



Original Article

Association of Hyperbaric Oxygen Therapy with Healing Trajectories in Chronic Non-Healing Wounds: A Prospective Observational Analysis

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ABSTRACT

Background: Chronic non-healing wounds represent as a substantial clinical challenge and are frequently associated with tissue hypoxia, persistent inflammation, infection, and increased risk of limb loss. Hyperbaric oxygen therapy (HBOT), by increasing tissue oxygen availability under hyperbaric conditions, has been used as an adjunctive modality in the management of refractory wounds; however, the clinical association between this therapy and wound-healing outcomes remains variable.

Objective: To evaluate the association between hyperbaric oxygen therapy and healing outcomes in patients with chronic non-healing wounds.

Methods: A prospective observational study was conducted over a one-year period at a tertiary care center. Sixty adult patients (29 patients (<26sessions), 31 (27-37 sessions)) with chronic non-healing wounds (Wagner grade 2–4) were enrolled and received hyperbaric oxygen therapy at 2.0–2.5 atmospheres absolute for 60–90 minutes per session, five days per week, for four weeks. Wound surface area, granulation tissue formation, wound discharge, local inflammation, and final wound outcomes were assessed at baseline and at weekly intervals. Patients were stratified based on the number of HBOT sessions completed. Data were analyzed using IBM SPSS version 25, and statistical significance was set at $p \leq 0.05$.

Results: A progressive reduction in wound surface area was observed over the treatment period, with patients completing a higher number of HBOT sessions demonstrating a significantly greater reduction by day 21 ($p < 0.001$). Significant reductions in wound discharge ($p = 0.002$) and local inflammation ($p = 0.002$) were also observed. Improvement in granulation tissue formation was noted in both groups, although intergroup differences were not statistically significant. Complete wound healing was observed in a higher proportion of patients who completed 27–37 HBOT sessions (93.5%) compared to those who completed fewer sessions (65.5%), with a significant association between session number and wound outcome ($p = 0.002$).

Conclusion: In this prospective observational cohort, hyperbaric oxygen therapy was associated with favorable wound healing outcomes, including reduced wound size, decreased discharge and inflammation, and improved overall healing, particularly with higher treatment exposure. These findings supported the role of HBOT as a potential adjunct to standard wound care in selected patients with chronic non-healing wounds, while underscoring the need for controlled studies to establish causality.

Keywords: Hyperbaric oxygen therapy, chronic wounds, non-healing ulcers, wound healing, hypoxia.

INTRODUCTION

Chronic non-healing wounds continue to pose a significant clinical challenge and constitute a major source of morbidity, prolonged hospitalization, and healthcare expenditure worldwide. These wounds are commonly encountered in association with diabetes mellitus, peripheral vascular disease, venous insufficiency, pressure injuries, and post-surgical infections. Failure of wounds to progress through the orderly phases of healing results in persistent inflammation, recurrent infection, impaired tissue regeneration, and an increased risk of limb loss and mortality. [1]

Tissue hypoxia has been recognized as a central pathophysiological mechanism contributing to delayed and impaired wound healing. Adequate oxygen availability is essential for key reparative processes, including fibroblast proliferation, collagen synthesis, angiogenesis, epithelialization, and effective leukocyte-mediated bacterial clearance. In chronic wounds, compromised microcirculation, edema, and vascular insufficiency limit oxygen diffusion to the wound bed, thereby disrupting cellular metabolism and prolonging the inflammatory phase of healing. [2]

Hyperbaric oxygen therapy (HBOT) involves the intermittent administration of 100% oxygen at pressures greater than atmospheric pressure, typically between 2.0 and 3.0 atmospheres absolute, delivered within a sealed hyperbaric chamber (Figure 1). Under hyperbaric conditions, oxygen dissolves directly into plasma in accordance with Henry's law, resulting in markedly increased tissue oxygen tension independent of hemoglobin-bound oxygen. This hyperoxygenated environment has been shown to enhance angiogenesis through upregulation of vascular endothelial growth factor, stimulate fibroblast activity and collagen deposition, modulate inflammatory pathways, and augment leukocyte oxidative killing of microorganisms. [3,4]

