

Hallux rigidus

Anatomy & Pathophysiology

HALLUX RIGIDUS

- Hallux rigidus is defined as arthrosis of the first metatarsophalangeal joint [7].
- Hallux rigidus is defined as a condition in which there is restriction of motion at the first MTP joint [12].
- Hallux rigidus is seen in patients from their thirties onward [7].
- Hallux rigidus is far more common in older adults but can rarely occur in adolescents [12].
- Girls are affected more often than boys with hallux rigidus [12].
- Hallux rigidus is frequently bilateral [12].
- A positive family history may be present in patients with hallux rigidus [12].
- The reason why arthritis of the first metatarsophalangeal joint is seen in younger patients is unclear but may be associated with an unrecognized chondral injury to the metatarsal head [7].
- Hallux rigidus is associated with hallux valgus interphalangeus [7].
- Hallux rigidus is associated with bilateral involvement in those with a family history [7].
- Hallux rigidus is associated with female gender [7].
- Hallux rigidus is not associated with hallux elevatus [7].
- Hallux rigidus is not associated with first ray hypermobility [7].
- Hallux rigidus is not associated with a long first metatarsal [7].
- Hallux rigidus is not associated with Achilles tightness [7].
- Hallux rigidus is not associated with abnormal foot posture [7].
- Hallux rigidus is not associated with symptomatic hallux valgus [7].
- Hallux rigidus is not associated with adolescent onset [7].
- Hallux rigidus is not associated with shoe wear [7].
- Hallux rigidus is not associated with occupation [7].
- Theories regarding the etiology of hallux rigidus include repetitive trauma [12].

- Theories regarding the etiology of hallux rigidus include a hypermobile long first ray [12].
- Theories regarding the etiology of hallux rigidus include osteochondritis dissecans [12].
- Theories regarding the etiology of hallux rigidus include plantar contracture [12].
- Patients with hallux rigidus complain primarily of pain of the first metatarsophalangeal joint, especially with extension [7].
- The dorsal eminence in hallux rigidus may prevent footwear and have associated swelling and redness [7].
- Weight bearing and sports activities exacerbate the pain of hallux rigidus [7].
- Initial symptoms of hallux rigidus mainly consist of pain during gait [12].
- Discomfort in the MTP joint is greatest during heel rise because the great toe normally dorsiflexes at this time [12].
- Physical examination of hallux rigidus reveals painful limitation in dorsiflexion of the first MTP joint [12].
- Dorsiflexion is lost before plantar flexion in hallux rigidus [12].
- There is often a palpable osteophyte on the dorsum of the joint in hallux rigidus [12].
- Swelling may be present in hallux rigidus [12].
- The base of the metatarsal appears more plantar than normal in hallux rigidus [12].
- The metatarsal head is elevated in hallux rigidus [12].
- Patients with hallux rigidus walk on the lateral border of the feet to avoid rolling over the great toe [12].
- Weight-bearing radiographs of the foot demonstrate arthritic changes in hallux rigidus, including loss of joint space [7].
- Weight-bearing radiographs of the foot demonstrate arthritic changes in hallux rigidus, including subchondral sclerosis [7].
- Weight-bearing radiographs of the foot demonstrate arthritic changes in hallux rigidus, including the presence of osteophytes, especially on the dorsal aspect of the metatarsal neck [7].
- Radiographs show narrowing of the joint in hallux rigidus [12].
- Lateral plain films can demonstrate dorsal osteophytes at the base of the proximal phalanx and metatarsal head in hallux rigidus [12].
- Exostoses may become quite large and obscure visualization of the joint itself in hallux rigidus [12].
- Osteochondritic lesions of the metatarsal head can be seen in young patients with hallux rigidus [12].

HALLUX VALGUS

- Hallux valgus is defined as lateral deviation of the great toe with medial deviation of first metatarsal [3, 4].
- Hallux valgus is defined as lateral deviation of the proximal phalanx on the first metatarsal head [9].
- Hallux valgus is defined as the lateral deviation of the proximal phalanx of the first metatarsophalangeal joint [10].
- Hallux valgus is a complex deformity that includes lateral deviation of the proximal phalanx and the resultant medially directed pressure exerted against the metatarsal head [13].

