OSTEOCHONDROSIS

Osteochondrosis refers to any of a number of diseases that destroy bone tissue. The condition affects growing bone, or epiphysis, and is therefore generally found in the joints of children and teenagers.

A lack of blood supply to the bone tissue destroys it, and though it is gradually replaced over a number of years, growth progress is delayed. It is sometimes also referred to as osteochondritis.

The underlying causes of osteochondrosis are unknown. Some possible culprits are genetics, rapid bone growth, or poor diet. In some cases, stress and overuse of the joint seems to play a role.

Any bone in the body can be affected, but some areas tend to be afflicted more often than others.

Osteochondrosis occurring in those areas often has named diseases associated with it.

Hip	Legg-Calve-Perthes syndrome
II metatarsal head	Freiburg's disease
Navicular	Kohler's disease
Capitulum[e;bow]	Panner's disease
Spine	Scheuermann's disease
Knee	Larsen Johnson
Lunate[wrist]	Keinbocks

Symptoms of osteochondrosis typically include pain, tenderness, and sometimes swelling at the site of the bone loss.

Depending where the condition manifests, a patient's range of movement can be decreased.

One rare form of the disease, osteochondritis dissecans, causes irregularities and fragmentation of the bone and cartilage which can lead to stiffness and locking of the joint.

FREIBURG DISEASE

More common in females [5:1]
Bilateral involvement in 10% o
The second metatarsal is affected in 68%, the third metatarsal in 27%,.
The peak age at onset for most osteochondroses is 11 years

CAUSES

The two most popular theories include trauma and vascular compromise; however, many believe causes are multifactorial.
Moreover, other systemic disorders such as diabetes mellitus, SLE, and hypercoagulability have been implicated in the development of Freiberg's disease.

The relative longer length of second metatarsal predisposes it to sustain greater stresses during normal gait.

The second metatarsal is the least mobile, thereby conferring the greatest stress at that metatarsal head distally.

High-heeled shoe wear has been argued to play a contributing role in the development of Freiberg's disease because of its predisposition in females.

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PATHOPHYSIOLOGY

Smillie five stages.

Stage I: A narrow fissure fracture develops in the ischemic epiphysis. Surrounding cancellous bone appears sclerotic.

Stage II: Absorption of cancellous bone occurs within the metatarsal head centrally, causing collapse of the overlying subchondral bone. The overlying cartilage is depressed, hinging on the intact cartilage at the plantar aspect, altering the contour of the articular surface.

Stage III: Further absorption occurs, allowing the central portion to sink deeper and leaving projections on either side. The plantar cartilage remains intact.

Stage IV: The central portion of the articular surface has sunk enough to fracture the plantar hinge. Peripheral projections have fractured to produce loose bodies. Restoration of the anatomy is no longer possible.

Stage V: The final stage demonstrates arthrosis with marked flattening. Most of the loose bodies have reduced in size and the shaft of the metatarsal is thickened and dense.

CLINICAL PRESENTATION

1. Pain localized to the involved metatarsal head region.
2. They will often describe a sense that they are walking on something hard, such a stone or marble.
3. Symptoms are exacerbated with walking, particularly barefoot.
4. On examination, the toe may have a swollen appearance that can range from mild fullness around the MTP joint to fusiform swelling of the affected toe.
5. Elevation of the toe may be present. In more chronic or advanced stages, sagittal or coronal plane malalignment may develop, such as hammer toes or crossover deformities.
6. Range of motion across the MTP joint is variably reduced, with crepitation palpated.

7. Along the plantar fat pad, a callus may develop under the involved metatarsal head.
8. In earlier stages, tenderness over the metatarsal head or MTP joint may be the only physical sign.
9. Lachman testing evaluates joint instability and is graded based on the amount of translation of the proximal phalanx relative to the metatarsal head.

Radiographs

The earliest finding is joint space widening, which can be present 3 to 6 weeks following onset of symptoms.

As the disease progresses, increased bone density within the subchondral bone and flattening of the metatarsal head may be seen.

Later radiographic findings include central joint depression, rarefaction, loose bodies, and sclerosis.

Thickening of the metatarsal shaft can be a late finding and may represent a response to abnormal stress.

The final stage of the process involves frank joint space narrowing and arthrosis.

10% of patients demonstrated bilateral flattened appearance to the second metatarsal head with joint space widening compared with adjacent joints. In the absence of increased subchondral bone density.

Magnetic Resonance Imaging

MRI images reflect changes within marrow intensity. Consistent with osteonecrosis seen elsewhere in the body, MRI may demonstrate hypointense signal on T1-weighted images and mixed hypointense and hyperintense signals on T2-weighted images.

Bone Scan

Early-stage disease may show a photopenic area surrounded by a very active revascularized collar, typical for the pattern of early avascular necrosis.