Clinically, hyperbaric oxygen therapy is administered using monoplace or multiplace chambers, with treatment parameters carefully regulated through pressure control systems and continuous safety monitoring (Figures 1 and 2). Hyperbaric oxygen therapy has been employed as an adjunctive treatment in a range of hypoxia-related clinical conditions, including refractory diabetic foot ulcers, radiation-induced tissue injury, necrotizing soft tissue infections, chronic osteomyelitis, and compromised grafts and flaps. [5]



Figure 1: Patient undergoing hyperbaric oxygen therapy within a sealed monoplace chamber.

The image illustrates patient positioning and treatment setup during a hyperbaric oxygen therapy session in our center



Figure 2: Hyperbaric oxygen therapy chamber control panel and pressure monitoring system

The control interface displays chamber pressure and treatment parameters used during hyperbaric oxygen therapy sessions. However, contemporary clinical guidelines recommend HBOT selectively, particularly in carefully chosen patients with refractory wounds that fail to respond to optimal standard wound care. Evidence supporting its use remains variable, with heterogeneity in patient selection, wound etiology, treatment protocols, and outcome measures across published studies. [6,7]

Chronic non-healing wounds represent a heterogeneous group of conditions with diverse etiologies, biological behavior, and responses to adjunctive therapies. While several studies have suggested that HBOT may be associated with improved short-term wound healing outcomes in selected populations, particularly among patients with diabetic foot ulcers, concerns remain regarding the generalizability of these findings, long-term benefits, and methodological limitations of existing evidence. [8,9]

In this context, the present prospective observational study was undertaken to evaluate the association between hyperbaric oxygen therapy and wound healing outcomes in patients with chronic non-healing wounds managed at a tertiary care center. The study aimed to assess changes in wound surface area, granulation tissue formation, wound discharge, inflammation, and final wound outcomes following HBOT, thereby contributing to the growing body of evidence on the role of HBOT as an adjunctive modality in chronic wound management. [10]

AIM AND OBJECTIVES

Aim

To evaluate the association between hyperbaric oxygen therapy and wound healing outcomes in patients with chronic non-healing wounds.

Objectives

- To assess changes in wound surface area in patients with chronic non-healing wounds undergoing hyperbaric oxygen therapy over a defined treatment period.

- To evaluate the effect of hyperbaric oxygen therapy on wound characteristics, including granulation tissue formation, wound discharge, and local inflammation.
- To analyze the relationship between the number of hyperbaric oxygen therapy sessions completed and overall wound healing outcomes.
- To document clinical wound outcomes, including healing, need for surgical intervention, or amputation, following hyperbaric oxygen therapy.

MATERIALS AND METHODS

Study Design and Setting

A prospective observational study was conducted over 1 year at the Department of General Surgery, Vydehi Institute of Medical Sciences, a tertiary-care teaching hospital in Bengaluru, India.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment. Patient confidentiality was maintained throughout the study, and all data were anonymized prior to analysis.

Study Population

Adult patients presenting with chronic non-healing wounds to the surgical outpatient department during the study period were screened for eligibility.

Inclusion Criteria

Patients aged 18 years and above.

- Presence of chronic non-healing wounds of more than four weeks' duration with inadequate response to standard wound care.
- Wounds classified as Wagner grade 2 to 4.
- Patients medically fit and cleared to undergo hyperbaric oxygen therapy.
- Patients who provided written informed consent.

Exclusion Criteria

- Presence of contraindications to hyperbaric oxygen therapy, including untreated pneumothorax, severe claustrophobia, uncontrolled cardiovascular disorders, or significant ear, nose, and throat pathology.
- Presence of malignancy at the wound site.
- Severe peripheral arterial disease requiring immediate surgical intervention.
- Pregnant or lactating women.
- Patients participating in other interventional clinical trials that could influence wound healing outcomes.

