# COMPREHENSIVE ANALYSIS OF BURN INJURIES AND ADVANCED METHODS FOR BURN WOUND MANAGEMENT

Dissertation Submitted to

**The IIHMR University, Jaipur**

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Pharmaceutical Management

By

Manish

Under the Supervision and Guidance of

Dr. Saurabh Kumar

2024

FIBROHEAL™
WOUNDCARE PVT. LTD.

# COMPLETION CERTIFICATE

This is to certify that Mr. MANISH MAURYA

in partial fulfillment of the requirements for the award of MBA Pharmaceutical Management from the IIHMR University, Jaipur has successfully completed his internship at Fibroheal Woundcare Pvt. Ltd. during 18/03/2024 to 18/06/2024.

Place : Bengaluru

Date : 24-06-2024

**Vivek Mishra**
Director

## DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Comprehensive Analysis of Burn Injuries and Advanced Methods for Burn Wound Management** is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)
Manish

Date: 5/07/24

IIHMR UNIVERSITY

## CERTIFICATE

This is to certify that dissertation titled. **"Comprehensive Analysis of Burn Injuries and Advanced Methods for Burn Wound Management"** is a record of the research work undertaken by **Manish** in partial fulfillment of the requirements for the award of the degree **MBA in Pharmaceutical Management** from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

5/7/2024

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Date: 05/07/2024

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I am overpowered in all humbleness and appreciation to perceive my significance to every single one of the people who have helped me to put these contemplations. I might want to communicate my unique gratitude to my parents and friends for their support during the whole course.

**Date:**
**Place:**

**(Manish)**

# CERTIFICATE

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# Abstract

Burn injuries represent a significant public health challenge in India, affecting millions annually with profound implications for health outcomes and economic stability. This paper provides a comprehensive analysis of burn injuries, focusing on their prevalence, demographic patterns, and socio-economic impact. In India, an estimated 6-7 million people suffer from burns each year, with a disproportionate burden on women and children, primarily due to domestic accidents involving cooking practices. Rural areas bear the brunt of these injuries, exacerbated by limited access to safe cooking facilities and healthcare services. The economic toll of burn injuries is substantial, encompassing treatment costs, lost productivity, and long-term rehabilitation expenses.

Advancements in burn wound management are crucial to improving outcomes for affected individuals. This study explores current treatment strategies, including acute care interventions, surgical techniques, and rehabilitative therapies. It highlights the challenges in accessing specialized burn care facilities and trained healthcare professionals, particularly in rural and underserved regions. Government initiatives and advocacy efforts are discussed, emphasizing the importance of preventive measures, public awareness campaigns, and policy interventions to enhance burn care infrastructure nationwide.

The integration of innovative technologies, such as telemedicine and regenerative medicine, offers promising avenues for improving burn treatment and patient outcomes. However, significant gaps remain in research, healthcare delivery, and socio-economic support systems. This paper concludes by identifying key areas for future research and policy development aimed at reducing the incidence of burn injuries, enhancing access to quality care, and mitigating the socio-economic impact on affected individuals and communities in India.

# Introduction

Burn injuries represent a significant global health concern, affecting millions of individuals annually and leading to substantial morbidity, mortality, and healthcare costs. The complexity of burn wounds, which can range from superficial to deep tissue damage, necessitates a multifaceted approach to treatment that addresses both immediate and long-term care needs. Advances in medical technology and research have continually improved our understanding of burn pathophysiology and the development of innovative treatment methodologies.

This comprehensive analysis aims to explore the various types of burns, their physiological impact, and the latest advancements in burn wound management. The study will delve into acute care strategies, including emergency response and initial wound care, as well as long-term rehabilitation and psychological support essential for holistic recovery. By examining both traditional and emerging treatment approaches, this research seeks to provide a detailed overview of current best practices and future directions in burn care.

The critical nature of prompt and effective treatment for burn injuries cannot be overstated. Innovations in surgical techniques, regenerative medicine, and pain management have significantly enhanced patient outcomes. Additionally, the integration of telemedicine and remote monitoring technologies offers new possibilities for continuous care and support. This paper will highlight these advancements and discuss their implications for improving the quality of life for burn survivors.

Burn wound management encompasses a wide array of treatments, from advanced dressings and topical agents to complex reconstructive surgeries. Emerging therapies such as stem cell applications and bioengineered skin substitutes promise to revolutionize the field, offering new hope for patients with extensive burns. Moreover, understanding the importance of nutritional support and metabolic management in burn recovery is crucial, as these factors play a significant role in healing and overall patient health.

The psychological impact of burn injuries is another critical aspect that warrants attention. Burn survivors often face significant emotional and mental health challenges, necessitating comprehensive psychological care and support systems. This paper will explore the integration of mental health services into burn treatment plans, emphasizing the importance of addressing both physical and psychological needs for a successful recovery.

Furthermore, the study will consider the socioeconomic factors influencing burn care, including access to healthcare resources, disparities in treatment outcomes, and the economic burden on patients and healthcare systems. By examining these broader issues, the research aims to provide a holistic understanding of burn injury treatment and management, identifying key areas for policy intervention and resource allocation.

Through a thorough review of existing literature and recent studies, this analysis will provide valuable insights into the state-of-the-art in burn wound management, identifying key trends, challenges, and opportunities for further research and development. By doing so, it seeks to contribute to the ongoing efforts to improve burn care practices and enhance the quality of life for burn survivors worldwide.

## Prevalence

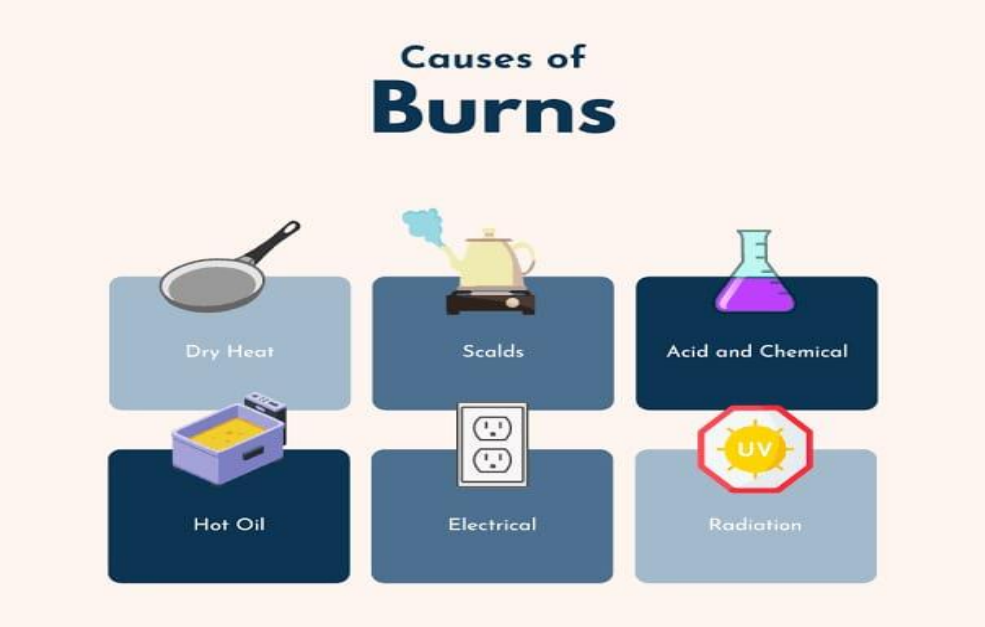
In India, burn injuries are a significant public health issue, with a high prevalence and substantial impact on affected individuals and communities. Here are some key data points regarding the prevalence of burns in India:

