INTRODUCTION

Diabetic foot infections (DFIs) are a frequent clinical problem. Properly managed, most can be cured, but many patients needlessly undergo amputations because of improper diagnostic and therapeutic approaches. Infection in foot wounds should be defined clinically by the presence of inflammation or purulence, and then classified by severity. Many organisms, alone or in combinations, can cause DFI, but gram-positive cocci (GPC), especially staphylococci, are the most common ***(Lipsky et al., 2012).***

Empiric antibiotic regimens must be based on available clinical and epidemiologic data, but definitive therapy should be based on cultures of infected tissue. Imaging is especially helpful when seeking evidence of underlying osteomyelitis. Surgical interventions are often needed and proper wound care is important. Patients with a DFI should also be evaluated for an ischemic foot ***(Lipsky et al., 2012).***

In light of the complex pathophysiology of diabetic foot wounds, most are unlikely to be healed by any single treatment. Several basic principles for managing diabetic foot wounds, often called “standard/good wound care.” These include sharp debridement, moist wound healing, and pressure or weight displacement off the affected area of the foot. Other factors that are important in healing a wound include ensuring adequate arterial perfusion to the site and controlling any concomitant infection ***(Apelqvist et al., 2008).***

The principal function of a wound dressing is to help achieve an optimal healing environment and to serve various functions, such as protecting the wound, encouraging wound healing, and preventing or treating infection. Because diabetic foot wounds are heterogeneous, no single dressing is suitable for all types. Dressing selections should be based on the wound's location, size, depth, amount of exudate, presence of infection or necrosis, the wound bed characteristics: if dry, it should be hydrated; if draining, the exudate should be absorbed; if necrotic, it should be debrided and the condition of the surrounding tissue. The goal is to create a moist wound environment to promote granulation, autolytic processes (wherein host generated enzymes help break down devitalized tissues), angiogenesis , and more rapid migration of epidermal cells across the wound base ***(Lipsky et al., 2012).***

Debridement involves removing necrotic or nonviable tissue, slough, or foreign material from the wound, as well as trimming any surrounding hyperkeratosis (callus).This process also removes colonizing bacteria, aids granulation tissue formation and re-epithelialization, reduces pressure at callused sites, facilitates the collection of appropriate specimens for culture, and permits examination for the presence of deep tissue (especially bone) involvement. The goal is to enable wound healing and to remove a reservoir of potential pathogens ***(Lipsky et al., 2012).***

Debridement may be relatively contraindicated in wounds that are primarily ischemic. Debridement should be repeated if nonviable tissue continues to form. Other methods of debridement include autolytic dressings and biological debridement ***(Edwards and Stapley, 2010).***

Limited evidence supports the use of hydrosurgery systems, that simultaneously cuts and aspirates soft tissue, but they are relatively expensive ***(Sainsbury, 2009).***

Relieving pressure from a diabetic foot wound (off-loading) is a vital part of wound care. The choice of off-loading modality should be based on the wound's location, the presence and severity of infection, and the physical characteristics of the patient and their psychological and social situation. The total contact cast, often considered the "gold standard" device, redistributes pressure to the entire weight bearing surface to accelerate healing of a neuropathic ulcer ***(Bus et al., 2008).***

If a diabetic foot wound fails to heal despite good wound care, the clinician should initiate a reevaluation of management. This should include ensuring that perfusion of the limb is adequate and that any infection (especially osteomyelitis) has been adequately addressed. Consider obtaining a biopsy of atypical wound, as a lesion that appears to be a diabetic foot ulcer may on occasion be a malignancy (eg, a melanoma or Kaposi sarcoma) ***(Lipsky and Berendt, 2010).***

Granulocyte colony-stimulating factor (G-CSF): was associated with a significantly reduced likelihood of lower extremity surgical interventions (including amputation) and reduced duration of hospital stay, but not duration of systemic antibiotic therapy ***(Cruciani et al., 2009).***

Topical negative pressure: Although may safely improve healing of a diabetic foot ulcer, especially after a surgical procedure (eg, wide debridement or partial amputation) ***(Wu et al., 2010)*** there is limited evidence to support widespread utilization, especially in an infected wound ***(Ubbink et al., 2008).***

AIM OF THE ESSAY

Is to review literature regarding new trends in management of diabetic foot infections.

