

## Original Article

# Rhomboid Flap Method for the Treatment of Severe Club Foot Deformity

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**ABSTRACT**

**Objective:** The rhomboid flap method (RFM) is a new technique for primary skin closure utilizing a modified posteromedial approach to cover skin and soft tissue defect which is the result of full correction of the severe club foot deformity.

**Setting:** Al-Razi Orthopedic Hospital, Kuwait.

**Method:** The vertical incision of the posteromedial approach declines laterally at approximately 30 degrees from midline which widens the rhomboid flap thus preserving blood supply to the flap and preventing scar adhesions to the Achilles tendon. After full correction, the

wound is covered by the stretched rhomboid flap.

**Results:** The RFM was used in 51 patients aged between 6 months and 8.5 years. The follow-up was between 11 and 48 months. The RFM was used in 62 cases: 59 primary surgeries and three revisions of previous surgeries. Sufficient skin cover was achieved in all cases. In 59, healing was by primary intention and in three necroses smaller than 1 square centimeter developed.

**Conclusion:** The RFM proved to be a beneficial method in the treatment of severe clubfoot in the concerned age group.

KEY WORDS: severe clubfoot, surgical treatment

**INTRODUCTION**

Skin closure problems on the medial side of the foot often arise after a full correction of a severe rigid clubfoot. After the classical posteromedial or Cincinnati approaches, a high rate of skin necrosis with a healing period of two to four months or the necessity of another surgery with skin graft, both with cosmetic consequences, are seen. This led to the development of the new rhomboid flap method (RFM) thus called because it uses a rhomboid full thickness skin flap to cover the defect on the medial side of the foot. The results of the application of this new approach over a period of three years are evaluated in this prospective study.

**MATERIAL**

From 1 November 1996 to 31 December 1999, the RFM was used in 51 patients; 39 males and 12 females aged between 6 months and 8.5 years. The average age was 14 months with a follow-up from 11 to 48 months, an average of 24 months. Clubfoot was present bilaterally in 20 cases, on the right side in 13 cases and on the left side in 18 cases. The RFM was used and results documented for 62 feet. In 59 cases, surgery was primary and three cases were revisions after the failure of previous surgery.

**OPERATIVE TECHNIQUE**

The medial part of the incision of the RFM along the medial edge of the foot is parallel to the incision

of both the classical posteromedial and Cincinnati approaches. After crossing the Achilles tendon, the incision of the RFM follows an angle of approximately 60 degrees medially with the lateral part of the incision of the Cincinnati approach and an angle of approximately 30 degrees laterally with the vertical incision of the classical posteromedial approach (Figs. 1 – 5).

After the skin incision, subcutaneous soft tissue is released towards the Achilles tendon and the sural nerve and saphenous vein are isolated and preserved. A full thickness skin flap consisting of skin and subcutaneous fat tissue is separated from the fascia. The incision line on the posterior and distal sides defines the area of the separation of the flap by the anterior edge of the medial ankle on the anterior side. Proximally the flap extends to the top of the vertical incision which varies from 8 to 12 cm in length according to the age of the child (Fig. 1). The rhomboid flap of an average size of 10 cm by 12 cm with an apex of 120 degrees with a wide basis and a preserved blood supply is ready to cover the newly developed medial part of the foot after the correction. The new cover is created by the stretched skin flap (Fig. 3 and 5).

The surgery itself consists of Z elongation of the Achilles tendon in the frontal plane, release of the ankle joint with preservation of deltoid ligament, release of subtalar, talonavicular and calcaneocuboid joints from plantar, medial and dorsal sides. The

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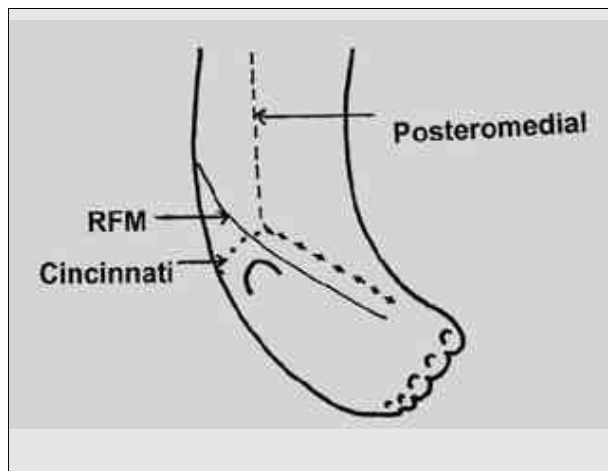


Fig. 1: Posteromedial view of the foot with marked skin incisions for posteromedial, Cincinnati and RFM approach.

