

# In Brief

## Sprains

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### Author Disclosure

Drs Canares and Lockhart have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

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Ligaments, which connect bone to bone, stabilize joints by restricting the range and direction of the bones' movement. A sprain is an injury to a ligament caused by a force that exceeds the ligament's tensile strength. Children differ from adults in that their ligaments are stronger relative to their bones; so the clinician diagnosing a sprain in a growing child must be confident that there is no underlying fracture.

When faced with trauma to an extremity, the clinician must inquire about the mechanism of injury to help focus the examination, which should include inspection for swelling and ecchymosis, palpation along bones and ligaments, assessment for effusion, evaluation of range of motion and neurovascular status, and comparison of the injured with the uninjured side. Ambulation must be evaluated in injuries to a lower extremity.

Sprains can be classified by the severity of injury. A grade 1 sprain involves stretching of a ligament without a tear, usually manifested by mild soft tissue swelling or pain, with no joint laxity. A grade 2 sprain, or a partially torn ligament, presents with soft tissue swelling or an effusion, and usually with more joint laxity than the contralateral side, but with a definite end point. These sprains often require external support during healing, such as a brace or splint. A grade 3 sprain is a completely torn ligament, resulting in gross laxity. When ligamentous strength is tested, the end point is soft, suggesting that other tissues are providing joint stability. Constant external support may be needed for weeks after the injury, although it should be noted that healing of a sprain is not always proportional to the grade of injury.

Ankle sprains occur most commonly from inversion rather than from eversion or dorsiflexion. The lateral ankle has three ligaments: the anterior talofibular (ATFL), calcaneofibular (CFL), and posterior talofibular. The ATFL is injured first during inversion, followed by the CFL and posterior talofibular in extreme inversion and plantar flexion. The medial ankle is supported by the deltoid ligament and is injured in eversion. Children

who have experienced previous ankle injuries and athletes who perform jumping and "cutting" motions are at increased risk for sprains.

Inversion injury to the ankle may cause an audible pop, followed by rapid swelling, pain, and difficulty bearing weight. Examination should include palpation of the medial and lateral malleoli and assessment of tenderness and laxity of ankle ligaments. The anterior drawer test of the ankle assesses integrity of the ATFL; the clinician holds the lower leg with one hand and, while gripping the heel with the other hand, pulls anteriorly. Anterior displacement of the heel beneath the ankle in comparison with the contralateral side indicates a tear of the ATFL. The talar tilt test is performed by inversion of the heel to test stability of the CFL, or eversion of the heel to assess integrity of the deltoid ligament.

A syndesmotic (so-called high-ankle) sprain occurs with forced dorsiflexion and eversion that can occur when a child jumps from a height, slides into a base, or decelerates wearing rigid boots (eg, skiing). The syndesmosis is the membrane between the distal tibia and fibula. The patient reports pain along the fibula, superior to the lateral malleolus, that worsens with passive dorsiflexion or passive external rotation of the talus. A positive tibia-fibula squeeze test identifies a syndesmotic sprain and occurs when there is pain anterior and proximal to the ankle joint upon squeezing the tibia against the fibula at mid-calf. An orthopedist should be consulted for a syndesmotic sprain because surgery may be needed to maintain joint integrity and stability.

When fracture is a consideration, radiography should include anterior-posterior, lateral, and oblique views.

Computed tomography may be used to rule out occult fracture. The Ottawa Ankle Rules were created to limit unnecessary radiographs and have been validated in children older than 6 years (sensitivity >97%). The rules recommend ankle radiography only if any one of the following is positive: acute blunt injury with pain in the malleolar zone, bony tenderness to palpation at the posterior edge or tip of either malleolus, or the inability to bear weight immediately after the injury. Clinicians should use caution in applying these rules to children under 6 years, and should not apply them to children who cannot ambulate at baseline.

Children's knees are also susceptible to sprains. The principle ligaments are the anterior cruciate (ACL), posterior cruciate, lateral collateral, and medial collateral ligaments. The ACL is most commonly affected; injury occurs by deceleration with hyperextension and rotation, often with a loud popping sound and rapid swelling. The Lachman test of ACL integrity is most specific; with the patient supine and the knee flexed at a 30 degree angle, the clinician grasps the distal femur in one hand and the proximal tibia in the other hand with the thumb on the tibial tuberosity and pulls anteriorly on the tibia. Laxity of the joint (>2 mm displacement) in comparison with the contralateral side suggests an injury to the ACL. Injury to the ACL may be managed conservatively with rehabilitation and bracing, or with surgery, indicated particularly if there is chronic instability. Injuries to the medial collateral, lateral collateral, and posterior cruciate ligaments generally heal with rehabilitation without surgery. Pain with weight bearing or signs of instability may warrant immobilization of the sprained knee with an elastic wrap and crutches. Straight-leg knee immobilizers, which may be indicated for an unstable knee, do not provide structural support.

The most common shoulder sprain, acromioclavicular (AC) separation, can

be caused by direct trauma from a tackle, diving for a baseball, or a fall on an outstretched hand. This sprain occurs in older adolescent and young adult athletes and may be associated with a fracture or intra-articular injury (eg, rotator cuff tear). Physical examination may detect tenderness at the AC joint; pain on forward flexion, adduction, or abduction of the shoulder; or an asymmetric step at the AC joint. Injuries involving no, mild, or moderate displacement of the clavicle from the acromion are managed conservatively with a sling for 3 to 7 days, provided there is no overlying skin damage or neurovascular compromise. More severe injuries should be referred to an orthopedist.

