Posterior Shoulder Instability, Part II—Glenoid Bone Grafting, Glenoid Osteotomy, and Rehabilitation/ Return to Play—An International Expert Delphi Consensus Statement

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Purpose: To establish consensus statements on glenoid bone grafting, glenoid osteotomy, rehabilitation, return to play, and follow-up for posterior shoulder instability. **Methods:** A consensus process on the treatment of posterior shoulder instability was conducted, with 71 shoulder/sports surgeons from 12 countries participating on the basis of their level of expertise in the field. Experts were assigned to 1 of 6 working groups defined by specific subtopics within posterior shoulder instability. Consensus was defined as achieving 80% to 89% agreement, whereas strong consensus was defined as 90% to 99% agreement, and unanimous consensus was indicated by 100% agreement with a proposed statement. **Results:** All of the statements relating to rehabilitation, return to play, and follow-up achieved consensus. There was unanimous consensus that the following criteria should be considered: restoration of strength, range of motion, proprioception, and sport-specific skills, with a lack of symptoms. There is no minimum time point required to return to play. Collision athletes and military athletes may take longer to return because of their greater risk for recurrent instability, and more caution should be exercised in clearing them to return to play, with elite athletes potentially having different considerations in returning to play. The relative indications for revision surgery are symptomatic apprehension, multiple recurrent instability episodes, further intra-articular pathologies, hardware failure, and pain. **Conclusions:** The study group achieved strong or unanimous consensus on 59% of statements. Unanimous consensus was reached regarding the criteria for return to play, collision/elite athletes having different considerations in return to play, indications for revision surgery, and imaging only required as routine for those with glenoid bone grafting/osteotomies at subsequent follow-ups. There was no consensus on optimal fixation method for a glenoid bone block, the relative indications for glenoid osteotomy, whether fluoroscopy is required or if the labrum should be concomitantly repaired. **Level of Evidence:** Level V, expert opinion.

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The prevalence and severity of posterior bone loss increases with further episodes of recurrent instability, although it is also observed in atraumatic cases, whereas retroversion and dysplasia are also known to be risk factors.[1,2] Increasing severity of posterior bone loss has been shown to be risk factor for further recurrence.[1-3] Bone loss is a challenging problem in the setting of posterior shoulder instability, as the treatment guidelines are unclear, with low-level evidence guiding treatment and a lack of long-term follow-up.[3,4] It is unclear when bony augmentation is required and what is the ideal graft required, but it has been of interest for many in recent literature.[5,6] Both autograft and allograft can be used, with proponents existing for each.[5,6]

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Furthermore, the use of glenoid osteotomy is also controversial, and concerns persist about the reported high rate of complications.[7] Most evidence comes from a few centers, and it is not widely used despite the potential ability to correct retroversion.[7]

The phases of rehabilitation after surgical management and the eventual return to play hold paramount importance in determining the overall success of the procedure. This necessitates careful consideration of factors such as the duration of immobilization and the specific criteria employed to gauge a patient's readiness to resume sports activities.[8,9] There is a need to balance protecting the surgical site and promoting early mobilization, which is crucial to ensuring optimal healing and long-term functional recovery. Furthermore, a notable gap exists in the establishment of clear-cut guidelines regarding the optimal duration and frequency of clinical follow-up visits for individuals who have undergone this procedure.[1] This lack of standardized postoperative care protocols can potentially lead to variations in patient outcomes and may contribute to a less-efficient recovery process.[10] Another area of uncertainty surrounds the necessity and timing of routine imaging studies after surgery.

Several previous societies have developed both national and international consensus statements on a variety of topics.[11-18] Previous consensus statements have been developed for anterior shoulder instability through the Neer Circle group of the American Shoulder and Elbow Surgeons and the Anterior Shoulder Instability International Consensus Group.[11,19-21] The purpose of this study was to establish consensus statements on the glenoid bone grafting, glenoid osteotomy, rehabilitation, return to play, and follow-up for posterior shoulder instability. Our hypothesis was that there would be consensus on most statements regarding glenoid bone grafting, glenoid osteotomy, rehabilitation, return to play, and follow-up for posterior shoulder instability.

Methods

Consensus Working Groups

Seventy-one shoulder/sports surgeons from 12 countries on 4 continents participated in these consensus statements on posterior shoulder instability, with 74 initially being invited and 3 declining. The working groups were established by the steering committee (E.H., J.L., L.J., G.G., S.N., J.H., B.M., P.C., B.W., B.E., C.K., O.A., J.D.). These authors contributed to the creation and recommended people to be involved in the process. Furthermore, recent conferences of the Arthroscopy Association of North America, American Orthopaedic Society for Sports Medicine, American Shoulder and Elbow Surgeons, European Society for Surgery of the Shoulder and Elbow, European Society of Sports Traumatology, Knee Surgery, and Arthroscopy, and the International Congress of Shoulder and Elbow Surgery were screened for who were the invited speakers on the topic/presenting research on the topic to ensure that the thought leaders in the area were invited. Furthermore, we sought to include surgeons from multiple countries so that different philosophies and viewpoints were included.

Experts were assigned to 1 of 6 working groups defined by specific subtopics of interest within posterior shoulder instability, including (1) diagnosis, (2) nonoperative management, (3) labrum repair, (4) glenoid bone grafts, (5) glenoid osteotomy, and (6) rehabilitation, return to play, and follow-up. This study represents the final 3 working groups topics, whereas a separate companion article focuses on the first 3.[22] 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 countries involved in an effort to minimize regional bias. The working groups and members are shown in Appendix Table 1, available at www.arthroscopyjournal.org. Furthermore, the participants were instructed to answer the questionnaires on the basis of 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. In addition, the liaison formulated each subsequent round of questionnaires on the basis of the previous 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.

Consensus Method

Six working groups covering the principal topics of interest in the area of posterior shoulder instability were established. A set of questions pertaining to each working group was generated on the basis of clinical relevance and areas of controversy identified through systematic review of the literature and by the 9 experts on the steering committee. A modification of the Delphi method used in previous consensus studies was used to generate consensus statements.[19-22] The modified process consisted of working groups each completing 3 initial rounds of questionnaires, with feedback between rounds. Statements were amended accordingly, and lastly a final vote by was undertaken by all participants. Surveys were distributed in a blinded fashion using REDCap (Vanderbilt University, Nashville, TN). All of

