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Special Article

Hallux rigidus: clinical examination, radiology, and classification

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Abstract

The severity of hallux rigidus depends on the degree of joint involvement, from local pain to stress fractures of other bones of the foot due to hyper-support. Radiology is mandatory to have an accurate diagnosis and gives us a parameter of joint injury. We use the Coughlin and Shurnas classification as the gold standard for treatment.

Level of Evidence IV.

Keywords: Hallux rigidus/therapy; Hallux rigidus/classification; Hallux rigidus/diagnostic imaging; Metatarsophalangeal joint.

Introduction

Hallux rigidus is a disabling disease that affects the first metatarsophalangeal joint (MTPJ), causing arthritis/arthrosis. Different classifications have been described to assess and treat this condition, the most used of which is that of Coughlin and Shurnas[1].

Clinical assessment

The severity of signs and symptoms of hallux rigidus depends on the degree of MTPJ involvement, ranging from mild local pain just before the takeoff phase of the gait to ambulation disorders, with hyper-support in the lateral of the foot that may cause bursitis in the fifth MTPJ, overload of calcaneocuboid and metatarsocuboid joints, and sometimes even fifth metatarsal fractures in athletes. Shoes often hurt due to the proliferation of dorsal osteophytes, and wearing heel shoes lead to increased symptoms. This osteophyte proliferation in the dorsal and medial edges of the primer metatarsal head and in the base of the first phalanx increases over time, which reduces range of mobility and may compress the dorsal cutaneous nerve, thus producing numbness in the medial edge of the foot and possible Tinel's sign with paresthesia in chronic cases[2,3] (Figure 1A).

On physical examination with the patient seated with no support, the hallux is usually in the equine position with regard to the other toes, a deformity that is exacerbated when pressure is applied to the plantar surface of the first metatarsal head (Figure 1B). Erythema, edema, and hyper-pigmentation due to footwear pressure may occur; therefore, differential diagnosis with crystal deposits and septic arthritis is mandatory.

The joint is painful; in milder disorders, this pain is observed at the end range of motion, and pain throughout the entire range of motion indicates a more diffuse level of arthritics changes[4]. Vulcano et al.[5] showed the clinical versus radiographic difference in range of motion measures, with clinical dorsiflexion being equal to or lower than dorsiflexion as measured radiologically. This difference was significantly greater in patients with a clinical dorsiflexion of less than 30 degrees of dorsiflexion than in patients with 30 degrees or more (14° versus 9.9° respectively)

Radiology

Radiographic evaluation is performed with the patient in the standing position, requiring anteroposterior (AP) (15° of cephalic angulation)[6,7] and lateral views of the foot, the oblique incidence is the best one to assess joint space narrowing, since dorsal osteophytes may give the impression of a more advanced degree of joint impingement on AP view[2] and it was also described that osteophytes may maintain the joint space in a distracted position[4].

Profile radiograph may allow for observing dorsal osteophytes (Figure 2A2 and B2), equine position of the hallux, and metatarsus primus elevates, which was measured according

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to the method proposed by Bouaicha et al.[8]. According to this method, first a circle (Mose's technique) is fit within in the first metatarsal head congruent with the joint surface, then a line is drawn from the dorsal surface of the first metatarsus, and a perpendicular line is drawn from the point where this line insects with proximal end of circle until the dorsal aspect of the second metatarsal. A distance along the perpendicular line greater than 5 mm indicates metatarsus primus elevatus (Figure 1C). It firstly affects the dorsal surface of the joint and, as disease advances, cartilage is lost towards the plantar surface, the joint space is narrowed, and dorsal and lateral osteophytes emerge both in the head and in the base of the phalanx (Figure 2C1 and C2).

Degenerative changes and sesamoid arthrosis may occur independently and are less symptomatic. Sesamoids may be bipartite but with no associated disease (Figure 2A1), hypertrophic on AP incidence, enteropathic at distal and proximal sites due to constant traction, and osteopenic possibly due to lack of use. In many changes, sesamoids may be found much behind their usual location (sesamoid retraction) due to flexor hallucis brevis spasm[3,9]. It is possible to measure sesamoid retraction in profile radiographs by drawing a mid-diaphyseal line along the first metatarsal and a perpendicular line along to the articular facet of the first metatarsal head, with the distance between the latter and the sesamoid being the distance of sesamoid retraction (Figure 1D).

Magnetic resonance imaging and axial computed tomography are needed when there is no radiological evidence of lesion and in case of other suspected diseases, such as osteochondral lesion.