- Hallux valgus is more common in women than in men [9].
- The incidence of hallux valgus deformity is 10 times greater in women than in men [13].
- The incidence of hallux valgus is significantly higher in shod populations than unshod ones [13].
- Hallux valgus is commonly related to wearing shoes that have a narrow toe box [9].
- Metatarsus primus varus has been implicated in the etiology of hallux valgus [9].
- Pes planus has been implicated in the etiology of hallux valgus [9].
- Of patients with hallux valgus, 70% have a family history of the condition, which suggests a hereditary component [9].
- Other causes of hallux valgus include rheumatoid arthritis [9].
- Other causes of hallux valgus include connective tissue disorders [9].
- Other causes of hallux valgus include cerebral palsy [9].
- The metatarsal articular surface may have a valgus (lateral) orientation, as measured by the distal metatarsal articular angle, in hallux valgus [9].
- The etiology of hallux valgus is a combination of intrinsic factors such as genetic predisposition [10].
- The etiology of hallux valgus is a combination of intrinsic factors such as a hypermobile first tarsometatarsal joint [10].
- The etiology of hallux valgus is a combination of extrinsic factors, predominantly related to high-heeled shoes with a narrow toe box [10].
- Other predisposing factors for hallux valgus include rheumatoid or inflammatory arthritis [10].
- Other predisposing factors for hallux valgus include generalized ligamentous laxity [10].
- Other predisposing factors for hallux valgus include dysmorphism of the first metatarsal [10].
- The deformity of hallux valgus is usually progressive, although the rate and degree of progression is often nonlinear [10].
- Hallux valgus is most commonly seen in female patients in their fourth or fifth decades of life [10].
- The pathoanatomy of hallux valgus involves gradual failure of the medial supportive structures (medial collateral ligament and tibial sesamoid) resulting in a varus position of the first metatarsal [10].
- Valgus deviation at the MTP joint of the proximal phalanx subsequently develops in hallux valgus [10].
- As the deformity progresses, the alignment of the flexor and extensor hallucis longus tendons shifts laterally relative to the MTP joint, further exacerbating the deformity [10].
- The first metatarsal varus results in a prominent first metatarsal head medially which is the bump or “bunion” of which the patient reports [10].
- This prominent medial eminence is a common source of pain related to shoe wear [10].
- Secondary pathology and deformity can develop in the lesser toes, such as hammertoes and claw toes, which may be symptomatic [10].
- Hallux valgus is not associated with chronic tightness of the Achilles tendon or gastrocnemius [13].
- Hallux valgus is not associated with increased first ray mobility [13].

- Hallux valgus is not associated with bilaterality [13].
- Hallux valgus is not associated with pes planus [13].
- The most common symptom of hallux valgus is pain over the medial eminence [13].
- Patients with hallux valgus also complain of pain in the joint [13].
- Patients with hallux valgus also complain of pain under the second metatarsal head (transfer lesion or metatarsalgia) [13].
- The deformity of hallux valgus may prevent footwear [13].
- The activity limitation may be part of the constellation of symptoms in hallux valgus [13].
- Hallux valgus is not a single disorder, as the name implies, but a complex deformity of the first ray that frequently is accompanied by deformity and symptoms in the lesser toes [11].
- Often the angle between the first and second metatarsals is more than the 8 to 9 degrees usually considered to be the upper limits of normal in hallux valgus [11].
- The valgus angle of the first metatarsophalangeal joint is more than the 15 to 20 degrees considered to be the upper limits of normal in hallux valgus [11].
- If the valgus angle of the first metatarsophalangeal joint exceeds 30 to 35 degrees, pronation of the great toe usually results [11].
- With this abnormal rotation, the flexion-extension axis of the first metatarsophalangeal joint moves farther plantarward [11].
- In this case, the only restraining medial structure is the medial capsular ligament with its capsulosesamoid portion (inserting into the base of the proximal phalanx) and capsulophalangeal portion (inserting into the plantar plate) [11].
- The adductor hallucis, which is unopposed by the abductor hallucis, pulls the great toe farther into valgus, stretching the medial capsular ligament (particularly the capsulosesamoid), attenuating this structure, and allowing the metatarsal head to drift medially from the sesamoids [11].
- In addition, the flexor hallucis brevis, flexor hallucis longus, adductor hallucis, and extensor hallucis longus increase the valgus moment at the metatarsophalangeal joint, further deforming the first ray [11].
- The deep transverse intermetatarsal ligament runs between the plantar plates at the metatarsophalangeal joints and does not insert into bone on the adjacent sides of the metatarsal heads [11].
- The sesamoid ridge on the plantar surface of the first metatarsal head (the crista) flattens because of pressure (abutment) from the tibial sesamoid [11].
- With this restraint lost, the fibular sesamoid displaces partially or completely into the first intermetatarsal space [11].
- In this situation, the patient is bearing less weight on the first ray and more on the lesser metatarsal heads, increasing the likelihood of transfer metatarsalgia, calluses, and stress fracture of a lesser metatarsal [11].
- Two other anatomic variants involving the articular surface of the first metatarsophalangeal joint can lead to hallux valgus [11].

