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REVIEW ARTICLES

Results and complications of head-preserving techniques in chronic neglected shoulder dislocation: a systematic review

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Background: Humeral head–preserving procedures may be needed for chronic neglected shoulder dislocation because the presenting age of the patient is often reported to be less than 45 years. The aim of this systematic review was to evaluate the results of the various head-preserving procedures for chronic anterior dislocation (CAD) and chronic posterior dislocation (CPD). This review also aimed to evaluate the results of conservative neglect for CAD.

Methods: PubMed, Embase, and Cochrane library databases were queried for studies that reported on results of head-preserving procedures for CAD or CPD and for studies that reported on the results of conservative neglect for CAD. Case reports, review articles, acute dislocations, and fracture-dislocations were excluded. The results of the different techniques were pooled for further evaluation.

Results: Seventeen studies were selected for qualitative analysis. These were further subdivided into 9 studies for the CAD group and 11 studies for the CPD group. In the CAD intervention group, 53 shoulders in 7 studies were managed by 5 different head-preserving techniques. The choice of procedure to stabilize the shoulder after open reduction varied between coracoid transfer, capsulolabral repair, remplissage, and Putti-Platt procedure and acromiohumeral K-wire fixation. High resubluxation rates and early arthrosis were reported after open reduction techniques for CAD. In the CAD conservative group, 8 shoulders in 2 studies were managed by conservative methods. In the CPD group, the 2 most common techniques, McLaughlin or modified McLaughlin and bone grafting, were used to treat 74 shoulders in 7 studies and showed good functional outcomes.

Conclusion: The choice of open reduction and stabilization technique for CAD was highly variable between the different studies and led to a wide variation in the reported outcomes with a high number of complications such as resubluxation and early arthrosis. The conservative treatment of CAD led to poor functional results. The choice of treatment for CPD was mostly between 2 techniques—McLaughlin and modified McLaughlin reconstruction or the bone graft reconstruction—and they consistently led to good functional outcomes with less complications.

Level of evidence: Level IV; Systematic Review

Keywords: Chronic anterior dislocation; chronic posterior dislocation; neglected dislocation; Latarjet procedure; open reduction of shoulder dislocation; McLaughlin reconstruction

Institutional review board approval was not required for this systematic review.

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Chronic dislocation of the shoulder, although an uncommon problem, has been reported in the literature since the 1940s.[19] Even in the present era, both anterior and posterior shoulder dislocation continue to present as chronically neglected conditions and are associated with several treatment challenges such as glenoid or humeral bone loss, contracted capsules, and rotator cuff deficiency.[5,27] Their treatment has varied from open reduction, McLaughlin procedure, bone grafting, to arthroplasty for chronic posterior dislocation (CPD) and from open reduction, capsular repair, to arthroplasty for chronic anterior dislocation (CAD).[11,18,22] Because the patient's age is often reported to be less than or around 45 years,[2,12,15] the options of shoulder arthroplasty may not always be feasible for many such patients. Although some authors have reported good results after head-preserving interventions for CPD and CAD, several complications such as resubluxation, avascular necrosis, and early degenerative arthritis also have been reported.[17,18] Additionally, the problem of redislocation has been an unforgiving and frequent complication that has been associated with unsatisfactory outcomes.[17] Intuitively, CPD should be more common than CAD because there are higher chances of missing the diagnosis of a posterior dislocation in initial single-plane radiographs.[13,22] However, Rowe et al[22] reported that, surprisingly, CAD presented more frequently than CPD. This may be reflected in the current scenario, where physicians often face problems of CAD in younger patients and where head-preserving interventions should be attempted, but being unsure of the results and being fearful of neurovascular complications of such interventions, patients have been advised to continue and adjust with their mildly painful but limited functional status. The primary purpose of this review was to evaluate the results of the head-preserving interventions in CAD and CPD. The secondary purpose was to evaluate the results of conservative treatment of CAD.

Materials and methods

PubMed, Embase, and Cochrane library databases were queried with the search keywords *chronic*, *shoulder*, *dislocation*, or *neglected*, *shoulder*, *dislocation*, or *locked shoulder*, *dislocation* connected with the Boolean operator AND according to PRISMA guidelines, in June 2020. The reference lists of the most relevant publications were also scanned for additional articles. The search was conducted for studies in English language and with an abstract that reported on adult patients aged $\geq$18 years.

