Anterior Shoulder Instability Part I—Diagnosis, Nonoperative Management, and Bankart Repair—An International Consensus Statement

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Purpose: The purpose of this study was to establish consensus statements via a modified Delphi process on the diagnosis, nonoperative management, and Bankart repair for anterior shoulder instability. **Methods:** A consensus process on the treatment using a modified Delphi technique was conducted, with 65 shoulder surgeons from 14 countries across 5 continents participating. Experts were assigned to one of 9 working groups defined by specific subtopics of interest within anterior shoulder instability. **Results:** The independent factors identified in the 2 statements that reached unanimous agreement in diagnosis and nonoperative management were age, gender, mechanism of injury, number of instability events, whether reduction was required, occupation, sport/position/level played, collision sport, glenoid or humeral bone-loss, and hyperlaxity. Of the 3 total statements reaching unanimous agreement in Bankart repair, additional factors included overhead sport participation, prior shoulder surgery, patient expectations, and ability to comply with post-operative rehabilitation. Additionally, there was unanimous agreement that complications are rare following Bankart repair and that recurrence rates can be diminished by a well-defined rehabilitation protocol, inferior anchor placement (5-8 mm apart), multiple small-anchor fixation points, treatment of concomitant pathologies, careful capsulolabral debridement/reattachment, and appropriate indications/assessment of risk factors. **Conclusion:** Overall, 77% of statements reached unanimous or strong consensus. The statements that reached unanimous consensus were the aspects of patient history that should be evaluated in those with acute instability, the prognostic factors for nonoperative management, and Bankart repair. Furthermore, there was unanimous consensus on the steps to minimize complications for Bankart repair, and the placement of anchors 5-8 mm apart. Finally, there was no consensus on the optimal position for shoulder immobilization. **Level of Evidence:** Level V, expert opinion.

See commentaries on pages 243, 247, and 250

Introduction

Anterior shoulder instability occurs in a wide range of patient populations with different needs that require an individualized treatment strategy.[1,2] However, many aspects of the management of this pathology remain controversial because of a relative lack of high-

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level evidence to guide treatment.[3] Furthermore, there are often regional philosophical differences in how anterior shoulder instability is approached that result in a dichotomous treatment algorithm between surgeons, further adding to this controversy.[4,5]

The diagnosis of anterior shoulder instability requires a thorough clinical evaluation to determine a patient's risk of recurrent instability, which ultimately dictates treatment.[6] Although there exists a vast number of factors that can be obtained on patient history and physical examination, there is little indication in the literature as to which are most relevant in this clinical context.[7,8] Similarly, choice of imaging is often variable because of a lack of standardized guidelines between surgeons and institutions.[9] Additionally, there still exists a lack of agreement regarding which patients should be managed surgically. However, most surgeons reserve nonoperative management for patients with a relatively lower risk of recurrence.[10-12] These patients are often initially treated with a short period of shoulder immobilization for symptomatic relief, followed by a progressive rehabilitation protocol. Despite the several trials published on the subject of shoulder immobilization for first-time dislocators, there is disagreement about the optimal position of immobilization, with some surgeons advocating for immobilization in external rotation.[13,14] When surgery is elected, the treatment usually consists of an arthroscopic Bankart repair. While this is the most commonly performed procedure for anterior shoulder instability worldwide, there are many nuances to anterior shoulder instability that may require additional, or potentially more invasive, procedures.[15] As such, there are interesting regional and geographical variations in the surgical treatment of these patients, including the decision to perform Bankart repair via an open or arthroscopic approach.[15,16]

Several previous societies have developed both national and international consensus statements on a variety of topics using the Delphi method.[17-24] The Delphi method requires multiple rounds of questionnaires to encompass expert opinion on a topic, to ultimately lead to defined consensus statements. The Neer Circle of the American Shoulder and Elbow Surgeons created consensus statements based on clinical scenarios aimed at individualizing the treatment of patients with first-time anterior shoulder instability.[17] Ultimately, they found that patient-specific factors, such as the presence of participation in collision sports, age >14 years, meaningful bone-loss, and

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apprehension increased the probability of recommending surgery for first-time anterior shoulder instability. Although this group succeeded in providing important recommendations on the management of this pathology in the United States, its focused approach also served as a stimulus for the creation of a global initiative aimed at identifying commonalities between how surgeons approach various key aspects of anterior shoulder instability. Thus, the Anterior Shoulder Instability International Consensus Group (ASI-ICG) was created with a mandate to establish clinical guidelines for key aspects of the treatment of this pathology. The purpose of this study was to establish consensus statements via a modified Delphi process on the diagnosis, nonoperative management, and Bankart repair for anterior shoulder instability. Our hypothesis was that there would be consensus on the majority of statements regarding the diagnosis, nonoperative management, and Bankart repair for anterior shoulder instability.

Methods

Consensus Working Groups

Sixty-five shoulder surgeons from 14 countries across 5 continents participated in these consensus statements on anterior shoulder instability, with 69 initially being invited and 4 declining. The working groups were established by the steering committee: Laith M. Jazrawi, Bogdan A. Matache, Ivan Wong, Eiji Itoi, Eric J. Strauss, Ruth A. Delaney, Lionel Neyton, George S. Athwal, Leo Pauzenberger, and Hannan Mullett. These authors contributed to the creation of the consensus working groups and recommended people to be involved in the process. Furthermore, the proceedings and agendas of recent conferences of the American Association of Nurse Anesthetists, the American Orthopaedic Society for Sports Medicine, the American Shoulder and Elbow Surgeons, the European Society for Surgery of the Shoulder and Elbow, the European Society of Sports Traumatology, the Knee Surgery & Arthroscopy, and the International Conference on Sustainable Expert Systems were screened for those invited speakers whose speech or research focused on anterior shoulder instability to ensure that the thought leaders in this area were invited. Furthermore, we sought to include surgeons from multiple countries so that different philosophies and viewpoints were included. Experts were assigned to one of 9 working groups defined by specific subtopics of interest within anterior shoulder instability, including 1) diagnosis, 2) nonoperative management, 3) Bankart repair, 4) Latarjet procedure, 5) remplissage, 6) glenoid bone grafting, 7) revision surgery, 8) rehabilitation and return to play, and 9) follow-up. This study represents three of the working groups topics, and two separate companion articles focus on the other topics. Working groups were kept geographically balanced to limit bias and ensure the groups were representative of the field at large. Thus, each working group was assigned surgeons from at least 2 different continents, and all groups had surgeons from at least 3 different countries involved in an effort to minimize regional bias. The working groups are shown in Appendix Box 1. Furthermore, the participants were instructed to answer the questionnaires based on the best available evidence rather than personal preference. A liaison (E.T.H.) served as the primary point of contact and facilitated communication and the distribution of surveys to ensure consistency across the working groups. Additionally, the liaison formulated each subsequent round of questionnaires based on the prior round's responses. To reduce the potential for bias in the data analysis and/or literature review, the liaison did not submit answers to the questionnaires or partake in the voting process.

