Eduvest – Journal of Universal Studies
Volume 6 Number 6, June, 2026
p- ISSN 2775-3735- e-ISSN 2775-3727

Challenging Management of Wound Infection with Silver Sulfadiazine in a Rural Hospital: A Case Series and Literature Review

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Keywords:
Wound infections, silver sulfadiazine, limited medical resources, rural hospital

ABSTRACT

Wound infection is one of the most common obstacles to wound healing, leading to significant morbidity and mortality. Management strategies for wound infection remain challenging, especially in rural hospitals with limited medical resources, such as West Bangka Hospital. We present three cases of patients with wound infections of varying ages. The first case involved a neonate who developed an infected wound on the left foot at a previous intravenous cannulation site after two weeks of hospitalization. Silver sulfadiazine cream was applied topically to the wound once daily, and the wound was dressed with gauze. Within three days, edema and purulent discharge had diminished, and no adverse effects were observed. The second and third cases involved a 50-year-old man with a history of diabetes who had an infected wound on his right foot for several days and a 63-year-old man with a wound infection on his left buttock due to prolonged bed rest. Silver sulfadiazine cream was applied to the wounds, which were then dressed with gauze. Following application, no adverse reactions were observed. However, both patients did not undergo follow-up or further documentation. Our review shows that silver sulfadiazine exhibits bactericidal activity against both Gram-positive and Gram-negative bacteria and may positively influence wound healing by modulating zinc levels and inflammatory cytokine production. The cream base helps absorb exudate and maintain a moist wound environment. Silver sulfadiazine is commonly used to treat burn wounds because of its cost-effectiveness, tolerability, and safety. Silver sulfadiazine may be an effective treatment for managing wound infections in neonates and adults, especially in rural hospitals with limited medical resources. Further studies with more comprehensive documentation and follow-up are needed to confirm its long-term safety and efficacy.

INTRODUCTION

Wound infection is the most common health problem worldwide. Wound infection can inhibit wound healing, leading to morbidity and mortality. There is a study that shows infected wounds can cause the death of at least 10,000 people for every million patients (Wong et al.,

2015). The systemic inflammatory response or sepsis occurs if microorganisms in the wound spread systemically, leading to organ dysfunction (International Wound Infection Institute [IWII], 2016).

Wound infections are generally classified into two types: acute and chronic wounds (Raziyeva *et al.* 2021; Ding *et al.* 2022; Hurlow dan Bowler 2022). Suboptimal management of acute wounds can lead to chronic wounds and cause numerous problems, making healing unpredictable (Wong et al., 2015). The most important aspect of wound management is preparing the wound bed to facilitate rapid and effective healing. Wound bed preparation can be done by managing non-vital tissue, wound exudate, and bacterial control. Administering antibiotics is very important to control microbial load in an infected wound. Timely diagnosis and management are needed to prevent prolonged clinical conditions (Hurlow & Bowler, 2022; Perdanakusuma, 2022).

In 1968, silver-based antibacterials were introduced for burn treatment. Due to increasing antibiotic resistance, silver-containing wound dressings were used (Capeding et al., 2017). Silver sulfadiazine (SSD) is a broad-spectrum topical antimicrobial against gram-positive bacteria, some fungi, and viruses (Chalupczak et al., 2025). SSD is also known to have a role in maintaining wound moisture and reducing pain (Wardhana & Farhana, 2025). Silver sulfadiazine is known to be very safe, but its use should still be limited because several side effects have been reported, such as agranulocytosis, aplastic anemia, hemolytic anemia, leukopenia, and dermatological reactions. Practitioners should follow up on laboratory test results and ask about symptoms during SSD therapy (Oaks & Cindass, 2023).

The novelty of this research lies in its focus on the practical application of silver sulfadiazine for wound infection management in a rural Indonesian hospital with limited medical resources. While silver sulfadiazine has been widely studied in the context of burn wound management, its use for other types of infected wounds in rural settings has received limited attention. This case series contributes to the existing literature by documenting the clinical outcomes and practical considerations associated with silver sulfadiazine use in a rural hospital, including its applicability for neonatal wound infections and chronic wounds in adult patients with comorbidities. The research also addresses the gap between evidence-based recommendations and real-world practice in resource-limited settings, providing insights that may inform clinical decision-making and policy development.

