Bezawit Teferi, Biruk Lambisso, Geletaw Tessema, Tesfaye Guddisa, Loch Trimingham. *Ethiop Med J, 2020, Vol. 58, Supp. 3*

ORIGINAL ARTICLE

ASSESSMENT OF NEGATIVE PRESSURE WOUND THERAPY FOLLOWUP AND REPORT INITIATIVE IN TIKUR ANBESSA SPECIALIZED HOSPITAL

Bezawit Teferi, MD[1]; Biruk Lambisso, MD[1]; Geletaw Tessema, MD[1]; Tesfaye Guddisa, MA,BSc[2], Loch Trimingham, MD[3]

ABSTRACT

Introduction-*Negative pressure wound therapy is a way of treating wounds using a vacuum-assisted system that is applied over the wound bed and helps expedite wound healing process.*

Objective-*The objective of this study is to understand the contents of Negative pressure wound therapy reports in Tikur Anbessa Specialized Hospital.*

Method-*Patients who have been admitted to Orthopedics ward for various musculoskeletal pathologies and treated with wound Vacuum assisted therapy (VAT) have been included in this study Descriptive analysis of these case series was performed with data obtained from nursing follow-up forms and serial pictures.*

Result-*The report included 28 patients, out of whom 18 were men, and 10 were women.71% of patients were between the age of 15-49, 4 patients between the age of 50-65, 2 pediatric patients under 15 years and 2 patients above the age of 65. More than half of the patients ,52 %, in the report had dressing changes up to 5 times and 48% required between 5-10 times. According to the report the most common cause of injury is road traffic injuries, 16 patients. The second most common cause is bullet injury, followed by falling down accidents in 4 patients. The average percentage of reduction in size was 49%, with a maximum of 94% on one patient, and a minimum of 0 % on 5 patients. Wounds were covered with primary closure in 11, secondary intention in 10, and skin graft was done for 7 patients. The report did not include other parameters.*

Conclusion-*Reporting of patient progress on negative pressure wound therapy needs to be more detailed, inclusive of more variables, and this requires creating a formal database to be used uniformly among care givers.*

Keywords- *Negative pressure wound therapy, wound healing, Trauma*

INTRODUCTION

Treating patients with a high degree of soft tissue injury is a common practice in a day to day practice in orthopedics. With the increasing number of patients sustaining trauma to the soft tissue together with different degrees of skeletal injuries, creating an effective wound care strategy is very critical. Negative Pressure Wound Therapy (NPWT) has been proved to be an effective tool to wound care as it decreases wound exudates and edema, increases the formation of new blood vessels, potentially minimizes the number of contaminating bacterial colony in the wound, and decreases the wound size significantly which allows for early definitive care (1). It can be used to treat a wide range of both acute traumatic, burn, surgical wounds, and chronic difficult to treat pressure ulcers.

Since the first report of NPWT device use in 1997 by Argenta and Morykwas, there has been a lot of change in the design but the basic structural framework of this device includes a foam dressing that will be applied on the wound which will shrinks while absorbing moisture out of the wound bed with the application of pressure, an electrically driven power source that creates the optimum preset pressure conducive to wound healing, and a connecting tube that is attached to both ends (2). It is possible to apply this device either intermittently or continuously.

Continuous application results in a faster wound healing but causes more pain and discomfort to the patient, the continuous application allows the negative pressure wound therapy to be applied at a set pressure constantly for the set period (2,3). The most crucial part of the use of Negative pressure wound therapy is to make sure that the vacuum seal is intact and the pressure is optimal (2).

It has been shown that using NPWT is practical and important in low-income countries as it decreases the length of hospital stay, and is patient-friendly (2). Studies show that NPWT decreases the time taken for a wound to heal compared to conventional methods but has a higher material cost (4).

[1],Department of Orthopedics and Traumatology, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia. [2]Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.[3] Foot and Ankle ambulatory sugary center, USA.
*Corresponding Author E-mail: bezawittsegaye1987@gmail.com

In spite of evidences supporting the use of NPWT, many low-income countries including ours is still a long way from implementing NPWT as a primary wound care method due to the expensive price of the devise and issues on availability including the need for manpower required to train caregivers, even if there are new initiatives undergoing in some Orthopedic centers in Ethiopia (5).

