[Orthopaedic Surgery]

In-game Management of Common Joint Dislocations

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Context: Sideline management of sports-related joint dislocations often places the treating medical professional in a challenging position. These injuries frequently require prompt evaluation, diagnosis, reduction, and postreduction management before they can be evaluated at a medical facility. Our objective is to review the mechanism, evaluation, reduction, and postreduction management of sports-related dislocations to the shoulder, elbow, finger, knee, patella, and ankle joints.

Evidence Acquisition: A literature review was performed using the PubMed database to evaluate previous and current publications focused on joint dislocations. This review focused on articles published between 1980 and 2013.

Study Design: Clinical review.

Level of Evidence: Level 4.

Results: The clinician should weigh the benefits and risks of on-field reduction based on their knowledge of the injury and the presence of associated injuries.

Conclusion: When properly evaluated and diagnosed, most sports-related dislocations can be reduced and initially managed at the game.

Keywords: sport; dislocation; joint; reduction; sideline; review

On-field management of sports-related dislocations can be challenging. These injuries require immediate evaluation and decisive intervention, often in front of teammates, coaches, and spectators. Immediate diagnosis and intervention can result in improved patient outcomes.[11,17] A recent study found that joint dislocations represented 3.6% of all high school athletic injuries.[13] Dislocations are also common among recreational and professional athletes. To manage these injuries, the treating professional needs a detailed knowledge of joint anatomy, an understanding of potential neurovascular injuries associated with the dislocation, and the skills necessary to perform a reduction maneuver if indicated. There have been significant advances in sideline imaging technologies; however, much of the clinical assessment and initial treatment is dependent on the clinical judgment of the sideline physician.[28]

SHOULDER DISLOCATIONS

The shoulder is the most commonly dislocated joint.[2] It accounts for approximately half (54.9%) of sports-related dislocations in high school athletes.[2,13,14] The shoulder has the greatest range of motion of any joint in the body, placing it at risk for dislocation. The glenohumeral joint has a shallow articular surface that is deepened by the glenoid labrum. The shoulder is stabilized by the ligamentous restraints connecting the humerus to the glenoid and the muscle forces that cross the joint. The majority of shoulder dislocations (>95%) occur in an anterior and inferior direction.[30] Anterior dislocations commonly occur as a result of forceful abduction and external rotation.[23] Posterior dislocations are less common and result from forceful internal rotation and adduction.

Evaluation

On initial evaluation, the patient with an anterior dislocation is often hesitant to move the shoulder and usually holds the shoulder in an adducted cradle-like position.[11] The humeral head can be felt anterior, inferior, and medially in most anterior shoulder dislocations.[2,30] This is better appreciated when comparing the injured shoulder to the uninjured side. Posterior dislocations typically place the arm in an internally rotated and adducted

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Figure 1. (a) The patient is supine with a towel wrapped around his torso. An assistant provides countertraction with the towel while the clinician supports the injured arm and creates traction and gradual abduction until the shoulder reduces. (b) If no assistant is available, the clinician places 1 hand in the patient's axilla for countertraction and uses the other hand to support the arm and provide gradual abduction.

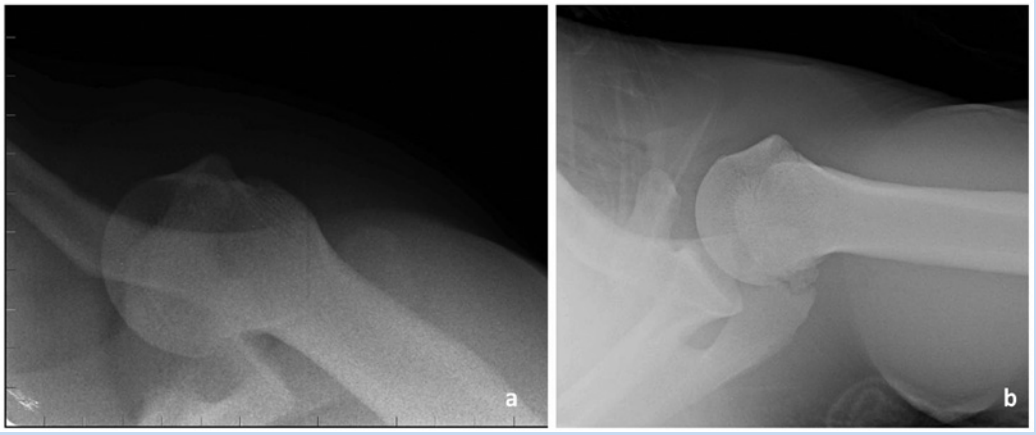

Figure 2. (a) Axillary radiograph of the left shoulder demonstrating anterior displacement on the humerus on the glenoid. (b) Postreduction axillary radiograph demonstrating joint congruency.