1. Incidence Rates: India has one of the highest rates of burn injuries globally, with an estimated 6-7 million people suffering from burns annually (Source: National Health Portal of India).
2. Demographic Patterns: Burns disproportionately affect women and children in India, with women often affected due to accidents during cooking with open flames or traditional stoves. Children are also vulnerable, primarily due to scalds from hot liquids or accidental fires.
3. Rural-Urban Disparities: Rural areas experience a higher incidence of burns compared to urban areas, attributed to factors such as limited access to safe cooking facilities and healthcare services. Approximately 70% of burn injuries occur in rural India (Source: World Health Organization).
4. Economic Impact: Burn injuries impose a significant economic burden on individuals and families. Treatment costs, loss of income due to disability, and long-term rehabilitation contribute to the economic impact.
5. Preventive Measures: Efforts to prevent burn injuries in India include educational campaigns on safe cooking practices, promotion of smokeless stoves, and community-based interventions to raise awareness about fire safety.

Treatment Challenges: Access to specialized burn care facilities and trained healthcare professionals remains limited, especially in rural and underserved areas. India has approximately 130 specialized burn care units, which are unevenly distributed across the country (Source: National Health Portal of India).

# ETIOLOGY

## 1.ON THE BASIS OF CAUSES OF BURNS




### 1.Thermal injuries

• Hot

Scalds account for about 70% of burn injuries in youngsters.

• Ablaze

Fifty percent of burns in adults are from flames. They are frequently linked to concurrent trauma and inhalational injuries. Full thickness or deep dermal burns are the most common types.

### 2. Burning chemicals

The symptoms of chemical burns to the skin are typically the same as those of superficial (first-degree) burns. There is no blister development, but the area is painful, swollen, and red. Deeper burns with blisters and excruciating pain might occur occasionally.

Strong acids or alkali compounds are the cause of it. Until the chemical is neutralized, they keep burning the skin and surrounding tissue. Because they interact with the lipids in the skin, alkali chemicals usually result in more serious burn damage.
Acids: Acetic acid, phosphoric, sulfuric, nitric, hydrofluoric, hydrochloric, formic, and phenols.

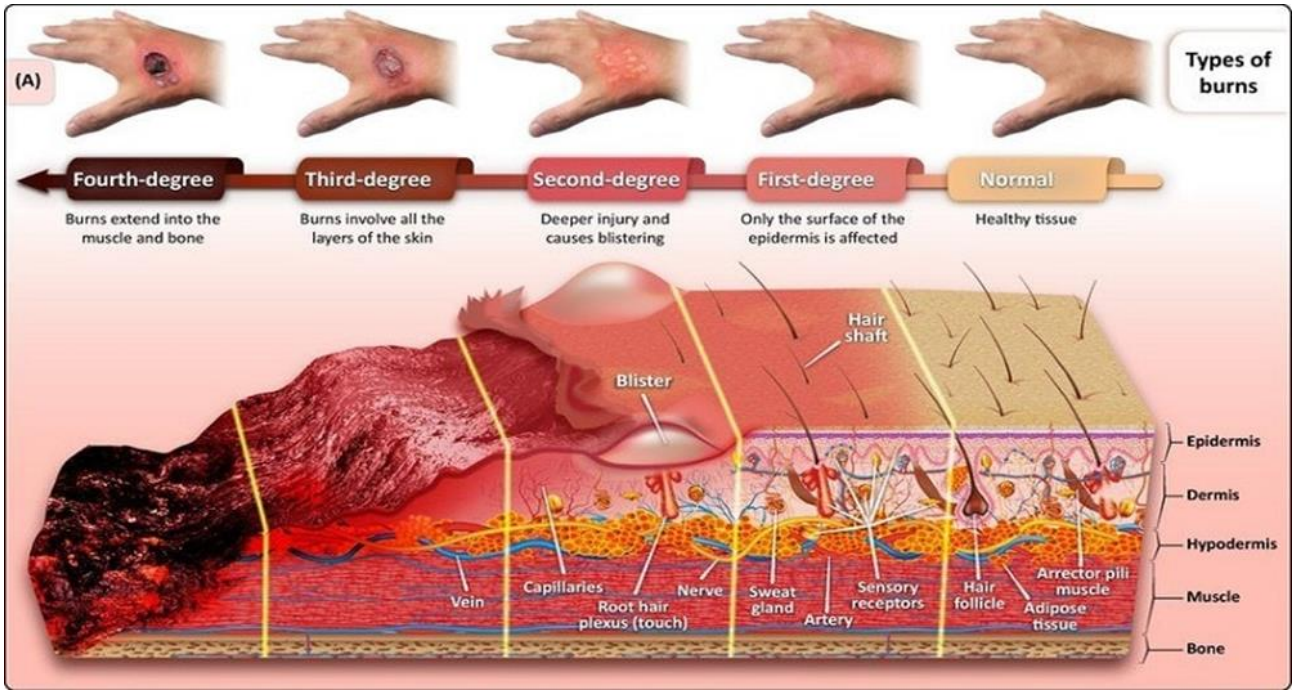
**3.Electrical burn**

Electrocution injuries, caused by AC or DC current, account for 3-4% of burn unit admissions. The voltage of the current is the main determinant of tissue damage. High voltage injuries can be divided into true high tension and flash injuries. Electrical current passes through the path of least resistance and causes injury in areas other than the contact/entry site. The extent and severity of electrical burns cannot be determined from external injury alone.

**3.Radiological burn**

Damage to the skin or other biological tissue brought on by exposure to ionizing radiation or radiofrequency energy is known as radiation burn. Sunburn brought on by ultraviolet radiation is the most prevalent kind of radiation burn. High power radio transmitters have the potential to cause radiation burns. Radiation burns can also be caused by prolonged high exposure to X-rays during diagnostic medical imaging, interventional radiology (IR), or radiotherapy (RT). The radiation burn with therapeutic radiation is the most prevalent type Radiation from alpha, beta, or gamma sources is the cause.

