Evaluation of Ankle Pain

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1 Introduction

Injuries below the knee constitute a large volume of both primary care and specialty visits. The complexity of these injuries is complicated by the intricate anatomy between the 28 bones, 33 joints, and numerous tendons and ligaments—all of which bear upwards of 45 times the body weight based on the activity the patient is participating in. A thorough history and anatomic-focused physical examination can often help the practitioner concisely identify a specific diagnosis.

2 History of Present Illness

Examination of all patients with foot and ankle pathology should begin with a complete history. Special attention should be placed into obtaining pertinent past medical and surgical history, duration and quality of symptoms, attempted treatment modalities, and the length of treatment prior to current presentation.

2.1 Medical History

Evaluation of a patient's medical history should start with a detailed list of chronic medical problems and current medications. While this helps the practitioner understand the patient's overall health, it also assists in surgical planning by identifying what pre-operative clearance must be obtained and the setting in which a surgical patient can be cared for (i.e., ambulatory surgery center versus in-patient). Furthermore, certain medications must be modified or held prior to surgery, such as anticoagulation immunomodulatory (affecting the immune system) medications.

Special attention should be paid to those with diabetes mellitus and chronic kidney disease. Identifying patient with these co-morbidities is critical. Further, obtaining updated lab work, such as Hemoglobin A1C levels and creatinine is important for the co-medical management of these patients. For diabetic patients, it is important to understand what their day-to-day blood glucose levels are and if they are controlled or if there are wide fluctuations. For those on dialysis, it is important to determine when their dialysis schedule is and where their vascular access points are located. Multiple studies suggest an A1C level less than 8.0% prior to proceeding with elective procedures [1, 2]. As mentioned above, immune compromising conditions and current immune-modulating agents should be identified and coordination with the patient's rheumatologist surrounding discontinuation of disease

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modifying agents surrounding surgical procedures should be done. Patients with diabetes, chronic kidney disease, and rheumatologic conditions are often high-risk surgical candidates. Therefore, it is important to identify these conditions when counseling patients about surgical risks.

Past surgical and/or trauma history is also important to obtain as this can often point to the etiology of a patient's pain. For example, a previous history of a calcaneus fracture, and the subsequent development of subtalar joint arthrosis, may provide information as to why the patient is complaining of hindfoot pain. If patients sustain complications after surgery, documenting these problems may also play a role when counseling patients about any potential surgeries. Additionally, social factors, such as the patient's smoking history and whom they live with at home, may indicate sources available for their post-operative care. The amount of social support and self-efficacy, as demonstrated by the LEAP study, directly predict outcomes and patient's abilities to maintain engaged with the recovery process [3]. Thus, social support following an injury or surgery is critical because some patients are required to be partial or non-weight bearing, with long periods of immobilization. This significantly limits their mobility and their independence, to such activities as driving, further stressing the patient's social support network. All these factors are crucial in the ultimate recovery of the patient.

2.2 Symptoms/Previous Treatments

Patients will often present with a chief complaint of pain, which may also be accompanied by swelling and a deformity. While diffuse swelling can be a sign of an underlying systemic problem, swelling confined to the foot and ankle often indicates where the problematic area is. Having the patient identify their exact source of pain, ideally with one finger, can help to focus the examination to a more anatomic region (e.g., anterolateral ankle, lateral border of the forefoot, etc.) Duration of symptoms and history of any inciting event can also give a clue to chronicity of the patient's complaint.

Additionally, details listing previous treatment modalities, including surgical and non-surgical treatments, should be noted. Many patients will have often undergone some attempted non-surgical care (e.g., physical therapy, orthotics, trial of anti-inflammatories), and it is important to document these specific interventions. For patients presenting for a second opinion, in the setting of previous surgical care, it is imperative that you obtain previous operative reports. Patients may not completely understand the surgeries that they have undergone. Having the operative report will allow you to review the procedure(s) previously performed, identify the type(s) of implant that was used, and identify the name of the company that provided the implants. This last information is important because if further surgery is necessary, having this knowledge preoperatively will allow the correct instrumentation to be available for removal of these implants.

Lastly, if patients present with or describe a deformity that has developed, it is important to know if the deformity is progressing or static. Other questions to ask about any deformity include, how or when it occurred? Whether it was the result of the initial trauma or injury? And, whether the deformity occurred because of any previous surgeries? This may also include any discussion about difficulty with shoe wear.

After a thorough history has been obtained, the physical examination is the next step in helping to obtain a diagnosis. This should be completed with the patient in appropriate clothing, ideally shorts, so that the entirety of the lower extremity can be visualized from the patella to the tips of the toes. The following section will detail the examination and specific tests of the foot and ankle that the authors recommend for all new patients presenting with complaints of ankle pain.

