

OPEN WOUND TREATMENT FROM HETROGENIOUS API MIXTURE

E. Elavarasi¹, S. M. Syed Abdul Subuhan^{2*}, Subhash³, Khushi Singh⁴, A. Dinesh Babu⁵, G. Ranjith⁶

¹Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

^{2,3,4,5,6}Department of Pharmacy, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

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*Corresponding Author: S. M. Syed Abdul Subuhan

Department of Pharmacy, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

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ABSTRACT

The goals of wound care are to lessen scarring, stop infection, and encourage healing. While improved dressings and treatments help healing, moisture management and APIs such as antibiotics aid in recovery. These techniques promote better results and a quicker recover hear we have formulate an topical treating agent with the following drugs. Copper Sulfate: Antimicrobials help treat infections but must be given in small, controlled doses to minimize the risk of toxicity. Zinc oxide: Creates a barrier, protects the skin, and has some antibacterial qualities. Frequently used to treat small burns and diaper rash. An antimicrobial agent used to treat bacterial infections is sulfanilamide, often known as sulphamine. Think about allergies; some people are allergic to sulfa medications. Boric acid is an antiseptic that can be hazardous in large quantities but is helpful for small burns and wounds. Petroleum Jelly: A moisturizing and protective base that aids in the retention of active substances. Hence over aim to prepare a topical oinment with the above drugs. Wich may have a higher Therapeutical activity then other marketed product.

KEYWORDS: API- Active Pharmaceutical Ingredients, Antimicrobial, Moisture Management, Antibiotics, Therapeutical Activity.

INTRODUCTION

Any injury when the skin breaks and exposes the underlying tissues is called an open wound. Cuts, abrasions, punctures, or lacerations can cause this kind of wound, which puts the body at risk of infection because broken skin allows bacteria and other pathogens to enter. An open wound can get infected when bacteria, viruses, fungus, or other

pathogens get inside it and start to grow. The infection may remain localized at the location of the incision or it may disseminate and cause major difficulties if it spreads to other areas of the body.^[1,2]



Fig 1: Open wound of the patient who faced a major accident.

Indications and Signs of Infection in the Wound

1. **Redness:** The area of skin around the wound turns red or swollen.
2. **Swelling:** Swelling surrounding the injury or region.
3. **Pain:** Severe or persistent pain at the location of the wound.
4. **Warmth:** To the touch, the region surrounding the wound may feel warm.
5. **Pus or Discharge:** A foul-smelling, green, or yellowish discharge emanating from the wound.
6. **Fever:** A systemic fever could result from the infection spreading.

The following are some of the more dangerous problems that might develop from an infected wound if treatment is not received:^[1,6]

Cellulitis is a kind of skin and subcutaneous tissue infection caused by bacteria. Warmth, redness, swelling, and discomfort may result from this. Sepsis may result if it spreads and enters the circulation.

An **abscess** is a buildup of pus that may grow around a wound and may require surgical drainage.

Osteomyelitis: An infection can result in osteomyelitis, a dangerous illness that needs ongoing care, if it spreads to the bone.

Tetanus: *Clostridium tetani*, a bacterial infection that can enter through deep wounds, produces a toxin that affects the neurological system and causes spasms and stiffness in the muscles.^[2,7]

Factors That Increase the Risk of Wound Infection:

- Wounds that come into contact with dirt, saliva, or other bacteria-laden substances significantly raise the risk of infection.
- Huge or deep wounds.
- People with impaired immune systems, such as those using immunosuppressive medications, diabetes, or cancer.
- Bad wound care: Using soiled bandages or failing to adequately clean the wound.
- Diabetes and cardiovascular disease are examples of chronic illnesses that impede healing.^[5]



Fig. 2: Patient with the treated wounds.

Keeping Open Wounds Free from Infections

Clean the Wound: To get rid of germs and dirt, wash the wound right away with soap and water. An antiseptic solution such as iodine or hydrogen peroxide can also be used.

Use an Antibiotic Ointment: Using a topical antibiotic (such as neomycin or bacitracin) after cleaning can aid in the prevention of infection.

