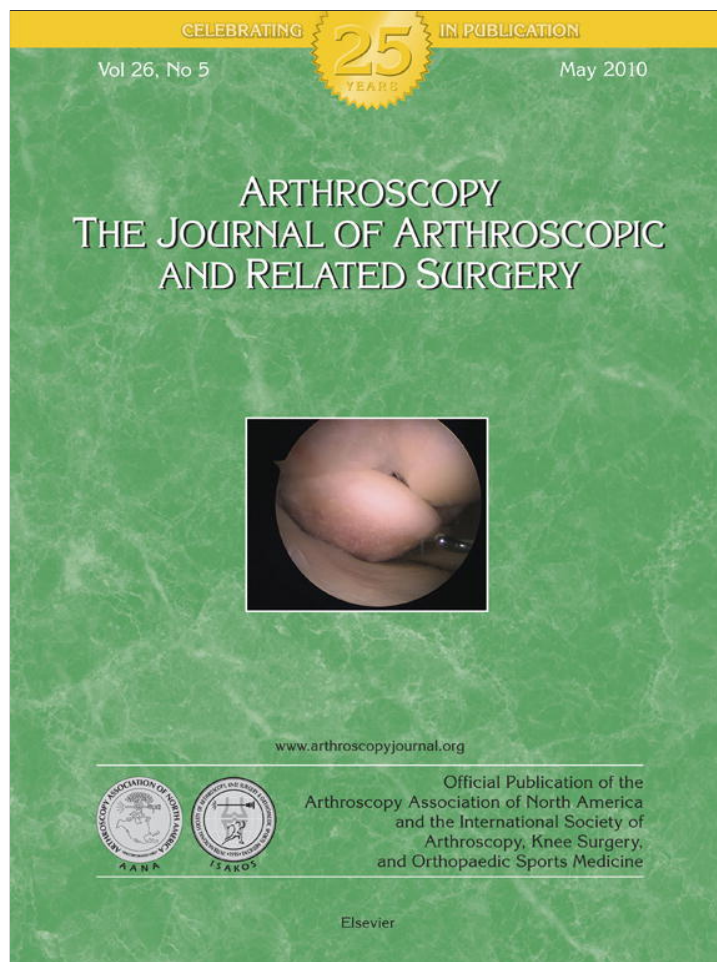


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Systematic Review

Open Versus Arthroscopic Distal Clavicle Resection

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Purpose: The purpose of this systematic review was to critically evaluate the available literature in an attempt to compare the outcome of open versus arthroscopic distal clavicle resection in the treatment of acromioclavicular joint pathology. **Methods:** From January 1966 to December 2008, Medline was searched for the following key words: “acromioclavicular joint arthritis,” “acromioclavicular osteolysis,” “distal clavicle excision,” “acromioclavicular joint excision,” “Mumford,” and “clavicle.” Inclusion criteria included studies that compared the outcome of open versus arthroscopic distal clavicle resection. Studies that could not be translated into the English language or were not published in a peer-reviewed journal were excluded. Data were abstracted from the studies, including patient demographics, surgical procedure, rehabilitation, strength, range of motion, and clinical scoring system. **Results:** Seventeen studies met the inclusion criteria, including 2 Level II studies, 1 Level III and 14 Level IV studies. Arthroscopic distal clavicle excision results in more “good” or “excellent” outcomes compared with the open procedure. Both arthroscopic techniques result in success rates in excess of 90%, with the direct procedure permitting a quicker return to athletic activities. Performing distal clavicle excision in conjunction with either subacromial decompression or rotator cuff repair also has a high degree of success. A trend toward more “poor” results is seen when distal clavicle excision is performed in patients with post-traumatic acromioclavicular instability or in Workers’ Compensation patients. **Conclusions:** Our analysis suggests that among patients undergoing distal clavicle excision for acromioclavicular joint pathology, those having an arthroscopic procedure, specifically through the direct approach, can expect a faster return to activities while obtaining similar long-term outcomes compared with the open procedure. **Level of Evidence:** Level III, systematic review.