position, with the arm at the patient's side. Direct inferior dislocations (luxatio erecta) lock the shoulder in abduction and can be especially difficult to reduce.[4] With all suspected shoulder dislocations, assessment of axillary nerve function should be performed by feeling for deltoid contraction and evaluating sensation to light touch over the lateral upper arm.

Reduction

Immediate assessment and treatment of a shoulder dislocation is important because once muscle spasm occurs, it is very difficult to reduce the shoulder joint without anesthesia.[23] The traction/countertraction technique is a commonly used method for reduction and is the most practical to perform on the field immediately after injury. This technique is performed by pulling longitudinal traction on the injured arm and slowly abducting the arm while using one hand to manipulate the humeral head.[2] An assistant may be helpful for applying countertraction with a towel around the athlete's torso and pulling in the opposite direction (Figure 1). The hand manipulating the humeral head can also provide countertraction in the axilla if no assistant is available to help with the reduction. Once the arm is abducted above the head, the humeral head should reduce. A postreduction neurologic assessment should be performed, particularly focusing on axillary nerve function. For an inferior dislocation, overhead traction is applied with the arm in hyperabduction while an assistant applies countertraction.[4] Then, an upward force is applied to the humeral head as the arm is taken into adduction.

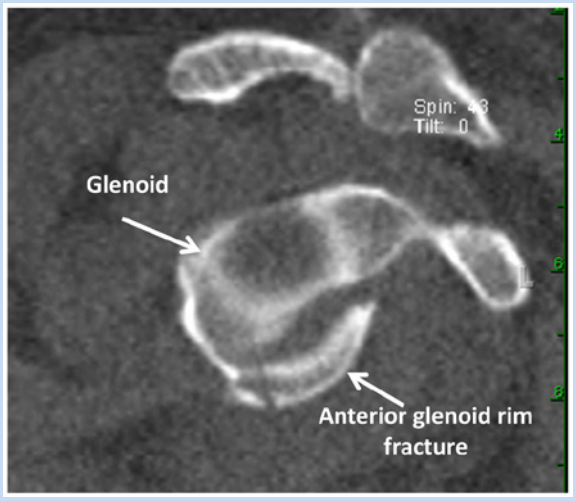

Figure 3. Sagittal shoulder computed tomography image demonstrating glenoid fracture after successful field reduction.

Postreduction Management

If the reduction is successful, the patient commonly notes pain relief and improved shoulder motion. An axillary radiographic view is the most helpful view to assess the reduction (Figure 2). The patient should be evaluated with radiographs as soon as possible to confirm joint congruency and to evaluate glenoid rim fractures (Figure 3). The injured arm should be placed in a sling. Immobilization in internal rotation or external rotation remains a matter of debate.[12,16,20,30] Then, physical therapy is initiated, aimed at periscapular and rotator cuff strengthening with the goal to return the patient to athletic activities within 4 to 6 weeks after the injury. Return to play for overhead athletes may take longer (6-12 weeks) depending on the presence of symptoms in the abducted and externally rotated position. Recurrent shoulder instability is common in athletes, especially when the first dislocation occurs at a young age.[30] The decision to treat primary shoulder instability with surgery is patient- and surgeon-dependent.

ELBOW DISLOCATIONS

The elbow is a unique trochoginglymus joint that places the hand in space for many athletic activities. The elbow is the second most commonly dislocated joint.[11] In more than 90% of cases, the elbow is dislocated in a posterior-lateral direction (Figure 4). The elbow dislocates after the ring of soft tissues surrounding the joint are compromised, including the lateral collateral ligament, anterior capsule, and medial collateral ligament. The structures are usually disrupted in that order with progressive translation from stable to perched and, finally, complete dislocation.[19]

Evaluation

Frequently, there is an obvious deformity of the elbow. Attempts at moving the elbow will cause pain. The close proximity of neurovascular structures crossing the elbow joint necessitate a thorough neurovascular assessment before and after the reduction as these structures can be injured in the initial injury or during any reduction maneuver.[3]

Reduction

There are several reduction maneuvers based around traction/countertraction principles.[1,2,3,19,23,25] For a posterolateral dislocation, the reduction is performed with gentle supination and valgus stress (Figure 5). This maneuver re-creates the injury mechanism and replicates the deformity. Once the elbow begins to shift, longitudinal traction is applied with a varus stress and simultaneous pronation. Once the elbow reduces, the forearm is held in pronation to stabilize the joint. The elbow is typically immobilized at 90° of elbow flexion, with the forearm in pronation for a posterolateral dislocation.

