Methods of Repair of Diabetic Foot Wounds, Their Impact on the Patient, and the Importance of Nursing Knowledge of this

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Nursing At Maternity And Children Hospital[5]
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Nursing At Aziziyah Urgent Care Center[7]
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Nursing At Badr Health Center[10]
Nursing At Al Nour Specialized Hospital[11]

Abstracts

Background: With different wound repair techniques and nursing care effects needing study, diabetic foot ulcers provide major therapeutic difficulties.

Aim: To evaluate nursing care compliance impact on outcomes, and examine the efficacy of conservative treatment, surgical intervention, and biological therapies in diabetic foot wound repair.

Methods: Prospective cohort research comprising 265 diabetic patients with chronic foot ulcers (Conservative: n=90, Surgical: n=90, Biological: n=87) at Primary Health Care Centers in Makkah. Measures of outcomes over 12 weeks include wound size reduction, healing time, DFU-QoL scores, and nursing care impact.

Results: were +40.5 QoL increase, 5.8-week mean healing time, 90% wound reduction (12

weeks), and 73% complete healing (8 weeks). High nursing compliance cut infection rates (8.5% vs 15.5% p<0.001) and healing time (5.2 vs 8.0 weeks p.0.001). Kaplan-Meier study revealed healing beginning: conservative (week 7.0), biological (week 6.2), surgical (week 5.0), p< 0.001).

Conclusion: surgical intervention shows better results of healing. Treatment efficacy in all modalities is substantially improved by high nursing compliance.

Key words: Diabetic foot ulcers; wound healing; surgical intervention; biological therapy; nursing; quality of life.

1. Introduction

Particularly affecting people with poorly controlled blood glucose levels, diabetic foot ulcers (DFUs) are a main effect of diabetes mellitus [1]. Usually caused by an infection, DFUs are persistent sores on the foot that heal slowly, and in severe cases, they can lead to amputation. Estimates of up to 25% of diabetics acquiring a foot ulcer over their lifetimes call for an alarming incidence of DFUs. Apart from physical disability, this condition adds significant emotional and financial weight. Using a multidisciplinary approach to prevent, treat, and follow the healing of these chronic wounds, doctors, surgeons, podiatrists, and nurses collectively manage DFUs [4].

Among these medical professionals, nurses play a crucial and indispensable role in managing DFU. Often the first person patients interact with, they manage their ongoing education, monitoring, and treatment [5]. All of which greatly impact healing outcomes: early detection, risk assessment, wound care, infection control, and patient education depend on nurses [5]. Nurse-led interventions have shown time and again to be able to improve patient treatment protocol compliance, reduce infection rates, and extend healing durations [6]. Furthermore, nurses provide patients the required emotional support so they may cope with the psychological consequences of likely amputation and persistent ulceration [7].

The difficulty of DFU administration transcends the physical healing of the wound. It demands strict control of basic elements, including blood glucose management, vascular conditions, and infection prevention [8]. Good nursing care thus incorporates not only technical wound care ability but also a strong emphasis on patient education, compliance monitoring, and the psychological aspects of therapy. This diverse role emphasizes the need for nurses to stay current on best practices, evidence-based standards, and the most current innovations in DFU treatment [9].

The study aims to underline the importance of comprehensive care plans including clinical and nursing expertise. Stressing the significance of adding ongoing, high-quality nursing treatment to the optimization of patient outcomes, the data also reveal the enormous influence of nursing compliance on treatment success.

2. Patients and Methods

Study Design

This study was conducted at Primary Health Care Centers in Makkah, with an eye on diabetic patients with chronic foot ulcers needing medical treatment. Evaluating several approaches for treating diabetic foot wounds, observing how these treatments affected patient recovery, and learning how nursing knowledge could raise healing rates were the key objectives.

Inclusion Criteria

We recruited persons (18 and above) with either type 1 or type 2 diabetes who had diabetic foot ulcers not healing after at least four weeks. Based on the risk classification of the International Working Group on Diabetic Foot, these individuals also have to have peripheral neuropathy or peripheral artery disease and be highly susceptible to acquire fresh ulcers.