Distal clavicle excision (DCE) is the operative procedure of choice for osteolysis and arthritis of the acromioclavicular (AC) joint that is refractory to conservative treatment modalities. An open technique to remove the distal end of the clavicle was first

reported in 1941, independently, by Gurd¹ and Mumford.² Originally, this technique was described to treat chronic AC instability. In 1977 Kessel and Watson³ described excision of the distal end of the clavicle in an effort to treat patients with a “painful arc” of motion. This technique was later expanded in 1982 by Neviasser et al.⁴ to include a “four-in-one” arthroplasty designed to treat the “painful arc” causing rotator cuff tendinitis and biceps tenosynovitis. This procedure effectively decompressed the acromial arch by removing the distal end of the clavicle and the anterior/inferior aspect of the acromion. With the evolution of modern arthroscopic techniques, there has been a transition to arthroscopic DCEs to minimize trauma to the surrounding tissues and ease rehabilitation. This transition to arthroscopic resection may be attributed to

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complications noted with open resection such as distal clavicle instability (excessive resection, capsular injury) and dehiscence of deltotrapezial fascia, as well as several biomechanical studies evaluating the critical role of the superior capsule to AC joint stability.^{5,6} To date, the 3 most commonly performed operations for AC joint pathology are open DCE, direct arthroscopic excision, and indirect arthroscopic excision. The procedure of choice is typically dictated by the surgeon's preference and experience.

OVERVIEW OF SURGICAL TECHNIQUE

Open DCE is performed with either a transverse or "saber"-type incision over the AC joint. The deltotrapezial fascia is divided in line with the longitudinal axis of the clavicle, and a subperiosteal dissection is performed to expose the distal clavicle. An oscillating saw is used to resect the distal clavicle in an oblique fashion (superolateral to inferomedial). Resecting 8 to 10 mm of distal clavicle is typically sufficient. Additional resection may risk detaching the superior AC ligament, leading to instability of the distal clavicle and increased strain on the supporting coracoclavicular ligaments.⁶ When closing, careful attention must be given to repair of the superior joint capsule and deltoid insertion⁷ to preserve clavicular stability and prevent dehiscence of the deltotrapezial attachment.

Direct arthroscopic DCE is performed with a bursal-sparing approach as described by Flatow et al.⁸ After determining joint position and angle of inclination with three 22-gauge needles, the surgeon creates anterosuperior and posterosuperior portals with 2 small stab incisions in line with the AC joint. A 2.7-mm arthroscope and motorized bur are introduced to begin the excision. Once the joint is sufficiently widened, a standard 4-mm arthroscope is introduced to further visualize and complete the margin of resection. Electrocautery is a useful adjunct to "shell out" the distal clavicle from the surrounding soft tissues. The capsule and ligaments are not violated in this approach; rather, they are subperiosteally elevated to expose the distal clavicle.^{8,9}

The indirect bursal approach can be used alone or in conjunction with an acromioplasty, arthroscopic subacromial decompression (ASD), and/or rotator cuff repair (RCR). Standard arthroscopic anterior, posterior, and lateral portals are established with instrument introduction to facilitate a bursectomy. Once the AC joint is visualized, a round or oval bur is introduced to resect the inferior distal clavicle cortex. Intermittent manual pressure can be applied over the distal clavicle

if joint position ever comes into question. Additional accessory portals may be used to complete the resection.¹⁰⁻¹⁴

The purpose of this study was to compare the results of these procedures in the treatment of arthrosis or osteolysis of the distal clavicle. Our hypothesis was that, among a group of patients undergoing a distal clavicle resection for AC joint pathology, those having an arthroscopic procedure would have similar long-term outcomes compared with open techniques but would have a faster return to activity postoperatively because of the minimally invasive nature of the procedure.

