Diagnosis and Treatment of First Metatarsophalangeal Joint Disorders. Section 2: Hallux Rigidus

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This clinical practice guideline (CPG) is based upon consensus of current clinical practice and review of the clinical literature. The guideline was developed by the Clinical Practice Guideline First Metatarsophalangeal (MTP) Joint Disorders Panel of the American College of Foot and Ankle Surgeons. The guideline and references annotate each node of the corresponding pathways.

Hallux Rigidus (Pathway 3)

Hallux rigidus is a progressive disorder of the first MTP joint, characterized by a diminished range of motion (ROM) and degenerative alterations of the joint (1–9). Because some degree of movement is generally available, the term hallux limitus (7) has been used to describe the condition, although the pathologic process is one of progressive degenerative joint disease secondary to biomechanical disturbance or local pathology (Fig. 1). Generally, a cyclic deterioration of the articulation and the reduction of motion occur, and ultimately, ankylosis with virtual absence of joint movement results (3, 10).

Significant History (Node 1)

Patients who present with the condition of hallux rigidus usually do so with complaints of pain localized to the first MTP joint or joint stiffness. Onset of symptoms may be insidious or subsequent to injury; a history of an arthritic condition may be given (4,8,11).

Significant Findings (Node 2)

Patient symptoms are often associated with increased activities or occupational demands that require patients to extend the first MTP joint; for example, stooping or squatting by a laborer. Symptoms also may be caused by shoes that irritate the soft tissues overlying the subcutaneous bony prominence or by high-heeled shoes that increase joint jamming. Patients may present with lateral metatarsalgia and/or suprastructural complaints secondary to gait alteration (12).

Associated Findings (Node 3)

Compensatory gait patterns can lead to central metatarsalgia and plantar hyperkeratotic lesions at the hallucal interphalangeal joint or lesser metatarsal heads.

Radiographic Findings/Classification (Node 4)

Because hallux rigidus is a disorder of osteoarthrosis, the radiographic findings are characteristic of this arthritic process. Hallux rigidus is often categorized or divided into stages predominantly based on the progression of the osteoarthrosis. Regnauld (15) proposed a 3-stage classification from developing arthrosis, estab-
Hallux Rigidus

**Significant History**
- Painful 1st MTP Joint
- 1st MTP Joint Stiffness
- Pain Increases with Activity
- Pain Aggravated by Shoes
- Suprastructural Musculoskeletal Complaints
- Insidious Onset c/s 1st MTP Joint Trauma
- Arthritis

**Significant Findings**
- Dorsal "Bump" / Prominence
- Hallux Equinus
- IPJ Hyperextension
- +/- Abnormal ROM 1st MTP Joint

**Radiographic Findings**
- Disorder is one of Progressive Degenerative Changes at 1st MTP Joint
- See Figure 2: Classification & Radiographic Findings

**Associated Findings**
- Central Metatarsalgia
- IPJ Plantar Callous

**INITIAL TREATMENT OPTIONS**
- NSAIDs
- Corticosteroid Injections
- Orthoses
- Shoe Modifications
- Operative Treatment

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**CLINICAL RESPONSE**

- NO Improvement
- IMPROVED

**REFERENCES**

**CONDITION DETERIORATES**
- REFER TO PODIATRIC FOOT & ANKLE SURGEON
  - Figure 13: Surgical Treatment
- IMPROVED
  - Continue Initial Treatment
- DETERIORATES AFTER INITIAL IMPROVEMENT
  - Re-Evaluate & / or Refer

Pathway 3
lished arthrosis, to ankylosis describing the end-stage joint disease. Later, a fourth stage was included to address the biomechanical imbalance without radiographic joint changes (7). This modified 4-stage classification has been adopted (6,10,16). Therefore, a patient may present with little to no radiographic joint findings (stage I) or severe end-stage arthrosis, (stage IV) (Figs. 3–6).

**FIGURE 1** Etiology of hallux rigidus. MPJ, metatarsophalangeal joint.

**FIGURE 2** Normal first MTP joint motion (A) requires initial stability of the first metatarsal and subsequent plantarflexion. In the presence of (B) first ray instability, ROM is restricted with jamming of the base of the proximal phalanx into the first metatarsal head and thus initiating the degenerative process.
Initial Treatment Options (Node 5)

Initial treatment options are symptom driven (17). Joint pain, capsulitis, or other acute episodic pain may be alleviated with the use of nonsteroidal anti-inflammatory drugs (18). Judicious use of corticosteroid injections may provide rapid relief, even in recalcitrant joint pain. Modalities that relieve inflammation and pain are often indicated.

Biomechanical treatment is often an integral component of initial treatment. Orthotic management in the treatment of hallux rigidus should attempt to improve the abnormal pathomechanics or to limit joint motion (12,19,20). Shoe modifications with stiff or rocker-bottom soles or extra-depth shoes may be helpful.

