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Our Experience of Treatment of Large Skin Wounds with Excessively Tense Margins

M. Sulamanidze*, R. Adamyan, I. Gulyaev, K. Sulamanidze, G. Sulamanidze

Department of Clinic of plastic and aesthetic surgery TotalCharm, Moscow, Georgia

Abstract

Introduction: During the skin-plasty operation quite often it becomes necessary to excise a size able pathologically modified skin flap. Suture of the wound arisen proceeding from the mentioned is not always possible without significant intention of its margins resulting in various complications (dehiscence, margins' necrosis, hypertrophic, vicious cicatrices, etc). Therefore, in such cases the method of postoperative wound closing (microsurgical free transplantation, plasty by free flap, and application of local plasty method) is planned in advance or operation is conducted in two stages (dermotension).

Objective: Development of tense operative (or etiologically other) wounds suture method with equal intention of its margins along the length.

Material and technique: Original surgical technique of skin wounds suture with equal intention of its margins along the length without placing tensing sutures on its margins is presented. Since 2008 this method has been applied in 9 cases. Out of these: during aesthetic operations-in 5 cases, during skin-plasty operations-in 3 cases and in one case-during acute injury.

Outcomes and discussion: Clinical observations with various character and shape skin wounds have been presented, which were sutured by means of the given technique. Obtained outcomes are discussed as from functional so aesthetic point of view. On the basis of the experience are suggested advanced indications to application of this technique.

Conclusion: Presented technique of the wounds suture may become an operation of choice during closure of large skin wound surface during plasty, reconstruction and aesthetic operations, also in case of acute injury.

Introduction

During skin-plastic surgery, it is often necessary to excise a significant area of pathologically altered skin flap. Suturing of the resulting skin wound without significant tension of its edges is not always possible, which leads to various complications (divergence of the edges, their necrosis, production of hypertrophic, deforming scars, etc.). The main reason for the divergence of the edges of intense wounds is a violation of microcirculation in the tissues at the point of contact of the two edges of the wound. Disturbance of microcirculation can be a consequence of excessive tension of tissues, and can be caused by compression of the edges of the wound with the application of a large number of sub epidermal sutures. As a result, local ischemia and necrosis occur, the edges of the wound diverge and healing takes a long time with secondary tension, which subsequently negatively affects the quality of the postoperative scar and may require additional, sometimes multi-stage, interventions.

In such cases, a method of closing a postoperative wound is usually planned in advance. This can be a microsurgical free transplantation, plastic surgery with a rotational or free epidermal flap, local plastic. For suturing the stressed edges of the wound, methods of tissue dermotension are also known - gradual reduction of the wound edges with special devices, for example, approximants, spokes [Figure 1]. In this case, one of the basic principles of preventing ischemia of the wound edges and the opening of the sutures is realized: the location of the fixation points of the constrictive element at a sufficiently large distance from the edge of the wound [1-5].

Material and Methods

Back in 2002, we conducted an experiment to study the parameters of skin tension depending on the place of application of force. [Figure 2a and 2b] shows that mechanical force is applied to the edges of the mobilized skin-fat flap and it is maximally stretched. In this case, each of the marked 3cm segments of the initial marking elongated differently: the further the distance from the point of application of the force, the less it stretches.

This experience pushed us to the idea of developing such a method of primary suturing of stressed wounds, in which the tension of the edges of the wound would be distributed evenly on the entire mobilized flap, and the point of application of the tension force would be remote as far as possible from the wound edge [6-12].

Methods

This effect is achieved by the method of suturing the wound with barbed threads.

[Figure 3a] shows an enlarged thread with barbs. If such thread is passed through the tissues from right to left, it will easily slip through

***Address for Correspondence:** Dr. Sulamanidze, Department of Clinic of plastic and aesthetic surgery, TotalCharm, Moscow, Tbilisi 18 , Georgia, V. Orbeliani str. 0105, Tel: +99532 2920371; E-Mail: info@aptos.ge