Table 1. Glenoid Bone Grafting

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: What are the indications for glenoid bone grafting? A: The relative indications for glenoid bone grafting are (1) severe glenoid bone loss and (2) revision surgery.	0%	0%	3%	57%	40%	Strong Consensus (97%)
Q: What are the contraindications for glenoid bone grafting? A: The relative contraindications for glenoid bone grafting are (1) minimal glenoid bone loss, (2) first-time dislocation, (3) osteoarthritis, (4) likelihood of poor compliance with postoperative rehabilitation, (5) uncontrolled epilepsy, and (6) nerve dysfunction.	0%	0%	4%	47%	49%	Strong Consensus (98%)
Q: Is there an optimal glenoid bone graft for treating posterior shoulder instability? A: The choice of glenoid bone graft for treating posterior shoulder instability should be dictated by surgeon preference.	0%	0%	1%	35%	64%	Strong Consensus (99%)
Q: Should a glenoid bone-grafting procedure be performed arthroscopically? A: A glenoid bone-grafting procedure be should performed arthroscopically only if the surgeon is technically proficient.	0%	0%	6%	26%	68%	Strong Consensus (94%)
Q: What are the indications for performing concomitant procedures with a glenoid bone-grafting procedure? A: The relative indications for performing concomitant procedures with a glenoid bone grafting are (1) reverse Hill-Sachs lesions, (2) anterior labral tear, (3) superior labral tear, and (4) long head of biceps tear/instability.	0%	0%	8%	35%	57%	Strong Consensus (92%)
Q: What steps should be taken to minimize complications following a glenoid bone-grafting procedure? A: The steps that should be taken to minimize complications after a glenoid bone-grafting procedure are (1) attention to detail, (2) careful dissection, (3) protecting the musculocutaneous and axillary nerves, (4) careful preparation of the glenoid neck and bone graft with adequate decortication, (5) preventing overlateralization/medialization of the graft and contour flush to native cartilage, (6) accurate screw/suture-button placement, (7) appropriate postoperative imaging, and (8) a well-defined rehabilitation protocol.	0%	1%	3%	28%	68%	Strong Consensus (96%)
Q: What is the optimal method of fixation of a glenoid bone graft? A: Two solid screws should be used for glenoid bone graft fixation.	0%	1%	23%	41%	35%	No Consensus (76%)
Q: Is a capsular repair required with a glenoid bone-grafting procedure? A: A capsular repair should be performed if it is technically feasible.	0%	5%	12%	39%	44%	Consensus (83%)
Q: Is resorption of the bone graft correlated with an inferior outcome after glenoid bone grafting? A: Remodeling is normal, but true resorption is correlated with an inferior outcome after glenoid bone grafting.	0%	3%	12%	50%	35%	Consensus (85%)

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. The 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 "strongly agreed," "agreed," were "neutral," "disagreed," or "strongly disagreed" with them; thus, all statements were voted on by all 71 participants.

Final Voting

After the final votes for each question occurred, the degree of agreement was expressed using a percentage rounded to the nearest whole number. Consensus was defined as 80% to 89%, whereas strong consensus was defined as 90% to 99%, and unanimous consensus was indicated by receiving 100% of the votes in favor of a proposed statement.[19-21,23] This consensus study was conducted in accordance with best practice for Delphi process.[24,25] Descriptive statistics were calculated using Excel (2023; Microsoft Corp., Redmond, WA).

Results

Glenoid Bone Grafting

Of the 9 total questions and consensus statements in this group, none achieved unanimous consensus, 6 achieved strong consensus, 2 achieved consensus, and 1 did not achieve any level of consensus. The statement that did not achieve consensus was that 2 solid screws should be used for glenoid bone graft fixation, which achieved 76% consensus. All of these statements are shown in Table 1, and the initial questions from Rounds 1 to 3 are included in Appendix Table 2, available at www.arthroscopyjournal.org.

Glenoid Osteotomy

Of the 13 total questions and consensus statements in this group, none achieved unanimous consensus, 7 achieved strong consensus, 3 achieved consensus, and 3 did not achieve consensus. There was no consensus on the statement "the relative indications for a glenoid osteotomy are (1) severe retroversion and (2) moderate glenoid dysplasia," which achieved 71% consensus. There was no consensus on whether labral repair should be performed, when possible, when performing a glenoid osteotomy, which achieved 77% consensus. There was no consensus on the role fluoroscopy being used intraoperatively, which achieved 76% consensus. All of these statements are shown in Table 2, and the initial questions from Rounds 1-3 are included in Appendix Table 3, available at www.arthroscopyjournal.org.

Rehabilitation, Return to Play, and Follow-Up

Of the 15 total questions and consensus statements in this group, 4 achieved unanimous consensus, 9 achieved strong consensus, and 2 achieved consensus. There was unanimous consensus that the following criteria should be considered: (1) restoration of strength (>90% of contralateral), (2) restoration of range of motion (>90% of contralateral), (3) lack of apprehension, (4) pain-free condition, (5) sport-specific skills, and (6) restoration of proprioception. There is no minimum time point required to return to play. There was unanimous consensus that collision athletes and athletes of consequence (i.e., active-duty personnel, or extreme sports) may take longer to return because of their greater risk for recurrent instability, and more caution should be exercised in clearing them to return to play. Elite athletes may have different considerations in returning to play as the result of their financial considerations, superior premorbid conditioning, and easier access to high-quality rehabilitation and medical evaluation. There was unanimous consensus that the relative indications for revision surgery are (1) symptomatic apprehension, (2) multiple recurrent instability episodes, (3) further intra-articular pathologies, (4) hardware failure, and (5) pain. There was unanimous consensus that those undergoing a bone graft or osteotomy procedure should have routine imaging performed at initial follow-up visits and before return to play; otherwise, imaging should only be used if clinically indicated on the basis of symptoms. All of these statements are shown in Table 3, and the initial questions from Rounds 1 to 3 are included in Appendix Table 4, available at www.arthroscopyjournal.org.

Discussion

The most important finding from this study was that most of the statements reached consensus. Four of the included statements reached unanimous agreement. The statements that achieved unanimous consensus were the criteria for return to play, collision/elite athletes having different considerations in return to play, indications for revision surgery, and imaging only required as routine for those with glenoid bone grafting/osteotomies at subsequent follow-ups. There was no consensus on optimal fixation method for a glenoid bone block, relative indications for glenoid osteotomy, whether a labral repair should be performed alongside a glenoid osteotomy, and whether fluoroscopy is required for a glenoid osteotomy. These consensus