Delphi Consensus Method

Nine working groups covering the principal topics of interest in the area of anterior shoulder instability were established. A set of questions pertaining to each working group was generated based on clinical relevance and areas of controversy identified through systematic review of the literature and by the nine experts on the steering committee. A modification of the Delphi method was used to generate consensus statements for each working group, with groups completing 3 initial rounds of questionnaires, followed by amendments, and lastly a final vote. Surveys were distributed in a blinded fashion using RedCap. All of the questionnaire responses and votes were anonymized. Questions progressed from an open-ended to a more structured format, and were designed to elucidate areas of agreement and disagreement between group members. Once a preliminary consensus statement was generated within a working group, participants were asked whether they "agreed" or "disagreed" with it. If there were unanimous agreement within a group on a preliminary consensus statement, this statement was elevated to a final vote. If the agreement was not unanimous within a group, these questions were subject to further suggested changes anonymously through the RedCap software by members of the entire consensus group, with statements being amended where there was agreement with the proposed change. The final voting process allowed all study participants to assess the consensus statements generated by the other working groups and vote on whether they "agreed" or "disagreed" with them; thus, all statements were voted on by all 65 participants.

Final Voting

After the final votes for each question occurred, the degree of agreement was expressed using a percentage

Table 1. Diagnosis

Questions and Answers	Agreement	Consensus
Q: Which aspect(s) of the patient history should be evaluated in the setting of suspected/known primary anterior shoulder instability?	100%	Unanimous
A: The following should be evaluated a) age, b) gender, c) mechanism of injury, d) occupation, e) sport played and position, f) level of sport, g) whether it required reduction, and h) hyperlaxity.		
Q: Which aspect(s) of the patient history should be evaluated in the setting of suspected/known recurrent anterior shoulder instability?	95%	Strong Consensus
A: The following aspects of the patient history should be evaluated in the setting of suspected/known recurrent anterior shoulder instability a) age, b) age at first instability event, c) number of dislocations, d) original and most recent mechanism of injury, e) pain, f) instability symptoms, g) occupation, h) sport played and position, i) level of sport, j) hand dominance, k) whether they require reduction/can self-reduce, l) hyperlaxity, m) instability with low energy, n) prior treatment(s), and o) other injuries/surgical history.		
Q: Which aspect(s) of the physical examination should be performed in the setting of suspected/known anterior shoulder instability?	95%	Strong Consensus
A: The following aspect(s) of the physical examination should be performed in the setting of suspected/known anterior shoulder instability a) rotator cuff strength testing, b) neurological exam, c) anterior/posterior apprehension, d) load and shift, e) ABER apprehension/relocation, f) sulcus sign, g) Beighton score/hyperlaxity of the shoulder at external rotation at side >85°, h) Gagey test, and i) findings on inspection.		
Q: In the acute setting, are radiographs required prior to attempting reduction of a dislocated shoulder? Are post-reduction images required?	90%	Strong Consensus
A: In the acute setting, radiographs should be performed prior to attempting reduction of a dislocated shoulder, and post-reduction images should be obtained. However, closed reductions can be performed on the field/training room without concern for pre-reduction radiographs, but post-reduction images should still be obtained.		
Q: Which plain radiographic views should be obtained to evaluate suspected/known shoulder instability?	92%	Strong Consensus
A: The following plain radiographic views should be obtained to evaluate suspected/known shoulder instability a) anterior-posterior, b) axillary, and c) scapular-Y.		
Q: When should advanced imaging (MRI/CT) be performed in a patient presenting with suspected/known anterior shoulder instability?	90%	Strong Consensus
A: Advanced imaging should be performed in the following scenarios a) irreducible in ED, b) preoperatively, c) patient has high risk for recurrence, or d) suspected rotator cuff injury.		
Q: Which advanced imaging modality is preferred for a patient presenting with suspected/known anterior shoulder instability, CT, or MRI?	84%	Consensus
A: CT should be performed if there is suspected bone loss; otherwise, MRI should be performed.		
Q: How should glenoid bone loss be quantified?	87%	Consensus
A: Glenoid bone loss should be quantified via the circle method using an enface view of a 3D CT.		
Q: How should humeral bone loss be quantified?	93%	Strong Consensus
A: Humeral bone loss should be quantified using 3D CT, and the glenoid track should be evaluated.		
Q: What limitations should be considered with radiological imaging when extrapolating to expected surgical findings in anterior shoulder instability?	90%	Strong Consensus
A: Radiographic approximation of glenoid bone loss may underestimate that identified during surgical evaluation with anterior shoulder instability.		

rounded to the nearest whole number. Consensus was defined as 80-89%, whereas strong consensus was defined as 90-99%, and unanimous consensus was indicated by receiving 100% of the votes in favor of a proposed statement.

Results

Diagnosis

Of the 10 total questions and consensus statements in this group, 1 achieved unanimous consensus, 7 achieved strong consensus, and 2 achieved consensus. The statement achieving unanimous consensus was that the following aspect of patient history should be evaluated: a) age, b) gender, c) mechanism of injury, d) occupation, e) sport played and position, f) level of sport, g) whether it required reduction, and h) hyperlaxity. All of these statements are shown in Table 1, and the initial questions from Rounds 1-3 are included in Appendix Box 2.

