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The Influence of Evidence-Based Surgical Indications and Techniques on Failure Rates After Arthroscopic Shoulder Stabilization in the Contact or Collision Athlete With Anterior Shoulder Instability

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Background: It has been reported that arthroscopic shoulder stabilization yields higher rates of failure in contact or collision athletes as compared with open shoulder stabilization; however, this is largely based upon studies that do not employ modern, evidence-based surgical indications and techniques for arthroscopic shoulder stabilization.

Purpose: To (1) determine the pooled failure rate across all studies reporting failure after primary arthroscopic shoulder stabilization for anterior shoulder instability in contact or collision athletes and (2) stratify failure rates according to studies that use evidence-based surgical indications and techniques.

Study Design: Systematic review.

Methods: A review of PubMed, Medline, and Embase was performed to identify all clinical studies with a minimum of 1-year follow-up that reported failure rates after arthroscopic shoulder stabilization for anterior shoulder instability in contact or collision athletes. Data pertaining to patient demographics, clinical and radiographic preoperative assessment, surgical indications, surgical technique, rehabilitation, and outcome were collected from each included study. An overall failure rate was determined across all included studies. After this, a secondary literature review was performed to identify factors related to patient selection and surgical technique that significantly influence failure after primary arthroscopic shoulder stabilization. Failure rates were then determined among included studies that used these evidence-based indications and techniques.

Results: Overall, 26 studies reporting on 779 contact or collision athletes met the inclusion criteria. The mean patient age was 19.9 years, 90.3% were male, and the most common sport was rugby. There was considerable variability in the reporting of patient demographics, preoperative assessment, surgical indications, surgical technique, and patient outcomes. Across all included studies, the pooled failure rate after arthroscopic shoulder stabilization in the contact or collision athlete was 17.8%; however, among studies that excluded patients with significant bone loss, used a minimum of 3 suture anchors, and performed the stabilization in the lateral decubitus position, the failure rate was 7.9%.

Conclusion: The rate of failure after arthroscopic shoulder stabilization in contact or collision athletes decreases from 17.8% to 7.9% after the use of evidence-based surgical indications and techniques.

Keywords: arthroscopic shoulder stabilization; failure; contact athletes

The surgical management of recurrent anterior shoulder instability in the contact or collision athlete is often debated, but historically, open stabilization has been advocated given the commonly held belief that contact or collision athletes are at a higher risk for failure after arthroscopic stabilization.[3,4,33] Despite this, evidence to suggest that arthroscopic stabilization in contact or collision athletes has higher failure rates is limited. The purpose of this systematic review was to (1) determine the pooled failure rate after arthroscopic stabilization for anterior shoulder instability in contact or collision athletes and (2) determine the failure rate after arthroscopic stabilization for anterior shoulder instability in contact or collision athletes among studies that use modern, evidence-based surgical indications and techniques. Our hypothesis was that the published data pertaining to failure rates of contact or collision athletes undergoing arthroscopic stabilization for anterior shoulder instability are of poor quality,

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reflect outdated surgical indications and techniques, and rarely consider patient-, injury-, and procedure-specific factors that have been identified to significantly influence failure after arthroscopic shoulder stabilization.

METHODS

A search using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines was undertaken to identify all studies that reported failure rates after primary arthroscopic shoulder stabilization of anterior shoulder instability in contact or collision athletes.[21] For the purpose of this study, contact and collision sports were defined using the American Academy of Pediatrics Committee on Sports Medicine (AAPCSM) criteria (includes the following sports: boxing, field hockey, American football, ice hockey, lacrosse, martial arts, rodeo, soccer, wrestling, and rugby),[1] and we defined failure as apprehension, subluxation, or dislocation after arthroscopic shoulder stabilization. Exclusion criteria included non-English studies, nonclinical studies, studies with less than 1-year follow-up, and clinical studies pertaining to arthroscopic stabilization of posterior or inferior shoulder instability, revision shoulder stabilization, or bone block glenoid procedures, including the Latarjet procedure, the Bristow procedure, or allograft glenoid reconstruction. The search term "contact OR collision AND shoulder" was used to search all published literature from Medline (1946 to the third week of January 2016), the Cochrane Central Register of Controlled Trials, Embase (1947 to the third week of January 2016), and PubMed. In addition to the primary literature search, we identified all clinical studies pertaining to primary arthroscopic shoulder stabilization, and we reviewed each article to determine if outcomes of arthroscopic shoulder stabilization in contact or collision athletes were reported as a subgroup and met the criteria for inclusion in the present study. Finally, the references of all included studies were manually cross-referenced to ensure that all relevant studies were captured.