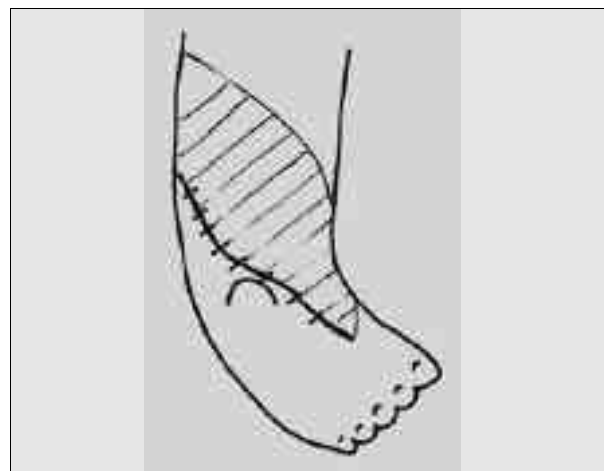


Fig. 2: Schematic drawing of skin incision with an area of full thickness rhomboid skin flap before the surgery. Note that before surgery skin marks perpendicular to skin incision form continuous unbroken lines.

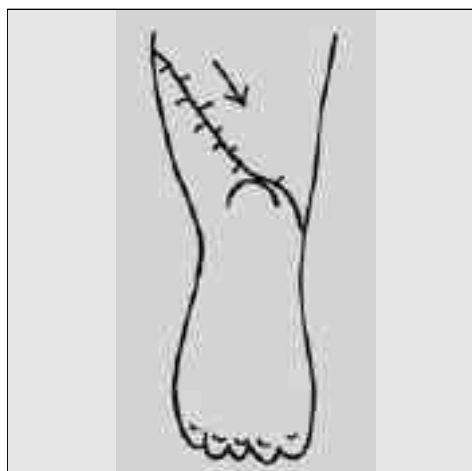


Fig. 3: Schematic drawing of rhomboid skin flap stretched over the defect after the surgery. Note the change of the position of the skin marks illustrating the extent of the stretching of the flap.



Fig. 4: Intraoperative photograph from medial view showing rhomboid skin flap turned over to the dorsal side of the foot and fixed by stitch.

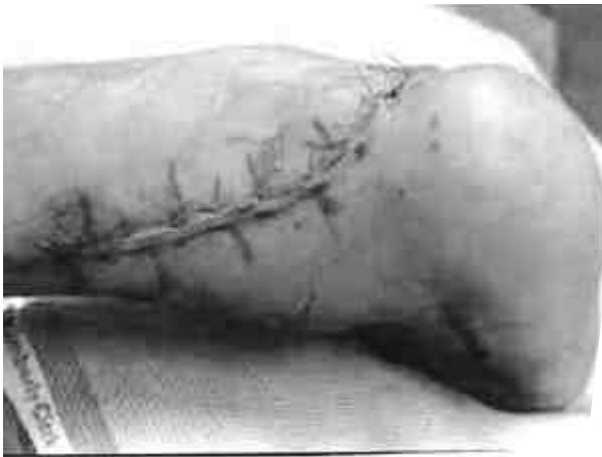
lengthening of the tibial posterior, flexor hallucis and flexor digitorum muscles is performed at the musculotendinous junction above the area of the joint releases which prevents later adhesions of tendons. The reduction of the talonavicular and the calcaneocuboid joints is fixed with one horizontal K-wire and the reduction of the talocalcaneal joint with one vertical K-wire. The suture of tendons, including the restoration of the tendon sheaths, is followed by hemostasis. The next step is the closing of the wound with the flap prepared as described above.