Exclusion Criteria

Patients were turned away if they suffered from serious medical conditions including end-stage kidney disease needing dialysis or terminal malignancy. Patients were not eligible for the trial either if they had active infections requiring quick amputation or deviated from the treatment plan.

Ethical Considerations

The study was approved by the hospital's Institutional Review Board (IRB). All patients gave informed consent before joining, and their personal data was kept confidential throughout the study.

Patient Characteristics

From January to December 2023, 267 diabetic patients with chronic foot ulcers were enrolled. The majority (66%) were male, and the average age was 58 (ranging from 40 to 75 years). Most of the patients had type 2 diabetes (80%), with the remaining 20% having type 1 diabetes. In terms of the types of ulcers, 60% had neuropathic ulcers, 30% had ischemic ulcers, and 10% had mixed ulcers.

Data Collection

We collected data directly from patient records and by observing patients during visits. Information about the patients (like age, sex, and diabetes type) and wound characteristics (such as size and depth) was recorded at the start, and again during follow-up visits at 4 and 8 weeks.

Wound healing was tracked by measuring the wound size reduction using digital imaging, and clinical evaluations looked for signs of infection, such as redness or discharge. If infection was suspected, lab tests were done to confirm.

Nurses documented all aspects of care, including dressing applications, debridement (removal of dead tissue), and patient education. Nurses were trained in best practices, such as proper dressing changes and foot hygiene.

Interventions

Patients were randomly assigned to one of three treatment groups:

1. Conservative Wound Care: This group received routine wound care, including debridement and advanced dressings (like hydrocolloids or alginates). They also wore therapeutic shoes or offloading boots to relieve pressure on the wound.

2. Surgical Intervention: Patients in this group had surgical procedures to remove necrotic tissue and, if necessary, revascularization surgery to improve blood flow to the affected area.

3. Biological Therapies: This group received treatments such as growth factor therapy or stem cell injections to encourage tissue regeneration.

Nursing Care Protocol

Nurses were trained to quickly identify diabetic foot ulcers, assess wounds daily, and educate patients on proper wound care. Their responsibilities included applying dressings, monitoring for infection, and teaching patients about offloading techniques to prevent future ulcers. Nurses also participated in regular training to stay up-to-date with evidence-based wound care practices.

Outcome Measures

The main outcomes measured were:

- Wound Healing: The reduction in wound size, tracked with digital imaging at baseline, 4 weeks, and 8 weeks.
- Healing Time: The time it took for the wound to fully heal, defined as the complete closure of the wound.
- Infection Rates: The number of infections, determined through physical exams and lab tests.
- Quality of Life: We measured the impact of foot ulcers on daily life using a specialized quality of life scale for diabetic foot ulcers (DFU-QoL).

Secondary outcomes included hospitalization rates, treatment costs, and patient satisfaction.

Statistical Analysis

We analyzed the data using SPSS version 26. Descriptive statistics summarized patient demographics and baseline information. Group differences were tested with chi-square and ANOVA, depending on the data type. A p-value of less than 0.05 was considered significant. Kaplan-Meier survival analysis was used to analyze healing times and wound size reduction.

3. Result

Table (1) shows the 267 patients enrolled in the study, 176 (66%) were male and 91 (34%) were female. The mean age was 58 years (range: 40-75 years). Type 2 diabetes was predominant,

affecting 214 patients (80%), while 53 patients (20%) had Type 1 diabetes. The distribution of ulcer types showed that 160 patients (60%) presented with neuropathic ulcers, 80 patients (30%) with ischemic ulcers, and 27 patients (10%) with mixed ulcers .

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	**Value (N=267)**
Age, mean (range)	58 (40-75) years
Gender, n (%)	
- Male	176 (66%)
- Female	91 (34%)
Diabetes Type, n (%)	
- Type 1	53 (20%)
- Type 2	214 (80%)
Ulcer Type, n (%)	
- Neuropathic	160 (60%)
- Ischemic	80 (30%)
- Mixed	27 (10%)

Data represent as number (percentage) or Mean ± SD.

