International Journal of Research in Orthopaedics
Shihora U et al. Int J Res Orthop. 2018 Mar;4(2):271-273
http://www.ijoro.org

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20180678

Efficacy of negative pressure wound therapy in open tibial fractures: a prospective study

Umang Shihora[1], Bimal Modi[2]*

Department of Orthopedics, [1]Gujarat Adani Institute of Medical Science, Bhuj, Kutch, [2]GMERS Medical College, Gandhinagar, Gujarat, India

Received: 11 August 2017
Revised: 12 October 2017
Accepted: 13 October 2017

***Correspondence:**
Dr. Bimal Modi,
E-mail: researchguide86@gmail.com

ABSTRACT

Background: Open fracture of tibia is a surgical crisis. This study aims to discover out the efficacy of negative pressure wound therapy in these fractures.
Methods: Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat. 35 patients with type III open Tibia fractures, managed with wound debridement and external fixation were divided in two groups of 17 and 18 as Group A and Group B.
Results: The incidence of wound infection was fewer and wound coverage was enhanced in Group A ($p \leq 0.05$) when compared to Group B. Wound healed before and hospital reside was not as much of in Group A ($p > 0.05$).
Conclusions: Early on management with debridement after VAC (vacuum assisted closure) therapy has abridged wound infection rate and instance for soft tissue coverage in patients with open fracture tibia.

Keywords: Bhuj, External fixation, Fracture, Tibia

INTRODUCTION

The yearly occurrence of open fractures of long bone has been predictable to be 11.5 per 1, 00,000 persons with 40% happening in the lower limb of which Tibia is the mainly fractured long bone with occurrence of around 11–26 fractures per 100,000 populations per year.

Infection rates of open tibial fractures have traditionally been renowned as 10–20 times that of additional open skeletal fractures and deep infection rates range between 8-12%.[1] It has been established that open fractures need early bony stabilization and soft tissue reform.[2] Unluckily, primary soft tissue exposure is not all time probable in an keen setting for frequent motives. Negative pressure wound therapy (NPWT) is a method to achieve wound closure or manage the wound bed for additional surgical intercessions.[3] It aids remedial by maintaining a wet wound environment, rising local blood flow, dropping infection. Before accomplishment of wound closure or plastic surgical exposure, additional debridement of non-viable tissue may be required. NPWT seals the wound from the hospital environment, acts as a provisional dermal substitute, and stops bacterial access to the wound bed, thus presenting defense from nosocomial contaminants and endorse local wound perfusion and drainage.

The VA Negative pressure wound therapy system is made up of 4 major components. Present study evaluates the rate of wound infection, primary wound exposure and hospital wait and curative of soft tissue injury connected with open fractures managed with two dissimilar standard techniques.

METHODS

Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat from May 2014 to December 2014. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. The present study is a prospective study of 35 patients aged more than 16 years, treated by external fixation in the Department of Orthopaedics at Gujarat Adani Institute of Medical Science, Bhuj.

Patients who had anastomotic sites or nerve; those with connected neurovascular injuries were excluded from the study. They were divided in two groups. Group A (VAC group) had 17 participants and Group B (sterile dressing group) had 18 participants. All these patients were treated with wound debridement and external fixation. This was followed by application of VAC in Group A and sterile dressings for group B patients. Infected wounds were managed with wound care and parenteral antibiotics based on pus culture and sensitivity report.

To get vacuum support closure of the wound, a polyurethane open celled sponge acquired from upholstery shop, which was cut to contest the shape of the wound and autoclaved was utilized. The whole dressing was enclosed by a fanatic clear plastic film to create it air taut. The suction tube is now associated to the suction equipment which was made to work cyclically 20 minutes every 2 hours to get cyclical negative pressure at the wound site.

Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. Descriptive statistics included computation of percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively. Chi-square/Fisher exact test has been used to find the significance of study.

RESULTS

The participants included 29 males and 6 females. The mean age was 44.23±12.56 years. 10 patients had type III A tibia fracture and 25 patients had type III B tibia fracture. There was a significant difference between the two groups in the rate of wound infection ($p \leq 0.05$).

Wound coverage was attained within 3 weeks in 5 patients of group A and 11 patients in group B. Significant difference was observed in wound coverage between Group A and Group B (p=0.001). Wound completely healed within 6 weeks in 14 patients of group A and 8 patients of group B.

Table 1: Sex distribution of the participants.

Gender	Number	Percentage (%)
Male	29	82.85
Female	6	17.14

Table 2: Type of fracture among study participants.

Fracture type	Number	Percentage (%)
Type III A tibia fracture	10	28.57
Type III B tibia fracture	25	71.42

Table 3: Wound infections in the study population.

Wound infection	Group A	Group B
Present	5	11
Absent	12	7

DISCUSSION

The actions essential the development in wound healing pragmatic with VAC can be generally classified as primary mechanisms and their associated secondary effects. Overall, 4 primary mechanisms of action proposed include: There are also numerous minor things counting angiogenesis, neurogenesis, granulation tissue formation, cellular proliferation, differentiation, and migration.