Nonoperative Management

Of the 9 total questions and consensus statements in this group, 1 achieved unanimous consensus, 6 achieved strong consensus, 1 achieved consensus, and 1 did not achieve consensus. The statement achieving unanimous consensus was that the prognostic factors that are important to consider specifically in those undergoing non-operative management include: a) age, b) athletic demands/activity level, c) collision/contact athlete, d)

Table 2. Nonoperative Management

Questions and Answers	Agreement	Consensus
Q: What are the indications for nonoperative management?	92%	Strong Consensus
A: The primary relative indications for nonoperative management include a) low risk of recurrence, b) patient preference to avoid surgery, c) low functional demand, d) primary instability, e) no glenoid bone loss, f) >30 years old or <14 years old, and g) timing in-season to allow for return to play.		
Q: What are the contraindications for nonoperative management?	92%	Strong Consensus
A: The primary relative contraindications for nonoperative management include a) multiple instability events, b) high risk for further recurrence, c) severe glenoid bone loss or large bony fragment, d) instability in low-energy mechanisms, e) collision athletes, and f) competitive athletes.		
Q: What prognostic factors should be considered in patients undergoing nonoperative management?	100%	Unanimous
A: The prognostic factors that are important to consider specifically in those undergoing nonoperative management include a) age, b) athletic demands/activity level, c) collision/contact athlete, d) number and method of instability events, e) glenoid bone-loss, f) Hill-Sachs lesion, and g) hyperlaxity.		
Q: Does immobilization play a role in the nonoperative management of anterior shoulder instability? If so, for what duration of time?	92%	Strong Consensus
A: Immobilization may play a role in the early phase of non-operative management of anterior shoulder instability; however, it is unclear how long patients may require to be immobilized.		
Q: If shoulder immobilization is indicated, should the shoulder be immobilized in neutral, internal, or external rotation?	66%	No Consensus
A: If patients are immobilized, then they should be immobilized in either neutral or external rotation.		
Q: When should patients start shoulder range-of-motion exercises?	90%	Strong Consensus
A: Patients should start shoulder range-of-motion exercises after 1-2 weeks, once comfort permits.		
Q: When should patients start resistance training exercises?	95%	Strong Consensus
A: Patients should start resistance training exercises once full range of motion is restored, and patients can perform the exercises without apprehension.		
Q: When should patients start sport-specific training exercises?	98%	Strong Consensus
A: Patients should start sport-specific training exercises once full range of motion and strength are restored, dependent on the timing in the season.		
Q: Do corticosteroids or orthobiologics play a role in nonoperative management?	85%	Consensus
A: There is no role for corticosteroids or orthobiologics in nonoperative management.		

number and method of instability events, e) glenoid bone-loss, f) Hill-Sachs lesion, and g) hyperlaxity. Additionally, the statement that did not achieve consensus was that if patients are immobilized, then they should be immobilized in either neutral or external rotation, which had 66% consensus. All of these statements are shown in Table 2, and the initial questions from Rounds 1-3 are included in Appendix Box 3.

Bankart Repair

Of the 12 total questions and consensus statements in this group, 3 achieved unanimous consensus, 7 achieved strong consensus, and 2 achieved consensus. These statements achieved unanimous consensus: the following prognostic factors should be considered in patients undergoing a Bankart repair: a) younger age, b) glenoid bone-loss, c) Hill-Sachs lesion, d) male, e) competitive athlete, f) overhead athlete, g) number of preoperative dislocations, h) prior shoulder surgery, i) hyperlaxity, j) expectations, and k) ability to comply with postoperative rehabilitation. Complications, other than recurrence, are rare following a Bankart repair procedure. However, the following can be used to reduce recurrence: a) well-defined rehabilitation protocol, b) inferior anchor placement, c) multiple anchor fixation points, d) small anchors to minimize postage stamp fractures, e) treat concomitant pathologies, f) careful capsulolabral debridement and reattachment, g) appropriate indication and assessment of risk factors. Finally, anchors should be placed 5-8 mm apart when performing a Bankart repair. All of these statements are shown in Table 3, and the initial questions from Rounds 1-3 are included in Appendix Box 4.

Discussion

The most important finding from this study was that all but one of the statements reached consensus. Six of the included statements reached unanimous agreement. Overall, 84% of statements reached unanimous or strong consensus. Only one statement pertaining to shoulder immobilization did not achieve consensus agreement. The statements that reached unanimous consensus were the aspects of patient history that should be evaluated in patients with acute instability, the prognostic factors for nonoperative management, and Bankart repair. Furthermore, there was unanimous consensus on the steps to minimize complications for Bankart repair, and the placement of anchors 5-8 mm apart. Finally, there was no consensus on the optimal position of shoulder immobilization for nonsurgically managed patients. These consensus statements represent the ASI-ICG's expert agreement on diagnosis, nonoperative management, and Bankart repair for anterior shoulder instability.

Table 3. Bankart Repair

Questions and Answers	Agreement	Consensus
Q: What are the indications for a Bankart repair?	97%	Strong Consensus
A: The primary relative indications for a Bankart repair are a) primary or recurrent instability, b) high risk for failure with nonoperative management, c) minimal glenoid bone loss, d) on-track Hill-Sachs lesion, e) patient preference for surgery over nonoperative management, f) symptomatic instability on exam, and g) MRI confirmation of labrum tear/Bankart lesion.		
Q: What are the contraindications for Bankart repair?	93%	Strong Consensus
A: The primary relative contraindications for a Bankart repair are a) severe glenoid bone loss, b) off-track Hill-Sachs lesion, c) uncontrolled epilepsy, d) posterior instability, e) multidirectional instability, and f) likelihood of poor compliance with postoperative rehabilitation.		
Q: Should Bankart repair be performed arthroscopically or via an open approach? If so, is there an indication for open Bankart repair?	80%	Consensus
A: A Bankart repair should be performed arthroscopically. However, an open Bankart repair may be indicated in patients with high risk for recurrence but minimal glenoid bone loss.		
Q: Is there an amount of glenoid bone loss above which a Bankart repair should not be performed?	90%	Strong Consensus
A: A Bankart repair should not be performed in patients with >15-20% glenoid bone loss.		
Q: Which prognostic factors should be considered in patients undergoing a Bankart repair?	100%	Unanimous
A: The following prognostic factors should be considered in patients undergoing a Bankart repair a) younger age, b) glenoid bone loss, c) Hill-Sachs lesion, d) male, e) competitive athlete, f) overhead athlete, g) number of preoperative dislocations, h) prior shoulder surgery, i) hyperlaxity, j) expectations, and k) ability to comply with postoperative rehabilitation.		
Q: What are the indications for performing concomitant procedures with a Bankart repair?	98%	Strong Consensus
A: In the setting of a Bankart repair, other pathologies contributing to instability, such as posterior or superior labral tears or Hill-Sachs lesion, should be addressed when performing Bankart repair.		
Q: Should Bankart repair be performed in the beach/captain's chair or lateral decubitus position?	92%	Strong Consensus
A: It is based on surgeon preference whether a Bankart repair is performed in the beach/captain's chair or lateral decubitus position.		
Q: What steps should be taken to minimize complications following a Bankart repair procedure?	100%	Unanimous
A: Complications, other than recurrence, are rare following a Bankart repair procedure. However, the following can be used to reduce recurrence a) well-defined rehabilitation protocol, b) inferior anchor placement, c) multiple anchor fixation points, d) small anchors to minimize postage stamp fractures, e) treatment of concomitant pathologies, f) careful capsulolabral debridement and reattachment, and g) appropriate indication and assessment of risk factors.		
Q: What is the optimal number of anchors when performing a standard Bankart repair?	94%	Strong Consensus
A: A minimum of 3 anchors should be used when performing a standard Bankart repair; however, this may be greater in a more extensive labral tear.		
Q: How far apart should anchors be placed when performing a Bankart repair?	100%	Unanimous
A: Anchors should be placed 5-8 mm apart when performing a Bankart repair.		
Q: Where should the lowest anchor be placed when performing a Bankart repair in a right shoulder?	89%	Consensus
A: The lowest anchor should be placed at 5:30-6:00 o'clock when performing a Bankart repair.		
Q: When should a rotator interval closure be performed?	97%	Strong Consensus
A: A rotator interval closure may not be routinely recommended but can be considered in those with hyperlaxity.		

