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Role of Topical Phenytoin Dressing in Treatment of Split Thickness Skin Autograft Donor Site

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ABSTRACT

Introduction: Burn injuries, mainly in pediatric patients, often use autografts for wound care. The donor site of a skin graft causes pain and takes time to heal. Phenytoin enhances wound healing by aiding fibroblast growth, reducing exudate, and promoting granulation tissue formation. This study compared the pain reduction and healing of donor site wound with phenytoin dressing and traditional Sufretulle gauze dressing. **Methodology:** A six-month randomized controlled trial occurred at Mayo Hospital, Lahore, involving 72 pediatric scald burn patients needing skin grafts. They were splited into Group 1 (Phenytoin dressing) and Group 2 (Sufretulle dressing), 36 patients each. Pain was monitored using FLACC and Wong-Baker FACES scales based on age. Wound healing progress was tracked using PUSH score on specific days. Data were analyzed with SPSS version 21, setting statistical significance at $p \leq 0.05$. **Results:** The Phenytoin group had consistently lower pain scores than the Sufretulle group ($p = 0.001$). On Day 15, mean pain scores were 0.03 ± 0.16 for Phenytoin and 1.50 ± 0.97 for Sufretulle. Phenytoin group showed better wound healing (PUSH score: 2.56 ± 1.88) than Sufretulle group (6.67 ± 1.41, $p = 0.001$). No severe adverse effects were reported in either group. **Conclusion:** The use of topical phenytoin dressing showed faster wound healing and less pain at the donor site for skin grafts compared to sufretulle dressing. This cost-effective, low-risk option is a valuable alternative for managing donor sites in pediatric burn patients.

INTRODUCTION

Burn injuries are among the most common accidental injuries in humans, with children accounting for over 50% of cases. Severe burns often necessitate surgical intervention, with pediatric surgeons frequently managing such cases. Burns result in the devitalization of affected tissue, leading to the formation of raw wound surfaces. The exudation of plasma from these wounds provides a conducive environment for bacterial colonization, thereby increasing the risk of infection. The overall mortality rate for burn patients is estimated to be approximately 22%.[1-2]

Effective burn management aims to prevent infection, promote wound healing, and, when necessary, prepare the wound bed for grafting. Auto-grafting is a widely used technique in burn wound management, but the donor site itself can be a significant source of pain and morbidity. Conventional donor site treatments include traditional gauze dressings with antibacterial agents, petroleum jelly-based dressings, and occlusive dressings. However, alternative approaches, such as the use of topical phenytoin, have been suggested to accelerate wound healing and reduce patient discomfort.[3-4]

Phenytoin, a hydantoin derivative first synthesized in 1908 and is being used primarily as an anticonvulsant since 1937.[2,5-6] Its potential role in wound healing was first noted in 1939 when Kimball et al. observed gingival hypertrophy in patients using phenytoin, leading to subsequent investigations into its effects on tissue regeneration.[6] The first report of phenytoin's efficacy in wound healing was published by Shapiro and colleagues in 1958.[3] Since then, research has suggested that phenytoin promotes wound healing through multiple mechanisms, including increased fibroblast proliferation, inhibition of collagenase activity, enhanced collagen deposition, stimulation of granulation tissue formation, reduction in bacterial contamination, and regulation of growth factors.[2,4-5]

Notably, aside from mild generalized rash, no significant adverse effects have been reported with the topical application of phenytoin. Patients often report greater pain, pruritus, and discomfort at the donor site compared to the grafted area.[2,7] This study aimed to evaluate the efficacy of topical phenytoin dressings in promoting wound healing at split-thickness skin graft donor sites compared to conventional sufretulle gauze dressings. The expected outcome includes improved healing time, reduced pain, and decreased discomfort at the donor site, ultimately enhancing overall patient management.

METHODOLOGY

A randomized controlled trial was conducted to evaluate the efficacy of topical phenytoin dressing in promoting wound healing at split-thickness skin graft donor sites compared to conventional sufretulle gauze dressing. The study was carried out in the Paediatric Surgery and Pediatric Burn Unit, Mayo Hospital, Lahore. Institutional review board approved study on 12th of November 2024. Duration given was six months from approval of study for collection of data. But due to high influx of patients data collection was completed in 4 months, from 13th November 2024 to 12th March 2025.

The sample size was calculated to be 72 patients, with 36 in each group, based on a 95% confidence interval and a 5% margin of error, using an anticipated patient satisfaction rate of 80%.[1] A simple random sampling technique was employed for patient selection. Patients who met the inclusion criteria were prepared for grafting and randomly allocated into two groups using the lottery method. In Group 1, phenytoin dressing was applied at the donor site, while in Group 2, traditional Sufretulle gauze dressing was used. Both groups were assessed on days 0, 3, 6, 9, 12, and 15 post-application.

