Coverage Of Soft tissue Defects Of The Dorsum Of The Hand

Thesis

Submitted for partial fulfillment of master degree in general surgery

By

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2009

Acknowledgements

Praise to **Allah** who helped me accomplish this work and all other things in life.

I would like to express my deepest gratitude to **Prof. Dr. Maamoun Ismail,** Professor of General and Plastic Surgery, Faculty of Medicine, Cairo University, for his supervision, support and expert advice.

I am deeply indebted to **Dr. Tarek Amer**, Assistant Professor of General and Plastic Surgery, Faculty of Medicine, Cairo University, for his meticulous supervision, continuous guidance, valuable advice and remarks throughout this work.

My special thanks are dedicated to **Dr. Ashraf Abolfotooh**, Lecturer of General and Plastic Surgery, Faculty of Medicine, Cairo University, for his extreme kindness and extensive support.

I am also obliged to all my professors, my seniors and my colleagues for their continuous help and endless encouragement.

Abstract

Management of acute defects of the dorsum of the hand following complex injuries or surgical procedures, which necessitate flap coverage, still represents a challenge. The aim of this work is to enlight the principles of coverage of dorsal hand defects putting into consideration better restoration of hand function.15 patients with soft tissue defects of the dorsum of the hand were chosen and different techniques of coverage were used with evaluation of their outcome.

Key Words : coverage - soft tissue - dorsum of the hand

List of abbreviations

ABPL	: abductor pollicis longus
Br	: brachialis
D I P	**:** distal interphalangeal joint
ECRB	: extensor carpi radialis brebrevis
ECU	: extensor carpi ulnaris
EDB	: extensor digitorum brevis
EDL	: extensor digitorum longus
EPL	:extensor pollicis longus
FCR	:flexor carpi radialis
FCU	:flexor carpi ulnaris
FDP	: flexor digitorum profundus
FDS	: flexor digitorum superficialis
FPL	: flexor pollicis longus
FTG	: full thickness graft
I P	: interphalangeal joint
MCP	: metacrpo-phalangeal joint
P I P	: Proximal intrphalangeal joint
PT	: pronator teres
S	: supinator
STG	: split thickness graft

Contents

Introduction

Management of the acute defects of the dorsum of the hand following complex injuries or surgical procedures, which necessitate flap coverage, still represents a challenge **(Flugel A., 2005).**

The dorsum of the hand is covered by a thin skin envelope with a thin subcutaneous tissue, which renders the underlying extensor tendons and bone structures vulnerable to trauma. Usually, these injuries are managed by primary soft tissue coverage **(Schaller P., 2003).**

There are various approaches for the management of these difficult defects, including skin grafts, local and regional flaps, pedicled distant flaps and microsurgical free tissue transfers **(Koch H., 2003).**

Skin grafts including partial and full thickness types are the simplest techniques for coverage of soft tissue defects of the hand, however not every case is amenable to this technique.

Ideally, the flap used for closure should be thin and supple to avoid unnecessary bulk and meanwhile should provide sufficient durability **(Flugel A., 2005).**

Usually, thinner and pliable fasciocutaneous flaps are preferred in hand defects, and distally based radial forearm flap, reverse posterior interosseous flap and the dorsal ulnar artery flap are the main three local flaps used for coverage of hand defects. However raising a large local flap near the injury site may inflict additional iatrogenic injury on an already traumatized forearm and hand. In addition, the posterior interosseous and dorsoulnar flaps are hirsute and insensate flaps **(Yajima H., 2004).**

Distant pedicled flaps like groin flap and abdominal flap are a simple, easy and versatile distant flaps that took a great place in the beginning era of reconstructive surgery **(Yilmaz S., 2005).**

Free flaps are alternative option to reconstruct soft tissue defects of the hand and forearm. Free flaps offer flexibility in size, shape and positioning and don't add donor site morbidity to the injured hand, however free flap coverage is a time consuming procedure, requiring a more difficult technique and complicated post operative care **(Zhou L.R.,2003).**

A good anatomic knowledge and experience in different reconstructive techniques of soft tissue defects of the dorsum of the hand, we believe, can easily solve this problem. Moreover, various detailed descriptions of the surgical procedures can be found in the literature **(Brunelli F., 2001).**

Aim of the work:

Verifying different techniques of coverage of soft tissue defects of the dorsum of the hand including skin grafts, locoregional flaps, distant pedicled flaps and free flaps and the indications for each patient and advantages and disadvantages of each technique.