Data were then abstracted from each study, including study characteristics, patient demographics, diagnostic details, procedure details, and patient outcomes. Study characteristics included study type, year of publication, journal of publication, level of evidence, number of contact or collision athletes, duration of follow-up, and percentage of follow-up. Patient demographics included age, sex, contact or collision sport type, number of preoperative shoulder instability events, and time from first dislocation to surgery. Diagnostic details included clinical examination maneuvers (apprehension and load and shift) and imaging modalities (radiographs, magnetic resonance imaging [MRI], magnetic resonance arthrogram [MRA], and a computed tomography [CT] scan). Procedure details included year of surgery, position (beach chair or lateral decubitus), fixation type (suture anchor, Suretacs, transglenoid sutures, or other methods of fixation), fixation number, concomitant procedures (capsular shift, rotator interval closure and posteroinferior plication), and postoperative care and rehabilitation (duration of immobilization, position of immobilization, and time to return to sport). The primary outcome in this study was failure, which we previously defined as apprehension (as determined on clinical examination or reported by the patient), subluxation, or frank dislocation after arthroscopic shoulder stabilization. Secondary outcomes included patient-reported outcome measures, range of motion, and return to sport.

A major focus of this study was to correlate failure of arthroscopic shoulder stabilization in contact or collision athletes with the use of evidence-based surgical indications and techniques. In accordance with this, data pertaining to patient selection and surgical indications were collected from each study, including the identification, quantification, and exclusion threshold for glenoid and humeral bone loss, as well as the identification and exclusion of concurrent shoulder injuries (humeral avulsion glenohumeral ligament, superior labral anterior-posterior, glenolabral articular disruption, anterior labroligamentous periosteal sleeve avulsion, and/or rotator cuff tear).

A detailed review of the literature was undertaken to determine the injury- and procedure-specific factors that have been shown to significantly influence failure after primary arthroscopic shoulder stabilization for anterior shoulder instability. Based upon this review, we identified the following factors that significantly influenced failure: bone loss (glenoid: inverted pear configuration or >20%-25% of glenoid bone loss; humeral head: engaging Hill-Sachs defect),[4,19,29] preoperative number of dislocations (≥3 preoperative dislocations),[41] young age (<20 years),[41] sex (male),[41] suture anchor number (<4 suture anchors),[4] and patient positioning (beach chair).[11] Studies included in this review were then stratified into subgroups according to the presence or absence of these factors. The mean failure rate for the entire cohort and for each subgroup was determined.

RESULTS

Overall, we identified 1307 articles following the initial search, of which 26 studies met the inclusion criteria for this study[‡] (Figure 1). Among the included studies, only 7 studies reported results exclusive to a cohort of contact

[‡]References 2, 5-9, 13-18, 20, 24, 25, 27, 28, 30-32, 34-36, 43, 44.

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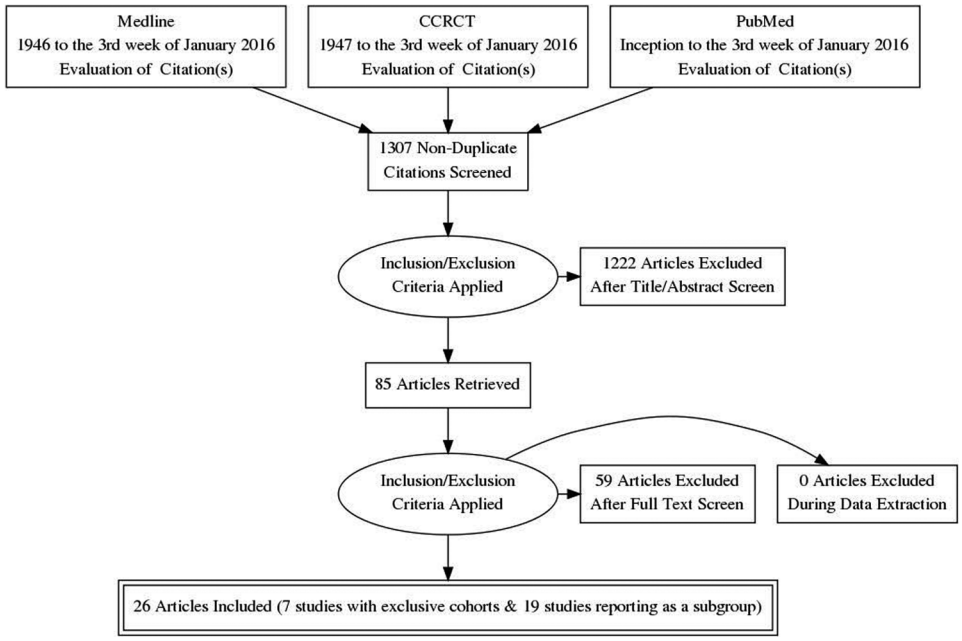