Formerly primary wound closure was evaded in open tibia fracture followed by research screening that chief internal fixation and wound closure gives fine results.[4,5] Modern researches observed that towards radical debridement, immediate fracture stabilization and immediate definitive coverage offers good results.[6] A variety of surgical techniques have been developed to obtain soft tissue coverage.[7]

A number of former studies have evaluated NPWT with WTD dressings in this setting.[8-10] Stannard et al in their study showed that the NPWT group showed significantly fewer infections than the control.[10] A further study by Sinha et al randomized 30 open musculoskeletal injuries to NPWT dressings distorted every 3-4 days or normal dressings every day.[11] Every time the dressings were changed, dimensions were taken and at day 4 and 8 post-initial debridement, tissue biopsies were taken for histopathological study. They observed a significantly reduced wound size and a decrease in bacterial augmentation in the NPWT group and significantly enlarged angiogenesis, granulation tissue and fibrosis.[9] Blum et al retrospectively evaluated 229 open tibia fractures with 72% receiving NPWT and 28% conformist dressings and found a significantly abridged profound infection rate in the NPWT group by approximately 80%.[12] Early NPWT animal model studies by Lalliss et al showed condensed bacterial loads of *Staphylococcus*

aureus and *Pseudomonas aeruginosa* respectively.[13] Appliance of NPWT to a recently laid down skin graft explains development in graft incorporation utilizing a pressure range between -50 to -80 mm Hg. The success or failure of NPWT versus gauze dressings could be prejudiced by the fixation method. Infection rates reported was not full whether it was minor to bony stabilization or not. It was not determined if the method and sequence of bony stabilization had any relationship with the generally infection rates. The results of the present study are similar with that of the earlier studies in terms of stoppage in wound coverage, final curative and hospital wait.

CONCLUSION

Sufficient early on debridement followed by appliance of primary VAC has condensed wound infection rate, time gap between soft tissue cover and first wound and period of hospital stay in patients with rigorous soft tissue injury connected with open tibia fractures. Early wound healing present's psychological, social and financial reimbursement to the patient by tumbling the hospital stay and allow early on arrival to usual life. The technique utilizes simply obtainable and reasonably priced materials and is effortlessly reproducible in any hospital setting.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: Retrospective and prospective analyses. J Bone Joint Surg Am. 1976;58:453–8.
2. Godina M. Early Microsurgical Reconstruction Of Complex Trauma Of The Extremities. Plastic Reconstructive Surg. 1986;78(3):285-92.
3. Argenta L, Morykwas M. Vacuum-Assisted Closure: A New Method for Wound Control and Treatment. Annals Plastic Surg. 1997;38(6):563-77.
4. Griffiths R, Russell GG, Henderson R, Arnett G. Primary or delayed closure for open tibial fractures. Plastic Reconstructive Surg. 1991;87(3):596.
5. Veliskakis KP. Primary Internal Fixation in Open Fractures of the Tibial Shaft. J Bone Joint Surg Br. 1959;78(3):342–54.
6. Sinclair JS, McNally MA, Small JO. Primary free flap cover of open tibial fractures. Injury. 1997;28:581-7.
7. Narayanan K, Futrell JW, Bentz M, Hurwitz D. Comparative clinical study of the sureclosure device with conventional wound closure device with conventional wound closure techniques. Ann Plast Surg. 1995;35:485-91.
8. Feleischmann W, Strecker W, Bombelli M, Kinzil. Vacuum sealing as treatment of soft tissue Damage in open fractures. Unfallchirug. 1993;96(9):488-92.
9. Lee HJ, Kim JW, Oh CW. Negative pressure wound therapy for soft tissue injuries around the foot and ankle. J Orthop Surg. 2009;4:14.
10. Stannard JP, Robinson JT, Anderson ER, McGwin GJR, Volgas DA, Alonso JE. Negative pressure wound therapy to treat hematomas and surgical incisions following high-energy trauma. J Trauma. 2006;60(6):1301-6.
11. Sinha K, Chauhan VD, Maheshwari R, Chauhan N, Rajan M, Agrawal A. Vacuum assisted closure therapy versus standard wound therapy for open musculoskeletal injuries. Adv Orthop. 2013:245(9):40.
12. Blum ML, Esser M, Richardson M, Paul E, Rosenfeldt FL. Negative pressure wound therapy reduces deep infection rate in open tibial fractures. J Orthop Trauma. 2012;26(9):499-505.
13. Lalliss SJ, Stinner DJ, Waterman SM, Branstetter JG, Masini BD, Wenke JC. Negative pressure wound therapy reduces Pseudomonas wound contamination more than *Staphylococcus aureus*. J Orthop Trauma. 2010;24(9):598-602.

Cite this article as: Shihora U, Modi B. Efficacy of negative pressure wound therapy in open tibial fractures: a prospective study. Int J Res Orthop 2018;4:271-3.