Following the progress of a wound after various types of wound care strategies involve some important parameters including wound bed clinical appearance (granulating, epithelializing, sloughing, necrotic), wound size measurement, wound edges (color, evidence of contraction), exudates, surrounding skin, presence of infection, and pain (6). One of the most important parameter to use in assessing the progress of wound healing is assessing the change in wound size over time, multiple alternatives have been studied according to inter and intra-observer reliability, ease of usage and, reproducibility including ruler measure, wound surface racing, computerized planimetry, digital image analysis, three-dimensional laser, optical coherence tomography, and light imaging (7). The commonly used parameter to follow wound progress in our setup is a clinical judgment by the physician seeing the degree of new granulation tissue formation, presence or absence of gross infection, amount of exudates from the wound bed, and subjective assessment of the wound size.

Assessing the wound size has been a subject of debate because wound surfaces have different shapes that do not fall into specific geometry and analyzing a three-dimensional wound using two-dimensional parameters underestimates the actual size of the wound (8). Measuring wound size using rulers have been easy to apply, cheap and fast but have been shown to overestimate measurements by 10-44% which increases with an increase in wound size, on the other hand, measurement using manual tracing, where a metric grid is used to measure the wound size by counting the numbers of squares covered under the surface area, has shown some inconsistencies in deciding the actual values of partially filled holes and proper cutting added to the fact that it is time consuming (8). Using photography to measure wound size by tracing wound edges from pictures using a ruler or any other calibrations has shown good inter and intra observer reliabilities despite some shortcomings including underestimation of size by about 10% especially in circumferential wounds or those found in curves areas. It also allows for repeated measurement and uses for any future reference as it can easily be stored and accessed (8).

It has been 9 years since the wound VAT initiative has been started in our department but reporting on the outcomes has not been done until after 8years following the new collaboration with Peace Health Wound care center, Seatle, USA, and the availability of new designs of NPWT. Five nurses who are trained to work with the NPWT appliance are in charge of applying NPWT, according to the suggestion by the physician in charge of the patient, and follow the progress. Continuous application at a constant pressure of 125mm-Hg is used and wound covers are changed every 48 hours. In this study, we are going to describe the profiles of patients who underwent treatment with NPWT with their wound profiles accessed through serial pictures. A total of 28 Patients are included in the study.

OBJECTIVES

The objective of this study is to understand the contents of negative pressure wound therapy reports in the department of Orthopedics. We also analyze potential drawbacks that are impeding efficacious reporting system.

PATIENTS AND METHOD

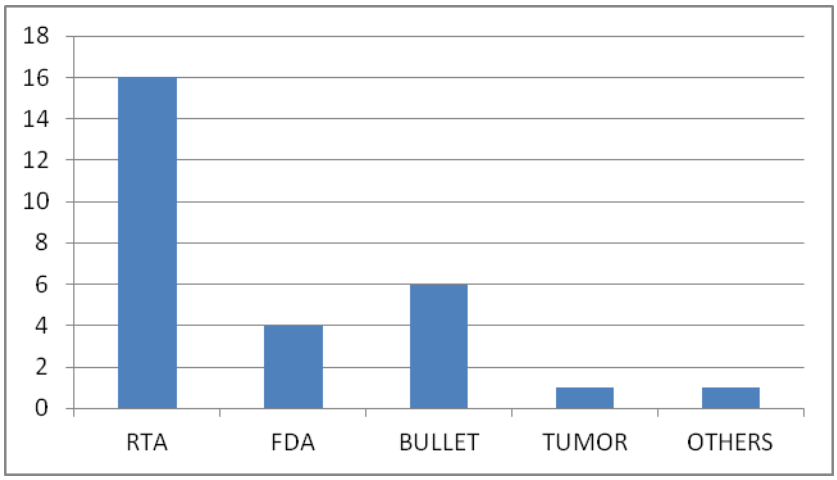
This study was conducted at the Tikur Anbessa Specialized Hospital, Department of Orthopedic and Traumatology. It has 75 beds specifically for orthopedic patients, and an outpatient clinic serving 11,945 Adult, 2812 Pediatric, and 2302 pediatric club foot patients a year. This study is a prospective descriptive study involving a cohort of 28 patients who were admitted in the department for different degrees of musculoskeletal injuries from February 2019 to September 2020, and has a progressive follow up picture of their wounds, taken after every wound care. Every patient with a follow up picture and progress report was included.