Search criteria

Studies fulfilling the following criteria were included: studies that reported on shoulder dislocation, either anterior or posterior, that was neglected and chronic (either reported by the authors as chronic or if it was neglected for more than 3 weeks), managed by head-preserving surgery or by active neglect, with follow-up of more than 6 months. The following studies were excluded: case reports of 3 or fewer patients, review articles, recurrent dislocations, fracture dislocations, studies without outcome data, acute dislocations, and where it was not possible to separate the data of chronic dislocations from the acute ones.

Two authors (D.S. and V.R.) independently searched the database for relevant articles and then jointly screened the full text of the final articles for final inclusion. Any disagreement was solved in consultation with the third author. The Methodological Index for Non-randomized Studies (MINORS) appraisal tool for observational studies was used to evaluate the quality of the included studies.[25] Two authors independently scored all the studies, and the interrater agreement between them was assessed by intraclass correlation coefficient. The level of evidence was allotted to the studies in accordance with the criteria by Wright and Swiontkowski.[28]

The following data were extracted from the studies and charted in a Google spreadsheet

1. Study details such as author, year, and journal
2. Level of evidence and type of study
3. Age of patients
4. Dislocation direction as anterior or posterior and its period of neglect
5. Size of humeral head defect and glenoid bone defect
6. Type of intervention
7. Complications as noted by the author
8. Gain in functional score or the final functional score
9. Gain in range of motion (ROM) or final range in elevation, external rotation, and internal rotation
10. Follow-up period

Statistical analysis

The data were statistically pooled the using the meta-analysis workbooks.[26] Because many different techniques were expected to be reported, only the outcome data of the studies that used similar surgical techniques were weighted and pooled. Functional outcomes and ROM data were weighted and pooled, wherever possible, by a random sampling method in view of the expected heterogeneity. Preoperative and postoperative data of results were not available in all the studies. If both the preoperative and postoperative data of functional outcomes or ROM could be extracted, Hedge's g was calculated to standardize the gain in the results. The Hedge's g was represented as forest plot analysis to show the combined gain in ROM or functional results. Some studies did not report the measures of dispersion such as standard error (SE) or standard deviation (SD). The primary authors were contacted for the missing data. If the data could not be obtained from the primary authors, the SD was calculated from one of the following 2 methods: (1) First,[23] the SE was calculated from the P and the t value by the formula: SE = mean difference / t; and then the corresponding SD was calculated by the formula: $SD = SE * \sqrt{n}$. (2) If only the range was available, the SD was calculated with the following formula[20]: SD $\approx$ n+1/(n-1) * range/$\sqrt{12}$. I^2 statistics were used to evaluate the heterogeneity of the results within the studies. I^2 was categorized as follows: 0%-24.9% as no heterogeneity, 25%-49.9% as low heterogeneity, 50%-74.9% as moderate heterogeneity, and 75%-100% as high heterogeneity. The presence of publication bias was judged by

