VACUUM-ASSISTED CLOSURE OF WOUNDS- AN EFFECTIVE METHOD FOR DIABETIC ULCERS

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ABSTRACT

BACKGROUND
Wounds are a major source of morbidity, lead to considerable disability and are associated with increased mortality; therefore, they have a significant impact on public health and the expenditure of healthcare resources. Vacuum-Assisted Closure (VAC) uses negative pressure to assist wound healing. Negative pressure drains fluid from the wound, thus removing the substrate for growth of microorganisms. Negative pressure may also accelerate granulation tissue formation and promote angiogenesis. The mechanical stimulation of cells by tensile forces may also play a role by increasing cellular proliferation and protein synthesis. Negative Pressure Wound Therapy (NPWT) involves the use of a negative pressure therapy or suction device to aspirate and remove fluids, debris and infectious materials from the wound bed to promote the formation of granulation tissue.

MATERIALS AND METHODS
A total of 50 cases clinically presenting as ulcer between January 2011 and July 2012 were taken for study. Each case was examined clinically in systematic manner as per the proforma drafted for study of all patients presenting with ulcer. VAC dressing was done, and outcome was measured by recording wound scores on days 3, 7 and 10.

RESULTS
In our clinical study of 30 cases managed by VAC dressing 63.3% of the cases were of traumatic, 13.3% iatrogenic and 23.3% cases of vascular aetiology. Wound healing was better in the controlled diabetic group compared to uncontrolled diabetic group. Commonest organisms isolated were Staphylococcus, Pseudomonas and Proteus.

CONCLUSION
In our study, VAC therapy enhanced granulation tissue formation leading to better wound healing and faster recovery. VAC is thus a promising new technology in the field of wound healing with multiple applications in a variety of wounds and can be used in both acute and chronic wounds, salvage procedures or as an adjuvant therapy to improve the results of various surgical procedures.

KEY WORDS
VAC, Negative Pressure Wound Therapy, Wound Healing.

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Exclusion Criteria
- Patients diagnosed as malignancies.
- Patients with venous ulcers.

Clinical examination of each case was done systematically as per the proforma drafted for the study.

Sequence of Procedure
Wound Preparation
Any dressings from the wound was removed and discarded. A culture swab for microbiology was taken before wound irrigation with normal saline. Surgical debridement was done and adequate haemostasis achieved. The wound was gently packed with saline. Any dressings from the wound was removed and discarded. A sterile, open-cell foam dressing was gently placed into the wound cavity.

Sealing with Drapes
The site was then sealed with an adhesive drape ensuring that the drapes covered the foam and tubing and at least three to five centimetres of surrounding healthy tissue.

Application of Negative Pressure
Controlled pressure was uniformly applied to all tissues on the inner surface of the wound using centralised vacuum pump, which could deliver either continuous or intermittent pressures ranging from 50 to 125 mmHg. The foam dressing was compressed in response to the negative pressure. The pressure was applied continuously for the first 3 days and changed as required thereafter.

The outcome was measured using wound scoring system consisting of area of wound covered with granulation tissue and its colour and consistency on each change of dressings.

Statistical methods applied include Kruskal-Wallis test. All the statistical calculations were done through SPSS 16.0 (2007) for windows.

RESULTS
An interventional study involving 30 cases of wound was done in the Department of Surgery, KR Hospital, Mysore between January 2016 and June 2017.

| Age in Years | N   | Mean | SD  | Median |
|--------------|-----|------|-----|--------|
| <40          | 11  | 5.09 | 0.94| 5      |
| 41-50        | 15  | 4.73 | 1.22| 5      |
| >50          | 15  | 4.87 | 1.06| 5      |
| Total        | 41  | 4.88 | 1.08| 5      |

Table 2. Age Wise evaluation of Wound Score on Day 7

Kruskal-Wallis test, p= 0.8.

Most of the patients presenting with wounds were in the 5th decade of life 13 cases (43.3%), followed by the 4th decade 10 (33.3%) and < 4th decade 7 cases (23.3%).

Wounds were more common in males 22 cases (73.3%) than in females 0 cases (26.7%).

Male: Female ratio was 2.75: 1.

| Frequency | Percent |
|-----------|---------|
| < 10 days | 7       | 23.3  |
| 10-30 days| 15      | 50.0  |
| > 30 days | 8       | 26.7  |
| Total     | 30      | 100.0 |

Table 3. Wound Duration

Based on the duration of wounds, cases were grouped into 3 categories: < 10 days, 10 – 30 days and > 30 days. Most cases fall in the group 10 – 30 days 15 (50%), 7 cases (23.3%) in the group > 10 days and 8 cases (26.7%) in the group of > 30 days.20-30

Wounds were most commonly located in the foot 15 (50%) followed by the leg 11 (36.7%). Gluteal area, ankle, sole and abdomen 1, each 3.3%. One case of wound in the abdomen was included. There was significant difference in wound healing in different location of wounds.