## 2.CLASSIFICATION ON THE BASIS OF DEPTH OF THE BURN




**A. First-Degree Burns**: These burns are limited to the epidermis, the skin's outermost layer, and are superficial. They are characterized by pain, moderate swelling, and redness. One common example of a first-degree burn is a sunburn. Usually, these burns heal completely in 7–10 days.

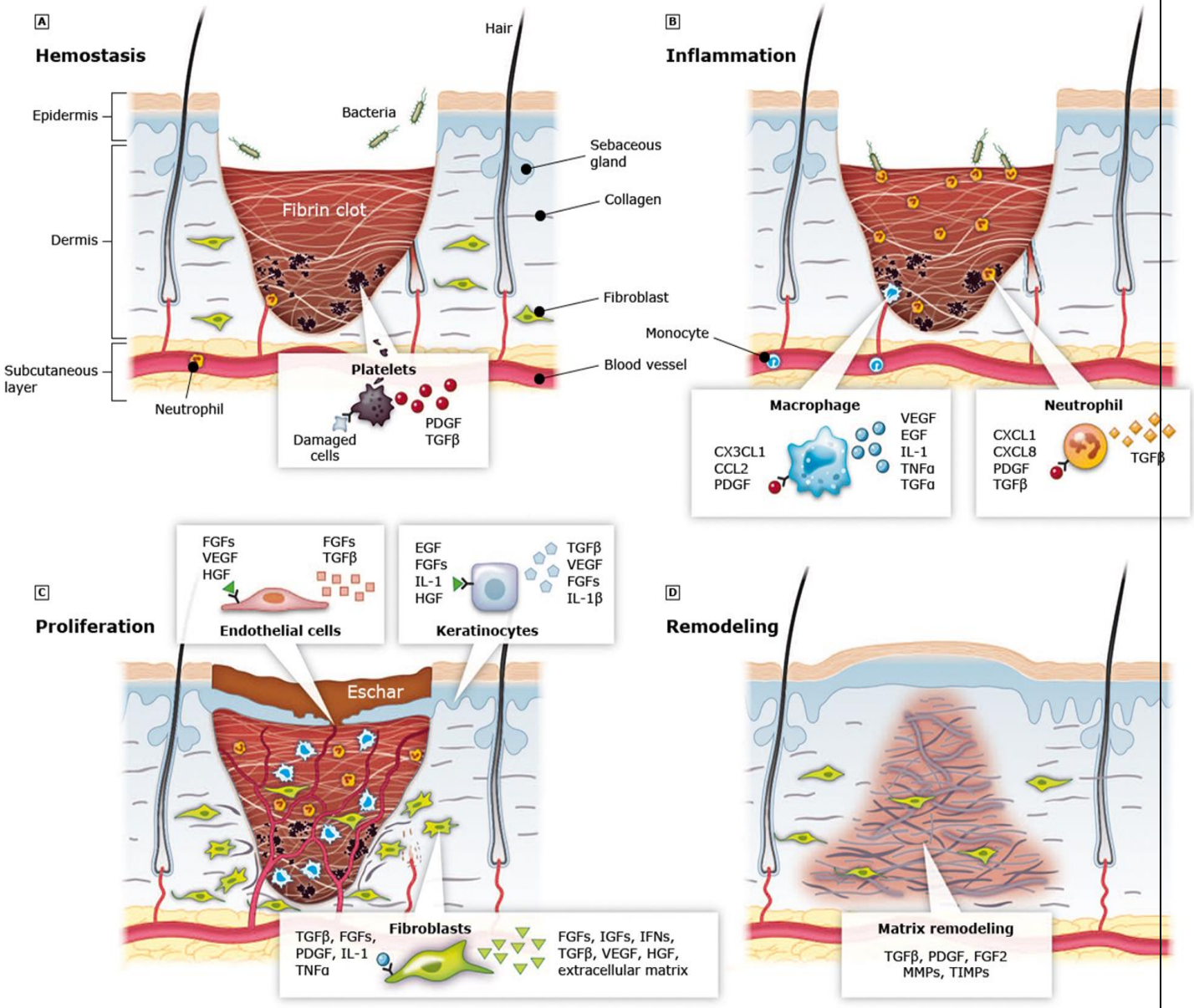
**B. Burns at a Second Degree**: Burns of the second degree are further divided into two categories:
i. Burns with Superficial Partial Thickness: These burns affect the top layer of the dermis and the epidermis. They resemble red, blistering, wet sores. They are usually tender to the touch and unpleasant. There is little chance of scarring, and healing typically takes one to three weeks.

ii. Burns with Deep Partial Thickness: These burns penetrate further into the dermis. They often have a mottled or blotchy pattern and appear waxy or white. Damage to the nerves may make the wound less painful. If deep partial-thickness burns are not treated properly, they might lead to contractures or hypertrophic scars. They heal more slowly, typically taking longer than three weeks.

**C. Third-Degree Burns:**
Also called" full-thickness burns", these burns penetrate all skin layers, including the dermal layer and epidermis, and they may even reach the subcutaneous fat layer. The afflicted region could seem burnt, brown, or white. Burns of the third degree typically generate no pain since the nerve endings have been damaged. Due to the sluggish healing process, skin grafting and other surgical procedures are frequently required..

**D. Fourth-Degree Burns**:
These burns are the worst because they damage underlying structures including muscles, tendons, and bones in addition to the skin. The burned region could seem necrotic and scorched. Due to significant tissue damage and possible consequences, fourth-degree burns have a dismal prognosis and necessitate prompt medical intervention.

# STAGES OF BURN WOUND HEALING




**Hemostasis**

When it comes to burn wounds, this stage of wound healing is typically ignored. Since burn wounds do not bleed, the previously described idea of homeostasis to stop bleeding in these kinds of wounds does not apply to burn wounds. However, these outcomes in burn wounds differ significantly according on the extent of burns. Following a burn, there is an increase in capillary permeability in burn sites, which causes microvessels to lose their ability to retain fluids outside of the interstitial area. Severe protein and fluid loss that coincides with a change in the ionic composition of the cells (ischemia).