SURGICAL ANATOMY OF THE FOOT

The foot supports the body weight and provides leverage, for walking and running. It is unique in that it is constructed in the form of arches, which enable it to adapt its shape to uneven surfaces. It also serves as a spring to absorb shocks, such as in jumping **(Snell, 2012).**

The Sole of the Foot

1. Skin

The skin of the sole of the foot is thick and hairless. It is firmly bound down to the underlying deep fascia by numerous fibrous bands. The sensory nerve supply to the skin of the sole of the foot is derived from the medial calcaneal branch of the tibial nerve, which innervates the medial side of the heel; branches from the medial plantar nerve, which innervate the medial two thirds of the sole; and branches from the lateral plantar nerve, which innervate the lateral third of the sole **(Snell, 2012).**

2. Deep Fascia

The plantar aponeurosis is a triangular thickening of the deep fascia that protects the underlying nerves, blood vessels, and muscles. Its apex is attached to the medial and lateral tubercles of the calcaneum. The base of the aponeurosis divides into five slips that pass into the toes **(Snell, 2012).**

Muscles of the Sole of the Foot

The muscles of the sole are conveniently described in four layers from the inferior layer superiorly (fig. 1 a,b).

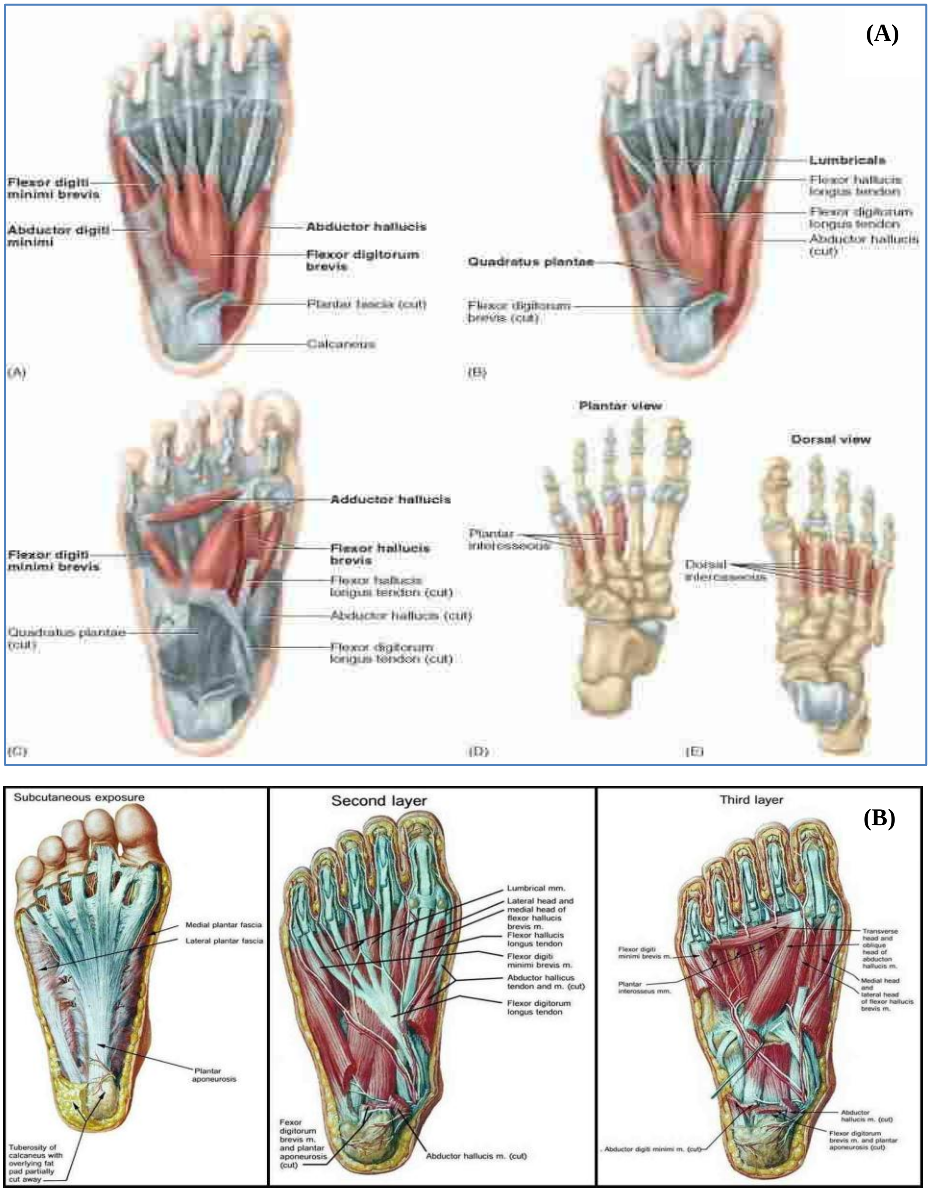

Fig. (1): a.b. Muscles of the Sole of the Foot ***(Snell, 2012).***

<u>First layer</u>: Abductor hallucis, flexor digitorum brevis, abductor digiti minimi (fig. 2) **(Agur and Dalley, 2013).**

Table 1: Muscles of the Sole of the Foot- First layer.

Muscle	Proximal Attachment	Distal Attachment	Innervation	Actions
Abductor hallucis	Medial process of tuberosity of calcaneus, flexor retinaculum, and plantar aponeurosis	Medial side of base of proximal phalanx of first digit	Medial planar nerve (S2-S3)	Abducts and flexes first digit
flexor digitorum brevis	Medial process of tuberosity of calcaneus, plantar aponeurosis and intermuscular septa	Both sides of middle phalanges of lateral four digits		Flexes lateral four digits