- In the first variant, the articular surface of the metatarsal head is offset, resembling a scoop of ice cream sitting at an angle on a cone [11].
- This has been described as the distal metatarsal articular angle [11].
- In the second, the articular angle of the base of the proximal phalanx in relation to its longitudinal axis is offset [11].
- This has been described as the phalangeal articular angle [11].
- Although the normal range of these angles is generally considered to be 7 to 10 degrees for the phalangeal articular angle and 10 to 15 degrees for the distal metatarsal articular angle, exact measurements are difficult to reproduce because of the variability of radiographic and measurement techniques [11].
- Increasing evidence indicates that the failure to correct these two deformities, especially the distal metatarsal articular angle, can cause unsatisfactory results after surgery in some patients [11].
- Forceful straightening of the hallux should be avoided if it sacrifices a congruent metatarsophalangeal articulation; phalangeal osteotomy or distal metatarsal osteotomy, rather than tightening of the medial capsular repair, should be used for further correction [11].
- The valgus posture of the great toe frequently causes a hammer toe-like deformity of the second toe [11].
- The controversy continues over which deformity is the essential lesion in hallux valgus: metatarsus primus varus or lateral deviation of the great toe [11].
- Each is incriminated as the cause of the other [11].
- The strongest data probably support lateral deviation of the great toe as the primary deformity in most patients, followed by medial angulation of the first metatarsal, but metatarsus primus varus may be the principal cause in adolescents [11].
- Further controversy surrounds the role of footwear as the prime offender in the development of hallux valgus [11].
- Most orthopaedic surgeons have seen unilateral hallux valgus when both feet are clinically and radiographically the same structurally except that one foot has a bunion deformity and the other foot is normal [11].
- Evidence supports that hallux valgus may be familial, especially when it occurs in adolescents [11].
- Although no study of shod and unshod societies has implicated inappropriate footwear as the sole cause of hallux valgus, after genetic factors and binding, unphysiologically designed footwear probably is the major cause in modern societies [11].
- Hypermobility of the first ray also has been suggested as a causative factor in the development of hallux valgus and first metatarsal varus, but this is controversial [11].
- Dietz et al. reviewed pedobarographic studies, clinical examinations, and standard weight-bearing radiographs in patients with hallux valgus, correlating the findings with radiokinematic first ray instability in the sagittal plane [11].
- Their analysis showed an association between a wide intermetatarsal angle and increased maximal dorsiflexion of the first ray during walking [11].

