

Delayed Primary Closure of Open Double Fasciotomy Wounds at Leg with “Pasha Device” A Novel Method

Ibrahim Farooq Pasha,¹ Muhammed Abid Qureshi,² Rana Muhammed Arshad,³ Usama Bin Tahir,⁴ Muhammed Akram⁵ and Syed Muhammed Awais⁶

Abstract

Objective: The objective of this study was to close open fasciotomy wounds using a new external fixation device. The principal behind this new development was based on dermotraction and Ilizarov traction regeneration technique.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted in Combined Military Hospital Peshawar for a period of 6 months from September 2011.

Patients and Methods: Nine patients with fascio-

tomy wounds were studied. A new skin External fixation device was designed and manufactured from components of Ilizarov set. The name of device was given after the name of the first author “Pasha Device – PD” of Skin Traction Regeneration. The aim was to achieve delayed primary closure.

Results: All of our patients were male. The average age was 30.3 years range 45 – 20. The aetiology was high energy bullet injury in 3, road traffic accidents in 5 and bomb blast splinters in 1. Tibia was affected in 5 cases, Femur in 3 and ankle 1 case. 7 patients had open fractures and 2 had closed. Fasciotomy was done at mean interval of 11.7 hours after injury range 23 – 2. The mean time between fasciotomy and application of Device was 5.22 days range 8-0. The mean length of fasciotomy was 19.4 cm range 24 – 17 and breadth 5.75 range 7 – 4.5. The fractures were fixed with AO fixators in 4 patients, Naseer Awais fixator in 3 and Ilizarov fixator in 2. Vacuum suction pack dressings (Vac – pack Dressing) were applied on individual basis in 4 patients. Delayed primary wound closure was possible in all 9 cases. The mean time for wound closure was 6.66 days range 8 – 5. We had 1 minor complication.

Conclusion: We described a new technique to close fasciotomy wounds with dermotraction using “Pasha Device”. This is cheap, simple, user friendly and reliable and will decrease the need for skin grafting for coverage of such wounds. The review of the international literature shows that the “Pasha Device” and technique of its application to close fasciotomy wou-

Pasha I.F.¹
Combined Military Hospital, Peshawar

Qureshi M.A.²
Combined Military Hospital, Peshawar

Arshad R.M.³
Department of Orthopaedic Surgery, Unit II
King Edward Medical College / Mayo Hospital, Lahore

Tahir U.B.⁴
Combined Military Hospital, Peshawar

Akram M.⁵
Department of Orthopaedic Surgery, Unit I
Mayo Hospital, Lahore

Awais S.M.⁶
Department of Orthopaedic Surgery, Unit I
King Edward Medical College / Mayo Hospital, Lahore

nds is addition of new knowledge and technology in field of treatment of such defects.

Keywords: Pasha Device, Fasciotomy wound, open fracture, Dermotractor.

Introduction

Fasciotomy is a common procedure done for the treatment of acute compartment syndrome in any osseofascial compartment. The increased compartmental pressure may be due to trauma,¹ burn, frost bite² insect bite,³ muscle tear,⁴ infection etc. It is also done as prophylactic procedure by the vascular surgeons in most cases of vascular repair and embolectomy.⁵ Closed fasciotomy can be done in imminent compartment syndrome but manifested compartment syndrome necessitates therapeutic fasciotomy, which means long incisions of skin, fascia and splitting of retinacula.⁶ The number and placement of incisions require detailed knowledge of anatomy of these osseofacial compartments. In leg it can be done with bilateral incisions or by single incision parafibular decompression.⁷

Delayed primary closure is ideal, but because of skin edge retraction, the open wound must either heal secondarily or be closed with a split – thickness skin graft (STSGs).⁸ STSGs may have to be done in over 50% of lower limb fasciotomies.⁹ Primary closure is often impossible and STSGs leaves a thin, insensate, and often aesthetically displeasing result. Gradual mechanical dermal apposition has been used with increasing frequency and efficacy.¹⁰ There are different techniques of gradual closure of fasciotomy wounds. Closure can be achieved by placing staples at the edges then a large nylon suture is threaded through the staples in a pattern similar to the lacing of a shoe which are gradually tightened daily till closure.⁸ Subcuticular prolene suture which are gradually tightened have been used for the delayed primary closure.⁹

The skin – stretching device produced excellent functional and cosmetic wound closure results and eliminated the need for additional operative procedures.² Vacuum – assisted wound closure dressing is an alternative to more traditional closure techniques such as suture retention devices and STSGs.¹¹ Vacuum – assisted dermal recruitment,¹² Canica Wound Closure System,¹³ Wise bands device,¹⁴ Silver Bullet Wound Closure Device¹⁵ and Sure-Closure device¹⁶ have been used for delayed primary closure of fasciotomy wounds in order to avoid STSGs, multiple surgical procedures and complications. Wound complica-

tions and need for skin grafting are more in lower extremities, vascular injuries, fasciotomies performed prophylactically, and delay of more than eight hours.¹

We used Pasha Device made from components of Ilizarov set to close fasciotomy wounds. To our knowledge this is the first presentation in literature to close such wounds using this method.