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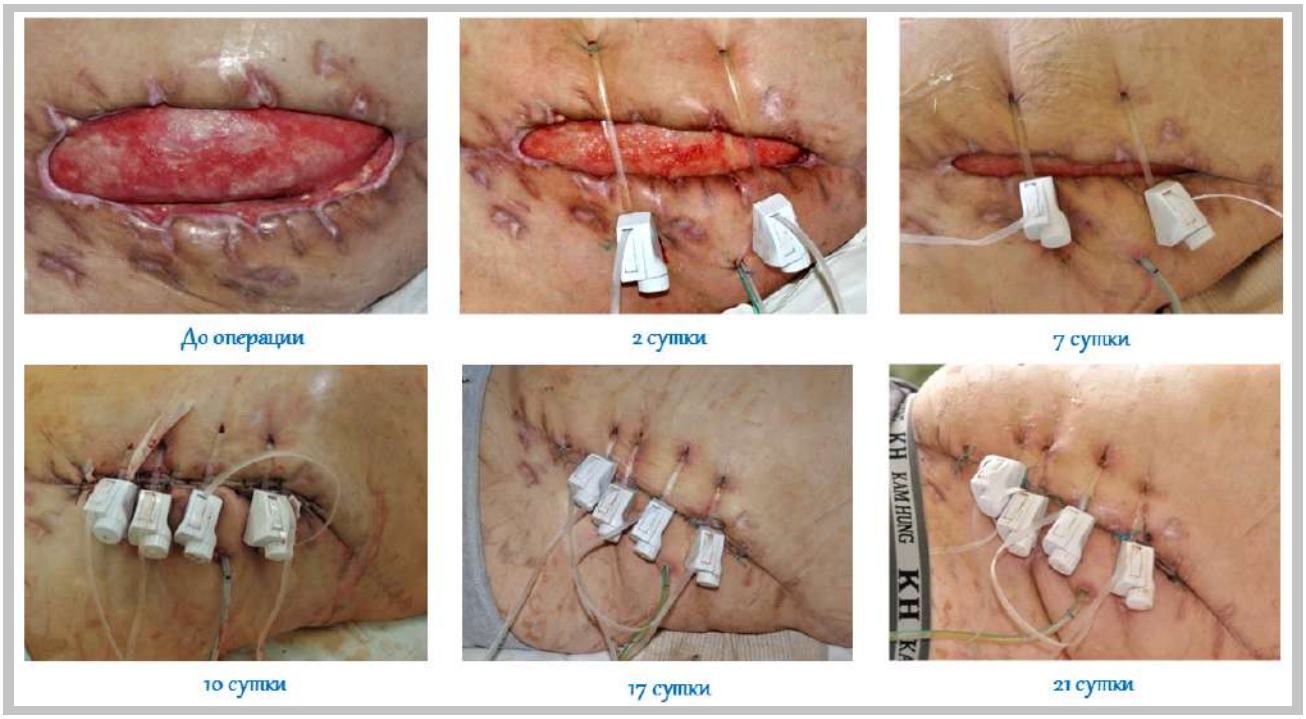

Figure 1: Application of approximators for secondary reduction of wound edges.

Figure 2a **Figure 2b**

Figure 2: An experiment showing the different stretching of the areas of the mobilized skin-fat layer with the application of mechanical force.

them, because the barbs are folded and pressed along the thread length, but when the thread is pulled to the opposite direction, the barbs open, turn into hooks and are reliably integrated into the surrounding tissues. At the same time, a small traction force will be applied to each traction site, which will allow to stretch the flap evenly - in total these small traction forces will constitute the force of tension that is needed to reduce the edges of the wound.

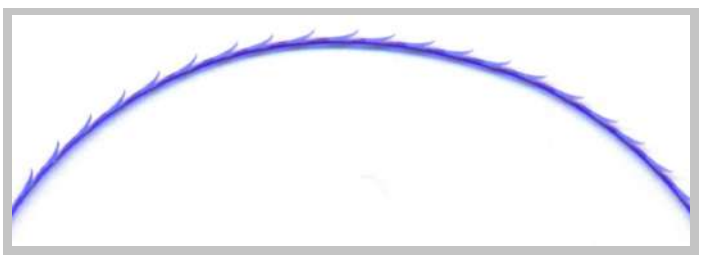

Figure 3a

This operation is performed by Aptos Needle 2G threads [Figure 3b].

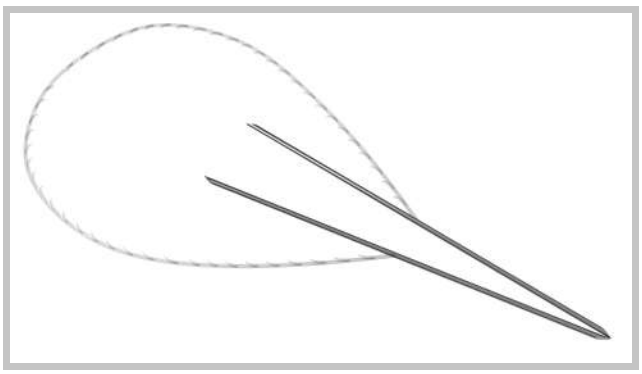

Figure 3b

Figure 3a and 3b: Figures 3a, 3b: Scheme of barbed thread and Aptos Needle 2G.