METHODS

By use of the Medline database, a systematic review of the English-language literature was performed on the topics of "acromioclavicular joint arthritis" and "acromioclavicular osteolysis." Other terms searched included "distal clavicle excision," "acromioclavicular joint excision," "Mumford," and "clavicle." The abstracts generated from the Medline searches were reviewed, and their respective full-length articles were obtained primarily through online journal databases, interlibrary loans, or a medical library. To be included in the systematic review, all articles had to report data from clinical studies that were published in peer-reviewed journals. Any study that was not in the English language or not published in a peer-reviewed journal was excluded. The references of all relevant articles and review articles were manually cross-referenced to ensure that all possible articles were considered. Study design, patient demographics, surgical technique, outcome, and complications were recorded. In an effort to standardize the outcome measures, any study that recorded patient satisfaction as "satisfactory" as the highest level of outcome was included in the "good/excellent" category for comparison.

RESULTS

The Medline search yielded 377 abstracts. After critical review of inclusion criteria and cross-referencing the bibliographic references to prevent inadvertent exclusion of studies, a total of 25 articles qualified for the systematic review.

Open DCE

We identified 9 studies that reported the results of isolated open DCE for the treatment of traumatic and

atraumatic AC joint osteoarthritis and osteolysis. A total of 287 distal clavicle resections were performed in 284 patients, with a mean follow up of 5 years within the 9 studies. Of the 9 open studies evaluated, 5 did not use a specific scoring system.¹⁴⁻¹⁸ Moreover, 3 of these 5 studies evaluated patients based on pain relief without using any descriptive terms to quantify the degree of improvement.^{14,15,18} These 3 studies represented 98 patients, 97 of whom were either satisfied or had relief of their symptoms, and these were thus deemed to be equivalent to good or excellent results. The 2 other studies that did not use a specific scoring system but evaluated their patients with the aforementioned subjective terms comprised 55 patients.^{16,17} In total, 227 good or excellent results, representing 79% of the open operations, were reported. These data represent the outcomes of mostly Level IV studies, although there was 1 Level III study included in the grouping¹⁴⁻²² (Table 1).

Arthroscopic DCE

A total of 6 studies evaluated the use of isolated arthroscopic DCE for the treatment of traumatic or atraumatic osteoarthritis or osteolysis of the AC joint. These studies evaluated 142 shoulders, and 129 had either good or excellent outcomes, representing 91% of the patients treated. Three of the six arthroscopic studies used the direct approach and evaluated 93

patients, 86 of whom had good or excellent results, representing 92% of the patients.²³⁻²⁵ Three studies evaluated the indirect arthroscopic approach and looked at 49 shoulders, 43 of which had good or excellent outcomes, representing 93% of the patients.^{10,11,14} According to the available data, both arthroscopic techniques have very high rates of good or excellent outcomes (Table 2).

Open Versus Arthroscopic DCE

Freedman et al.²⁶ conducted a prospective, randomized study of 17 patients undergoing open or indirect arthroscopic DCE. Patients were randomized based on the etiology of their AC joint symptoms (osteoarthritis, post-traumatic, osteolysis) and preoperative visual analog scale (VAS) pain score (Table 3). The primary outcome measures were the VAS score, Modified American Shoulder and Elbow Surgeons score, and Short Form 36 score. VAS scores improved sequentially in both groups from baseline at 6 months to 1 year postoperatively. The improvement in VAS scores in the arthroscopically treated group was significant at 1-year follow up, but such a finding was not present in the open group.

Direct Versus Indirect DCE

To date, only 1 prospective randomized controlled trial comparing the direct and indirect arthroscopic

TABLE 1. Comparison of Clinical Outcome Results for Open DCE Including Study Size, Qualitative Assessment, Mean Time to Follow Up, Scoring System, Diagnosis, and Level of Evidence

Study	No.	Good/Excellent Results (%)	Mean Follow Up (yr)	Scoring System	Diagnosis	Level of Evidence
Worcester and Green ¹⁴	56	"Majority pain free in 4-8 weeks"	4.5	None	AC arthritis/pain	IV
Cahill ¹⁵	21	100	7	None	Osteolysis	III
Peterson ¹⁶	50	54	9	None	Nontraumatic and traumatic AC arthrosis	IV
Scavenuis et al. ¹⁷	8	80		None	Nontraumatic and traumatic osteolysis	IV
Cook and Tibone ¹⁸	23	96	3.7	None	AC arthrosis after grade I or II separations	IV
Novak et al. ²⁰	23	78	2.5	HSS	AC arthritis, osteolysis, grade I AC separation	IV
Eskola et al. ²¹	73	68	9	Darrow (pain), radiography, range of motion, subjective	AC separation, fracture, osteoarthritis	IV
Slawski and Cahill ²²	17	100	2.1	UCLA	Nontraumatic osteolysis	IV
Petchell et al. ¹⁹	18	72	3	UCLA, Constant, ASES, Neer	Osteoarthritis, post-traumatic osteolysis, nontraumatic osteolysis	IV

Abbreviation: HSS, Hospital for Special Surgery.