Patients and Methods

This study was conducted in Combined Military Hospital Peshawar for 7 months from August 2011. The patients with fasciotomy wounds needing delayed primary closure were included in the study. A Performa was made for each patient. The consent for study was taken from patients and hospital ethical board.

A new modified Device from Ilizarov set was used. Locally made K-wires were passed subcutaneously / subdermally along the long axis of fasciotomy wound. These were bent at 15 – 20 degree to clear skin then fixed to threaded rods with cannulated bolts (Fig. 1). The patients were operated under regional or general anaesthesia. A vacuum suction vacuum pack was applied as needed on individual basis. The rods were compressed till patient get tightening effect on skin on first post operative day. K-wires were gradually compressed at rate of 1 – 2 millimeter twice a day thereafter. The patients were advised quantitative weight bearing¹⁷ and self range of motion exercises. The fixator pins were cleaned with a set protocol.¹⁸ Once the fasciotomy defect was approximated, delayed primary closure done. Patients were followed after one, two and four week. The complications were classified into category I minor, II major and III sequelae.¹⁹

Results

All of our patients were male. The average age was 30.3 years, the youngest being 20 and eldest 45 years. 3 patients had Castillo grade IIIC open fractures, 3 had GIIIA, 1 had GII and 2 had closed. The aetiology was high energy bullet injury in 3, road traffic accidents in 5 and bomb blast splinters in 1. Tibia was affected in 5 cases, Femur in 3 and ankle 1 case. Therapeutic fasciotomy was done in 6 and prophylactic in 3 cases due to arterial repair in thigh (Fig. 2). Fasciotomy was done at mean interval of 11.7 hours after injury range 23 – 2. The mean time between fasciotomy and application of Device was 5.22 days range 8 – 0. The mean length