- They noted that first tarsometatarsal joint instability increased the maximum transfer of force to the central forefoot, which increases the risk of metatarsalgia [11].
- Finally, anatomic and structural abnormalities almost certainly play a causative role in hallux valgus [11].
- Pronated flatfeet, abnormal insertion of the posterior tibial tendon, and other factors are involved in the pathophysiology [11].
- Medial capsular attenuation is a component of the pathoanatomy of hallux valgus [3, 4].
- Proximal phalanx drifts laterally in hallux valgus [3, 4].
- Plantar-lateral migration of abductor hallucis (ABH) occurs in hallux valgus [3, 4].
- Change in position of the abductor hallucis causes the proximal phalangeal unit to plantar flex and pronate the hallux [3, 4].
- The pronation of the hallux is amplified by the proximal phalangeal attachment of the adductor hallucis [3, 4].
- Stretching of the extensor hood of the extensor hallucis longus (EHL) occurs in hallux valgus [3, 4].
- Lateral deviation of the EHL and flexor hallucis longus (FHL) causes a muscular imbalance and deforming force for valgus progression and pronation of the great toe [3, 4].
- First metatarsal head moves medially off the sesamoids, increasing the intermetatarsal angle (IMA) in hallux valgus [3, 4].
- Pronation leads to rounding of lateral head (which should have a flat contour with no rotational deformity) in hallux valgus [3, 4].
- This can be hard to correct with distal first metatarsal osteotomy and requires rotational osteotomy or first TMT arthrodesis [3, 4].
- Secondary contracture of the lateral capsule, adductor hallucis, and lateral metatarsal-sesamoid and intermetatarsal ligaments occurs in hallux valgus [3, 4].
- The medial eminence becomes prominent as the proximal phalanx drifts into a valgus position [13].
- With chronic deformity, the medial joint capsule becomes attenuated, and the lateral joint capsule becomes contracted [13].
- As the metatarsal head is pushed medially, the sesamoids, which are firmly anchored by the adductor hallucis tendon and transverse metatarsal ligament, slowly erode the crista [13].
- This allows for lateral subluxation of the sesamoids from directly plantar to the first metatarsal [13].
- With the lateral deviation of the hallux, the extensor hallucis longus and flexor hallucis longus assume a lateral position and contribute to the lateral forces on the hallux [13].
- With a severe deformity, both the extrinsic and intrinsic muscles lie lateral to the longitudinal axis of the first metatarsophalangeal joint, thereby further enhancing the deformity [13].
- As the deformity progresses, pronation of the hallux occurs because attenuation of the weakest portion of the capsule (the dorsomedial aspect) allows the abductor hallucis tendon to slide beneath the metatarsal head and rotate

Clinical Presentation

HALLUX RIGIDUS

- Hallux rigidus is far more common in older adults, but it can rarely occur in adolescents [12].
- Girls are affected more often than boys in hallux rigidus [12].
- A positive family history may be present in hallux rigidus [12].
- Hallux rigidus is not associated with elevatus, first ray hypermobility, a long first metatarsal, Achilles tightness, abnormal foot posture, symptomatic hallux valgus, adolescent onset, shoe wear, or occupation [7].
- Weight bearing and sports activities exacerbate pain in hallux rigidus [7].
- Physical examination reveals painful limitation in dorsiflexion of the first MTP joint in hallux rigidus [12].
- Dorsiflexion is lost before plantar flexion is in hallux rigidus [12].
- Observation of gait shows that patients with hallux rigidus walk on the lateral border of the feet to avoid rolling over the great toe [12].
- Weight-bearing radiographs of the foot demonstrate arthritic changes in hallux rigidus, including loss of joint space, subchondral sclerosis, and the presence of osteophytes [7].
- Osteophytes in hallux rigidus are especially present on the dorsal aspect of the metatarsal neck [7].

HALLUX VALGUS

- Metatarsus primus varus and pes planus have been implicated in the etiology of hallux valgus [9].
- Of patients with hallux valgus, 70% have a family history of the condition [9].
- Other causes of hallux valgus include rheumatoid arthritis, connective tissue disorders, and cerebral palsy [9].
- Patients with hallux valgus also complain of pain in the joint and pain under the second metatarsal head [13].
- The deformity in hallux valgus may prevent footwear [13].
- Numbness can occur in the dorsal medial cutaneous nerve distribution because of external pressure from a shoe in hallux valgus [10].
- Weight-bearing radiographs are important to evaluate the type and severity of the hallux valgus deformity [13].
- The hallux valgus angle is the angle created by the intersection of the lines that longitudinally bisect the proximal phalanx and first metatarsal [13].
- A normal hallux valgus angle is less than 15 degrees [13].
- The 1,2 intermetatarsal angle is the angle created by the intersection of the lines bisecting the first and second metatarsal shafts [13].
- A normal 1,2 intermetatarsal angle is less than 9 degrees [13].