Sample Size and Sampling Technique

A total of 60 patients were included in the study. Participants were enrolled using a consecutive sampling method, wherein all eligible patients meeting the inclusion criteria during the study period were recruited until the desired sample size was achieved. Group 1 included 29 patients who underwent 26 sessions and group 2 included 31 patients who underwent (27–37 sessions).

Baseline Assessment

At the time of enrollment, baseline demographic and clinical data were recorded using a structured case record form. Information collected included age, gender, comorbid conditions (such as diabetes mellitus), lifestyle factors (smoking and alcohol use), wound etiology, wound duration, and Wagner grade.

Intervention: Hyperbaric Oxygen Therapy

All enrolled patients underwent hyperbaric oxygen therapy as an adjunct to standard wound care. HBOT was administered in a monoplace hyperbaric chamber at pressures of 2.0–2.5 atmospheres absolute (ATA). Each session lasted 60–90 minutes, and treatments were delivered five days per week for four consecutive weeks.

Details of each HBOT session—including treatment pressure, duration, total number of sessions completed, and any adverse events such as barotrauma or symptoms suggestive of oxygen toxicity—were documented prospectively.

Wound Assessment and Follow-up

Wound assessment was performed at baseline and subsequently at weekly intervals during the four-week treatment period. Wounds were evaluated using standardized assessment tools and methods, including:

- Measurement of wound surface area (cm²) was performed using sterile measuring scales and surgical callipers by assessing the maximum wound length and width and calculating the area accordingly.

- Digital photographic documentation to allow visual comparison over time.
- Wound assessment was guided by the T.I.M.E. framework, which provides a structured approach to identify key barriers to wound healing, including tissue non-viability (T), infection or inflammation (I), moisture imbalance (M), and non-advancing wound edges (E). This framework was used to ensure systematic clinical evaluation and uniform documentation of wound characteristics during baseline assessment and subsequent follow-up visits.
- Assessment of granulation tissue formation, wound discharge (purulent or serous), and local inflammation.
- Granulation tissue was assessed using an ordinal grading system, where higher scores indicated greater granulation tissue formation.
- Monitoring for signs of infection or other wound-related complications.

All assessments were performed by trained clinicians using uniform criteria to minimize inter-observer variability.

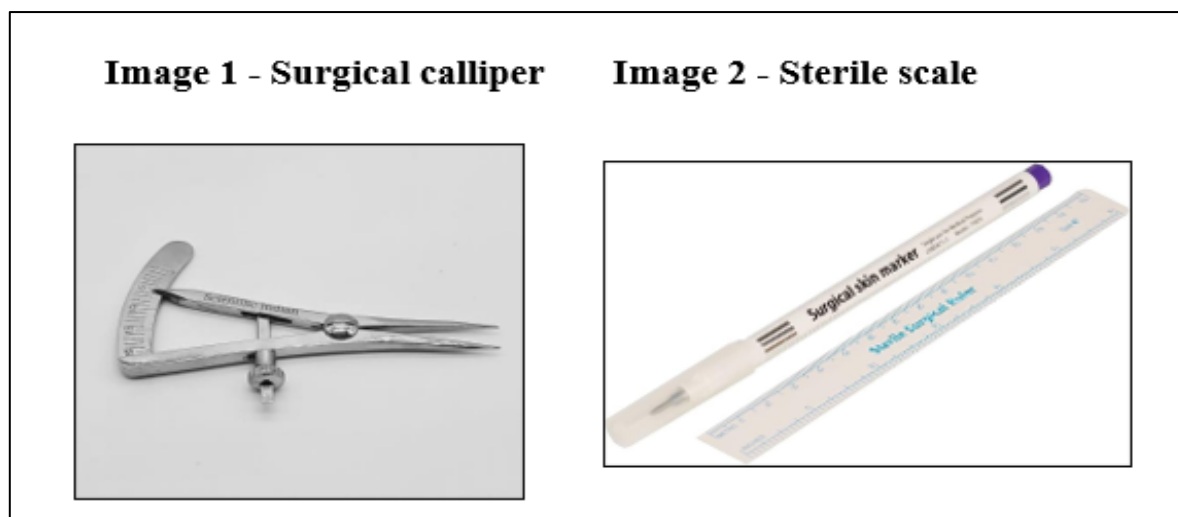


Figure 3. Measurement of wound surface area using sterile surgical callipers.