Postreduction Management

Prompt radiographic evaluation after the reduction is critical to assess for a congruent reduction as well as associated coronoid or radial head fractures (Figure 6) that may compromise elbow stability. Once the elbow has been reduced, the elbow should be ranged through an arc of motion to assess stability with the forearm in pronation and supination.[19,25] The elbow should be placed in a posterior splint until follow-up evaluation 1 week later for repeat motion and radiographic assessment. It is important to note that the radial head should point directly to the capitellum, with congruent articular surfaces in all radiographic views to confirm appropriate reduction (Figure 7).[1,19,25] If the elbow is stable throughout the arc of motion in forearm pronation and supination, the athlete can start immediate unrestricted range of motion. In general, return to sports is allowed if the elbow is clinically and radiographically stable throughout the entire arc of motion, the athlete has recovered full strength and range of motion, and the athlete has no tenderness around the elbow. The time frame for return to sports varies depending on the severity of the injury but takes between 6 and 12 weeks in most athletes. A hinged brace may be helpful for additional protection as the athlete returns to sports.

FINGER DISLOCATIONS

Hand and finger injuries are very common in athletes. They account for approximately 9% of all sports injuries.[24] The fingers are particularly vulnerable in sports requiring the use of the hands in outstretched positions. If the sport also requires grabbing or open hand techniques, it places the fingers in an even more vulnerable position.

Evaluation

Finger dislocations are usually obvious findings, but they are commonly disregarded as "minor" injuries by players and coaches.[21] The onus is on the sideline clinician to properly evaluate the injured finger for stability, rotational deformity,

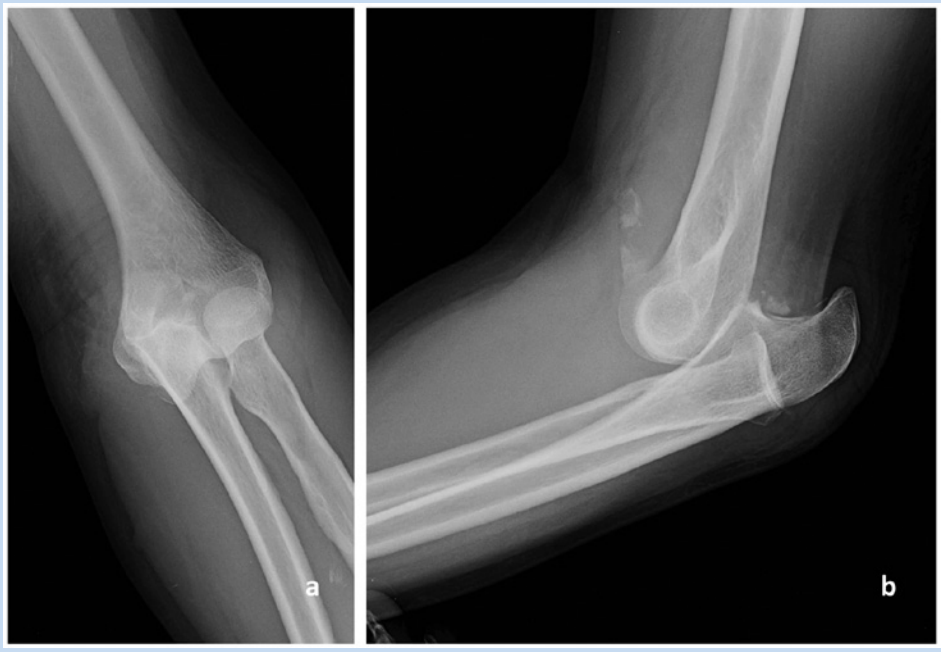

Figure 4. (a) Anterior-posterior radiograph of a left elbow posterolateral dislocation after a fall on an outstretched hand. (b) Lateral image of the same elbow dislocation demonstrating a coronoid fracture.

