

Research Article

Dermotraction as a Simple and Effective Technique for Fasciotomy Wound Closure

Kazi Muhammad Saeed¹, Raza Elahi Rana², Faisal Masood³, Syed Faraz ul Hassan Shah Gillani⁴

¹Former Chairman & HOD, Orthopaedic Surgery, KEMU/ Mayo Hospital, Lahore, ²Assistant Professor, Department of Orthopaedic Surgery, KEMU/ Mayo Hospital, Lahore, ³Associate Professor, Department of Orthopaedic Surgery, KEMU/ Mayo Hospital, Lahore, ⁴Senior Resident Orthopaedic Surgery, KEMU/ Mayo Hospital, Lahore

Abstract

Fasciotomy is the best treatment option of acute compartment syndrome, but it results into large wounds which are difficult to manage. Different techniques have been utilized to manage the fasciotomy wounds which have their respective merits and demerits. This study was conducted to evaluate yet another novel technique which requires skin stapler and Prolene 1 sutures.

Methods: This descriptive cases series was done using non-probability convenient sampling technique from January 2015 and June 2017 at Department of Orthopedics Surgery, King Edward Medical University / Mayo Hospital, Lahore. We included 24 fasciotomy wounds. They were managed with Dermotraction technique. We excluded patients with vascular injury. All wounds were successfully closed within an average time of seven days. The procedure was found to be cost effective, easy to execute and with minimal complications.

Results: Amongst the total 13 patients, all were males of age ranging from 14 to 45 year with mean age of 28.46 ± 9.97 . Majority, 10 patients (77 %) had acute compartment syndrome of leg and each patient managed with two fasciotomy wounds (N= 20). All fasciotomy wounds were closed with serial traction technique and the average time of closure was 07 days ranging from 3 days to 17 days 8.61 ± 2.63 .

Conclusion: We concluded from the study that dermotraction technique has good outcome in fasciotomy wound closure and healing and it is a cost effective.

Received | 04-12-2017: **Accepted** | 30-09-2018

Corresponding Author | Dr. Raza Elahi Rana, Assistant Professor, Department of Orthopaedic Surgery, KEMU/ Mayo Hospital, Lahore. **Email:** razaelahirana@gmail.com

Keywords | Dermotraction, Fasciotomy Wound, Prolene

Introduction

The acute compartment syndrome is a medical emergency in which increased interstitial pressure within a confined osteofascial compartment causes decline in the perfusion pressure to the tissues.¹ Left untreated, this can lead to ischemia and necrosis of the affected limb.² Long term complications of neglecting the prompt surgical release include contractures, neurological deficits, fracture non-union, infection, chronic pain, and in the worst cases amputation and even death.³

Emergent fasciotomy to decompress the compartment and restore the perfusion is the only option in most of the cases.⁴

The surgical decompression of the tight compartment is recommended at earliest possible time, under regional or local anesthesia as it has been shown that the shorter interval between injury and fasciotomy was associated with better outcome in terms of quality of life scores and return to work.⁵

Compartment syndrome can develop after tissue insult to the different parts of the body and the most

common site of involvement is the leg.⁶ The other sites, in order of frequency are, forearm⁷ although the arm,⁸ hand,⁹ gluteal regions, thigh,¹⁰ foot¹¹ and abdomen.¹²

After the life and limb threatening situation is over, the next challenge for the operating surgeon is to close the large fasciotomy wound because the muscles, tendons and the neurovascular structures are constantly exposed to the external environment and hence prone to infection and dehydration. The fate of this large surgical wound is variable and the wound itself imposes huge psychological and economic burden on the patient. Fitzgerald et al reported that 12 % of the patients in their study had to change the profession due to the appearance of wound and poor quality of life associated with fasciotomy wound.¹³

There is plethora of different closure techniques including immediate closure, delayed primary closure, and skin grafting to cover the gap. Infection rate may decrease with immediate or delayed primary wound closure.^{14,15} It improves cosmetic outcomes, when compared with secondary closure and skin grafting. However, primary closure is not always possible with edema of tissue.¹⁵ There exists no consensus regarding better outcome of one technique over other.¹⁴

Conventionally, the management of fasciotomy wounds involve long hospital stay, multiple surgeries and therefore extra burden on economy. This study was conducted to evaluate the effectiveness dermatraction technique as effective technique which does not need specific diverse device, success rate in term of wound closure, time of closure, cosmetic and complications rate in terms of infection of infection, staples dislodge and suture breakage.. It needs a skin stapler and Prolene 1-0, both of which are commonly used in wound closure. No local literature is available regarding this technique and this method of treatment could provide an alternative to the conventional mode of treatment i.e. split skin grafting.