The study included pediatric patients aged 1 to 12 years with scald wounds involving less than 15% of the total body surface area. Patients with electrical, chemical, circumferential, flame, or friction burns were excluded from the study. Data collection was conducted in the operating theater immediately after the patient was shifted for the procedure. The area of the autograft donor site was measured based on its length and width.

In Group 1, phenytoin dressing was prepared by crushing phenytoin tablets. A sterile gauze was soaked with 5 ml of normal saline, and the phenytoin powder was evenly spread over it. The dosage of phenytoin was determined based on the wound size, with incremental increases for larger wound areas. In Group 2, Sufretulle dressing was applied at a ratio of one patch per 10 cm^2 wound area.

Dressings in both groups were removed and evaluated on days 3, 6, 9, 12, and 15. The primary outcome variables included wound healing, pain, pruritus, presence of slough, granulation tissue color, amount of exudate, wound culture and sensitivity, and any other side effects. Wound healing was assessed using the Pressure Ulcer Scale for Healing (PUSH) by recording wound size, exudate amount, and tissue type at each evaluation point.

Pain was measured using the FLACC scale for children under 8 years of age and the Wong-Baker FACES Pain Scale for children older than 8 years. Pruritus was evaluated based on patient-reported discomfort. The presence of slough, granulation tissue color, and exudate were recorded through clinical observation. Wound infection was determined through culture and sensitivity testing, with samples collected from the donor site when signs of infection were present.

Pain scores were recorded daily for both groups, while wound healing and associated parameters were assessed on scheduled dressing removal days. Data were collected using structured questionnaires and retrieved from patient files for analysis. Cultural and ethical guidelines were strictly observed to ensure patient privacy and confidentiality. Informed written consent was obtained from parents or guardians before the inclusion of children in the study. Data analysis in SPSS v.21 included presenting categorical variables (e.g., gender, wound depth) as frequencies/percentages and continuous variables (e.g., age, pain scores, PUSH score) as mean ± SD. Mean values between groups were compared using independent sample t-test ($p \leq 0.05$ = statistically significant).

RESULTS

In the Phenytoin group, there were 20 males (55.6%) and 16 females (44.4%), while the Sufretulle group had 19 males (52.8%) and 17 females (47.2%). Phenytoin group had 20 children (55.6%) aged 1-8 years and 16 children (44.4%) aged 9-12 years. Sufretulle group had 23 patients (63.9%) aged 1-8 years and 13 patients (36.1%) aged 9-12 years. Mean age in Phenytoin group was 7.72 ± 2.63 years, and in Sufretulle group, it was 6.97 ± 3.38 years. Phenytoin group had 10 cases (27.8%) of deep partial-thickness wounds, 14 cases (38.9%) of partial-thickness wounds, and 12 cases (33.3%) of superficial wounds. Sufretulle group had 7 cases (19.4%) of deep partial-thickness wounds, 15 cases (41.7%) of partial-thickness wounds, and 14 cases (38.9%) of superficial wounds.

At baseline (Day 0), the mean pain scores were similar between the two groups (5.08 ± 0.77 in the Phenytoin group and 5.64 ± 1.75 in the Sufretulle group, $p = 0.096$), indicating no significant difference before the intervention. However, from Day 3 onward, the Phenytoin group exhibited consistently lower pain scores compared to the Sufretulle group, with the differences becoming statistically significant ($p < 0.05$) at all subsequent time points. By Day 15, the pain score

in the Phenytoin group had reduced to 1.03 ± 0.16, whereas it remained higher in the Sufretulle group at 1.50 ± 0.97 (p = 0.004), demonstrating a greater reduction in pain with phenytoin dressing. The PUSH score for healing was also significantly lower in the Phenytoin group (2.56 ± 1.88) compared to the Sufretulle group (6.67 ± 1.41, p = 0.001).

