

# Star-Ag<sup>®</sup> – Colloidal Nano Silver Gel Improves Diabetic Wounds Case Studies

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## ABSTRACT

Wound healing is a complex process, physiologically involves cascaded phases. Under compromised physiological state like diabetes, it's a challenging task for physician and dreadful experience for the patients. Infections by drug-resistant strains and increased inflammation make the wound non-healing. Although there are plenty of treatments currently used, new drugs are always needed for patients' betterment. Silver in various forms is used for wound healing since antiquity. Star-Ag<sup>®</sup>, a formulation containing Colloidal Nano Silver – SilverSol<sup>®</sup>, is a breakthrough among the currently available advanced wound-healing technologies. It acts through its remarkable antimicrobial, anti-inflammatory and wound healing properties. The clinical efficacy of SilverSol<sup>®</sup> products has been proven in wounds of varied etiology, including diabetic wound. Current paper describes case reports, wherein, Star-Ag<sup>®</sup> was used along with standard wound-healing strategy. Conclusion Star-Ag<sup>®</sup> demonstrated efficacy as antimicrobial agent, prevent necrotic tissue from increasing, and optimize wound closure and healing outcome.

## Diabetic Wound

Diabetes, a chronic condition with persistent high blood sugar due to lack of insulin, is associated with several pathological changes that contribute to poor wound healing. Wounds in diabetic patients have a complex pathophysiology that is attributed to a triad of neuropathies, trauma with secondary infection, and arterial occlusive disease [1]. Collectively these pathological processes make diabetic wounds non-healing due to excessive inflammation, secondary infections with resistant bacteria, decreased angiogenesis, disrupted keratinocyte migration, and decreased fibroblast proliferation [2]. The standard of care for diabetic wounds involves debridement, controlling blood glucose and infections, patient education, and various other treatments to aid wound healing. Although there are plenty of treatments currently used, new drugs are always needed for patients' betterment.

## Wound Healing

Under normal physiological conditions, the body follows the damage repair cascade - involving

1. cell migration and proliferation,
2. extracellular matrix deposition, and
3. remodelling, which leads to wound healing.

Under such normal physiological conditions, therapeutic management of wounds includes supportive drug/non-drug modalities to enhance the natural process. Various wound dressings and treatments have evolved considerably to handle such conditions. However, in case of impaired physiological conditions, such as in diabetes, their management is a foremost challenge. Wounds tend to become chronic, infectious, and non-healing, making patients suffer for a longer period. Infection of wounds is a major concern that complicates, and delays wound management. In turn, wounds that take longer to heal are more prone to infections.  $\beta$ -haemolytic *Streptococcus pyogenes* and *Streptococcus agalactiae*, *Staphylococcus aureus*, *Proteus*, *Klebsiella*, *Pseudomonas*, *Escherichia coli*, *Stenotrophomonas*, *Acinetobacter*, and *Xanthomonas* are common pathogens that can infect wounds [3,4]. Infections with the resistant strains of these microbes is an additional challenge in wound care.

## Silver in Wound Healing

The use of silver in wound healing has a long history. Hippocrates (400 BC) highlighted the ability of silver in tissue repair and wound healing and applied silver preparations for the treatment of ulcers. Since then, silver has been used in different forms in different eras for wounds and ulcers. Fine silver wires to close fistula after surgical repair, silver foils for treating wound infections etc., were used. Silver