Figure 1. The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram depicting study selection following application of the inclusion and exclusion criteria.

or collision athletes, while the remaining 19 studies reported results of contact or collision athletes as a subgroup within a larger study. Overall, there was one evidence level 1 study[2] and two level 3 studies,[17,28] and the remainder were level 4 studies.

Cochrane Central Register of Controlled Trials

Across all included studies, there were 779 contact or collision athletes (784 shoulders) who underwent arthroscopic shoulder stabilization for primary anterior shoulder instability. Patient demographics were infrequently reported, but the mean age was 19.9 years (8 studies) and 90.3% were male (4 studies). There were 16 studies that reported the distribution of patients within specific sports, of which the most common sport was rugby (59.9%; 287 patients), followed by American football (12.9%; 62 patients), soccer (9.2%; 44 patients), martial arts/boxing (5.0%; 24 patients), ice hockey (3.9%; 19 patients), and wrestling (3.5%; 17 patients). Rarely, studies defined contact or collision sports (6 studies) or reported the level of competition (12 studies). Overall, the mean follow-up was 43.7 months.

Information pertaining to preoperative dislocation events was reported by 16 (61.5%) studies, and the number of preoperative dislocations was quite variable and ranged from 1 to 50. Similarly, time from first dislocation to stabilization was quite variable and ranged from 10 days to 180 months.

Across all included studies, reporting of patient assessment via clinical examination maneuvers and the utilization of imaging modalities was infrequent. For instance, only 10 (38.5%) and 15 (57.7%) studies reported performing the anterior apprehension test or the load-and-shift test on their contact or collision athletes with anterior shoulder instability, respectively. Although 18 (69.2%) studies reported obtaining a preoperative shoulder radiograph, only 13 (50%) studies reported obtaining some form of advanced shoulder imaging (8 studies [30.8%] obtained an MRI scan, 5 studies [19.2%] obtained an MRA, and 7 studies [26.9%] obtained a CT scan).

Patient selection for arthroscopic shoulder stabilization was quite variable, as only 12 (46.2%) and 7 (26.9%) studies made specific mention of criteria used to exclude patients based on a threshold of glenoid and humeral head bone loss, respectively. Across studies that excluded bone loss, only 6 (23.1%) studies excluded both glenoid and humeral head bone loss. As illustrated in Table 1, the methods for determining glenoid and humeral head bone loss, and the thresholds for patient exclusion, were also quite variable.

As depicted in Table 2, surgical technique across all included studies was highly variable, and only 4 (15.4%) studies included contact or collision athletes who underwent stabilization within the past decade. Furthermore, only 11 (42.3%), 13 (50%), and 6 (23.1%) studies performed arthroscopic stabilization in the lateral decubitus position, with suture anchors, and used a minimum of 3 suture anchors for each case, respectively. Almost all included studies (23 studies, 88.5%) performed a capsular shift. Interestingly, 9 (34.6%) and 2 (7.7%) of the included studies reported performing a rotator interval closure and a thermal capsulorrhaphy, respectively. After stabilization, all studies reported immobilizing patients for a minimum of 2 weeks, but the vast majority immobilized patients for 3 to 4 weeks postoperatively. Return to sport was commonly permitted by 6 months postoperatively, but ranged from 3 to 9 months.