# INFLAMMATION,PROLIFERATION,REMODELLING

*48 hr post injury*

**INFLAMMATION**

***Early Phase***

- Neutrophil arrival
- Pioneering

***Late Phase***

- Monocyte- macrophage

*3-10 days post injury*

**PROLIFERATION**

***Re-epithelialisation***

- Keratinocyte migration

***Angiogenesis***

- Sprouting
- Endothelial migration

***Granulation tissue***

- Fibroblast migration
- Fibrin-collagen GT
- Glycosaminoglycans

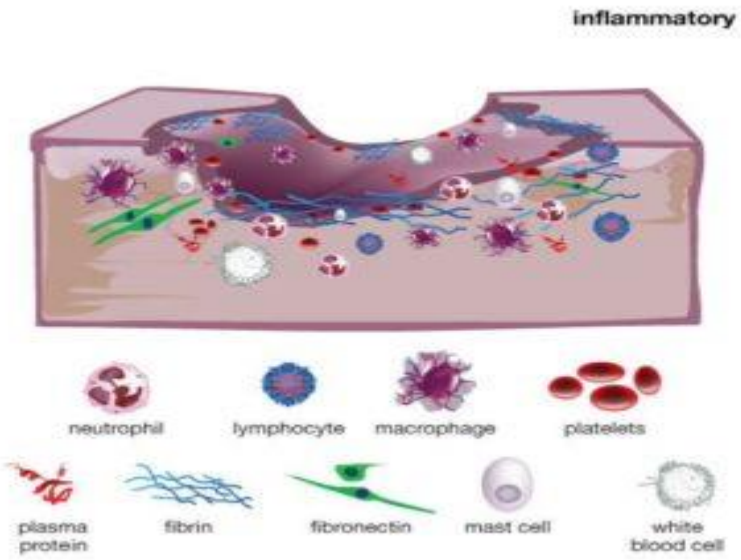
Proteoglycans

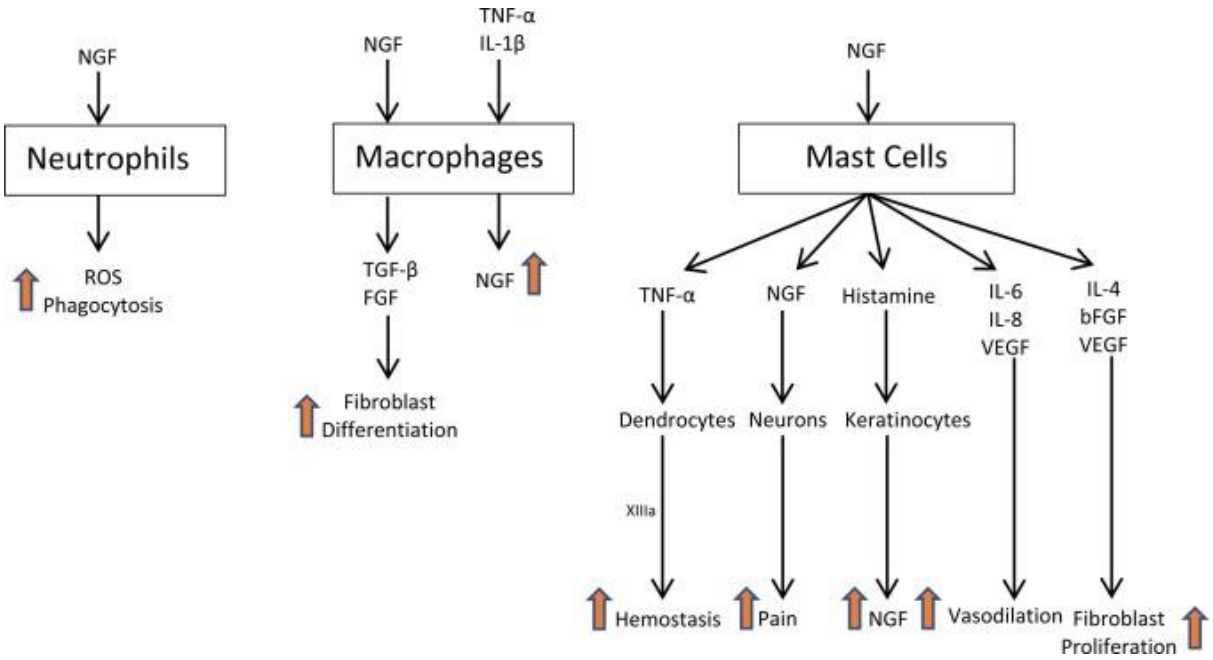
*21 days post injury*

**REMODELLING**

- Apoptosis
- Collagen III-I
- Matrix-metalloproteinase activity

## INFLAMMATION

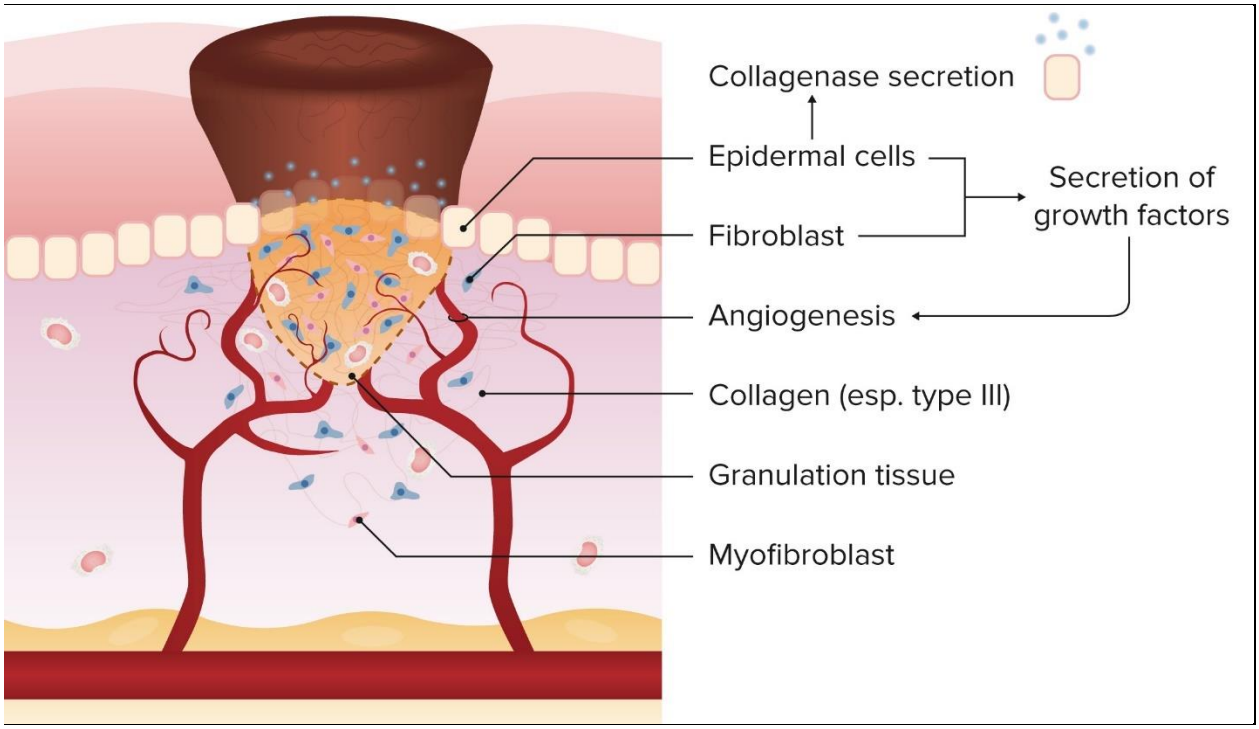





• There are a number of notable distinctions between the inflammatory response during thermal damage repair and the typical wound healing process.
• In the early stages of postburn edema, histamine release causes vasoconstriction, which raises blood pressure in injured areas. It also increases capillary permeability, which causes intravascular fluid to become depleted and hypovolemic shock. Lastly, a decrease in osmotic pressure results in increased protein leakage.In addition to vasoactive histamine in these kinds of wounds, this phase has been linked to heightened kinin system activation. In addition to having an impact on the complement, arachidonic acid, and coagulation fibrinolytic cascades, activation of the kinin system also increases activation of the kallikrein-bradykinin system.
• Rises in the cascade of arachidonic acid, notably in prostaglandins and prostacyclin,C3 and C5a complement regulates polymorphonuclear leucocytes function.

• When monocytes are activated as macrophages, they release 'IL-1 and tumor necrosis factor-α (TNF-α)' and can affect the regulation of distant activities (such as the synthesis of acute phase proteins, IL-6, and fever).
• Mast cells directly aid in the recruitment and interstitial migration of leucocytes in addition to secreting spasmogens and vaso activators and chemoattractants. In severe heat injury, immunosuppression due to substantially weakened lymphocytes is also observed. In the end, the cellular reaction of burnt tissue aids in the removal of poisons and dead tissue from the wound site by phagocytosis.

# Proliferation




At this phase, the wound site experiences several interconnected processes (re-epithelialization, angiogenesis, collagen synthesize, and ECM formation) to restore the vascular network and form granulation tissue.

**Re-epithelialization :**

Keratinocyte migration and differentiation in the wound edge occurs through MAP kinase pathways, activated by stimuli like calcium influx, EGF, and TNF. Proliferation occurs 2-3 days after injury, forming granulation tissue and re-epithelialization. Fibroblasts proliferate in deeper wounds, synthesizing collagen for further migration and ECM production.

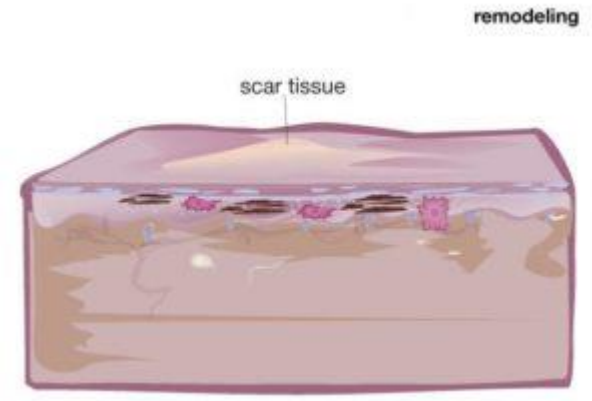
**Angiogenesis:**

Angiogenesis, the process of creating new blood vessels for wound repair, is facilitated by growth factors like VEGF, PDGF, bFGF, and thrombin. In first-degree burn wounds, the basement membrane remains intact, while deeper injuries cause normal epidermal cells to migrate and re-epithelialize the wound.