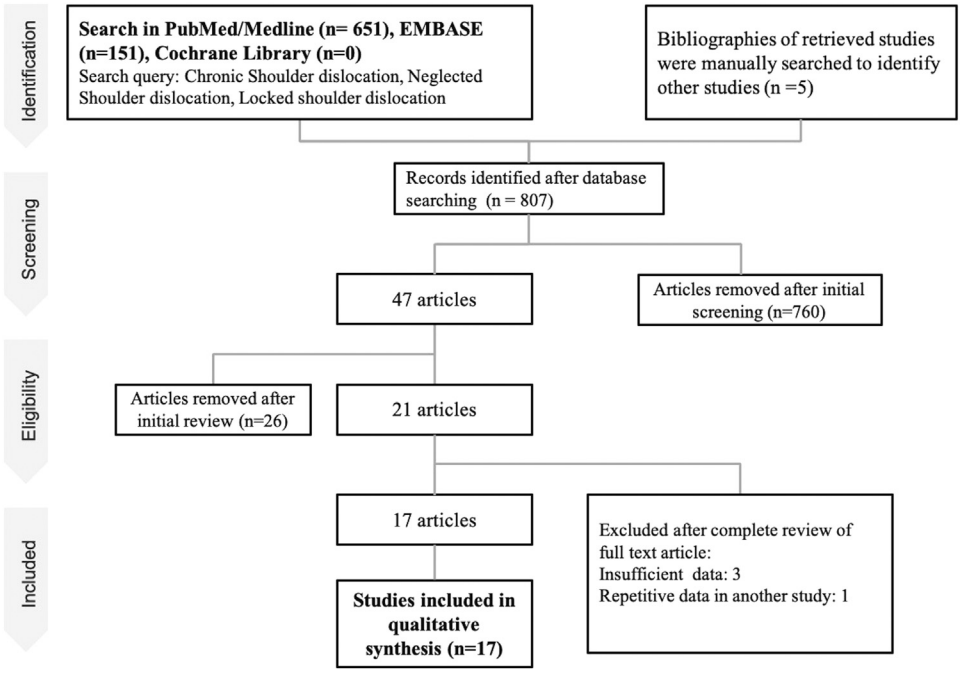

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram. Flow chart displays the search and eligibility strategy.

visual asymmetry of the funnel plot. Sensitivity analysis was done using a leave-1-out strategy to evaluate its effect on the pooled results.

Results

Search results

The database search yielded 651 results from PubMed, 151 from Embase, and 5 from the bibliographies of other relevant studies (Fig. 1). The initial screening led to 47 articles for further review. After applying the exclusion and inclusion criteria, 21 publications were found eligible for full-text review. Three studies were further excluded because of insufficient data, and 1 additional study was excluded because of overlapping data. Finally, 17 studies were selected for the qualitative analysis (Table I).

Qualitative assessment

The inter-rater agreement between the 2 observers who scored the MINORS independently was 0.92 (confidence interval, 0.76-0.97), which was considered excellent. Ten studies scored between 10 and 13 on the MINORS scale, and 7 studies scored between 6 and 9. The level of evidence of all studies was IV (Table II). Funnel plot asymmetry on visual analysis showed that publication bias may be present. Sensitivity analysis showed that no single study contributed to a significant alteration of the calculated Hedge's g of elevation or external rotation after the McLaughlin procedure for CPD.

Study characteristics and patient demographics

There were 9 studies in the CAD group: 7 in the intervention group[2-4,6,17,21] and 2 in the conservative neglect group.[6,22] The study by Li et al had 2 groups: one in which the subscapularis was split and the other in which the subscapularis was tenotomized and then repaired. Hence, these 2 groups were charted as separate studies for the purpose of evaluation. The study by Babalola et al[6] also had 2 groups: one group was managed conservatively and the other surgically by open reduction. These 2 groups were also taken as 2 separate studies for systematic evaluation. Overall, only 2 studies had outcome data of conservative management of CAD.

There were 11 studies in the CPD group.[1,5,7,8,10,12,14-16,22,24] The study by Rowe et al[22] that reported on CAD also reported on CPD. Hence, data on CPD was extracted from the study by Rowe et al and was considered as a separate study. In the CAD group, there were 60 patients with 61 shoulders having an average age of 44 years (range, 26.5-57.5 years). And in the CPD group, there were 114 patients with 116 shoulders having an average age of 43 years (range, 26-53.2 years).

Chronic anterior dislocation

In the CAD intervention group, 53 shoulders in 7 studies were managed by 5 different head-preserving techniques.