TABLE 1
Glenoid and Humeral Head Bone Loss Assessment and Exclusion Across Included Studies[a]

Study	Excluded Glenoid Bone Loss	Method of Assessment	Threshold	Excluded Humeral Bone Loss	Method of Assessment	Threshold
Yamamoto et al[43]	Yes	CT	>21%	Yes	Track theory	Engaging
Stein et al[35]	Yes	NR	"Any bone defect"	Yes	NR	"Any bone defect"
Nixon et al[24]	No			No		
Petrera et al[28]	Yes	Intraoperative	>25%	Yes	Intraoperative	Engaging
Kocaoglu et al[17]	No			No		
Rhee et al[31]	Yes	Intraoperative	>25%	No		
Mazzocca et al[20]	No			No		
Cho et al[8]	Yes	NR	>25%	Yes	Intraoperative	Engaging
Ide et al[16]	Yes	Intraoperative	Inverted pear	Yes	Intraoperative	Engaging
Carreira et al[6]	No			No		
O'Neill[25]	No			No		
Hubbell et al[15]	No			No		
Burkhart and De Beer[5]	Yes	Intraoperative	Inverted pear	Yes	Intraoperative	Engaging
Pagnani et al[27]	Yes	Radiograph	"Large defects"	No		
Speer et al[34]	No			No		
Arciero et al[2]	No			No		
Castagna et al[7]	Yes	Intraoperative	>25%	No		
DeBerardino et al[9]	No			No		
Hayashida et al[13]	Yes	CT or MRA	>20%	No		
Larrain et al[18]	Yes	CT and intraoperative	>25%	Yes	Intraoperative	Engaging
Roberts et al[32]	No			No		
Tauro[36]	No			No		
Voos et al[40]	No			No		
Hayashida et al[14]	Yes	NR	"Large bone defects"	Yes	NR	NR
Resch et al[30]	No			No		
Youssef et al[44]	No			No		

[a]CT, computed tomography; MRA, magnetic resonance arthrogram; NR, not reported.

After arthroscopic stabilization, the vast majority of studies reported rates of recurrent instability; however, only 10 (38.5%) studies were explicit in their definition of recurrent instability, denoting the inclusion of apprehension, subluxation, and/or dislocation in their definition. Across all included studies, the pooled rate of recurrent instability, which we defined as failure, was 17.8% (139 failures). As illustrated in Table 3, the rate of failure varied considerably based upon application of evidence-based patient selection and surgical technique, including a 7.9% (3 studies; 203 patients) failure rate among studies that used a minimum of 3 suture anchors, excluded glenoid and/or humeral bone loss, and performed the arthroscopic stabilization in the lateral decubitus position.

Based upon the heterogeneity and infrequency in the reporting of patient-reported outcome measures, range of motion, and rates of return to sport for contact or collision athletes, we were unable to pool data and draw conclusions regarding our secondary outcomes.

DISCUSSION

In this study, the pooled failure rate across 26 studies reporting outcomes after primary arthroscopic shoulder stabilization in contact or collision athletes was 17.8%; however, across studies using modern, evidence-based patient indications and surgical techniques, the failure rate was only 7.9%. Despite the ongoing debate regarding the role of arthroscopic stabilization in this historically high-risk patient population, it appears that the evidence drawn upon to dissuade use of arthroscopy is largely outdated and of poor quality. Ultimately, our study demonstrates that in the appropriately selected contact or collision athlete with no significant glenoid or humeral head bone loss, modern arthroscopic shoulder stabilization with a minimum of 3 suture anchors can yield failure rates akin to those commonly reported after arthroscopic (8.5%) or open stabilization (8.0%) in the general population.[12]

As suggested by the often-quoted study by Balg and Boileau,[3] with its inclusion in the instability severity index score, participation in contact or collision sports has long been considered a risk factor for failure after shoulder stabilization surgery. For this reason, the historical approach to the surgical management of contact or collision athletes has been open shoulder stabilization, where the rates of failure, as defined in the present study, have been reported to be as low as 3.4%.[26] On the other hand, there are studies that have reported the failure rate after open stabilization in contact or collision athletes to be as high as 30%,[32] and it is due to this variability that we believe the answer regarding the optimal surgical management of a contact or collision athlete with recurrent glenohumeral instability may not be so clear. To further this argument, we found the

TABLE 2
Surgical Technique Across Included Studies[a]

