The use of a silicon sheet for gradual wound closure after fasciotomy

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We present a silicon sheet for temporary wound covering and gradual wound closure after open fasciotomy. Fasciotomy was performed in a total of 70 limbs with compartment syndrome (CS). The main etiology of CS was predominantly vascular. All patients were treated with a silicon sheet to cover the soft tissue defect and gradually reapproximate the skin margins. In 53% of the patients, a delayed final wound closure was achieved after a mean of 11.9 days. This method allows final closure of fasciotomy wounds without scar contractures, marginal necrosis, infection, or significant pain. (J Vasc Surg 2012;55:1826-8.)

In compartment syndrome (CS), open fasciotomy is required within hours. Due to the swelling of the muscle tissue, a primary wound closure is often not possible or worthwhile. A mainly vascular-related type of CS is a post-ischemic edema caused by reperfusion of a preischemic limb before revascularization.

A review of Dente et al[1] describes approximately 20 different methods for primary or delayed primary wound closure after fasciotomy. A frequently used method with different modifications for the reapproximation of skin edges after fasciotomy is the so-called shoelace technique.[1] Recent studies have described negative pressure wound therapy (NPWT) in the treatment of fasciotomy wounds.[2,3]

The purpose of this study was to present our experience using a silicon sheet for temporary wound covering in CS.

METHODS

This study included 69 patients who had undergone 70 open fasciotomies (mean age, 65.3 ± 15.3 years; range, 20-95 years). The male:female ratio was 44:26. In 91.4% of the patients (n = 64), vascular ischemia was the cause of CS (Table). The preoperative duration of ischemia was an average of 6 hours to 4 days from onset of symptoms to fasciotomy. Fasciotomy was performed when accepted clinical signs of CS appeared.

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TECHNIQUE

A complete fasciotomy to decompress all compartments was performed. The silicon sheet (medical grade silicone sheeting, reinforced, BioPlexus, Vernon Rockville, Conn) was fixed with a running suture (eg, monofilament thread 2-0 Prolene) after it was cut to shape without any tension. Before fixing the sheet, two Redon-drains (proximal and distal) were inserted (Fig 1). After that, a wound dressing with absorbent compresses was applied.

When the exudates decreased, the drains were removed. After the edema subsided, the gradual tightening of the sheet under sterile conditions began. This can be performed bedside. For the tightening under sterile conditions, a running suture from the center of the sheet (from distal to proximal) was used (Fig 2). This procedure is absolutely painless for the patient. It should be repeated until the skin edges are approximated without tension (Fig 3). During the procedure, an inspection of the wound is possible. If there is a hematoma or repeated swelling and tension, the sheet can be easily incised to remove the hematoma, determine if there is necrosis of the muscle, or reduce tension. If there is a necrosis, the patient returns to the operating room for debridement and application of a new silicon sheet. The final primary closure is performed in the operating room with a monofilament thread-knotted suture after refreshing the skin edges (Fig 4).

RESULTS

In 53% of all cases, a delayed primary closure of the wound was achieved. The time to primary closure was a mean of 11.9 ± 6 days.

In 17 cases (24%), delayed primary closure was not possible and split-thickness skin grafting (SSG) was necessary after a mean of 33.3 ± 17.3 days. In 16 cases (23%), a major amputation was unavoidable due to the impossibility of arterial revascularization or necrosis after a mean of 9.0 ± 5.7 days.

DISCUSSION

A pre-existing peripheral arterial disease (PAD) can impair the postoperative course in CS. The frequency of

Table. Etiology of ischemia

Ischemia	*Cause of ischemia*	*No. of patients*
Acute	Thromboembolism and graft thrombosis	45
Subacute	Catheter-based thrombolysis	19
		n = 64
Other	Trauma	2
	Hematoma	2
	Phlegmasia coerulea dolens	1
	Bedding injury	1
		Total n = 70

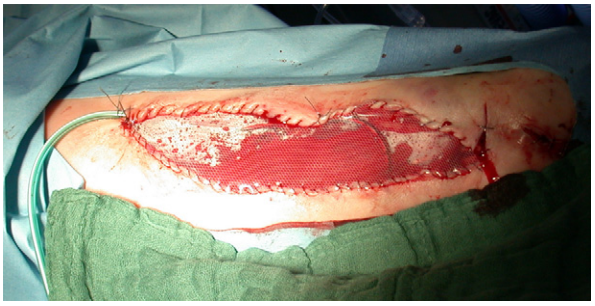

Fig 1. Fixing the sheet with a running suture without any tension (forearm).