**Granulation of tissue:**

After re-epithelialization, fibroblast proliferation restores the connective tissue to the wound bed, forming a membrane zone between dermis and epidermis. Angiogenesis and fibrogenesis reconstruct dermal tissue, depositing collagen. This phase can form rough scars and hard scabs without a moist healing environment..

# REMODELLING




The maturation phase involves fibroblast cells leaving the wound bed, transforming into a more organized matrix. After 2 weeks of injury, the wound contracts due to mechanical tension and differentiation of fibroblasts to myofibroblasts. Vitamin C aids in cross-linking between collagen fibrils. Myofibroblasts, deposited in the extracellular matrix (ECM), secrete the ECM and remodel it through matrix metalloproteinases and tissue inhibitors.

**Convert collagen III to collagen I:**
The healing process in burn wounds involves replacing collagen III with collagen I, which has higher tensile strength, but takes too long for deposition. Myofibroblasts undergo apoptosis when healing is complete, and angiogenesis declines, leading to a mature avascular and acellular environment. Recovery of skin components depends on wound severity, and in severe injuries, it may not be completely recovered. The healed tissue strength only achieves 70% to 80% of the original tensile strength after a year. Burn wounds also involve remodeling, contraction, and scar formation, with deeper and more severe burns requiring more time and higher skin contraction

# MANAGEMENT OF BURN INJURY

## 1.First-degree burns:

1. Put some coolant on the burn. Apply cold, wet compresses or submerge the burn in cool tap water right away. Continue doing this for ten minutes or until the pain stops.
2. Use petroleum jelly three or four times a day. Butter, toothpaste, and ointments should not be applied on burns as they could become infected. Do not use antibiotics topically.
3. Apply a sterile, nonstick bandage to the burn. If blisters appear, cover the affected area and allow the blisters to cure naturally. Avoid popping the blisters.
4. Take into account using over-the-counter painkillers. Ibuprofen or acetaminophen can help lower inflammation and ease discomfort.
5. Shield the region from the sun. After the burn heals, seek out shade and wear protective clothing to shield the region from the sun.

## 2.Second-degree burns:

Stronger antibiotic creams containing silver, like silver sulfadiazine, can be used to treat first- and second-degree burns. Elevating the burned area can also help to reduce

pain and swelling. Silver compounds show potential in clinical practice as localized therapies for antibiotics and polyclonal immunoglobulins. However, because of changed pharmacokinetic properties and notable individual differences, the use of antibiotics in burn patients is more difficult. Antibiotic resistance resulting from insufficient tissue concentration of the medication can diminish the effectiveness of standard dosages. Furthermore, there is doubt regarding the effectiveness of novel medications, and the impact of antibiotics like ciprofloxacin or penicillins resistant to Staphylococcus aureus has diminished.

## 3.THIRD DEGREE OF BURN

**Fluid Resuscitation**

After a burn injury, fluid resuscitation provides enough intravascular volume to prevent hypovolemia, preserve organ perfusion, and reduce tissue ischemia in the early post-burn phase.