Table 2. Glenoid Osteotomy

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: What are the indications for a glenoid osteotomy? A: The relative indications for a glenoid osteotomy are (1) severe retroversion and (2) moderate glenoid dysplasia.	1%	8%	20%	44%	27%	No Consensus (71%)
Q: What are the contraindications for a glenoid osteotomy? A: The relative contraindications for a glenoid osteotomy are (1) first-time dislocation, (2) severe glenoid bone loss, (3) minimal retroversion, (4) arthritic changes, (5) severe dysplasia, (6) nerve dysfunction, (7) static posterior humeral head subluxation, (8) biconcave glenoid, and (9) uncontrolled epilepsy.	0%	1%	6%	41%	52%	Strong Consensus (93%)
Q: Is there an amount of glenoid/humeral retroversion above which a glenoid osteotomy should be performed? A: There is no amount of glenoid/humeral retroversion above which a glenoid osteotomy should be performed, but it may be considered in those with >15° retroversion.	0%	4%	14%	56%	26%	Consensus (82%)
Q: How does bone loss influence the decision on whether a glenoid osteotomy should be performed? A: Severe glenoid bone loss may be a contraindication to performing glenoid osteotomy. However, this may be corrected with a bone block procedure instead.	1%	0%	5%	50%	44%	Strong Consensus (94%)
Q: In the presence of retroversion, does the degree of dysplasia influence the decision on whether a glenoid osteotomy should be performed? A: Yes, severe glenoid dysplasia may be a contraindication to performing a glenoid osteotomy.	0%	0%	8%	42%	50%	Strong Consensus (92%)
Q: What is the goal for correction for a glenoid osteotomy? A: The goal correction should be less than 10° of retroversion.	0%	3%	17%	45%	35%	Consensus (80%)
Q: Is a labral repair required when performing a glenoid osteotomy? A: Labral repair should be performed when possible if performing a glenoid osteotomy.	0%	3%	20%	27%	50%	No Consensus (77%)
Q: What are the indications for performing concomitant procedures with a glenoid osteotomy? A: The indications to perform a concomitant procedure with a glenoid osteotomy are those with (1) labral tears, (2) rotator cuff tears, and/or (3) bicipital tear/pain.	0%	1%	8%	45%	46%	Strong Consensus (91%)
Q: What steps should be taken to minimize complications after a glenoid osteotomy? A: The steps that should be taken to minimize complications after a glenoid osteotomy are (1) meticulous preoperative planning, (2) careful identification and protection of the neurovascular structure, (3) ensuring that the osteotome/saw is parallel to and does not pass through the articular surface, (4) ensure the osteotome blade is all the way to the anterior cortex before cracking the bone forward, (5) keep the anterior glenoid neck cortex intact, (6) avoid overcorrection, and (7) strict postoperative immobilization.	0%	0%	5%	36%	59%	Strong Consensus (95%)

(continued)

Table 2. Continued

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: Is hardware fixation necessary when performing a glenoid osteotomy?	0%	0%	8%	45%	47%	Strong Consensus (92%)
A: Hardware fixation is necessary when the anterior cortex is disrupted during a glenoid osteotomy, or if the bone graft is noted to be unstable intraoperatively.						
Q: What bone graft source should be used when performing a glenoid osteotomy?	1%	0%	11%	37%	51%	Consensus (88%)
A: There is no preferred bone graft source, although autograft may be preferable to allograft.						
Q: Is fluoroscopy necessary?	0%	0%	24%	38%	38%	No Consensus (76%)
A: Fluoroscopy should be used if possible.						
Q: Is 3-dimensional planning necessary?	0%	1%	6%	61%	32%	Strong Consensus (93%)
A: Three-dimensional planning is not necessary but may be beneficial.						

statements represent our group's expert agreement on diagnosis, nonoperative management, and labral repair for posterior shoulder instability. As with previous consensus statements, 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 on the basis of the current evidence.

Patients with severe glenoid bone loss or who were undergoing revision surgery were strongly agreed on to be indicated for glenoid bone grafting, whereas contraindications included patients with first-time dislocations, epilepsy, osteoarthritis, nerve dysfunction, and risk of poor compliance with rehabilitation. Because severe bone loss is well recognized as an indication for bone grafting, a clinically significant threshold remains to be agreed on. However, a case-control study by Arner et al.[3] reported that patients undergoing capsulolabral repair with greater than 11% posterior bone loss resulted in a 10-fold increased risk of treatment failure, whereas patients with greater than 15% of bone loss were 25 times more likely to experience an unsuccessful treatment. Graft type was strongly agreed on to be per the surgeon's preference, whereas arthroscopic management should be reserved for surgeons with technical proficiency. Graft options include iliac crest autograft, scapular spine autograft, distal clavicle autograft, and distal tibia allograft. Disadvantages of allograft have been reported to be associated with increased cost and concern for increased graft resorption, although data have demonstrated an 89% healing rate for distal tibia allografts in patients with anterior shoulder instability.[26] Healing rates of bone graft type should be considered, as it is generally agreed on that true graft resorption is correlated with inferior outcomes. The literature to date has been limited by heterogenous surgical methods and patient demographics mainly in small retrospective studies, which have often failed to report important patient characteristics.[5,6,27-29] In this working group, there was no consensus for the use of 2 solid screws for glenoid bone graft fixation. Current approaches to posterior graft fixation and effect on outcomes are most likely extrapolated from evidence obtained from anterior shoulder instability cohorts in which graft stability is biomechanically similar between screw and suture-button fixation constructs with favorable clinical results for both cohorts.[30,31] Lower rates of symptomatic hardware complications have been reported after suture-button fixation.[28,32] Issues persist regarding posterior bone block augmentation, including high rates of complications, recurrence, and revision, although the literature shows that patients do consistently show functional improvements despite the risk of recurrence, which it should be noted is less than in those undergoing soft-tissue stabilization.[5,27,28]

Glenoid osteotomy is intended to increase the mechanical stability of the shoulder by altering the anatomy to recenter the humeral head relative to the glenoid.[33] There was no consensus regarding the indications for performing a glenoid osteotomy in the setting of posterior shoulder instability. These results may be attributed to a limited quality of evidence, as a systematic review by Sardar et al.[7] of 9 studies of 356 shoulders evaluated the outcomes after glenoid osteotomies for the treatment of posterior shoulder instability and was limited by small case series, heterogenous bone graft type, fixation techniques, and use of advanced imaging. Although this review demonstrated generally favorable function and postoperative outcomes overall, the authors reported an overall complication rate of 34%, including 20% of shoulders experiencing persistent instability despite adequate restoration of glenoid version, and a 3% to 33% rate of

Table 3. Rehabilitation, Return to Play, and Follow-up

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: How long should patients be immobilized after a labral repair? A: Patients should be immobilized for 4 to 6 weeks after a labral repair.	0%	5%	5%	44%	46%	Consensus (90%)
Q: How long should patients be immobilized after glenoid bone grafting procedure? A: Patients should be immobilized for 6 weeks after a glenoid bone grafting procedure.	0%	6%	5%	36%	53%	Consensus (89%)
Q: How long should patients be immobilized after glenoid osteotomy procedure? A: Patients should be immobilized for 6 weeks after a glenoid bone grafting procedure.	0%	5%	5%	36%	54%	Strong Consensus (90%)
Q: Should psychological factors be considered in the rehabilitation process after operative stabilization for posterior shoulder instability? If so, how? A: Psychological factors should be considered in the rehabilitation process after operative stabilization for posterior shoulder instability. This should be based on subjective questioning, RSI scores, and feedback from physical therapy.	0%	0%	3%	42%	55%	Strong Consensus (97%)
Q: What criteria should be considered when making the decision to return an athlete to play after nonoperative management for posterior shoulder instability? Is there a minimum time point before allowing athletes to return to play? A: The following criteria should be considered: (a) restoration of strength (>90% of contralateral), (2) restoration of range of motion (>90% of contralateral), (3) lack of apprehension, (4) pain-free condition, (5) sport-specific skills, and (6) restoration of proprioception. There is no minimum time point required.	0%	0%	0%	36%	64%	Unanimous (100%)
Q: What criteria should be considered when making the decision to return an athlete to play after operative stabilization for posterior shoulder instability? Are there any procedure-specific criteria? Is there a minimum time point before allowing athletes to return to play? A: The following criteria should be considered: (1) restoration of strength (>90% of contralateral), (2) restoration of range of motion (>90% of contralateral), (3) lack of apprehension, (4) pain-free condition, (5) sport-specific skills, and (6) restoration of proprioception. A minimum of 4 months is required. In those undergoing a bone block grafting or osteotomy, imaging should be performed to assess for healing.	0%	0%	2%	33%	65%	Strong Consensus (98%)