Wrist sprains are rare in children, but may occur in adolescent athletes who experience twisting injuries. Of the three specific ligamentous injuries the clinician should be aware of, the most common is trauma to the scapholunate ligament, resulting from excessive wrist extension with pronation (eg, a fall on an extended wrist). Examination demonstrates swelling, audible clicks, tenderness out of proportion to injury, decreased range of motion, and decreased grip strength. Radiography findings may be normal or show an increased scapholunate distance. Orthopedic referral is recommended. Stabilization should be obtained with a thumb spica splint.

Lunotriquetral sprains result from sudden axial loading with wrist extension and radial deviation, causing pain along the ulnar aspect of the wrist. Examination may reveal ulnar wrist tenderness, weakness, and a clicking sound. Radiography findings are usually normal. This injury benefits from an ulnar gutter splint.

The ulnar collateral ligament is injured during forced hyperextension and abduction, also known as gamekeeper's thumb or skier's thumb. Pain is felt on the ulnar side of the metacarpophalangeal joint of the thumb, especially with valgus stress. Treatment is with a thumb spica splint and complete rest for 3

weeks, followed by passive range of motion exercises with continued splinting for several more weeks. Referral to a hand specialist should be considered because untreated ligamentous injuries to the wrist may result in chronic pain and functional compromise.

The primary goals of sprain management are to reduce swelling and inflammation. Mild to moderate sprains are managed conservatively with rest, ice, compression, and elevation for the first few days. Nonsteroidal anti-inflammatory drugs can be prescribed for inflammation and pain. A brace, splint, aircast, or walking shoe may improve comfort. For patients who cannot bear weight because of pain, crutches or a wheelchair should be provided until gait returns to normal. Treatment of severe or grade 3 sprains is variable, and, in general, requires immobilization for a short period (10 days), followed by early functional rehabilitation.

Recovery progresses in 3 phases. During phase 1, the patient has swelling and mild pain for several days to 1 week and should continue rest, ice, compression, and elevation and nonsteroidal anti-inflammatory drugs. In phase 2, the patient will begin range-of-motion exercises once acute pain and swelling resolve, usually 1 to 4 weeks after the injury. Exercise begins with joint movements against gravity, then later against low resistance with high repetition (eg, three sets of 20 repetitions). Exercises should not induce pain. A protective splint or brace is worn to prevent further injury in moderate to severe sprains. Functional rehabilitation promotes earlier return to activities, but a balance must be met between immobilization, which promotes tissue healing, and rehabilitation, which limits atrophy, scarring, and loss of flexibility, and promotes proprioception.

Phase 3 takes place 4 to 6 weeks after injury and includes rehabilitation exercises for strength training, which enhances proprioception and endurance.

Exercises may include higher resistance with fewer repetitions. Formal physical therapy may be indicated for severe injuries. Other treatment modalities include whirlpool therapy, ultrasound, or soft tissue massage. Although rarely indicated, surgery may be indicated for patients with severe sprains or elite athletes who are likely to have repeated joint stresses.

Patients can return to play once full, painless range of motion and full strength are obtained and the athlete is able to perform sport-specific tasks. Athletes who return to play with persistent pain and swelling are at risk for reinjury. Athletes playing high-risk sports will benefit from bracing or taping to prevent recurrent injury and improve proprioception.

Although the prognosis for sprains generally is very good with adequate treatment and rehabilitation, complications can include stiffness from prolonged immobilization, recurrent instability, or osteochondral defects. Persistent pain for more than 6 to 8 weeks after an injury may indicate a need for further imaging to rule out a fracture.

Indications for referral to an orthopedist include fracture, dislocation, subluxation, syndesmosis injury (high-ankle sprain), tendon rupture, intra-articular wound, hand injuries, and neurovascular compromise. Clinicians should remind patients to wear appropriate helmets, protective padding, wrist guards, and high-top shoes or lace-up braces to prevent injuries.

**Comments:** When last we published an In Brief on sprains in 2008, the Ottawa Ankle Rules, which provide indications for radiography in patients with trauma to the ankle, had been well validated only for adults. No surprise that studies involving children were late to come, but, at last, patients no longer have to be old enough to vote for the Rules to apply. As Drs Canares and Lockhart report, the Rules have been validated for children older than 6 years, covering the great majority of pediatric patients with ankle injuries and allowing us to safely reduce their exposure to radiation.

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Editor, In Brief

## Perinatal Varicella

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### Author Disclosure

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Varicella-zoster virus (VZV) is the human herpesvirus that causes primary varicella infection, known as chickenpox. Latent VZV infection can reactivate as herpes zoster, also called shingles. Before the availability of a highly effective vaccine, VZV was responsible for nearly universal infection in childhood, with very few

adults remaining susceptible to primary disease.

The clinical manifestations of chickenpox include a widespread, intensely pruritic vesicular rash. Affected individuals typically have between 250 and 500 lesions in varying stages of evolution, often associated with fever or other systemic symptoms. Infection in immunocompetent hosts generally is self-limited, but may vary greatly in severity. Adolescents, adults, and people who are immunocompromised are at particularly high risk for significant complications from this disease.

Although the most common complication of chickenpox is bacterial superinfection of skin lesions, varicella pneumonia is the most common cause of mortality, and pregnant women appear to be at particularly high risk of mortality from this complication. Other complications of chickenpox infection include postinfectious acute cerebellar ataxia, encephalitis, thrombocytopenia, and Reye Syndrome.

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