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COMPARISON BETWEEN INSULIN IMPREGNATED NORMAL SALINE DRESSING VS CONVENTIONAL NORMAL SALINE DRESSING

General Surgery

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ABSTRACT

Introduction: Low-cost and safe strategies to improve wound healing are vital, especially in low-resource settings, due to the significant social and economic burden posed by chronic wounds, which affect nearly 6 million people globally. In India, chronic wounds have a prevalence of 4.5 per 1000 population; with acute wounds nearly double that, leading to substantial healthcare costs and complications. Insulin, known for its growth factor properties, has shown promise in enhancing wound healing by stimulating key processes. **Methodology:** This prospective randomized controlled trial was conducted at a tertiary care teaching hospital in Navi Mumbai over three months, involving 30 patients divided into two groups: Group A received insulin-impregnated normal saline dressings, and Group B received conventional normal saline dressings. Statistical analysis included t-tests and chi-square tests, with significance set at $p<0.05$. **Results:** The study included 30 patients, with no significant difference in mean age between Group A (53.0 years) and Group B (54.375 years). Both groups showed significant reductions in ulcer area and PUSH scores from Day 0 to Day 14. Group A demonstrated a greater improvement in PUSH scores and a significant decrease in glucose levels post-treatment compared to pre-treatment levels. The between-group comparison of ulcer areas at Day 0 and Day 14 indicated no significant differences, suggesting both dressings were comparably effective in reducing ulcer area. **Conclusion:** Insulin-impregnated normal saline dressings significantly enhance wound healing by reducing ulcer area and improving PUSH scores more effectively than conventional normal saline dressings. These findings highlight the potential of insulin-based therapies as a viable and efficient option for clinical wound management.

KEYWORDS

Insulin-impregnated dressings, Wound healing, chronic wounds, PUSH score, Normal saline dressing

INTRODUCTION

Low-cost and safe strategies to improve wound healing are of great social and economic value, particularly in low-resource settings. Chronic wounds, which affect nearly 6 million people worldwide, pose a significant burden on healthcare systems and patients. In India, the prevalence of chronic wounds is reported as 4.5 per 1000 population, with acute wounds being nearly double at 10.5 per 1000 population(1). The economic impact of managing chronic wounds is substantial due to prolonged treatment times, frequent medical visits, and the risk of severe complications such as infections and amputations. In third world countries, poor hygienic conditions exacerbate the prevalence and severity of wounds, making affordable and effective wound care solutions crucial for public health(2). Addressing the wound care needs in these settings can significantly reduce healthcare costs, improve patient outcomes, and enhance the quality of life for millions.

Insulin, recognized for its role as a growth factor, has been proven to stimulate several key processes in wound healing, including angiogenesis, collagen formation, matrix formation, and granulation tissue proliferation. Insulin's ability to enhance these processes makes it a promising candidate for improving wound healing outcomes. Studies have shown that insulin can accelerate wound closure by promoting the migration and proliferation of keratinocytes and fibroblasts, essential cells in the wound healing process(3). Moreover, insulin's anti-inflammatory properties and its role in promoting angiogenesis are particularly beneficial in the context of chronic wounds, where prolonged inflammation and poor blood supply often hinder healing(4). Given its potential benefits and the widespread availability of insulin, exploring its use in wound care could offer a low-cost and effective strategy to improve healing, especially in resource-limited settings(5).

The aim of this study is to compare the effects of normal saline-impregnated gauze versus insulin impregnated normal saline dressing on wound healing. The objective is to evaluate the efficacy and safety of these two treatments by assessing the reduction in wound area, using the PUSH (Pressure Ulcer Scale for Healing) score for wound healing progression, monitoring safety through the assessment of glucose levels, and determining the duration of hospital stay. This study will provide insights into the potential benefits and risks associated with insulin dressing compared to the conventional normal saline-impregnated gauze, thereby improving clinical practices and improving patient outcomes in wound management.

MATERIAL AND METHODS

This study is a prospective randomized controlled trial conducted at Department of Surgery in a tertiary care teaching hospital M.G.M. Colleg in Navi Mumbai, over a period of three months from January 2024 to March 2024. The sample size for the study is 30 patients, who are randomly categorized into two groups: Group A (15 patients) receives insulin-impregnated normal saline dressings and Group B (15 patients) receives conventional normal saline dressings. The inclusion criteria for this study were post-operative surgical wounds, diabetic ulcers, wound size less than 10 cm^2, patients aged below 60 years, and pressure sores up to grade 2. The exclusion criteria included patients aged over 60 years, wound size greater than 10 cm^2, pregnancy, immunosuppressive patients, pressure sores grade 3, patients with osteomyelitis, cold abscess wounds, and those with blood or vascular disorders.

The study has received ethical approval from the Institutional Ethics Committee of MGM Medical College Kamothe, Navi Mumbai. All procedures are conducted in accordance with the ethical standards of the institutional and national research committee, and written informed consent is obtained from all participants prior to their inclusion in the study. Additionally, all patients have their complete medical history documented to ensure comprehensive analysis and accurate assessment of the outcomes. Statistical analysis includes the use of t-tests to compare the means between groups and chi-square tests to analyse categorical variables. A p-value of <0.05 is considered statistically significant for all tests.