(continued)

Table 3. Continued

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: Should different considerations be made in deciding when collision/noncollision athletes may return? And elite/nonelite athletes may return?	0%	0%	0%	41%	59%	Unanimous (100%)
A: Collision athletes and athletes of consequence (i.e., active-duty personnel, or extreme sports) may take longer to return because of their higher risk for recurrent instability, and more caution should be exercised in clearing them to return to play. Elite athletes may have different considerations in returning to play as the result of their financial considerations, superior premorbid conditioning, and easier access to high-quality rehabilitation and medical evaluation.						
Q: How should treatment success be defined?	0%	0%	5%	30%	65%	Strong Consensus (95%)
A: Treatment success after operative or nonoperative management should be defined as a stable, pain-free shoulder with return to full premorbid function.						
Q: What are the indications for revision surgery?	0%	0%	0%	38%	62%	Unanimous (100%
A: The relative indications for revision surgery are (1) symptomatic apprehension, (2) multiple recurrent instability episodes, (3) further intra-articular pathologies, (4) hardware failure, and (5) pain.						
Q: Which aspect(s) of the physical examination should be performed/ documented on patients after treatment of posterior shoulder instability?	0%	1%	3%	38%	58%	Strong Consensus (96%
A: The following aspects of the physical examination should be performed/ documented on patients after treatment of posterior shoulder instability: (1) range of motion, (2) apprehension, (3) relocation test, (4) load and shift, (5) strength, (6) Jerk test, (7) Kim test, and (8) posterior drawer.						
Q: For how long should patients being treated nonoperatively/or who underwent surgical stabilization be followed up?	1%	3%	11%	36%	49%	Consensus (85%)
A: Patients being treated nonoperatively or operatively should be clinically followed up for a minimum of 12 months or until they have returned to full sports, whichever occurs later, and then as needed.						
Q: What routine follow-up time points should be used for research purposes?	1%	0%	3%	40%	56%	Strong Consensus (96%)
A: The following time points should be used to routinely follow up patients for research purposes: (1) preoperative, (2) 6 weeks, (3) 3 months, (4) 6 months, (5) 12 months, (6) 2 years, (7) 5 years, and (8) 10 years.						

(continued)

Table 3. Continued

Questions and Answers	Strong Disagreement	Disagreement	Neutral	Agreement	Strong Agreement	Consensus
Q: What components should be included in a patient-reported outcome measure for posterior shoulder instability?	0%	2%	0%	46%	52%	Strong Consensus (98%)
A: The following components should be included in a patient-reported outcome measure for posterior shoulder instability: (1) function/limitations, (2) impact on activities of daily living, (3) return to sport/activity, (4) instability symptoms (including apprehension and recurrence), (5) confidence in shoulder, and (6) satisfaction.						
Q: Are there any preferred outcome scores for research on posterior shoulder instability?	0%	3%	3%	33%	61%	Strong Consensus (94%)
A: The preferred outcome scores for research on posterior shoulder instability are (1) WOSI, (2) ASES, and (3) SSV/SANE.						
Q: Should any routine imaging be performed at follow-up? If not, is there any patient population that should undergo follow-up imaging?	0%	0%	0%	39%	61%	Unanimous (100%)
A: Those undergoing a bone graft or osteotomy procedure should have routine imaging performed at initial follow-up visits and before return to play; otherwise, imaging should only be as clinically indicated on the basis of symptoms.						

ASES, American Shoulder and Elbow Surgeons; RSI, Return to Sport after Injury; SANE, Single Assessment Numeric Evaluation; SSV, Subjective Shoulder Value; WOSI, Western Ontario Shoulder Instability Index.

intraoperative glenoid neck fracture.[7] In this study, there was strong consensus on the steps that should be taken to minimize complications, which emphasize care to avoid iatrogenic glenoid fracture and neurovascular injury. Overall, the results of this working group suggests that careful consideration of the clinical risks, benefits, and associated pathology should take place on a case-by-case basis before indicating patients for a glenoid osteotomy procedure. It should be noted that posterior glenoid bone block and osteotomy procedures remain uncommon outside of specialist centers, and further study will be required to elucidate which patients will be best served by them, with a lack of consensus surrounding the indications for glenoid osteotomy.[6,29] In addition, patients with severe dysplasia and arthritis may be best served by arthroplasty with or without augmentation depending on the degree of retroversion.[34,35]

There was agreement among all statements regarding rehabilitation, return to play, and follow-up for patients undergoing stabilization procedures with or without bone grafting for patients with posterior shoulder instability. Overall, there is a high rate of return to sport and level of performance after posterior shoulder stabilization, although overhead athletes had a comparatively lower rate of return to preinjury level than contact athletes.[9,36,37] Risk factors for failure to return to play or to previous level of performance in both contact and overhead athletes have yet to be fully elucidated, although it is suggested that recurrence, poor healing, and loss of interest in sport may be implicated. Further study comparing the outcomes after surgical management of posterior labral tears in patients with and without clinical instability will be required. Defined timelines and objective return to play criteria are currently lacking, but this consensus group agreed that objective restoration of strength, range of motion, pain, sport-specific skill, and proprioception should be obtained before returning to sport. In patients undergoing nonoperative management, there is no minimum time point required. In contrast, patients undergoing posterior stabilization require a minimum of 4 months before they can return, and their physicians should obtain postoperative imaging to assess healing if bone grafting or osteotomy was performed, the latter of which reached unanimous consensus. There was also unanimous consensus that elite athletes and collision athletes also should receive special

consideration when determining return to play, as these cohorts may have extenuating circumstances, risks, and benefits of earlier return to play compared with the general population. However, follow-up and clinical assessment of outcomes appear to be uniform. Lastly, although high rates of subjective shoulder stability after surgery have been reported, 15% to 17.5% of active-military members and athletes report persistent pain after shoulder stabilization.[38] Therefore, it is critical to perform thorough physical examinations, routinely obtain outcome scores, and to consider patient-specific factors when defining treatment success or considering revision surgery. Indications for revision surgery reached unanimous consensus, which includes symptomatic apprehension, multiple recurrent instability episodes, further intra-articular pathology, hardware failure, and pain, as these all represent objective targets that could be benefited with a further surgery.