The purpose of this study is to determine the characteristics and management of wound infections that can be provided in health services with limited medical resources, specifically through the use of silver sulfadiazine as a topical antimicrobial agent. The research aims to evaluate the clinical effectiveness and safety of silver sulfadiazine in treating wound infections in a rural hospital setting, considering the constraints of limited drug availability and follow-up capabilities. The findings of this study are expected to contribute to the evidence base for wound infection management in resource-limited healthcare settings and may inform the development of practice guidelines tailored to rural hospitals in Indonesia and other developing countries.

The contribution of this research to the field of wound care includes the provision of practical evidence on the use of silver sulfadiazine in settings where alternative treatments may be unavailable (Nimia *et al.* 2019; Iswati *et al.* 2025). The case series approach allows for detailed documentation of clinical presentations and treatment responses, offering valuable insights for healthcare providers working in similar environments. The study's focus on diverse patient populations—including a neonate, an adult with diabetes, and an elderly patient with a

pressure injury—enhances the generalizability of the findings and highlights the versatility of silver sulfadiazine as a wound care intervention.

The objectives of this research are to describe the clinical characteristics of wound infections in patients treated at West Bangka Hospital, to evaluate the effectiveness of silver sulfadiazine in promoting wound healing and reducing signs of infection, and to assess the safety of silver sulfadiazine use in this patient population. The benefits of this research include providing practical guidance for wound management in rural hospitals, contributing to the evidence base for topical antimicrobial therapy in resource-limited settings, and identifying areas for future research to improve wound care outcomes in underserved populations.

Management strategies for wound infection remain a challenge, especially in a rural hospital with limited medical resources, such as West Bangka Hospital. We present three cases of patients with wound infections of various ages who were treated according to drug availability in a rural hospital. This study aims to determine the characteristics and management of wound infection that can be provided in health services with limited medical resources

METHOD

This case series was a retrospective study reporting several cases of wound infection at West Bangka Hospital, Indonesia. Data were collected from hospital medical records and available clinical documentation. Patients with wound infections who received topical silver sulfadiazine therapy were included in this report. The study involved three patients of different ages and sexes, with varying wound etiologies and durations. This study also reviewed relevant literature on infected wounds and their treatment with silver sulfadiazine.

RESULT AND DISCUSSION

Case illustration

Case 1

A newborn baby girl was hospitalized due to prematurity, very low birth weight, neonatal asphyxia, and icterus neonatorum. The infant received treatment with intravenous fluid therapy, antibiotic injection, OGT, and CPAP. After one week of hospitalization, the jaundice has improved, and bilirubin levels have decreased.

After two weeks of hospitalization, the infant developed a wound infection on the left foot at the site of the previous intravenous cannula insertion after two days of infusion on the foot. Examination of the left foot revealed oedema, erythema, several blisters with pus, and warmth. Wound treatment was performed with silver sulfadiazine ointment. Silver sulfadiazine was applied topically to the wound in a thin layer once daily and bandaged with gauze. Within three days, the oedema and purulent discharge had decreased. During therapy, no dermatological reactions occurred, and the infant did not appear to develop further jaundice.

After 1 week of silver sulfadiazine therapy, laboratory tests were performed, and the results showed haemoglobin 14.3 gr/dl, leukocytes 18,000/mm3, platelets 515,000/mm3, rod neutrophils 1%, segmented neutrophils 33%, and an absolute neutrophil count (ANC) of 6,120 cells/mm3. The patient did not undergo a re-examination of bilirubin levels because the physical examination showed that his jaundice had improved, and there were financial constraints because the patient was using national health insurance. The infant was discharged after 5 weeks of hospitalization in good clinical condition, and the wound had healed.