CONSERVATIVE MANAGEMENT

1.Activity modification

2. oral antiinflammatory medications,

3. protected weight bearing

4. shoe-wear modifications

Protected weight bearing can range from walking in a stiff-soled shoe, fracture boot, or cast to crutch use and non–weight bearing.

Rocker-bottom soles with stiff semirigid material can provide relief during gait.

Orthoses with metatarsal bars are designed to offload the painful metatarsal head.

SURGICAL MANAGEMENT

A large number of surgical procedures have been proposed in the treatment.

Core Decompression

Core decompression is intended to relieve the elevated intraosseous pressure at the site of avascular bone, allowing revascularization of the necrotic bone.

Decompression was performed using a 1.1-mm Kirschner wire to make multiple drill holes in the metatarsal head.

Open Joint Debridement

Joint debridement is a relatively simple procedure that can be applied at any stage of

the disease. Removal of loose bodies, osteophytes, and delaminated cartilage has been recommended with reported good results.
Joint debridement is a simple, reproducible procedure that is not very destructive and does not prevent subsequent procedures

Arthroscopic Joint Debridement

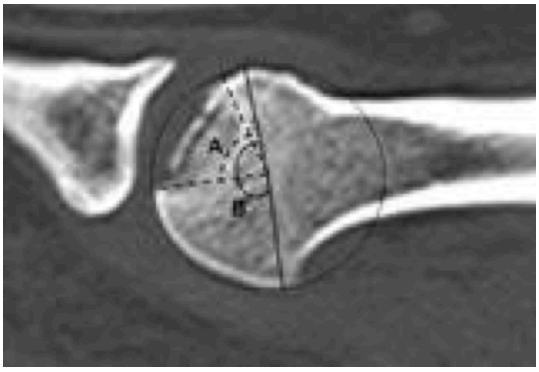
Arthroscopic joint debridement and drilling at metatarsal head.

Bone Grafting

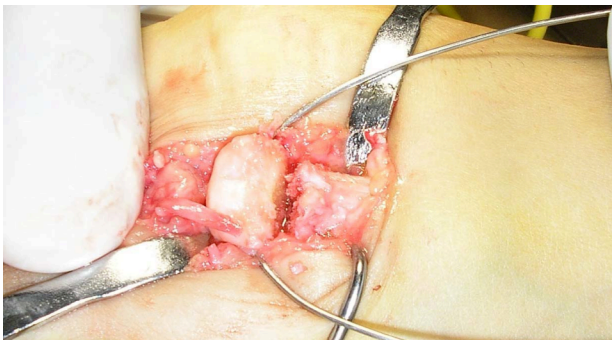
Helal reported on their experience with grafting
Osteochondral transplantation has been studied for its role in Freiberg's disease.

Metatarsal Osteotomies

The two basic types of osteotomies are dorsiflexion and shortening. The objective for the dorsal closing wedge osteotomy is to redirect the plantar articular cartilage to articulate with the proximal phalanx. The goal of the shortening osteotomy is to decompress or offload the abnormal metatarsal head.



Dorsal closing wedge osteotomy fixated with Kirschner wires.



The extraarticular osteotomy was performed at the metatarsal neck and stabilized with T-shaped small fragment plate.

Excision/Interpositional Arthroplasty

In later stages of the disease, metatarsal head excision can eliminate joint pain and has been frequently used.

Interpositional arthroplasty using soft tissues have been widely used in the treatment of degenerative joint disease of the lesser MTP joints. Tissues used include both flexor and extensor tendons.

Replacement Arthroplasty

Joint replacement arthroplasties have been created for the treatment of end-stage degenerative joint disease. Silicone implant arthroplasty has been described in the treatment of advanced Freiberg's disease.

A titanium hemiarthroplasty of the proximal phalanx combined with metatarsal head debridement has been used.

COMPLICATIONS

Although joint debridement procedures do not prevent other surgical techniques, they do alter the anatomic conditions at the MTP joint, which can precipitate the condition further. Similarly, metatarsal osteotomies introduce the risk of disrupting the tenuous blood supply and can result in further deterioration.

Transfer metatarsalgia, stress fracture, arthrofibrosis, and surgical wound infection are also potential complications following any surgical procedure.

Most commonly discussed, transfer metatarsalgia can result with excessive elevation. Common after distal dorsal closing wedge osteotomy. These investigators noted the occurrence of transfer metatarsalgia in 3 of 4 cases where the osteotomy resulted in more than 4.5 mm of head elevation.

SUMMARY

Freiberg's disease is a relatively uncommon disorder of the metatarsal head. Although trauma and circulatory disturbances likely contribute major roles in its development, it is widely accepted that Freiberg's etiology is multifactorial.

Conservative treatment, focused on offloading and relieving stress, is uniformly accepted as the appropriate initial management.

Surgical management can broadly be categorized as procedures which attempt to correct the pathophysiology and halt its progression, and procedures which address the sequelae of later stage disease. Newer strategies, including osteochondral transplantation, attempt to restore the damage metatarsal cartilage with a viable osteochondral plug.