Wound dimensions were measured using sterile surgical callipers during each follow-up visit to ensure consistent and reproducible assessment of wound size.

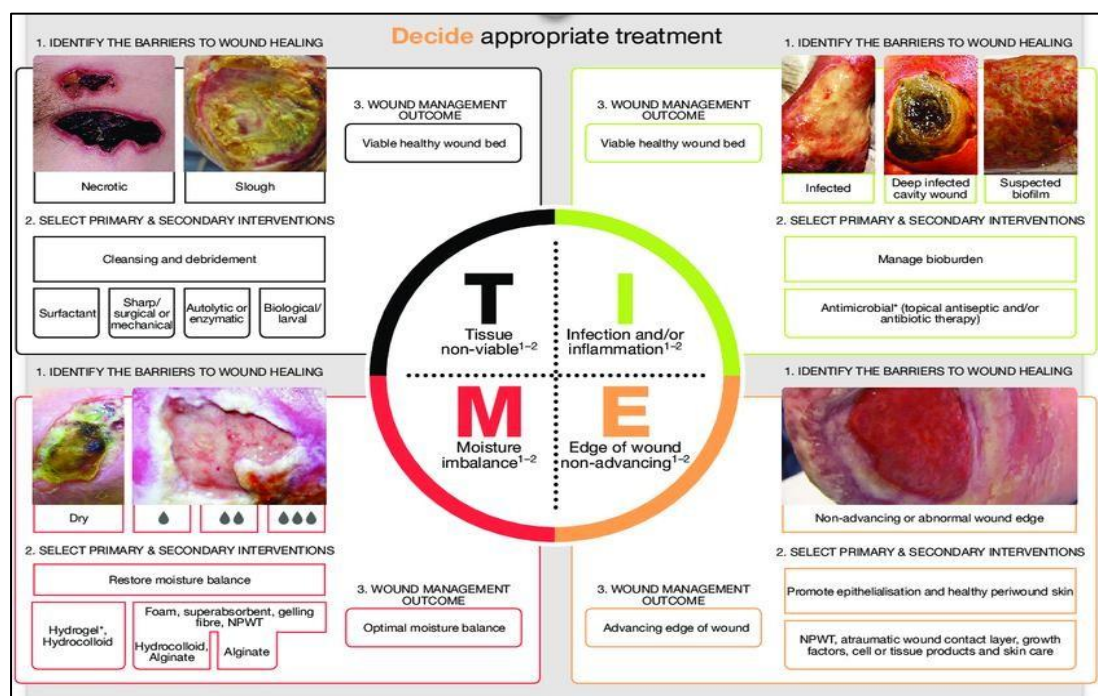


Figure 4. T.I.M.E. framework for systematic wound assessment.

The T.I.M.E. concept highlights key barriers to wound healing, including tissue non-viability (T), infection or inflammation (I), moisture imbalance (M), and non-advancing wound edges (E), and guides structured clinical wound evaluation. Outcome Measures

The primary outcome measure was the absolute change in wound surface area (cm²) over the treatment period. Secondary outcome measures included changes in granulation tissue formation, wound discharge characteristics, local inflammation scores, and final wound outcomes categorized as healed, requiring debridement, or requiring amputation. Adverse events related to hyperbaric oxygen therapy were also monitored.

Data Management and Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics for Windows (Version 25.0; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Normality was assessed using the Shapiro–Wilk test. Between-group comparisons of continuous outcomes at each time point were performed using the independent samples t-test or Mann–Whitney U test as appropriate, while within-group changes over time were analyzed using paired t-test or Wilcoxon signed-rank test. Categorical variables were analyzed using the chi-square test or Fisher’s exact test, and longitudinal changes in wound discharge were assessed using Cochran’s Q test. A two-tailed p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 60 patients with chronic non-healing wounds were included in the study. The cohort comprised 29 males (48.3%) and 31 females (51.7%). The majority of patients were aged between 40 and 70 years, accounting for 46 patients (76.6%). No patients were recorded in the 20–30 or 30–40 year age groups. Patients aged above 70 years constituted 23.3% of the study population (Table 1).