Abductor digiti minimi	Medial and lateral process of tuberosity of calcaneus, plantar aponeurosis and intermuscular septa	Medial side of base of proximal phalanx of fifth digit	Lareral planar nerve (S2-S3)	Abducts and flexes fifth digit

(Agur and Dalley, 2013)

<u>Second layer</u>: Quadratus plantae, lumbricals, flexor digitorum longus tendon, flexor hallucis longus tendon (fig. 3) **(Agur and Dalley, 2013).**

Table 2: Muscles of the Sole of the Foot- Second layer.

Muscle	Proximal Attachment	Distal Attachment	Innervation	Actions
Quadratus plantae	Medial surface and lateral margin of plantar surface of calcanes	Postrolateral margin of Tendon of flexor digitorm longus	Lareral planar nerve (S2-S3)	Assists flexor digitorm longus in flexing lateral four digits
Lumbricals	Tendons of flexor digitorm longus	Medial aspect of extensor expansion over lateral four digits	Medial one: Medial planar nerve Lateral three :Lareral planar nerve	Flex proximal phalanges and extend middle and distal phalanges of lateral four digits

(Agur and Dalley, 2013)

<u>Third layer</u>: Flexor hallucis brevis, adductor hallucis, flexor digitiminmi brevis (fig. 4) **(Agur and Dalley, 2013).**

Table 3: Muscles of the Sole of the Foot- Third layer.

Muscle	Proximal Attachment	Distal Attachment	Innervation	Actions
Flexor hallucis brevis	Plantar surfaces of cuboid and lateral cuneiforms	Both sides of Base of proximal phalanx of first digit	Medial planar nerve (S2-S3)	Flexes proximal phalanx of first digit
Adductor hallucis	Oblique head: bases of metatarsals 2-4 Transverse head: plantar ligaments of metatarsophalangeal joints	Tendons of both heads attach to lateral side of Base of proximal phalanx of first digit	Deep branch of Lareral planar nerve (S2-S3)	Adducts first digit assists in maintaining transverse arch of foot
Flexor digiti minmi	Base of fifth metatarsal	Base of proximal phalanx of fifth digit	Superficial branch of Lareral planar nerve (S2-S3)	Flexes proximal phalanx of fifth digit thereby assisting with its flexion

(Agur and Dalley, 2013)

<u>Fourth layer</u>: Interossei, peroneus longus tendon, tibialis posterior tendon (fig. 5) **(Agur and Dalley, 2013).**

Table 4: Muscles of the Sole of the Foot- Fourth layer.

