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Original Article

Release of Contractures by Subcutaneous Pedicled Rhomboid Flaps

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Abstract:

The subcutaneous pedicled rhomboid flap is a technique that can release scar contractures without skin graft or additional flap. This study was planned to evaluate the efficacy of this technique. This prospective interventional study was conducted in the department of Plastic Surgery, Dhaka Medical College Hospital, over a period of 16 months. A total of 28 procedures of subcutaneous pedicled rhomboid flap were performed on 12 patients. The contractures were released successfully by the rhomboid flaps. The mean percentage gain in length of the scar band was 77.28%. Most of the cases had complication free recovery. The clinical results indicated that the subcutaneous pedicled rhomboid flap is an effective and versatile technique for releasing scar contractures in different parts of the body.

Key words: *Subcutaneous pedicled rhomboid flap, Contracture*

Introduction

Contracture is defined as an abnormal permanent shortening of scar tissue resulting in distortion or deformity, especially of a joint of the body. It is one of the complications of burn or trauma when healing has occurred by second intention.

Release of contractures can be performed by either incising scars or excising scars. The resulting skin defect is then covered with a skin graft or a flap which gives rise to a new scar at the donor site. However, the creation of a new scar is not desirable as they usually produce additional problems.

Release by incision takes advantage of the healing that has already occurred and because of the relief of tension, it will usually improve the appearance and quality of the tissue that is retained. The subcutaneous pedicled rhomboid flap is a technique that has shown promise in releasing broad scar contractures without the use of a skin graft or additional flap. The study was planned to evaluate the efficacy of the Subcutaneous Pedicled Rhomboid Flap as a technique for releasing scar contractures.

The origin of the idea of skin flaps deriving their nutrition from pedicles of subcutaneous tissue is accredited to early workers in the field of reconstructive surgery. The first recorded example of the use of subcutaneous pedicle skin flap was in Vienna in 1887.[1] The first publication on subcutaneous pedicled flaps for release of contracture was by Suzuki et al in which an elliptical subcutaneous pedicled flap rotated 90 degrees was used to cover the skin defect produced by contracture release.[2]

Uzunismail et al presented the subcutaneous pedicled rhomboid flap with its definitive geometric pattern.[3] The major difference in his technique from Suzuki's was that he closed the skin defect resulting from contracture release with Y-V advancement of the rhomboid flap instead of rotation of the flap and used the technique only in digital burn contractures. Subsequently, similar techniques with different modifications have been practiced by various authors. In this study we evaluated the efficacy of this technique on the population of this country.

Patients and Methods

This prospective interventional study was conducted over a period of 16 months from October 2009 to February 2011 in the department of Plastic Surgery, Dhaka Medical College Hospital. A total of 28 procedures of subcutaneous pedicled rhomboid flaps were performed on 12 patients. The flaps

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were placed on the fingers in 12 cases, around the axillae in 7 cases, around the elbow in 4 cases, on the groin in 3 cases, on the wrist in 1 case and on the ankle in 1 case.

The subcutaneous pedicled rhomboid flaps were planned and marked along the long axis of the contracture band. All the flaps had 120æ% and 60æ% inner angles with the 60æ% angles placed along the contracture line. In case of long contracture bands, more than one rhomboid flaps were used.

Taking proper aseptic precautions, flaps were incised vertically down to the healthy subcutaneous tissue. No undermining of the rhomboid flap was performed. The tension on the lateral aspect of the contracture band was relieved by the relaxation incisions that were made outwards from the 120º angles. The length of the relaxation incisions were kept to that much which could be closed bilaterally as Y-V advancement of the rhomboid flap without any tension or residual skin defect.

The resultant defects were subsequently closed by suturing the rhomboid flaps in V–Y advancement along the long axis and in Y–V advancement along the transverse axis.

Results

There has been gain in the length of the scar band in each case though at different rates. The procedure was adequate to release the surface contracture in each case. There were residual extension deficits in 5 cases due to deformity of the joints.

It was observed that 10 cases (35.71%) had gained length in the range of 61-80%. There were 6 cases gained length in 81-100% range and 5 cases in 101-120% range. There were only 2 cases (7.14%) which gained less than 40% of the original length. The mean percentage gain in length was 77.28%. The 95% confidence limit was 68.24% to 86.32%.

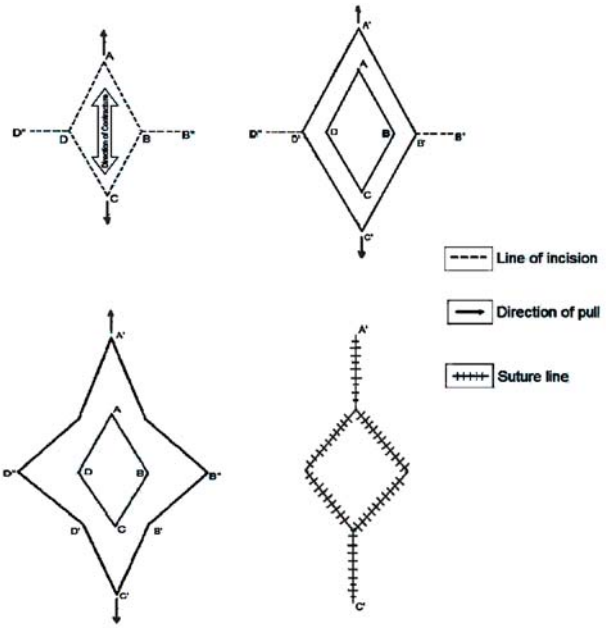

Fig.-1: *Surgical technique; Upper left – The marking; Upper right – Release after rhomboid incision; Lower left – Release after the relaxation incisions; Lower right – Final appearance.*