Chapter ١

ANATOMY OF THE HAND

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The great importance of the hand is accompanied by a sophisticated architecture .There are a vast array of tendons, neurovascular structures, ligaments and bone in close proximity to each other . Each finger ray can be considered as a separate system ,working in precise coordination with the other fingers to achieve a normal hand function. A stable supporting skeleton, stable mobile joints, a fine balance between intrinsic and extrinsic motors and between extensor and flexor motors and complex tendon mechanisms are all some of the components involved in this magnificent hand "machine"***(Barron et al,1980).***

Anatomically the hand is the region of upper limb distal to the wrist joint .It is subdivided into three parts :

1-the wrist

2-the metacarpus

3-the digits (the five fingers including the thumb)

Skeleton of the hand:

The skeleton of the hand is subdivided into three regions ; the carpus or wrist bone, the metacarpus or bones of the palm and the phalanges or bones of the digits .***(Williams and Dayson,1992)*** (fig.1)

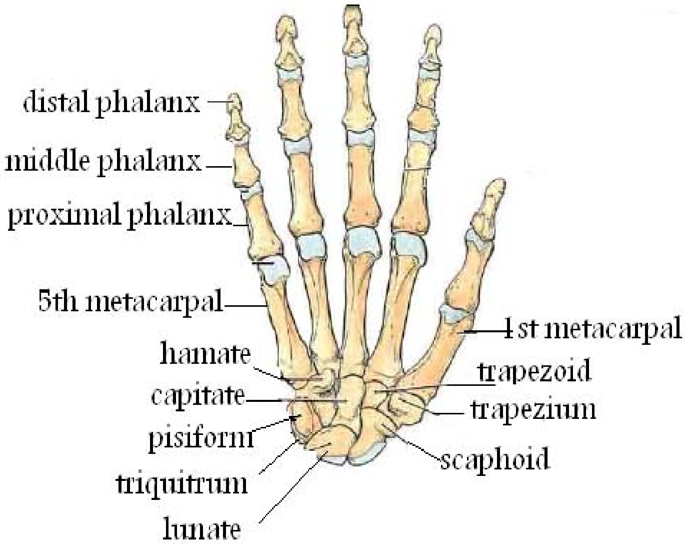

Fig.(1) Bones of the hand, (Grant's Atl. Of Anat. ,2009).

A. The Carpus :

It consists of 8 carpal bones made up of two rows of 4 bones each. From lateral to medial, the proximal row consists of the scaphoid ,lunate, triquitrum and pisiform bones. In the same order, the distal row consists of the trapezium, trapezoid, capitate and hamate bones. The anterolateral margins of the scaphoid and trapezium rise and protrude forward to make an attachment site for the flexor retinaculum.The hamate bone has a bony hook volarly, and the pisiform bone stands on the triquetrum,thus these 2 protrusions provide the medial attachment side for the flexor retinaculum. The distal row of the carpal bones joins to the metacarpal bones to form the carpometacarpal joints. The carpus is cartilaginous at birth.The capitate begins to ossify during the first year, and the others begin to ossify at intervals thereafter until the 12th year, when all bones are ossified ***(Woodburne and burkel,1999).***

B. Metacarpal bones :

The hand has five metacarpal bones. From proximal to distal ,each has a base, shaft and a head. The first metacarpal bone constitutes the skeleton of the thumb and is the shortest and most mobile .It is in contact with the trapezium proximally. The other 4 metacarpals contact with the trapezoid, capitatae and hamate and lateral-medial surfaces of metacarpal bones. The heads of the metacarpal bones, which form the knuckles, articulate with the proximal phalanges. The shaft of each metacarpal bone is slightly concave forward and is triangular in transverse section, with medial, lateral and posterior surfaces ***(Woodburne and Burkel,1999).***

C. Phalanges:

The hand has 14 phalanges. Each finger contains 3 phalanges, but each thumb only has 2. Each consists of a body and two extremities. The body tapers from above downward, convex posteriorly, concave in front from above downward, flat from side to side and its sides are marked by roughness which give attachment to the fibrous sheaths of the flexor tendons ***(McMinn,1994)***.

Skin and subcutaneous tissue of the hand:

The major difference between the skin on the dorsum of the hand and that of the palm is an example of the high specialization of hand structures necessary to fulfill their specific functions.

The palmar skin is thick and relatively immobile, providing stability for grip and pinch functions. It is also fixed to the underlying palmar fascia, digital tendon sheaths, and skeleton by a series of osseous cutaneous ligaments. The palm of the hand is richly supplied with sweat glands but contains neither sebaceous glands nor hair. A moderate amount of fat underlies the skin of the hand and fingers, enhancing its pliability ***(Naam,Cohen and Johnson,2000)***.