Dress the Wound: To keep the wound free of bacteria and debris, cover it with a sterile dressing or bandage.

Change Dressings Frequently: To keep the area sterile, change the bandages every day or if they get soiled or moist.

Watch for Infection: Seek out any swelling, redness, or discharge that could indicate an infection in the wound.

Seek Medical Assistance for Severe Wounds: Surgical stitches or other expert medical attention may be necessary for deep, big, or puncture wounds.^[8]

Treatment for an Infected Wound

In the event that a wound becomes infected, possible therapies include:

Cleaning and Debriding: A complete cleaning of the wound as well as the removal of any dead or contaminated tissue may be necessary.

Antibiotics: Antibiotics may be administered topically or orally to treat the illness. Antibiotics administered intravenously may be required in severe situations.

Drainage: A medical professional may be required to remove an abscess if one develops.

Tetanus Shot: In the event that the wound is serious or polluted and you have not received a tetanus shot within the previous five to ten years, you may need one.^[3]

When to Get Medical Help

- If the wound is deep, big, or won't stop bleeding, get medical help.
- There are indications of infection, such as redness, swelling, temperature, and pus.
- You have bodily aches or a fever.
- Tetanus risk is increased when an item that was sharp, rusty, or unclean created the wound.
- If you suffer from any underlying medical issues, such as diabetes or weakened immune system.

With severe or contaminated wounds in particular, "Proper wound care and infection control are essential." critical to preventing consequences.^[4,5]

TREATMENT

Over main aim to treat the open infected wound with help of the Homogenous mixture the following are.

- Copper Sulfate
- Zinc Oxide
- Sulfanilamide
- Boric acid
- Petroleum jelly

This mixture may be used as a protective, antibacterial ointment for small burns, wounds, or skin irritations. The quantities of sulfanilamide, boric acid, and copper sulfate, however, raise safety issues since they can be hazardous if not properly regulated.^[16,17,18,19]

1. Copper Sulfate

As an inorganic chemical, copper sulfate (CuSO_4) is used in a variety of industrial processes and as a fungicide. Because copper plays a biologically significant function in human physiology, recent study has also looked at its possible significance in aiding wound healing.

Research has shown that copper ions, particularly those from copper sulfate, can promote wound healing, despite the fact that copper sulphate itself has historically been employed as an antiseptic:

- Copper sulfate possesses antibacterial qualities that can lower the risk of infection in open wounds by preventing the growth of viruses, bacteria, and fungus.
- Copper ions can increase angiogenesis, collagen synthesis, and the creation of granulation tissue, which speeds up wound healing.
- Copper's anti-inflammatory properties allow it to control immune cell activity and lessen excessive inflammation, which can impede tissue repair. One of the essential elements of wound healing is inflammation.

Clinical Applications

The use of topical medications that gradually release copper ions at the wound site and dressings enriched with copper has showed promise in improving healing, especially in chronic wounds such as pressure sores and diabetic ulcers. These dressings ensure long-lasting wound healing by providing a regulated release of copper ions.

Future Prospects

Research on the use of copper sulfate and other copper compounds in wound healing is still under progress, with an emphasis on formulating formulations that will optimize advantages while reducing hazards. Treatments based on copper show great promise when added to traditional wound treatment, especially for wounds that heal slowly.

In conclusion, copper sulphate holds a great deal of promise for wound healing because of its antibacterial qualities and function in fostering angiogenesis and collagen synthesis. To prevent toxicity and provide the best possible therapeutic results, its use must be well controlled.^[16]

2. Zinc Oxide

Often included in ointments for diaper rash, small burns, and skin irritations, zinc oxide is a well-known skin protectant. Because of its antibacterial, anti-inflammatory, and skin-soothing qualities, zinc oxide (ZnO) is a substance that is

frequently used in wound treatment. It contributes significantly to the promotion of wound healing via a number of mechanisms:

Because of its potent **antibacterial qualities**, zinc oxide helps keep wounds from becoming infected. It lowers the chance of infection—a critical component in encouraging quicker wound healing—by fostering an environment that prevents the growth of bacteria and fungus.