Figure 5. The clinician supports the hand or wrist and applies traction and flexion while the other hand is placed on the humerus to provide countertraction. The clinician's left fingertips are placed over the tip of the dislocated ulna to guide the reduction.

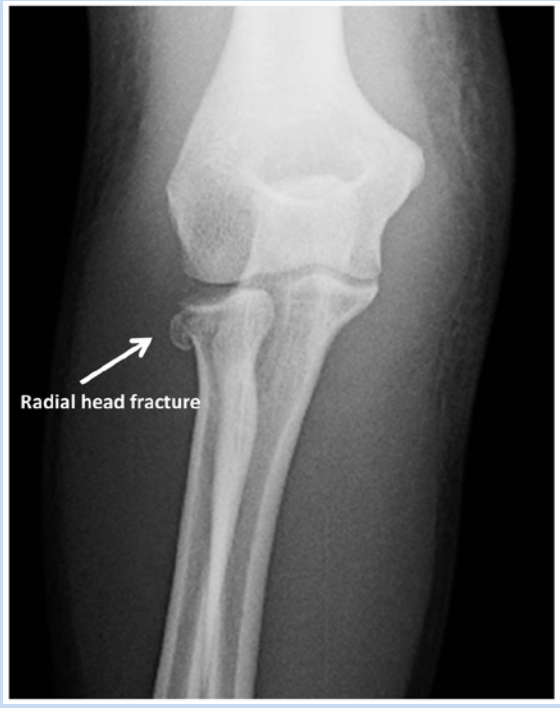

Figure 6. Anterior-posterior radiograph demonstrating a radial head fracture after successful elbow reduction.

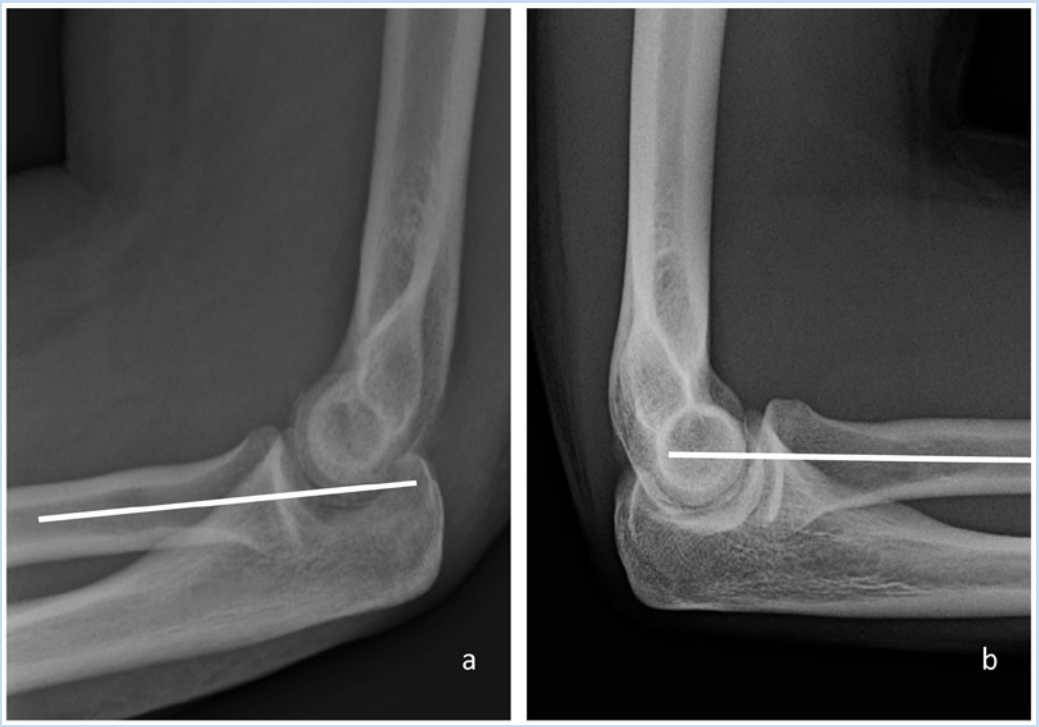

Figure 7. (a) Lateral radiograph demonstrating that the radial head is not in alignment (white line) with the humeral capitellum. (b) Lateral radiograph of a normal elbow with the radius aligned with the capitellum, as shown by the white line drawn in line with the radius bisecting the capitellum.