Picture 1. Wound infection on the left foot. (A) Before the application of silver sulfadiazine, the wound showed blister, purulent discharge, oedema, and erythema. (B) Within 3 days of silver sulfadiazine administration, the oedema and purulent discharge had decreased

Case 2

A 50-year-old man has a wound on his right foot that appeared several days ago and has been getting worse, accompanied by pain. The patient has a history of uncontrolled diabetes mellitus. Physical examination showed an infected wound on the right foot, with clinical manifestations of edema, erythema, slough, purulent discharge, local warmth, and tenderness. The patient received diabetes medication, systemic antibiotic therapy, and a topical silver sulfadiazine dressing. The wound on the patient's foot was cleaned, and silver sulfadiazine was applied to the wound and covered with sterile gauze. No adverse reactions were observed during treatment. However, the patient was subsequently lost to follow-up, limiting further clinical evaluation and documentation.

Picture 2 . Wound infection on the right foot after administration of silver sulfadiazine

Case 3

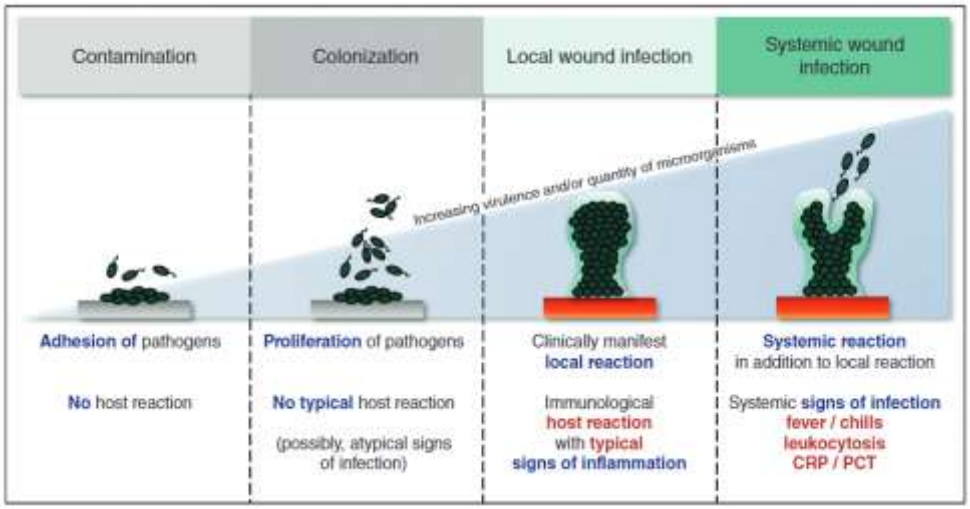
A 63-year-old man had a long-standing wound on his buttocks and was cared for solely by his family at home. The patient had had a wound on her buttocks for several months and was cared for solely by her family at home. He had a history of stroke and had been on bed rest for a prolonged period. The physical examination showed a wound infection on his left buttock due to pressure exposure. Clinical manifestation revealed edema, erythema, purulent discharge, necrotic tissue, local warmth, and tenderness. The patient was treated with systemic antibiotics and a topical silver sulfadiazine dressing. The patient's wound was cleaned, then silver sulfadiazine was applied topically and covered with a gauze bandage. No adverse reactions were identified during treatment. However, due to certain conditions, the patient was unable to undergo further documentation and follow-up for his clinical condition.

Picture 3. Wound infection on the left buttock due to prolonged bed rest, showed oedema, erythema, purulent discharge, and necrotic tissue

Discussion

Wound infections occur when microorganisms multiply within a wound and trigger a local or systemic immune response. This colonization can damage surrounding tissue and disrupt the normal wound-healing process. Microorganisms commonly associated with wound infections include *Staphylococcus aureus*, *methicillin-resistant Staphylococcus aureus* (MRSA), and *Pseudomonas aeruginosa* (Negut et al., 2018).

There are conceptual stages in wound infection: contamination, colonisation, local infection, and systemic infection (Figure 4). The likelihood of wound infection is affected by individual patients, wound conditions, and environmental factors. Individual risk factors include poorly controlled diabetes, malnutrition, and immune system disorders. Wound and environmental risk factors include a contaminated wound, an unhygienic environment, hospitalisation, and interface pressure (International Wound Infection Institute [IWII], 2022).



