



## ORIGINAL RESEARCH PAPER

## General Surgery

### OUTCOME OF NEWER MODALITIES OF MANAGEMENT IN CHRONIC NON-HEALING ULCER IN INDOOR PATIENTS OF THE SURGICAL DEPARTMENT OF A TERTIARY CARE HOSPITAL, SOUTH GUJARAT: A RETROSPECTIVE STUDY

**KEY WORDS:** Chronic non-healing ulcer, Diabetic foot ulcer, Venous stasis ulcer, Pressure ulcer, Vacuum-assisted closure (xVAC), Amnion dressing, Collagen dressing, Silver alginate, Wound healing.

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#### ABSTRACT

**Background:** Chronic non-healing ulcers of diabetic, venous, arterial, pressure and trauma are a substantial surgical burden and often respond poorly to conventional dressing alone. Newer local wound-care modalities, including vacuum-assisted closure (VAC), silver alginate, amnion dressing and collagen dressing, have been proposed to hasten wound-bed preparation, but comparative outcome data from Indian tertiary care settings are limited. **Aim:** To retrospectively assess the outcome of newer modalities of management in chronic non-healing ulcers, in comparison with conventional dressing, among indoor patients of the Department of General Surgery of a tertiary care hospital of South Gujarat. **Materials and Methods:** This retrospective observational study analysed 45 cases of chronic non-healing ulcer (diabetic, venous stasis, pressure, arterial and trauma ulcer) admitted over a one-year period, selected by convenient sampling. Case records were reviewed for socio-demographic profile, clinical presentation, type of surgical management, and dressing modality used (conventional, VAC, silver alginate, amnion or collagen dressing), and duration of hospital stay. Data were analysed using SPSS v26, and one-way ANOVA was used to compare mean hospital stay across dressing modalities, with  $p < 0.05$  taken as significant. **Results:** The mean age was  $48.4 \pm 15.6$  years, with a male preponderance (76%). Diabetic ulcer (33.4%) was the commonest presentation, followed by venous stasis ulcer (24.4%) and pressure ulcer (22.2%); diabetes mellitus (22.2%) was the most frequent comorbidity. Necrotic floor (88.9%) and discharge (68.9%) were the commonest examination findings, and debridement (44.5%) was the most frequently required surgical procedure. Conventional dressing was used in 37.8% of cases, while VAC, silver alginate, amnion and collagen dressing accounted for the remainder. Mean hospital stay was significantly longer with conventional dressing ( $51.1 \pm 16.3$  days) compared with VAC ( $16.5 \pm 4.3$  days), silver alginate ( $14.2 \pm 5.6$  days), amnion dressing ( $9.25 \pm 5.5$  days) and collagen dressing ( $8.8 \pm 3.2$  days) ( $p = 0.000$ ). **Conclusion:** Newer dressing modalities, particularly amnion and collagen dressing, were associated with significantly shorter hospital stay and, by inference, faster wound-bed preparation and healing than conventional dressing, and merit wider adoption in the management of chronic non-healing ulcers, subject to confirmation in larger prospective studies.

#### INTRODUCTION

Chronic non-healing ulcers pose a significant healthcare challenge globally, characterised by persistent skin defects below the knee level that resist healing for more than six weeks, often extending beyond three months [1,2]. These ulcers can arise from diverse factors such as venous or arterial insufficiency or a combination of both, diabetes, pressure, infections, skin malignancies, and autoimmune disorders [1,3]. Their deleterious effects include pain, infection, compromised mobility, and reduced quality of life. Prevalence rates are notable, affecting around 1% of the adult population and 3.6% of individuals over 65 years old, with even higher incidence observed in specific regions [4]. In India, the occurrence of chronic wounds is estimated at 4.5 per 1000 population [5].