Limitations

This study has several 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.[15,39] 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 on by the group leaders. In addition, these statements involved a modification of the Delphi process, as the participants worked on their individual groups for the first 3 rounds and not all of the statements. Participants may have accepted a statement without agreeing with each subsection of the statement. Finally, there are some limitations with the Delphi process itself, as it may represent the lowest common denominator of expert opinion with less of ownership of ideas, and ultimately represents Level V data.[39] The lack of robust evidence available to inform expert opinion regarding bone blocks and osteotomies may be considered a limitation, as well as the broad range of pathology that constitutes posterior instability.

Conclusions

The study group achieved strong or unanimous consensus on 59% of statements. Unanimous consensus was reached regarding the criteria for return to play, collision/elite athletes having different considerations in return to play, indications for revision surgery, and imaging only required as routine for those with glenoid bone grafting/osteotomies at subsequent follow-ups. There was no consensus on optimal fixation method for a glenoid bone block, the relative indications for glenoid osteotomy, whether fluoroscopy is required, or whether the labrum should be concomitantly repaired.

Disclosures

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Appendix

Appendix Table 1. Consensus Working Groups and Members

Group	Country of Practice
Diagnosis	
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Laith M. Jazrawi	U.S.A.
Leo Pauzenberger	Austria
Natalia Martinez-Catalan	Spain
Nicholas A. Trasolini	U.S.A.
Raffy Mirzayan	U.S.A.
Stephen A. Parada	U.S.A.
Travis A. Dekker	U.S.A.
Nonoperative management	
Alexandre Laedermann	France
Eiji Itoi	Japan
Grant E. Garrigues	U.S.A.
Jocelyn R. Wittstein	U.S.A.
John R. Wickman	U.S.A.
Jonathan F. Dickens	U.S.A.
Lance E. Leclere	U.S.A.
Mariano E. Menendez	U.S.A.
Maximiliano Ranalletta	Argentina
Michael J. O'Brien	U.S.A.
Philipp Moroder	Switzerland
Surena Namdari	U.S.A.
Labral repair	
Alison P. Toth	U.S.A.
Andreas B. Imhoff	Germany
Benjamin W. Hoyt	U.S.A.
Brandon J. Erickson	U.S.A.
Brett D. Owens	U.S.A.
Brian R. Waterman	U.S.A.
Christopher S. Klifto	U.S.A.
Dean C. Taylor	U.S.A.
Frank A. Cordasco	U.S.A.
Kelly G. Kilcoyne	U.S.A.
Luciano A. Rossi	Argentina
Peter J. Millett	U.S.A.
Bone block augmentation	Country of Practice
Bogdan A. Matache	Canada
George S. Athwal	Canada
Hannan Mullett	Ireland
Ivan Wong	Canada
Joaquin Sanchez-Sotelo	U.S.A.
Matthew T. Provencher	U.S.A.
Nata Parnes	U.S.A.
Oke A. Anakwenze	U.S.A.
Patrick J. Denard	U.S.A.
Rachel M. Frank	U.S.A.
Scott A. Rodeo	U.S.A.
Tally Lassiter	U.S.A.
Glenoid osteotomy	
Emilio Calvo	Spain
Greg Hoy	Australia
Lionel Neyton	France
Lukas Ernstbrunner	Australia
Philipp R. Heuberer	Austria
Ruth A. Delaney	Ireland
William N. Levine	U.S.A.
Xavier A. Duralde	U.S.A.
Yaw Boache-Adjei	U.S.A.
Rehabilitation and return to play	
Tristan Cassidy	Ireland
Brian C. Lau	U.S.A.
Christopher L. Camp	U.S.A.
Eric C. McCarty	U.S.A.
Eric R. Wagner	U.S.A.
John P. Scanaliato	U.S.A.
Julie Y. Bishop	U.S.A.
Michael T. Freehill	U.S.A.
Peter N. Chalmers	U.S.A.
Richard M. Danilkowicz	U.S.A.
Robert H. Brophy	U.S.A.
Salvatore J. Frangiamore	U.S.A.
Timothy B. Griffith	U.S.A.

Appendix Table 2. Group 4: Bone Block Augmentation

Round 1

(1) What are the indications for glenoid bone grafting?
(2) What are the contraindications for glenoid bone grafting?
(3) Is there an amount of glenoid bone loss above which a glenoid bone-grafting procedure should be performed?
(4) What prognostic factors should be considered in patients undergoing glenoid bone grafting?
(5) Is there a preferred bone graft for treating posterior shoulder instability? Is autologous or allogenic bone preferable?
(6) Should a glenoid bone graft procedure be performed arthroscopically?
(7) What are the indications for performing concomitant procedures with a glenoid bone-grafting procedure?
(8) What steps should be taken to minimize complications after a glenoid bone-grafting procedure?
(9) Is resorption of the bone graft correlated with an inferior outcome after glenoid bone grafting?
(10) What is the optimal method of fixation of a glenoid bone graft?
(11) Is a capsular repair required with a glenoid bone graft procedure?

Round 2

Which of the following are relative indications for glenoid bone grafting?
- Severe glenoid bone loss
- Large concomitant reverse Hill-Sachs lesions
- Revision surgery
- Recurrent dislocations

Is there an amount of glenoid bone loss above which a glenoid bone-grafting procedure should be performed?
- 11%
- 15%
- 20%
- 25%
- No cut-off

Which of the following are relative contraindications for glenoid bone grafting?
- Minimal glenoid bone loss
- First-time dislocation
- Static instability
- Severe retroversion
- Osteoarthritis
- Stiffness
- Likelihood of poor compliance with postoperative rehabilitation
- Uncontrolled epilepsy
- Severe dysplasia
- Nerve dysfunction
- Posterior humeral head subluxation
- Smoking

Which of the following do you agree are prognostic factors that should be considered in patients undergoing glenoid bone grafting?
- Age
- Gender
- Hand dominance
- Preoperative pain
- Glenoid bone loss
- Reverse Hill-Sachs lesion
- Glenoid version
- Ligamentous laxity
- Functional demand
- Competitive athlete
- Military personnel
- Collision athlete

(continued)

Appendix Table 2. Continued

- Overhead athlete
- Number of preoperative dislocations
- Previous shoulder surgery
- Hyperlaxity
- Arthritic change
- Centralization of humeral head
- Expectations
- Ability to comply with postoperative rehabilitation

There was considerable disagreement in the choice of optimal glenoid bone graft for treating posterior shoulder instability, and several participants noted it is dictated by surgeon preference
- Yes
- No

Do you agree with this statement? If not why not

Is autologous or allogenic bone preferable?
- Autologous
- Allogenic
- No preference

Should a glenoid bone graft procedure be performed arthroscopically?
- Yes, if proficient
- No

Which of the following are indications for performing concomitant procedures with a glenoid bone-grafting procedure?
- Reverse Hill-Sachs lesions
- Anterior labral tear
- Superior labral tear
- Long head of biceps tear/instability