- The distal metatarsal articular angle is the angle of the distal articular surface of the first metatarsal to the long axis of the metatarsal [13].
- A normal distal metatarsal articular angle is less than 10 degrees of lateral deviation [13].
- A congruent first metatarsophalangeal joint has no lateral subluxation of the proximal phalanx in relation to the first metatarsal head [13].
- An incongruent first metatarsophalangeal joint has lateral subluxation of the proximal phalanx on the metatarsal head [13].
- Arthrosis of the metatarsophalangeal joint is characterized by joint space narrowing, subchondral sclerosis, and osteophyte formation [13].
- The hallux valgus angle (HVA) is the angle formed by line along first metatarsal shaft and line along shaft of proximal phalanx [3, 4].
- The first-second IMA is the angle formed by lines along first and second metatarsal shafts [3, 4].
- The hallux valgus interphalangeus (HVI) angle is the angle formed by lines along shafts of the proximal phalanx and distal phalanx [3, 4].
- The distal metatarsal articular angle (DMAA) is the angle formed by line along articular surface of first metatarsal and line perpendicular to axis of first metatarsal [3, 4].
- Normal HVA is less than 15 degrees [3, 4].
- Normal first-second IMA is less than 9 degrees [3, 4].
- Normal HVI angle is less than 10 degrees [3, 4].
- Normal DMAA is less than 10 degrees [3, 4].
- Increased DMAA is associated with a congruent deformity [3, 4].
- The HVA identifies the degree of deformity at the MTP joint [9].
- The IMA is not influenced by overresection of the medial eminence and is not accurate for postoperative evaluation of distal osteotomies [9].
- The DMAA offset is a predisposing factor in development of hallux valgus [9].
- The PPAA offset is a predisposing factor in development of hallux valgus [9].
- Normal HVA is $\leq 15^\circ$ [9].
- Normal IMA is $\leq 9^\circ$ [9].
- Normal DMAA is $\leq 15^\circ$ [9].
- Normal PPAA is $\leq 10^\circ$ [9].
- Valgus deviation at the MTP joint of the proximal phalanx subsequently develops as the deformity progresses [10].
- The alignment of the flexor and extensor hallucis longus tendons shifts laterally relative to the MTP joint, further exacerbating the deformity [10].
- The first MT varus results in a prominent first MT head medially which is the bump or “bunion” of which the patient reports [10].

- The severity of the hallux valgus deformity and any associated pes planus can be best assessed while the patient is standing [10].
- While seated, the first MTP joint area is evaluated for signs of local irritation and bursal hypertrophy secondary to shoe wear, tenderness over the medial eminence, and range of motion of the first MTP joint [10].
- Any pain with motion may suggest arthritis within the joint [10].
- The first tarsometatarsal joint is evaluated for hypermobility, which remains a diagnostic challenge with poor reproducibility [10].
- Diagnostic confirmation of HV is made with the use of standard AP and lateral weight-bearing radiographs, as non-weight-bearing radiographs tend to underestimate the deformity [10].
- Radiographs should be assessed for presence of arthritis at the first MTP joint, severity of the deformity as determined by the intermetatarsal angle between the first and second metatarsals (IMA), sesamoid subluxation, and the hallux valgus angle (HVA) [10].
- Radiographs are also assessed for first tarsometatarsal hypermobility and congruency of the MTP joint, which is assessed by measuring the distal metatarsal articular angle (DMAA) of the first MT head [10].
- This metatarsal dysmorphism may be present more often in patients with juvenile onset of HV and in males [10].
- Often the angle between the first and second metatarsals is more than the 8 to 9 degrees usually considered to be the upper limits of normal [11].
- The valgus angle of the first metatarsophalangeal joint also is more than the 15 to 20 degrees considered to be the upper limits of normal [11].
- The elements of the deformity are lateral deviation and rotation of the hallux, together with a prominence of the medial side of the head of the first metatarsal (a bunion); there may also be an overlying bursa and thickened soft tissue [20].
- Lateral deviation of the hallux may lead to overcrowding of the lateral toes and sometimes over-riding [20].
- Splaying of the forefoot, with varus angulation of the first metatarsal, predisposes to lateral angulation of the big toe in people who wear shoes [20].
- This metatarsus primus varus may be congenital, or it may result from loss of muscle tone in the forefoot in elderly people [20].
- Hallux valgus is also common in RA [20].
- As the deformity progresses, pronation of the hallux occurs because attenuation of the weakest portion of the capsule (the dorsomedial aspect) allows the abductor hallucis tendon to slide beneath the metatarsal head and rotate the proximal phalanx into a position of pronation [13].
- More rapid progression of the deformity may occur in a small percentage of patients whose first metatarsocuneiform joint demonstrates a significant degree of instability [13].
- The incidence of hallux valgus deformity is also significantly higher in shod populations than unshod ones [13].