Table I Summary of results of the 20 divided studies

Author	Year	No. of shoulders included in the study	Mean age	Mean period of neglect, mo	Type of dislocation	Type of intervention	Preoperative glenoid bone defect	Preoperative humeral head defect	Postoperative average follow-up period, mo	Postoperative functional score	Elevation range (degrees)		External rotation (degrees)		Internal rotation (degrees or level of vertebra)		No. of postoperative complications	List of complications
											Pre operative	Post operative	Pre operative	Post operative	Pre operative	Post operative		
Rouhani et al[21]	2010	8	42	2.5	Anterior	Open reduction and capsulolabral complex repair	NR	Average defect <40%	12	75 ± 11.25 (RZ)	NR	140	NR	40	NR	T9	5	1 patient had mild OA, 2 had head subluxation, 2 had superior migration
Babalola et al[6]	2015	5	40.6	3	Anterior	Open reduction	NR		8	44.6 ± 15.51 (RZ)	NR	NR	NR	NR	NR	NR	1	1 patient had avascular necrosis
Li et al[17]	2016	15	57	3.7	Anterior	Subscapularis tenotomy and coracoid transfer	Average defect 22%		31.6	58 ± 24 (CS)	NR	94	NR	23	NR	L3	8	8 patients had redislocation and 93% of the patients had worsened arthritis
Abdelhady et al[2]	2015	6	26.5	2	Anterior	Posterior capsular release and coracoid transfer	Average defect 34%		36.66	78.6 ± 8 (CS)	NR	145	NR	46	NR	NR	1	1 patient had apprehension in ER
Abdelhady et al[3]	2010	4	27.2	3.7	Anterior	Open infraspinatus remplissage	1 patient had glenoid bone defect	3 patients had engaging Hill-Sachs	32	74 ± 5.23 (CS)	NR	135	NR	27.5	NR	60	NR	
Li et al[17]	2016	5	50	5.1	Anterior	Subscapularis splitting and coracoid transfer	Average defect 17%		31.6	82 ± 9 (CS)	NR	140	NR	36	NR	T12	1	20% of the patients had worsened arthritis
Akinci et al[4]	2009	10	39.7	2.11	Anterior	Open reduction with K-wire fixation	NR	Average defect <25%	98.4	NR	44	88	4.2	11.2	6	13.5	1	1 patient had persistent pain
Rowe et al[22]	1982	4	57.5	41.25	Anterior	No treatment	NR	NR	30	47.5 ± 11.5 (RZ)	NR	NR	NR	NR	NR	NR	0	None
Babalola et al[6]	2015	4	56	35	Anterior	No treatment	NR	NR	8	24 ± 5.22 (RZ)	NR	NR	NR	NR	NR	NR	NR	
Kokkalis et al[16]	2013	6	53.2	2	Posterior	Modified McLaughlin technique		Average defect 30%-45%	20	84 ± 5.35 (CS)	NR	163	NR	64	NR	47	NR	

Khira et al[15]	2017	12	26	2	Posterior	Modified McLaughlin technique with ICBG	Average defect 30%-45%	30	30 ± 1.68 (UCLA)	70	165	−25	75	25	50	2	2 patients had joint stiffness
Shams et al[24]	2016	11	39	2.5	Posterior	Modified McLaughlin technique	Average defect 35%	29	30 ± 4.8 (UCLA)	85	162	0	70	L5	45	2	2 patients were unsatisfied
Abdel-Hameed et al[1]	2015	9	29.5	NR	Posterior	Modified McLaughlin technique	Average defect 40%	18	31 ± 1.2 (UCLA)	90	166	0	75	L5	50	2	2 patients were unsatisfied
Dimitrov et al[8]	2012	12	NR	4.5	Posterior	McLaughlin technique	Average defect 30%)	36	22 ± 4.8 (UCLA)	72.5	175	0	60	NR	80	2	1 patient had early arthrosis, 1 patient had limited external rotation
Diklic et al[7]	2010	13	42	4	Posterior	Allograft reconstruction of the defect in the humeral head	Average defect 25%-50%	54	86.8 ± 18.33 (CS)	40	155	−25	53	NR	NR	1	1 patient had osteonecrosis
Gerber et al[12]	2014	11	44	6.3	Posterior	Auto-/allograft reconstruction of the humeral head	Average defect 43%	128	74 ± 10.36 (CS)	NR	145	NR	42	NR	NR	2	2 early failures (1 graft collapse and 1 flattening of the head and incomplete joint reduction)
El Shewy et al[10]	2008	17	48.5	2.6	Posterior	Posterior cruciate capsular repair	All patients had an impression fracture involving <25% of humeral head	93.6	33 ± 1.2 (UCLA)	NR	NR	NR	NR	NR	NR	3	3 patients developed severe OA at 3 years
Aksekili et al[5]	2015	10	42.4	4.95	Posterior	Posterior bone block augmentation method with bone graft		40.6	81.25 ± 17.8 (CS)	NR	NR	NR	NR	NR	NR	7	3 had mild arthrosis, 2 had moderate arthrosis, 2 had severe arthrosis
Keppler et al[14]	1994	10	53	5	Posterior	Rotational osteotomy	Average defect 20%-40%	20	78 ± 16.5 (RZ)	NR	131	NR	6	NR	84	3	1 patient had transient axillary nerve palsy; 2 poor results
Rowe et al[22]	1982	5	52	2.5	Posterior	Open reduction		57	81.66 ± 15.38 (RZ)	NR	NR	NR	NR	NR	NR	NR	