range of motion, and neurovascular compromise. Hand and wrist injuries are commonly associated with finger dislocations and should be included in the injury evaluation.[5,23]

Reduction

Distal and proximal interphalangeal (PIP) joints should not be reduced with simple axial traction as this can tighten the soft tissues around the joint and prevent the reduction. For the more common dorsal PIP joint dislocation, hyperextension of the PIP and distal translation of the middle phalanx typically reduces the joint. For the less common volar PIP dislocation, flexion of the PIP and distal translation the middle phalanx reduces the joint.[7] Some orthopaedists advocate that volar dislocation of the PIP joint should not be reduced in the field and may benefit from surgical reduction given the high prevalence of soft tissue interposition preventing reduction.[7] If the reduction is not successful, multiple attempts should not be performed.

Postreduction Management

Interphalangeal joint dislocations, collateral ligament sprains, and mallet fingers typically can be reduced and splinted with buddy taping. The athlete may return to play if no other injuries are noted. After completion of the game, a dorsal PIP joint dislocation should be splinted in slight flexion to maintain the reduction. A volar dislocation should be splinted in extension. If the athlete has sustained a metacarpophalangeal dislocation, return to play is not advised.[22,24] All fingers should be splinted postreduction until evaluation by a musculoskeletal specialist. Misdiagnosis or delayed diagnoses can lead to permanent long-term sequelae; fingers should not be splinted for more than 2 weeks without further assessment.[21,22,24]

HIP DISLOCATIONS

Hip dislocations are very rare sports injuries. However, their recognition is extremely important, and the in-game management of this dislocation differs from other joints. Avascular necrosis of the femoral head is one of the greatest concerns with this injury.[26] Hip dislocations require emergent identification and transportation to a hospital as soon as possible for proper treatment (Figure 8).[11,26] The hip should be reduced within 6 hours from the time of dislocation to decrease the chances of developing avascular necrosis.[11,23,26]

Evaluation

Athletes sustaining a hip dislocation have commonly experienced a high-energy impact with the hip and knee flexed. This position places the hip in an unstable orientation

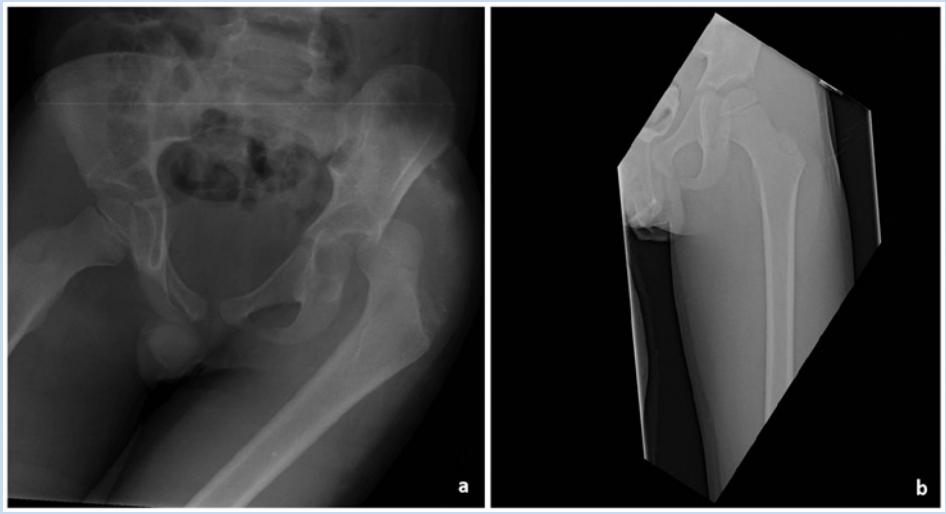

Figure 8. (a) Anterior-posterior radiograph of a left posterior hip dislocation. (b) After proper sedation in the emergency department, the hip was successfully reduced.

at risk of posterior displacement from an anterior to posterior directed force. Athletes most commonly experience a posterior dislocation of the hip and will hold the hip flexed and internally rotated. The hip commonly has a prominent deformity from the femoral head, and the leg length of the affected side is shorter than the contralateral side. The patient will experience pain with any range of motion about the hip. A neurovascular examination is necessary for this injury as the femoral head can impinge on the sciatic nerve.