The ramifications of chronic non-healing ulcers are profound, imposing a substantial socioeconomic burden due to frequent dressing changes, hospitalisations, and, in extreme cases, amputations, ultimately leading to poor quality of life and mental health. Approximately 80% of these ulcers are vascular in origin, while about 20-23% have complex causes such as vasculitis, pyoderma gangrenosum, and other autoimmune conditions [6]. Diabetes remains one of the major causes of non-traumatic amputation worldwide, with 15-25% of diabetics developing a foot ulcer, of which nearly 12% require lower extremity amputation, while venous disease accounts for almost 75-80% of all vascular ulcers [4,5]. Conventional treatment modalities for chronic ulcers include compression therapy, wound debridement, topical agents, skin grafts and vascular interventions; however, these are often limited by cost, slow healing and risk of recurrence. Newer modalities such as vacuum-assisted closure (VAC),

silver alginate, amnion dressing and collagen dressing have emerged as adjuncts that optimise the local wound environment, promote granulation and hasten epithelialisation. This study was undertaken to assess the outcome of these newer modalities of management in chronic non-healing ulcers among indoor patients admitted to the surgical department of a tertiary care hospital of South Gujarat, in comparison with conventional dressing.

#### AIMS AND OBJECTIVES

- To study the manifestations of various presentations of chronic non-healing ulcer (pressure ulcer, venous stasis ulcer, diabetic ulcer, arterial ulcer, traumatic ulcer).
- To study the various available newer modalities (VAC dressing, silver alginate, amnion dressing, collagen dressing) in comparison with conventional dressing, and to judge which is better in terms of healing, hospital stay, and rehabilitation.
- To determine the role of newer modalities in the treatment of chronic ulcer and to assess how these compare with conventional methods.
- To study the outcome and prognosis of chronic non-healing ulcer.

#### METHODOLOGY

##### Study Design, Setting and Sample Size

This was a retrospective observational study conducted in the Department of General Surgery of a tertiary care hospital of South Gujarat, over a period of one year. A total of 45 cases (approximately 4 cases per month) diagnosed with diabetic foot ulcer, venous ulcer, traumatic ulcer,

pressure ulcer and other chronic non-healing ulcers, and

admitted to the surgical wards, were included by convenient sampling.

### Inclusion and Exclusion Criteria

All patients aged 18 years and above admitted with diabetic ulcer, venous ulcer, traumatic ulcer and other chronic ulcers were included. Patients below 18 years of age, ulcers as a sequel of leprosy, ulcers in immunocompromised patients, and any ulcer present for less than two weeks were excluded.

### Methodology

Case details were collected from case record forms available in the medical records section of the hospital. Socio-demographic details (age, gender), full history, clinical examination, mode of presentation (cellulitis, abscess, necrotic floor, underlying abscess), radiological investigations, laboratory blood tests and the management done — including the type of surgical management (debridement, secondary closure, split-thickness skin graft, amputation) and the type of dressing used (conventional, VAC, silver alginate, amnion, collagen) — were recorded for all patients. Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants prior to enrolment.

Data was entered into MS Excel 2016 and analysed using SPSS software version 26. Descriptive statistics (frequency, percentage, mean  $\pm$  standard deviation) were used to summarise the data. One-way ANOVA was applied to compare the mean duration of hospital stay across the different dressing modalities, with  $p < 0.05$  considered statistically significant.

### RESULTS

A total of 45 cases of chronic non-healing ulcer admitted to the surgical wards were analysed.

**Table 1: Age Group Wise Distribution**

| Age group (years) | Frequency | Percentage |
|-------------------|-----------|------------|
| <20               | 2         | 4.4        |
| 21-30             | 3         | 6.6        |
| 31-40             | 10        | 22.3       |
| 41-50             | 10        | 22.3       |
| 51-60             | 11        | 24.4       |
| >60               | 9         | 20.0       |

The mean age of study participants was  $48.4 \pm 15.6$  years. Among the study participants, 11 (24.4%) cases belonged to the 51-60 year age group, followed by 10 cases each from the 31-40 and 41-50 year age groups. A total of 9 (20%) cases were aged more than 60 years.

**Table 2: Gender Wise Distribution**

| Gender | Frequency | Percentage |
|--------|-----------|------------|
| Male   | 34        | 76         |
| Female | 11        | 24         |

Of the total, 34 (76%) cases were males and 11 (24%) cases were females, indicating a marked male preponderance.

**Table 3: Past History of the Study Participants**

| Past History           | Frequency | Percentage |
|------------------------|-----------|------------|
| Diabetes Mellitus      | 10        | 22.2       |
| Hypertension           | 7         | 15.7       |
| Ischemic Heart Disease | 4         | 8.9        |
| Others*                | 8         | 17.7       |
| None                   | 16        | 35.5       |

Ten (22.2%) cases had a history of diabetes mellitus, 7 (15.6%) had hypertension, and 4 (8.9%) had ischemic heart disease. Eight cases had other past history such as carcinoma breast, varicose veins and paraplegia (\*Others).