Ultimately, these studies represent Level V data as expert opinion, and our hope is that it will serve as a catalyst to address the gaps in the evidence where they exist while providing guidance based on the current evidence.

The diagnosis and appropriate work-up is essential to appropriately individualize the treatment of anterior shoulder instability, and this requires extracting the necessary information from a detailed patient history. There was unanimous consensus within this working group that the aspects of patient history that need to be evaluated after an acute instability event include patient age, mechanism of injury, occupation, sport played and position, level of sport, whether it required reduction, and hyperlaxity. All of these factors are related to patient demand, and subsequently their risk of recurrent instability.[25-28] There was also strong consensus with regard to the aspects of patient history that need to be evaluated in the setting of recurrent instability, which include the number of dislocations, presence of low-energy mechanism of dislocation, and history of prior surgery. Although these patients are similar in terms of their unifying diagnosis of ASI, their history of recurrence requires a more thorough work-up to understand the gamut of pathology present and how to best manage it.

One-third of the statements on diagnostic imaging did not reach strong consensus, which may be as a result of differences in available technology across different hospital settings and is an important external factor to be appreciated. The use of advanced imaging was agreed upon for those at high-risk of recurrence and for the purpose of preoperative planning, with 3D-CT strongly deemed to be preferrable in the setting of suspected humeral bone loss. This is supported in the

literature, with a recent systematic review by Vopat et al.[29] showing that 3D-CT demonstrated the greatest intraobserver and interobserver reliabilities for Hill-Sachs measurement and glenoid track calculation. However, there are still some concerns over its use because of the potential concern for radiation exposure in what is primarily a younger population. Thus, some of the authors who have the access and capability prefer to use 3D-MRI, as recent advances in this technology have shown it may have the potential to accurately measure bone loss.[30] Furthermore, the best-fit circle and glenoid track methods were deemed to be the optimal method for measuring glenohumeral bone loss, and these are the most commonly used methods in the literature.[31] Interestingly, although there was strong consensus that radiographic calculations may underestimate the amount of glenoid bone loss encountered at the time of arthroscopy, recent literature rebuts this statement.[32] However, this finding may be at least partially reconciled with our consensus statement by the fact that in many parts of the world where universal healthcare exists, there is often a significant delay between the dates of surgical booking and surgery, during which time additional micro/macro instability events might occur that could conceivably alter the degree of glenoid bone loss encountered at the time of arthroscopy. Therefore, it may be the case that these time 0 findings may not be generally applicable.

Nonoperative management for anterior shoulder instability is important to discuss with all patients, but high rates of failure have been reported.[33] A recent meta-analysis demonstrated that nearly half of all patients who underwent nonoperative management for primary anterior shoulder instability ultimately required surgery.[34] Additionally, it should be noted that further instability events are not benign and may cause further tissue attenuation, cartilage injury, and bone loss, predisposing to higher risks of failure of arthroscopic Bankart repair and the requirement for a more invasive surgical procedure.[35-38] The Neer Circle created consensus statements on the decision-making algorithm for operative versus nonoperative management of primary anterior shoulder instability, and the indications/contraindications in our consensus statements are complementary to that effort.[17]

The only statement not achieving consensus agreement for nonoperative management is the preferred position of immobilization of the shoulder in either external or neutral rotation, with only 69% of participants agreeing with this statement. Itoi et al.[13,14] initially proposed the use of immobilization in external rotation based on cadaveric and MRI findings, which showed that the separation and displacement of the labrum were both significantly less in external as compared to internal rotation. Thus, they subsequently conducted a randomized controlled trial that established that immobilization in external rotation for a period of 3 weeks reduced the recurrence rate by 46.1%.[39,40] While meta-analyses looking at the outcomes of immobilization in external versus internal rotation have yielded differing results, the most recent and largest one performed by Hurley et al. support a short period of immobilization in external rotation following a primary anterior shoulder instability event.[41-47] Many of the participants in our international consensus group expressed strong and mixed opinions on this subject, with concerns voiced about discomfort and a lower compliance rate with immobilization in external rotation, which had led some to subsequently adopt a more neutral position. Additionally, several participants preferred immobilization in internal rotation, as they felt that outcomes were comparable, thus not justifying the increased cost of external rotation braces, and that it satisfies the primary purpose of immobilization, which is patient comfort. Furthermore, some participants felt that immobilization in external or neutral rotation were not equivalent entities and, therefore, ultimately disagreed with the unifying statement produced. Thus, while this is actually one of the subtopics with the greatest number of supporting randomized trials to help guide treatment, it was a challenging question to obtain consensus because of a variety of opinions and dogmatic practices. Finally, there was strong consensus on the stepwise return to play based on individual patient goals rather than time-based criteria, which have been advocated for in recent years.[48,49]