nitrate used to be most popular thereafter for oral and topical applications for wound care. The first record of applying colloidal silver on the wound as an antiseptic was found in 18916 Star-Ag<sup>®</sup>, a formulation containing Colloidal Nano Silver – SilverSol<sup>®</sup>, is a breakthrough among the currently available advanced wound-healing technologies. It offers a next-generation therapy for the treatment and management of severe, chronic, and infectious wounds that are difficult to manage. It acts through its remarkable antimicrobial, anti-inflammatory and wound healing properties. The clinical efficacy of SilverSol<sup>®</sup> products has been proven in wounds of varied etiology, such as acute and traumatic wounds, lacerations, diabetic-, pressure-, and venous-ulcers, infectious wounds, third-degree burns, MRSA-and VRE- infected wounds [5], [7-9] Star-Ag<sup>®</sup> can be applied locally on the wound alone or with wound dressings like Macfoam<sup>®</sup> (Nimbus<sup>®</sup> Technology, Barrier foam dressing). It is a highly absorbent polyurethane foam, that can absorb fluid, while maintaining moisture in wound environment. It has been shown that barrier foam accelerates wound healing through increasing granulation, pain reduction, absorption, and reduction of wound exudate, decrease in wound size and improvement in peri-wound skin condition [10]. In the present case report, we demonstrate wound-healing effect of Star – Ag in patients of Type 2 diabetes.

## Material and Methods

Patients visiting Surgery Clinic at Telogorejo Hospital Semarang,

with diabetic wounds were treated with the standard TIME approach that involves T—Tissue, removal of devitalized tissue; I— Inflammation/Infection and its prevention & control; M—Moisture Management; and E—Edge Protection [11]. The patients were known diabetics with the chief complaint of a swollen, reddish lesion on the leg, with pain, and in some cases, fever. Besides standard antibiotic treatment, diabetes correction was employed for all the patients.

Star-Ag<sup>®</sup> was applied alone or with Macfoam<sup>®</sup>, depending on the wound severity. Macfoam<sup>®</sup> was used for a severe deep wound to fill the cavity and optimize the contact of the antimicrobial agent with the wound surface. Star-Ag<sup>®</sup> was used to control infection and inflammation, thereby enhancing wound healing. In some cases, hydrophobic bacteria binding wound dressing was used [6].

## Case study Results

### Case 1 Mrs. TS

A 58-years-old female outpatient, known diabetic & obesity reported the hospital/clinic on 14th January 2025. Her left lower leg was swollen, reddish, painful, for 2 weeks and it became bluish and colder three days before reporting the hospital. The patient was weak & had a fever. The initial trigger/injury for this went unnoticed, instead, a sudden development of swelling that spreading up to calf was seen. The patient has been treated at another hospital, only given antibiotics, which worsen the condition (Table 1), (Figure 1).

**Table 1:** Management Strategy: Patient was hospitalized and standard wound management procedures with systemic antibiotic therapy, diabetes correction was initiated. An intense wound cleaning and care employed as above.

Intervention	Day	Outcome
Debridement was performed to eliminate pus & necrotic tissue	1	Condition did not improve
Amputation below-knee was performed, the stump was not completely closed, leaving a gap for drainage & evaluation.	3	3 <sup>rd</sup> day of amputation, still found continued infection & tissue death in the amputation stump.
Re-amputation was performed at knee level, with the installation of a vacuum drain. Dressing using regular gauze & reinforced with elastic bandages.	6	After 3 days of the knee amputation there was still pus production, the infection spread through the lymphatic channels to the mid-thigh, so it was decided to re-debride & perform open treatment on the amputation stump.
The patient's systemic condition improved, and was sent home, treatment was continued to manage infection of the amputation stump and tissue lysis with outpatient care every 2-3 days	20	Routine cleaning with 0.05% chlorhexidine solution & serial necrotomy was performed. -Since February 25, 2025*, wound care has been supplemented with the use of Star-Ag <sup>®</sup> & Macfoam <sup>®</sup> .
*The hollow/passageway is filled with Macfoam <sup>®</sup> by cutting it into pieces to suit the condition of the cavity/passageway. There was an improved wound condition by controlling infection, reducing bacterial load and creating a cleaner wound environment that supported new tissue growth without further necrosis.		



**Figure 1:** The infection was resolved, with a marked reduction of pus. Granulation tissue grew well, and no further necrosis was observed as of 21<sup>st</sup> March 2025, allowing for planned stump closure surgery within 1-2 weeks. By 19<sup>th</sup> June 2025, both granulation and epithelialization had progressed satisfactorily, resulting in complete wound closure and optimal healing.