Methods

This descriptive case series was conducted in the department of Orthopedic Surgery Unit-I of King Edward Medical University/ Mayo Hospital Lahore. Between January 2015 and June 2017, 24 fasciotomy wounds of 13 patients were enrolled in the descriptive

case series. All Patients with vascular injury were excluded from the study. After approval from ethical board of the hospital, we explained purpose of the study and took informed written consent from the patients. All patients were admitted through Accident and Emergency department and pre-operatively injection ceftriaxone 1gm was given half an hour before the surgery and 2gm 24 hourly for four days post-operatively. All patents were operated in spinal anesthesia. All patients were diagnosed according to Griffiths et al.¹⁶ criteria which manifest main symptoms of compartment syndrome; pain out of proportionate, paresthesia, paresis and pain on stretch and addition of more recent pulse and pallor of the fingers of the involved limb.¹⁷ (The fasciotomy was done, and acute emergency was over. In this study we evaluated the effectiveness of the Dermotraction technique, in terms of success rate as wound closure, time of closure of wound, cosmetics and complications rate in term of superficial and deep infection, staples dislodge and suture breakage. After closure, all patients were retained in the ward till complete closure of the wound and outcomes were recorded.

On the second or third post-operative day after fasciotomy, when the dressing of the wound was changed in the operation theatre, aseptic measures were taken and wound was washed with normal saline and pyodine solution applied at the edges of the wound. Local anesthetic agent was applied on the margins of the wound. Skin staples were applied at a distance of 2 to 3 cm all over the margins of the wound.



Fig.1 Skin Staple Applied Perpendicular to the Wound Margin and Prolene 1 Passed through them in Zig zag Pattern



Fig.2 Fasciotomy Wound Closed by Serial Traction Technique

Results

Amongst the total 13 patients, all were males of age ranging from 14 to 45year with mean age of 28.46 ± 9.97 . All fasciotomy wounds were closed successfully. Majority, 10 patients (77 %) had acute compartment syndrome of leg and each patient managed with two fasciotomy wounds (N= 20). Only 3 patients (23%) had acute compartment syndrome of forearm, two (66.7%) of them managed with single valor incision (N=2) and one (33.3%) patient managed with two incisions (N=2). Mechanism of injury was road traffic accident in 09 (69.2%) patients and fire arm injury in 4 (30.8%).

All fasciotomy wounds were closed with serial traction technique and the average time of closure was 07 days ranging from 3 days to 17 days 8.61 ± 2.63 . Two (15.4%) patients developed mild cellulitis as complication over the wound edges, but it settled after the removal of staples when wound closure was complete. There was no deep infection in our cases. Dislodgement of a few staples was a frequent problem, but it did not grossly affect the time taken for wound closure. Breakage of suture was also seen in 03 (23.1%) cases. The sutures were easily placed in these cases.



Fig.3: Fasciotomy of the Forearm



Fig.4: Fasciotomy Wound Managed with Traction Technique

Discussion

Both the upper and the lower limbs can develop compartment syndrome following tissue insults such as fracture, ischemia, reperfusion, crush injury, burns and over-exertion⁽¹⁸⁾. Fasciotomy in established cases of compartment syndrome is a limb saving procedure and is routinely done in the emergency setting. Emergent decompressive fasciotomy in doubtful cases of compartment syndrome is still valid option because the morbidity of fasciotomy wounds is far less than the morbidity that follows an undiagnosed and untreated case of compartment syndrome. If not treated in time compartment syndrome can lead to devastating consequences.