Demographic and medical data were collected from patients charts during their initial encounter with the responsible nurse in charge of wound care, consecutive wound pictures were taken with each change of wound VAC dressing were collected and wound size was measured in two of the longest dimensions (length and width) from the pictures. Verbal informed consent was collected from each patient during the time wound pictures were taken and the patients included have fully agreed on the terms of possible use of medical information and pictures for academic purpose and ethical clearance was granted by the department research committee. The data collected was analyzed in SPSS-23.

RESULT

Out of the 28 patients, 18 were men, accounting for 65% and 10 of them, 35%, were women. The age distribution of the patients includes patients aged 15-49 making up for 71%, there were 4 patients between the age of 50-65 years, we had 2 pediatric patients under 5 years and 2 patients above the age of 65.52 % of the patients had wound VAC changed up to 5 times using the intermittent method of application and 48% required between 5-10 times throughout their hospital stay.

The most common cause of injury is road traffic accident, 16 out of the 28 patients, accounting for 57%, the second most common cause is bullet injury-causing wounds in 6 patients, and falling down accidents in 4 patients, one patient had a tumor and another patient stick injury related wounds (Figure-1).



Key
•RTA-Road Traffic Accident

•FDA-Fall Down Accident

Figure 1: Summary of the most commonly reported causes of wounds requiring negative pressure therapy among patients in Orthopedics department.

The average percentage of reduction in size, as calculated from initial and final wound sizes, which were estimated from pictures of the wounds was 49%, there was a maximum of 94%, and a minimum of 0 % where there was no apparent change in the surface area of the wound on 5 patients, the wound beds were subsequently covered with primary closure in 2 patients, healing with secondary intention in 2 and skin graft was done for one patient. Out of the rest of 22 patients, 8 patients or 33% had up to 50% reduction in wound surface area and the rest 14 patients had more than 50% reduction.

Out of the 15 patients with more than 50% reduction of wound size only 4 of them, and from among patients with under 50% reduction only 3 out of the 13 patients required skin grafting for final closure (Table 1). There has been missing data on the type of emergency stabilization surgeries done for these patients, but 11 patients were reported to have external fixation done during their initial visits.

Table-1: Table summary of the correlation between the average change in size of wounds after negative pressure therapy, in percentage, with the final treatment required for wound closure.

Percent wound size change	**Final outcome of the wound**			
	skin graft	**primary closure**	**skin graft**	**Total**
0-49%	3	7	3	13
50-100%	4	3	8	15
	7	10	11	28

Ten patients underwent primary wound closure and 11 patients had healed with secondary intention the remaining 7 had surgery for coverage with skin graft after they completed the required numbers of negative pressure therapies. 6 out of the 10 patients whose wounds were treated with primary closure underwent a total of 5-10 VAC therapy and 7 out of the 11 patients healed with secondary intention had up to 5 rounds of VAC treatment. Of the 7 wounds closed with skin graft, 4 patients had 1-5, and the rest 3, 5-10 of VAC therapy changes in total.

DISCUSSION

A prospective descriptive study done on the pattern of injuries in public health facilities in Addis Ababa, Ethiopia which included 40,572 patients showed that road traffic injury is the most common cause of injury among 15-49 years old patients, even though fall down accidents were the commonest cause of injuries in general followed by road traffic (9). A cross-sectional study which was done to analyze the pattern of injury among trauma patients' different age and gender in southern Iraq also revealed 75% of the patients were between 15 to 44 year old, supporting the idea that most patients sustaining injuries are mostly young people (10).

A systematic review done on trauma in Ethiopia stated that the majority of traumas happen on the active group between 15-59 years of age and 2/3 occur in men with only a small percentage occurring in women (11). These studies show confirming more injury among the young age group, and males are supported by many studies. In addition the commonest causes of injury in our study including road traffic injury, and fall down accident are the most commonly encountered causes of injury .Bullet injury, even if it's one of the commonest causes in this study it doesn't reflect on the everyday encounter.