TABLE 2. Comparison of Clinical Outcome Results for Direct and Indirect Arthroscopic DCE Including Study Size, Qualitative Assessment, Mean Time to Follow Up, Scoring System, Diagnosis, and Level of Evidence

Study	No.	Good/Excellent Results (%)	Mean Follow Up (yr)	Scoring System	Diagnosis	Level of Evidence
Gartsman ¹⁰	20	85	2.4	ASES	Osteoarthritis	IV
Kay et al. ¹¹	6	100	1.2	UCLA	Osteoarthritis	IV
Tolin and Snyder ¹³	23	87	2.1	UCLA	Osteoarthritis	IV
Zawadsky et al. ²³	41	93	6.2	None	Osteolysis	IV
Auge and Fischer ²⁵	10	100	1.5	None	Osteolysis	IV
Bigliani et al. ²⁴	42	91	1.75	None	Osteoarthritis, osteolysis	IV

approaches for DCE has been performed. Charron et al.²⁷ randomized 34 collegiate or recreational athletes with osteolysis or post-traumatic osteoarthrosis into 2 groups to receive either a direct or indirect arthroscopic DCE. The 2 patient groups had equivalent demographics as well as preoperative American Shoulder and Elbow Surgeons (ASES) and Athletic Shoulder Scoring Systems (ATH) scores. Patients treated with the direct arthroscopic approach had statistically higher functional scores at 2 weeks and 6 weeks postoperatively as compared with patients treated with the indirect approach. At the final follow-up, a mean of 27 months postoperatively (range, 21 to 32 months), both groups showed excellent clinical outcome scores (Table 3). The direct-approach cohort did obtain statistically significantly higher ASES and ATH scores: 96 and 91, respectively, compared with 95 and 88, respectively, in the indirect group. In comparing return to sport, the authors found that the direct group returned in half the time when compared with the indirect group (mean, 21 days v 42 days).²⁷

DCE With Concomitant Procedure

There are 7 studies in the literature that evaluated the outcomes of DCE in conjunction with concomitant

ASD or RCR.²⁸⁻³⁴ There were 212 patients across these studies evaluated at a mean of 3.2 years after the index operation. Good or excellent results were noted in 95% of cases. Although these data come exclusively from Level IV studies, they do support DCE in conjunction with ASD or RCR in patients with a symptomatic AC joint at the time of surgery. The rates of good or excellent outcomes were very similar to isolated indirect or direct arthroscopic DCE^{28-31,33} (Table 4).

Post-traumatic AC Joint

Six studies evaluated the results of DCE in patients with AC joint symptoms from varying degrees of AC dislocations or fractures of the lateral third of the clavicle that were refractory to conservative management.^{16-18,21,23,30} These 6 studies evaluated a total of 133 patients with a prior history of trauma to the shoulder including fractures of the distal third of the clavicle and AC joint dislocations. The overall rate of a “poor” result was 23%, which is higher than the rate of poor outcomes reported in patients undergoing DCE for nontraumatic causes of AC joint symptoms. Four of these six studies used an open DCE and

TABLE 3. Level II Clinical Evidence Comparing Open Versus Arthroscopic DCE and Direct Versus Indirect Arthroscopic DCE Including Study Size, Qualitative Assessment, Mean Time to Follow Up, Scoring System, Diagnosis, and Level of Evidence

Study	No.	Good/Excellent Results (%)	Mean Follow Up (yr)	Scoring System	Diagnosis	Level of Evidence
Freedman et al. ²⁶	17 (9 open DCE, 8 indirect arthroscopic DCE)	100	0.5, 1	VAS, MASES, SF-36, subjective satisfaction	Osteoarthritis, post-traumatic osteolysis	II
Charron et al. ²⁷	34 patients eligible for follow up (18 direct arthroscopic DCE, 16 indirect arthroscopic DCE)	97	2.25	ASES, ATH	Osteolysis of isolated post-traumatic arthrosis	II

Abbreviations: MASES, Modified American Shoulder and Elbow Surgeons; SF-36, Short Form 36.