**Table 4: Type of Ulcer**

| Type of Ulcer  | Frequency | Percentage |
|----------------|-----------|------------|
| Diabetic ulcer | 15        | 33.4       |

|                     |    |      |
|---------------------|----|------|
| Venous stasis ulcer | 11 | 24.4 |
| Pressure ulcer      | 10 | 22.2 |
| Arterial ulcer      | 5  | 11.1 |
| Traumatic ulcer     | 4  | 8.9  |

Diabetic ulcer was the most common presentation, seen in 15 (33.4%) cases, followed by venous stasis ulcer in 11 (24.4%), pressure ulcer in 10 (22.2%), arterial ulcer in 5 (11.1%) and traumatic ulcer in 4 (8.9%) cases.

**Table 5: Ulcer Examination Findings**

| Ulcer Examination Findings* | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Discharge                   | 31        | 68.9       |
| Cellulitis                  | 10        | 22.2       |
| Sign of ischemia            | 3         | 6.7        |
| Necrotic floor              | 40        | 88.9       |
| Underlying abscess          | 9         | 20.0       |

Necrotic floor was the most frequent finding (88.9%), followed by discharge (68.9%), cellulitis (22.2%), underlying abscess (20%) and signs of ischemia (6.7%). (\*multiple choices allowed)

**Table 6: Type of Surgical Management**

| Type of Surgical Management | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Debridement                 | 20        | 44.5       |
| Split-thickness skin graft  | 9         | 20.0       |
| Secondary closure           | 5         | 11.1       |
| Amputation                  | 2         | 4.4        |
| None                        | 9         | 20.0       |

Debridement was required in 20 (44.5%) cases, split-thickness skin graft in 9 (20%), secondary closure in 5 (11.1%) and amputation in 2 (4.4%) cases; 9 (20%) cases were managed with dressing alone.

**Table 7: Various Modalities of Dressing Used**

| Modality of Dressing  | Frequency | Percentage |
|-----------------------|-----------|------------|
| Conventional dressing | 17        | 37.8       |
| Silver alginate       | 8         | 17.8       |
| Amnion dressing       | 8         | 17.8       |
| VAC dressing          | 6         | 13.3       |
| Collagen dressing     | 6         | 13.3       |

The majority of patients (37.8%) received conventional dressing, followed by silver alginate and amnion dressing (17.8% each), while VAC dressing and collagen dressing were each used in 13.3% of cases.

**Table 8: Duration of Hospital Stay**

| Duration of Hospital Stay (days) | Frequency | Percentage |
|----------------------------------|-----------|------------|
| $\leq 10$                        | 11        | 24         |
| $> 10$                           | 34        | 76         |

Thirty-four (76%) cases had a hospital stay of more than 10 days, while 11 (24%) cases were discharged within 10 days. The overall mean hospital stay was  $26.8 \pm 11.9$  days.

**Table 9: Comparison of Various Dressing Modalities with Duration of Hospital Stay**

| Modality of Dressing  | Mean Hospital Stay (days) $\pm$ SD | ANOVA (p-value) |
|-----------------------|------------------------------------|-----------------|
| Conventional dressing | $51.1 \pm 16.3$                    | 0.000           |
| VAC dressing          | $16.5 \pm 4.3$                     |                 |
| Silver alginate       | $14.2 \pm 5.6$                     |                 |
| Amnion dressing       | $9.25 \pm 5.5$                     |                 |
| Collagen dressing     | $8.8 \pm 3.2$                      |                 |

The mean hospital stay was longest with conventional dressing ( $51.1 \pm 16.3$  days) and shortest with collagen dressing ( $8.8 \pm 3.2$  days), followed by amnion dressing ( $9.25 \pm 5.5$  days), silver alginate ( $14.2 \pm 5.6$  days) and VAC dressing ( $16.5 \pm 4.3$  days). This difference across dressing modalities was statistically highly significant ( $p = 0.000$ , one-way ANOVA), with conventional dressing associated with a markedly prolonged hospital stay compared to all the newer modalities.

## DISCUSSION

Chronic non-healing ulcers continue to pose a major clinical and economic burden, and the choice of dressing material plays a decisive role in the rate and quality of wound healing. As newer dressing materials continue to be introduced, it becomes essential to evaluate their comparative efficacy against conventional dressing in routine surgical practice.

