Advances in Plastic & Reconstructive Surgery

Applis Publishers

Research Article KUUP 4794/88:

Postburn Scar Contractures: Formation, Anatomy and Classification

Viktor M. Grishkevich M.D.* and Max Grishkevich M.D.

Department of Reconstructive and Plastic Surgery, A.V.Vishnevsky Institute of Surgery of the Russian Academy of Medical Sciences, Moscow, Russia.

Abstract

Background: Anatomy of postburn scar contractures is insufficiently researched. A commonly accepted anatomic classification, serving as a guide for reconstructive surgery, is not developed. Existing scar contractures names (linear, wide, long and other) do not highlight particular anatomic features. Classifications of separate joints contractures are confusing and are not used in clinical practices. The true anatomical cause of the contracture has not been explored.

Methods: More than three thousand patients with postburn scar contractures, in different locations and of various severities, were operated on personally. Unsatisfactory functional results after the use of classical local-flap techniques (Z- and Y-V plasty and their modifications) urged us to investigate the anatomy of contractures depending on their location and severity, and ultimately categorize the anatomic and clinical features of contractures into distinguished several types.

Results: All postburn scar contractures are anatomically divided into three types: edge, medial, and total, regardless of their location and severity. Burns and scars of joint's flexion lateral surface cause edge contractures; burns of joint's medial flexion surface form medial contractures. After burns of joint's flexion surfaces or circularly, a total contracture is formed. Every type has specific anatomic features and clinical signs allowing an easy diagnosis of the contracture type and thus an easy indication of a surgical technique to be used. New data on contractures' anatomy laid grounds for the development of new, more effective surgical methods and made surgical rehabilitation of burned patients more effective.

Conclusion: Scars located on joint's flexion lateral surface or flexion medial surface or on both form three contracture types: edge, medial and total. Every contracture form has specific anatomic features and clinical signs. New anatomic data was used as the basis for new effective surgical technique development.

Keywords: *Scar Contractures; Contractures Formation; Anatomy of Contractures; Classification of Scar Contractures.*

Introduction

Inspite of significant achievements in burns treatment, the quantity of scar contractures is high [1]. Among three burn consequences-scar deformity, contracture, and tissue defect contractures most often lead to disability. Therefore, an efficient scar contractures treatment has a paramount meaning in surgical rehabilitation of burned patients. Complete contracture removal significantly improves the appearance of the contracted region. For many years, contracture treatment lied in a classic approach employing local flap techniques. Triangular-flap techniques-Z- and V-Y plasty and their various modifications and combinations continue to be the basis for scar contractures treatment [2-4]. The techniques based on triangular-flaps have known disadvantages; therefore, the results of rehabilitation of burned patients with contractures are far from perfect [5]. According to our experience, the main cause of such limited progress in scar contractures treatment with local tissues lies in the insufficient study of the following aspects: (a) contractures' anatomy, (b) contracture cause (scar surface deficit), and (c) anatomical classification of scar contractures. New data on scar contractures anatomy is presented in this paper.

***Address for Correspondence:** Viktor M. Grishkevich, Professor of Surgery, 11546 SE Verns Way Happy Valley, OR 97086, USA. E-Mail: grishkevichmail@gmail.com

Received: October 26, 2016; Accepted: December 02, 2016; Published: December 24, 2016

Material and Methods

Since 1979, several thousand patients with postburn scar contractures of different joints and body areas were operated on in the specialized Department of Reconstructive and Plastic surgery that contained 55 beds. Different surgical methods were tested and results were compared. The commonly known disadvantages and complications of classic methods (Z- and Y-V plasty) were obvious. This observation of dissatisfactory outcomes led us to conclude that the anatomy of the contractures was not sufficiently researched.

Methods

The anatomic features of contractures were studied before surgery and during operation, noting contractures location and severity, contracture cause, and scars spread. Next criteria were used: (a) scar

location caused contracture in relation to joint surface (flexion lateral, flexion medial, an extension surfaces; (b) is there fold or surface surplus and healthy region (donor site); (c) fold location in relation to joint surfaces; (d) quality of the sheets of the fold; severity of the contracture. The specific features were categorized into distinguished several types. The revealed anatomic and clinical features were classified to determine the true anatomic contracture type. During operations, the contracture cause was explored (scar surface deficit) for understanding of the shape of local flaps necessary for contracture elimination. Anatomy (classification) of contractures and research of real anatomy of contracture cause were used to develop new and more effective reconstructive techniques.