Fluid calculations are based on the burn's time of occurrence rather than the patient's hospital arrival time. Before estimating the amount of burn fluid needed, it should be noted if the patient is clinically shocked upon arrival.

The most popular formula for determining initial fluid requirements is the modified Parkland formula. This only serves as a recommendation; each patient needs to be continuously observed and evaluated to determine how they are responding to the fluid that has been given.

The amount of crystalloid fluid (preferably Hartmann's solution) that should be given within the first 24 hours following a burn is specified by the modified Parkland formula:

- 4mL (Hartmann's) x Weight (kg) x %TBSA burnt during the first 24 hours in adults
- Children: 3mL (Hartmann's) x Weight (kg) x %TBSA burnt in the first 24 hours

- During the first eight hours following the burn, 50% of the computed volume is administered; the remaining 50% is administered during the next sixteen hours.

**Fluid therapy for the first 24 hours**

The aim of fluid therapy is to ensure sufficient blood supply to all vital organs with as little added fluid as possible. In the first 12 – 24 hours after the injury, a balanced electrolyte solution is given, e.g. Ringer's acetate. An hourly diuresis of 0.5 ml/kg/h should be aimed for in adults and 1 ml/kg/h in children , somewhat higher if muscle necrosis is suspected .

The leakage of protein molecules is reduced after 12 – 30 hours , so it is expected that colloids added later than 24 hours after the injury are better retained in the bloodstream. If colloids are given earlier, a larger portion will leak through the capillary membrane into the interstitium . In patients with a large fluid requirement, colloids may be necessary as early as 8 – 12 hours after the time of injury.

The Parkland formula provides an estimate of fluid requirements, but fluid administration must always be adjusted according to clinical response to avoid hypovolemia and to limit unnecessary overhydration and edema formation. In this phase, lack of diuresis with an open urinary catheter is usually due to hypovolemia

Diuretics should be avoided in the resuscitation phase because it destroys the possibility of using hourly diuresis as a clinical response to fluid administration. Clinical experience shows

that the fluid requirement in the first 24 hours after the injury is often increased in burn victims with simultaneous inhalation injury.

**Liquid treatment after 24 – 48 hours**

After 24 hours the capillary leakage is usually less. Ringer's acetate should then be discontinued and colloids should be started.

A starting point for the colloid supply may be 0.5 ml/kg/percentage of damaged area over an eight-hour period, but it will often be necessary to give a larger volume. In addition, glucose 50 mg/ml is given intravenously, tube feeding and possibly drink that contributes to the desired diuresis of 0.5 - 1 ml/kg/h.

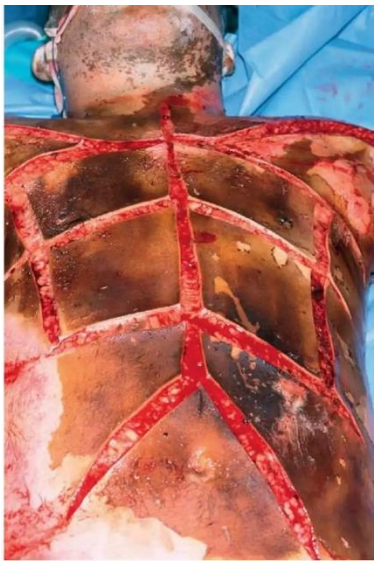
The aim is that the fluid treatment starting 48 hours after the injury should provide a negative water-and-salt balance while maintaining the circulating blood volume. In this phase, moderate hyponatremia (130 mmol/l) is common. The administration of additional sodium is usually not indicated in this phase, due to an absolute sodium excess after the large administration of sodium in the first 24 hours after the injury.

**Liquid treatment after 48 hours (dewatering phase)**

As long as the patient has wound surfaces that have not healed, the fluid requirement will be increased due to seepage and evaporation. Along with free water, protein-containing fluid will also be lost, and eventually there will be a need for an additional supply of water and sodium as well as extra colloids.

## RELEASE THE PRESSURE BY SURGICAL METHODS

- **Escharotomy**



An escharotomy is a surgical incision made through burn eschar, a tough, leathery skin condition caused by thermal, chemical, or electrical assault, typically performed within 24

hours of a burn injury, characterized by coagulated capillaries and denatured proteins

**Purpose**

Tissue edema occurs during the acute phase of burn resuscitation within 48 hours after injury, causing increased interstitial pressures in body structures with a circumferential burn eschar. This condition, also known as "compartment syndrome," can cause necrosis, ischemia, or dysfunction. Loss of muscles and nerves in limbs may require amputation or permanent disability. Hepatic and renal failure can develop quickly due to intestinal ischemia, diaphragmatic restriction, and impaired blood supply to internal organs. Burn eschar compression on the chest also worsens pulmonary compliance associated with smoke inhalation injury.

**Technique**

The restricting tissue is released by an escharotomy, or cut through the eschar, enabling the organs and tissues of the body to continue functioning normally. A single incision is usually insufficient to relieve the restricting burn eschar. “The medial and lateral sides of each affected limb, as well as both sides of the torso, are frequently incised during escarotomy procedures. Transverse incisions are frequently necessary for the abdomen and chest in order to restore respiratory mobility.

Although it can be done in the operating room if general anesthesia is needed, the escharotomy operation is most frequently carried out under conscious sedation at the patient's bedside, in the emergency room, hydrotherapy room, or intensive care unit.

**Subsequent Surgical Excision of the Burn Wound.**

Although they do not eliminate the eschar, escarotomies relieve the tightness brought on the burn eschar. The burn eschar is removed to the level of viable underlying tissue after the patient is stable enough to be brought to the operating room, usually between the second and seventh day postburn. Refer to "Burn Wound Excision". Sometimes,” partial-thickness burns (second degree burns), which heal without requiring excision and grafting, are used to perform escharotomies”. Better functional and aesthetic outcomes could arise from delaying the primary closure of escharotomy wounds than from allowing the incisions to seal by secondary purpose

## Debridement of Burn Wounds

It is the process of applying mechanical or sharp procedures (such as curetting, scraping, rongeuring, or cutting) to remove loose, devitalized, necrotic, and/or contaminated tissue, foreign substances, and other material on the wound. The amount of tissue eliminated determines the degree of debridement, not the amount of tissue made visible during the debridement procedure.

**Purpose**

When wound surfaces are free of bacteria and have less necrotic material, wound healing is maximized. Debridement removes dirt from the area and promotes faster healing while lowering the chance of infection. Generally speaking, superficial burns that are anticipated to heal without requiring skin grafting are treated with debridement. The surface of a debrided is wound is not prepared to support the quick insertion of a permanent wound cover, in contrast to burn wound excision.