Properties that Reduce Inflammation

An essential stage in the healing of wounds is inflammation. Prolonged inflammation, though, can impede recovery. By modulating the immune system and limiting the generation of pro-inflammatory cytokines, zinc oxide helps lower inflammation. As a result, the wound healing process moves more quickly from the inflammatory to the repair phases.

Regeneration of the Skin

For tissue healing and cell proliferation, zinc is necessary. Collagen is a structural protein required for wound healing and skin regeneration. Zinc oxide aids in its formation. Additionally, it helps the healing process by promoting angiogenesis, the process of forming new blood vessels.

Barrier Protection

Zinc oxide functions as a physical barrier on the skin, keeping the area wet and shielding the wound from outside pollutants so that it may heal. This characteristic is particularly helpful in the treatment of chronic wounds, burns, and ulcers.

Uses

Topical wound care treatments including ointments, lotions, and dressings frequently include zinc oxide. It works very well for mild burns, abrasions, cuts, and skin irritations.

In conclusion, zinc oxide is a crucial component of contemporary wound care because of its antibacterial, anti-inflammatory, and skin-regenerative qualities, which contribute to its wound healing activity.^[17]

3. Sulfanilamide (also known as sulphamine)

Sulfur-containing sulfamine, sometimes referred to as sulfanilamide, has long been employed as an antibacterial agent, especially in the treatment of bacterial infections. It is a member of the sulfonamide family, which works by preventing bacteria from synthesizing folic acid, an essential step in the development and replication of germs.

The main reason sulfamine is beneficial in healing wounds is because of its antibacterial characteristics. It contributes to the reduction of wound infections, which is essential for appropriate healing, by inhibiting bacterial development. Sulfamine keeps the wound environment cleaner, which stops infection from causing tissue damage and delaying wound healing. Current research is looking into adding sulfamine to sophisticated wound dressings, including hydrogels or films, that can deliver the medication to the wound site over an extended period of time. By preserving a moist wound environment that promotes tissue repair, these developments seek to enhance both the antibacterial efficacy and the healing process as a whole.

Sulfamine is frequently used in topical preparations—such as creams or powders—that are applied to wounds in order to treat or avoid infections. Burns, ulcers, and other open wounds that are prone to bacterial colonization can benefit most from this type of treatment.

In summary, sulfamine plays a crucial role in wound healing by preventing bacterial infections, which are a major hindrance to the healing process. It is still a crucial substance for wound care, especially when it comes to infection control, even if its usage has decreased in favor of more modern therapies.^[18]

4. Boric Acid

Because it may stop the growth of germs and fungi, boron-derived boric acid (H_3BO_3) has long been used as an antiseptic and antibacterial agent. Though its usage is sometimes contested because to worries about toxicity with continuous exposure, its usefulness in wound healing has been investigated in a variety of medical situations. An outline of its abilities to cure wounds is provided below:

Antimicrobial Characteristics

It is possible to eradicate or stop the growth of bacteria, fungus, and other pathogens that can infect wounds with boric acid. One important component of effective wound healing is infection prevention, which may be achieved by lowering the microbial burden in wounds. Because of its antibacterial qualities, it may be used to treat small burns, abrasions, and wounds.

Effects of Anti-Inflammation

According to certain research, boric acid may possess anti-inflammatory qualities that may reduce swelling and encourage tissue healing. In the early phases of wound care, chemicals that reduce inflammation can be helpful since it can impede wound healing if left unchecked.

Accelerated Healing of Wounds

Boric acid has been shown to have antibacterial and anti-inflammatory qualities in addition to encouraging re-epithelialization, which is the process by which new skin cells develop over a lesion. This can hasten the healing process of wounds, particularly those that are superficial. Nonetheless, since infection control is a top concern, its application is more prevalent in the management of chronic wounds and ulcers.

Topical Utilization

In several topical formulations, including ointments, solutions, and creams, boric acid has been used—often in conjunction with other therapeutic substances. Boric acid solutions, for instance, have been used as burn irrigation or to treat infected wounds. Additionally, bandages for infections and skin ulcers frequently include it.