Which of the following steps should be taken to minimize complications after a glenoid bone-grafting procedure?
- Attention to detail
- Well-defined rehabilitation protocol
- Strict postoperative immobilization
- Careful dissection
- Protecting the musculocutaneous and axillary nerves
- Relax retractor pressure occasionally for nerve protection
- Preventing overlateralization/medialization of the graft and contour flush to native cartilage
- Tranexamic acid to reduce blood loss
- Accurate screw/suture-button placement
- Careful preparation of the glenoid neck and coracoid
- Appropriate postoperative imaging
- Adequate glenoid decortication

Remodeling is normal, but true resorption of the bone graft is correlated with an inferior outcome after glenoid bone grafting?
- Yes
- No

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

What is the optimal method of fixation of a glenoid bone graft?
- 1 screw
- 2 screws
- Suture-button

If screws are used, should they be solid or cannulated?
- Solid screws
- Cannulated screws
- No preference

Is a capsular repair required with a glenoid bone graft procedure?
- Yes; it is preferred if technically feasible
- No benefit

(continued)

Appendix Table 2. Continued

Round 3

Q: What are the indications for glenoid bone grafting?

A: The relative indications for glenoid bone grafting are
(1) severe glenoid bone loss
(2) revision surgery

Do you have any suggested changes?

Q: What are the contraindications for glenoid bone grafting?

A: The relative contraindications for glenoid bone grafting are
(1) minimal glenoid bone loss
(2) first-time dislocation
(3) osteoarthritis
(4) likelihood of poor compliance with postoperative rehabilitation
(5) uncontrolled epilepsy
(6) nerve dysfunction

Do you have any suggested changes?

Q: Is there an optimal glenoid bone graft for treating posterior shoulder instability?

A: The choice of glenoid bone graft for treating posterior shoulder instability should be dictated by surgeon preference.

Do you have any suggested changes?

Q: Should a glenoid bone-grafting procedure be performed arthroscopically?

A: A glenoid bone-grafting procedure be should performed arthroscopically only if technically proficient.

Do you have any suggested changes?

Q: What are the indications for performing concomitant procedures with a glenoid bone-grafting procedure?

A: The relative indications for performing concomitant procedures with a glenoid bone grafting are
(1) reverse Hill-Sachs lesions
(2) anterior labral tear
(3) superior labral tear
(4) long head of biceps tear/instability

Do you have any suggested changes?

Q: What steps should be taken to minimize complications after a glenoid bone-grafting procedure?

A: The steps that should be taken to minimize complications after a glenoid bone-grafting procedure are
(1) attention to detail
(2) careful dissection
(3) protecting the musculocutaneous and axillary nerves
(4) careful preparation of the glenoid neck and coracoid with adequate decortication
(5) preventing overlateralization/medialization of the graft and contour flush to native cartilage
(6) accurate screw/suture-button placement
(7) appropriate postoperative imaging
(8) a well-defined rehabilitation protocol

Do you have any suggested changes?

Q: What is the optimal method of fixation of a glenoid bone graft?

A: Two solid screws should be used for glenoid bone graft fixation.

Do you have any suggested changes?

Q: Is a capsular repair required with a glenoid bone-grafting procedure?

A: A capsular repair should be performed if it is technically feasible.

Do you have any suggested changes?

Q: Is resorption of the bone graft correlated with an inferior outcome after glenoid bone grafting?

A: Remodeling is normal, but true resorption is correlated with an inferior outcome after glenoid bone grafting.

Do you have any suggested changes?

Appendix Table 3. Group 5: Glenoid Osteotomy

Round 1

(1) What are the indications for a glenoid osteotomy?
(2) What are the contraindications for a glenoid osteotomy?
(3) Is there an amount of glenoid/humeral retroversion above which a glenoid osteotomy should be performed?
(4) How does bone loss influence the decision on whether a glenoid osteotomy should be performed?
(5) In the presence of retroversion, does the degree of dysplasia (posterior labrum hypertrophy) influence the decision on whether a glenoid osteotomy should be performed?
(6) What is the goal for correction for a glenoid osteotomy?
(7) What prognostic factors should be considered in patients undergoing a glenoid osteotomy?
(8) Is a labral repair required when performing a glenoid osteotomy?
(9) What are the indications for performing concomitant procedures with a glenoid osteotomy?
(10) What steps should be taken to minimize complications after a glenoid osteotomy?
(11) Is hardware fixation necessary when performing a glenoid osteotomy?
(12) What bone graft source should be used when performing a glenoid osteotomy?
(13) Should intraoperative fluoroscopy be used?
(14) Is 3-dimensional planning necessary?

Round 2

Which of the following are relative indications for a glenoid osteotomy?

- Recurrent instability
- Severe retroversion
- Moderate glenoid dysplasia
- Persistent pain

Which of the following are relative contraindications for a glenoid osteotomy?

- First-time dislocation
- Severe glenoid bone loss
- Minimal retroversion
- Arthritic changes
- Severe dysplasia
- Nerve dysfunction
- Static posterior humeral head subluxation
- Biconcave glenoid
- Smoking
- Osteoporosis
- Stiffness
- Likelihood of poor compliance with postoperative rehabilitation
- Uncontrolled epilepsy

Is there an amount of glenoid/humeral retroversion above which a glenoid osteotomy may be considered?

- 10° of retroversion
- 15° of retroversion

Severe glenoid bone loss may be a contraindication as to whether a glenoid osteotomy should be performed.

- Yes
- No

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

Should severe bone loss be corrected with a bone block to allow for an osteotomy to be performed?

- Yes
- No

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

In the presence of retroversion, does the degree of dysplasia influence the decision on whether a glenoid osteotomy should be performed?

(continued)

Appendix Table 3. Continued

- No
- Yes, severe dysplasia means a glenoid osteotomy should not be performed

What is the goal for correction for a glenoid osteotomy?

- 0° of retroversion
- <10° of retroversion

What prognostic factors should be considered in patients undergoing a glenoid osteotomy?

- Age
- Pain
- Arthritis
- Static posterior humeral head subluxation
- Humeral version
- Degree of glenoid retroversion
- Sport played
- Functional demand
- Previous surgeries

Is a labral repair required when performing a glenoid osteotomy?

- Yes, routinely
- No, never

What are the indications for performing concomitant procedures with a glenoid osteotomy?

- Labral tear
- Significant posterior subluxation
- Rotator cuff tear
- Bicipital tear/pain

Which of the following steps should be taken to minimize complications after a glenoid osteotomy?

- Meticulous preoperative planning
- Strict postoperative immobilization
- Ensure that the osteotome/saw is parallel to and does not pass through the articular surface
- Careful identification and protection of the neurovascular structure
- Avoid overcorrection
- Tranexamic acid
- Keep the anterior glenoid neck cortex intact
- Ensure the osteotome blade is all the way to the anterior cortex before cracking the bone forward
- Patient-specific instrumentation

Is hardware fixation necessary when performing a glenoid osteotomy?