Picture 4. Conceptual stages in wound infection (Dissemond et al., 2025)

Currently, wound infection remains a significant challenge for both healthcare professionals and patients, as the diagnosis of infection is still largely dependent on subjective clinical assessment. Signs and symptoms of wound infection include erythema/hyperemia, local warmth, oedema, purulent discharge, increasing pain, and increasing malodour. If the infection has spread systemically, signs and symptoms will include malaise, fever/pyrexia, loss of appetite, lymphangitis, and septic shock. Various updated infection classification systems have been developed to help evaluate wound infections, utilizing clinical signs and symptoms and, in some cases, supported by laboratory findings. The choice between local therapy, systemic therapy, or a combination of both should be determined based on the established diagnosis of infection (Probst et al., 2022).

Comprehensive history taking is a crucial component in the management of all types of wounds. Important information includes the wound etiology, when identifiable, the patient's nutritional condition, wound duration, prior history of trauma or ulceration, and earlier treatment approaches. Wound examination should be conducted systematically to ensure accurate assessment. One widely used method is the TIMES framework. TIMES refers to Tissue type within the wound, signs of Infection or inflammation, assessment of Moisture balance, evaluation of Epithelialization, and condition of the Surrounding skin (Labib & Winters, 2023).

Silver sulfadiazine is a topical antimicrobial containing sulfonamide with a broad spectrum that exhibits bactericidal activity against both Gram-positive and Gram-negative bacteria. Silver sulfadiazine works by slowly releasing silver ions into the wound area, which disrupt bacterial cell membranes, increase membrane permeability, and interact with bacterial DNA and RNA. This process inhibits bacterial replication and cell division, ultimately leading to bacterial cell death. Silver sulfadiazine, which is widely available in 1% cream or ointment formulations, has received approval from the FDA. Silver sulfadiazine is known to accelerate the wound healing process by shifting zinc from metallothionin, altering metalloprotein concentrations within the wound, and modulating inflammatory cytokine activity, which contributes to the process of re-epithelialization. The silver cream component continuously absorbs exudate, maintaining the wound in a moist environment (Mohan et al., 2019).

Silver sulfadiazine is commonly used to treat burn wounds due to its cost-effectiveness, tolerability, and safety. Although considered safe, its use should still be limited. Side effects of silver sulfadiazine have been reported to include agranulocytosis (ANC <100 cells/µl), aplastic anemia, hemolytic anemia, leukopenia, hyperbilirubinemia, kernicterus, and dermatological

reactions such as erythema multiforme, pruritus, skin discoloration, and rash. Practitioners should evaluate the patient's symptoms and perform laboratory tests.

The neonatal case in this series represents a unique clinical challenge. Newborns are highly vulnerable to wound infection because of their immature immune system and fragile skin barrier. Intravenous cannulation injuries can become an entry point for bacterial colonization, especially after prolonged hospitalization. Although the use of SSD in neonates is generally approached cautiously because systemic absorption of sulfonamides may increase the risk of kernicterus, the short-term topical use and less frequent administration in this patient did not produce any observable adverse effects. Previous literature suggests that SSD should be used carefully in infants younger than two months; however, localized, monitored application may still provide clinical benefits when alternative wound-care options are limited.

CONCLUSION

Wound infection remains a significant contributor to delayed wound healing and increased morbidity. Clinical manifestations such as edema, erythema, local warmth, and purulent discharge require prompt recognition and management to prevent disease progression. This case series demonstrates that silver sulfadiazine may serve as an effective, affordable, and practical option for managing wound infections in both neonatal and adult patients, particularly in rural hospitals with limited medical resources. Careful monitoring, especially in neonates, is essential to minimize potential adverse effects. Further studies with larger sample sizes, standardized wound assessments, microbiological evaluations, and longer follow-up periods are required to more definitively establish the efficacy and safety of silver sulfadiazine across diverse patient populations

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