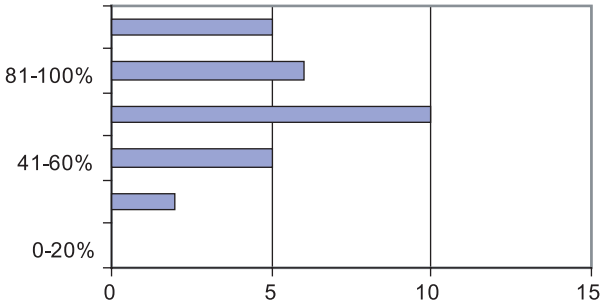

Fig.-2: *The percentage gain in length*

Fig.-3 ***(a)*** *Restricted abduction due to axillary contracture* ***(b)*** *Use of two rhomboids for long contracture band* ***(c)*** *Appearance of the scar band immediately after release* ***(d)*** *Complete release of contracture by subcutaneous pedicled rhomboid flaps*

Fig.4 (a) *Flexion contracture of right middle finger (b) Follow up at 6 weeks after release of contracture by subcutaneous pedicled rhomboid flap*

Fig.-5: *(a) A patient with contractures of the left hand (b) Contracture released by subcutaneous pedicled rhomboid flap. Residual extension deficit in PIP joint of left little finger due to joint deformity despite complete release of surface contracture*

22 cases (78.57%) had complication free recovery. The cases which developed complications usually had more than one complication. Partial dehiscence occurred in 5 cases (17.86%) and marginal necrosis in 4 cases (14.29%). The 6 cases which had complications showed delayed healing but secondary procedures were not required as the wounds healed spontaneously.

Discussion

All scar contractures are formed by shortening of scars that produce restriction in tissue movement. The subcutaneous pedicled rhomboid flap technique produces increase in the length of scar at the expense of width thereby releases the contracture. The subsequent alteration in the nature of the scar results in the scar becoming more soft and pliable.

The earliest paper on the use of subcutaneous pedicled flaps in releasing burn contractures was published by Suzuki et al.[2] In their 17 cases elliptical subcutaneous pedicled flap consisting of scar tissue was rotated 90 degrees to cover defects produced by contracture release. Rotating the scar on a subcutaneous pedicle had the advantage of changing the direction of the scar band but required greater surgical skill in dissecting the pedicle. Adequate release and primary closure was achieved in all the cases.

Our clinical results indicate that the subcutaneous pedicled rhomboid flap technique was effective in releasing the surface contracture in all the cases. Nevertheless, 5 cases had residual extension deficit due to joint deformity. In the current study, mean increase in length of the scar was 77.29%. One patient in the present study required additional Z-plasty.

Uzunismail et al performed 15 subcutaneous pedicled rhomboid flaps on fingers.[3] The results of the study showed a total release of contracture in all cases but 4 cases had

residual extension deficit due to joint deformity. Ogawa et al performed 11 subcutaneous pedicled propeller flaps to release axillary contractures.[5] Ibrahim Askar published 19 cases of post-burn scar contractures released by using the subcutaneous pedicled rhomboid flap technique.[6] There was no flap necrosis and the contractures were released with functionally and aesthetically acceptable results. Ertas et al measured the actual gain in length achieved by release of the contracture using the subcutaneous pedicled rhomboid flap technique.[7] The initial study was performed on rat inguinal skin where the average gain in length was 327 % from each subcutaneous pedicled rhomboid flap. In a subsequent study on human post-burn scar contractures, Ertas et al was able to completely release 28 out of 31 contractures with single subcutaneous pedicled rhomboid flaps.[8] The gain in length achieved by each rhomboid in this study ranged from 75% to 90%. Three patients needed additional Z-plasty for complete release of contractures. Another study evaluated the use of two consequent subcutaneous pedicled rhomboid flaps on rat inguinal skin.[9] In the twenty cases studied, the two flaps in combination produced 139% gain in length on average. The application of this concept of multiple subcutaneous pedicled rhomboid flaps on long post-burn contractures proved to be effective in human scars too. Total 43 flaps were used to release long contracture bands in 12 patients with approximately 3-4 rhomboids per length of scar.[10] The gain in length provided by the technique ranged from 90% to 100% and adequate release of contracture was achieved in all the cases.

In a study by Murakami et al, a modified technique of subcutaneous pedicled propeller flap was used.[11] The 12 flaps performed in 7 patients produced complete release and favourable aesthetic outcome. In a study on 7 patients with recontracture the subcutaneous pedicled rhomboid flap proved to be very useful.[12] Sixteen rhomboid flaps were designed over previously skin grafted recontractures and three flaps were designed over recontractures following Z-plasty. The technique was able to achieve 60% - 70% gain in length.

This study demonstrated that the subcutaneous pedicle alone is capable of providing adequate blood supply to the flap which is necessary for survival. This has been supported by all the literatures that have been reviewed. Even the propeller flaps, where scrupulous dissection was performed to narrow the pedicle, showed good survival.[2, 5, 11] In the present study, only one rhomboid flap showed signs of superficial ischaemia followed by epidermal necrosis but healed spontaneously. Another 4 flaps which were complicated by marginal necrosis may suggest marginal ischaemia but may have been due to tight suturing as well.

Considering all the information reviewed and obtained from the current study, we may conclude that the subcutaneous pedicled rhomboid flap is a reliable and versatile flap, used single or in multiples, in effectively releasing scar contractures in different areas of the body.

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