NR, not reported; *ICBG*, iliac crest bone graft; *RZ*, Rowe and Zarins score; *CS*, Constant-Murley score; *UCLA*, University of California, Los Angeles, shoulder score; *OA*, osteoarthritis; *ER*, external rotation. Results of Babalola et al, Rowe et al, and Li et al were subdivided into 2 groups each.

Table II Methodological Index for Non-Randomized Studies (MINORS) scoring and level of evidence of 17 included studies

Author	Year	MINORS score (Max = 16)	Level of evidence
Rouhani et al[21]	2010	6	Level IV
Babalola et al[6]	2015	10	Level IV
Abdelhady et al[3]	2010	9	Level IV
Li et al[17]	2016	11	Level IV
Akinci et al[4]	2009	10	Level IV
Abdelhady et al[2]	2015	11	Level IV
Rowe et al[22]	1982	9	Level IV
Kokkalis et al[16]	2013	8	Level IV
EL Shewy et al[10]	2008	8	Level IV
Aksekili et al[5]	2015	10	Level IV
Diklic et al[7]	2010	10	Level IV
Khira et al[15]	2017	11	Level IV
Shams et al[24]	2016	12	Level IV
Abdel-Hameed et al[1]	2015	12	Level IV
Dimitrov et al[8]	2012	7	Level IV
Gerber et al[12]	2014	13	Level IV
Keppler et al[14]	1994	8	Level IV

In the CAD conservative group, 8 shoulders in 2 studies were managed by conservative methods.

Open reduction and capsulolabral repair only

In 2 studies[6,21] (n = 13), the authors managed their dislocated shoulders by open reduction and capsulolabral repair. Only the final scores and ROM were stated. The final weighted Rowe and Zarins score was 60.33. The final score achieved in one study was 75 ± 11.25 in 13 shoulders with a follow-up of 12 months. The final ROM achieved was 140° of elevation, 40° of external rotation, and T9 level of internal rotation. They noted 5 complications (1 mild osteoarthritis, 2 head subluxations, and 2 superior head migrations). The final score achieved by the other study was 44.6 ± 15.5 in 5 shoulders with a follow-up of 8 months. They reported 1 case of avascular necrosis. No ROM details were stated in this study.

Open reduction and coracoid transfer by subscapularis removal and repair approach

In 2 studies,[2,17] the authors managed their patients (n = 21) by open reduction and coracoid transfer by subscapularis removal and repair approach. The 2 studies had wide variation in their final scores and ROM. One study provided preoperative scores as well. The final weighted Constant-Murley score was 69, the final weighted elevation was 120.5°, and the final weighted external rotation was 34.6°. The final outcomes by Abdelhady et al[2] were better than that by Li et al.[17] The final Constant-Murley score achieved in the study by Li et al (n = 15) was 58 ± 24 at a follow-up of 31.6 months. Their patients had an average age of 57 years and average period of neglect of 3.7 months. There were 8 (56%) cases with redislocations and 93% cases with progression of arthritis. In the study by Abdelhady et al, the improvement in Constant-Murley score was from a preoperative score of 17 to a follow-up score of 78.6 ± 8 in 6 shoulders at a follow-up of 36.6 months. Their patients had an average age of 26.5 years and an average period of neglect of 2 months. Only 1 complication of apprehension was noted at follow-up.

Open reduction and coracoid transfer by subscapularis-splitting approach

Li et al[17] also reported open reduction and coracoid transfer by subscapularis-splitting approach in 5 patients of average age 50 years with an average period of neglect of 5.1 months. Their final Constant-Murley score was 82 ± 9; elevation was 140°, external rotation was 36°, and internal rotation to the T12 level was achieved at a follow-up of 31.6 months. Arthritis worsened in 20% of their patients.

Open reduction and infraspinatus remplissage

In one study,[3] the authors used open reduction and infraspinatus remplissage with Putti-Platt stabilization in 4 shoulders (average age 27.2 years and average period of neglect 3.7 months). The final Constant-Murley score was 74 ± 5.2, elevation was 135°, external rotation was 27.5°, and internal rotation was 60° at the 32-month follow-up.