The dorsal skin; by contrast, is thin, mobile and elastic with loose areolar tissue between it and an investing layer of fascia. This design permits increased joint mobility. These characteristics, coupled with the fact that the major venous and lymphatic drainage in the hand course distally explain that hand edema is first evident dorsally regardless of its cause. The same characteristics make the dorsum of hand vulnerable to skin avulsion injuries ***(Chase,1990).***

The cutaneous innervation of the dorsum is by the terminal branches of the radial nerve and the dorsal branch of the ulnar nerve. They share the hand and its digits 3.5 to 1.5 . The ends of the nerves pass to the dorsum of each digit, where they stop short of the nail beds.

The skin of the palm is bound to the underlying deep fascia by numerous fibrous bands as stability of the palmar skin is critical to hand function. It shows many flexion creases at the sites of skin movement that correspond to the sites of skin folding when the hand is closed or the thumb is opposed. At the same time, if scar fixation or loss of elasticity occurs in palmar skin, contractures and functional loss result ***(Chase,1990).***

The surgeon must understand the relationship of the skin creases and the underlying structures in order to plan precise placement of incisions for exposure . Thus palmar flexion creases constitute useful landmarks. The radial longitudinal crease partially encircles the thenar eminence, formed by the short muscles of the thumb. ***(Chase,1990)***.

The proximal transverse palmar crease commences on the lateral border of the palm, in common with the radial longitudinal crease, and superficial to the head of the second metacarpal bone. It extends medially and slightly proximal across the palm, superficial to the bodies of the third to fifth metacarpal bones. The distal transverse palmar crease begins at or near the web between the index and middle fingers and crosses the palm superficial to the heads of the second to fourth metacarpal bones.

Digital flexion creases occur over the palmar skin of the digits. Each of the medial four digits usually has three transverse flexion creases. The proximal one is located at the root of the digit, about 2 cm distal to the MCP joint. The middle crease lies over the PIP joint while the most distal one is just proximal to the DIP joint.

The thumb, having two phalanges, has only two flexion creases that deepen when the thumb is flexed. The proximal flexion crease crosses the thumb obliquely proximal to the first MP joint. The distal flexion crease on the thumb lies at the IP joint ***(Moore,1995)***

The palmar skin shows multiple cutaneous striations of papillary ridges, which are better developed in areas used for grasp. They assume a concentric orientation in the pulp. Apart from their legal importance, these ridges serve to improve the contact with objects during grasping to prevent slipping. They also play a role in the tactile functions of the digits by virtue of the distribution of Meissner's corpuscles ***(Naam, Cohen and Johnson,2000).***

Fascia of the hand :

The fascia of the hand performs a number of different, but inter-related, functions. It ensheaths and lubricates structures in transit between the forearm and the digits, transmits loads, anchors the skin, protects underlying vessels and provides a framework for muscle attachments ***(Gray's, 2005).***

The deep fascia of the palm is continuous proximally with the antebrachial fascia (fascia of the forearm) and with the fascia on the dorsum of the hand. The fascia is thin over the thenar and hypothenar eminences (thenar and hypothenar fascia), but it is thick in the palm where it forms the palmar apponeurosis ***(Moore,1995)***.fig.(2)

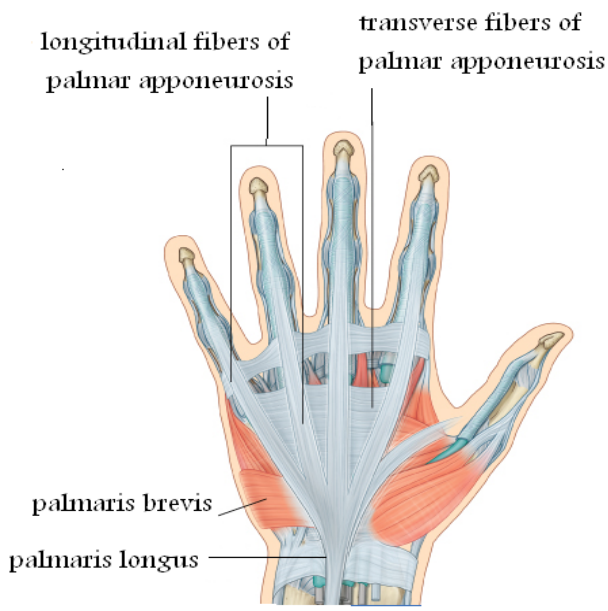

Fig.(2) Palmar apponeurosis,(Gray's anat. ,2005).