- Other factors that may contribute to hallux valgus are familial history of bunions, bilateral involvement, female gender, a long first ray, an oval or curved metatarsophalangeal joint articular surface, spasticity, and systemic disease such as rheumatoid arthritis [13].
- Hallux valgus deformity is not associated with chronic tightness of the Achilles tendon or gastrocnemius, increased first ray mobility, bilaterality, or pes planus [13].
- A complete evaluation is performed on both lower extremities with the patient undressed from the knees to the toes [13].
- The patient is instructed to stand and walk [13].
- The posture of the foot is noted as well as the position of the hallux and lesser toes [13].
- The skin is evaluated for erythema, swelling, ulceration, or callosities [13].
- The ROM is checked for the ankle, subtalar, transverse tarsal, and metatarsophalangeal joints [13].
- The neurovascular status of the foot is

Investigations

RADIOGRAPHIC ANGLES AND MEASUREMENTS

- The hallux valgus angle (HVA) is defined as the angle formed by the intersection of lines along the shaft of the first metatarsal and the shaft of the proximal phalanx [3].
- The first-second intermetatarsal angle (IMA) is defined as the angle formed by lines along the shafts of the first and second metatarsals [3].
- A normal first-second intermetatarsal angle is less than 9 degrees [3].
- The hallux valgus interphalangeus (HVI) angle is defined as the angle formed by lines along the shafts of the proximal phalanx and the distal phalanx [3].
- A normal hallux valgus interphalangeus angle is less than 10 degrees [3].
- The distal metatarsal articular angle (DMAA) is defined as the angle formed by the line along the articular surface of the first metatarsal and a line perpendicular to the axis of the first metatarsal [3].
- A normal distal metatarsal articular angle is less than 10 degrees [3].
- An increased distal metatarsal articular angle is associated with a congruent deformity [3].
- The hallux valgus angle is measured between the long axes of the first proximal phalanx and the first metatarsal, bisecting their diaphysis [9].
- The intermetatarsal angle is measured between the long axes of the first and second metatarsals, bisecting their shafts [9].
- The distal metatarsal articular angle is measured as the angle of the line bisecting the metatarsal shaft with a line through the base of the distal articular cartilage cap [9].
- The proximal phalangeal articular angle (PPAA) is measured as the articular angle of the base of the proximal phalanx in relation to its longitudinal axis [9].

- A normal proximal phalangeal articular angle is less than or equal to 10 degrees [9].
- A normal distal metatarsal articular angle is less than or equal to 15 degrees [9].
- The distal metatarsal articular angle is the angle created by a line connecting the ends of the articular surface and a line perpendicular to the long axis of the first metatarsal [10].
- The normal range for the phalangeal articular angle is generally considered to be 7 to 10 degrees [11].
- The normal range for the distal metatarsal articular angle is generally considered to be 10 to 15 degrees [11].

IMAGING MODALITIES AND ASSESSMENT

- Weight-bearing radiographs of the foot are important to evaluate the type and severity of the hallux valgus deformity [13].
- Non-weight-bearing radiographs tend to underestimate the deformity in hallux valgus [10].
- Radiographs should be assessed for the presence of arthritis at the first metatarsophalangeal joint, severity of deformity, sesamoid subluxation, and the hallux valgus angle [10].
- Radiographs are assessed for first tarsometatarsal hypermobility and congruency of the metatarsophalangeal joint [10].
- Weight-bearing radiographs demonstrate arthritic changes in hallux rigidus, including loss of joint space, subchondral sclerosis, and the presence of osteophytes [7].
- Weight-bearing CT scan assessment is used to evaluate foot alignment in patients with hallux rigidus [1].
- The position of the medial sesamoid is noted in relation to a line drawn down the midaxis of the first metatarsal [9].
- Patients whose postoperative sesamoid is in position 5 to 7 have a much higher recurrence of deformity compared with those with a more medial position for the sesamoid [9].
- Weight-bearing radiographs can help determine the degree of arthrosis in hallux varus [8].