Open reduction and Kirschner-wire fixation

In one study[4] (n = 10), the authors used Kirschner-wire fixation from the humerus to the glenoid in 6 cases and from the acromion to the humerus in 4 cases for joint stabilization after open reduction of the dislocated shoulders. They had 1 poor result. The abduction improved from 38° ± 15.1° to 91° ± 13.2°, flexion improved from 44° ± 13.2° to 88.5° ± 29.7°, whereas internal and external rotations improved from 6° ± 2° and 4.2° ± 1° preoperatively to 13.5° ± 7.4° and 11.5° ± 7.3° at the last follow-up.

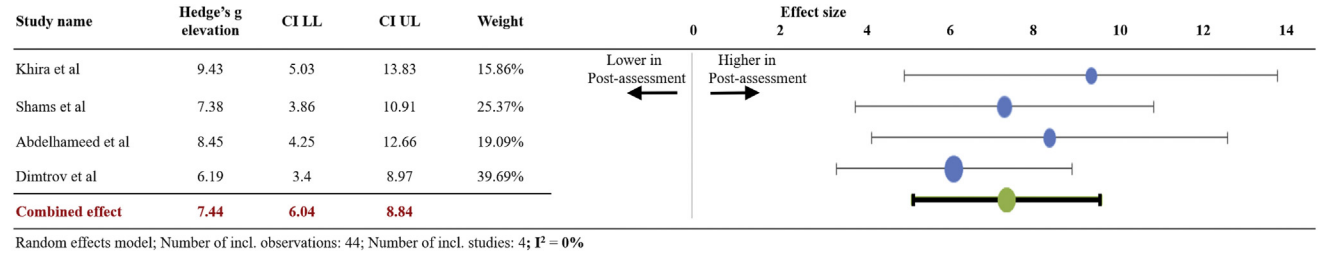

Figure 2 Forest plot of weighted effect size (Hedge's g) for elevation post intervention (McLaughlin or modified McLaughlin) in the CPD group. Blue ovals indicate individual weighted effect size; green ovals indicate the overall combined effect size. Horizontal bars indicate confidence intervals (CIs) of individual studies. *CPD*, chronic posterior dislocation; *CI LL*, confidence interval lower limit (5%); *CI UL*, confidence interval upper limit (95%).

Conservative neglect

Only 2 studies[6,22] reported on conservative treatment of CAD. Both stated that the patients had marked functional limitation and pain. The final weighted Rowe and Zarins score was 35.19. The study by Rowe et al[22] reported final scores of 47.5 ± 11.5, and the study by Babalola et al[6] reported final scores of 24 ± 5.22.

Chronic posterior dislocation

In the CPD group, 74 shoulders in 7 studies were managed by the following 2 techniques: (1) McLaughlin or modified McLaughlin procedure and (2) bone graft (autograft or allograft) to fill the head defect. There were 4 other techniques that were used in 4 different papers.

McLaughlin or modified McLaughlin reconstruction

In 5 studies[1,8,15,16,24] (n = 50), the patients with CPD were managed by McLaughlin or modified McLaughlin procedure. The average humeral head defect ranged between 30% and 45% and the average period of neglect ranged between 2 and 4.5 months. Four of the 5 studies mentioned their postoperative final functional score at an average of 26.6 months' follow-up. However, the data for pre- and postoperative ROM was available in 4 studies. The final functional outcomes and gain in ROM were good to excellent. The final weighted University of California, Los Angeles, shoulder score in 3 studies (n = 32) was 30.47 (95% CI, 28.8-31.9, I^2 38%). The final Constant-Murley score in the study by Kokkalis et al[16] was 84 ± 5.3. The data available from 4 studies (n = 44) showed that the weighted gain in elevation as calculated by Hedge's g was 7.44 (95% CI, 6.04-8.84; I^2 0%) (Fig. 2) and the weighted gain in external rotation as calculated by Hedge's g was 6.86 (95% CI, 4.81-8.91; I^2 44%) (Fig. 3). The final weighted internal rotation in 5 studies (n=50) was 54.42° (95% CI, 36.44-72.41). There were 2 unsatisfactory results in each of the following 3 studies: Khira et al (n = 12),[15] Shams et al (n = 11),[24] and Abdel-Hameed et al (n = 9).[1]

