forty years of age: the role of the anterior mechanism. *Bull Hosp Jt Dis* 2005;62:99–101.
2. Erickson J, Lavery K, Monica J, Gatt C, Dhawan A. Surgical treatment of symptomatic superior labrum anterior-posterior tears in patients older than 40 years: a systematic review. *Am J Sports Med* 2015;43:1274–82. <https://doi.org/10.1177/0363546514536874>.
3. Gomberawalla MM, Sekiya JK. Rotator cuff tear and glenohumeral instability: a systematic review. *Clin Orthop Relat Res* 2014;472:2448–56. <https://doi.org/10.1007/s11999-013-3290-2>.
4. Hawkins RJ, Bell RH, Hawkins RH, Koppert GJ. Anterior dislocation of the shoulder in the older patient. *Clin Orthop Relat Res* 1986;192–5.
5. Hovelius L, Olofsson A, Sandström B, Augustini BG, Krantz L, Fredin H, et al. Nonoperative treatment of primary anterior shoulder dislocation in patients forty years of age and younger: a prospective twenty-five-year follow up. *J Bone Joint Surg Am* 2008;90:945–52. <https://doi.org/10.2106/JBJS.G.00070>.
6. Howell SM, Galinat BJ, Renzi AJ, Marone PJ. Normal and abnormal mechanics of the glenohumeral joint in the horizontal plane. *J Bone Joint Surg Am* 1988;70:227–32.
7. Kelkar R, Wang VM, Flatow EL, Newton PM, Ateshian GA, Bigliani LU, et al. Glenohumeral mechanics: a study of articular geometry, contact, and kinematics. *J Shoulder Elbow Surg* 2001;10:73–84.
8. Kirkley A, Griffin S, McLintock H, Ng L. The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability: the

- Western Ontario Shoulder Instability Index (WOSI). *Am J Sports Med* 1998;26:764–72.
9. Leggin BG, Michener LA, Shaffer MA, Brenneman SK, Iannotti JP, Williams GR. The Penn Shoulder Score: reliability and validity. *J Orthop Sports Phys Ther* 2006;36:138–51. <https://doi.org/10.2519/jospt.2006.36.3.138>.
 10. Levy O, Pritsch M, Rath E. An operative technique for recurrent shoulder dislocations in older patients. *J Shoulder Elbow Surg* 1999;8:452–7.
 11. McLaughlin H. Injuries of the shoulder and arm. In: Harrison L, editor. *Trauma*. Philadelphia: W.B. Saunders Co.; 1959. p. 233–96.
 12. Michener LA, McClure PW, Sennett BJ. American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form, patient self-report section: reliability, validity, and responsiveness. *J Shoulder Elbow Surg* 2002;11:587–94. <https://doi.org/10.1067/mse.2002.127096>.
 13. Murthi AM, Ramirez MA. Shoulder dislocation in the older patient. *J Am Acad Orthop Surg* 2012;20:615–22. <https://doi.org/10.5435/JAAOS-20-10-615>.
 14. Neviasser RJ, Neviasser TJ, Neviasser JS. Concurrent rupture of the rotator cuff and anterior dislocation of the shoulder in the older patient. *J Bone Joint Surg Am* 1988;70:1308–11.
 15. Pevny T, Hunter RE, Freeman JR. Primary traumatic anterior shoulder dislocation in patients 40 years of age and older. *Arthroscopy* 1998;14:289–94.
 16. Pouliart N, Gagey O. Concomitant rotator cuff and capsuloligamentous lesions of the shoulder: a cadaver study. *Arthroscopy* 2006;22:728–35. <https://doi.org/10.1016/j.arthro.2006.03.015>.
 17. Ro K, Kim MS, Kim JD, Rhee YG. Arthroscopic findings and clinical outcomes in patients 40 years of age and older with recurrent shoulder dislocation. *Arthroscopy* 2019;35:314–22. <https://doi.org/10.1016/j.arthro.2018.08.041>.