Possible Hazards

Although boric acid helps prevent infections, using it should be done so carefully. Toxic effects might result from prolonged or excessive use, especially in vulnerable groups such young children, the elderly, or people with renal impairments. If absorbed in substantial quantities through damaged skin, overexposure can result in systemic toxicity, delayed wound healing, and skin irritation.

In summary

Boric acid's antibacterial and anti-inflammatory qualities make it a great tool for wound healing. It works well for small wounds and infections because it helps speed up wound healing and prevent infections. To prevent toxicity, it must be used carefully, and short-term usage under medical supervision is usually advised.

5. Petroleum Jelly**Petroleum jelly's benefits for wound healing**

Moisture Retention: The hydrophobic coating that petroleum jelly creates on the skin keeps moisture inside the wound. It is well known that moist conditions hasten the healing of wounds by encouraging cell proliferation and inhibiting the development of a hard crust, which can impede A common component of more comprehensive treatment plans that also contain additional active pharmaceutical ingredients (APIs), petroleum jelly, also known as vaseline, plays a significant role in wound healing. Its main purpose is to cover the wound with a barrier that keeps it wet and stops it from drying out. Scabbing and scarring are less likely as a result, and healing proceeds more quickly. Petroleum jelly functions with other APIs in the following ways to help with wound healing:^[19]

The healing process

Barrier Protection: It prevents dirt, germs, and other possible irritants from entering the system, hence lowering the chance of illness. Additionally, this barrier reduces irritability and friction at the wound site.

Scar Reduction: Petroleum jelly helps lessen the visibility of scars by keeping the site wet. An atmosphere that is wet may promote healing of the wound with less obvious harm since scabbing and dryness lead to more noticeable scarring.

Soothing Irritation: The surrounding skin, which might get irritated during the healing process, is soothed and softened by its emollient qualities.

Combining Petroleum Jelly with Various APIs

To improve the efficacy of the treatment as a whole, petroleum jelly is frequently used in concert with other wound-healing agents. Among the frequently used APIs are:

Antibiotics: Petroleum jelly and antibiotic ointments work together to prevent bacterial infection in small wounds. Examples of antibiotics are Neomycin, Bacitracin, and Polymyxin B. As the antibiotic either eradicates or stops the development of germs, the petroleum jelly maintains the site moist.

Antiseptics (such as chlorhexidine and povidone-iodine): These aid in wound disinfection, particularly in situations when infection risk is high. After using antiseptics, petroleum jelly can be used to provide a barrier that stops more contamination.

Silver-based Dressings: Due to its antibacterial qualities, silver is frequently used to treat burn or chronic wounds. When petroleum jelly is mixed with silver, the silver kills germs and the jelly keeps the wound covered and moist.

Low-strength corticosteroids, such as hydrocortisone, may be administered in some situations to lessen inflammation or itching surrounding the incision. Petroleum jelly stops additional discomfort and aids in the corticosteroid's retention.

Hyaluronic Acid: Well-known for its ability to hydrate the skin, hyaluronic acid also promotes cell migration and proliferation, which speeds up the healing process from wounds. When mixed with petroleum jelly, it helps to keep the wound moist and promotes wound healing.

Zinc Oxide: Due to its calming and protecting qualities, zinc oxide is frequently used in the treatment of burns and skin irritations.

In summary, petroleum jelly can be a useful and efficient portion of wound treatment, especially when combined with other APIs such as antiseptics, antibiotics, and anti-inflammatory drugs. Its functions in maintaining moisture in the wound, shielding it from outside influences, and minimizing scarring make it an important adjunct in both mild and more involved wound healing procedures.^[15,16,17]

CONCLUSION

We now comprehend the medicinal properties of these heterogeneous mixtures as well as their warnings. Although we are developing this formulation to improve the therapeutic action of the wound therapy, which will aid the patient in recovering from the wound, the medicine is available on the market today in a variety of formulations. This should help with the persistent wounds, we hope. This medication is beneficial for patients who have suffered serious injuries or accidents. It works as an antimicrobial, antibiotic, and anti-inflammatory agent, helps to keep the wound moist, guards against microbial infection, and lessens scarring after the wound has been closed.^[19,20,21]

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