Bone graft reconstruction of the humeral head

Two studies[7,12] (n = 24) reported good outcomes with their technique of bone graft reconstruction of the humeral head defect after open reduction of the dislocated shoulder. Their final weighted pooled Constant-Murley score was 79.8. The final ROM reported in the study by Gerber et al[12] was an elevation of 145° and an external rotation of 42°. Diklic et al[7] reported their preoperative and postoperative elevation and external rotation values, and the gain at follow-up was 115° of elevation and 70° of external rotation. There were 2 early collapses of the humeral head in the series by Gerber et al and 1 osteonecrosis in the series by Diklic et al.

Other techniques

Four other techniques were reported in 4 different papers. El Shewy et al[10] shifted and overlapped the posteroinferior capsule to stabilize the joint after open reduction through the posterior approach; they achieved a final University of California, Los Angeles, shoulder score of 33 ± 1.2 at an average follow-up of 93.6 months. Aksekili et al[5] augmented the posterior glenoid with bone graft after open reduction and achieved a final Constant-Murley score of 81.25 ± 17.8. Worsened glenohumeral osteoarthritis was noted in 3 patients at 3 years of follow-up in the study by El Shewy et al and in 7 patients at 41-55 months of follow-up in the Aksekili et al study. Keppler et al[14] used rotational osteotomy to stabilize the joint after open reduction. One patient had temporary axillary nerve palsy and 2 patients had poor results in their study. Rowe et al[22] also used open reduction techniques through deltoid take-down lateral approach in 5 patients, although it is not clear if they used the McLaughlin procedure in all their patients. Their final mean Rowe and Zarins score was 81.66 ± 15.38.

Discussion

There are 3 broad findings of our study. First, the choice of open reduction techniques for CAD was different in each study, and they led to wide variation in results and high number of complications. Second, the conservative treatment of CAD led to poor functional results. Third, the

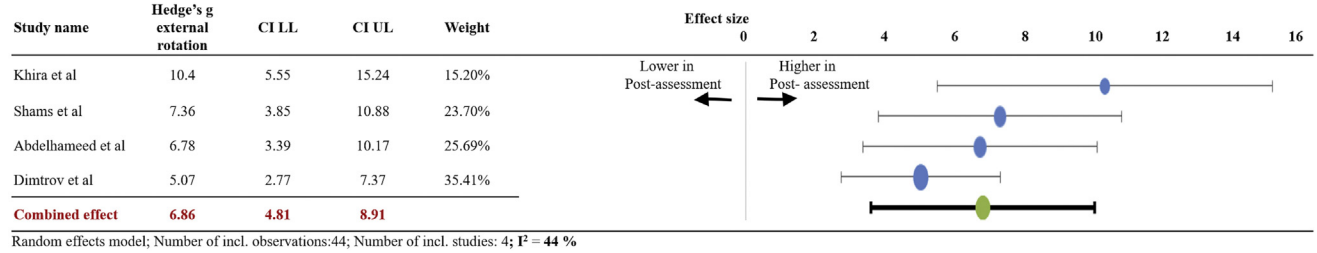

Figure 3 Forest plot of weighted effect size (Hedge's g) for external rotation post-intervention (McLaughlin or modified McLaughlin) in the CPD group. Blue ovals indicate individual weighted effect size; green ovals indicate overall combined effect size. Horizontal bars indicate confidence intervals (CIs) of individual studies. *CPD*, chronic posterior dislocation; *CI LL*, confidence interval lower limit (5%); *CI UL*, confidence interval upper limit (95%).

choice of treatment for CPD was mostly between 2 techniques (McLaughlin or modified McLaughlin reconstruction and the bone graft reconstruction) and they consistently showed good functional outcomes and less complications.

