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EXOTIC PATHOLOGY OF THE HAND AND FOOT. A PICTORIAL REVIEW*

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In this article, the imaging findings of the most frequently encountered import pathology of the hand and foot are reviewed, including leprosy, loiasis, snake bites or penetration of spines of sea urchins in the hand and foot. Our objective is to familiarize the radiologist of the Western countries with these diseases, which are still prevalent in developing areas. Due to the rising traveling to foreign countries and continuous immigration, it is important that these disorders be considered in the differential diagnosis in a specific population of asylum-seekers, economic refugees and any other group of persons traveling around the globe. Imaging findings on conventional radiography will be emphasized.

Key-words: Extremities.

Leprosy

Leprosy is an infectious disease which is caused by Mycobacterium leprae. This is an acid fast bacillus which grows preferentially at temperatures lower than body core including the skin, upper respiratory mucosa, superficial nerves, testes and the anterior chamber of the eye (1).

Fig. 1. — Cupping and pencil pointing. Plain radiograph of the forefoot. Note characteristic pointing of the metatarsal head 3-5, as well as the proximal aspect of the proximal phalanx of the fourth toe (arrowheads). Remark also the cupping of the proximal phalanx of the fifth ray (arrow). The third toe is amputated and the metatarsal head is deformed . Note also the synostosis of the metatarsal head and the proximal phalanx of the second toe.

Fig. 2. — Pencil pointing. Plain radiograph of both feet. There is marked pencil pointing of multiple phalanges (arrowheads). Note also partial amputation of multiple toes.

It is a cosmopolic disease which affects particularly the poor. About 500 000 people are infected and probably as many still are not diagnosed. The disease is most prevalent in India, Brazil, Bangladesh, Indonesia, Burma and Nigeria, accounting for nearly 80 % of cases worldwide.

Radiologically, the primary skeletal changes in the small bones of hands and feet consists of honeycombing and osteoporosis of the subarticular part of metacarpals, metatarsals and phalanges that causes collapse of the articular surface and may lead eventually to cupping (Fig. 1). Concentric bone resorption due to formation of hyperemic granulomas causes reduction of the medullary space or even obliteration with typical pencil pointing (Fig. 2) as a result (2). M. leprae can also develop within multiple bone cavities, causing bone and joint destruction by pathological fractures, fragmentation and resorption (3).

Neurological and vascular deficit may contribute to secondary changes, resulting in amputation of digits or limbs (Fig. 3). Changing

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Fig. 3. — Amputation and deformity. Plain radiograph of the right hand. Partial amputation of the index (arrow) and severe deformity of metacarpophalangeal joint of the thumb. The interphalangeal joints of the third, fourth and fifth finger are deformed as well.

Fig. 4. — Flexion deformity of the proximal interphalangeal joints of the fourth and fifth finger (arrows).

Fig. 5. — Foot deformity and amputation. Plain radiograph of the left foot.
A. AP-view: notice acroosteolysis of the distal phalanges (arrowheads) and partial amputation of the fourth ray (arrow) and more extense amputation of the fifth ray.
B. Lateral view: amputation at the level of metatarsal five (arrow).

weight bearing and repeated trauma can evolve to neuroarthropathic joints, also known as Charcot joints (3-6). When motor or sensory nerves are affected, symptoms and signs are depending on the region which is innervated. Paralysis of the median or ulnar nerve cause a claw hand which may end in subluxation or pseudarthrosis (Fig. 4). Altering use of hands can lead to erosions and amputations of digits. Anesthesia and paralysis of the foot together with altering gait may cause severe foot deformity (Fig. 5). This may progress by continuing shrinking of soft tissues and development of trophic ulcers and end up in terminal evolution to a stump.

Decrease of the blood flow is caused by denervation of blood vessels and augmenting arteriovenous communications in palms of hand and foot soles.

MRI seems to be more sensitive than plain radiography to depict subtle neuroarthropathic changes in asymptomatic patients, such as degradation and interruption of the subcutaneous fat and effusion and synovitis of the metatarsophalangeal joints (7).

Superimposed compartment syndrome due to ascending infection (see tertiary changes) may further impair circulation. Ulcerations and bad healing wounds are the result.

Tertiary changes are caused by trauma and subsequent infection of trophic ulcers, open wounds and fissures in palms and soles (3).

Radiographically, it may be difficult to distinguish neuroarthropathic changes from (super)imposed infection.

MRI with the use of Two Point Dixon Chemical Shift Imaging has been described as a useful diagnostic modality to depict osteomyelitis in the presence of neuroarthropathic changes (8).