**Technique**

There are several methods for accomplishing daubing, and most of them include the use of the same

surgical tools as excision. (Wound debridement by enzyme is not included in this.)

**SKIN GRAFTING**

- **Single-Stage Excision and Grafting.**

In Burn wounds that are surgically closed accomplish two things. The first is to promote the most favorable functional and esthetic results while limiting harmful effects like scar contracture and promoting optimal and quick healing of the wound. The second goal is to lessen the damaging effects that burn injuries have on the body's immune and metabolic systems, in particular. Excellent functional and cosmetic outcomes can be achieved with meticulous wound preparation and skin graft application; however, this becomes increasingly challenging for patients with more severe burn injuries. Procedures that increase patient survival in life-threatening burn cases by lowering wound infection, hypermetabolism, and immunosuppression take precedence over treatments that could improve functional and cosmetic outcomes later on..

1. 1. Making initial decisions, which are adjusted as needed along the process, including,
   a.Area(s) to be removed, often determined by the patient's physiologic state;
   b. Excisional depth; and c. Donor site location.

   2. Because of intraoperative blood loss, the burn wound will be excised, and the patient's vital signs will be closely monitored.
   3. Applying topical solutions containing vasoconstrictive drugs (like phenylephrine or adrenaline) and/or pro-coagulants (like thrombin) to achieve hemostasis.
   4. “Harvesting the donor skin (which could be preceded by an electrolyte solution injection under the skin that contains local anesthetics to minimize postoperative discomfort and vasoconstrictive drugs to minimize blood loss).
   5.Expansion/modification of the skin graft using meshing (typical mesh ratios are 1:1 and 2).4:1; 5:1, 2:1; 3:1; and 4:1. Any given piece of donor skin can cover a bigger area of the burn wound that has been removed when the ratio is higher.
   6. Applying and fastening the skin graft to the removed wound bed using a mix of synthetic adhesives, absorbable or nonabsorbable sutures, staples, and fibrin glue
   7. Applying dressings and splints. Generally, nonadherent gauze is placed directly on the graft to prevent it from moving during a subsequent dressing change. This is followed by an antibiotic-containing dressing.

“It is evident that single-stage excision and grafting is a difficult, drawn-out procedure that frequently causes the patient physiological stress and may not be well tolerated in individuals with severe burn injuries.”

In summary, a single stage excision and grafting procedure could not be acceptable for two reasons: first, the patient might not be able to withstand the significant blood loss that comes with the excision and the extended amount of time that is required to complete all of the skin grafting procedures during the procedure.

Second, incomplete graft loss could lead to undesirable functional and esthetic outcomes.

**<u>Multiple-Stage Excision and Grafting</u>**

An alternative to the single-stage excision and the grafting is to carry out the required procedures in a prearranged order, whereby a portion of the burn wound is removed at the outset and the remaining portion is removed during one or more follow-up procedures. This is frequently done for more serious burns or burns in individuals whose physiological

stability is compromised, as well as for cosmetically significant parts like the face.

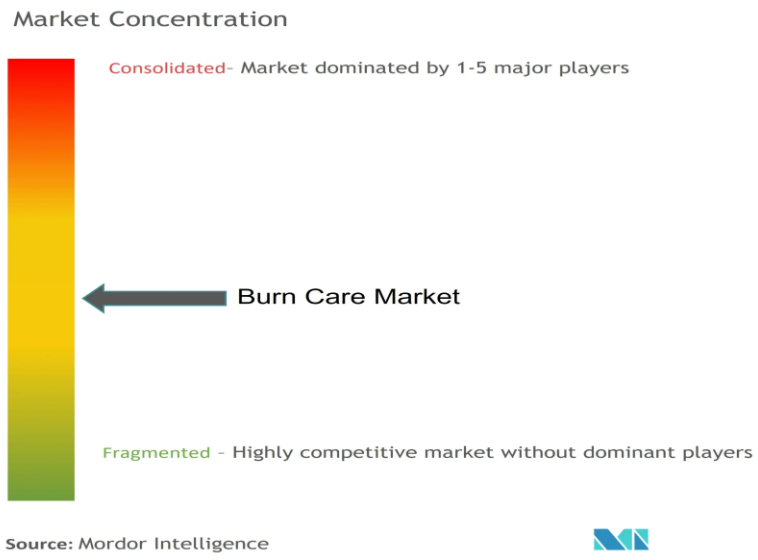
## MARKET SIZE

- The Indian burn care market is projected to register a CAGR of 7.09% during the forecast period, 2021-2026
- Out of 70 lac burn cases, about 10 lac cases are of moderate to extreme burn injury requiring rest and high-quality medical care are recorded annually in India.

**Global burn care market size**

| Year | CAGR | Market size |
|---|---|---|
| 2023-2033 | 8.4% | INR 14,777-33,248 cr |
| 2022-2023 | 7.5% | INR 13,710-14,777 cr |
| 2018-2022 | 6.0% | INR 10,663-13,710 cr |

Big players




# Burn Care Market Trends

- The market is rapidly evolving, driven significantly by advancements in burn care technologies. These technological innovations are transforming treatment protocols, improving patient outcomes, and fostering market expansion.
- Stem cell therapies are revolutionizing burn care by offering innovative solutions for skin regeneration and repair. These therapies utilize the regenerative properties of stem cells to heal burn wounds more efficiently and with fewer complications.
- The growing interest and investment in stem cell technologies are propelling the market forward, as these therapies become more accessible and widely used.
- Additionally, the development of advanced wound dressings has significantly enhanced burn care management. These dressings, often imbued with antimicrobial agents and designed for optimal moisture retention, facilitate faster healing and reduce the risk of infection. Innovations such as hydrocolloid, hydrogel, and foam dressings are tailored to address various stages of burn wound healing, offering customized care solutions.
- Furthermore, nanotechnology is making a substantial impact on burn care by enabling the creation of products that enhance healing at the cellular level. Nanoparticles can be used to deliver drugs directly to the burn site, ensuring targeted treatment and minimizing side effects.
- Moreover, nanomaterials can be incorporated into dressings to provide sustained antimicrobial effects, further preventing infections. The incorporation of nanotechnology in burn care products is attracting significant interest and investment, contributing to the market's expansion.

**Forecast of Burn care market**

| Differentiating Aspects | Burn care market |
|---|---|
| CAGR 2023-2033 | 8.4% |
| Market valuation in 2023 | INR 14,777 Cr |
| Projected market value in 2033 | INR 33,248 Cr |
| Growth factor | Increasing incidence of burn injuries and growing awareness about burn care treatments |
| Opportunities | Technological advancements in burn care products such as biologics and grafts |
| Key trend | Growing demand for minimally invasive procedures |

# Literature Review:

Burn injuries are a big global public health problem, affecting millions of people every year and posing difficult problems in management from the start to the end of treatment. The burden of burn injuries in India is high, with an estimated 7 million cases annually out of which 1 million require heavy medical attention due to severe burns. The continuum of care for burns encompasses first aid, surgical therapy and advanced wound healing technologies, all wrapped up into multifaceted approaches as part of their care.