The choice of procedure to stabilize the shoulder after open reduction varied from coracoid transfer, capsulolabral repair, remplissage, Putti-Platt procedure, glenohumeral K-wire fixation, to acromiohumeral K-wire fixation. The reported complications included early arthrosis, osteonecrosis, and resubluxation. In particular, the open reduction for CAD led to an unacceptably high resubluxation rate. Li et al showed that there was no resubluxation, if the open reduction and coracoid transfer was done through a subscapularis-splitting approach.[17] However, we agree with the authors that often, it may be impossible to achieve a concentric reduction with an intact subscapularis. If the subscapularis was cut and later repaired, there were 2 contrasting results, whereas Li et al[17] said that more than 50% of heads resubluxated, Abdelhady et al[2] noted no such complications. The only difference in technique between the 2 studies was that the latter released the posterior capsule in addition to the coracoid transfer. The posteroinferior capsule is often found contracted in longstanding dislocations.[11] But will the postoperative resubluxation decrease by an additional step of posterior capsular release remains to be determined. Notably, it is our conjecture that the role of coracoid transfer is controversial because the sling effect of the Latarjet procedure is ineffective if the subscapularis is removed and repaired. Moreover, the Latarjet procedure is contraindicated in cases of locked dislocations according to Domos and colleagues.[9] The only argument that can be made for the coracoid transfer is that its use can supplant the glenoid bone defect, which can be around 30%-40% in some cases.[11] Coracoid osteotomy can also aid in the joint visualization and reduction, and the osteotomized bone can be transferred to the glenoid if deemed necessary for filling in the glenoid defect. Additionally, a significant anterior glenoid defect may also be one of the factors that result in resubluxation. The acromiohumeral pin fixation may be used for temporary stabilization, but in the face of glenoid deficiency and subscapularis removal, there will always be a risk of resubluxation. Hence, there are 2 important technical recommendations that can be made to avoid a resubluxation: (1) retain as much subscapularis as possible and (2) reconstruct the anterior glenoid deficiency with bone graft. We found only 2 papers that reported the results of conservative treatment for CAD, and both of them reported poor functional results. This was also found to be true in the study by Flatow et al,[11] in which a few patients who declined treatment had very limited functional abilities. Rowe et al[22] also found that untreated CPD leads to better function than untreated CAD, because in untreated CPD, patients can bring their hand to the face and the body, thus enabling the hand to be used for some functions of daily activity. Although there are not a large number of studies reporting on the long-term outcomes of conservative neglect, the available evidence does suggest that patients with CAD continue to have poor function. The other surprising observation in our study was that we did not find a high incidence of neurovascular complications after open reduction in CAD or CPD. There was only 1 transient axillary nerve paresis noted after the rotational osteotomy technique for CPD. The apprehension of a neurovascular complication is one of the factors that may prevent physicians from offering any surgical treatment in CAD. Based on our study results, we feel that this apprehension is unfounded. However, vascular injuries have been reported in the treatment of chronic shoulder dislocations.[22]

The 2 most commonly reported procedures that showed good outcomes in CPD were the McLaughlin or the modified McLaughlin procedure and the autograft or allograft reconstruction of the humeral head. The McLaughlin procedure has found wider acceptance among surgeons as the lesser tuberosity (LT) used to fill the defect in the humeral head is easily accessible and the approach of LT osteotomy leads to a good exposure of the joint. All the included studies showed good functional outcomes with excellent ROM. The bone graft reconstruction of the humeral head reported in 2 papers has also been a good alternative to the McLaughlin technique because it has shown excellent outcomes. The article by Gerber et al[12] had 15 years' follow-up and showed only modest progression of

glenohumeral arthrosis. However, the progression of glenohumeral arthritis was markedly high in the first 3 years after posterior augmentation of the glenoid with bone graft in CPD and after posterior capsular shift in CPD. Thus, the techniques with a posterior approach to CPD may not be preferred over the ones with an anterior approach.

The limitations of this study are that the pooling of data was done with only a small number of studies with similar techniques. And because several of the studies did not provide their preoperative data, the gain in movement and functional scores were computed with few studies only. The available studies were of Level IV evidence, had fewer patients, and had an average follow-up of 38 months; hence, we may have underestimated the complications in CAD and CPD.

Conclusion

Open reduction techniques for CAD have a high resubluxation rate, and hence attempts should be made to preserve as much of the subscapularis as possible and to reconstruct the anterior glenoid bone defect. Open reduction techniques for CPD such as the modified McLaughlin procedure and the bone graft reconstruction procedure lead to good functional results. Conservative neglect of CAD leads to poor functional results.

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