Another pathognomonic feature of leprosy is thickening and calcification of peripheral nerves. Calcification may be due to intraneural abscess formation. Caseous pus within the abscess has a high lipid content with raised cholesterol and cholesterol ester ratio to total lipids, suggesting a dystrophic nature of calcification. Radiographs demonstrate linear soft tissue calcifications along the course of the peripheral nerves (Fig. 6). Ultrasound may show focal nerve thickening (Fig. 7). In patients with an optimal immune status, an increased endoneural color flow on power Doppler may indicate an active reversal reaction. On MRI, this is characterized by an increased T2 signal and enhancement after intravenous administration of Gadolinium contrast (9, 10).

Nerve involvement can be proven by biopsy, showing intraneural inflammation and perineural thickening. Moreover intraneural acid fast bacilli may be demonstrated. Fine Needle Aspiration Cytology (FNAC)

Fig. 6. — Soft tissue calcifications of the ulnar nerve.
A. AP-view of the right elbow: linear calcifications at the medial aspect of the distal humerus (arrowheads).
B. Lateral view showing these calcifications along the course of the ulnar nerve (arrowheads).

Fig. 8. — Psoriatic arthritis.Plain radiograph of the left hand. Note pencil painting (arrows) and cupping (arrowheads). Note also radiographic features of arthritis of the carpal bones and metacarpophalangeal joints.

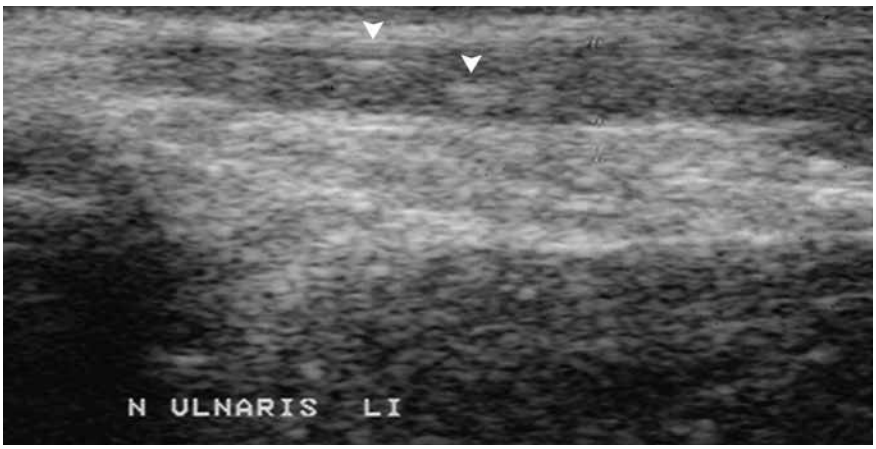

Fig. 7. — Nerve calcification. Ultrasound of the ulnar nerve shows nerve thickening and internal calcifications (arrowheads).

Table I. — Differential diagnosis of leprosy of the hand and feet.

Early stage disease	*Late stage disease*
Scleroderma	syphilis
Psoriasis	diabetes
Raynaud's disease	congenital indifference to pain
Frostbite	syringomyelia
mycotic infections	
soft tissue infections	

has been described as another sensitive tool in the detection of nerve involvement (9).

Other disorders may cause similar imaging characteristics. The differential diagnosis in the Western world has to be made in the early stage with psoriasis (Fig. 8) and mycotic infections. At a later stage of the disease, leprosy may mimic neuroarthropathy caused by diabetes.

The potential differential diagnoses are summarized in Table I.

Loiasis

Loiasis is a parasitic disease caused by the filarial worm Loa-Loa, which is endemic in Central and West-Africa. The most typical manifestation of the disease is the presence of so called Calabar swellings. These are erythematous mass lesions caused by local angioedema. Nearly 13 million people are affected. The female worm can attain a length of 5 to 7 cm and the male 3 to 4 cm (11).

Plain radiography shows typically threadlike calcifications mostly located in the hand, feet and breast (Fig. 9, 10, 11). The calcifications can be coiled or broken by muscle contraction (12).

Differential diagnosis with cysticercosis and other linear parasitic calcifications like onchocercosis, dracunculiasis, dirofilariasis and toxocara has to be made.