TABLE 4. Comparison of Clinical Outcome Results for DCE With Concomitant ASD or RCR Including Study Size, Qualitative Assessment, Mean Time to Follow Up, Scoring System, Diagnosis, and Level of Evidence

Study	No.	Good/Excellent Results (%)	Mean Follow Up (yr)	Scoring System	Diagnosis	Level of Evidence
Kay et al. ²⁸	20	100	6	UCLA, Constant	Osteoarthritis, impingement syndrome	IV
Martin et al. ³⁰	32	100	4.8	Matsen	Osteoarthritis, post-traumatic pathology, osteolysis, impingement syndrome	IV
Lozman et al. ²⁹	18	89	2.67	UCLA	Osteoarthritis, impingement, trauma	IV
Snyder et al. ³³	50	94	2	UCLA	AC degeneration, osteolysis, subacromial spur or bursal rotator cuff irritation	IV
Levine et al. ³¹	24	88	2.7	Excellent (no pain), good (minimal pain), failure (all others)	AC arthrosis, AC separation, impingement syndrome	IV
Lesko ³²	57 (18 with ASD and DCE, while 39 had rotator cuff tear repairs)	94	0.4	Pain, strength, range of motion	Impingement, osteoarthritis	IV
Daluga and Dobozi ³⁴	50	100 (ASD/DCE), 80 (ASD/DCE/RCR)	3.75	Loyola	Impingement syndrome, rotator cuff tear, AC arthritis	IV

reported poor results in 27 of 99 patients (27%).^{16-18,21} Of these 27 poor results, 10 occurred in patients with a history of fracture or direct trauma to the AC joint, representing 37% of the poor outcomes. Thirty-four patients had an arthroscopic DCE for AC joint symptoms resulting from a previous trauma. Only 3 poor outcomes (9%) were observed among this cohort.¹⁷

DISCUSSION

This systematic review was designed to update the previous review of the topic by Rabalais and McCarty³⁵ with the specific goal of finding higher-level evidence in support of the current surgical procedures for DCE. The strength of this review has been improved by incorporating the results of 2 Level II studies that were published since the previous systematic review.

Open Versus Arthroscopic Resection

The available clinical data support open or arthroscopically isolated surgical resection of the distal clavicle for the treatment of AC osteoarthritis or osteolysis refractory to conservative management. Nine clinical

studies report the outcomes of open isolated distal clavicle resection. Eight of these studies consist of Level IV evidence. A total of 287 DCEs were performed across these studies, with 227 good or excellent outcomes, representing 79% (range, 54% to 100%) of the open cases.¹⁴⁻²² These outcomes suggest that open DCE is a safe and beneficial operation. There are 6 Level IV studies in support of arthroscopic DCE. The overall rate of good or excellent outcomes was 91% (range, 85% to 100%).^{10,11,13,23-25} Although both open and arthroscopic methods have high rates of positive outcomes, the arthroscopic technique has a higher success rate than the open procedure, 91% compared with 79%. In support of this conclusion is the study by Freedman et al.,²⁶ which compared the outcomes of arthroscopic indirect DCE versus open DCE. There was a trend for earlier and better outcomes after arthroscopic treatment. The improvement in VAS pain score from preoperatively to 1 year postoperatively was significant for the arthroscopic group but not for the open group. However, both cohorts did have significant improvements in their pain reduction at 1 year postoperatively. This study was limited by the number of subjects, and a post hoc

power analysis showed that the sample size was insufficiently powered. It should also be emphasized that patients who underwent arthroscopic DCE were found to have occult labral pathology, SLAP tears, labral fraying, and partial-thickness rotator cuff tears that were all treated at the time of DCE. Therefore, although the authors reported trends toward improvement in all outcome measures for arthroscopic versus open DCE, these trends could have been because of the treatment of other pathologies and must be interpreted with an appropriate degree of caution. To our knowledge, this is the only prospective Level II study reporting the results of arthroscopic versus open DCE.