Arthroscopic Bankart repair is the most common procedure performed worldwide for anterior shoulder instability.[15] Ten of the twelve statements in this working group achieved at least strong consensus, with several being unanimously agreed upon, despite many philosophical differences in treatment among the participants based on their location of practice.[4] However, one of the more controversial topics pertained to the role of open Bankart repair, with several participants having abandoned its use in high-risk patients in favor of a Latarjet procedure, while others still prefer it because of its comparatively lower complication profile. This trend was observed in a database study by Riff et al., who showed that there was a 15% increase and 9% decrease per year in the number of Latarjet and open Bankart procedures being performed in the United States, respectively.[50] The indications for Bankart repair and prognostic factors all achieved strong consensus, although it should be noted that this is one of the best researched topics in the area of shoulder instability, with many large-scale studies evaluating the risk factors for recurrence and treatment algorithms based on this.[26,51,52] The extent of critical bone loss that may predispose a patient to having a high-risk of postoperative recurrence remains controversial, with studies ranging from 15% to 25%.[53,54] However, it is generally

agreed upon that the critical threshold may be on the lower end of that spectrum, and this notion is reflected in the consensus that 15-20% is a reasonable cut-off for performing a Bankart repair.

All of the technical factors in performing a Bankart repair achieved strong or unanimous consensus, including the minimum number of anchors to be used (3), location of the first anchor (5:30-6 o'clock in a right shoulder), and the spacing between anchors (5-8 mm).[55,56] This was very interesting because of the wide varieties in training philosophies among members of this group. However, given the several clinical and biomechanical studies evaluating the factors associated with technical success that have been published in recent years, as well as the ease of dissemination of this information through technique journals and online videos, it is unsurprising that this level of consensus was reached. With regard to intraoperative patient positioning, while many surgeons have positioning preferences due to personal bias, familiarity, and training, they agreed that this should be an individual surgeon's decision. Finally, while a recent editorial noted that "rotator interval closure continues to be a challenge in consensus", this group found strong consensus among the participants that rotator interval closure is a potentially useful technique to reduce capsular volume in patients with hyperlaxity.[57,58] However, rotator interval closure should be avoided in those with isolated anterior shoulder instability as it may cause iatrogenic stiffness.

Limitations

This study has several potential limitations. First, consensus statements are considered to be Level V data, as they represent expert opinion, which makes them susceptible to inherent biases in the selection and allocation of participants.[21,59] Ultimately, it is somewhat subjective in how the experts were selected, but that is the case with any expert panel, and we tried to minimize this bias. Furthermore, the questions and topics addressed may represent a potential source of bias, as there was no standardized process for generating them. Instead, they were each selected and agreed upon by the group leaders. Furthermore, the use of a Likert scale may have allowed for more nuanced responses, allowing authors to have varying levels of agreement where statements had multiple components, and allowing participants to indicate varying levels of agreement with such statements. Also, there were some limitations in the content discussed, as this article did not address the specifics of concomitant pathologies, such as rotator cuff tears, which may occur alongside anterior shoulder instability. Additionally, these statements involved a modification of the Delphi process, as the participants worked on their individual groups for the first three rounds and not all of the statements. Finally, there are some limitations with the Delphi process itself, as it may represent the lowest common denominator of expert opinion with less ownership of ideas, and ultimately represents Level V data.[59]

Conclusions

Overall, 84% of statements reached unanimous or strong consensus. The statements that reached unanimous consensus were the aspects of patient history that should be evaluated in those with acute instability, the prognostic factors for nonoperative management, and Bankart repair. Furthermore, there was unanimous consensus on the steps to minimize complications for Bankart repair, and the placement of anchors 5-8 mm apart. Finally, there was no consensus on the optimal position for shoulder immobilization.

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Appendix

Appendix Box 1. List of Consensus Members

G1 Diagnosis	
Alaia	USA
Cassidy	Ireland
Collin	France
Di Giacomo	Italy
Frank	USA
Waterman	USA
Wong	Canada
G2 Nonoperative Management	
Carter	USA
Erickson	USA
Itoi	Japan
Kuhn	USA
O'Shea	Ireland
Rokito	USA
Whelan	Canada
G3 Bankart Repair	
Calvo	Spain
Campbell	USA
Imhoff	Germany
Millett	USA
Moran	Ireland
Strauss	USA
Verma	USA
G4 Latarjet	
Delaney	Ireland
Garrigues	USA
Lim Fat	Mauritius
Neyton	France
Moya	Argentina
Scheibel	Germany
Virk	USA
G5 Remplissage	
Athwal	Canada
Kelly	USA
Khan	Canada
Meislin	USA
MacDonald	Canada
Molony	Ireland
Rhee	South Korea
G6 Glenoid Bone Grafting	
Heuberer	Austria
Kwon	USA
Mazzoca	USA
Moroder	Germany
Pauzenberger	Austria
Provencher	USA
Rosso	Switzerland
G7 Revision Surgery	
Arciero	USA
Cordasco	USA
Jazrawi	USA
Ladermann	Switzerland
Levine	USA
McCarty	USA
Walch	France
Warner	USA
G8 Rehabilitation/Return to Play	
Brophy	USA
Cole	USA
Ciccotti	USA
Funk	United Kingdom
Lomas	USA
Mullett	Ireland
Owens	USA
Warren	USA
G9 Follow-up	
Bedi	USA
Favard	France
Krych	USA
Matache	Canada
Rodeo	USA
Edwards	USA
Zuckerman	USA

(continued)

Appendix Box 2: Group 2 Diagnosis

Round 1

1. Which aspect(s) of the patient history should be documented in the setting of suspected/known primary anterior shoulder instability?
2. Which aspect(s) of the patient history should be evaluated in the setting of suspected/known recurrent anterior shoulder instability?
3. Which aspect(s) of the physical examination should be performed in the setting of suspected/known anterior shoulder instability?
4. In the acute setting, are radiographs required prior to attempting reduction of a dislocated shoulder? Are post-reduction images required?
5. Which plain radiographic views should be obtained to evaluate suspected/known shoulder instability?
6. When should advanced imaging (MRI/CT) be performed in a patient presenting with suspected/known anterior shoulder instability?
7. Which advanced imaging modality is preferred for a patient presenting with suspected/known anterior shoulder instability, CT, or MRI?
8. How should glenoid bone loss be quantified?
9. How should humeral bone loss be quantified?
10. What limitations should be considered with radiological imaging when extrapolating to expected surgical findings in anterior shoulder instability?