In the present study, the mean age of participants was  $48.4 \pm 15.6$  years, with the maximum number of cases (24.4%) in the 51-60 year age group. This is comparable to the study by Thekdi PI et al [7], who reported a mean age of  $46.2 \pm 16.97$  years, and Yadav AK et al [8], who observed a mean age of  $41.7 \pm 23.6$  years.

Males were more commonly affected (76%) than females (24%) in this study, a finding consistent with the observations of Thekdi PI et al [7] and Yadav AK et al [8], both of whom reported a similar male preponderance, possibly reflecting greater occupational trauma exposure and outdoor activity among males.

Diabetes mellitus was the most common comorbidity (22.2%), and diabetic ulcer was the commonest type of ulcer encountered (33.4%), followed by venous stasis ulcer (24.4%) and pressure ulcer (22.2%). Nwabudike LC et al [9] similarly reported that more than 80% of cases had a past history of diabetes mellitus, reinforcing diabetes as a leading contributor to chronic non-healing ulceration.

On local examination, a necrotic floor (88.9%) and discharge (68.9%) were the most frequent findings, indicating that most ulcers presented late, with established slough and infection — findings similar to those reported by Thekdi PI et al [7]. Debridement was the most frequently required surgical procedure (44.5%), followed by split-thickness skin grafting (20%), reflecting the need for active wound-bed preparation prior to definitive closure in the majority of cases.

Regarding the choice of dressing, conventional dressing remained the most frequently used modality (37.8%) in this cohort, followed by silver alginate and amnion dressing (17.8% each). This is broadly consistent with the observation of Kapur V et al [10], who also noted conventional heavily exuding wounds.

The mean hospital stay in this study was  $26.8 \pm 11.9$  days, with 76% of patients staying beyond 10 days. When stratified by dressing modality, patients managed with conventional dressing had a significantly longer hospital stay ( $51.1 \pm 16.3$  days) compared to those managed with VAC dressing ( $16.5 \pm 4.3$  days), silver alginate ( $14.2 \pm 5.6$  days), amnion dressing ( $9.25 \pm 5.5$  days) and collagen dressing ( $8.8 \pm 3.2$  days), a difference that was statistically highly significant ( $p=0.000$ ). A similar trend was reported by Subbiah MA et al [11], who found a highly significant difference in the rate of granulation tissue formation between conventional dressing and VAC dressing groups ( $p<0.001$ ), with a correspondingly shorter hospital stay in the VAC group (21 days) compared to the conventional dressing group (28 days). Yadav AK et al [8] likewise observed comparable healing rates across conventional, foam and VAC dressing groups (90%, 93.3% and 93.3% respectively), though the requirement of secondary procedures such as local flap or split-skin grafting was highest in the VAC group (43.3%).

Taken together, these findings suggest that although conventional dressing remains the most widely used and cost-effective modality, the newer dressing materials — particularly amnion and collagen dressing — are associated with a substantially shorter hospital stay, and by extension, more rapid wound-bed preparation and healing, in patients with chronic non-healing ulcers. This has direct implications for reducing the socio-economic burden of prolonged

hospitalisation, particularly in a high-volume tertiary care setting.

The retrospective, single-centre design with a relatively modest sample size ( $n=45$ ) and the non-randomised allocation of dressing modality are limitations of this study, and the findings should be corroborated by larger prospective, randomised trials before newer dressing materials can be recommended as the standard of care over conventional dressing in all settings.

## CONCLUSION

This retrospective study of 45 cases of chronic non-healing ulcer highlights that diabetic ulcer, venous stasis ulcer and pressure ulcer remain the predominant presentations, most commonly affecting males in the fifth and sixth decades of life, with diabetes mellitus as the leading associated comorbidity. Newer dressing materials — VAC, silver alginate, amnion and collagen dressing — were associated with a significantly shorter duration of hospital stay compared to conventional dressing, indicating faster wound-bed preparation and healing.

Despite a modestly higher cost and limited availability, the newer dressing modalities, particularly amnion and collagen dressing, appear to offer a distinct advantage over conventional dressing at every stage of chronic ulcer management and merit wider adoption in the surgical management of chronic non-healing ulcers, subject to confirmation by larger prospective studies.

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