 18. Robinson EC, Thangamani VB, Kuhn MA, Ross G. Arthroscopic findings after traumatic shoulder instability in patients older than 35 years. *Orthop J Sports Med* 2015;3. <https://doi.org/10.1177/2325967115584318>. 2325967115584318.
 19. Rowe CR. Prognosis in dislocations of the shoulder. *J Bone Joint Surg Am* 1956;38-A:957–77.
 20. Rowe CR, Sakellarides HT. Factors related to recurrences of anterior dislocations of the shoulder. *Clin Orthop Relat Res* 1961;20:40–8.
 21. Shields E, Mirabelli M, Amsdell S, Thorsness R, Goldblatt J, Maloney M, et al. Functional and imaging outcomes of arthroscopic simultaneous rotator cuff repair and Bankart repair after shoulder dislocations. *Am J Sports Med* 2014;42:2614–20. <https://doi.org/10.1177/0363546514550993>.
 22. Simank HG, Dauer G, Schneider S, Loew M. Incidence of rotator cuff tears in shoulder dislocations and results of therapy in older patients. *Arch Orthop Trauma Surg* 2006;126:235–40. <https://doi.org/10.1007/s00402-005-0034-0>.
 23. Simonet WT, Cofield RH. Prognosis in anterior shoulder dislocation. *Am J Sports Med* 1984;12:19–24.
 24. Sonnabend DH. Treatment of primary anterior shoulder dislocation in patients older than 40 years of age: conservative versus operative. *Clin Orthop Relat Res* 1994;74–7.
 25. Sperling JW, Duncan SFM, Torchia ME, O'Driscoll SW, Cofield RH. Bankart repair in patients aged fifty years or greater: results of arthroscopic and open repairs. *J Shoulder Elbow Surg* 2005;14:111–3. <https://doi.org/10.1016/j.jse.2004.06.011>.
 26. Stayner LR, Cummings J, Andersen J, Jobe CM. Shoulder dislocations in patients older than 40 years of age. *Orthop Clin North Am* 2000;31:231–9.
 27. Tempelhof S, Rupp S, Seil R. Age-related prevalence of rotator cuff tears in asymptomatic shoulders. *J Shoulder Elbow Surg* 1999;8:296–9.
 28. Toolanen G, Hildingsson C, Hedlund T, Knibestöl M, Öberg L. Early complications after anterior dislocation of the shoulder in patients over 40 years: an ultrasonographic and electromyographic study. *Acta Orthop Scand* 1993;64:549–52.
 29. Vermeiren J, Handelberg F, Casteleyn PP, Opdecam P. The rate of recurrence of traumatic anterior dislocation of the shoulder—a study of 154 cases and a review of the literature. *Int Orthop* 1993;17:337–41.
 30. Walch G, Dejour H, Trillat AG. La luxation récidivante antérieure de l'épaule survenant après 40 ans [Recurrent anterior dislocation of the shoulder with onset after the age of forty years]. *Rev Chir Orthop Reparatrice Appar Mot* 1987;73:609–16 [in French].
 31. Williams GN, Gangel TJ, Arciero RA, Uhorchak JM, Taylor DC. Comparison of the single assessment numeric evaluation method and two shoulder rating scales. Outcomes measures after shoulder surgery. *Am J Sports Med* 1999;27:214–21.
 32. Yamaguchi K, Ditsios K, Middleton WD, Hildebolt CF, Galatz LM, Teefey SA. The demographic and morphological features of rotator cuff disease: a comparison of asymptomatic and symptomatic shoulders. *J Bone Joint Surg Am* 2006;88:1699–704. <https://doi.org/10.2106/JBJS.E.00835>.
 33. Zacchilli MA, Owens BD. Epidemiology of shoulder dislocations presenting to emergency departments in the United States. *J Bone Joint Surg Am* 2010;92:542–9. <https://doi.org/10.2106/JBJS.I.00450>.