Reconstruction of Soft Tissue Defects of the Heel, Overview and Recent Trends

Essay

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General Surgery

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INTRODUCTION

Since the conquest of the upright position, the foot has gained more importance as an organ that supports both the lower limb and the whole body weight and allows humans to stand up, walk, run, and jump ***(Williams et al., 2005).***

The hindfoot or the heel is an especially important part of the foot because of its integrated function as both a sensor and an effector. The covering skin of the heel is very peculiar, especially in the weight-bearing areas, where the non-shearing and padding properties make it quite resistant and strong enough to withstand friction ***(Chen et al., 2005).***

The Heel is the important integrated part of the sole of the foot which is essential for smooth walking and without the heel, the propelling function of the foot during walking is severely interrupted ***(El-Shazly and Makboul, 2007).***

Trauma is the leading cause of soft tissue loss of the heel followed by infection, ischemia, neuropathy, venous insufficiency, lymphatic obstruction, immunological diseases, neoplasms, pressure sores, burn or any combination of these causes. Due to a higher number of vehicular accidents, defects of the heel have increased, mostly afflicting young active people. Moreover, being multi-structural injuries and the stress caused by weight-bearing make durable repair of these areas challenging ***(Boehmler and Attinger, 2007).***

Defects over the posterior heel have been difficult to cover especially combined injuries involving the weight bearing part of the heel and require a well vascularised reconstruction having a good durability and sensation because of its location ***(Suri et al., 2005).***

In the past therapeutic options were mostly limited to local flaps, skin grafts or cross-leg flaps. However, with a better understanding of the vascular anatomy of the heel & foot, pathology of different various etiologies and the development of microsurgery and the expansion of plastic surgery techniques have led to a significant increase in the surgical options and solutions for reconstruction of heel defects ***(Gomez and Casal, 2012).***

Foot surgery began to be more accurate and sophisticated, as surgeons sought a proper functional reconstruction rather than a pure morphologic restoration of the shape ***(Attinger and Ducic, 2007).***

AIM OF THE WORK

Our work aims to study and review different aetiologies of soft tissue defects of the heel and different modalities for reconstruction of these defects.

ANATOMY OF THE ANKLE AND FOOT

Knowledge of the anatomy of the ankle &foot starting from the embryological development of the lower limb is essential so that progression of heel defects can be understood and proper surgical treatment applied. Effective clinical evaluation and effective surgery are based on an understanding of the gross anatomy and of alterations produced by disease ***(Klenerman et al., 2006).***

I. Development of the Lower Limb:

The limb buds appear during the sixth week of development as the result of a localized proliferation of the somatopleuric mesenchyme. This causes the overlying ectoderm to bulge from the trunk as two pairs of flattened paddles.

The flattened limb buds have a cephalic preaxial border and a caudal postaxial border. As the limb buds elongate, the mesenchyme along the preaxial border becomes innervated by the second lumbar nerve to the first sacral nerve and that of the postaxial border becomes innervated by the first to the third sacral nerves. Later, the mesenchymal masses divide into anterior and posterior groups, and the nerve trunks entering the base of each limb also divide into anterior and posterior divisions. As development continues and the limbs further

elongate, their attachment to the trunk moves caudally. At the same time, the mesenchyme within the limbs differentiates into individual muscles that migrate within each limb. As a consequence of these two factors, the anterior rami of the spinal nerves become arranged near the base of the limb into the complicated lumbosacral plexus.

It is interesting to note that the dermatomal pattern in the lower limb appears to be more complicated than that of the upper limb. This can be explained embryologically, since during fetal development, the lower limb bud undergoes medial rotation as it grows out from the trunk. This results in the big toe coming to lie on the medial side of the foot and accounts for the spiraling pattern of the dermatomes.***(Snell et al., 2008)***.

II. Bones of the Foot:

There are three groups of bones in the foot:

- The seven tarsal bones, which form the skeletal framework for the ankle;

- Metatarsals, There are five metatarsals in the foot, numbered I to V from medial to lateral (Fig. 2). The plantar surface of the head of metatarsal I also articulate with two sesamoid bones. The sides of the bases of metatarsals II to V also articulate with each other.

- The phalanges, which are the bones of the toes-each toe have three phalanges, except for the great toe, which has two (Fig. 1)

1. Tarsal bones

The tarsal bones are arranged in a proximal group and a distal group with an intermediate bone between the two groups on the medial side of the foot ***(Drake et al., 2004).***