Early surgical intervention with performance of joint preservation procedures may be appropriate in patients with lesser degrees of arthrosis. Although it has not been proven, this may restore function and should be part of the patient education process.

Clinical Response (Node 6)

When nonsurgical care is rendered, the clinical response is assessed. If the patient is doing well, initial treatment may be continued (Node 8). If there has been little or no improvement or if initial improvement deteriorates, surgical treatment is appropriate. If a primary care physician performed the initial evaluation and treatment, referral to a podiatric foot and ankle surgeon is indicated (Node 7).

Surgery is considered in patients who continue with symptoms (Node 7), or simply prefer surgical intervention (Node 7). The surgical treatment of hallux rigidus will be predicated on recognition of the condition of the joint as one that is still salvageable through primary joint reconstruction or one that would be more appropriately treated with a joint-destructive procedure (Fig. 7).

Surgical Treatment: Joint-Salvage Procedures

Joint-preservation procedures usually use cheilectomy by itself or in combination with additional procedures. These procedures include cheilectomy, metatarsal osteotomy, and phalangeal osteotomy. Chondroplasty has also been performed as an adjunctive procedure in this group.

Cheilectomy. Cheilectomy is the resection of hypertrophic bony or osteochondral proliferation along the periphery of the articulation, which may be restricting joint motion (9,21–37). There is some debate about the appropriate amount of bone that should be resected. All osteophytosis should be resected from the metatarsal, phalanx, and sesamoids; some authors advocate aggressive partial joint resections (38,39).

Metatarsal osteotomy. Metatarsal osteotomy is performed to plantarflex the first metatarsal, to transpose a distal segment in a plantar direction, to realign the metatarsal articular surface, or to shorten the metatarsal to achieve decompression (6,7,10,22,40–47). Both distal and proximal osteotomies have been performed for correction of these deformities; Figure 13 shows the comparison of the surgical procedures.

The extent of elevatus will determine the anatomic location of the osteotomy. Distal first metatarsal procedures can provide for plantar displacement of the capital fragment, but to a lesser degree than a proximal osteotomy. Often moderate degrees of elevatus can be reduced simply through a joint decompression procedure (Fig. 8).

In cases of significant metatarsus primus elevatus, a proximal osteotomy should be considered. These procedures should be reserved for rigid or structural deformity, as opposed to positional elevatus. A variety of osteotomies have also been described to plantarflex the first metatarsal, such as the sagittal Z or crescentic osteotomy (30). Alternatively, the Lapidus first metatarsal-cuneiform arthrodesis with or without a bone graft may be considered (Fig. 9).

Phalangeal osteotomy. Limitation of first MTP joint dorsiflexion in patients with hallux rigidus and the presence of an adequate range of plantarflexion may be addressed through phalangeal osteotomy. A dorsal-based wedge osteotomy within proximal phalanx realigns the toe and reduces the hallux equinus (7,48–53).

A separate category of phalangeal osteotomies approaches the problem from the concept of joint decompression (6,10,30,47,54). By achieving relaxation of the first MTP joint, any secondary elevation of the first metatarsal as a result of hallux equinus should reduce (Fig. 10). This should occur whether the relaxation is accomplished on the phalangeal side or on the metatarsal side of the joint.

Chondroplasty. At surgery, the first metatarsal articular surface must be evaluated. Degeneration of the cartilaginous surface is usually present predominantly centrally and dorsally. Chondroplasty by abrasion, with or without subchondral drilling, has been advocated to initiate cartilage repair of both chondromalacia and areas of full-thickness cartilage excoriation (30,55).

Joint-Destructive Procedures

As the arthrosis of hallux rigidus progresses, the first MTP joint may be altered to such an extent that salvage procedures are not appropriate. Joint-destructive procedures include resection arthroplasty, implant arthroplasty, and arthrodesis.

Resection arthroplasty. Resection arthroplasty of the first MTP joint may include excision of either or both sides of
Classification of Hallux Rigidus: Staging of Joint Pathology Based on Degree of Arthrosis

**FIGURE 3**
Stage I: Stage of Functional Limitus
- Hallux equinus/flexus
- Plantar subluxation proximal phalanx
- Metatarsus primus elevatus
- Joint dorsiflexion may be normal with nonweightbearing, but ground reactive forces elevate the first metatarsal and yield limitation
- No degenerative joint changes noted radiographically
- Hyperextension of the hallucal interphalangeal joint
- Pronatory architecture