## Case 2 Mrs. LH

A 65-year-old female outpatient reported to the clinic of the hospital with swelling and redness of the right foot for 4 days on 2nd December 2024. The patient was afebrile and in generally good condition. She had a history of diabetes with obesity and had developed

neuropathy and blockage of arteries in both lower legs. No treatment was taken before reporting to the clinic (Table 2), (Figure 2). The final outcome was partial improvement with significant infection control and healthy granulation tissue formation; minimal pus remained at the Achilles tendon area.

**Table 2:** Management Strategy: Patient was hospitalized and standard wound management procedures with systemic antibiotic therapy, diabetes correction was initiated. An intense wound cleaning and care employed as above.

Intervention	Day	Outcome
Debridement was performed to eliminate pus and necrotic tissue. The patient refused revascularization on 2/Dec/2025	Day 1	After 3 days of treatment the patient was allowed to go home. Further wound care was continued as an outpatient.
The wound continued to produce pus, the abscess cavity between the 4 <sup>th</sup> and 5 <sup>th</sup> toes extends to the back and soles of the feet. - Serial debridement was performed under local anesthesia in the outpatient clinic.	Day 13	As the necrosis area became wider, digiti 1 became blackish, so amputation of digiti 1 was performed in the outpatient clinic.
Infection & necrosis extends to digiti 2 <sup>nd</sup> ,3 <sup>rd</sup> ,4 <sup>th</sup> finger, the patient is anemic, so hospitalization is performed to correct anemia with transfusion, and debridement & transmetatarsal amputation of 2 <sup>nd</sup> ,3 <sup>rd</sup> ,4 <sup>th</sup> was performed.	Day 23	After the transfusion program is completed, treatment is continued as an outpatient.
Serial debridement & cleaning using 0.05% chlorhexidine solution was performed	Day 39	No satisfactory results. Since February 27, 2025, Star-Ag® & Macfoam® was additionally introduced.
Star-Ag® was applied; the wound was covered with Macfoam® Then the leg is wrapped with thick gauze on the outside + elastic band. Dressing was changed every 3 days.		



**Figure 2:** The continuation of Star-Ag® + Macfoam® dressing with days intervals continued along with other treatment from 27/2/2025 till 24/3/2025. The infection is more resolved, the pus is much reduced, granulation tissue is growing well, necrotic tissue is not increasing. Currently the accumulation of pus remains only from the Achilles tendon area as on 24/03/2025. The final outcome was partial improvement with significant infection control and healthy granulation tissue formation; minimal pus remained at the Achilles tendon area.

**Case Mrs. SU**

A 45-year-old female outpatient reported to the clinic of hospital with swelling, redness, and pain of the left lower leg on 22nd January 2025, with the main complaint of left lower leg being swollen, red-dish, and painful for 1 week before admission to the hospital. She had

history of diabetes and she was obese. The patient has been treated at another hospital and underwent debridement surgery once. On examination, a wound was found at the base of the first toe, with foot massage, pus started coming out of the wound, the base of the wound is blackish, emitting a foul odor (Table 3), (Figure 3).



**Figure 3:** The infection became more controlled, with a marked reduction of pus. Granulation tissue showed excessive growth, and there was no increase in necrotic tissue. A staged stump closure surgery was planned within the week due to insufficient soft tissue for complete closure of the stump. After months of continued management, granulation and epithelialization developed well, resulting in complete wound closure and optimal healing outcome.