Most of the clinical evidence in support of DCE comes from retrospective studies, and although a few comparative studies have been published, the low-level nature of the scientific evidence makes it difficult for the results to be interpreted with any significant amount of objectivity. Furthermore, many of these Level III and IV studies include DCE for multiple diagnoses or in combination with other procedures, making it difficult to draw accurate conclusions about each procedure's effectiveness. Finally, the interpretation of apparently poorer results with the open technique must be considered with an understanding of the advancing knowledge about the disease process and surgeons' ability at the time of the study. Most studies reporting the results of an open DCE preceded 1995. This time was relatively early in the transition from open to arthroscopic treatment for a variety of shoulder conditions and a time where a majority of the distal clavicle resections were being performed by general orthopaedists. This is compared with the early arthroscopic studies that were performed by shoulder "experts" and may account for improved results. In addition, this was the beginning of the understanding of SLAP tears, both of which (SLAP tears and distal clavicle pathology) are now widely recognized to have overlapping clinical presentations and physical examination findings. As such, perhaps an inaccurate diagnosis at the time of the open DCE contributed to poorer results. Other factors that may have been associated with the poorer outcomes in these early open studies include excessive resection of the distal clavicle (e.g., >1 inch) and poor deltoid reapproximation, which are now recognized as essential components to successful outcomes.

To our knowledge, a cost analysis of the open and arthroscopic procedures for DCE has never been performed. In general, arthroscopic procedures have longer setup times and require the use of more expensive instrumentation when compared with open pro-

cedures. With consideration of the previously mentioned factors and the available literature, we believe that we cannot draw a reasonable conclusion regarding a potential improved outcome in arthroscopic DCE compared with the open technique.

Direct Versus Indirect Resection

Three studies evaluated the direct technique²³⁻²⁵ and three studies evaluated the indirect technique^{10,11,13} for arthroscopic DCE, with success rates of 92% and 93%, respectively. It is virtually impossible to favor one arthroscopic technique over the other with such high rates of positive outcomes after DCE with either procedure because of the high numbers of patients needed for such a study. There is only 1 Level II prospective study comparing the outcomes of the direct and indirect approach for DCE. Charron et al.²⁷ evaluated 34 athletes with osteolysis of the distal clavicle or isolated post-traumatic arthrosis of the AC joint at 2 years postoperatively with ASES and ATH clinical assessment tools. Both approaches were found to result in successful clinical outcomes with clinically insignificant differences at final follow up. According to both scoring systems, the direct approach showed much more dramatic improvement at 2 and 6 weeks postoperatively compared with preoperatively. Because the direct approach permitted a faster return to athletic activity than the indirect approach, the authors recommend it as the procedure of choice in competitive athletes where speed of rehabilitation and time to return to sport are important factors.

Both the direct and indirect arthroscopic procedures for DCE have many attractive features compared with their open-operation counterpart. Most notable are the higher success rates, superior visibility of the AC joint, and the ability to address concomitant glenohumeral joint or rotator cuff pathology. Yet, these procedures do have shortcomings. Arthroscopic DCE is technically more demanding than open DCE. Even in the hands of experienced arthroscopists, issues of inadequate resection of the superior aspect of the AC joint and/or incomplete posterior resection may occur and lead to poor outcomes. Occasionally, one may encounter the patient with a clavicle that has a large sagittal width, which can complicate the procedure and possibly compromise the outcome. With respect to indirect resection, this procedure mandates a concomitant ASD, which is a procedure that is not without risk, especially when done in patients without clinical evidence of impingement. ASD can be associated with adhesions in the subacromial space with

resultant stiffness. Furthermore, excessive removal of the acromial spur has been associated with stress fractures of the acromion. These avoidable complications must be considered in patients undergoing indirect DCE. Finally, there has not been a biomechanical study evaluating the effects of perforation of the AC capsule with the arthroscope and instrumentation on distal clavicle stability.