3 Physical Examination

3.1 Inspection

The first step in the examination of a patient is to place them comfortably into gowns or paper shorts that will allow the examiner to evaluate the patient from the patella to the tips of their toes. A

thorough inspection should also include an examination of the contralateral, non-affected limb.

The skin should be assessed first. Any skin changes, including ulcerations, should be noted as these may warrant a work-up for infectious diseases. Special attention should also be paid to any redness to the skin, commonly referred to as erythema or rubor. Dependent rubor, a common sequela of peripheral vascular disease, can be distinguished from erythema secondary to cellulitis by elevating the affected extremity. Erythema that remains, despite elevation of the leg above the level of the heart, may be indicative of cellulitis, and may also warrant a further work-up for infection. Ecchymosis and swelling often follow specific anatomic patterns and these may help provide a differential diagnosis for the examiner. Special notation should also be made of any previous surgical scars, their proximity to one another, and the quality of the surrounding tissue. This is crucial for preoperative planning as it allows surgeons a chance to evaluate the soft tissue envelope and best decide where future incisions can safely be placed to avoid skin breakdowns, wound complications, and surgical site infections. Lastly, especially in the setting of trauma, inspection of the skin is important to determine when further surgery can safely be performed. When a patient has a splint that cannot be removed, due to instability, we recommend removing the anterior half of the splint to allow for inspection of the skin and to evaluate the extent of swelling. The ability of the examiner to wrinkle the skin indicates that the edema of the extremity has decreased enough to safely proceed with any further surgical intervention the patient may require, while decreasing the risk of wound healing issues post-operatively [4].

Next, the anatomic axis of both extremities should be evaluated, anteriorly and posteriorly, with special attention paid to the patient's hindfoot alignment. If possible, this should be done with the patient standing and bearing full weight in an unassisted manner. One should also inspect and palpate all the bones and joints of the lower extremity as a potential cause of pain. Lastly, the greater and lesser toes should be inspected, and any abnormalities should be evaluated to determine if they are fixed or flexible deformities.

3.2 Palpation

Palpation for areas of tenderness should follow a methodical, anatomic-based approach. We recommend starting lateral and proximal and working distal and medial. Following a strict approach for each patient visit will ensure that no areas are missed on routine examinations. If the patient has sustained a recent trauma, working furthest away from injured area and finishing with injured area is also an option.

3.3 Evaluation of Motion

Evaluating a patient's preoperative motion is important prior to initiating any treatment. The Silverskiöld test is a specific test to evaluate shortening or contractures of the Achilles tendon, as it affects ankle joint motion. It is performed in two different ways, first with the knee in full extension and then flexed to 90°. With the patient in a sitting position, and the hindfoot held in the neutral (0° of inversion and eversion) position, dorsiflexion of the ankle is assessed with the knee in full extension. The knee is then flexed to 90°, which takes tension off the gastrocnemius muscle, and passive dorsiflexion of the ankle is reassessed. If the patient demonstrates an increase in passive dorsiflexion with the knee flexed, this indicates that the patient has an isolated gastrocnemius contracture. If there appears to be no difference with either extension or flexion of the knee, this will indicate a combined gastroc-soleus contracture. Differentiation of the location of the contracture (e.g., an equinus position) is important if one anticipates that the patient will need any adjunctive soft tissue releases, to help realign the position of the ankle.

Subtalar joint motion should again be measured with the patient in sitting position. The ankle should be held into a neutral (0° dorsi- and plantarflexion) position to avoid any compensatory movement through the tibiotalar joint.

Subtalar motion, consisting of inversion and eversion, is then evaluated. Understanding how to place the foot and ankle into a neutral position, prior to testing the motion of the ankle or subtalar joints, is critical for patients with ankle pain as the foot can often influence the etiology and treatment of ankle pathology. As an example, patients with chronic ankle instability can present with a cavus (high-arched) foot deformity. As the arch increases in height, it causes the foot to supinate which places a greater strain on the lateral structures of the foot and ankle. This can lead to chronic lateral ligamentous instability and should be assessed prior to any surgical intervention.

Midfoot motion is assessed by stabilizing the hindfoot with one hand while the other moves the forefoot laterally for abduction and medially for adduction. Special attention should be placed on the first tarsometatarsal articulation for hypermobility, especially in the setting of flatfoot and hallux valgus. Limitations in movement of the toes can be secondary to degenerative changes, primarily in the hallux but may also be due to contractures of the tendons. Both hallux metatarsophalangeal joint dorsiflexion and plantarflexion should be assessed, with special attention paid to pain elicited throughout the arc of motion and at which points that pain is present. It is also important to examine the motion on the contralateral extremity, which can help to set baseline motions for the patient.