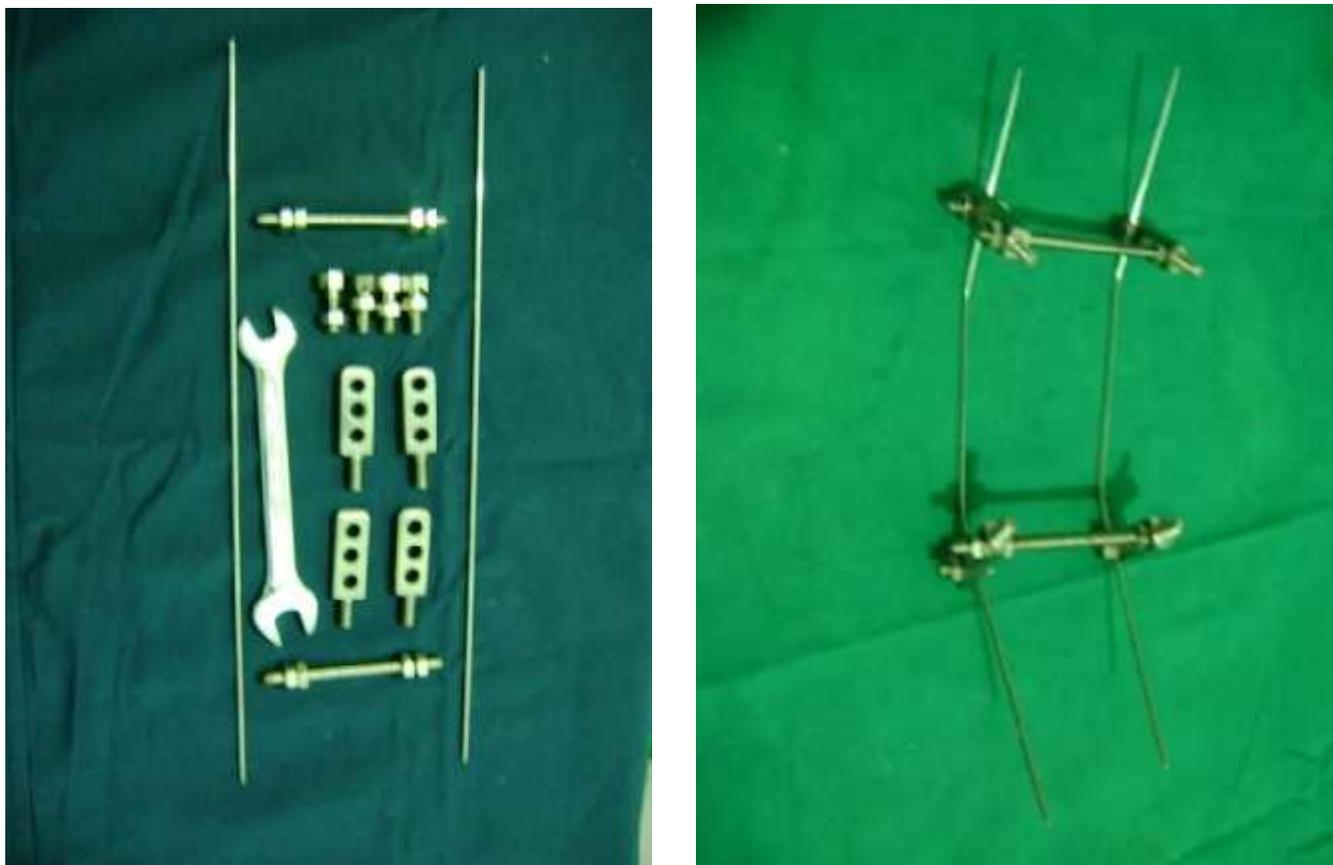


Fig. 1: Component and assembled Pasha Device.



Fig. 2: Device applied in Prophylactic fasciotomy.

of fasciotomy was 19.4 cm range 24 – 17 and breadth 5.75 range 7 – 4.5. The femur fractures were fixed with AO fixators in 3 patients tibia was fixed with Naseer Awais fixator in 3 (Fig. 3), Ilizarov fixator in 2 (Fig. 4) and AO fixator in 1. Vacuum suction pack dressings (Vac – pack Dressing) were applied on individual basis in 4 patients and in 5 non-suction dressings were done. We achieved delayed primary wound closure in

all 9 cases at fasciotomy. The mean time for wound closure was 6.66 days range 8 – 5. Pain during skin distraction was observed, mild in 2 and moderate in 2 according to graphic rating scale. We had 2 minor and 1 major complication. 1 patient had minor pin tract infection needing antibiotic and cleaning. 1 patient required sural flap to cover defect at ankle joint not related to fasciotomy wound (Fig. 5).



Fig. 3: Device applied with Naseer Awais Fixator.



Fig. 4: Ilizarov fixator with fasciotomy in open ankle fracture.



Fig. 5: Fasciotomy closure and sural flap.



Fig. 6: Minor complication.

Discussion

Closure of fasciotomy wounds is often a clinical problem, split – thickness skin grafts or regional composite grafts are used for fasciotomy closure. The functional and cosmetic results are ideal after delayed primary closure which is many time not possible due to excessive tension on the wound edges.² There are different methods to obtain delayed primary closure. Gradual mechanical dermal apposition has been used with increasing frequency takes 7 – 10 days for closure.¹⁰

In this study gradual, controlled dermatraction was done with Pasha Device which is simple, cheap, user friendly and components of which are already available to most of the orthopaedic surgeons. Kirschner wires were passed along edge of wound, which were

then approximated with threaded rod by tightening nuts. Delayed primary closure was done in mean 6.66 days in 18 (100%) fasciotomy wounds in 9 (100%) patients. The shoelace technique involves running a silastic vessel loop through skin staples placed at the skin edge and daily tightening of which permits gradual closure after 5 to 10 days.⁸ With closed dermatraction with vessel loops skin approximation system delayed primary closure time is 9 days.²⁰

Pasha Device allows full access to for re – look, curettage and debridement which can be obstructed by device components, silastic vessel loop in shoelace and zigzag running nylon thread in other methods. Dermatraction is controlled as it done by nut tightening on threaded rods and principle of tissue Ilizarov traction regeneration can be applied if done at a rate of 1mm in increments or more rapid skin traction using elasticity of skin. Using Canica device with initial wound size of 8.1 cm delayed primary wound closure was done in 91% patients with edge necrosis in 9 %.²¹

Vacuum assisted closure (VAC) also helps in fasciotomy wound closure.²² VAC can be combined with dermatraction with shoelace suture technique which achieves wound closure by progressive suture tightening.¹² VAC dressings can also be done with the new Device. VAC dressings were done in 4 cases combined with dermatraction.