Round 2

1. Which of the following aspects of the patient history should be documented in the setting of suspected/known primary anterior shoulder instability?
   a. Age
   b. Mechanism of injury
   c. Occupation
   d. Sport played and position
   e. Level of sport
   f. Hand dominance
   g. Whether it required reduction
   h. Beighton Score
   i. Other injury/surgical history
2. Which aspect(s) of the patient history should be documented in the setting of suspected/known recurrent anterior shoulder instability?
   a. Age
   b. Age at first instability event
   c. Number of dislocations
   d. Original mechanism of injury
   e. Most recent mechanism of injury
   f. Pain
   g. Instability symptoms
   h. Occupation
   i. Sport played and position
   j. Level of sport
   k. Hand dominance
   l. Whether they require reduction/can self-reduce
   m. Beighton Score
   n. Instability with low energy, i.e., sleep
   o. Prior treatment(s)
   p. Other injury/surgical history
3. Which aspect(s) of the physical examination should be performed/documented in the setting of suspected/known anterior shoulder instability?
   a. Rotator cuff strength testing
   b. Neurological exam
   c. Anterior/posterior apprehension
   d. Load and shift
   e. ABER apprehension/relocation
   f. Jerk test
   g. Sulcus sign
   h. Beighton score
   i. Gages test
   j. Findings on inspection
4. In the acute setting, radiographs are required prior to attempting reduction of a dislocated shoulder and post-reduction images should be obtained. Do you agree with this statement? If not, why not?
5. Which of the following plain radiographic views should be obtained to evaluate suspected/known shoulder instability?
   a. AP
   b. Grashey
   c. Axillary
   d. Scapular Y
   e. West point view
   f. Stryker notch view
6. Which of the following do you agree are relative indications advanced imaging (MRI/CT) be performed in a patient presenting with suspected/known anterior shoulder instability?
   a. Irreducible in ED
   b. Preoperatively
   c. Patient is at high risk for recurrence
   d. No radiographs with shoulder dislocated
   e. Suspected rotator cuff injury
7. The group was divided on which advanced imaging modality is preferred for a patient presenting with suspected/known anterior shoulder instability, with suggestions that CT should be performed if there is suspected bone-loss and otherwise MRI should be performed. Do you agree with this statement? If not, why not?
8. Glenoid bone loss should be quantified via the circle method using an enface view of a 3D CT. Do you agree with this statement? If not, why not?
9. Humeral bone loss should be quantified using 3D CT, and the glenoid track should be evaluated. Do you agree with this statement? If not, why not?
10. Glenoid bone loss being underestimated should be considered as a limitation of radiological imaging when extrapolating to expected surgical findings in

anterior shoulder instability. Do you agree with this statement? If not, why not?

Round 3

1. Q: Which aspect(s) of the patient history should be documented in the setting of suspected/known primary anterior shoulder instability?
   A: The following should be documented a) age, b) mechanism of injury, c) occupation, d) sport played and position, e) level of sport, f) whether it required reduction, and g) Beighton score.

   Do you agree with this statement? If not, why not?
2. Q: Which aspect(s) of the patient history should be documented in the setting of suspected/known recurrent anterior shoulder instability?
   A: The following aspects of the patient history should be documented in the setting of suspected/known recurrent anterior shoulder instability a) age, b) age at first instability event, c) number of dislocations, d) original and most recent mechanism of injury, e) pain, f) instability symptoms, g) occupation, h) sport played & position, i) level of sport, j) hand dominance, k) whether they require reduction/can self-reduce, l) Beighton score, m) instability with low energy, n) prior treatment(s), and o) other injury/surgical history.

   Do you agree with this statement? If not, why not?
3. Q: Which aspect(s) of the physical examination should be performed/documented in the setting of suspected/known anterior shoulder instability?
   A: The following aspect(s) of the physical examination should be performed/documented in the setting of suspected/known anterior shoulder instability a) rotator cuff strength testing, b) neurological exam, c) anterior/posterior apprehension, d) load and shift, e) ABER apprehension/relocation, f) jerk test, g) sulcus sign, h) Beighton score, i) Gagey test, and j) findings on inspection.

   Do you agree with this statement? If not, why not?
4. Q: In the acute setting, are radiographs required prior to attempting reduction of a dislocated shoulder? Are post-reduction images required?
   A: In the acute setting, radiographs are required prior to attempting reduction of a dislocated shoulder and post-reduction images should be obtained.

   Do you agree with this statement? If not, why not?
5. Q: Which plain radiographic views should be obtained to evaluate suspected/known shoulder instability?
   A: The following plain radiographic views should be obtained to evaluate suspected/known shoulder instability a) anterior-posterior, b) axillary, and c) scapular-Y.

   Do you agree with this statement? If not, why not?
6. Q: When should advanced imaging (MRI/CT) be performed in a patient presenting with suspected/known anterior shoulder instability?
   A: Advanced imaging should be performed in the following scenarios a) irreducible in ED, b) preoperatively, c) patient is at high risk for recurrence, and d) suspected rotator cuff injury.

   Do you agree with this statement? If not, why?
7. Q: Which advanced imaging modality is preferred for a patient presenting with suspected/known anterior shoulder instability, CT arthrogram, or MRI?
   A: CT should be performed if there is suspected bone loss; otherwise, MRI should be performed.

   Do you agree with this statement? If not, why not?
8. Q: How should glenoid bone loss be quantified?
   A: Glenoid bone loss should be quantified via the circle method using an enface view of a 3D CT.

   Do you agree with this statement? If not, why not?
9. Q: How should humeral bone loss be quantified?
   A: Humeral bone loss should be quantified using 3D CT, and the glenoid track should be evaluated.

   Do you agree with this statement? If not, why not?
10. Q: What limitations should be considered with radiological imaging, when extrapolating to expected surgical findings in anterior shoulder instability?
    A: Glenoid bone loss being underestimated should be considered as a limitation of radiological imaging when extrapolating to expected surgical findings in anterior shoulder instability.