Study	Year	Position	Fixation	Minimum No. of Anchors	Suture Type	Capsular Shift
Yamamoto et al[43]	2001-2011	Beach	SA	3	NR	Yes
Stein et al[35]	2006-2007	Lateral	SA	NR	No.2 FiberWire	Yes
Nixon et al[24]	NR	Beach	SA	NR	NR	Yes
Petrera et al[28]	2005-2008	Lateral	SA	3	NR	Yes
Kocaoglu et al[17]	2004-2006	Beach	SA	3	No. 2 FiberWire	Yes
Rhee et al[31]	1994-2000	Beach	ST or SA	3	NR	NR
Mazzocca et al[20]	1995-1999	NR	SA	2	Mixed[b]	Yes
Cho et al[8]	1994-2000	Beach	ST or SA	3	NR	NR
Ide et al[16]	1997-2001	Lateral	SA	3	No.2 Ethibond	Yes
Carreira et al[6]	1994-1999	Beach or lateral	SA	2	No. 2 nonabsorbable braided	Yes
O'Neill[25]	1991-1996	Beach	TG	4	Nonabsorbable braided	Yes
Hubbell et al[15]	1989-1995	NR	TG	NR	NR	Yes
Burkhart and De Beer[5]	1994-1998	NR	SA	NR	Braided polyester	Yes
Pagnani et al[27]	1983-1989	NR	ST or TG	NR	NR	Yes
Speer et al[34]	NR	Beach	ST	1	Maxon	Yes
Arciero et al[2]	1988-1991	Lateral	TG	2	No. 1 PDS	No
Castagna et al[7]	2002-2005	Lateral	SA	2	NR	Yes
DeBerardino et al[9]	1992-1998	Beach	ST	1	NR	Yes
Hayashida et al[13]	2000-2002	Lateral	SA	3	NR	Yes
Larrain et al[18]	1996-2001	Lateral	SA	3	No. 2 nonabsorbable	Yes
Roberts et al[32]	NR	Lateral	ST or TG	1	NR	Yes
Tauro[36]	NR	Lateral	SA or TG	3	PDS	Yes
Voos et al[40]	2003-2004	Beach	SA	1	Nonabsorbable braided	Yes
Hayashida et al[14]	1989-1994	Lateral	TG	4	1-0 or 2-0 PDS II	NR
Resch et al[30]	1989-1995	Beach	ST	1	NR	Yes
Youssef et al[44]	NR	Lateral	TG	2	NR	Yes

[a]NR, not reported; PDS, polydioxanone; SA, suture anchor; ST, Suretacs; TG, transglenoid sutures.
[b]Absorbable braided suture, long-term absorbable suture, or monofilament suture.

TABLE 3
Stratified Failure Rates According to Patient Selection and Surgical Technique[a]

Factor	No. of Applicable Studies	Total No. of Patients	Failure Rate, %
ST or TG	13	244	25.0
Only SA	13	535	14.6
SA minimum	6	275	8.7
Excluded bone loss[b]	6	331	8.8
Lateral position	11	345	17.4
Lateral position and excluded bone loss[b]	3	203	7.9
Lateral position and SA minimum	4	215	8.8
Lateral position, excluded bone loss,[b] and SA minimum	3	203	7.9

[a]SA, suture anchor; ST, Suretacs; TG, transglenoid sutures.
[b]Accepted parameters for bone loss exclusion: inverted pear configuration of glenoid, >20% to 25% of glenoid bone loss, or engaging Hill-Sachs defect.

results of several prominent studies on this topic to be slightly misleading. For instance, in the Balg and Boileau study, contact or collision sports are included in the instability severity index score even though the authors did not find sport type to influence failure after shoulder stabilization ($P = .3$). Similarly, Sachs et al[33] concluded in their study that higher-risk patients are those who participate in contact sports, but in their multivariate analysis sport type did not reach statistical significance ($P = .1$). Collectively, we believe that some of the conclusions made in these studies may reflect opinion rather than direct observations of the study in question.