3.4 Neurologic

Muscle strength should be evaluated for all major muscle groups consisting of posterior tibial, peroneals, gastrocnemius-soleus complex, flexor hallucis longus, flexors to the lesser toes, and extensor hallucis longus and extensors to the lesser toes. Sensation should also be assessed in the following distributions: superficial peroneal, deep peroneal, sural, saphenous, and tibial nerves. Again, examining the contralateral extremity is important to set the baseline for the patient. In the setting of peripheral neuropathy, Semmes-Weinstein monofilament testing should be completed. This simple exam is performed with the patient's eyes closed and has a sensitivity and specificity of 91% and 86%, respectively, which increases with a minimum testing of four plantar sites (great toe, first, third, and fifth metatarsal heads) [5]. An inability to detect a 5.07 filament (10-g) Semmes-Weinstein monofilament indicates the loss of protective sensation [6].

3.5 Vascular

Vascular evaluation of both the dorsalis pedis and posterior tibial pulses should be documented. There is a relatively low percentage of congenitally absent posterior tibial (0.18%) and dorsalis pedis (2.7%) pulses [7]. If neither pulse cannot be palpated, we recommend the use of doppler ultrasound and specific notation of anatomic location pulses are found for future reference. Any concern for peripheral vascular disease warrants evaluation with ankle/toe brachial index or toe pressures and referral to vascular surgery if necessary.

4 Special Tests

In patients presenting with a suspected Achilles rupture, it is important to first discern whether the patient had any pre-existing pain, since this may be indicative of an acute rupture in a patient with chronic tendinosis. To adequately assess for a ruptured tendon, the patient is placed into a prone position. Integrity of the Achilles tendon is performed using three different tests. The first is to palpate the entire tendon for any defects. The second, known as the Thompson test, is performed by squeezing the gastrocnemius-soleus complex. If no plantarflexion of the ankle is felt or observed, then an Achilles tendon rupture is presumed. Lastly, the patient flexes their knee to 90° and comparing the resting tension and plantar flexion against resistance is performed. Again, comparison of the contralateral extremity is recommended. Current AAOS clinical guidelines recommend at least two clinical exam findings to establish the diagnosis, with the Thompson test having the highest sensitivity (0.96) and specificity (0.93) [8].

4.1 Differential Diagnoses of Pain

Once the history and physical examinations are performed, the examiner should consider the cause of the pain, based on their anatomic location.

4.1.1 Lateral Ankle Pain

In patients who provide a history of an inversion injury or feelings of instability, the authors recommend documenting the cumulative lifetime injury occurrences. This is followed by formal testing of the lateral ankle and syndesmotic ligaments. While this is less useful, and often very painful in the acute setting, it can be especially helpful in patients with more chronic symptoms. Anterior drawer test of the ankle elicits pain in patients with an injury of the anterior talofibular ligament. It is performed with the patient sitting, knee bent with the leg hanging off the exam table. One hand stabilizes the midshaft of the tibia while the other cups the hindfoot and places an anteriorly directed force on the ankle. The presence of an anterior shift and an endpoint should be noted and compared to the contralateral ankle. An inversion stress of the calcaneus that produces pain may suggest a calcaneofibular injury.

Syndesmotic stability must also be assessed, especially when a high ankle sprain is suspected. Several tests have been described to evaluate for a syndesmotic sprain. The first is the *squeeze test and* is performed by squeezing the fibula and tibia together at the junction of the distal third of the tibia [9]. Pain is produced by tensioning the fibers at the distal tibiofibular complex. The second test is *the tibiofibular shuck or Cotton test* and is performed with the distal leg steadied with one hand while the opposite hand grasps the heel and moves it side to side. Excessive movement of the talus within the mortise, as compared to the contralateral ankle, suggests an unstable mortise [10]. The third test is the *abduction and external rotation test* [11]. This test is performed by stabilizing the leg, with the knee flexed to 90°, while the foot is abducted and externally rotated. Pain at the syndesmosis suggests a positive test. The last test is the *fibular translation test* [12]. This is performed with the patient sitting while an attempt is made to translate the fibula anteriorly and posteriorly. Any pain and excessive motion at the distal fibula, as compared to the contralateral side, may indicate a syndesmotic injury. While these tests can indeed elicit pain, the literature does not support any specific biomechanical test as being superior to the others, other than suggesting that there may be a syndesmotic injury [11, 13]. The authors support the use of radiographs and magnetic resonance imaging (MRI) studies and the anatomic location of pain around the syndesmosis as better indicators to identify a syndesmotic injury.