The above-knee slab of plaster of Paris is applied in plantar flexion of the foot. The change of plaster to the fully corrected foot position and the removal of the K-wire is performed two weeks after surgery. Complete plaster of Paris above the knee is applied for another four weeks. After the plaster is removed, physiotherapy combined with a plastic splint is continued for one month.

## RESULTS

In all of the 62 clubfoot cases, the use of the rhomboid flap enabled easy skin suture without marked tension on the medial side of the foot. The healing occurred by primary intention in 59 cases, including all cases of revision. In three cases, the healing occurred by secondary intention due to skin necrosis. These necroses, however, did not exceed one square centimeter in area and the wound healed while the foot was still in plaster of Paris.

In one case, an infection of skin occurred around the K-wire entry area outside the surgery wound itself. However, this infection healed promptly after the removal of the K-wire. All 62 clubfeet were fully corrected. Therefore, there was no need to perform additional surgery in this group at the time of the above-mentioned follow-up (Fig. 6).



**Fig. 5:** Intraoperative photograph from posterior view showing the direction of vertical part of incision laterally to the Achilles tendon with perpendicular marks moved against each other after suture of the skin. The split of the marks, which were originally identical lines perpendicular to the skin incision - see Fig 2, is caused by the stretching of the rhomboid skin flap enabling cover of the medial side with acceptable tension of the skin cover. Compare Fig. 3.



**Fig. 6:** Three year old child with severe bilateral clubfoot. The right foot after the surgery. Full correction with easy skin suture and primary healing. Note direction of the proximal part of the skin incision, which creates an angle 30 degrees laterally to the Achilles tendon.

## DISCUSSION

Full correction of a severe clubfoot is accompanied by both a marked lack of skin cover on the medial side of the foot and an excess of skin on the lateral side of the foot after the surgery. Various methods for solving this problem have been proposed. Rotation fasciocutaneous flap<sup>[1]</sup> necessitates an additional incision leading to another triangular skin defect. This represents another problem for complete skin closure. Incomplete skin closure<sup>[2-4]</sup> risks an infection of the wound and the appearance of the scar even though the authors claim to have achieved healing with minimal scarring.

The shortage of skin can be solved by soft tissue expander<sup>[5,6]</sup>. However, a failure of the expander due to infection or ischemia was mentioned both by the authors themselves and by others<sup>[7]</sup>.

The excessive skin on the lateral side can be cut out and used as a full thickness graft for the closure of the wound on the opposite side of the foot<sup>[8]</sup> which is associated with the risks of an additional surgery. The soft tissue defect can also be treated by a free gracilis muscle transfer<sup>[9]</sup> necessitating a microvascular surgery. This demanding method represents an option to cover soft tissue defects in the treatment of severe clubfoot in older children.

Double incision<sup>[10]</sup> prevents skin necrosis. The author's experience has been that this method is suitable mainly for release and correction of a mild clubfoot deformity in younger children due to a limited approach for proper release of the subtalar joint.

The RFM offers the following three advantages. First, a full release and a full correction of the clubfoot and a complete skin closure on the medial side of the foot can be done without excessive skin

tension and without additional surgery. Second, the elongation of tendons above the level of the release of the joints prevents a possible development of adhesions in scars. Moreover, elongation is done between muscular and tendinous parts without disturbing the integrity of the tendon which also prevents any adhesions of the tendons in scars. Third, the direction of the lateral part of the incision prevents any adhesions of the surgical scar to the Achilles tendon since the incision crosses the tendon only at the point of the insertion to the calcaneal bone and it declines laterally at an angle of approximately 30 degrees.

The postoperative fixation of the foot in plantar flexion during the first two weeks is very important to prevent both excessive skin tension and an intrinsic compartment syndrome<sup>[11]</sup>.

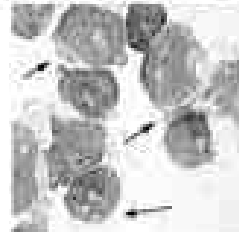
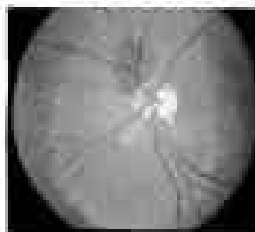
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