After the emergency situation is over sometimes it becomes very difficult to manage the large fasciotomy wounds because of the protrusion of the muscles out of the fascial compartment. The presence of edema makes the situation even more difficult to manage. To limit the hospital-stay and the morbidity associated with fasciotomy wounds, it is aimed to close the wounds in the shortest possible time. However, since bony injury is also present in most of the cases, the combined Orthopaedic and Plastic Surgical management is required.

Split Skin grafting is conventionally done to cover the herniated muscles. However, Split-thickness skin grafting results in a thin, insensate and unsightly scar which has limited capacity of tolerating friction to which normal skin of lower limb is exposed⁽¹⁹⁾. It required additional surgery under general anesthesia, pain at graft donor site, infection, risk of graft non-

adherence and cosmetic problem.¹⁴ Therefore, many different innovative techniques have been introduced to overcome the complications of Split-thickness skin grafting like negative pressure wound therapy,²⁰ subcuticular suture,^{19,21} Ty-Rap (Thomas & Betts, USA),²² STAR (WoundTEKInc, USA)²³ and Pasha device²⁴ using Ilizarov technique. When we compared with the literature with our study, this novel technique did not require additional anesthesia, superficial infection, no cosmetic problem after wound closure and no additional wound closure device.

When we compared cost of our technique with “dynamic Dermotraction device” developed by Kakagia et al.¹⁴ it cost 500 USD to 1000 USD per device, we found that this technique is cost effective which only required staples and prolene 1-0 for closure. The above mentioned techniques mentioned in the literature have been shown to be highly effective in the management of fasciotomy wounds, but they require specific devices as in Pasha technique and negative pressure or devices like STAR (Wound-TEKInc, USA), which are not commercially available or too expensive for the patients of developing countries like Pakistan.

Dynamic Dermotraction devices has success rate of 92.7% in fasciotomy wound¹⁴, while in our study we have success rate in 99.9% cases. Our results represent the success of our technique as wound closure in all cases without deep infection which were settled after removal of the staples. The was sutures breakage 03 (23.1%) cases. Sutures were easily replaced in all cases. The wound cosmetic appearance was satisfactory with dermotraction when compared with split thickness skin graft (Figure 05) Our study has limitation that it has small sample size and it lack control group. Furthermore, patients with co-morbidities were not included to see the outcomes. When compared to the above mentioned commercial products and specific technical devices, our approach does not require any expensive material. The good outcome with respect to shorter time of closure, good cosmesis and being simple, make this approach ideal for closing fasciotomy wounds with limited resources.



Fig. 5: Comparison of Two Fasciotomy Wounds, One on the Left Treated with Split Skin Grafting and the Other with Dermotraction Technique.

Conclusion

Dermotraction with the help skin staples and Prolene 1-0 is an efficient and cost effective technique which can easily be executed and does not need expensive or complicated devices.

Ethical Approval: Given

Conflict of Interest: None

Funding Source: None

References

1. McQueen MM. Acute compartment syndrome. In: Bucholz RW, Court-Brown CM, Heckman JD, Tornetta P 3rd, eds. Rockwood and Green's Fractures in Adults. Seventh ed. Philadelphia: Lippincott Williams & Wilkins, 2010:689-708.
2. Cone J, Inaba K. Lower extremity compartment syndrome. Trauma Surg Acute Care Open. 2017; 2(1): 1-6. doi: 10.1136/tsaco-2017-000094
3. Donaldson J, Haddad B, Khan WS. The pathophysiology, diagnosis and current management of acute compartment syndrome. Open Orthop J. 2014;8:185-93.
4. Goyal S, Naik MA, Tripathy SK, Rao SK. Functional outcome of tibial fracture with acute compartment syndrome and correlation to deep posterior compartment pressure. World J Orthop. 2017; 8(5): 385-93. DOI: 10.5312/wjo.v8.i5.385