Immediate Management and First Aid: Superficial first degree burns characterized by damage only to the epidermis are managed with cooling and topic treatments like petroleum jelly to prevent infection and promote healing. Deep second degree requires antibiotics creams while third degree should be treated with immediate fluid resuscitation as well as escharotomy that relieve pressure leading to reduced complications such compartment syndrome.

Surgical Interventions: Escharotomy performed within 24 hours after burn involves incising through the eschar on a burn site releasing constriction and restoring circulation. This procedure is essential for preventing tissue necrosis as well as systemic complications associated with severe burns.

Surgical removal of burn eschar occurs after the patient has stabilized, usually within the first week of injury, to promote wound closure and decrease chances of infection.

Advanced Treatment Modalities: Technological advancements in burn care have revolutionized treatment outcomes. Stem cell therapies are emerging as a promising approach to enhance wound healing by utilizing the regenerative properties of stem cells. These treatments seek to hasten skin regeneration as well as reduce scarring which is more applicable in severe burns where the normal ways might not be enough.

Market Dynamics and Future Trends: Globally, the burn care market is expected to grow at a CAGR of 8.4% between 2023 and 2033 due to increasing investments in advanced wound care technologies. Innovations including nanotechnology-infused dressings and biologics are improving treatment effectiveness by ensuring faster healing process alongside reducing infection rates. The rise of minimally invasive procedures and personalized medicine approaches is also reflective of shifts occurring in burn wound management.

Regulatory Framework and Challenges: Even with advances, there still remain some challenges in medical device regulations in India. Traditionally, medical devices were considered drugs under drug legislations until the Medical Device Rules were introduced of the Medical Device Rules in 2017. These rules aimed to establish clearer guidelines and separate regulations for medical devices, aligning with international standards to enhance product quality and patient safety.

## Research Methodology

This study aims at an in depth examination of the effectiveness of advanced burn wound management techniques as compared to conventional ones. It will employ a mixed methods design where data would be collected using both qualitative and quantitative methods to gain greater insight into how they affect patients.

Research Questions:

Primary Question: How much do advanced burn wound management techniques enhance

patient outcomes (healing time, infection rates, mortality) in comparison to traditional methods?

Secondary Questions:

What are the perceptions and experiences of burn patients and healthcare professionals regarding burn wound management, particularly with advanced therapies?

What are the hindrances or constraints that prevent implementation of advanced burn wound management techniques within clinical settings?

**Objectives:**
Evaluate whether advanced burn wound management techniques have better patient outcomes than traditional practices.

Unveil the opinions and occurrences which exist among patients suffering from burns as well as caregivers regarding their managing their wounds including employment of modern approaches.

Discover barriers associated with adopting more complex approaches for dealing with wounds in medical practice.

This study follows mixed methods approach, with quantitative and qualitative data collection methods.

To identify whether the provision of healthcare services meets the acceptable standards.

**Qualitative Methods:**
A retrospective cohort study:

Place: A burn unit in a hospital or burn centers network only treating burns.

Participants: Patients admitted with burn injuries over a designated timeframe (e.g., past five years).

Data Collection: Medical records will provide information about patients' characteristics (age, gender), extent and depth of burns (Total Body Surface Area burned), treatments received (traditional and advanced methods used) and results achieved (healing time, infection rates, length of stay, and death cases).

**Quantitative Methods:**

Semi-structured Interviews:

Burns was included because it is one of the most industrialized regions worldwide. For instance how they can feed themselves for a long period of time without getting tired. Additionally, they have other alternatives such as eating insects instead of chicken during meals. The findings are expected to help public health practitioners in planning for

interventions that may potentially improve food security and alleviate malnutrition in this area.

**Participants:**

Adult burned patients who have used advanced wound management techniques as well as their parents/guardians if in case they are children.

The chances are good that these professionals would have experience using advanced wound management techniques in burn treatment include surgeons, nurses and therapists.

Experts in the field of advanced wound management such as researchers and industry representatives

**Interview Guide**: A standardized interview guide should be developed which has open-ended questions addressing patient experiences; perspectives on various treatment approaches; perceived advantages/ disadvantages associated with cutting-edge medications like AdviaCentaur XP Immunoassay System for overall treatment process.
HCPs who deals with burn victims like surgeons, nurses and therapists that are experienced in the use of advanced wound management techniques.

Surgeons, nurses, therapists experienced in managing complex wounds.
Experts in the field of advanced wound management (researchers, industry representatives).

Interview Guide: A standardized interview guide was developed with open-ended questions to explore patient experiences, perspectives on different treatment approaches and perceived benefits/challenges of advanced therapies. The experiences of healthcare professionals and experts will be sought regarding their knowledge about modern therapies and how they have used them.

Data Collection: Prior consent will be obtained from all participants. Interviews will be audio-recorded and transcribed verbatim.

3.5 Sampling Techniques:

Quantitative: Convenient sampling from medical records held at any of the designated burn centers or hospitals in the network.

Qualitative: To include a range of burn patients, healthcare professionals, experts who are familiar with cases involving advanced wound management.

3.6 Data Analysis Plan:

Quantitative Data: Descriptive statistics will analyze data such as frequencies, means, standard deviations; inferential statistics (e.g., chi-square tests); logistic regression could compare patient outcomes between groups treated with traditional versus advanced methods.
Qualitative Data: Conduct thematic analysis to identify recurring themes and patterns in interview transcripts. Utilize software for qualitative data analysis if applicable. Integrate qualitative findings with quantitative results for a comprehensive understanding.

3.7Ethical Considerations:

The qualitative study must have informed consent from participants, which should include a clear explanation of the research objectives and an indication of how the data will be used or disclosed.
Maintain confidentiality of patient data and participant identities. Anonymize transcripts during analysis and reporting.
Follow to ethical principles of data collection and analysis throughout the research process.

# CONCLUSION

In summary: the field of burn wound management keeps changing because of technology and advancements in treatment methods. From first aid to highly advanced surgery as well as novel therapies such as stem cell transplantation, every stage is important is playing a significant role towards ensuring that the patients' outcomes are maximized. The anticipated expansion of the global market for burn care demonstrates escalating awareness and funding towards progressive answers to the intricacies surrounding burns across continents. In addition, research and development efforts should be geared towards improving access, cost-effectiveness, and effectiveness of treatments for all burns regardless of location in order to help patients worldwide.

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