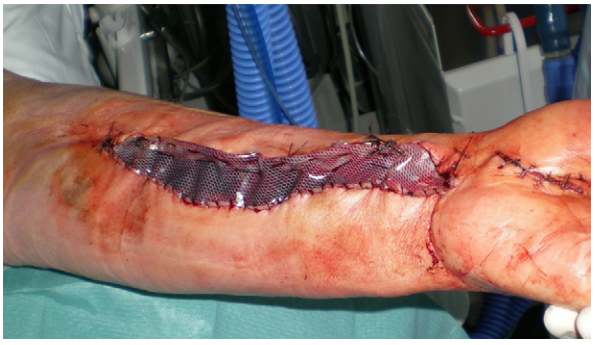

Fig 2. After the edema subsided, the painless, gradual tightening of the sheet began (bedside). For the tightening, a running suture from the center of the sheet was used (forearm).

fasciotomy after arterial embolism and arterial thrombosis in PAD varies from 2% to over 20%.[4,5]

With the vessel-loop shoelace technique, the duration until final wound closure varies between 4 and 17 days.[6-8] In a recent study, 77% of all patients required an SSG.[9] In all studies, the method and samples were often not comparable. Using a device, the Wisebands, Barnea et al[10] described a mean duration to final wound closure of 13 days in 88% of a total of 16 patients. It is important to mention that in half of the patients, the device was applied after a mean of 7 days.

Yang et al[2] reported on 34 patients treated with NPWT vs standard therapy with saline wound coverage after fasciotomy in patients with traumatic CS. The definitive closure was after a mean of 6.1 days in the NPWT group vs 16.1 days in the standard group, and there was a need for SSG in 27% (NPWT group) vs 36% in the standard group.[2] A recently published study of NPWT investigated a total of 804 fasciotomy wounds.[3] NPWT was applied in 438 cases vs only 270 cases in the saline-soaked dressing group. Delayed primary closure was achieved in 78.8% (NPWT group) after a mean of 7.1 days in comparison to 50.4% after 11.5 days in the non-NPWT group. SSG was necessary in 20.5% of patients in the NPWT group vs 27.8% in the non-NPWT group. All the results were assessed critically considering the unequal distribution of the groups. Moreover, NPWT dressings had to be changed every 2 to 3 days in the operating room. The majority were young patients without PAD.

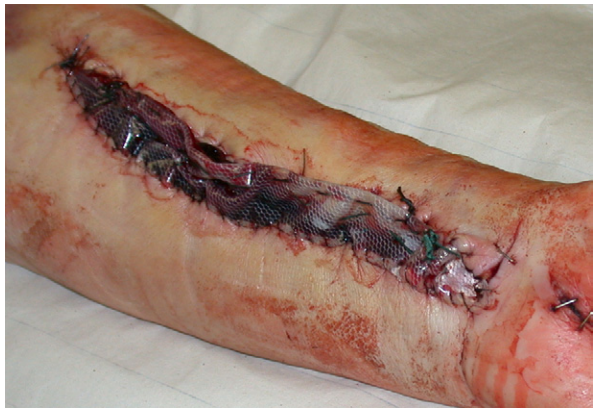

Fig 3. Skin edges are almost approximated after repeated tightening (forearm).

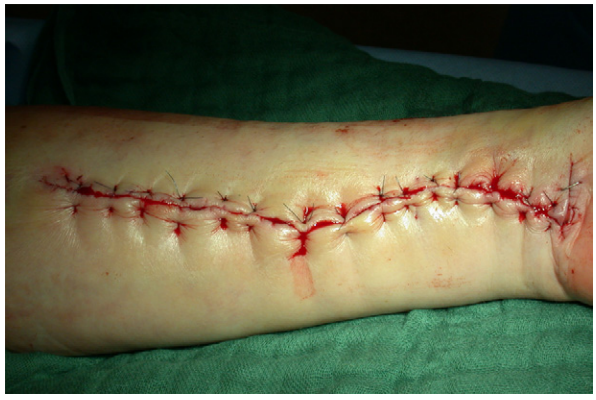

Fig 4. Final primary closure after the skin edges are approximated without tension (forearm).

With our technique, the silicon sheet can be reduced bedside with gradual reapproximation of the skin edges. The wound is under constant control, and, with any occurring complications, the sheet can easily be incised or removed. It is a very safe, painless, and cost-effective method for the gradual readaptation of fasciotomy wounds. Routine dressing changes in the operating room are not neces-

sary. A delayed primary closure of the wound can be achieved in the majority of wounds. In comparison to other techniques, duration to final wound closure seems to be equal or somewhat shorter. With regard to SSG with our technique, the rate of SSG is not higher in comparison to NPWT or other techniques.

There are considerable advantages to using a silicon sheet as a temporary covering in the treatment of CS. The dressing changes are nearly painless, there might be a reduced risk of infection, and there are improved cosmetic results. Future randomized trials are warranted with respect to length of stay and cost savings.

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