Table 1

Comparison of distribution of different variables between groups

Variables		Groups	
		Phenytoin	Sufretulle
Gender	Male	20(55.6%)	19(52.8%)
	Female	16(44.4%)	17(47.2%)
Age groups	1-8 years	20(55.6%)	23(63.9%)
	9-12 years	16(44.4%)	13(36.1%)
	Mean±S.D	7.72±2.63	6.97±3.38
Depth of wound	Deep partial thickness	10(27.8%)	7(19.4%)
	Partial thickness	14(38.9%)	15(41.7%)
	Superficial	12(33.3%)	14(38.9%)

Table 2

Comparison of mean pain scores at different intervals and mean PUSH score for healing between groups

Outcome variables	Groups		p-value
	Phenytoin	Sufretulle	
Pain score (Day 0)	5.08±0.77	5.64±1.75	0.096
Pain score (Day 3)	3.86±0.96	4.69±1.52	0.038
Pain score (Day 6)	2.64±1.09	3.89±1.43	0.031
Pain score (Day 9)	1.69±0.88	3.06±1.39	0.027
Pain score (Day 12)	1.19±0.46	2.33±1.30	0.011
Pain score (Day 15)	1.03±0.16	1.50±0.97	0.004
PUSH Score for healing	2.56±1.88	6.67±1.41	0.001

DISCUSSION

The occurrence of burn injuries in pediatric patients poses various challenges related to wound management and pain control that can impact recovery. Split-thickness skin grafting, a common surgical technique for extensive burns, can lead to pain and delays in healing at the donor site. Managing primary burn injuries and donor site complications requires a comprehensive, multidisciplinary approach focusing on pain control and wound healing in this vulnerable patient group.[8-10]

An ideal donor site dressing should promote fast healing, relieve pain, and reduce the risk of complications like infections and scarring. Various dressings, including gauze, hydrocolloids, hydrofiber, and petroleum-based coverings, offer distinct benefits. Phenytoin application shows promise due to its healing and anti-inflammatory properties, as well as cost-effectiveness. Continuous research is vital to enhance donor site management and patient outcomes.[11-14]

Phenytoin, initially developed as an anticonvulsant, has been found to enhance wound healing through mechanisms like fibroblast proliferation, collagenase inhibition, and granulation tissue formation. Research shows its effectiveness in reducing wound exudate, controlling bacterial contamination, and accelerating skin barrier restoration. These multifaceted effects suggest phenytoin's potential for wider applications in tissue repair, warranting further investigation for optimal clinical use.[15-16]

Previous researches have highlighted phenytoin's effectiveness in treating various wounds like diabetic ulcers, pressure sores, and burns. Sufretulle dressing is beneficial for creating a moist wound environment, preventing adhesion, reducing pain, and minimizing trauma during dressing changes. Unlike phenytoin, which aids healing, sufretulle acts as a protective barrier without actively promoting healing. While sufretulle offers protection and comfort, it plays a passive role in wound management compared to phenytoin's dynamic healing effects in similar scenarios.[17-19]

The findings of this study indicate that topical phenytoin dressing was significantly more effective than sufretulle in reducing pain and accelerating wound healing at the split-thickness skin graft donor site. The mean pain scores were consistently lower in the phenytoin group at all time points, with Day 15 scores approaching near-zero levels, while pain remained persistently higher in the sufretulle group (p = 0.001).

Similar results have been reported by other researchers, such as Shukla et al., who found that phenytoin application resulted in faster epithelialization and significant pain reduction compared to traditional dressings.[15] Another randomized controlled trial by Modaghegh et al. also observed a significant reduction in wound healing time with topical phenytoin in burn injuries.[16] Furthermore, a study by Talas et al. demonstrated that phenytoin dressing led to improved granulation tissue formation and reduced inflammatory response, supporting its efficacy in donor site management.[20]

The PUSH scores in this study also confirmed better healing outcomes with phenytoin dressing, aligning with findings from previous trials that highlighted its ability to enhance epithelialization and decrease wound healing time.[21]

Despite these promising results, the study had some limitations. The sample size was relatively small, which may limit the generalizability of the findings. Additionally, the study was conducted in a single-center setting, restricting the external validity of the results. Pain assessment, though measured using validated scales, remained subjective, and individual pain tolerance levels could have influenced responses. Moreover, the long-term effects of phenytoin dressing on scarring and cosmetic outcomes were not assessed, which could be an area for future research.

Overall, this study supports the use of topical phenytoin dressing as a superior alternative to sufretulle for donor site management in pediatric burn patients. Its

ability to significantly reduce pain and promote faster wound healing suggests that it may be a valuable addition to burn care protocols. However, further multi-center trials with larger sample sizes and long-term follow-up are recommended to validate these findings and assess potential impacts on scarring and overall skin quality.

CONCLUSION

Topical phenytoin dressing significantly accelerated wound healing and reduced pain at the split-thickness skin graft donor site compared to traditional sufretulle dressing. Its effectiveness, low cost, and minimal side effects suggest that it can be a beneficial alternative for donor site management in pediatric burn patients.

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