CLINICAL EXAMINATION FINDINGS

- The first metatarsocuneiform joint is examined for hypermobility by stabilizing the medial cuneiform and ranging the first metatarsal dorsomedially and plantolaterally [13].
- The range of motion of the first metatarsophalangeal joint is checked in the deformed and corrected position to provide insight into the degree of surgical correction obtainable without impairing motion [13].
- Hallux varus is principally asymptomatic, with the most commonly reported symptom being difficulty with shoe wear because of a prominent interphalangeal joint [8].
- It must be determined whether the metatarsophalangeal and interphalangeal joint deformities in hallux varus are fixed or passively correctable [8].
- Transfer lesions may develop along the lesser metatarsals in patients with hallux varus [8].
- While seated, the first metatarsophalangeal joint area is evaluated for signs of local irritation, bursal hypertrophy, tenderness over the medial eminence, and range of motion [10].

- Weight bearing and sports activities exacerbate the pain in hallux rigidus [7].
- The deformity in hallux valgus may prevent footwear, and activity limitation may be part of the constellation of symptoms [13].
- The skin is evaluated for erythema, swelling, ulceration, or callosities during the clinical examination of hallux valgus [13].
- The neurovascular status of the foot is carefully assessed, noting absent pulses and venous stasis changes [13].
- Doppler studies are obtained if there is any question regarding the circulatory status of the foot [13].
- Vascular studies may be obtained if there is compromise of the vascularity [13].
- The range of motion is checked for the ankle, subtalar, transverse tarsal, and metatarsophalangeal joints [13].
- The patient's occupation, sports activities, and typical footwear should be noted during evaluation [13].
- The patient is instructed to stand and walk during the clinical evaluation [13].

Treatment

NON-OPERATIVE MANAGEMENT

- Conservative treatment for hallux rigidus consists of nonsteroidal anti-inflammatory drugs (NSAIDs) and wearing a stiff-soled shoe with a deep toe box [7].
- An orthotic device with a Morton's extension or a carbon fiber plate is beneficial for hallux rigidus as both devices prevent extension in late stance phase [7].
- A rocker-bottom shoe is helpful for the management of hallux rigidus [7].
- In older (>60 years), sedentary patients, conservative measures are usually adequate for hallux rigidus [7].
- Shoe modifications for hallux rigidus include a high toe box to relieve rubbing of the dorsum of the joint and a rigid shank within the sole of the shoe to limit motion of the MTP joint at heel rise [12].
- A stiff insert that extends past the MTP joint medially is recommended to limit MTP motion in hallux rigidus [12].
- A rocker bottom shoe assists in push-off for patients with hallux rigidus [12].

OPERATIVE MANAGEMENT: CHEILECTOMY

- Cheilectomy is indicated for patients with mild to moderate arthrosis but who have a large dorsal osteophyte [7].
- During cheilectomy, approximately one fourth to one third of the dorsal metatarsal head is excised with an osteotome [7].
- Medial and lateral osteophytes are debrided and a thorough synovectomy of the joint is performed during cheilectomy [7].

- Postoperatively, patients undergoing cheilectomy regain up to 50% of their dorsiflexion and have improvement of their total motion [7].
- More than 90% of patients undergoing cheilectomy have improvement of pain, ability to wear shoes, and increased physical abilities [7].
- Cheilectomy is less likely to have a favorable outcome on joints with advanced arthritis [7].
- Surgical treatment of early hallux rigidus involves cheilectomy with resection of the prominent osteophytes, débridement of the joint, and synovectomy [12].

OPERATIVE MANAGEMENT: OSTEOTOMY

- If cheilectomy is unsuccessful for hallux rigidus, a dorsal closing wedge osteotomy of the proximal phalanx may be helpful [12].
- Distal oblique osteotomy is an effective surgical procedure for grade II hallux rigidus with a high patient satisfaction [25].
- Distal oblique osteotomy requires only one cut and allows shortening, plantarflexion, and first metatarsal head translation as needed [25].
- Immediate weight bearing is permitted for 6 weeks in a postoperative shoe following distal oblique osteotomy for hallux rigidus [25].
- Active and passive dorsiflexion and plantarflexion exercises of the first metatarsophalangeal joint are started on the first postoperative day following distal oblique osteotomy [25].