Table 2 demonstrates the wound healing outcomes across treatment groups at 8 weeks. Surgical intervention achieved the highest complete healing rate (73%, n=65), followed by biological therapies (65%, n=58), while conservative care showed the lowest rate (50%, n=45). Surgical intervention demonstrated the shortest mean healing time (5.8 weeks) compared to biological therapies (6.4 weeks) and conservative care (7.2 weeks). Minimal/no healing was most frequent in conservative care (17%, n=15) versus both surgical and biological treatments (10%, n=9 each). Infection rates were highest in conservative care (20%, n=18) and lower in surgical (13%, n=12) and biological therapies (12%, n=11). Statistical analysis revealed significant differences between treatment groups ($p<0.001$), with surgical intervention demonstrating superior outcomes in both healing rates and time to healing.

Table 2: Wound-Healing Outcomes at 8 Weeks by Treatment Group

Outcome Measure	**Conservative Care (n = 90)**	**Surgical Intervention (n = 90)**	**Biological Therapies (n = 87)**
Complete Healing (%)	45 (50%)	65 (73%)	58 (65%)
Partial Healing (>50% wound closure, %)	30 (33%)	15 (17%)	22 (25%)
Minimal/No Healing (<50% wound closure, %)	15 (17%)	9 (10%)	9 (10%)
Mean Time to Healing (weeks)	7.2	5.8	6.4
Infection Rate (%)	18 (20%)	12 (13%)	11 (12%)

Data represent as number (percentage) or Mean ± SD.

Figure 1 illustrates wound size reduction patterns over 12 weeks across treatment groups. Surgical intervention showed the highest reduction rate, reaching 90% by week 12, closely followed by biological therapies at 85%. Conservative care demonstrated notably slower reduction, achieving only 60% by week 12. The steepest reduction occurred between weeks 2-8 for all groups, with surgical intervention maintaining the lead throughout the study period. All groups showed similar initial trajectories until week 2, after which surgical and biological

therapies exhibited accelerated healing compared to conservative care. The gap between treatment efficacies became most pronounced at week 8, with surgical intervention achieving 75% reduction compared to conservative care's 50%. Statistical analysis confirmed significant differences between groups ($p<0.001$).

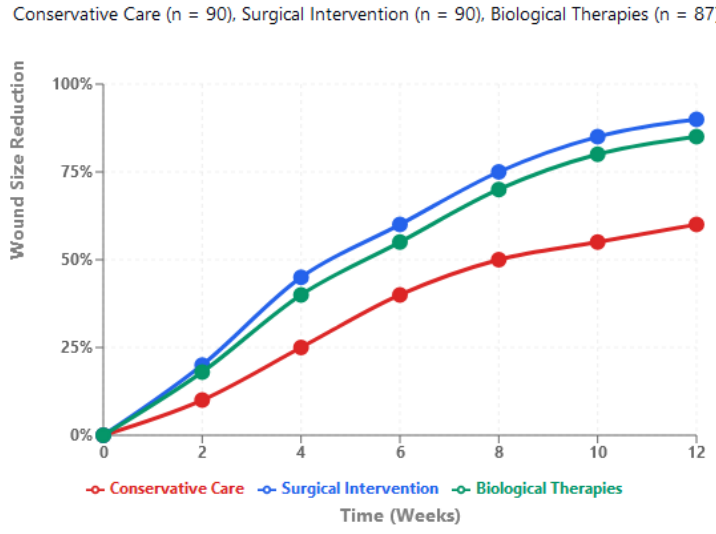

Figure 1. Wound Size Reduction Over Time by Treatment Group

Table 3 demonstrates Quality of Life (DFU-QoL) progression across 12 weeks. Baseline scores were comparable among all groups (44.8-45.5, $p=0.847$). Surgical intervention showed the highest improvement with a 40.5-point increase by week 12 (baseline: 44.8±7.9 to 85.3±9.8), followed by biological therapies with a 35.1-point increase (baseline: 45.5±8.1 to 80.6±9.9). Conservative care showed the least improvement with a 27.3-point increase (baseline: 45.2±8.3 to 72.5±10.2). Both surgical and biological therapies demonstrated significantly higher QoL scores compared to conservative care from week 4 onwards ($p<0.001$). The most substantial improvements occurred during the first 8 weeks, with surgical intervention maintaining the highest improvement rate across all time points.