5. Han F, Daruwalla ZJ, Shen L, Kumar VP. A prospective study of surgical outcomes and quality of life in severe foot trauma and associated compartment syndrome after fasciotomy. *J Foot Ankle Surg.* 2015; 54(3):417-23.
6. Pechar J, Lyons MM. Acute Compartment Syndrome of the Lower Leg: A Review. *J Nurse Pract.* 2016; 12(4): 265-70. doi:10.1016/j.nurpra.2015.10.013.
7. Smith K. Acute Idiopathic Compartment Syndrome of the Forearm in an Adolescent. *West J Emerg Med.* 2015; 16(1): 158-60. doi: 10.5811/westjem.2014.9.23019
8. Prasarn ML, Ouellette EA. Acute compartment syndrome of the upper extremity. *J Am Acad Orthop Surg.* 2011; 19:49-58.
9. Songur M, Şahin E, Zehir S, Oz II, Kalem M. Gluteal compartment syndrome secondary to superior gluteal artery injury following pelvis fracture: A case report and review of literature. *Turk J Emerg Med.* 2016; 16(1): 29-31. doi: 10.1016/j.tjem.2016.02.006
10. Tarlow SD, Achterman CA, Hayhurst J, Ovadia DN. Acute compartment syndrome in the thigh complicating fracture of the femur: a report of three cases. *J Bone Joint Surg [Am]* 1986; 68-A:1439-43.
11. Frink M, Hildebrand F, Krettek C, Brand J, Hankemeier S. Compartment syndrome of the lower leg and foot. *Clin Orthop.* 2010; 468:940-50.
12. Hunt L, Frost SA, Hillman K, Newton PJ, Davidson PM. Management of intra-abdominal hypertension and abdominal compartment syndrome: a review. *J Trauma Manag Outcomes.* 2014; 8:1-8. doi: 10.1186/1752-2897-8-2.
13. Bengezi O, VoA. Elevation as a treatment for fasciotomy wound closure. *Can J Plast Surg.* 2013; 21(3): 192-94.
14. Kakagia D, Karadimas EJ, Drosos G, et al. Wound closure of leg fasciotomy: comparison of vacuum-assisted closure versus shoelace technique. A randomised study. *Injury* 2014; 45(5): 890-93.
15. Weissman O, Goldman N, Stavrou D, et al. Adhesive skin closure technique for closure of fasciotomy wounds in pediatric patients: a case series. *Wounds* 2015; 27(5): 118-22.
16. Griffiths DL. The management of acute circulatory failure in an injured limb. *J Bone Joint Surg Br.* 1948; 30:280-98.
17. Garner MR, Taylor SA, Gausden E, Lyden JP. Compartment Syndrome: Diagnosis, Management, and Unique Concerns in the Twenty-First Century. *HSS J.* 2014 Jul; 10(2): 143-52. doi:10.1007/s11420-014-9386-8
18. McQueen MM, Gaston P, Court-Brown CM. Acute compartment syndrome: Who is at risk? *J Bone Joint Surg Br* 2000; 82:200-3
19. Mittal N, Bohat R, Virk JS, Mittal P. Dermotaxis v/s loop suture technique for closure of fasciotomy wounds: a study of 50 cases. *Strategies Trauma Limb Reconstr.* 2018; 13(1): 35-41. doi: 10.1007/s11751-017-0299-1
20. Lee P. Treating Fasciotomy Wounds with Negative Pressure Wound Therapy with Instillation and Dwell Time (NPWTi-d) Cureus. 2016; 8(10):1-10. doi: 10.7759/cureus.852
21. Chiverton N, Redden JF. A new technique for delayed primary closure of fasciotomy wounds. *Injury.* 2000; 31:21-4.
22. Geertruida AM, Govaert G, van Helden S. Ty-Raps in trauma: A novel closing technique of extremity fasciotomy wounds. *J Trauma.* 2010; 69:972-5.
23. McKenney M, Nir I, Fee T, Martin L, Lentz K. A simple device for closure of fasciotomy wounds. *Am J Surg.* 1996; 172:275-7.
24. Pasha IF, Qureshi MA, Arshad RA, Tahir UB, Akram M, Awais SM. Delayed primary closure of open double fasciotomy wounds at leg with Pasha device a novel method. *Ann King Edward Med Uni Apr - Jun* 2012; 18(2):168-73.