Diabetes mellitus was present in 42 patients (70.0%). Lifestyle risk factors were common, with 35 patients (58.3%) reporting smoking and 31 patients (51.7%) reporting alcohol use. Most wounds were classified as Wagner grade 3 (55.0%), followed by grade 2 (38.3%) and grade 4 (6.7%). Based on the number of hyperbaric oxygen therapy sessions completed, 29 patients (48.3%) were assigned to Group 1 (≤ 26 sessions) and 31 patients (51.7%) to Group 2 (27–37 sessions) (Table 1).

Table 1. Baseline demographic and clinical characteristics of the study population

Category	Sub-category	Frequency	Percentage
Gender	Male	29	48.3%
	Female	31	51.7%
Age (years)	40–50	17	28.3%
	50–60	14	23.3%
	60–70	15	25.0%
	>70	14	23.3%
Diabetes mellitus	Yes	42	70.0%
	No	18	30.0%
Alcohol use	Yes	31	51.7%
	No	29	48.3%
Smoking	Yes	35	58.3%
	No	25	41.7%
Wagner grade	Grade 2	23	38.3%
	Grade 3	33	55.0%
	Grade 4	4	6.7%
HBOT sessions	Group 1 (≤ 26 sessions)	29	48.3%
	Group 2 (27–37 sessions)	31	51.7%

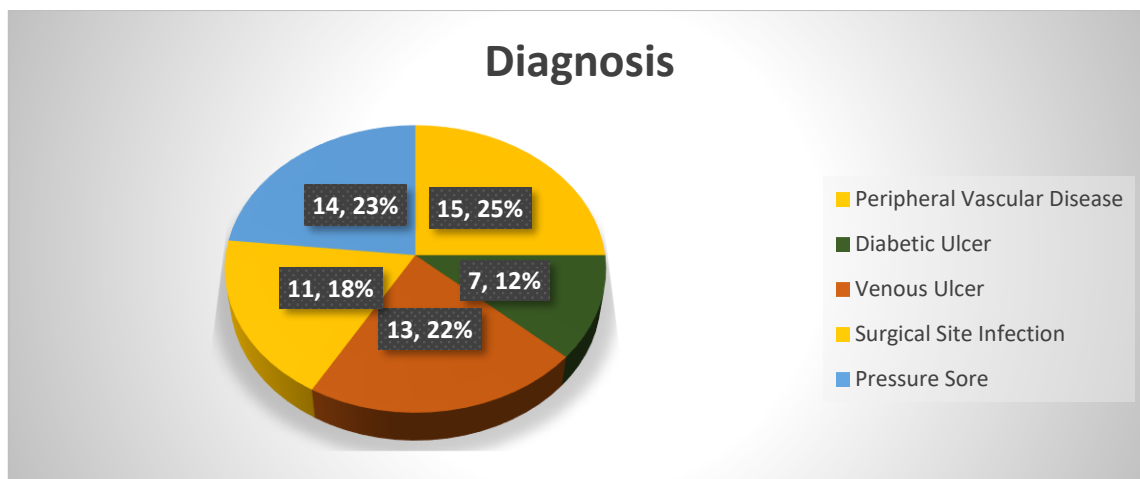


Figure 5. Distribution of wound diagnoses among study participants

The mean age of the study population was 58.57 ± 11.35 years, with a mean Wagner grade of 2.68 ± 0.60 . Progressive reductions in wound size, slough percentage, and inflammation scores were observed over the 21-day follow-up period, along with improvements in granulation tissue scores (Table 2).