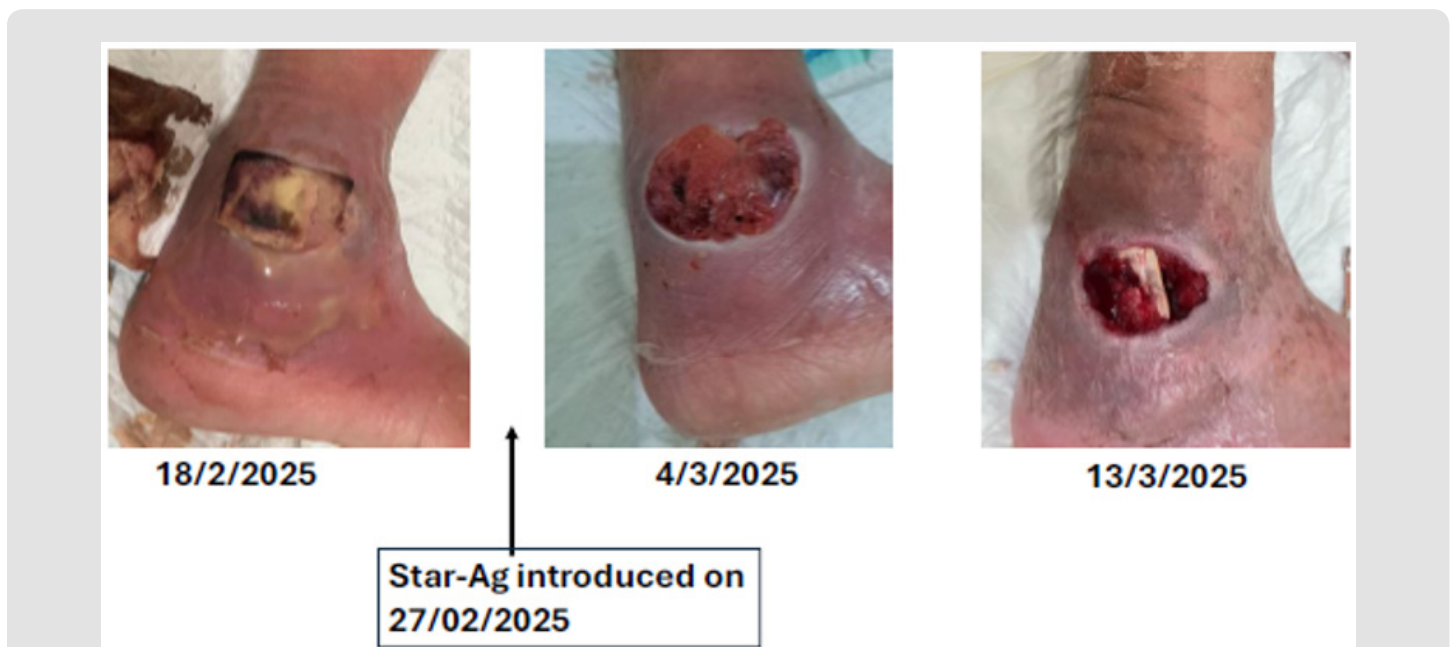
**Table 3:** Management Strategy: The patient was hospitalized. Debridement was performed to eliminate pus and necrotic tissue. Systemic antibiotic therapy, diabetes correction initiated. An intense wound cleaning and care employed as above.

Intervention	Day	Outcome
All necrotic tissue was removed during surgery. Extensive necrotic tissue was found up to the heel (necrotizing fasciitis), the plantar fascia & foot muscles were blackish brown, with lots of pus & a foul odor - 22 <sup>nd</sup> January 2025	Day 1	On the 3rd day the infection was still ongoing, pus was still productive, it was decided to amputate below-knee.
Amputation below knee was performed. Stump sutures were done sparsely to maintain drainage. Dressing was done using regular gauze & reinforced with elastic bandage.	Day 10	After 7 days of treatment the patient was discharged, treatment was continued with outpatient care every 2-3 days
Routine cleaning was carried out with 0.05% chlorhexidine solution & standard gauze dressing.	Day 32	Since February 27, 2025, wound care was supplemented with the use of Star-Ag <sup>®</sup> & Macfoam <sup>®</sup> as the infection was persistent, with tissue lysis

**Case 4 Mr. OKT**

A 51-year-old male outpatient reported to the clinic of hospital with an ulcer on the right ankle on 18th February 2025, with the main complaint of Ulcer with 4-5 cm diameter, on the right ankle for 2 weeks ago. One week before admission, the swelling started spread-

ing to the back of the foot & ankle with a lot of cloudy brown pus, foul odor discharge with reddish & swollen ulcer edge. At the base of ulcer, granulated & necrotic tissue was found. The patient was pale, complaining of feeling cold. He had of history of diabetes. The patient had been treated at another hospital, given antibiotics, and had the wound cleaned, but the condition did not improve (Table 4), (Figure 4).