This product has a resorbable thread(L-lactide of L-polylactic acid and caprolactone) up to 50 cm long, with barbs converging in the middle. The thread by its ends is connected to the middle part of two double-pointed needles. These needles allow to pass soft tissue through any contour, dragging the thread and performing the continuous suturing without having to re-insert and retract the skin. In this case, the barbs on the thread fix the result.

Operation method

One of the needles is injected in the middle part of one of the edges of the wound and is pass sub cutaneously, parallel to the skin, but perpendicular to the edges of the wound for a length of about 4-8 cm. Here, it is punctured out, the needle exits to the surface but not completely - the second sharp point is left under the skin at a depth up to 2-5 mm, depending on the thickness of the subcutaneous tissue. Then pull the thread to the stop, i.e to the point where the direction of the barbs changes. After that, we are inserting the sharp point of the other needle into the opposite edge of the wound, also run subcutaneously parallel to the skin and puncture out after about 4-8 cm on the other side, removing the needle not completely and leaving the second end under the skin. Then pull the thread up to the stop, holding the edge of the wound in an approximated state. In this case, the edges of the wound at this point are joined together and fixed by barbs, which prevent the divergence of the edges of the wound when applying subsequent stitches. Thus, when the wound is sutured, there is no need for a "third hand" to hold the thread in tension. Then alternately, each of the needles is unfolded, a sharp end left under the skin grabs the area of the subcutaneous tissue, and also subcutaneously, parallel to the dermis, returns to the lumen of the wound. From here, the needle is injected into the opposite edge of the wound and is passed subcutaneously, removing it 4-8 cm on the other side and pulling the thread up to the stop. We also act with another needle, but from the opposite side. At the same time, each time the needle with the thread exits, the last one is pulled out, further tightening the edges of the wound. Needles, in turn, are passed to opposite corners of the wound [Figure 4].

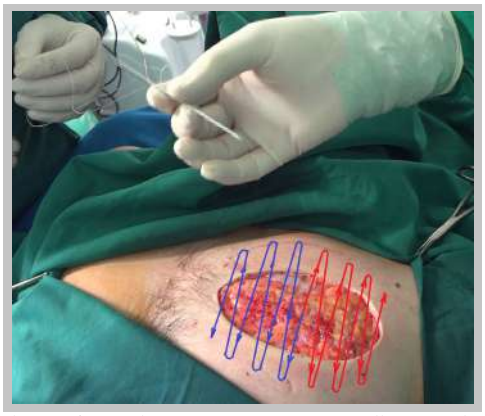

Figure 4: Scheme of wound suturing using Aptos Needle 2G method.

Thus, by gradual passes of needles we sew the wound with a series of U-shaped uninterrupted sutures, which allow it to stretch its edges evenly throughout. If necessary, we place adaptive sutures [Figure 5a, 5b].

Results and discussion

The basic principles of thread failure are well known: excessive stretching of the edges of the wound due to low skin elasticity or scar deformity, violation of surgical technique and post-operative wound suturing principles, and infection. Also of great importance is the initial direction of the cut, which must follow along the Langer lines.

Figure 5

Figure 5(a)

Figure 5(b)

Figures 5, 5a, and5b: Result: before, immediately after suturing, after 7 days.

The cause of ischemia and partial necrosis of the wound skin edges of can be several, from the disturbance of microcirculation due to common causes to an inadequately wide detachment of tissues.

An important aspect is the correct suturing of the wound. At the same time, special attention should be paid to strengthening the fascial structures, correct wound suturing, which provides a good discharge of its edges. The tension of the cutting zone can be reduced by several discharging sutures applied over the detachment zone.

But even despite all these preventive measures, especially in patients with reduced skin elasticity or the presence of systemic diseases and conditions leading to a disruption of microcirculation in tissues (eg, diabetes mellitus, accompanied by micro angiopathy, smoking, etc) marginal ischemia and then the divergence of the wounds edges are not so uncommon.

Figure 6a

Figure 6 b

Figure 6 a and b: Eruption of discharging sutures.