Table 2. Comparison of wound surface area between HBOT groups

Time point	Group 1 (cm ²)	Group 2 (cm ²)	P-value
Baseline	11.68	13.47	0.304
Day 7	11.68	10.45	0.424
Day 14	11.10	7.36	0.007
Day 21	10.52	4.88	0.0001*

At baseline, there was no statistically significant difference in mean wound surface area between Group 1 and Group 2 (11.68 cm² vs 13.47 cm²; $p = 0.304$). By day 7, wound size remained comparable between the two groups ($p = 0.424$). A statistically significant reduction in wound surface area was observed by day 14 in Group 2 compared to Group 1 (7.36 cm² vs 11.10 cm²; $p = 0.007$). A statistically significant reduction in wound surface area over time was observed, with patients completing 27–37 hyperbaric oxygen therapy sessions (Group 2) demonstrating a greater reduction compared with the other group (10.52 cm² vs 4.88 cm²; $p = 0.0001$) (Table 3).

Table 3. Granulation tissue scores during HBOT

Time point	Group 1	Group 2	P-value
Baseline	1.31	1.39	0.746
Day 7	2.31	2.39	0.714
Day 14	2.93	3.19	0.687
Day 21	3.29	3.33	0.474

Granulation tissue scores increased progressively in both groups over the treatment period. At baseline, granulation scores were comparable between Group 1 and Group 2 (1.31 vs 1.39; $p = 0.746$). Although Group 2 demonstrated slightly higher granulation scores at all subsequent time points, the differences between groups were not statistically significant at day 7 ($p = 0.714$), day 14 ($p = 0.687$), or day 21 ($p = 0.474$) (Table 4).

Table 4. Changes in wound discharge during HBOT

Time point	Purulent n (%)	Serous n (%)
Baseline	23 (38.3%)	37 (61.7%)
Day 7	8 (13.3%)	25 (41.7%)
Day 14	4 (6.7%)	24 (40.0%)
Day 21	0 (0.0%)	8 (13.3%)
P-value	0.025	0.002*

A progressive reduction in wound discharge was observed over the treatment period. Purulent discharge decreased from 23 patients (38.3%) at baseline to 8 patients (13.3%) by day 7 and was absent by day 21. Serous discharge decreased from 37 patients (61.7%) at baseline to 8 patients (13.3%) by day 21. The reduction in purulent discharge was statistically significant ($p = 0.025$), as was the reduction in serous discharge ($p = 0.002$) (Table 5).

Wound discharge characteristics were analyzed for the overall study population, and group-wise comparison between HBOT exposure groups was not performed.

Table 5. Changes in inflammation scores during HBOT

Time point	Group 1	Group 2	P-value
Baseline	2.9	3.13	0.272
Day 7	1.6	2.11	0.172
Day 14	0.9	1.36	0.070
Day 21	0.4	0.2	0.002*

Inflammation scores showed a consistent decline in both groups over the treatment period. At baseline and during the first two weeks, differences between groups were not statistically significant. By day 21, Group 2 demonstrated a significantly lower inflammation score compared to Group 1 (0.2 vs 0.4; $p = 0.002$), indicating greater reduction in local inflammatory response with higher HBOT exposure (Table 6).

Table 6. Final wound outcomes according to hyperbaric oxygen therapy session exposure

HBOT group	Amputation n (%)	Debridement n (%)	Healed n (%)	P-value
Group 1 (≤ 26 sessions, $n=29$)	2 (6.9%)	8 (27.6%)	19 (65.5%)	0.002*
Group 2 (27–37 sessions, $n=31$)	0 (0.0%)	2 (6.5%)	29 (93.5%)	

In Group 1, complete wound healing was achieved in 19 patients (65.5%), while 8 patients (27.6%) required debridement and 2 patients (6.9%) underwent amputation. In contrast, Group 2 demonstrated complete wound healing in 29 patients (93.5%), with only 2 patients (6.5%) requiring debridement and no amputations recorded (Table 7). A statistically significant association was observed between the number of hyperbaric oxygen therapy sessions completed and final wound outcome ($p = 0.002$).

No major adverse events related to hyperbaric oxygen therapy, including barotrauma or oxygen toxicity, were observed during the study period.