Reduction

The athlete should lay supine for this reduction maneuver. The knee is flexed to approximately 90° while the clinician provides axial traction on the leg. Frequently, an assistant is needed to provide downward countertraction with both hands on top of the athlete's anterior superior iliac spine while the clinician provides traction to reduce the hip. Given the complexity and risk of causing further injury and discomfort, we recommend prompt transfer to a hospital emergency department that can provide sedation and radiographic evaluation of the hip reduction. If arrival at a medical facility would take longer than 6 hours, reduction should be considered on the field. Open surgical reduction may be necessary if the hip cannot be reduced in a closed fashion.

Postreduction Management

After the hip is reduced and confirmed on radiographic views, the patient should have a pillow placed between the legs to keep the leg in slight abduction. A computed tomography (CT) scan of the hip is very useful to evaluate the reduction, inspect for intra-articular fragments, and determine any associated fractures, and magnetic resonance imaging (MRI) 6 weeks after the injury can assess for early avascular necrosis.[26] Weightbearing after a reduction is controversial and depends on the nature of the injury and the time to reduction.[11] We recommend strengthening and range of motion exercises for approximately 6 weeks, with return to sport after full range of motion and strength have been obtained and no signs of avascular necrosis are present on MRI.[26]

KNEE DISLOCATIONS

Knee dislocations are uncommon sports injuries, but they can be an extremely serious injury with emergent surgical indications if a patient has vascular compromise. Popliteal artery disruptions occur in 20% to 40% of knee dislocations.[8,9,11] This dislocation is especially difficult to diagnose given that many patients spontaneously reduce before the clinician examines the patient. This also makes quantifying the prevalence of this injury difficult.[9]

Evaluation

There may not be an obvious deformity of an acutely dislocated knee. Many knee dislocations spontaneously reduce prior to evaluation by a clinician. The physician must be highly suspicious of this injury if an athlete demonstrates multiplanar instability after a knee injury. Immediate identification of a popliteal artery injury is of utmost importance. Therefore, distal pulses should be checked and compared in both lower extremities before and after a reduction is performed. Peroneal nerve function should be assessed before and after reduction. Injuries to the peroneal nerve are common after a knee dislocation.[18]

Reduction

A neurovascular examination should be recorded before and after any manipulation of the knee. To reduce the knee,

traction is applied with medial, lateral, anterior, or posterior translation depending on the direction of the dislocation. Often, traction alone will reduce the knee. The goal is to extend the lower extremity. Care should be taken to avoid placing pressure in the popliteal fossa during the reduction to avoid additional injury to the neurovascular structures that may already be stretched from the injury. Once reduced, the knee should be immobilized in extension. Dimpling of the skin over the medial femoral condyle may indicate a posterolateral dislocation with the medial femoral condyle "button-holed" through the medial capsule. This injury may not be reducible with closed treatment, and emergent treatment is indicated.

Postreduction Management

Any athlete with a suspected knee dislocation warrants immediate transfer to a hospital for a thorough vascular evaluation with an ankle-brachial index or angiography. A vascular injury places the athlete at risk of an amputation and requires evaluation and treatment by a vascular surgeon. The pulse should be periodically checked after the injury as vessel occlusion or expansion of an intimal tear in the arterial wall can lead to vessel compromise from the dislocation.[23] Knee dislocations are also commonly associated with multiligament injuries. Surgery is frequently needed to stabilize the knee. The duration of initial immobilization and the timing of surgery after a multiligament knee injury depends on the pattern of injury and remains a source of debate among knee surgeons.[6,8,29]

PATELLAR DISLOCATIONS

The patella is the largest sesamoid bone in the body. It is commonly dislocated with a twisting injury or direct contact to the anterior aspect of the knee. The patella usually dislocates laterally resulting in disruption of the medial patellofemoral ligament. Athletes frequently report that their knee gave way and that they felt a pop when the injury occurred. The reported mechanism may be confused for an anterior cruciate ligament (ACL) injury. Often, the patella reduces spontaneously, making the diagnosis less clear if the athlete cannot clearly identify what happened during the injury. The clinician should consider both injuries when given this history. A careful examination of the knee should distinguish a spontaneously reduced patellar dislocation from an acute ACL injury.