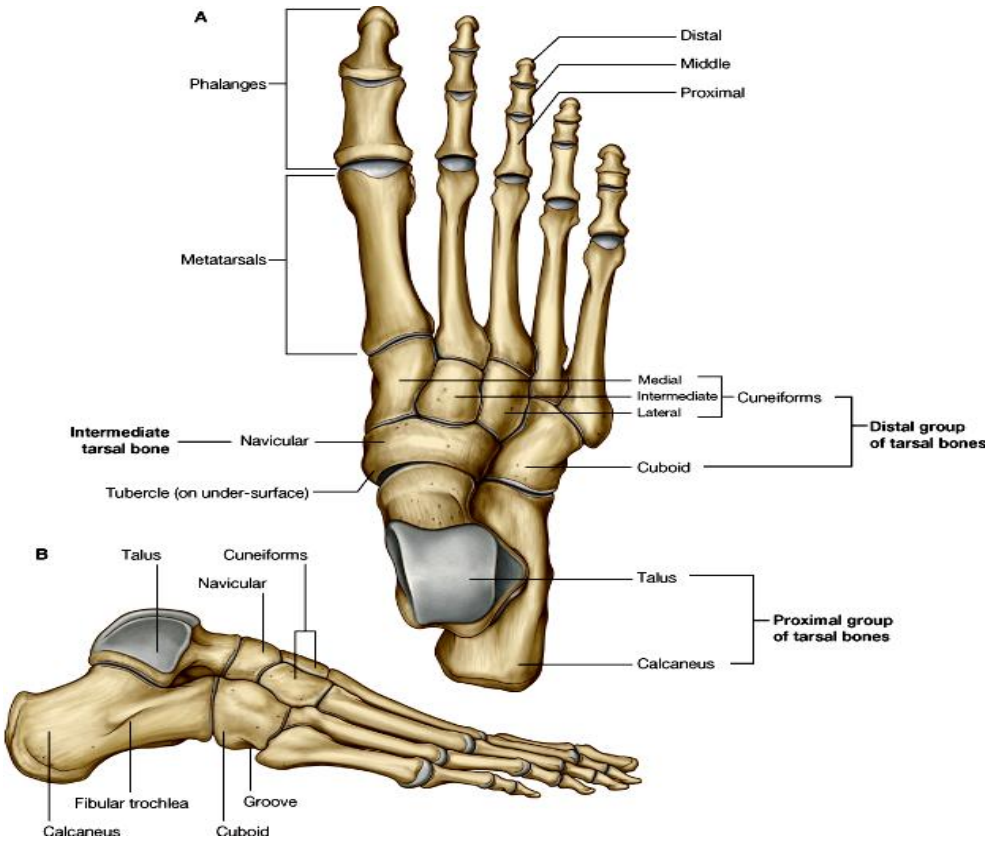

Figure (1): Bones of the foot. **A.** Dorsal view, right foot. **B.** Lateral view, right foot ***(Drake et al., 2004).***

- **Proximal group**

The proximal group consists of two large bones, the talus (Latin for ankle) and the calcaneus (Latin for heel).

- **The intermediate tarsal bone**

On the medial side of the foot is the navicular (boat shaped). This bone articulates behind with the talus and articulates in front and on the lateral side with the distal group of tarsal bones.

- **Distal group**

From lateral to medial, the distal group of tarsal bones consists of:

- The cuboid (Greek for cube).
- Three cuneiforms (Latin for wedge)-the lateral, intermediate, and medial cuneiform bones.

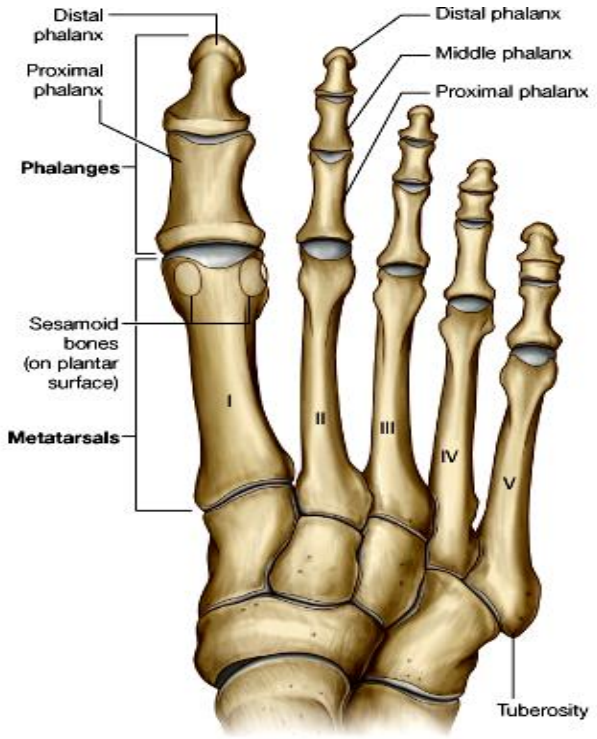

Figure (2): Metatarsals and phalanges. Dorsal view ***(Drake et al., 2004).***

III. Joints of the Foot:

- **Ankle joint:**

The ankle joint is synovial in type and involves the talus of the foot and the tibia and fibula of the leg (Fig. 3). It mainly allows hinge-like dorsiflexion and plantarflexion of the foot on the leg. It is also stabilized by medial (deltoid) and lateral ligaments ***(Drake et al., 2004).***