Lateral malleolar stress fractures, while rare, must be included in the differential diagnosis of lateral ankle pain. The patient will often complain of vague lateral ankle pain proximal to the ankle joint and will be tender along the bone on examination. Unlike their counter parts on the medial side, these are considered low-risk stress injuries and often heal with nonoperative treatment [14]. Pain slightly distal to the tip of the fibula, versus on the actual bone as seen with stress fractures, can be secondary to peroneal tendon pathology, with or without an os fibularis. Peroneal pathology is a spectrum of disease, ranging from tendonitis to fulminant tears and can include both the longus and brevis tendon. This pain can extend proximal up the posterior aspect of the fibula as the tendons course through the retromalleolar groove. Exclusion of peroneal tendon dislocations, via attempted manual tendon dislocation from behind the fibula while the patient everts their hindfoot, is crucial in diagnosing this problem.

Anterolateral ankle pain can also be secondary to an accessory anterior inferior tibiofibular ligament, located just distal to the native AITFL, known as Bassett's ligament [15]. Recurrent trauma, leading to attenuation and fibrosis of this ligament, leads to anterolateral impingement and ultimately becomes a source of pain for the patient.

4.1.2 Posterior Ankle Pain

The differential diagnosis for posterior ankle pain includes insertional and non-insertional Achilles tendonitis, posterior ankle impingement, and flexor

hallucis longus (FHL) tenosynovitis. Patients with insertional Achilles tendonitis often complain of pain most commonly at the insertion into the calcaneus. A large deformity near the insertion of the Achilles tendon may be present in the patients. Those with an inflamed retrocalcaneal bursa, may also have some tenderness with palpation, anterior to the distal aspect of the tendon. This contrasts with patients who have non-insertional Achilles tendinosis as the pain is often more diffuse and located more proximal, often times in the watershed region of the Achilles tendon but may extend up into the musculotendinous junction.

Another source of posterior ankle pain may be due to posterior impingement, often caused by patients with a symptomatic os trigonum. These patients will complain of pain with hyperplantarflexion of the ankle, often seen in ballet dancers. This pain is reproducible on examination with hyper-dorsiflexion of the ankle. Given the proximity of the FHL to the os trigonum, these patients may also have a component of FHL tenosynovitis that can be exacerbated by dorsi- and plantarflexion of the great toe.

4.1.3 Anterior Ankle Pain

In patients who present with anterior ankle pain it is important to understand the position of the ankle that elicits the pain. Patients with anterior impingement, and a history of trauma, can develop anterior distal tibia osteophytes, which will produce pain and decreased motion with dorsiflexion of the ankle. These patients will be diffusely tender to palpation along the entire anterior joint line. This differs from patients who have pain secondary to the development of an osteochondral defect (OCD) in the talus. Patients with an OCD often have more point tender at the anteromedial region of the ankle, and less frequently at the anterolateral joint line.

Pathology of the tibialis anterior tendon is also a contributor to anterior ankle pain. Like any other tendon in the body, it is subject to inflammatory changes leading to tendonitis. Tendon rupture must also be on the practitioner's differential. These may or may not be preceded by an episode of trauma as they can be attritional in nature. If a palpable tendon defect is present (e.g., a rupture) swelling may make this portion of the examination difficult to assess. Ankle dorsiflexion may still be present, even in complete rupture, due to the competence and recruitment of the toe extensors. A simple test to asses for a rupture is to have the patient attempt to walk on their heels, as this is nearly impossible to due in the absence of a tibialis anterior tendon.

4.1.4 Medial Ankle Pain

A patient's complaint of medial ankle pain may occur because of problems with the posterior tibial tendon, especially in the setting of pes planovalgus (flatfoot). These patients will describe pain proximal to the medial malleolus or point to the insertion of the posterior tibial tendon on the navicular tuberosity, as the location of their pain. To differentiate this foot problem from ankle pain, it is important to assess the mid- and hindfoot. This is performed with the patient standing on the affected limb. While balancing themselves, an attempt is made to perform a single leg heel rise (SLHR). In normal patients, the SLHR produces a reconstitution of the arch and a varus positioning of the hindfoot. Patients with tendinosis of the posterior tibial tendon may be unable or have some difficulty performing a SLHR.

Another potential cause of medial sided ankle pain are medial malleolar stress fractures. These commonly occur in active, high-demand patients. These patients present without a history of trauma and often describe a gradual onset of pain and swelling of the medial ankle that is alleviated with cessation of activity. They will often be point tender directly over the bone and plain radiographs or MRI studies will help to confirm the diagnosis.

5 Conclusions

Ankle pain can occur in multiple locations. A thorough and systematic approach to evaluating the patient's complaint will help to differentiate the potential causes of their pain. At the conclusion of the examination, and once a presumed diagnosis has been made, a better discussion between the examiner and the patient, regarding treatments and outcomes, can be undertaken.

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