As we have demonstrated in the present study, there is wide variability in the quality of the literature pertaining to arthroscopic stabilization in the contact or collision athlete. In addition, there is wide variability in sport type, patient selection, surgical technique, and, perhaps most important, the definition of failure. Defining failure has

long been debated in the literature, and it has been suggested that a more inclusive definition, including apprehension, subluxation, and dislocation, is a truer reflection of overall failure.[38] For this reason, we kept our definition broad to capture all possible cases of a failed stabilization, but we do admit that given the variability in how failure is defined across all 26 studies, some patients we would consider failures may have been missed. Collectively, this wide variability in outcome reporting suggests an inherent imprecision in the consolidation of individual studies' data within this review; more important, it highlights the inconsistencies in the literature from which recommendations against arthroscopic stabilization in contact or collision athletes have come.

Perhaps the most important consideration in the contact or collision athlete is the presence of glenoid and/or humeral head bone loss. It has been reported that a high number of contact or collision athletes with traumatic anterior glenohumeral instability have bone loss, and up to 60% of contact athletes have bipolar bony lesions.[23] Furthermore, more than a decade of literature has supported the notion that failure rates after stabilization in contact or collision athletes with bone loss are high.[5] Despite this, we found that only 12 of 26 studies specifically mentioned assessing for glenoid and/or humeral head bone loss preoperatively, and even fewer employed commonly accepted thresholds for abandoning a primary arthroscopic labral repair in favor of a bone block or Remplissage procedure (>20%-25% of glenoid bone loss, inverted pear configuration of glenoid, and/or a large, engaging Hill-Sachs defect).[4,19,29] Perhaps even more interesting was the use of advanced imaging in the assessment of glenoid and/or humeral head bone loss, whereby most based their indications for a soft tissue procedure solely upon a radiograph, where advanced imaging such as MRI or CT would otherwise be recommended.[29] Ultimately, we observed that when evidence-based thresholds for glenoid and humeral head bone loss were considered in the selection of patients for arthroscopic shoulder stabilization, postoperative failure rates improved to 8.8%. This finding suggests that in the contact or collision athlete, patient selection is critical to the outcome of the procedure and that failure is not necessarily a reflection of sport type, rather more a product of preoperative bone loss and procedure indicated to address the pathology at hand.

In addition to bone loss, several additional preoperative patient and injury factors have been noted to increase the risk of failure after arthroscopic shoulder stabilization. Perhaps most notable is the influence of young patient age and male sex on failure after arthroscopic shoulder stabilization,[41] arguably the 2 strongest predictors for failure in the current literature. In the present study, the vast majority of patients were young and male, and given our inability to access individual patient data, there was no way to eliminate the influence of age and sex on our reported failure rates. However, these patient variables would be important to consider in any future study analyzing the influence of sport type on failure rates. Similarly, heterogeneity in the reporting of preoperative dislocation number and time from first dislocation to stabilization surgery precluded us from assessing the influence of these factors on our reported failure rates. For instance, preoperative dislocation number varied from 1 to upwards of 50 events, while time from first dislocation to surgery varied from 10 days to upwards of 13 years. Finally, the exclusion of patients with concomitant injuries was not uniform, and given our inability to access patient imaging or intraoperative photographs, we cannot comment on the influence of concomitant injuries on our reported failure rates.

It has been well documented that surgical technique can influence failure rates after arthroscopic shoulder stabilization. In 2006, Boileau et al[4] demonstrated that a labral fixation construct that used fewer than 4 suture anchors significantly increased risk for failure. Despite this, we observed that no study used a minimum of 4 suture anchors; however, across those studies that specifically stated using a minimum of 3 suture anchors, failure rates improved to 8.7%. In addition to suture anchor number, patient positioning in the lateral decubitus position has been shown to significantly decrease failure rates after arthroscopic shoulder stabilization.[11] Interestingly, we did not observe that patient positioning in isolation improved failure rates after arthroscopic stabilization in contact or collision athletes (17.4%). Ultimately, our observations suggest that surgical technique can influence failure rates after arthroscopic stabilization in the contact or collision athlete, and it appears as though the most significant influence is the use of multiple points of labral fixation. It remains to be seen how using a minimum of 4 suture anchors, as Boileau et al demonstrated, can influence failure rates in this notoriously high-risk patient population.