**FIGURE 4**
Stage II: Stage of Joint Adaptation
- Flattening of the first metatarsal head
- Osteochondral defect/lesion
- Cartilage fibrillation and erosion
- Pain on end ROM
- Passive ROM may be limited
- Small dorsal exostosis
- Subchondral eburnation
- Periarticular lipping of the proximal phalanx, the first metatarsal head, and the individual sesamoids
FIGURE 5
Stage III: Stage of Established Arthritis
- Severe flattening of the first metatarsal head
- Osteophytosis, particularly dorsally
- Asymmetric narrowing of the joint space
- Degeneration of articular cartilage
- Erosions, excoriations
- Crepitus
- Subchondral cysts
- Pain on full ROM
- Associated inflammatory joint flares

FIGURE 6
Stage IV: Stage of Ankylosis
- Obliteration of joint space
- Exuberant osteophytosis with loose bodies within the joint space or capsule
- <10° ROM
- Deformity and/or malalignment
- Total ankylosis may occur
- Inflammatory joint flares possible
- Local pain is most likely secondary to skin irritation or bursitis caused by the underlying osteophytosis
the joint. In the case of hallux rigidus with its severe proliferative activity and progressive loss of joint space, resection arthroplasty reestablishes joint space and allows movement.

The most commonly practiced resection arthroplasty is the removal of the base of the proximal phalanx (54). Resection arthroplasty varies from excision of only the proximal phalangeal base with cheilectomy of the first metatarsal head to resection on both sides of the joint (38,39,47,56–60).

The choice of procedure must be tailored to the age and the biomechanical demands of the particular patient. Resection arthroplasties are probably most appropriate for end-stage arthritis in older patients with limited functional demands because of frequency of postoperative metatarsalgia.

**Interpositional implant arthroplasty.** Interpositional implant arthroplasty may be performed with hemi or double-stem implants. Hemi silicone implants were used in the past, but because of complications, they are no longer considered appropriate for patients with hallux rigidus (61–67). The second generation of hemi implants is metallic and requires less bone resection and less disruption of the intrinsic musculature; these may be considered in younger patients (Fig. 11) (68,69).

Interpositional arthroplasty with double-stem silicone hinged implants is still a useful procedure for the end-stage arthritis.
FIGURE 8  Distal first metatarsal osteotomy may be performed to allow joint decompression (shortening), plantar transposition of the capital fragment, or realignment of the metatarsal articular surface; (A) preoperative anteroposterior (AP) and (B) lateral radiograph, and (C) postoperative AP and (D) lateral views.
Proximal osteotomy may be performed as a metatarsal osteotomy or, as shown, a Lapidus first metatarsal cuneiform fusion. Preoperative (A) AP and (B) lateral radiographs show degenerative changes in the presence of metatarsus primus elevatus treated with cheilectomy and metatarsal cuneiform fusion. Postoperative (C) AP and (D) lateral radiographs.
FIGURE 10 Phalangeal osteotomy is useful particularly as a Regnault decompression procedure. (A) Preoperative AP radiograph of hallux valgus rigidus with (B) postoperative Regnault phalangeal-type procedure with Herbert bone screw fixation.

FIGURE 11 Implant arthroplasty is still a useful procedure for (A) stage 3 and 4 hallux rigidus with a (B) metallic hemi implant.
arthrosis of hallux (36,70,71). Titanium grommets are recommended as an adjunct to minimize ectopic bone formation, although their main benefit may be in protection of the implant from the adjacent bone (71). Patients should be informed of the alternatives to implant arthroplasty and their potential complications.

**Total joint replacement.** Total joint systems have been designed for the first MTP joint generally as 2-component nonconstrained articulations in an effort to allow motion in more than 1 plane. Materials used for opposing articular surfaces are chosen for their low coefficient of friction and for their minimum wear characteristics. Numerous implant systems have been developed during the years, and several are still used clinically, although long-term clinical usefulness has yet to be established (72,73). Judicious use and strict criteria are recommended to avoid complications and problematic revisions.

**Arthrodesis.** Arthrodesis has been a mainstay of surgical treatment both as an initial treatment of end-stage disease and as a revision of prior surgical intervention (5,74–86). Although arthrodesis eliminates movement at the first MTP joint, it provides stability of the medial column and efficient weight transfer through the medial portion of the foot (87–90).

The technique of obtaining the arthrodesis is less a consideration than the actual position of the fusion (Fig. 12). The sagittal plane position is based on the normal declination of the first metatarsal and the shoe types and functional demands of the patient. The transverse plane position is usually reflected to that of the lesser toes.

**Summary**

Hallux rigidus is a progressive osteoarthrosis of the first MTP joint, and although numerous etiologic factors exist, the most common are attributable to biomechanical defects. Surgical procedures have been discussed in light of appropriateness to the degree of joint arthrosis, based on classification.

The goal is to reduce pain and to improve the function of the foot. This means that a rational approach to joint preservation is necessary to salvage joints, whenever possible, particularly in the younger patient.

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**References**

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