ORIGINAL RESEARCH PAPER
Volume-8 | Issue-9 | September - 2019 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

TREATMENT OF SOFT TISSUE INJURIES IN GUSTILO ANDERSON GRADE IIIB OPEN FRACTURES BY VACUUM ASSISTED CLOSURE THERAPY A CASE SERIES

Orthopaedics

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ABSTRACT

Gustilo Anderson compound grade III B fractures have severe soft tissue contamination along with the exposure of the fracture bones to the surrounding environment. Usually the management protocol for wound or soft tissue contamination include wound debribment followed by regular dressing with antibiotic coverage which would take a prolong duration of time for the control of infection. Our main aim is to find out the importance of Vacuum Assisted Closure (VAC) in contaminated wound management with bone or tendon exposure and if there is any difference between the conventional methods or in Vacuum Assisted Closure methods regarding early control of infection, healing of soft tissue etc. In this prospective study we have recruited 20 cases of Gustilo Anderson compound grade IIIB fractures who came to Sree Balaji Medical College And Hospital, Chennai from January 2015 to December 2018. VAC therapy was given to see the time taken for a healthy granulation tissue to cover the soft tissue injury and followed by split skin grafting was done. We found out that out of 20 cases, 14 cases had a good outcome of SSG which was 90% to 95% of taken up. 6 cases had SSG failure and local flap coverage was done. We came to a conclusion that Vacuum Assisted Closure helps in early formation of granulation tissue compared to the other methods.

KEYWORDS

open fracture, Gustilo Anderson compound grade IIIB fractures, Vacuum Assisted Closure (VAC)

INTRODUCTION:

Open fractures are becoming very common in today's clinical setting, especially Gustilo Anderson IIIB/C open fractures. It is very difficult to treat patients who have serious fractures with crushing of surrounding soft tissue. In addition, open fractures also results with other complications like osteomyelitis, soft tissue necrosis, wound infection, bone nonunions etc .In extremely badly contaminated wounds patients need to be hospitalized for a long period of time along with temporarily closure of the wounds.

There are several methods for fracture with soft tissue injuries management .However, the results of treatment for these injuries is often unsatisfactory. Repeated debridement, bone handling, bone grafting, and replacement of external fixators are often necessary for the treatment of this type of fracture. Hence a good outcome for these fracture injuries has a tough challenges for microscopic surgeons ,orthopedic surgeons, and plastic surgeons[1].

VAC creates a suction force and hence by using a negative pressure principle there will be wound drainage which helps in early wound healing, which is shown in many research articles [2–9]. This negative pressure created which eliminates excess fluids in turn increases capillary permeability and also reduced the bacterial content.

MATERIALS AND METHODS:

All the patients had given a written consent for publication of there clinical and radiological data and appropriate clearance was obtained from the institute's research and ethical committee.

Our main aim of our case series is to assess the efficacy and the functional outcomes by using Vacuum Assisted Closure (VAC) in Gustiloanderson compound grade IIIB fractures. This is a prospective case series study of Gustiloanderson compound grade IIIB fractures reporting at the Department of Orthopaedics at Sree Balaji Medical College And Hospital, Chennai from January 2015 to December 2018. Recruitment of cases stopped in December 2017, so that the follow up time is for a minimum of 12 months, while the recruitment of patients was for 36 months .We have taken 20 cases of Gustilo Anderson compound grade IIIB fractures.

INCLUSION CRITERIA:

- Both men and women in age group of 20 to 80 years were taken in the study
- Gustilo Anderson compound grade III B fractures.
- Injuries within 7 days.

EXCLUSION CRITERIA:

- Patients not fulfilling the above inclusion criteria were excluded.
- Other Gustilo Anderson grade fractures
- Pathological fractures
- Injuries after 7 days

As soon as the patient came to our institution wound swab for sensitivity and culture was taken. Through wound wash with 5 liters of normal saline was given followed by betadine wash and sterile dressing was done Patient was taken up for emergency OT, under anesthesia again wound wash was given with 5 liters of normal saline and with betadine solution. Wound debribment was done .Intraoperative samples were collected for sensitivity and culture again and fracture was stabilized with external fixators. This was followed by parenteral broad spectrum antibiotics was given in the OT which was continued postoperatively until definitive culture and sensitivity reports are available. Specific parenteral antibiotics were given for 2 week and later changed to oral antibiotics till infection subsided. Regular dressing was done from postoperative day(POD) 1 and Vacuum Assisted Closure (VAC) was started from POD 3 and continued till a healthy granulation tissue cover is seen. Regular wound swab for sensitivity and culture was taken to asses the control of infection. Blood investigations like ESR and CRP was done every 10 days. After achieving a healthy granulation tissue coverage split skin graft was done. If the SSG failed patient was again taken up for wound debribment and VAC therapy was given and if the granulation tissue area coverage was not obtained with exposed bone then flap coverage was done.

RESULTS:

Table 1: Age and sex distribution.