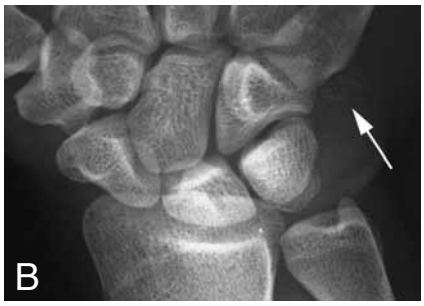

Fig. 9. — Calcifications in loiasis. Plain radiograph of right hand.

A. Threadlike calcifications at the base of the fifth metacarpal and at the intermetacarpal space 2-3 (arrows).

B. Cone down view demonstrating typical threadlike morphology of the calcifications (arrow).

Fig. 10. — Calcifications in loiasis. Lateral view of the right ankle.

Threadlike calcifications at the dorsal aspect of the tarsus mimicking vascular calcifications (arrowhead).

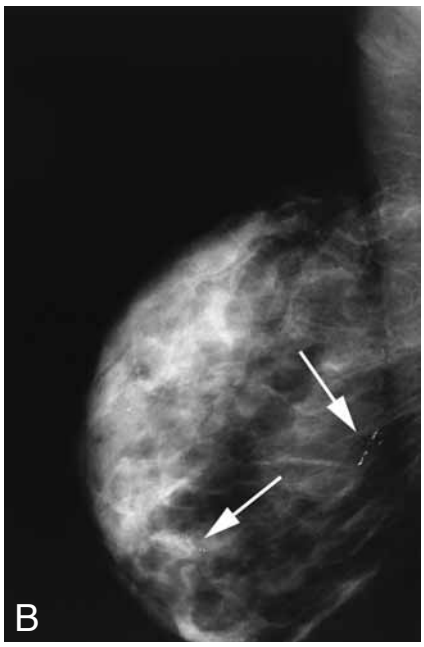

Fig. 11. — Breast calcifications due to loiasis. A and B. Craniocaudal and oblique view of the right breast. Similar calcifications as previously demonstrated in hand and foot can also be found in the breast (arrows).

Fig. 12. — Sea urchin spine. Lateral plain radiograph of the right ankle.

Corpus alienum at the plantar aspect of the right foot due to penetration of a sea urchin spine (arrow).

Sea urchins

The increasing popularity of diving will confront the radiologist more and more with the sequelae of mechanical injuries caused by skin puncture by solid-spined sea urchins. The variety of different sea urchins species are summarized in Table II. Most of these species have long or short venomous spines and pedicellariae. These are small grasping organs between spines and scattered all over most sea urchins. Apart from causing localized pain, the spines can break off and penetrate within soft tissues. If the spines are vemenous they can cause local redness and paresthesiae. Furthermore systemic effects can develop such as nausea, local numbness, muscular weakness and respiratory distress (13-15).

Sea urchin spines are discovered radiologically by looking for typical spinelike corpora aliena in the soft tissues of the hand and feet (Fig. 12, 13). Superimposed soft tissue infection and/or adjacent joint infection may develop.

Another midterm complication consists of foreign body granuloma formation occurring usually 3 to 4 months after penetration.

Snake bite

The sequelae of a snake bite resemble infection of the soft tissues and bone. Edema, osteoporosis, periostitis and osteomyelitis are likely to evolve.

Response to treatment can be monitored radiographically (Fig. 14) until resolution of the abnormalities (15, 16).

Fig. 13. — Sea urchin spines at the palmar aspect of the left index as demonstrated on plain radiographs (arrows).

Table II. — Sea urchins species.

Family Diadematidae
With venomous long spines
Diadema setosum
Diadema savignyi
Echinothrix calamaris
Echinothrix diadema
With long spines and venomous pedicellariae
Centrostephanus tenuispinus
Centrostephanus rodgersii
Family Echinothuriidae
With venomous short spines
Araeosoma owstoni
Areaosoma tesselatum
Areaosoma thetidis
Asthenosoma varium
Asthenosoma ijimai
Asthenosoma intermedium
Family Toxopneustidae
With venomous pedicellariae
Toxopneustes pileolus
Tripneustes gratilla
Family Echinometridae
Heterocentrotus mammillatus
Family Temnopleuridae
Salmacis sphaeroides

Fig. 14. — Snake bite. A,B. Plain radiographs of the left index (AP and lateral view). Localized osteoporosis of the distal phalanx a week after the bite of a viper.

C. Radiograph at follow up three months later show reappearance of normal bone mineralization.

Conclusion

Many tropical conditions may affect the hand and foot. The rising travelling to foreign destinations and the continuous immigration from tropical countries will increase definitely the likelihood for the radiologist to be confronted with some of these disorders. A high index of suspicion is needed to make the correct diagnosis on imaging.

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