Even though our reports are done using the number of VAC sessions required to achieve target wound size and condition, it is difficult to compare the findings with the results of other facilities with similar experience as majority of the reports included the total days/ hours used instead of the number of VAC changes to compare outcomes. Calculating the percentage change in wound size was not standardized and reliable method of calculating the change in wound size was unavailable which is vital in tracking progress and understanding the effectiveness of wound care we provideOur reporting system lacked other important variables that should be included in the patient data including the time between injury and administration of antibiotics or surgical intervention like Incision and debridement, detailed characterization of the fracture and soft tissue injury, type of NPWT used, presence or absence of signs of infection, the progress of pain as reported by the patient, the total duration of hospital stay, number of operation room visits, effect it has on quality of life using patient-reported outcome measures, the total cost of inpatient service. In addition there is a need to establish standard method of collecting wound site pictures to be used by everyone following patients to decrease the difference in quality and coverage of pictures taken. It is beyond the scope of this study to focus on the variables with the most effect on patient outcome and progress on wounds but it will be utmost importance to be all inclusive in the reporting mechanism.

Conclusion – Even though Negative pressure wound therapy has been used in dealing with both traumatic and atraumatic wounds in the department there is no standard reporting and follow up system in place. Properly following each individual's progress and keeping a record is vital in understanding the shortcomings and improve. It appears more suitable to report the total number of VAC changes as the days required to have the wound clean and ready for definitive closure which will give a more reproducible way of following wound condition.

Recommendation –We recommend establishing a better wound care report system should include creating wound care only database where patients will be enrolled in since the first day of NPWT application with, important demographic and clinical data vital for follow up and future research activities. Wound pictures should be taken and uploaded and any change in wound parameters should be documented as well, and after the patient finishes NPWT the final outcomes including definitive wound coverage should be documented. This way a database that can uniformly be used in any facility that utilizes NPWT will be available for any future research and helps in understanding what our patients require to get effective wound care that improves their quality of life.

ACKNOWLEDGMENT

We acknowledge Dr.Lock Trimingham and his wound care team from Peace Health Wound care center for training our nurses, and residents and for providing us with VAC appliances.

Competing of interest-There is no conflict of interest.

REFERENCES

1. Robert N. Negative pressure wound therapy in Orthopaedic surgery. Orthop traumatol surg res 2017; 103 (1 suppl): 99-103.
2. Yadav V, Rawal G , Bax M. Vacuum assisted closure technique: a short review. Pan Afr Med J 2017; 28: 246-251.
3. Malmsjö M, Gustafsson L, Lindstedt S, Gesslein B, and Ingemansson R. The Effects of Variable, Intermittent, and Continuous Negative Pressure Wound Therapy, Using Foam or Gauze, on Wound Contraction, Granulation Tissue Formation, and In growth Into the Wound Filler . *Eplasty* 2012;11:42-54
4. Thompson G. An overview of negative pressure wound therapy (NPWT). *Br J Community Nurs* 2008; 13 (6 suppl): 23-30.
5. Sirisena R , Bellot G, and Puhaindran M . The Role of Negative-Pressure Wound Therapy in Lower-Limb Reconstruction, *Indian J Plast Surg* 2019; 52(1): 73–80.
6. Davidson K. Wound assessment and management. https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Wound_assessment_and_management/. Accessed on Aug. 26, 2020.
7. Bloemen M, Boekema B, Van M, Middelkoop Z. Digital image analysis versus clinical assessment of wound epithelialization: A validation study. *Burns* 2012; 38(4):501-505.
8. Chang A,Dearman B, and Greenwood J .A Comparison of Wound Area Measurement Techniques: Visitrak Versus Photography, *Eplasty* 2011; 11: 158-166.
9. Wolde A, Abdella K, Ahmed E, et al. Pattern of Injuries in Addis Ababa, Ethiopia: A One-year Descriptive Study. *East Cent Afr J Surg* 2008; 13(2): 14-22.
10. Bolandparvaz S, Yadollahi M, Abbasi H, Anvar M. Injury patterns among various age and gender groups of trauma patients in southern Iran: A cross-sectional study. *Medicine (Baltimore)* 2017; 96: 41-48.
11. Azaj A, Seyoum N, Nega B. Trauma in Ethiopia Revisited: A systematic Review, *East Cent Afr J surg* 2013; 18(2): 112-113.
12. Arti H, Khorami M, Nejad V. Comparison of negative pressure wound therapy (NPWT) &conventional wound dressings in the open fracture wounds**.** *Pak J Med Sci* 2016**;** 32(1): 65–69**.**