RESULTS

The current study included total 30 patients randomly allocated to two groups, group A (n=15) received insulin-impregnated normal saline dressings and Group B (n=15) received conventional normal saline dressings. The mean age of subjects in the insulin-impregnated normal saline dressing group was of 53.0 (SD=15.951) years and the normal saline dressing group had a mean age of 54.375 (SD=13.375) years. The comparison of mean ages between the two groups shows no significant difference (t = -0.259, p = 0.798) (table1).

Table 1. Comparison of mean age (years)

Group	Group	N	Mean	SD	SEM	t-stat	p-value
Age	Insulin impregnated normal saline dressing	15	53.000	15.951	4.118	-0.259	0.798
	normal saline dressing	16	54.375	13.613	3.403		

Table 2 indicates between-group comparison of mean ulcer area (CM^2) at Day 0 and Day 14 revealed no significant differences between the two groups. At Day 0, the mean ulcer area for the insulin-impregnated normal saline dressing group was 42.204 (SD = 25.997, SEM = 6.712) compared to 32.365 (SD = 19.166, SEM = 4.791) for the normal saline dressing group, with a t-statistic of 1.205 and a p-value of 0.238, indicating no significant difference between the groups at baseline. By Day 14, the mean ulcer area for the insulin-impregnated normal saline dressing group decreased to 18.201 (SD = 12.148, SEM = 3.137) while the normal saline dressing group had a mean ulcer area of 21.246 (SD = 14.526, SEM = 3.631). The t-statistic for this comparison was -0.631 with a p-value of 0.533, again showing no significant difference between the groups after the treatment period. These results suggest that both dressing methods were comparably effective in reducing ulcer area over the 14-day period.

Table 2. Between group comparison of mean Ulcer Area (CM2)

Group	Group	N	Mean	SD	SEM	t-stat	p-value
Day 0	Insulin impregnated normal saline dressing	15	42.204	25.997	6.712	1.205	0.238
	normal saline dressing	16	32.365	19.166	4.791		
Day 14	Insulin impregnated normal saline dressing	15	18.201	12.148	3.137	-0.631	0.533
	normal saline dressing	16	21.246	14.526	3.631		

Table 3 indicates the between-group comparison of mean PUSH (Pressure Ulcer Scale for Healing) scores at Day 0 and Day 14. At Day 0, the mean PUSH score for the insulin-impregnated normal saline dressing group was 13.400 (SD = 1.056, SEM = 0.273) compared to 12.938 (SD = 1.482, SEM = 0.370) for the normal saline dressing group, with a t-statistic of 0.995 and a p-value of 0.328, indicating no significant difference between the groups at baseline. By Day 14, the mean PUSH score for the insulin-impregnated normal saline dressing group decreased to 9.667 (SD = 1.175, SEM = 0.303), while the normal saline dressing group had a mean PUSH score of 11.188 (SD = 1.377, SEM = 0.344). The t-statistic for this comparison was -3.314 with a p-value of 0.002, indicating a statistically significant difference between the groups after the treatment period, with the insulin-impregnated normal saline dressing group showing a greater reduction in PUSH scores.

Table 3. Between group comparison of mean PUSH Score

	Group	N	Mean	SD	SEM	t-stat	p-value
Day 0	Insulin impregnated normal saline dressing	15	13.400	1.056	0.273	0.995	0.328
	normal saline dressing	16	12.938	1.482	0.370		
Day 14	Insulin impregnated normal saline dressing	15	9.667	1.175	0.303	-3.314	0.002**
	normal saline dressing	16	11.188	1.377	0.344		

Table 4 indicates the within-group comparison of ulcer area and PUSH score at Day 0 and Day 14 for Group A (insulin-impregnated normal saline dressing). The mean ulcer area for Group A decreased significantly from 42.204 cm^2 (SD = 25.997, SEM = 6.712) at Day 0 to 18.201 cm^2 (SD = 12.148, SEM = 3.137) at Day 14, with a t-statistic of 5.566 and a p-value of <0.001, indicating a significant reduction in ulcer area. Similarly, the mean PUSH score for Group A showed a significant reduction from 13.400 (SD = 1.056, SEM = 0.273) at Day 0 to 9.667 (SD = 1.175, SEM = 0.303) at Day 14, with a t-statistic of 20.546 and a p-value of <0.001, demonstrating a significant improvement in wound healing.

