



## Comparing the Outcomes Between Silver Sulfadiazine (SSD) versus Sustained-release Silver Foam in Treatment of Partial Thickness Burn Patients

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### ABSTRACT

**Objective:** To compare the outcomes between silver sulfadiazine (SSD) versus sustained-release silver foam in treatment of partial thickness burn patients.

**Methods:** All patients of second degree partial thickness burns (n=164) were divided in equally in two groups through draw method, 82 patients in each, group (A) treated with silver sulfadiazine and group (B) with sustained-release silver foam dressing. Baseline data and outcome i.e., pain, wound healing and hospital stay were recorded on predesigned proforma.

**Results:** In Group I, there were 15.0% patients who had wound healed and 25.0% patients had wound healed in Group II. The mean VAS score at 5, 10, 15 and 20 day of Group II was less than the Group I ( $p < 0.001$ ). whereas, the wound healing in both the groups were almost equal at 5, 10, 15 and 20 day, and the differences were statistically insignificant, ( $p > 0.050$ ).

**Conclusion:** utilization of sustained-release silver dressing exhibits notable advantages in the wound healing process, including accelerated recovery rates, reduced pain levels, and consequently, earlier hospital discharge, when compared to silver sulfadiazine (SSD) dressings in treatment of partial thickness burn patients.

**Keywords:** Partial thickness burns, Silver sulfadiazine (SSD), Sustained-release silver dressing, Wound healing.

## 1. INTRODUCTION

Since the 1800s, silver has been utilized for its antimicrobial properties, serving as an antiseptic and a broad-spectrum antibiotic with anti-inflammatory effects; in the late 1960s<sup>1</sup>, SSD cream was introduced by Fox for burn wound management, although it has limitations such as a relatively short action, poor penetration of the burn eschar, and the formation of a pseudo-eschar, necessitating frequent dressing changes for both silver nitrate dressings and SSD cream<sup>2</sup>.

The use of dressings containing silver has seen a notable rise in recent times, with numerous studies highlighting the effectiveness of sustained-release silver foam dressings in microbial assays; however, there is a notable scarcity of research focusing on clinical basis associated with their usage<sup>3</sup>. Silver dressings can exist in various forms, and certain types are designed to release silver continuously, serving as an ongoing protective barrier against microorganisms to enhance wound conditions<sup>4</sup>. In its biologically active state, silver manifests as Ag<sup>+</sup> or Ag<sup>0</sup> clusters, with Ag<sup>+</sup> being the ionic form found in substances like silver nitrate or SSD, while Ag<sup>0</sup> represents the uncharged metallic silver form present in nanocrystalline silver<sup>5</sup>.

Free silver cations exhibit a powerful antimicrobial impact by binding to and denaturing bacterial DNA and RNA, inhibiting cell replication<sup>6</sup>. Nanocrystalline silver, employing nanotechnology, releases clusters of extremely small and reactive silver particles, maximizing wound surface area contact and enhancing bioactivity and silver solubility<sup>7</sup>. Sustained-release silver products have been shown through research to exhibit bactericidal action, effectively managing both odor and exudate, thereby

reducing the risk of colonization and preventing infection<sup>8,9</sup>.

The presence of bacterial biofilms and multi-resistant organisms significantly hinders the healing process, particularly in chronic wounds, as local infection leads to tissue necrosis, an increase in hypoxia and wound size, all contributing to further delays in the wound healing process<sup>10</sup>. A wound bioburden occurs when bacterial cells actively produce and release various enzymes and toxins into the wound, exacerbating the challenges associated with healing<sup>11</sup>.

Partial thickness burns are a common form of thermal injury that requires effective and timely intervention to promote optimal wound healing and prevent complications. Silver-based dressings, such as silver sulfadiazine (SSD) and sustained-release silver foam, are widely used in burn care due to their antimicrobial properties. So, this study was planned to evaluate and compare the outcomes of these two treatments to determine their relative efficacy and potential impact on patient outcomes.

## 2. METHODOLOGY

The study, conducted at Pak Italian Modern Burn Center, Multan from August 1, 2022, to July 31, 2023, was designed as a prospective observational investigation. It included patients aged 18–60 years who suffered thermal burn injuries ranging from 20% to 60% total burn surface area (TBSA) on trunk anteriorly or posteriorly, provided they were admitted within 48 hours of the burn incident. Exclusion criteria involved patients with chemical and electrical burns, as well as those with comorbidities or other associated injuries.

After obtaining informed consent and providing a detailed explanation of the study procedure, all participants received treatment based on a standardized unit treatment protocol. Patients included in the study were alternately selected to receive two types of

dressings, leading to the formation of two distinct groups: Group 1, comprising patients who underwent dressing with 1% SSD, and Group 2, consisting of patients who received sustained-release silver dressing.

The study involved two groups of patients with different dressing schedules: Group 1 patients were dressed on alternate days, while Group 2 dressing of patients was done 5<sup>th</sup> day or earlier in the presence of soakage, odor and purulent discharge. Analgesics were administered exclusively before dressing changes according to the plan of treatment. Regular assessments of both the wound and the patient, utilizing photographs and clinical parameters, were conducted throughout the study.

