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Foot & Ankle Tips & Tricks: The Essentials of Physical Examination

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Introduction

A thorough physical examination is an essential part of any clinical encounter for patients presenting with foot and ankle (F&A) complaints. In this article, we review the essentials of physical examination, which combined with the history, can assist the clinician in making accurate diagnoses. Physical examination of the F&A can be broadly divided into the following: inspection, palpation, gait, range of motion (ROM), neurological exam, vascular exam, and special testing.

Inspection

Inspection of the foot and ankle can provide valuable clues as to the underlying disease process. Firstly, it is important to note whether the patient has any swelling. Diffuse swelling/edema, especially that which extends proximal to the malleoli or is bilateral, can be a sign of systemic disease such as kidney disease, hepatic compromise, congestive heart failure, vascular insufficiency or lymphedema. Localized swelling over a joint can be a sign of rheumatoid or osteoarthritis. Swelling along the course of a tendon may indicate a tendinopathy. Areas with both swelling and ecchymosis may indicate a fracture or sprain.

Inspection of the skin is also a vital component of the F&A exam. Bluish pigmentation of the skin represents hemosiderin deposits from extravasation and subsequent lysis of red blood cells. It can be a sign of venous stasis, varicose veins, or even a chronic deep venous thrombosis. Hypertrophic nails, decreased hair growth on the lower leg, and thin, shiny, pearlescent skin can also be signs of poor vascular supply. With the high prevalence of diabetes, skin ulcerations should be noted, their size documented and the wounds probed to assess their depth. In patients with diffuse erythema, the limb can be elevated to determine if the erythema improves. Lack of improvement may point to an infectious etiology while improvement can indicate Charcot arthropathy.

Inspection of the patient's standing alignment is a key part of the examination. Weight bearing is essential to understand the orientation of the joints, the position or splaying of the toes, and the extent of deformities. The alignment of the hindfoot should be assessed with the clinician standing behind the patient to determine whether the hindfoot is in neutral, valgus, or varus. Subtle differences in where the calcaneus contacts the ground in relation to the tibia should be noted, as it may indicate risk factors for other pathologies. The alignment of the knees and tibia should be noted as it may help identify other deformities. For example, a patient with a severe valgus knee may also have a valgus hindfoot to compensate. The shape of the arch should be examined to determine whether the patient is flat-footed or high-arched.

The forefoot should be examined with the patient standing to determine if it is abducted or adducted. The forefoot should also be examined with the patient seated, to assess for compensatory rotational pronation/supination, which may manifest only when the foot is unweighted.

The alignment of the toes should also be assessed with the patient standing. Standing examination makes varus, valgus, and cross-over deformities of the toes more apparent, allowing the clinician to understand how the pull of the long flexors and extensors are affecting the deformity. Claw toes, hammer toes, and mallet toes present similarly and should be differentiated.

The soles of the feet should be examined for plantar calluses, or mechanical hyperkeratoses. The location of these calluses can provide valuable clues into the underlying disease process. For example, a child with lateral plantar calluses may have a rigid varus hindfoot alignment that causes him to walk on the lateral aspect of his foot.

Palpation

Due to the foot's thin skin and superficial contours, surface anatomy can be an excellent guide to identify the location of pathologic processes. Ligamentous, boney, and tendinous injuries are usually painful immediately over the site of injury. For example, ankle and syndesmotic ligaments are located in areas with very little overlying tissue, making them easily identifiable with palpation. In the neuropathic population, however, palpation may not be as helpful, given the diminished sensation.

In the midfoot, boney osteophytes can be easily palpated, despite the small size of these

joints, again due to the thin soft tissue coverage. Masses can be identified easily on the dorsum of the foot and most commonly represent ganglion cysts.

In the traumatic setting, all four compartments of the affected leg should be palpated to assess for compartment syndrome. Pain with passive stretching of the toes can also be used to aid in the detection of this emergent diagnosis.

Some of the common areas of tenderness and their correlating differential diagnoses are listed in the Figure 1 and Figure 2.

Gait Examination

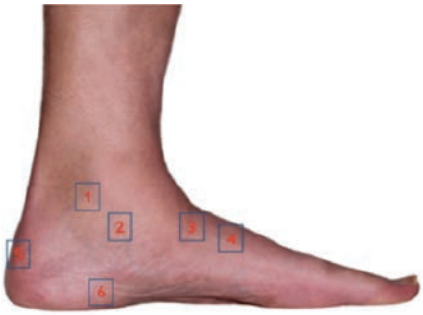
The patient should be asked to ambulate in the hallway for best assessment. Asymmetry of the direction in which the toes point, known as the foot progression angle, can be a clue to underlying pathology. For example, a patient who walks with his toes pointed in may have metatarsus adductus, internal tibial torsion, or increased femoral anteversion.

The stride length and rhythm should also be noted. A high steppage gait with slapping of the foot on the ground may be a result of a peroneal nerve palsy. Truncal balance should be assessed as well. A truncal thrust may represent a Trendelenberg gait and can be a sign of proximal muscle weakness.

A decrease in the stance phase on one leg results in an antalgic gait and should warrant further testing. In the normal gait cycle, the heel strikes the ground first. This is followed by the foot landing flat and then to toe off. If this sequence is disrupted, an underlying pathology should be investigated.

Range Of Motion Testing

ROM of the ankle and foot joints should be assessed in a systematic fashion. Like all joints, it is important to assess both passive and active ROM and compare to the contralateral side.