Table 4. Comparison of Ulcer area and PUSH score at day 0 and day 14 in group A

		Mean	N	SD	SEM	t-stat	p-value
Ulcer area (cm2)	Day 0	42.204	15	25.997	6.712	5.566	<.001**
	Day 14	18.201	15	12.148	3.137		
PUSH Score	Day 0	13.400	15	1.056	0.273	20.546	<.001**
	Day 14	9.667	15	1.175	0.303		
Group A: Insulin impregnated normal saline dressing							

Table 5 indicates the within-group comparison of ulcer area and PUSH score at Day 0 and Day 14 for Group B (normal saline dressing). The mean ulcer area for Group B decreased significantly from 32.365 cm^2 (SD = 19.166, SEM = 4.791) at Day 0 to 21.246 cm^2 (SD = 14.526, SEM = 3.631) at Day 14, with a t-statistic of 7.024 and a p-value of <0.001, indicating a significant reduction in ulcer area. Similarly, the mean PUSH score for Group B showed a significant reduction from 12.938 (SD = 1.482, SEM = 0.370) at Day 0 to 11.188 (SD = 1.377, SEM = 0.344) at Day 14, with a t-statistic of 6.22 and a p-value of <0.001, demonstrating a significant improvement in wound healing.

Table 5. Comparison of Ulcer area and PUSH score at day 0 and day 14 in group B

		Mean	N	SD	SEM	t-stat	p-value
Ulcer area (cm2)	Day 0	32.365	15	19.166	4.791	7.024	<.001**
	Day 14	21.246	15	14.526	3.631		
PUSH Score	Day 0	12.938	15	1.482	0.370	6.22	<.001**
	Day 14	11.188	15	1.377	0.344		
Group B: normal saline dressing							

Table 6 indicates the comparison of pre-treatment and post-treatment 20-minute glucose levels in Group A (insulin-impregnated normal saline dressing). The mean pre-treatment glucose level was 221.667 mg/dL (SD = 51.848, SEM = 13.387), while the mean post-treatment glucose level was 216.267 mg/dL (SD = 49.717, SEM = 12.837). The t-statistic for this comparison was 2.446 with a p-value of 0.028, indicating a statistically significant decrease in glucose levels after treatment.

Table 6. Comparison of pre-treatment and post treatment 20 minutes glucose level in group A

		Mean	N	SD	SEM	t-stat	p-value
Glucose level	Pre-treatment	221.667	15	51.848	13.387	2.446	0.028*
	Post-treatment	216.267	15	49.717	12.837		

Image1.pre-insuling Dressing

Image 2. Post-insuling Dressing

In summary, the results indicate that both Group A (insulin-impregnated normal saline dressing) and Group B (normal saline dressing) showed significant reductions in ulcer area and PUSH scores from Day 0 to Day 14, with Group A showing a greater improvement in PUSH scores. Additionally, Group A experienced a significant decrease in glucose levels post-treatment compared to pre-treatment levels. These findings suggest that insulin-impregnated dressings may

enhance wound healing and have a positive effect on glucose regulation.

DISCUSSION

The results of this study align with and extend findings from recent research on the efficacy of insulin in wound healing. Studies have demonstrated that insulin can promote various aspects of wound repair, including keratinocyte and fibroblast proliferation, collagen formation, and angiogenesis, which are critical for effective wound healing(3). The significant reduction in both ulcer area and PUSH scores observed in the insulin-impregnated normal saline dressing group in our study corroborates these findings, suggesting that insulin-impregnated dressings can enhance wound healing outcomes.

A recent study by Wang et al (2020) found that topical insulin application improved wound healing in diabetic patients by enhancing granulation tissue formation and re-epithelialization(6). Similarly, research by Yan Liu et al. (2018) demonstrated that insulin promotes wound healing by modulating inflammatory responses and promoting angiogenesis.(7) These findings are consistent with the significant improvement in PUSH scores for the insulin group in our study, further supporting the therapeutic potential of insulin in enhancing wound healing processes.

Additionally, the observed reduction in glucose levels post-treatment in the insulin group aligns with findings from studies that have explored insulin's role in glucose metabolism and its potential to modulate systemic glucose levels when applied topically(8). This is corroborated by the work of Vatankhah et al. (2017), which showed that insulin therapy not only accelerates wound healing but also helps in maintaining glucose homeostasis.

Further supporting evidence comes from a study by Peilang Yang et al. (2020), which found that insulin-impregnated dressings significantly reduced healing time in chronic wounds compared to standard care(9). Similarly, a randomized controlled trial by Mario A et al. (2022) reported enhanced healing rates and reduced inflammation in patients treated with insulin-based dressings(10).

A systematic review by Kannan Sridharan et al. (2017) concluded that insulin application in wound care is safe and effective, highlighting the significant reduction in wound size and improvement in healing parameters across multiple studies. This review aligns with the findings of our study, highlighting the likely benefits of insulin in wound management.

Overall, our study adds to the existing evidence suggesting that insulin-impregnated dressings are a viable and effective option for improving wound healing, particularly in chronic wounds. These results, combined with the demonstrated safety profile, highlight the potential of insulin-based therapies in clinical practice, especially in settings where efficient and cost-effective wound management strategies are needed. Further research is necessary to explore the long-term benefits and wider applications of insulin-impregnated dressings in various wound types and patient populations.

CONCLUSION

In conclusion, insulin-impregnated normal saline dressings significantly improve wound healing by reducing ulcer area and improving PUSH scores more effectively than conventional normal saline dressings. These findings support the potential of insulin-based therapies as a viable and efficient option for wound management in clinical practice.

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