Evaluation

Patellar dislocations are associated with a hemarthrosis. If the patient is comfortable, patellar tracking should be assessed. The patellar mobility can be checked by placing the index finger and thumb on the medial and lateral sides of the patella. The patella is shifted medially and laterally using the opposite thumb on the tibial tuberosity as a reference for the amount of translation (Figure 9). It is helpful to compare lateral patellar translation of the affected knee to the other knee, assuming the other knee is normal. Apprehension with lateral patellar translation and tenderness along the medial patella or medial epicondyle should heighten suspicion for a patellar dislocation.

Reduction

Similar to knee dislocations, the patella does not usually require complicated reduction maneuvers. The sideline clinician can assist the reduction by applying a medially directed force with knee extension to push the patella over the lateral trochlea and back into the trochlear groove. If the patella does not easily reduce, the procedure should be aborted. A fracture fragment of the patella or condyle may limit the reduction and can be verified with radiographic studies.

Postreduction Management

The knee should be splinted in extension, and the athlete should obtain radiographs. A sunrise view can assess lateral patellar tilt and lateral patellar translation.[23] First-time patella dislocations are commonly treated nonoperatively with a period of rest and vastus medialis–focused quadriceps strengthening. Acute surgical intervention may be indicated if there is an osteochondral fracture with associated loose body in the joint.[14,15] Athletes with recurrent patellar dislocations may benefit from surgical stabilization.[10]

ANKLE DISLOCATIONS

Ankle injuries account for approximately 45% of athletic injuries. However, isolated ankle dislocations without fracture are uncommon (Figure 10).[27] Injury mechanisms that displace the talus are likely to result in a fracture of the distal fibula, tibia, or both. Subtalar dislocations can occur in athletes and must be considered when evaluating the injured ankle.

Evaluation

In ankle fracture-dislocations and subtalar dislocations, the athlete will often report severe discomfort. Deformity of the hindfoot and ankle will be evident when footwear is removed. A neurovascular assessment is critical. The skin should be evaluated for open wounds or tenting, as these findings necessitate immediate intervention. In athletes with tibiotalar dislocations, the entire foot is displaced relative to the tibia. Ankle motion will be severely limited because the ankle joint is not congruent. In athletes with subtalar dislocations, the calcaneus will be translated medial or lateral relative to the talus. The athlete may tolerate movement of the ankle joint because the tibiotalar articulation is congruent. Subtalar dislocations are associated with high-energy mechanisms and lock the foot in either supination with a medial dislocation or pronation with a lateral dislocation. Subtalar dislocations can be difficult to reduce on the field secondary to tendon, ligament, or other soft tissue interposition.[23]