Results

Functional zones of joint and commissural surfaces [Figure 1-3]

Our observations showed, that first one had to determine the contracted scars location in relation to joint's surface which was divided into extension (E) and flexion (F) [Figure 1]; the boundary between them passes along the joint rotation axis level (+ symbol). The flexion surface of big joints and commissures has curvature of nearly 90 degrees; the curvature divides the flexion surface (FL) into flexion medial (FM) surface and flexion lateral (FL) surface [Figure 1 and 2]. The curvature or divided line between them passes along the edges of joint fossa and ankle anterior surface. The round flexion surface of contractures, where the curvature is absent or barely expressed (interphalangeal joints, perineum and lateral trunk) is not divided [Figure 3].

Fig. 1A

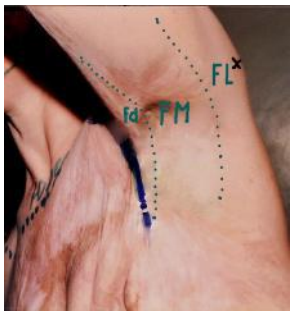

Fig. 1B

Figure 1: Functional zones of joint surface; shoulder and elbow edge contracture. (A and B): E – Joint extension surface above joint rotation axis (symbol "+"); F – joint flexion surface which divided by curvature, causing with fossa's edge in large joints, into flexion lateral (FL) and flexion medial (FM) surfaces; lateral flexion surface is scars, medial flexion surface (joint fossa) is healthy skin; scars formed the fold, crest of fold (Cr) is edge of scars .

Figure 2: J Round surfaces of finger flexion surface, neck, trunk, perineum are considered as flexion medial surface (and contractures)

Specific anatomic features and types of the postburn flexion contractures are the result of the scar location on the joint surface: flexion lateral (one or both joint's sides), flexion medial surface, or on three surfaces (both lateral and flexion) together. Depending on which flexion surface covered by scars, specific anatomic contracture types become obvious.

Edge contracture formation [Figure 3A and 3B]

Burns and scars, covering the joint's flexion lateral surface (FL), commissural zone and neck posterior surface, spread distally on neighboring anatomic segments forming joint, commissure (lips, hand lateral and dorsal surfaces). Growing distally, scars involve the neighboring healthy skin of the joint's fossa (flexion medial surface) and commissural fossa [Figure 3B]. As a result, the fold is formed between the flexion lateral and flexion medial surfaces, along joints' fossa and commissural edge. Therefore, the fold consists of two sheets of different quality (this is the most important anatomic feature and clinical sign): the lateral sheet is scars, and the medial sheet is healthy skin which spreads on undamaged joint's fossa (joint's flexion medial surface, commissural fossa) which becomes the donor site [Figure 3B]. The crest of the fold (Cr) is the scars' edge.

Fig. 3A

Fig. 3B

Figure 3: Joint's edge flexion contracture formation (shoulder joint edge anterior contracture). (A and B)- Scars on joint lateral flexion (FL) surface and neighbor zones spread downward (distally), involving healthy skin of flexion medial surface and connecting joint segments; as a result, a fold FD was formed, located along edge of joint fossa edge, among FL and FM surface. Flexion medial (FM) surface is undamaged; therefore, the fold's sheets have a different quality. Scar sheet has surface deficit in length, between two segments forming the joint (contracture cause) and both sheets have surface surplus in width (from the fold crest to the joint rotation axis) allowing contracture release with local tissue.

In the fold, the lateral scar sheet is continuation of the scars of flexion lateral surface which have a surface deficit in length (distance between two segments forming joint) that causes the contracture. Both fold's sheets have surface surplus in width, which in conjunction with healthy neighboring tissue (joint's flexion medial surface, commissural fossa) allows contracture elimination with local tissues. Thus, in all cases, the scars, located on joint flexion lateral surface and lateral commissural surface (cheek, dorsal and palmar hand surfaces) form the edge contracture.

Medial contracture formation [Figure 4]

Burns of the large joints' fossa, flexion medial surface (FM), ankle anterior surface, finger flexion surface, commissural fossa, lateral and anterior neck, truncal surfaces, and perineum lead to a specific contracture formation. During wound healing, scar's connective tissue undergoes contraction. Attempts to keep joints extended and withstand to flexion the neck and trunk stimulates scar growth. As a result, scars are elevated over joint and commissural fossa and the fold formed, crest of which is located along the middle line of FM