**Figure 6. Representative chronic non-healing wound before (A) and after (B) hyperbaric oxygen therapy**

Wound appearance at initial assessment prior to initiation of hyperbaric oxygen therapy, showing a chronic non-healing wound with granulation tissue and surrounding skin changes. (B) Wound appearance at day 21 following completion of hyperbaric oxygen therapy sessions, demonstrating reduction in wound size, improved granulation tissue, and epithelialization. (Images are representative and shown for illustrative purposes only)

DISCUSSION

In the present study, chronic non-healing wounds were observed across a heterogeneous patient population, with peripheral vascular disease (25%) and pressure sores (23%) constituting the most common etiologies, followed by venous ulcers (22%), surgical site infections (18%), and diabetic ulcers (12%), as illustrated in Figure 5. This diagnostic distribution reflected the multifactorial nature of chronic wounds encountered in routine surgical practice. Sen et al. emphasized that vascular insufficiency and pressure-related injuries frequently coexist with metabolic and lifestyle risk factors in tertiary care populations. [1] Frykberg and Banks similarly reported that non-diabetic etiologies contribute substantially to the burden of chronic wounds managed in hospital-based wound clinics. [2] In contrast, studies by Löndahl et al. and Fedorko et al. predominantly focused on diabetic foot ulcers, which may limit the applicability of their findings to mixed-etiology wound populations such as that observed in the present study. [12,13] Although peripheral vascular disease and pressure sores constituted the largest proportion of wounds in the study cohort, the present study was not designed to evaluate differential healing responses across wound etiologies.

Baseline demographic characteristics demonstrated an almost equal gender distribution and a predominance of patients aged 40 years and above, with 76.6% of the cohort falling within the 40–70-year age range. Diabetes mellitus was present in 70% of patients, while smoking (58.3%) and alcohol use (51.7%) were common risk factors, as shown in Table 1. These findings were consistent with observations by Margolis et al., who identified diabetes and tobacco use as major contributors to impaired wound healing and delayed tissue repair. [14] Capó et al. similarly reported high rates of metabolic comorbidities among patients receiving hyperbaric oxygen therapy for chronic wounds. [9] However, Kranke et al., in their Cochrane review, reported variability in baseline comorbidity profiles across studies, reflecting differences in patient selection and healthcare settings. [6]

With respect to wound severity, the majority of wounds in the present study were classified as Wagner grade 3 (55%), followed by grade 2 (38.3%) and grade 4 (6.7%). This distribution indicated that most patients presented with moderate to advanced wound depth. Salama et al. reported a similar predominance of Wagner grade 3 ulcers among patients undergoing adjunctive hyperbaric oxygen therapy. [15] Brouwer et al. also observed that advanced Wagner grades were more frequently referred for hyperbaric treatment, particularly in the setting of delayed healing despite optimal standard care. [10] Conversely, Abidia et al. reported a higher proportion of grade 2 ulcers in their randomized trial, which may partly explain the more favorable healing rates observed in that study. [16]

Analysis of wound surface area revealed no statistically significant difference between the two hyperbaric oxygen therapy groups at baseline or by day 7; however, a significant reduction in wound size was observed in patients who completed 27–37 sessions by day 14, with this difference becoming highly significant by day 21 (Table 3). These findings indicated that greater wound area reduction was observed among patients with higher treatment exposure. Goldman reported similar temporal trends, noting progressive wound contraction with increasing exposure to hyperbaric oxygen therapy. [17] Thom attributed such reductions to enhanced fibroblast proliferation, collagen synthesis, and angiogenesis under hyperoxic conditions. [18] In contrast, Kranke et al. and Margolis et al. reported that although short-term reductions in wound size were observed, long-term benefits remained inconsistent, highlighting the limitations of observational and heterogeneous study designs. [6,14]