Muscle	Proximal Attachment	Distal Attachment	Innervation	Actions
Plantar Interossei (3 muscles; P1-P3)	Plantar aspect of medial sides of shafts of metatarsals 3-5	Medial sides of bases of proximal phalanges of third to fifth digits	Lareral planar nerve (S2-S3)	Adduct digits 3-5 and flex metatarsophalangeal joints
Dorsal Interossei (4 muscles; D1-D4)	Adjacent sides of shafts of metatarsals 1-5	First Medial side of proximal phalanx of second digit Second to fourth lateral sides of Second to fourth digits		Adduct digits 2-4 and flex metatarsophalangeal joints

(Agur and Dalley, 2013)

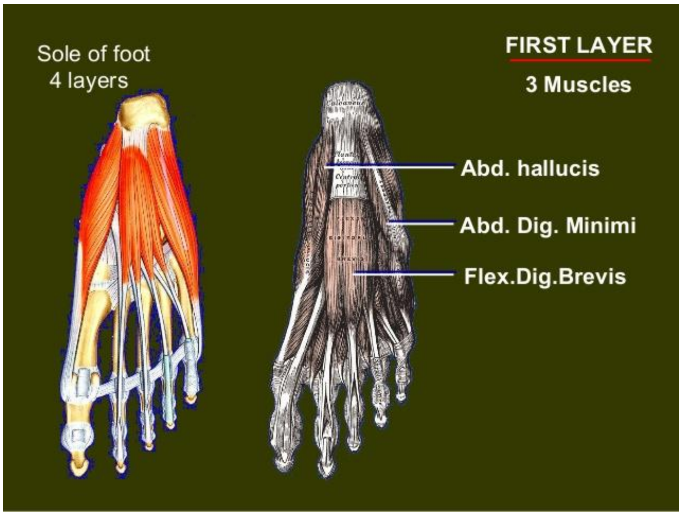

Fig. 2 Muscles of the Sole of the Foot- First layer **(Agur and Dalley, 2013)**

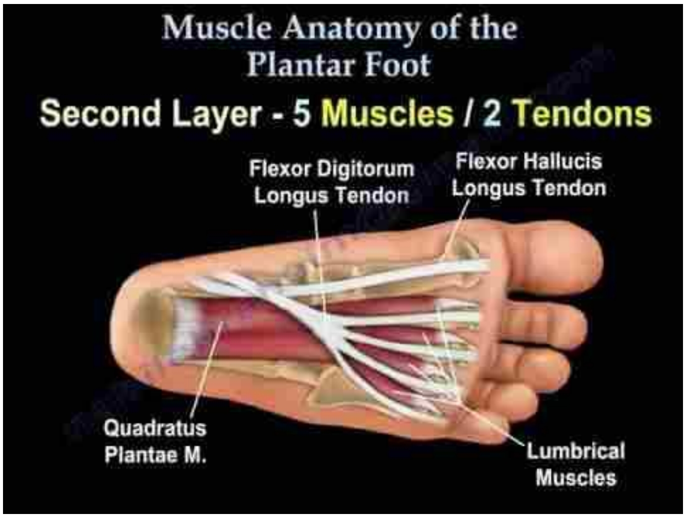

Fig. 3 Muscles of the Sole of the- Foot second layer **(Agur and Dalley, 2013)**

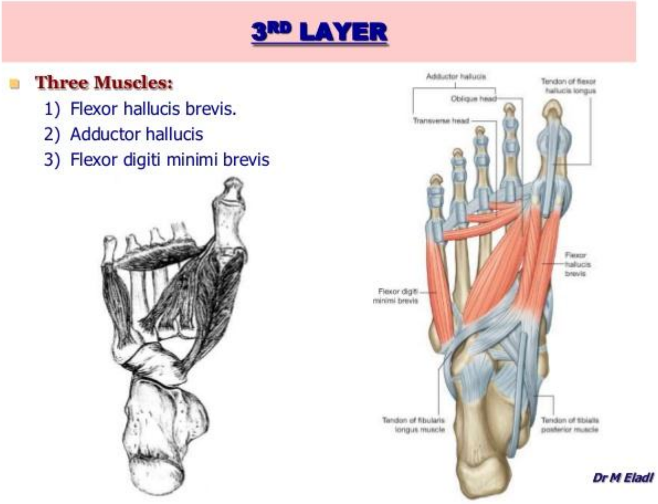

Fig. 4 Muscles of the Sole of the Foot- Third layer **(Agur and Dalley, 2013)**

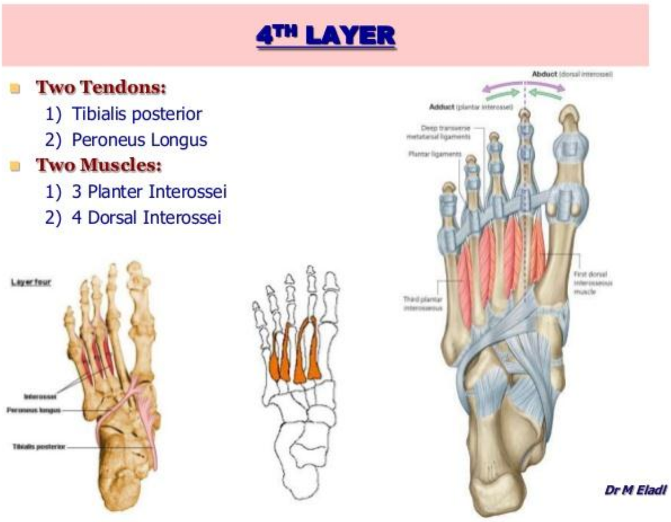

Fig. 5 Muscles of the Sole of the Foot- Fourth layer **(Agur and Dalley, 2013)**

Regions of the foot:

The forefoot is composed of the five toes (called phalanges) and their connecting long bones (metatarsals). Each toe (phalanx) is made up of several small bones. The big toe (also known as the hallux) has two phalanx bones distal and proximal. It has one joint, called the interphalangeal joint. The big toe articulates with the head of the first metatarsal and is called the first metatarsophalangeal joint (MTPJ for short) **(John, 2014).**