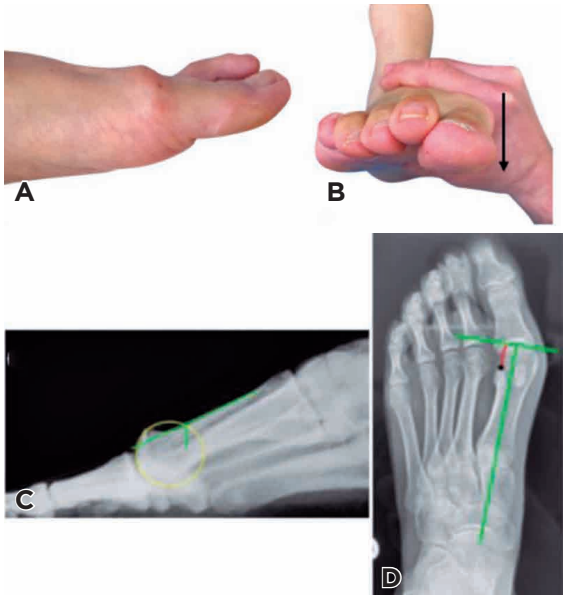

Figure 1. A) Clinical image showing skin protrusion resulting from osteophyte proliferation in the MTPJ of the hallux. B) Hallux in the equine position, a deformity that is increased when pressure is applied to the plantar surface of this joint. C) Method by Bouaicha et al., with a distance greater than 5 mm indicating the presence of metatarsus primus elevatus. D) Mid-diaphyseal line passing along the first metatarsal and a perpendicular line along the articular facet of the first metatarsal head. The distance between the latter line and the sesamoid is the distance of sesamoid retraction.

Classification

Many classifications of hallux rigidus have been developed[10]. Regnauld[11] radiologically describes degenerative MTPJ changes and divides them into 3 grades: Grade 1: flattening of metatarsal head, incipient peripheral osteophytosis; Grade 2: there is also joint impingement, subchondral sclerosis, dorsal osteophytes, sesamoid changes; and Grade 3: disappearance of joint space, major sclerosis, ankylosis between the sesamoid and the joint. The most used classification, i.e., the gold standard, is that proposed by Coughlin and Shurnas[1], which modifies the classification proposed by Easley et al.[12] and divides the disease into 5 grades (0 to 4), considering MTPJ range of motion, radiological changes, and clinical manifestations (Table 1).

Conclusion

The diagnosis of hallux rigidus is clinical and radiological; with regard to the latter, the oblique incidence is very useful to predict articular status. We used the Coughlin and Shurnas classification, since it encompasses clinical and radiological criteria and provides us with therapeutic parameters for the different disease stages.

Figure 2. A1) Front and A2) Profile: dorsal osteophyte, minimum joint space narrowing, minimum periarticular sclerosis, minimum metatarsal head narrowing, emergence of osteophytes. B1) Front and B2) Profile: dorsal, lateral, and possibly medial osteophytes that give a flattened aspect to the metatarsal head, not more than 1/4 of dorsal joint space involvement on lateral radiography, mild to moderate joint space narrowing, and sclerosis. C1) Front and C2) Profile: considerable narrowing, possible periarticular cystic changes, more than 1/4 dorsal joint space involvement on lateral radiography, enlarged, cystic, and/or irregular sesamoid.

Table 1. Clinical and Radiological Classification of Hallux Rigidus by Coughlin and Shurnas (1999)

Grade	Range of motion	Radiographic findings	Clinical findings
0	Dorsiflexion of 40°-60° (10-20% below normal motility)	Normal	No pain
1	Dorsiflexion of 30°-40° (20-50% below normal range of motion)	Main finding is dorsal osteophyte, minimal or no joint changes.	Mild pain and stiffness
2	Dorsiflexion of 10°-30° (50-75% below normal range of motion)	Mild joint flattening, not greater than1/4 of dorsal MTPJ seen on a profile radiograph, mild to moderate reduction in joint space, osteophytes, and sesamoid sclerosis	Moderate to severe pain and stiffness
3	Dorsal and plantar flexion below 10° (75-100% below normal range of motion)	More than 1/4 of dorsal joint space involvement on profile radiographic view, severe radiological changes with subchondral cysts or erosions, sesamoid involvement, constant moderate to severe pain and pain at extremes of motion	Near-constant pain and major stiffness
4	Stiff joint	Radiographs show free bodies or osteochondral defects and pain throughout range of motion (no mobility)	Constant pain, stiffness, supination

Source: Coughlin MJ, Shurnas PS. Hallux rigidus. Grading and long-term results of operative treatment. J Bone Joint Surg Am. 2003;85(11):2072-88.

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