If there is a risk of divergence of the edges of surgical wounds, laxative and discharging sutures are usually applied, and also, secondary wound suturing is performed.

Often this also does not help, since even the discharging sutures are penetrated [Figure 6]. The main reason is the uneven stretching of the flap - the main tension comes at the edges of the wounds, whereas the farther from the edge, the less the pull of the tension

Good results in such cases showed such a method of tissue dermotension as a stage approximation and spokes, but this method in plastic surgery is not applied for the primary approximation of the wound edges due to the inevitable appearance of rough scars at the fixation points of approximants or spokes.

As can be seen, both presented methods are aimed at the secondary tension of the stressed edges of wounds. The basic principle of this approach is the maximum possible separation of the points of dermotension (tension) from the edges of wounds.

[Figure 7-9] shows complications and negative results of inadequate, excessive stretching of the edges of the wound when it is sutured.

There were proposals for rapid expansion of the skin using a linen surgical clamp [4]. Undoubtedly, for the surgeon the proposed method is simple and convenient, since within a few minutes the skin can be stretched and the edges of the wound sutured. However, there is no uniform stretching of the flaps in the more remote areas from the edges of the wounds, and with the final stitching, the main load

Figure 7

Figure 8

Figure 9

Figures 7-9: Complications and negative results of inadequate, excessive stretching of the wound edges when it is sutured.

falls mainly on the edges of the wounds. Such a method cannot be considered aesthetically acceptable, since it, at best, leads to a scar hypertrophy, and at worst - a discrepancy and necrosis of the edges of the wound in the postoperative period.

The method we used allows us to redistribute the tension force that must be applied to the edges of the wounds in order to approximate them by dividing the total tension force into components (divided by the number of protrusions, one or two shoulders of the U-shaped suture). i.e. the tension force of the point near the edge of the wound becomes as small as at the farthest point of the mobilized flap from it.

The proposed method allows us to achieve the following advantages:

1. A continuous series of U-shaped sutures, the points of the main fixation of which are located at a significant/necessary distance from the edge of the wound, exclude local compression of tissues, allowing to reduce the risk of eruption of sutures and divergence of the edges of the wound.
2. There is no need to impose on the edge of the wound rough knotted sutures with the capture of a significant portion of the mobilized flap, both deep and wide. It is enough after the end of suturing of the wound by our method, if necessary, to apply adaptive intradermal sutures from a thin a traumatic material or use cyano acrylate skin glue.
3. Microcirculation of tissues wound edges is practically not disturbed.
4. Because the thread is made of a long-absorbing material (L-lactide L-polylactic acid and caprolactone) - about 180 days - the wound can heal without fear of divergence of its edges.
5. Clinically admitted and the experience proves the fact that each of the U-shaped sutures approximates the edges of the wound in such a way that the dermal part is not screwed into the wound, but is somewhat turned out and elevated, which allows to accelerate the healing process and improve the quality of the scar in a remote postoperative period. This effect cannot be achieved by knotted sutures without additional manipulations.
6. Because threads have barbs, when each subsequent suture the thread does not need constant tension, which frees the surgeon from the need for a so-called "third hand".

Conclusions

The presented method of wound suturing can become a method of choice when closing extensive wound skin surfaces with plastic, reconstructive and aesthetic operations, as well as in cases of acute trauma. Probably, in some cases this technique can be used instead of the complex one-or two-stage classical skin-plastic operations, because it involves reducing the operating time, shortening the rehabilitation period, and obtaining the best aesthetic results [Figures 10-14].

Figure 10

Figure 10a

Figure 10b

Figure 10c

Figure 11a

Figure 11b

Figure 12a

Figure 12b

Figure 13a

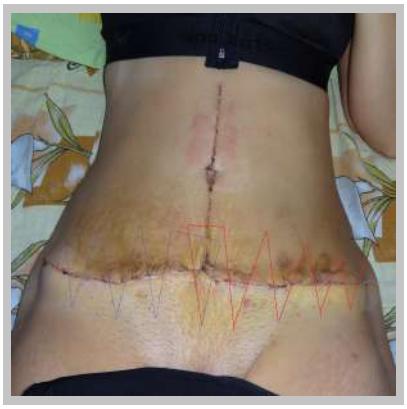

Figure 13b

Figure 14a

Figure 14b

Figure 14c

Figures 10-14: The results of operations performed by our wound-healing technique.

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