Underneath the first metatarsal head are two tiny, round bones called sesamoids. The other four toes each have three bones and two joints. The phalanges are connected to the metatarsals by five metatarsal phalangeal joints at the ball of the foot. The forefoot bears half the body's weight and balances pressure on the ball of the foot **(John, 2014)**.

The midfoot has five irregularly shaped tarsal bones, forms the foot's arch, and serves as a shock absorber. The bones of the midfoot are connected to the forefoot and the hindfoot by muscles and the plantar fascia (arch ligament) **(John, 2014)**.

The hindfoot is composed of three joints and links the midfoot to the ankle (talus). The top of the talus is connected to the two long bones of the lower leg (tibia and fibula), forming a hinge that allows the foot to move up and down. The heel bone (calcaneus) is the largest bone in the foot. It joins the talus to form the subtalar joint. The bottom of the heel bone is cushioned by a layer of fat **(John, 2014)**.

Talus

The talus has a body, neck, and head. The superior surface, or trochlea of the talus, is gripped by the two malleoli and receives the weight of the body from the tibia. The talus transmits that weight in turn, dividing it between the calcaneus, on which the body of talus rests, and the forefoot, via an osseoligamentous "hammock" that receives the rounded and anteromedially directed head of talus. The hammock (spring ligament) is suspended across a gap between a shelf-like medial projection of the calcaneus (sustentaculum tali) and the navicular bone, which lies anteriorly (fig. 6) **(Moore et al., 2013).**