Labeled Point	Differential Diagnosis
1	Posterior Tibialis Tendon
2	Deltoid Ligament
3	Navicular, Accessory Navicular
4	First Tarsometatarsal Joint
5	Achilles Tendon Insertion
6	Plantar Fascia Insertion

Figure 1. Lateral view of the foot and ankle.

Labeled Point	Differential Diagnosis
1	Peroneal tendons
2	Base of the 5th Metatarsal
3	Anterior Talofibular ligament
4	Calcaneus body
5	Peroneal Tubercle
6	Groove for Peronus Longus at the Cuboid

Figure 2. Medial view of the foot and ankle.

The ankle joint is primarily responsible for dorsiflexion and plantar flexion. Restriction of ankle ROM can have multiple causes, including ankle arthritis and heel cord tightness. The subtalar joint is primarily responsible for eversion and inversion.

In patients with equinus contractures, the Silfverskiold test can be used to determine the role of the Achilles tendon on the limited range of motion. The degree of ankle dorsiflexion is measured with the knee extended, which engages both the gastrocnemius and the soleus. Thereafter, the degree of dorsiflexion is measured with the knee flexed, which engages only the soleus—the gastrocnemius has been taken off tension because it crosses the knee joint in addition to the ankle. If dorsiflexion improves with flexion of the knee, the equinus contracture is the result of the gastrocnemius tightness. If dorsiflexion does not improve with knee flexion, the contracture is a result of both the gastrocnemius and the soleus in the Achilles tendon.

The motion of the first MTP joint should also be assessed, especially in the setting of hallux valgus. It is important to note if the first MTP joint is correctable to a neutral alignment, as this affects treatment options.

Throughout the foot, understanding the relative flexibility of each joint is important, as options for surgery frequently differ based on the range of motion. In some instances, if a foot deformity is passively correctible, then conservative therapy or soft tissue procedures alone may be sufficient to correct it. For rigid deformities, however, osteotomies or fusions may be necessary.

While deficits in the range of motion of the foot may be caused by pathology within the foot and ankle, it is important to remember that the culprit may be in a different anatomic location. For example, a patient who is unable to extend the

first toe may have a laceration of the extensor hallucis longus tendon or severe MTP arthritis, but may also have a higher deep peroneal nerve injury or even an L5 radiculopathy.

Neurological Examination

A comprehensive neurological examination is critical, particularly in diabetics who commonly present with foot and ankle ailments. Sensation of the five nerves to the foot—sural, saphenous, superficial peroneal, deep peroneal, and tibial—should be evaluated. Specific testing with 5.07 monofilament is imperative to identify underlying neuropathy. Loss of "protective" sensations can lead to an increased incidence of foot wounds, amputations, Charcot arthropathy and generalized foot pain. Operative and post-operative management can also change dramatically in patients with underlying neuropathy, making proper identification of neuropathy all the more important.

Manual muscle testing of all the major extrinsic muscles to the foot is also a standard part of the examination. A careful strength examination can help differentiate between neurologic and musculoskeletal causes of weakness.

Reflexes should also be tested, namely the S1 reflex. Loss of the S1 reflex can be part of the normal aging process. However, when the S1 reflex is lost in combination with the inability to plantar flex the foot, the clinician should investigate for a true neurological injury.

Vascular Examination

Understanding the health of the patient's blood supply is important for surgical planning and identifying when other interventions may be needed. Skin changes associated with compromised blood supply are detailed in the inspection section above.

The dorsalis pedis and posterior tibialis pulses must be identified at every examination. In patients without palpable pulses, Doppler ultrasound should be used to identify flow. Ankle-brachial indices can be obtained to quantify the degree of vascular compromise. While a small percentage of the population does not have a clear dorsalis pedis pulse, patients with skin changes or risk factors for vascular disease should be considered for referral to a vascular surgeon.

Special Testing

In addition to the physical exam findings listed above, a few special tests can be performed to identify specific injuries. A description of the Silfverskiold test can be found in the ROM section.

In patients with cavovarus deformity of the foot, the Coleman block test can be used to assess the flexibility of the hindfoot. The patient stands with the affected foot on a block approximately 1-2cm thick, with the lateral heel and lateral foot firmly planted as the first ray hangs free. If the hindfoot varus corrects to neutral upon standing on the block, the hindfoot is deemed flexible. As such, one can infer that the pathology is likely in the forefoot, resulting in a compensatory varus hindfoot.

Single leg heel rise is a specific test to assess the function of the posterior tibial tendon. The patient is asked to stand on one limb and onto their toes as the clinician examines him from behind. Normally, the posterior tibial tendon initiates heel rise by locking the mid-tarsal joints and turns the hindfoot into varus. Patients with posterior tibial tendon dysfunction are unable to initiate the heel rise and lack the associated heel inversion.

The anterior drawer test can be used to examine the integrity of the anterior talofibular ligament, which is commonly injured during inversion ankle sprains. The clinician stabilizes the lower leg with one hand while applying an anteriorly directed force on the heel, assessing for translation. It is often helpful to perform the test bilaterally and compare both sides to better judge the degree of translation. A torn anterior talofibuar ligament results in increased translation.

The Thompson test can be used to assess for Achilles tendon tears. The patient lays prone on the table with the feet hanging freely of the edge. The clinician squeezes the calf and determines whether the foot plantar-flexes. Lack of plantar flexion or decreased plantar flexion compared to the contralateral side is a sign of an Achilles tendon tear.

Conclusion

The physical examination of the foot and ankle is a valuable tool to help clinicians make accurate diagnoses. Combined with the history and a thorough knowledge of anatomy, the physical exam can help not only in making diagnoses but also with surgical planning.

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