The variables utilized to assess and compare the dressings included: Pain during dressing change, measured using a visual analog score (VAS) on the 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup>, and 20<sup>th</sup> days. The percentage of wound healing on the anterior and posterior trunk, evaluated through graphical representation at the 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup>, and 20<sup>th</sup> days. Duration of hospital stay.

SPSS version 27 was used. Descriptive statistical analysis was presented with medians and standard deviations (SD) reported. Significance was determined at a threshold of  $P < 0.05$ .

### 3. RESULTS

Overall, 40 patients were included in this study. The study patients were equally divided into two groups Group I 20 (50.0%) and Group II 20 (50.0%). The distribution of age, sex and hospital stay of both the groups were almost equal, and the differences were statistically insignificant, ( $p > 0.050$ ). (Table. I).

In Group I, there were 3 (15.0%) patients who had wound healed and 5 (25.0%) patients had wound healed in Group II. (Figure. I). The mean VAS score at 5, 10, 15 and 20 day of Group II was less than the

Group II, and the differences were statistically significant, ( $p < 0.001$ ). (Table. II). whereas, the wound healing in both the groups were almost equal at 5, 10, 15 and 20 day, and the differences were statistically insignificant, ( $p > 0.050$ ). (Table. II).

**Table. I**

**Demographic characteristics and length of hospital stay of the study groups**

Characteristics	Group I 20 (50.0%)	Group II 20 (50.0%)	p-value
Age (years)	38.25±4.59	38.21±4.73	0.60
Sex			
Male	12 (60.0)	15 (75.0)	0.311
Female	8 (40.0)	5 (25.0)	
Length of hospital stay (days)	2.75±1.06	1.90±0.44	0.850

**Table. II**

**Distribution of VAS score among the study groups**

VAS score	Group I 20 (50.0%)	Group II 20 (50.0%)	p-value
At 5 <sup>th</sup> day	8.35±1.42	5.30±0.65	<0.001
At 10 <sup>th</sup> day	7.11±0.55	4.15±0.48	<0.001
At 15 <sup>th</sup> day	4.15±0.58	3.55±0.75	<0.001
At 20 <sup>th</sup> day	3.90±0.64	1.70±0.47	<0.001

**Table. III**

**Distribution of wound healing among the study groups**

Wound healing	Group I 20 (50.0%)	Group II 20 (50.0%)	p-value
At 5 <sup>th</sup> day	6 (30.0)	3 (15.0)	0.225
At 10 <sup>th</sup> day	9 (45.0)	3 (15.0)	0.082
At 15 <sup>th</sup> day	7 (35.0)	10 (50.0)	0.337
At 20 <sup>th</sup> day	14 (70.0)	15 (75.0)	0.723

**Figure. I**



#### 4. DISCUSSION

The treatment of burn wounds typically involves either changing dressing or undergoing surgery. While surgery can yield satisfactory healing outcomes, it may not be a viable option for all patients due to its high cost<sup>12</sup>. Alternatively, changing dressing is a more cost-effective approach widely employed in clinical practice, but it is associated with slower wound healing. Therefore, the selection of appropriate dressings is crucial to manage local infections and facilitate healing<sup>13</sup>. Ideally, these dressings should be easily applicable, possess good penetration, offer broad-spectrum effectiveness without inducing drug resistance, and avoid local or systemic adverse reactions<sup>14</sup>.

In a study conducted by Gupta et al<sup>15</sup> on the Indian population, it was observed that patients treated with sustained-release silver dressings exhibited lower Visual Analog Scale (VAS) scores compared to those treated with silver sulfadiazine (SSD). The comparative analysis with our results further revealed that sustained-release silver foam dressing resulted in rapid healing of wound, shorter hospital stay, pain reduction, and lower expenses when considering the overall hospital burden.

In 2006, Caruso et al<sup>16</sup> assessed pain levels using Visual Analog Scale (VAS) for individuals aged 4 years and older. Their findings revealed that hydrogel fiber dressing proved more effective in reducing pain at the time of dressing when compared to silver sulfadiazine (SSD). Sustained-release silver dressings, supplied in sheet and pad form, were noted to be easier to apply and remove, thereby causing less pain during the dressing change process.

The group receiving sustained-release silver dressings exhibited a higher percentage of improved wound healing compared to those using SSD. According to Aziz et al<sup>17</sup> topical silver and silver-

containing dressings were reported to be either no more effective or even less effective than control dressings in facilitating the healing of wounds of burn. In their study, Silverstein et al<sup>18</sup> conducted a comparison between silver-containing silicon dressings and silver sulfadiazine (SSD), finding that the silver-containing soft silicone foam dressing proved to be equally effective in treating patients with SSD in terms of wound healing.

In their 2012 study, Palmieri et al<sup>19</sup> compared a hydrogel fiber dressing to silver sulfadiazine (SSD) and found no significant difference in the time required for wound healing between the two treatments. Barret et al<sup>20</sup> conducted a study that highlighted the considerable pain associated with traditional dressings in the pediatric age group, and they subsequently compared the use of 1% silver sulfadiazine (SSD) with Biobrane for the management of partial-thickness burns in this population.

#### 5. CONCLUSION

Results of this comparative study has demonstrated that the utilization of sustained-release silver dressing exhibits notable advantages in the wound healing process, including accelerated recovery rates, reduced pain levels, and consequently, earlier hospital discharge, when compared to traditional silver sulfadiazine (SSD) dressings.

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