    Do you agree with this statement? If not, why not?

CT, computed tomography; ED, emergency department; MRI, magnetic resonance imaging; 3D, three dimensional.

Appendix Box 3. Group 2: Nonoperative Management

Round 1

1. What are the indications for nonoperative management?
2. What are the contraindications for nonoperative management?
3. What prognostic factors should be considered in patients undergoing nonoperative management?
4. Does immobilization play a role in the nonoperative management of anterior shoulder instability? If so, for what duration of time?
5. If shoulder immobilization is indicated, should the shoulder be immobilized in neutral, internal, or external rotation?
6. When should patients start shoulder range-of-motion exercises?

7. When should patients start resistance training exercises?
8. When should patients start sport-specific training exercises?
9. Do corticosteroids play a role in nonoperative management?
10. Do orthobiologics play a role in nonoperative management?

Round 2

1. Which of the following do you agree are indications for nonoperative management?
   a. Low risk of recurrence
   b. Patient preference to avoid surgery
   c. Low functional demand
   d. Primary instability
   e. No glenoid bone loss
   → 30 years old
   f. <14 years old
   g. Timing in-season to allow for return to play
2. Which of the following do you agree are relative contraindications for nonoperative management?
   a. Multiple instability events
   b. High risk for further recurrence
   c. Severe glenoid bone loss or large bony fragment
   d. HAGL
   e. 15-25 years old
   f. Male
   g. Collision athletes
   h. Competitive athletes
3. Which of the following do you agree are prognostic factors that should be considered in patients undergoing nonoperative management?
   a. Age
   b. Athletic demands/activity level
   c. Collision/contact athlete
   d. Number and method of instability events
   e. Glenoid bone loss
   f. Hill-Sachs lesion
   g. Intra-articular pathologies
   h. Rotator cuff injury
   i. Arm dominance
   j. Hyperlaxity
4. Immobilization may play a role in early phase of nonoperative management of anterior shoulder instability; however, it is unclear how long patients may require to be immobilized. Do you agree with this statement? If not, why not?
5. If patients are immobilized, then they should be immobilized in either neutral or external rotation. Do you agree with this statement? If not, why not?
6. Patients should start shoulder range-of-motion exercises after 1-2 weeks once comfort permits. Do you agree with this statement? If not, why not?
7. Patients should start resistance training exercises once full range of motion is restored and patients can perform the exercises without apprehension. Do you agree with this statement? If not, why not?
8. Patients should start sport-specific training exercises once full range of motion and strength are restored, dependent on the timing in the season. Do you agree with this statement? If not, why not?
9. The questions on corticosteroids and orthobiologics were merged as the responses were very similar. There is no role for corticosteroids or orthobiologics in conservative management. Do you agree with this statement? If not, why not?

Round 3

11. Q: What are the indications for nonoperative management?
    A: The primary relative indications for nonoperative management include a) low risk of recurrence, b) patient preference to avoid surgery, c) low functional demand, d) primary instability, e) no glenoid bone loss, f) >30 years old or <14 years old, and g) timing in-season to allow for return to play.

    Do you agree with this statement? If not, why not?
12. Q: What are the contraindications for nonoperative management?
    A: The primary relative contraindications for nonoperative management include a) multiple instability events, b) high risk for further recurrence, c) severe glenoid bone loss or large bony fragment, d) HAGL, e) collision athletes, and f) competitive athletes.

    Do you agree with this statement? If not, why not?
13. Q: What prognostic factors should be considered in patients undergoing nonoperative management?
    A: The prognostic factors that are important to consider specifically in those undergoing nonoperative management include a) age, b) athletic demands/activity level, c) collision/contact athlete, d) number and method of instability events, e) glenoid bone loss, f) Hill-Sachs lesion, and g) hyperlaxity.

    Do you agree with this statement? If not, why not?
14. Q: Does immobilization play a role in the nonoperative management of anterior shoulder instability? If so, for what duration of time?
    A: Immobilization may play a role in early phase of nonoperative management of anterior shoulder instability; however, it is unclear how long patients may require to be immobilized.

    Do you agree with this statement? If not, why not?
15. Q: If shoulder immobilization is indicated, should the shoulder be immobilized in neutral, internal, or external rotation?
    A: If patients are immobilized, then they should be immobilized in either neutral or external rotation.

    Do you agree with this statement? If not, why not?

16. Q: When should patients start shoulder range-of-motion exercises?
    A: Patients should start shoulder range-of-motion exercises after 1-2 weeks once comfort permits.

    Do you agree with this statement? If not, why?
17. Q: When should patients start resistance training exercises?
    A: Patients should start resistance training exercises once full range of motion is restored and patients can perform the exercises without apprehension.

    Do you agree with this statement? If not, why not?
18. Q: When should patients start sport-specific training exercises?
    A: Patients should start sport-specific training exercises once full range of motion and strength are restored, dependent on the timing in the season.

    Do you agree with this statement? If not, why not?
19. Q: Do corticosteroids or orthobiologics play a role in nonoperative management?
    A: There is no role for corticosteroids or orthobiologics in nonoperative management.

    Do you agree with this statement? If not, why not?

Appendix Box 4. Group 3: Bankart Repair

Round 1

1. What are the indications for a Bankart repair?
2. What are the contraindications for Bankart repair?
3. Should Bankart repair performed arthroscopically or via an open approach? If so, is there an indication for open Bankart repair?
4. Is there an amount of glenoid bone loss above which a Bankart repair should not be performed?
5. Which prognostic factors should be considered in patients undergoing a Bankart repair?
6. What are the indications for performing concomitant procedures with a Bankart repair?
7. Should Bankart repair be performed in the beach/captain's chair or lateral decubitus position?
8. What steps should be taken to minimize complications following a Bankart repair procedure?
9. What is the optimal number of anchors when performing a standard Bankart repair?
10. How far apart should anchors be placed when performing a Bankart repair?
11. Where should the lowest anchor be placed when performing a Bankart repair in a right shoulder?
12. When should a rotator interval closure be performed?