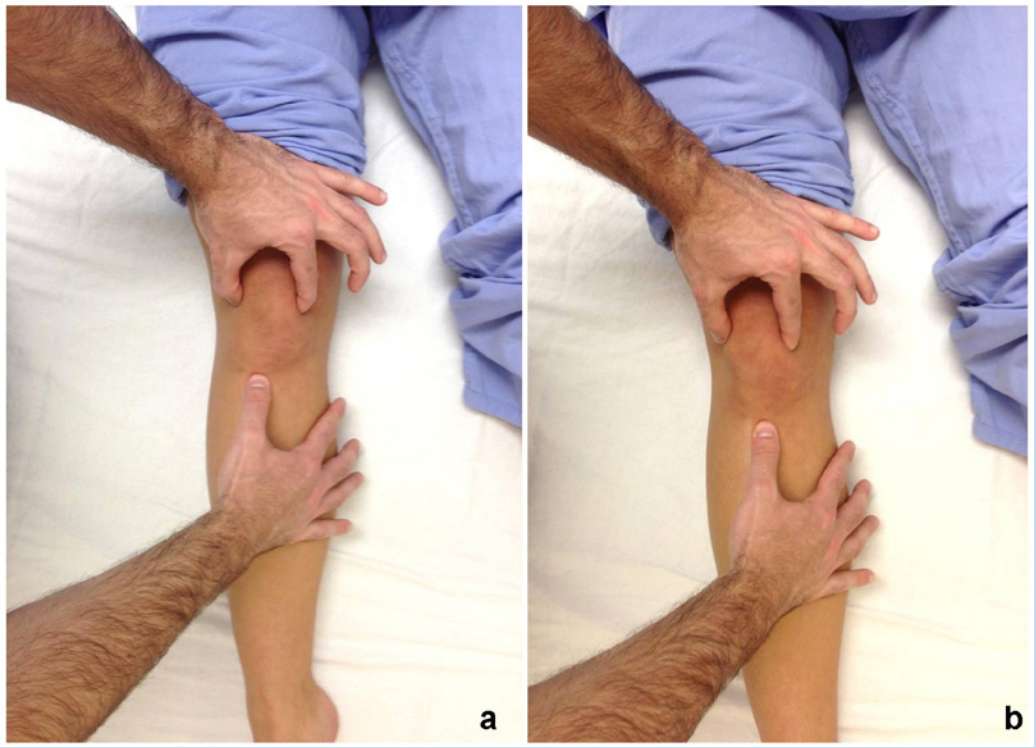

Figure 9. (a) The clinician places his thumb on the tibial tuberosity, as a reference point, with the patella in neutral. (b) He then translates the patella laterally evaluating for apprehension.

Figure 10. Lateral radiograph of a dislocated ankle without associated fractures.

Reduction

Once dislocation is diagnosed, reduction of isolated ankle and subtalar dislocations is performed through re-creation of the injury, gentle traction, and, finally, restoring anatomic alignment. One hand is placed under the athlete's heel and the other hand is placed over the anterior aspect of the ankle (Figure 11). This positioning helps control rotation, varus/valgus alignment, and traction about the ankle. If a posterior dislocation is suspected, the hand on the distal tibia can provide a downward force while pulling up with the hand holding the heel. Knee flexion may facilitate the reduction. In the case of a subtalar dislocation, a similar hand position can be utilized. In this situation, the hand on the calcaneus will attempt to move the hindfoot in a direction opposite the direction of dislocation (lateral for medial dislocation and medial for lateral dislocation). After reduction or if an attempted reduction is unsuccessful, the patient will require radiographic evaluation and definitive treatment. In some cases, soft tissue interposition may prevent complete reduction of the ankle and subtalar joint to their anatomic orientation. Operative management is necessary in these cases for proper reduction.

Figure 11. Clinician demonstrates hand positions for reduction of an ankle dislocation.

Management

The patient should be placed in a splint or immobilization boot until radiographic confirmation of the reduction and to rule out any fractures, which are commonly associated with this dislocation. In the case of a suspected subtalar joint dislocation, a CT scan is suggested to confirm anatomic joint reduction as well as to evaluate subtle fractures that may be unrecognized on plain radiographs. The patient should be non-weightbearing after the reduction maneuver. Definitive management is dependent on the associated injuries identified after the reduction.

CONCLUSION

The sideline clinician has unique challenges treating the athlete with a joint dislocation. Sideline clinicians have limited imaging options to diagnose other injuries and the risk of manipulating an associated fracture while trying to reduce the joint. Similarly, sideline reductions have limited anesthesia available for both patient comfort and facilitation of the reduction if muscle spasm has occurred.[11,23] Furthermore, there may be limited assistance from non–medically trained individuals attempting to help in a reduction procedure. All of these variables should be considered when caring for the athlete on the sidelines.

Despite these limitations, definite reduction and stabilization of joint dislocations can have a significant benefit for the patient by reducing pain and minimizing potential neurovascular compromise. The sideline clinician should be familiar with common dislocations and their reduction techniques. The clinician should weigh the benefits and risks of the reduction based on their comfort level with the reduction and on the presence of associated injuries. It is important that the sideline clinician document a neurovascular examination before and after a joint reduction. Once the reduction has been performed, the athlete needs radiographic confirmation of the successful joint reduction and evaluation for associated injuries.

There is some controversy among sideline clinicians regarding the sideline relocation of dislocated joints. The clinician performing the reduction should be experienced in reduction techniques and have a detailed understanding of the joint anatomy. Without experience, there is risk of causing undue pain or complicating the injury. Multiple reduction attempts should only occur if transportation to a medical facility is not readily available or significantly far away.

Acknowledging these factors, however, the sideline clinician can still greatly improve the comfort and postinjury care of an athlete suffering from a dislocated joint with an appropriate evaluation and well-executed reduction. When properly evaluated and diagnosed, most sports-related dislocations can be reduced and initially managed at the game.

Clinical Recommendations

SORT: Strength of Recommendation Taxonomy
A: consistent, good-quality patient-oriented evidence
B: inconsistent or limited-quality patient-oriented evidence
C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Prompt diagnosis and reduction of dislocated joints has been associated with improved patient comfort, joint integrity, and functional prognosis.[1,2,7,9,13,16,24,26]	B

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