One minor pin tract infections settled with conservatively were complication encountered (Fig. 6). There was no skin edges necrosis. Using Canica device there was 9% necrosis of the wound edges.²¹

Conclusion

Pasha Device can be effectively used to close fasciotomy wound to obtain delayed primary closure. The components of the device are already available in Ilizarov set. NPWT and further debridements can be done in its presence. This simple, cheap and user friendly method will aid general, plastic, vascular and orthopaedic surgeons in dealing closure of such wounds.

References

1. Velmahos GC, Theodorou D, Demetriades D, Chan L, Berne TV, Asensio J, et al. Complications and non-closure rates of fasciotomy for trauma and related risk factors. *World J Surg* 1997 Mar; 21 (3): 247-52.
2. Caruso DM, King TJ, Tsujimura RB, Weiland DE, Schiller WR. Primary closure of fasciotomy incisions

- with a skin-stretching device in patients with burn and trauma. *J Burn Care Rehabil* 1997 Mar; 18 (2): 125-32.
3. Sawyer JR, Kellum EL, Creek AT, Wood GW, III. Acute compartment syndrome of the hand after a wasp sting: a case report. *J Pediatr Orthop B* 2010 Jan; 19 (1): 82-5.
 4. Slabaugh M, Oldham J, Krause J. Acute isolated lateral leg compartment syndrome following a peroneus longus muscle tear. *Orthopedics* 2008 Mar; 31 (3): 272.
 5. Papalambros EL, Panayiotopoulos YP, Bastounis E, Zavos G, Balas P. Prophylactic fasciotomy of the legs following acute arterial occlusion procedures. *Int Angiol* 1989 Jul; 8 (3): 120-4.
 6. Echtermeyer V. (Compartment syndrome. Principles of therapy). *Unfallchirurg* 1991 May; 94 (5): 225-30.
 7. Kolman J, Slavik M, Soukup B. (Compartment syndrome in fractures of the shin). *Acta Chir Orthop Traumatol Cech* 1990 Apr; 57 (2): 127-37.
 8. Berman SS, Schilling JD, McIntyre KE, Hunter GC, Bernhard VM. Shoelace technique for delayed primary closure of fasciotomies. *Am J Surg* 1994 Apr; 167 (4): 435-6.
 9. Chiverton N. A new technique for delayed primary closure of fasciotomy wounds. 2000 Jan.
 10. McKenney MG, Nir I, Fee T, Martin L, Lentz K. A simple device for closure of fasciotomy wounds. *Am J Surg* 1996 Sep; 172 (3): 275-7.
 11. Lee AT, Fanton GS, McAdams TR. Acute compartment syndrome of the thigh in a football athlete: a case report and the role of the vacuum – assisted wound closure dressing. *J Orthop Trauma* 2005 Nov; 19 (10): 748-50.
 12. Van d, V. VADER (vacuum – assisted dermal recruitment): a new method of wound closure. 2005 Dec.
 13. Cin AD. Scalp expansion with the Canica Wound Closure System: First case report. 2006.
 14. Barnea Y. Delayed primary closure of fasciotomy wounds with Wisebands, a skin – and soft tissue-stretch device. 2006 Jun.
 15. Medina C. The use of an innovative device for wound closure after upper extremity fasciotomy. 2008 Jun.
 16. Narayanan K. Simultaneous primary closure of four fasciotomy wounds in a single setting using the Sure-Closure device. 1996 Jul.
 17. Pasha IF, Abid Q, Ahmed M, Zaidi R, Zaka U. Partial Weight Bearing; New Quantitative Approach. *Pakistan Armed Forces Medical Journal* 2010 Jul 3; 1 (60): 73-8.
 18. Pasha IF, Zaidi SR., Ahmed M., Abid Q. Pin Tract Care in Locally Made External Fixators; A New Treatment Protocol. *Pakistan Armed Forces Medical Journal* 2009 Jun; 59 (3): 170-4.
 19. Barreto BV, Caton J, Merbat Z, Panisset JC, Pracros JP. Complications of Ilizarov leg lengthening: a comparative study between patients with leg length discrepancy and short stature. *Int Orthop* 2007 Oct 10; 31 (5): 587-91.
 20. Janzing HM. Dermatotractor: an effective technique for the closure of fasciotomy wounds: a preliminary report of fifteen patients. 2001 Aug.
 21. Singh N. Dynamic wound closure for decompressive leg fasciotomy wounds. 2008 Mar.
 22. Webb LX. New techniques in wound management: vacuum – assisted wound closure. 2002 Sep.