Round 2

1. Which of the following do you agree are relative indications for Bankart repair?
   a. Primary or recurrent instability
   b. High risk for failure with nonoperative management
   c. Minimal glenoid bone loss
   d. On-track Hill-Sachs lesion
   e. Patient preference for surgery over nonoperative management
   f. Symptomatic instability on exam
   g. MRI confirmation of labrum tear/Bankart lesion
2. Which of the following do you agree are relative contraindications for Bankart repair?
   a. Severe glenoid bone loss
   b. Off-track Hill-Sachs lesion
   c. Uncontrolled epilepsy
   d. Posterior instability
   e. Multidirectional instability
   f. Likelihood of poor compliance with postoperative rehabilitation
   g. Collision athlete
   h. Overhead athletes
3. A Bankart repair performed arthroscopically should be considered the gold standard approach. Do you agree with this statement? If not, why not? An open Bankart repair is controversial, and it may be indicated in young patients with high-risk for recurrence such as collision athletes. Do you agree with this statement? If not, why not?
4. Is there an amount of glenoid bone loss above which a Bankart repair should not be performed?
   a. 15%
   b. 20%
5. Which of the following do you agree are prognostic factors that should be considered in patients undergoing a Bankart repair?
   a. Younger age
   b. Glenoid bone loss
   c. Hill-Sachs lesion
   d. Male
   e. Competitive athlete
   f. Overhead athlete
   g. Number of preoperative dislocations
   h. Prior shoulder surgery
   i. Hyperlaxity
   j. Expectations
   k. Ability to comply with postoperative rehabilitation
6. In the setting of a Bankart repair, other pathologies contributing to instability, such as posterior or superior labral tears or Hill-Sachs lesion, should be addressed when performing Bankart repair. Do you agree with this statement? If not, why not?
7. It is based on surgeon preference whether a Bankart repair is performed in the beach/captain's chair or lateral decubitus position. Do you agree with this statement? If not, why not?
8. Complications, other than recurrence, are rare following a Bankart repair procedure. However, which of the following do you think may help minimize complications including recurrence?
   a. Well-defined rehabilitation protocol

b. Inferior anchor placement
c. Multiple anchor fixation points
d. Small anchors to minimize postage stamp fractures
e. Knotless anchors to minimize chondral irritation
f. Treat concomitant pathologies
g. Careful capsulolabral debridement and reattachment
h. Appropriate indication and assessment of risk factors

9. A minimum of 3 anchors should be used when performing a standard Bankart repair. Do you agree with this statement? If not, why not?
10. Anchors should be placed 5-8 mm apart when performing a Bankart repair. Do you agree with this statement? If not, why not?
11. The lowest anchor should be placed at 5.30-6 when performing a Bankart repair. Do you agree with this statement? If not, why not?
12. A rotator interval closure should never be performed. Do you agree with this statement? If not, why not?listb

Round 3

20. Q: What are the indications for a Bankart repair? listb
    A: The primary relative indications for a Bankart repair are a) primary or recurrent instability, b) high risk for failure with nonoperative management, c) minimal glenoid bone loss, d) on-track Hill-Sachs lesion, e) patient preference for surgery over nonoperative management, f) symptomatic instability on exam, and g) MRI confirmation of labrum tear/Bankart lesion.

    Do you agree with this statement? If not, why not?
21. Q: What are the contraindications for Bankart repair?
    A: The primary relative contraindications for a Bankart repair are a) severe glenoid bone loss, b) off-track Hill-Sachs lesion, c) uncontrolled epilepsy, d) posterior instability, e) multidirectional instability, and f) likelihood of poor compliance with postoperative rehabilitation.

    Do you agree with this statement? If not, why not?
22. Q: Should Bankart repair performed arthroscopically be considered the gold standard approach? If so, is there an indication for open Bankart repair?
    A: A Bankart repair performed arthroscopically should be considered the gold standard approach. An open Bankart repair may be indicated in young patients with high-risk for recurrence such as collision athletes.

    Do you agree with this statement? If not, why not?
23. Q: Is there an amount of glenoid bone loss above which a Bankart repair should not be performed?
    A: A Bankart repair should not be performed in patients with >15-20% glenoid bone loss.

    Do you agree with this statement? If not, why not?
24. Q: Which prognostic factors should be considered in patients undergoing a Bankart repair?
    A: The following prognostic factors should be considered in patients undergoing a Bankart repair a) younger age, b) glenoid bone loss, c) Hill-Sachs lesion, d) male, e) competitive athlete, f) overhead athlete, g) number of preoperative dislocations, h) prior shoulder surgery, i) hyperlaxity, j) expectations, and k) ability to comply with postoperative rehabilitation.

    Do you agree with this statement? If not, why not?
25. Q: What are the indications for performing concomitant procedures with a Bankart repair?
    A: In the setting of a Bankart repair, other pathologies contributing to instability, such as posterior or superior labral tears or Hill-Sachs lesion, should be addressed when performing Bankart repair.

    Do you agree with this statement? If not, why not?
26. Q: Should Bankart repair be performed in the beach/captain's chair or lateral decubitus position, and why?
    A: It is based on surgeon preference whether a Bankart repair be performed in the beach/captain's chair or lateral decubitus position.

    Do you agree with this statement? If not, why not?
27. Q: What steps should be taken to minimize complications following a Bankart repair procedure?
    A: Complications, other than recurrence, are rare following a Bankart repair procedure. However, the following can be used to reduce recurrence a) well-defined rehabilitation protocol, b) inferior anchor placement, c) multiple anchor fixation points, d) small anchors to minimize postage stamp fractures, e) treatment of concomitant pathologies, f) careful capsulolabral debridement and reattachment, and g) appropriate indication and assessment of risk factors.

    Do you agree with this statement? If not, why not?
28. Q: What is the optimal number of anchors when performing a standard Bankart repair?
    A: A minimum of 3 anchors should be used when performing a standard Bankart repair; however, this may be greater in a more extensive labral tear.

    Do you agree with this statement? If not, why not?
29. Q: How far apart should anchors be placed when performing a Bankart repair?
    A: Anchors should be placed 5-8 mm apart when performing a Bankart repair.

    Do you agree with this statement? If not, why not?

30. Q: Where should the lowest anchor be placed when performing a Bankart repair in a right shoulder?
    A: The lowest anchor should be placed at 5.30-6 when performing a Bankart repair.

    Do you agree with this statement? If not, why not?

31. Q: When should a rotator interval closure be performed?
    A: A rotator interval closure should never be performed.

    Do you agree with this statement? If not, why not?