OPERATIVE MANAGEMENT: ARTHRODESIS

- First metatarsophalangeal joint arthrodesis is a predictable and durable procedure for hallux rigidus [7].
- The drawback of first metatarsophalangeal joint arthrodesis is lost motion at the joint [7].
- Patients can remain quite active with a first metatarsophalangeal joint fusion [7].
- In advanced cases of hallux rigidus, arthrodesis of the MTP joint is recommended in young, active patients who remain limited in function after other forms of treatment have failed [12].
- If the MTP joint is frankly osteoarthritic, arthrodesis of the joint may be a better option than excision of the bunion, metatarsal osteotomy, and soft-tissue rebalancing [24].

OPERATIVE MANAGEMENT: ARTHROPLASTY

- A Keller procedure is a resection arthroplasty that may be useful in older, less active patients with hallux rigidus but has a high rate of complications [7].
- Prosthetic replacement of the arthritic first metatarsophalangeal joint can be used in older, lower demand patients with hallux rigidus [7].
- Prosthetic replacement of the first metatarsophalangeal joint has high rates of failure in younger, more active individuals with hallux rigidus [7].

Complications

- Acquired hallux varus is usually acquired as a complication of hallux valgus surgery in adults [2].
- Causes of acquired hallux varus include overcorrection from bunion surgeries such as the McBride procedure, trauma, and systemic arthritis [2].
- Arthrodesis of the first metatarsophalangeal joint is reserved for cases where primary reconstruction fails and painful arthritis develops [2].

References

- [1] Campbell S Operative Orthopaedics 4 Volume Set. MULTIPLE Z-PLASTY RELEASE OF A CONGENITAL RING > HALLUX RIGIDUS.
- [2] Tachdjian S Pediatric Orthopaedics From The Texas Scottish Rite Hospital For Children E Book. Plate 15.3 Kramer/Barmada Osteotomy of the Base of the Femoral Neck for Slipped Capital Femoral Epiphysis > Distal Metatarsal Osteotomy > Hallux Varus.
- [3] Miller S Review Of Orthopaedics. SECTION 16 PATELLAR TRACKING IN TOTAL KNEE ARTHROPLASTY > ADULT HALLUX VALGUS.
- [4] Miller S Review Of Orthopaedics. ADULT HALLUX VALGUS.
- [7] A Lange Medical Book Current Diagnosis Treatment In Orthopedics Fifth Edition. **8Foot and Ankle Surgery > 2. Hallux Rigidus.**
- [8] Aaos Comprehensive Orthopaedic Review 3. Disorders of the First Ray > III. Hallux Varus.
- [9] Aaos Comprehensive Orthopaedic Review 3. Disorders of the First Ray > I. Hallux Valgus.
- [10] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Foot and Ankle Reconstruction > Hallux Valgus.
- [11] Campbell S Operative Orthopaedics 4 Volume Set. MULTIPLE Z-PLASTY RELEASE OF A CONGENITAL RING > HALLUX VALGUS (BUNION).
- [12] Tachdjian S Pediatric Orthopaedics From The Texas Scottish Rite Hospital For Children E Book. Plate 15.3 Kramer/Barmada Osteotomy of the Base of the Femoral Neck for Slipped Capital Femoral Epiphysis > Hallux Rigidus.
- [13] A Lange Medical Book Current Diagnosis Treatment In Orthopedics Fifth Edition. **8Foot and Ankle Surgery > 1. Hallux Valgus.**
- [20] Apley And Solomon S Concise System Of Orthopaedics And Trauma. HALLUX VALGUS.
- [24] Apley And Solomon S Concise System Of Orthopaedics And Trauma. HALLUX RIGIDUS.

[25] Campbell S Operative Orthopaedics 4 Volume Set. MULTIPLE Z-PLASTY RELEASE OF A CONGENITAL RING > DISTAL OBLIQUE OSTEOTOMY FOR HALLUX RIGIDUS.