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Useful technique using negative pressure wound therapy on postoperative lower leg open wounds with compartment syndrome

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ABSTRACT

Background: Compartment syndrome (CS) of the lower leg in need of a fasciotomy for quick decompression and closure of the wound remains an issue. We report positive outcomes from combining two methods, the shoelace technique and negative pressure wound therapy (NPWT) together, to address this problem.
Patients and methods: Five patients were diagnosed with the lower leg CS and underwent surgery. The wounds were treated by combining the shoelace technique and V.A.C.® Therapy, and the wounds' shoelaces were gradually tightened.
Results: Eight emergency fasciotomies were performed in five patients with CS. The mean time to wound closure by suturing was 16.2 days and additional skin grafting was performed in only one case.
Conclusion: The use of this combination of treatments may prevent the need to use a skin graft, which has problems providing pleasing aesthetic results.

1. Introduction

Compartment syndrome (CS) of the lower leg may need for a fasciotomy for quick decompression, although this provides a treatment for CS, closure of the wound is still an issue. We report positive outcomes from combining two methods, the shoelace technique for closing fasciotomy wounds in stages, and negative pressure wound therapy (NPWT) for decreasing oedema and controlling exudates, and discuss the efficiency of using these methods together to address this problem.

2. Patients and methods

From January 2011 to December 2011, five patients (male: 4, female: 1) were diagnosed with the lower leg compartment syndrome and underwent surgery. Patient mean age was 36.6 years (range 18–64 years) and mean follow-up duration was 8.6 months (ranged from 6 to 12 months). Study end points included time to suturing wound closure, number of dressing changes, the presence or absence of additional skin graft (and estimate the area if present), and presence or absence of complications.

The list of cases is shown in Table 1.

2.1. Method of wound management

(1) *Shoelace technique*. The silastic vessel loops were applied to the wound edges using a skin stapler, closing the wound in stages [6].
(2) *NPWT*. The V.A.C.® GranuFoam™ Dressing was applied to the open wounds treated with the shoelace technique and V.A.C. ATS® System (KCI, Japan) was initiated to control exudates, decrease oedema and prevent infection. Pressure settings were continuous at −125 mm Hg basically.

The wound was treated by combining both methods [6,7], with V.A.C.® Dressing changes occurring once every 2–3 days, while the wounds' shoelace were gradually tightened.

3. Results

Eight emergency fasciotomies (four medial and four lateral surface of the lower leg) were performed in five patients with CS. The mean number of V.A.C.® Dressing changes was four times

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Table 1
Cases details.

Case	Age	Sex	Reason of injury	AO/OTA classification
1	20	M	Was caught in a power shovel	42-A2, G III A
2	18	M	Fell on the concrete road gully	42-A3
3	64	F	Traffic accident (bicycle)	42-C2
4	59	M	Compression due to long hour surgery	(–)
5	22	M	Traffic accident (motorbike)	42-B2, G III B

(range 3–5). The mean time to wound closure by suturing was 16.2 days (range 9–27 days). Additional skin grafting with 50 cm^2 was performed in only one case, and one wound complication occurred including partial wound edge necrosis, however, it was resolved by conservatively. Data are summarized in Table 2.

3.1. Case 1 (Table 1, Case 4)

A 58-year-old male had a laparoscopic operation (lithotomy position, approx. 7 h) at our gastric surgical department. The next day, patient developed severe oedema and numbness all over his left lower leg, with passive extension pain to the toe and ankle. Patient's creatinine phosphokinase level was high at 12.452 U/l, and was therefore sent to our department. He was diagnosed with CS of the lower leg requiring emergency fasciotomies (medial and lateral) 18 h after his laparoscopic operation (Fig. 1). The shoelace technique was applied (Fig. 2) and V.A.C.® Therapy was initiated (Fig. 3). The vacuum pressure was set at −125 mm Hg continuously. After four dressing changes, the oedema of left lower leg had been reduced, and both medial and lateral wounds were closed with sutures on POD 11 (Fig. 4).

3.2. Case 2 (Table 1, Case 5)

A 22-year-old, male suffered from a rollover bike accident and was taken to the emergency department. Patient presented with an open fracture of right lower leg (Gustilo III B) (Fig. 5). Upon admission, emergency irrigation, debridement and external skeletal fixation was performed. However, his entire right lower leg developed high tension, diagnosed as CS of the lower leg. The wound was left opened, the shoelace technique was performed and V.A.C.® Therapy was applied, aiming at gradual closure (Fig. 6). Because the wound was near the fracture site and there was the potential of excessive exudate, the vacuum pressure was set low at −75 mm Hg, continuous mode. After three dressing changes, oedema of right lower leg was reduced, and the medial wound was closed with sutures on POD 9. Due to possible closure of the open wound, the diagnosis changed from Gustilo III B to Gustilo III A (Fig. 7).

4. Discussion

If CS is diagnosed promptly, with fascia incision quickly enforced, functional disorder will not occur. However there may be trouble with the closing and management of the open wound.

Table 2
Results of treatment.

Case	Wound type	# of dressing changes	Time to closure (days)	Additional skin graft	Complications
1	Medial and lateral	5	27	50 cm^2	–
2	Medial and lateral	4	21	–	Wound edge partial necrosis
3	Lateral	4	13	–	–
4	Medial and lateral	4	11	–	–
5	Medial	3	9	–	–
Mean	8 wounds	4.0	16.2	–	–

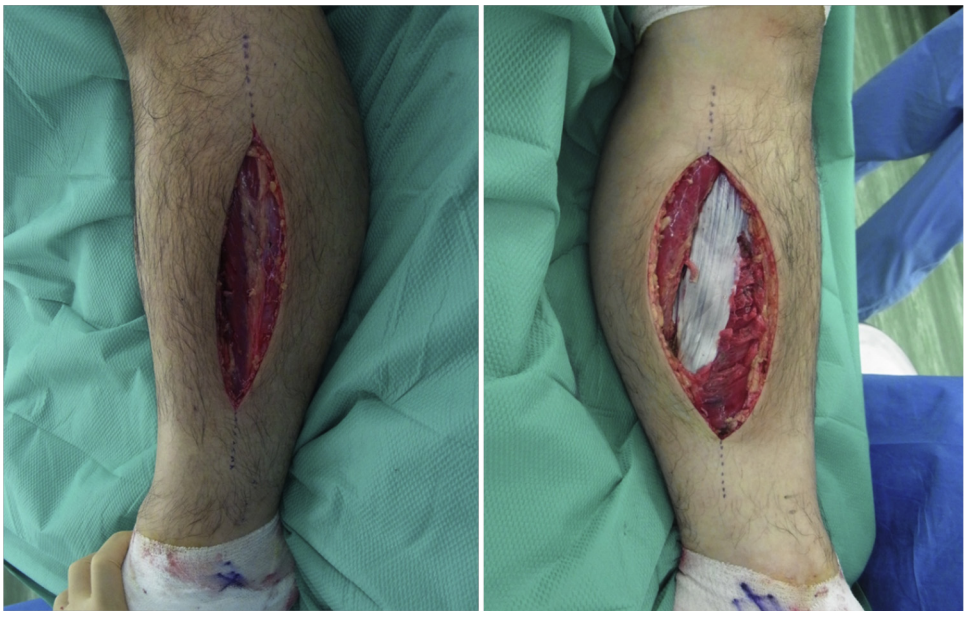

Fig. 1. 58-year-old male patient with CS required emergency fasciotomies both external (left) and medial (right).