Age	Male 'n' (%age)	Female 'n' (%age)
20-29	1 (8.3%)	-
30-39	3 (25%)	1(12.5%)
40-49	5 (41.8%)	3 (37.5%)
50-59	1(8.3%)	2(25%)
60-69	1(8.3%)	1(12.5%)
70-89	1(8.3%)	1(12.5%)
TOTAL	12 (60%)	8 (40%)

Table 2: Site of wound.

SITE	'n'	PERCENTAGE %	RIGHT 'n'	LEFT 'n'
ULNAR & RADIUS OR FOREARM	3	15	3	-

FEMUR OR THIGH	4	20	2	2
TIBIA & FIBULA OR LEG	11	55	8	3
FOOT	2	10	1	1
TOTAL	20		14(70%)	6(30%)

Table 3: Size of wound..

SIZE (in cm)	BEFORE VAC 'n' (%age)	AFTER VAC 'n' (%age)
5-8	4(20%)	10(50%)
9-12	11(55%)	7(35%)
13-16	3(15%)	2(10%)
17-20	2(10%)	1(5%)
TOTAL	20	20

Table 4; Time period taken for wound to heal.

TIME (In weeks)	BONE 'n' (%age)	TENDON 'n' (%age)	BONE & TENDON 'n' (%age)	TOTAL TIME 'n' (%age)
2-3	1	1	-	2(10%)
4-5	7	2	5	14(70%)
6-7	2	1	-	3(15%)
8-9	-	-	1	1(5%)
TOTAL	10 (50%)	4(20%)	6(30%)	20

In the 24 months of recruitment we could enroll 20 patients who satisfied our inclusion criteria. Of these 20 patients, there were 60% (n = 12) males and 40% (n = 8) females. There was a preponderance of right sidedness in 70% of cases. Major part of limb involved was leg or tibia and fibula bone of 55% (n=11) followed by lesion around the thigh or femur bone of 20% (n=4). When compared between the wound size there is significant reduction from the time of injury and after using VAC, the maximum reduction was seen when the size was between 5cm to 8 cm from 20% to 50% as shown in Table 3.

In this case series we have compared the time taken for the wound to heal over bone, tendon and both bone and tendon as shown in Table 4 which shows that most of the time taken is from 4 weeks to 5 weeks followed by 6 to 7 weeks.

DISCUSSION:

When there is a disruption to a normal anatomical form and function it is called a wound [10]. A wound can vary from a simple abrasion or it can extend into deeper anatomical structures like muscle, tendons, bone and even organs etc[11]. Wound healing or soft tissue management plays a major role especially in open fracture injuries of Gustilo Anderson type of compound fractures[12].

From orthopaedic point of view bone and surrounding soft tissue go hand in hand, soft tissue management is most important factor for fracture healing and also it acts as a barriers to protect the bones hence dealing with open fractures healing of the soft tissue is needed as soon as possible. There are various methods for wound healing management like local antiseptic agents, hyperbaric oxygen etc., but there is always a new methods in wound management which should be more efficient and to get faster better results of wound healing[13]. One of these methods are negative pressure wound therapy (NPWT) using the vacuum assisted closure (VAC) and its used for wound management was first described by Fleischman et al; [14].

Our main objective of this case series was to find out if VAC helps in early and better wound or soft tissue injury management in cases with open fractures. There are systemic and local factors which affects would healing as given by Gogia PP [15] like local vascular compromise, Inadequate matrix proteins and locally acting growth factors, no proper migration of macrophages and their composition etc. if these factors are not addresses to a proper care the wound might turn into a chronic infection [16], which might lead to non union of fracture. When a fracture happens with soft tissue damage there will be significant periosteal blood supply. VAC mainly helps in targeting these issues locally, but the accurate mechanism of action is still not known, but various hypothesis have been proposed. One of them are by applying negative pressure will remove the excess fluids which are known to obstruct the microcirculation and help in clearing locally accumulated toxins and also increase the oxygen supply. After applying the negative pressure, micro tissues had been shown to be drawn into a foam contact dressing which causes mechanical stress and intern helps in the process of angiogenesis and tissue growth which will lead to better capillary permeability and hyperaemia [7]. Locally there will be increase in protein and matrix molecule synthesis and hence the cell proliferation rate also increases by mechanical deformation of cells [17].

In our case series there is significant decrease in wound size after VAC application along with less hospital stay. Majority of our cases took an average time taken for a healthy granulation tissue to develop over the bone was between 4 weeks to 5 weeks. Research studies done by Joseph et al; [18], Morykwas and Argenta [19]have said that VAC is a better option in reducing the wound width over the time compared to the standard regular wound dressings. Morykwas et al; also had found that VAC lowers the number of organisms per gram of tissue [19] thus VAC therapy also provides a sterile environment to the fracture In open fracture the VAC helps in converting open type into a temporary closed type mechanically with negative pressure uniformly applied over it.

One of the main disadvantages is that economically vacuum system treatment is expensive but has a lesser hospital stay when compared with regular saline dressings which take longer duration for wound healing. [20, 21].

CONCLUSION:

Vacuum assisted closure therapy has a better outcome in treatment of soft tissue coverage compared to a regular dressing. After the initial debridement to the wound, VAC helps in increasing the rate of granulation tissue formation with an additional advantage of local decrease in bacteria.

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