Based on aetiology of wounds, which were determined by history and clinical examination, wounds were divided into Traumatic, Latrogenic and Vascular. A major portion 19 (63.3%) of cases fell into traumatic group and 4 (23.3%) into iatrogenic and 7 (23.3%) into vascular group.

| Wound Area | Wound Score |
|------------|-------------|
| Total      | 36          |
| < 10 cm²   | 5           |
| 10-20 cm²  | 2           |
| > 20 cm²   | 1           |

Table 4. Wound Area Evaluation of Wound Score on Day 7

Wound area 21 - 40 sq.cm constitute maximum number of cases - 17 (56.7%).

Wound area has an impact on wound healing. Smaller the wound area, wound healing was better compared to larger wound area.

P value - 0.001

Most common organism cultured from the wounds was Staphylococcus aureus 14 (46.7%) followed by Pseudomonas and E. coli.
Following VAC therapy for 3 to 7 days, most of the wounds showed progress in wound healing.

Patients with blood sugar levels < 100, 100 - 150 showed initial good response by increased wound scoring, whereas sugar values > 150 had no positive wound healing response.
DISCUSSION

Delayed wound healing is a significant health problem and a challenge in the community setting, particularly in older adults with diabetes as co-morbidity. Often requires daily or more frequent hospital visits. With conventional wound-healing methods, it may take several months to heal the wound. In addition to the pain and sufferings, failure of the wound to heal also imposes social and financial burdens. Vacuum-Assisted Closure (VAC) therapy has been developed as an alternative to the standard forms of wound management, which incorporates the use of negative pressure to optimise conditions for wound healing and requires fewer painful dressing changes.31

Negative pressure therapy is an expensive treatment modality and because the costs are high, the recent consensus report suggests that use as a first-line therapy is inappropriate. However, others suggest that negative pressure therapy has the potential for saving money if it is used on the “right patients, the right wound, at the right time.”

The use of negative pressure therapy has been proposed as a novel method of manipulating the chronic wound environment to assist and accelerate wound healing. Although, initial clinical results are promising, the gap between available scientific evidence and everyday clinical practice does not give a balanced view of the appropriate use of negative pressure therapy.32

Although, most studies were probably too small to detect significant difference between wounds managed by conservative dressings and by VAC, some did show VAC to result in better healing than standard methods with few serious complications. VAC appears to be a promising alternative for management of wounds. VAC was also more effective at treating various chronic and complex wounds with a significantly greater reduction in wound volume, depth and treatment’s duration for VAC. It has the potential to reduce health care costs for both hospital and patients, and enhance patient satisfaction and quality of life.

Despite the early clinical success and widespread empirical introduction of VAC into clinical practice, it is not known exactly how it may exert effects on the wound. Several mechanisms have been proposed. VAC is said to increase local blood flow and reduce oedema and bacterial colonisation rates. It is thought to promote closure of the wound by promoting the rapid formation of granulation tissue as well as by mechanical and removes excess wound exudates, thus aiding in the creation of the “ideal wound healing environment.”33

In our study, following VAC therapy, wound scoring was done with scores from 1 - 7 given for area of granulation tissue, colour and consistency of granulation tissue. The wounds with scores > 5 following VAC therapy can be considered for skin graft. In the present study, > 70% cases showed wound scores > 5 following a week of VAC therapy.

The use of subatmospheric pressure dressings, available commercially as the VAC device, has been shown to be an effective way to accelerate healing of various wounds. The optimal subatmospheric pressure for wound healing appears to be approximately 125 mmHg. VAC has significantly increased the skin graft success rate when used as a bolster over the freshly skin-grafted wound. VAC is generally well tolerated and with few contraindications or complications is fast becoming a mainstay of current wound care.34

> 50% of cases among diabetic wounds and 30% of cases among smokers showed scores > 5 on day 7 of VAC therapy; thus, were showing slower healing in diabetics and smokers in spite of VAC dressings.

Diabetes mellitus is recognised as a risk factor for compromised wound healing. These data suggest that delayed healing in diabetes is associated with altered
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ations between VAC and standard dressings. More rigorous studies

wound types are required. Awareness about VAC and training on application

of VAC dressings will allow its utilisation more often.

CONCLUSION

VAC therapy is a recent modality of treatment of wounds. Its

introduction has changed the course of management of

wounds. Based on the data from the present study and other

studies available, VAC does appear to result in better healing

with few serious complications and thus looks to be a

promising alternative for the management of various

wounds. The application of VAC is simple, but requires

training to ensure appropriate and competent use. The cost

of VAC will vary and depend on the length of hospital stay

and cost of supplies. There is paucity of high quality RCTs on

VAC therapy for wound management with sufficient sample

size and adequate power to detect differences if any

between VAC and standard dressings. More rigorous studies

with larger sample sizes assessing the use and cost-

effectiveness of VAC therapy on different wound types are

required. Awareness about VAC and training on application

of VAC dressings will allow its utilisation more often.

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