**Figure 4:** As on 13/3/2025, Pus is still produced but is markedly reduced; granulation tissue is growing well, necrotic tissue is not increasing. The infection has not been completely resolved because the infection may have involved the distal fibula bone.

**Table 4:** Management Strategy: - The patient was hospitalized. Debridement was performed (22/2/2025) to eliminate pus & necrotic tissue. Systemic antibiotic therapy, diabetes correction with intense wound care initiated.

Intervention	Day	Outcome
Debridement was performed to eliminate pus and necrotic tissue. A Hydrophobic bacteria-binding wound dressing tampon was installed. Blood transfusion was given to correct anemia. -20/2/2025	Day 3	After 2 days - the pus was still productive,
Washing was carried out with 0.05% chlorhexidine solution, necrotic tissue was cured, and a hydrophobic wound dressing tampon was re-installed.	Day 5	Two days later the tampon was removed, pus production decreased, tissue edema decreased,
Washing with 0.05% chlorhexidine, curettage of necrotic tissue, followed by re-installation of hydrophobic wound dressing tampon	Day 7	The patient was discharged with a planned control 3 days later.
The patient was continued to be an outpatient with a planned control 3 days later and trained for changing dressing with pus cleaning every day.	Day 9	Star-Ag <sup>®</sup> was introduced 27/2/2025 and was applied & wrapped with regular gauze by patient. The patient checked every 5 days

**Case 5 Mr. SR**

A 71-year-old male outpatient reported to the clinic hospital on 21st February 2025, with the main complaint of swollen right leg for 1 week before the examination, fluid started coming out for 1 day be-

fore the examination. The ulcer is 1 cm in diameter, produces a lot of cloudy yellow pus, the edges of the ulcer are red & swollen. The patient is in pain & subfebrile fever. He had of history of diabetes. The patient did not receive any treatment till the date of reporting (Table 5), (Figure 5).



**Figure 5:** Pus production stopped, granulation tissue grew abundantly, and tissue necrosis did not occur again. The infection was resolved; just waiting for epithelialization to fill the entire ulcer as secondary healing.

**Table 5:** Management Strategy: The patient was hospitalized. Debridement was performed (22/2/2025) to eliminate pus & necrotic tissue. Systemic antibiotic therapy, diabetes correction initiated. An intense wound cleaning and care employed as above.

Intervention	Day	Outcome
After debridement, incision was made in the proximal & distal ulcer, a hydrophobic wound dressing tampon was installed -18 <sup>th</sup> February 2025	Day 2	On examination 2 days later, pus reduced
Washing was performed with 0.05% chlorhexidine solution, curettage was performed to remove necrotic tissue, and tampon was reinstalled	Day 4	The patient was discharged allowed to be outpatient with follow up after 3 days
On follow up - the tampon was removed, and the wound was examined	Day 8	Pus & necrotic tissue decreased. Star-Ag <sup>®</sup> was introduced - 26/2/2025
Patient was trained to change the dressing every day, instructed to apply Star-Ag <sup>®</sup> and Macfoam <sup>®</sup> after cleaning and followed up every 5 <sup>th</sup> day	Day 13	3 weeks followed-up until 21 <sup>st</sup> March 2025 - Wound was improving.

## Conclusion

Star-Ag<sup>®</sup>, a formulation containing Colloidal Nano Silver – SilverSol<sup>®</sup>, is a breakthrough among the currently available advanced wound-healing technologies. In 5 different cases, Star-Ag<sup>®</sup> demonstrated efficacy as antimicrobial agent, prevented necrotic tissue from increasing, and optimize wound closure and healing outcome. However controlled studies in larger population will help in comparing efficacy and probably establishing superiority of Star-Ag<sup>®</sup> for wound management in comparison with presently available drug eluting dressings.

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