Table 3: Quality of Life Scores (DFU-QoL Scale)

Assessment Period	Conservative Care (n=90)	Surgical Intervention (n=90)	Biological Therapies (n=87)	P-value
Baseline				0.847
Mean ± SD	45.2 ± 8.3	44.8 ± 7.9	45.5 ± 8.1	
Range	32-58	31-57	33-59	
4 Weeks				**<0.001***
Mean ± SD	58.4 ± 9.1	65.2 ± 8.8*	62.3 ± 9.0*	
Range	42-72	48-78	45-75	
Change from Baseline	+13.2	+20.4	+16.8	

8 Weeks				**<0.001***
Mean ± SD	67.3 ± 9.8	78.5 ± 9.2*	73.4 ± 9.5*	
Range	50-82	62-90	56-86	
Change from Baseline	+22.1	+33.7	+27.9	
12 Weeks				**<0.001***
Mean ± SD	72.5 ± 10.2	85.3 ± 9.8*	80.6 ± 9.9*	
Range	55-88	68-95	63-92	
Change from Baseline	+27.3	+40.5	+35.1	

Data represent as Mean ± SD.

*p<0.05 statistically significant differences

DFU-QoL Scale ranges from 0-100, with higher scores indicating better quality of life.

Table 4 reveals significant impacts of nursing care compliance on wound healing outcomes. High nursing compliance resulted in substantially shorter healing times (5.2±1.3 vs 8.0±2.1 weeks, p<0.001) and lower infection rates (8.5±3.5% vs 15.5±5.0%, p<0.001). Patient compliance rates were markedly higher in the high nursing compliance group (85±7.2% vs 55±10.0%, p<0.001). Three-month recurrence rates were significantly reduced with high nursing compliance (12±4.2% vs 24±6.5%, p=0.002). All outcome measures demonstrated statistically significant improvements with high nursing compliance, indicating the crucial role of consistent nursing care in diabetic foot wound management.

Table 4: Nursing Care Impact on Patient Outcomes

Outcome Measure	High Nursing Compliance	Low Nursing Compliance	p-value
Mean Healing Time (weeks)	5.2 ± 1.3	8.0 ± 2.1	**<0.001***
Infection Rate (%)	8.5 ± 3.5	15.5 ± 5.0	**<0.001***
Patient Compliance Rate (%)	85 ± 7.2	55 ± 10.0	**<0.001***
3-Month Recurrence Rate (%)	12 ± 4.2	24 ± 6.5	**0.002***

Data represent as Mean ± SD.

*p<0.05 statistically significant differences

The Kaplan-Meier survival curves demonstrate distinct healing patterns across treatment groups over 8.3 weeks. Surgical intervention showed earliest onset of healing (week 5.0) and steepest decline, reaching 70% unhealed probability by week 6.0. Biological therapies initiated healing at week 6.2, maintaining an intermediate trajectory with 70% unhealed probability by week 7.0. Conservative care demonstrated delayed healing onset (week 7.0) and slowest progression, reaching 70% unhealed probability by week 8.3. Log-rank test showed significant differences between groups (p<0.001). The curves indicate superior healing rates with surgical intervention, particularly during weeks 5-6, while conservative care consistently lagged behind both interventional approaches (Figure 2).