- Yes
- No

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

Which of the following bone-graft source should be used when performing a glenoid osteotomy?

- Iliac crest
- Scapular spine
- Distal clavicle
- Acromion

Should autograft or allograft be used?

- Autograft
- Allograft
- Either

Should intra-operative fluoroscopy be used?

- Yes, it is essential
- Yes, if possible
- Not required

Is 3-dimensional planning necessary?

- Yes, it is essential
- Yes, if possible
- Not required

(continued)

Appendix Table 3. Continued

Round 3

Q: What are the indications for a glenoid osteotomy?

A: The relative indications for a glenoid osteotomy are
(1) severe retroversion
(2) moderate glenoid dysplasia

Do you have any suggested changes?

Q: What are the contraindications for a glenoid osteotomy?

A: The relative contraindications for a glenoid osteotomy are
(1) first-time dislocation
(2) severe glenoid bone loss
(3) minimal retroversion
(4) arthritic changes
(5) severe dysplasia
(6) nerve dysfunction
(7) static posterior humeral head subluxation
(8) biconcave glenoid
(9) uncontrolled epilepsy

Do you have any suggested changes?

Q: Is there an amount of glenoid/humeral retroversion above which a glenoid osteotomy should be performed?

A: There is no amount of glenoid/humeral retroversion above which a glenoid osteotomy should be performed, but it may be considered in those with >15° retroversion.

Do you have any suggested changes?

Q: How does bone loss influence the decision on whether a glenoid osteotomy should be performed?

A: Severe glenoid bone loss may be a contraindication to performing glenoid osteotomy. However, this may be corrected with a bone block procedure instead.

Do you have any suggested changes?

Q: In the presence of retroversion, does the degree of dysplasia influence the decision on whether a glenoid osteotomy should be performed?

A: Yes, severe glenoid dysplasia may be a contraindication to performing a glenoid osteotomy.

Do you have any suggested changes?

Q: What is the goal for correction for a glenoid osteotomy?

A: The goal correction should be less than 10° of retroversion.

Do you have any suggested changes?

Q: Is a labral repair required when performing a glenoid osteotomy?

A: Labral repair should be performed, when possible, when performing a glenoid osteotomy.

Do you have any suggested changes?

Q: What are the indications for performing concomitant procedures with a glenoid osteotomy?

A: The indications to perform a concomitant procedure with a glenoid osteotomy are those with
(1) labral tears
(2) rotator cuff tears
(3) bicipital tear/pain

Do you have any suggested changes?

Q: What steps should be taken to minimize complications after a glenoid osteotomy?

A: The steps that should be taken to minimize complications after a glenoid osteotomy are
(1) meticulous preoperative planning
(2) careful identification and protection of the neurovascular structure
(3) ensuring that the osteotome/saw is parallel to and does not pass through the articular surface
(4) ensure the osteotome blade is all the way to the anterior cortex before cracking the bone forward

(continued)

Appendix Table 3. Continued

(e) keep the anterior glenoid neck cortex intact
(6) avoid overcorrection
(7) Strict postoperative immobilization
Do you have any suggested changes?
Q: Is hardware fixation necessary when performing a glenoid osteotomy?
A: Yes, hardware fixation is necessary when performing a glenoid osteotomy.
Do you have any suggested changes?
Q: What bone-graft source should be used when performing a glenoid osteotomy?
A: There is no preferred bone graft source, although autograft may be preferable to allograft.
Do you have any suggested changes?
Q: Is fluoroscopy necessary?
A: Fluoroscopy should be used if possible
Do you have any suggested changes?
Q: Is 3-dimensional planning necessary?
A: 3-dimensional planning is not necessary but may be beneficial.
Do you have any suggested changes?

Appendix Table 4. Group 6: Nonoperative Management

Round 1
(1) How long should patients be immobilized after a labral repair?
(2) How long should patients be immobilized after glenoid bone grafting procedure?
(3) How long should patients be immobilized after glenoid osteotomy grafting?
(4) Is there a benefit to early versus delayed motion after shoulder stabilization surgery?
(5) Should psychological factors be considered in the rehabilitation process after operative stabilization for posterior shoulder instability? If so, how?
(6) What criteria should be considered when making the decision to return an athlete to play after nonoperative management/ operative stabilization for anterior shoulder instability? Are there any procedure-specific criteria? Is there a minimum time point before allowing athletes return to play?
(7) Should different considerations be made in deciding when collision/noncollision athletes may return? When elite/nonelite athletes may return?
(8) How should treatment success be defined?
(9) What are the indications for revision surgery?
(10) Which aspect(s) of the physical examination should be performed/documented on patients after treatment of posterior shoulder instability?
(11) For how long should patients being treated nonoperatively/or who underwent surgical stabilization be followed-up?
(12) What routine follow-up time points should be used for research purposes?
(13) What components should be included in a patient-reported outcome measure for posterior shoulder instability?
(14) Should any routine imaging be performed at follow-up? If not, is there any patient population which should undergo follow-up imaging?

Round 2
How long should patients be immobilized after a labral repair?
- 4 weeks
- 6 weeks

How long should patients be immobilized after a glenoid bone-grafting procedure?
- 4 weeks
- 6 weeks

How long should patients be immobilized after a glenoid osteotomy procedure?
- 4 weeks
- 6 weeks
- 8 weeks

There is a benefit to early motion over delayed motion after shoulder stabilization surgery to minimize stiffness.
- Yes
- No

Do you agree with this statement? If not, why not?
Psychological factors should be considered in the rehabilitation process after operative stabilization for posterior shoulder instability. This should be based on subjective questioning, RSI scores, and feedback from physical therapy.
- Yes
- No

Do you agree with this statement? If not, why not?
Which of the following criteria should be considered when making the decision to return an athlete to play following nonoperative management for posterior shoulder instability?

(continued)

Appendix Table 4. Continued

- Minimum 1 months
- Minimum 3 months
- Minimums 4 months
- No minimum time point
- Restoration of strength (>90% of contralateral)
- Restoration of range of motion (>90% of contralateral)
- Free of apprehension
- Pain free
- Sport-specific skills
- Restoration of proprioception

Which of the following criteria should be considered when making the decision to return an athlete to play after operative stabilization for posterior shoulder instability?

- Minimum 3 months
- Minimum 4 months
- Minimums 6 months
- No minimum time point
- Restoration of strength (>90% of contralateral)
- Restoration of range of motion (>90% of contralateral)
- Free of apprehension
- Pain free
- Sport-specific skills
- Restoration of proprioception
- XR in those undergoing bony procedures
- CT in those undergoing bony procedures
- Either XR or CT in those undergoing bony procedures

Collision athletes and athletes of consequence (i.e., active-duty personnel, or extreme sports) may take longer to return because of their greater risk for recurrent instability, and more caution should be exercised in clearing them to return to play.