Granulation tissue formation improved progressively in both hyperbaric oxygen therapy groups over the four-week treatment period, although intergroup differences were not statistically significant at any time point (Table 4). This suggested that granulation tissue development occurred over time irrespective of the number of sessions completed. Capó et al. reported comparable findings, with improved granulation observed during hyperbaric oxygen therapy but without consistent between-group superiority. [9] Abidia et al. similarly demonstrated gradual granulation tissue formation during treatment without statistically significant advantage over standard wound care. [16] In contrast, Löndahl et al. reported enhanced granulation in selected diabetic foot ulcer patients, possibly reflecting differences in wound etiology and baseline ischemia compared to the mixed wound population in the present study. [12]

Wound discharge characteristics demonstrated a marked and statistically significant improvement over the treatment period. Purulent discharge decreased from 38.3% at baseline to complete resolution by day 21, while serous discharge declined from 61.7% to 13.3% (Table 5). Thom demonstrated that hyperbaric oxygen therapy enhances leukocyte bactericidal activity, contributing to reduced wound exudate and infection. [18] Ortega et al. similarly described reductions in wound discharge and local infection markers following hyperbaric oxygen therapy. [4] Conversely, O'Reilly et al. reported no significant difference in discharge reduction when hyperbaric oxygen therapy was compared with optimized standard wound care alone, highlighting variability in clinical response. [8] Although a significant reduction in wound discharge was observed over time, the present study did not perform group-wise comparison of discharge outcomes between HBOT exposure groups.

Inflammation scores declined steadily in both groups, with a statistically significant between-group difference observed only at day 21, favoring patients who completed a higher number of hyperbaric oxygen therapy sessions (Table 6). Capó et al. demonstrated comparable anti-inflammatory effects of hyperbaric oxygen therapy, attributed to modulation of oxidative stress and inflammatory cytokine pathways. [9] Thom also reported downregulation of inflammatory mediators following repeated hyperbaric oxygen exposures. [18] In contrast, Fedorko et al. did not observe consistent inflammatory modulation, potentially due to shorter treatment duration and differences in outcome assessment. [13]

Final wound outcomes demonstrated a statistically significant association between hyperbaric oxygen therapy session exposure and healing status. Patients who completed 27–37 sessions exhibited substantially higher rates of complete wound healing (93.5%) compared to those who completed fewer sessions (65.5%), with a concomitant reduction in the need for debridement and absence of amputations in the higher-session group (Table 7). Similar findings were reported by Salama et al., who observed improved healing rates among patients receiving adjunctive hyperbaric oxygen therapy. [15] Brouwer et al. also described enhanced limb salvage outcomes in selected patient populations treated with hyperbaric oxygen therapy. [10] However, Margolis et al. and Kranke et al. cautioned that long-term amputation reduction remains inconsistent across heterogeneous wound populations, underscoring the need for cautious interpretation of observational data. [14,6]

STRENGTHS AND LIMITATIONS

The strengths of the present study include its prospective observational design, use of a standardized hyperbaric oxygen therapy protocol, systematic weekly wound assessment, and evaluation of multiple clinically relevant outcome measures reflective of real-world practice. Nevertheless, several limitations should be acknowledged. The absence of a control group limits causal inference, the sample size was modest, and the follow-up period of four weeks precluded assessment of long-term outcomes. Heterogeneity in wound etiology and the lack of objective perfusion assessments may have influenced healing responses. Furthermore, variation in the number of hyperbaric oxygen therapy sessions completed may have been influenced by patient tolerance, clinical response, or logistical factors, which were not formally analyzed. Outcomes were also not stratified by wound etiology, and the study was not powered to assess comparative effectiveness of hyperbaric oxygen therapy across different wound types. These limitations should be considered when interpreting the findings.

CONCLUSION

This prospective observational study demonstrated a significant association between hyperbaric oxygen therapy exposure and improved wound healing outcomes in patients with chronic non-healing wounds. Patients completing a higher number of hyperbaric oxygen therapy sessions showed greater reduction in wound surface area, inflammation, and need for surgical intervention, along with higher rates of complete healing. These findings support the role of hyperbaric oxygen therapy as a valuable adjunct to standard wound care in carefully selected patients. Larger controlled studies with longer follow-up are required to confirm these findings and define optimal patient selection.

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