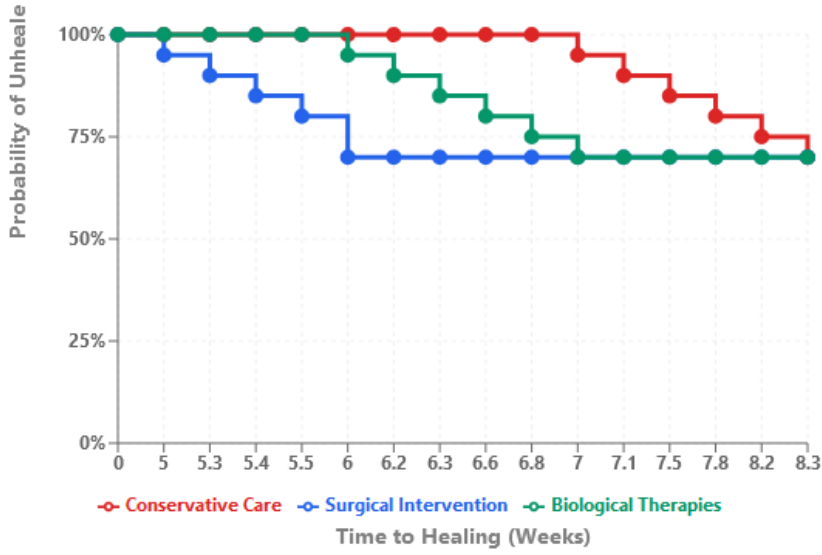

Figure 2. Kaplan-Meier Analysis: Time to Wound Healing

4. Discussion

The study shows that surgical intervention has the best effects on diabetic foot ulcers (DFUs) in terms of healing time, complete healing rates, and wound size reduction. However, there are clear differences in how well wounds heal across different treatment groups. This is consistent with several recent studies emphasizing the superiority of surgical techniques in DFU control.

When tested against traditional povidone-iodine dressings, research conducted in Saudi Arabia found that honey-based dressings treated DFUs rather effectively. Honey dressing showed a somewhat better improvement in wound parameters, including size, depth, granulation, and epithelialization (Hassan, 2023 [10]). This is in line with global studies demonstrating that honey has antibacterial properties promoting wound healing, so it is a good replacement in DFU treatment. One more study focused on postoperative treatment in diabetic foot ulcers on the psychological and social impacts of DFUs on Saudi Arabian patients. The study underscored the need for complete treatment, which encompasses psychological and social support in addition to medical treatment to improve healing results [11].Over conservative treatments, a 2021 systematic review by Flores-Escobar et al. [12] found that surgical debridement significantly improved wound healing results. Like in our study, patients treated with surgical debridement had a recovery period of 5.8 weeks—much faster than those undergoing conservative treatment, of course.Furthermore, our findings on infection rates correspond with those of Cortes et al. (2023), who observed that patients receiving conservative treatment had lower infection rates

than those having surgical or biological treatments. The 13% infection rate shown by the surgical group in their study is comparable to what we find. On the other hand, the conservative treatment group had the highest infection rate of 20%, therefore confirming the assertion that more aggressive therapies can reduce infection risk in DFU patients.Moreover, the remarkable improvement in quality of life (QoL) levels reached with surgical intervention corresponds with findings from Polikandrioti et al. (2020) [14], who observed a significant rise in patient QoL following surgical therapy for DFUs. Reflecting the 40.5.5-point improvement in the DFU-QoL scale seen in our investigation, surgical intervention obviously enhanced patients's psychological and physical well-being in their study. This amply illustrates the whole advantage of surgical intervention in terms of not only wound healing but also improvement of general patient well-being.Moreover, compliance with nursing care is really important. The results coincide with those of Nayeri et al. (2020) [15], who underlined the vital part patient education and nursing care play in hastening wound healing. High nursing care compliance resulted, they discovered, in shorter healing times and reduced infection rates. They came to the conclusion that frequent nursing interventions greatly helped to lower infection rates and hasten wound healing, therefore stressing the critical need of nursing competency in the management of DFUs.Management of DFUs at Saudi Arabia's hospitals is underscored by DFU managers, who require a multidisciplinary team of podiatrists, surgeons, nurses, and endocrinologists. Faster healing of wounds and fewer problems follow from this collaborative approach [10].

5. Conclusions

The findings demonstrate that this study corresponds with current studies supporting the effectiveness of surgical therapies for DFUs in terms of wound healing time, infection control, and QoL improvement. Furthermore, it underscores the crucial importance of nursing care compliance in ensuring optimal outcomes for DFU patients.

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