- Yes
- No

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

Elite athletes may have different considerations in returning to play as the result of their financial considerations, superior premorbid conditioning, and easier access to high-quality rehabilitation and medical evaluation.

- Yes
- No

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

Treatment success after operative or nonoperative management should be defined as a stable, pain-free shoulder with return to full premorbid function.

- Yes
- No

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

Which of the following are indications for revision surgery?

- Symptomatic apprehension
- Recurrent instability (single episode)
- Multiple recurrent instability episodes
- Further intra-articular pathologies
- Hardware failure
- Pain

Which of the following aspects of the physical examination can be performed on and documented in patients after treatment of posterior shoulder instability?

- Range of motion
- Strength
- Apprehension
- Relocation
- Load and shift
- Strength

(continued)

Appendix Table 4. Continued

- Jerk test
- Kim test
- Posterior drawer

Patients being treated nonoperatively or operatively should be clinically followed up for a minimum of 12 months, or until they have returned to full sports for a season, whichever occurs later, and then as needed.

- Yes
- No

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

Which of the following routine follow-up time points should be used for research purposes (i.e., a registry)?

- Preoperative
- 1-2 weeks
- 6 weeks
- 3 months
- 6 months
- 9 months
- 12 months
- 2 years
- 5 years
- 10 years

Which of the following components should be included in a patient-reported outcome measure for posterior shoulder instability?

- Functional limitations
- Impact on activities or daily living
- Return to sport/activity
- Instability symptoms (including apprehension and recurrence)
- Confidence in shoulder
- Satisfaction

Are there any preferred outcome scores for posterior shoulder instability?

- WOSI
- ASES
- SSV/SANE
- Oxford score
- Constant score

Those undergoing a bone graft or osteotomy procedure should have routine imaging performed at initial follow-up visits; otherwise, imaging should only be as clinically indicated on the basis of symptoms

- Yes
- No

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

Round 3

Q: How long should patients be immobilized after a labral repair?

A: Patients should be immobilized for 4 to 6 weeks after a labral repair.

Do you have any suggested changes?

Q: How long should patients be immobilized after glenoid bone grafting procedure?

A: Patients should be immobilized for 6 weeks after a glenoid bone grafting procedure.

Do you have any suggested changes?

Q: How long should patients be immobilized after glenoid osteotomy procedure?

A: Patients should be immobilized for 6 weeks after a glenoid bone grafting procedure.

Do you have any suggested changes?

Q: Should psychological factors be considered in the rehabilitation process after operative stabilization for posterior shoulder instability? If so, how?

(continued)

Appendix Table 4. Continued

A: Psychological factors should be considered in the rehabilitation process after operative stabilization for posterior shoulder instability. This should be based on subjective questioning, RSI scores, and feedback from physical therapy.
Do you have any suggested changes?
Q: What criteria should be considered when making the decision to return an athlete to play after nonoperative management for posterior shoulder instability? Is there a minimum time point before allowing athletes to return to play?
A: The following criteria should be considered
(1) restoration of strength (>90% of contralateral),
(2) restoration of range of motion (>90% of contralateral),
(3) lack of apprehension,
(4) pain-free condition,
(5) sport-specific skills,
(6) restoration of proprioception.
There is no minimum time point required.
Do you have any suggested changes?
Q: What criteria should be considered when making the decision to return an athlete to play after operative stabilization for posterior shoulder instability? Are there any procedure-specific criteria? Is there a minimum time point before allowing athletes to return to play?
A: The following criteria should be considered
(1) restoration of strength (>90% of contralateral)
(2) restoration of range of motion (>90% of contralateral)
(3) lack of apprehension
(4) pain-free condition
(5) sport-specific skills
(6) restoration of proprioception
A minimum of 4 months is required
In those undergoing a bone block grafting or osteotomy, imaging should be performed to assess for healing.
Do you have any suggested changes?
Q: Should different considerations be made in deciding when collision/noncollision athletes may return? When elite/nonelite athletes may return?
A: Collision athletes and athletes of consequence (i.e., active-duty personnel, or extreme sports) may take longer to return because of their greater risk for recurrent instability, and more caution should be exercised in clearing them to return to play. Elite athletes may have different considerations in returning to play as the result of their financial considerations, superior premorbid conditioning, and easier access to high-quality rehabilitation and medical evaluation.
Do you have any suggested changes?
Q: How should treatment success be defined?
A: Treatment success following operative or nonoperative management should be defined as a stable, pain-free shoulder with return to full premorbid function.
Do you have any suggested changes?
Q: What are the indications for revision surgery?
A: The relative indications for revision surgery are
(1) symptomatic apprehension
(2) multiple recurrent instability episodes
(3) further intra-articular pathologies
(4) hardware failure
(5) pain
Do you have any suggested changes?
Q: Which aspect(s) of the physical examination should be performed/documented on patients after treatment of posterior shoulder instability?

(continued)

Appendix Table 4. Continued

A: The following aspects of the physical examination should be performed/documented on patients after treatment of posterior shoulder instability
(1) range of motion
(2) apprehension
(3) relocation test
(4) load and shift
(5) strength
(6) Jerk test
(7) Kim test
(8) posterior drawer
Do you have any suggested changes?
Q: For how long should patients being treated nonoperatively/or who underwent surgical stabilization be followed up?
A: Patients being treated nonoperatively or operatively should be clinically followed up for a minimum of 12 months, or until they have returned to full sports, whichever occurs later, and then as needed.
Do you have any suggested changes?
Q: What routine follow-up time points should be used for research purposes?
A: The following time points should be used to routinely follow up patients for research purposes:
(1) preoperative
(2) 6 weeks
(3) 3 months
(4) 6 months
(5) 12 months
(6) 2 years
(7) 5 years
(8) 10 years
Do you have any suggested changes?
Q: What components should be included in a patient-reported outcome measure for posterior shoulder instability?
A: The following components should be included in a patient-reported outcome measure for posterior shoulder instability
(1) function/limitations
(2) impact on activities of daily living
(3) return to sport/activity
(4) instability symptoms (including apprehension and recurrence)
(5) confidence in shoulder
(6) satisfaction
Do you have any suggested changes?
Q: Are there any preferred outcome scores for research on posterior shoulder instability?
A: The preferred outcome scores for research on posterior shoulder instability are
(1) WOSI
(2) ASES
(3) SSV/SANE
Do you have any suggested changes?
Q: Should any routine imaging be performed at follow-up? If not, is there any patient population that should undergo follow-up imaging?
A: Those undergoing a bone graft or osteotomy procedure should have routine imaging performed at initial follow-up visits and before return to play; otherwise, imaging should only be as clinically indicated on the basis of symptoms.
Do you have any suggested changes?

ASES, American Shoulder and Elbow Surgeons; CT, computed tomography; RSI, Return to Sport after Injury; SANE, Single Assessment Numeric Evaluation; SSV, Subjective Shoulder Value; WOSI, Western Ontario Shoulder Instability Index; XR, radiograph.