Interestingly, all studies included in this review were performed between 1988 and 2011, with only 4 studies having stated that they included patients who underwent arthroscopic stabilization in the past decade. We believe this is an important consideration, particularly when generalizing these data to counsel patients regarding risks of failure following modern surgical techniques. For instance, the use of Suretacs and transglenoid sutures is largely outdated, but these fixation devices were used in half of the studies included in this study. Similarly, suture type was reported by only half of the included studies, but a large proportion of these used an absorbable suture (5/13 studies), which has demonstrated inferior results in a prior study.[10] Finally, thermal capsulorrhaphy has been shown to be associated with high failure rates after arthroscopic stabilization surgery and has largely been abandoned[39]; however, 2 studies included in this review performed this technique. Ultimately, our data suggest that there is a need for evidence that reflects modern, evidence-based surgical techniques to improve our understanding of our outcomes and to improve our communication to patients.

The postoperative management of the contact or collision athlete is also an important consideration. In this study, the vast majority of studies immobilized patients for 3 to 4 weeks and permitted return to contact sports by 6 months. We do caution that there is a distinct difference between permitted return to sport and actual return to sport. In the present study, a reliable rate of return to sport could not be determined given the variability in reporting of factors such as return to preinjury contact or

collision sport, as well as return to preinjury level of play. Despite this, return to play is an important consideration when counseling patients regarding their future risk of failure, particularly given evidence to suggest that in spite of excellent functional outcomes after arthroscopic shoulder stabilization, factors such as competing interests, kinesiophobia, and age can influence return to sport.[37] For patients who do not return to contact or collision sports, we argue that their risk of failure approaches that of the general population, and for this reason, there is a need for the clinician to explore patient goals and aspirations in the preoperative setting. Another consideration is competition level, which was infrequently reported among the 26 studies included in this review. Based upon the Balg and Boileau[3] study that generated the instability severity index score, competition level was a significant influence on risk of failure after an arthroscopic stabilization surgery, whereby patients who participated in competitive sports were at significantly higher risk for failure as compared with patients who participated in recreational sports ($P = .01$). Finally, consideration must be given to the mechanism of failure, whereby past studies have reported a higher frequency of patients' redislocating as a result of a new traumatic injury[22] and less commonly during their contact or collision sport of interest.

Although we sought to appropriately classify contact and collision sports according to the AAPCSM criteria,[1] we do acknowledge that the designation of contact or collision sport remains misleading and that a more appropriate and meaningful categorization of data would be to generate sport-specific risks of failure. For instance, the difference in anterior shoulder dislocation and bone defect incidence between American football players and rugby players—2 contact or collision sports—was so substantially different that it suggests a different mechanism of injury between the 2 groups.[5] Furthermore, there is recent evidence to suggest that the risk of injury is 4 times higher among rugby players as compared with American football players.[42] To take this argument even further, we believe that it is also important to consider sport-specific exposure in the determination of failure risk.[22] For instance, there is a distinct difference between a kicker and an offensive lineman in American football, as the former is not routinely involved in contact activities; however, both would be considered to play a contact or collision sport. Ultimately, we believe that clinicians can improve patient communication and expectation by considering factors in addition to sport type, such as position, frequency of play, competition level, and future goals.

As with any systematic review, the present study is limited by the quality of the included studies, of which 23 (88.5%) studies were level 4 evidence. Ultimately, the general point has been made throughout this article that there is great heterogeneity in the reporting of preoperative variables (patient demographics, patient assessment and workup, and injury characteristics), surgical technique, and postoperative outcomes (range of motion, return to sport, and patient-reported outcome measures). Going forward, there is a need to improve upon the quality of the evidence pertaining to the surgical management of contact or collision athletes, such that we can better inform our patients as to expected failure rates after the use of modern techniques, rather than draw upon the experiences of outdated techniques. There is also a need to determine how contact or collision patients fare aside from failure, including return to play, range of motion, and patient-reported outcome measures, as failure rates alone are not the only indicator of patient outcome after arthroscopic shoulder stabilization.

CONCLUSION

Across 26 studies reporting failure rates after arthroscopic shoulder stabilization in contact or collision athletes, the pooled failure rate is 17.8%; however, when studies are stratified according to evidence-based patient selection and surgical technique, the failure rate improves to 7.9% and is in keeping with the rates of failure after arthroscopic shoulder stabilization in the general population. Ultimately, this study demonstrates that despite the commonly held belief that contact or collision sports are themselves a risk factor for failure after arthroscopic stabilization, it may be less about sport type than it is about factors such as patient demographics, the presence of glenoid and/or humeral bone loss, and surgical technique.

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