DCE in Combination With ASD or RCR

According to the available literature, performing DCE in conjunction with either ASD or RCR results in a very high rate of good or excellent results (95%) in symptomatic individuals.²⁸⁻³⁴ Aside from these studies having low Levels of Evidence, they are further limited by flaws inherent to investigations that examine results of multiple procedures performed concomitantly. One problem that is universally encountered is the inability to correctly ascribe responsibility for good or poor outcomes to a specific part of the procedure, also known as performance bias.

Post-traumatic DCE

From the available literature, there is a trend toward more poor results when DCE is performed after a traumatic insult to the AC joint.^{16-18,21,23,30} Moreover, it seems that patients undergoing open DCE have higher rates of poor outcomes (27%) as compared with arthroscopic DCE (9%). However, limiting the validity of such conclusions is the low-level nature of the evidence from which these results were obtained.

Workers' Compensation

This review also sought to determine whether Workers' Compensation (WC) claims had an effect on the results among the various studies analyzed. To do so, we took a closer look at the "failed" or poor outcomes among the various studies that reported good or excellent results in less than 100% of patients.

Six of the nine open DCE studies met this criterion.¹⁶⁻²¹ Of these 6 studies, 2 had WC patients included in their poor or failed outcomes.^{19,20} In the study by Novak et al.,²⁰ the removal of WC patients from the final analysis improved the rate of good or excellent outcomes from 78% to over 90%. Petchell et al.¹⁹ reported 5 unsatisfactory outcomes (28%) by University of California, Los Angeles (UCLA) criteria (5 fair and 0 poor) despite all 18 patients separately indicating that they were satisfied with the outcome of the procedure. The unsatisfactory outcome included 1

WC patient who could not return to his sedentary work as a shearer.

Among the arthroscopic DCE studies, 4 of the 6 articles reported good or excellent results in less than 100% of their study population.^{10,13,23,24} Of these, only 1 study, that of Tolin and Snyder,¹³ included a WC patient in the cohort of patients with suboptimal outcomes. This patient was 1 of 3 patients whose outcomes were rated as "fair" by UCLA shoulder survey criteria and the only patient in the entire study population ($n = 23$) who subjectively claimed to be unsatisfied with the results of the procedure.

One Level II study reported good or excellent outcomes less than 100% of the time, and no WC patients were presented in the study.²⁷

Four of seven studies in the concomitant procedure group reported suboptimal outcomes after DCE.^{29,31-33} Two of these investigations involved WC patients.^{29,33} Lozman et al.²⁹ reported 2 poor outcomes by the UCLA scoring system, and both of these patients were involved in WC claims, one of whom had 3 prior surgical procedures for persistent shoulder pain. If these patients were removed from the study, then the rate of good or excellent outcomes would be 100% rather than 89%. Snyder et al.³³ reported 3 fair and 0 poor results by UCLA criteria. They failed to mention how the WC patients were distributed among the various UCLA outcomes (excellent, good, fair, or poor), but they did note that with regard to average pain relief, the total cohort averaged 87% whereas the subset of patients with unsettled WC claims averaged 66%.

Both open DCE and arthroscopic DCE are effective means for treating AC joint symptoms refractory to conservative measures. Open procedures result in success rates in excess of 75%, not as favorable as the greater than 90% good or excellent outcome rate achieved with arthroscopic techniques. It appears that the direct approach permits a faster return to athletic activities and may be an attractive option for the high-demand athlete undergoing surgical treatment for AC joint symptoms. Performing DCE in conjunction with either ASD or RCR also has a high degree of success. A trend toward more poor results is seen when DCE is performed in the patient with post-traumatic patient population. However, interpretation of these results must be considered with caution, given the evolution of surgical technique over the years, variable surgeon experience, and poorer results observed among WC patients as mentioned previously.

CONCLUSIONS

Our analysis suggests that among patients undergoing DCE for AC joint pathology, those having an arthroscopic procedure, specifically through the direct approach, can expect a faster return to activities while obtaining similar long-term outcomes compared with the open procedure.

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