COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS

Dissertation submitted to

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Coimbatore - 641 014

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Registration Number : 221711302

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled "**COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS**" is a bonafide dissertation done by **DR. ANKIT JAIPURIAR** in Department of General Surgery, Coimbatore Medical College and Hospital and is submitted in partial fulfillment of the requirement for the Degree of **M.S. GENERAL SURGERY, BRANCH I** of the Tamilnadu Dr. M.G.R. Medical University, Chennai.

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DECLARATION

I solemnly declare that the dissertation titled "**COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS**" was done by me from January 2018 to December 2018 under the guidance and supervision of **DR.R.NARAYANAMOORTHY, M.S.,** Associate Professor, Department of General Surgery, Coimbatore Medical College and Hospital. This dissertation is submitted to the Tamilnadu Dr. M.G.R Medical University towards the partial fulfillment of the requirement for the award of M.S Degree in General Surgery (Branch I).

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INSTITUTIONAL HUMAN ETHICS COMMITTEE
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CERTIFICATE OF APPROVAL

To
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Dear **Dr.Ankit Jaipuriar**

The Institutional Ethics Committee of Coimbatore Medical College, reviewed and discussed your application for approval of the proposal entitled **"Comparitive study in effectiveness of Topical Povidone Iodine with silver Sulfadiazine Oinment and only silver sulfadiazine ointment in the management of Burns."**No.0105/2017.

The following members of Ethics Committee were present in the meeting held on 30.11.2017.conducted at MM - II Seminar Hall, Coimbatore Medical College Hospital Coimbatore-18

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15	Mr.V.A.Shahul Hameed, +2	Lay-Person

We approve the Proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

MEMBER SECRETARY
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11

CERTIFICATE - II

This is to certify that this dissertation work titled "**COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS**" of the candidate **DR. ANKIT JAIPURIAR** with registration Number **221711302** for the award of **M.S. Degree in General Surgery (Branch I)** in the branch of General Medicine I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **6% (Six Percentage)** percentage of plagiarism in the dissertation.

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ACKNOWLEDGEMENT

Firstly I owe my reverential gratitude to the almighty for his blessings and my parents for being on my side and helping me complete this dissertation.

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TABLE OF CONTENTS

INTRODUCTION

The area of study and research works in the management of burn patients have increased many fold with the passing years as the incidence of burns in a developing country like India is very high and management of burns poses a big challenge for the treating doctors. The complications such as infection , sepsis and multiorgan dysfunction are common causes of burns related death.

The process of wound healing which involves various mediators, occurs in three phases:

- Inflammatory phase
- Proliferative phase
- Maturation phase

Any disruption in this process leads to abnormal wound healing.

In this study, conducted on 100 patients, the effectiveness of topical povidone iodine when used along with silver sulfadiazine ointment was compared with only silver sulfadiazine ointment.

AIM AND OBJECTIVES

To determine whether wound healing is better in burns by using topical povidone iodine for initial four days followed by silver sulfadiazine ointment further as compared to only silver sulfadiazine ointment.

IMPORTANCE OF THE PROJECT

Eschar formation is commonly seen in burns patients.Povidone iodine being a strong antioxidant can be used to target the oxidative stress that is high during the initial post burns days .If found to be useful it can be largely used to decrease eschar formation and better wound healing.Low cost, easy availability and minimal side effects are other advantages of povidone iodine ointment[3].

REVIEW OF LITERATURE

The incidence of burns varies greatly with age , demographics , socio economic , regional and cultural backgrounds. As per WHO , every year over 10 lakh people are moderately or severely burnt in India.

Flame and scald burns are most common among all forms. In children, scalds are most common mainly due to accidental burns.

Electrical and chemical burns mostly occur in adults.Frostbite and radiation injury are rare causes of burns admitted in hospital.

Psychiatric illness, seizure disorder and substance abuse are other conditions associated with burns in adults.

Mortality is more common in extremes of age.[1]

PATHOPHYSIOLOGY OF BURNS

1. Injury to skin
2. Injury to the airway
3. Changes in circulatory system leading to shock
4. Infection

5. Malabsorption from the GIT

6. Ischaemia due to circumferential burns

INJURY TO THE UPPER RESPIRATORY TRACT

Inhaled hot gases, smoke and steam can cause laryngeal edema, destruction of respiratory epithelium, alveolitis and respiratory failure.[1]

INJURY TO THE LOWER RESPIRATORY TRACT

Inhaled steam produces thermal injury to the epithelium of lower respiratory tract that becomes edematous, falls and blocks the main respiratory passage.

EFFECTS OF POISONOUS GASES

Carbon monoxide and Hydrogen Cyanide are metabolic poisonous gases produced.[1] Carbon monoxide hampers the transport of oxygen as it has more affinity to bind to haemoglobin. Hydrogen cyanide causes metabolic acidosis.

FOREIGN BODY INHALATION

Inhalation of various minute foreign bodies present in smoke are not filtered due to their small size. These particles cause alveolitis, chemical pneumonitis and lead to bacterial pneumonia which can be fatal.[1]

CHEST MOVEMENT BLOCK

Large and thick burns over chest can hinder mechanical movement of chest wall.

INFLAMMATORY CASCADE IN BURNS

Inflammatory cascade is activated in the burnt skin. Protein denaturation occurs due to heat. Pain fibres that are stimulated and the released neuropeptides activate various complements. Complements cause degranulation of mast cells and release of free radicals and proteases. Mast cells release TNF-alpha which trigger secondary cytokines. These factors lead to increase in permeability of blood vessels and escape of proteins.

Overall this leads to flow of solutes, water and proteins from intravascular to extravascular compartment during the first 36 hours after injury leading to shock. This is also directly proportional to the total body surface area involved. When TBSA is more than 15%, the loss of water, solutes and proteins produce shock.[1]

SECONDARY INFECTIONS

Injury due to burns significantly reduces cell mediated immunity. This leads to secondary bacterial and fungal infection. Source of infection can be from the burns wound itself or lung injury, intravenous cannula, foley's catheter, tracheostomy.

MALABSORPTION

Inflammatory cascade can injure microcirculation of gastrointestinal tract leading to decreased motility and decreased absorption of food. Failure of enteral feeding 1 damages gut mucosa, which inturn exposes the submucosa through which the bacteria present in the gut enter the systemic circulation and cause sepsis.

Abdominal compartment syndrome can also occur due to mucosal and peritoneal edema that can restrict the movement of diaphragm leading to respiratory failure.[2]

IMPACT ON PERIPHERAL CIRCULATION

Full thickness burns in upper limbs and lower limbs causes denaturation of collagen fibres, loss of skin elasticity. A 360 degree burns produces compression that can lead to swelling of the limb and then compartment syndrome leading to ischaemia and contracture.[2]

CLASSIFICATION OF BURNS

Based on etiology:

- Thermal burns : scald , flame burns , flash burns , contact burns.
- Electrical burns
- Chemical burns
- Cold injury : frostbite
- Sun burns
- Ionising radiation injury

Based on the thickness of skin involved:

- FIRST DEGREE BURNS: Injury is localised to the epidermis. Epidermis is red and painful. Healing occurs in 5-7 days without scarring. Capillary filling is present.

- SECOND DEGREE BURNS: Injury occurs to epidermis and superficial dermis. Affected area is red, mottled and painful with blisters. Healing occurs in 2-3 weeks by epithelialisation.

- THIRD DEGREE BURNS: complete injury to epidermis and dermis with involvement of subcutaneous fat. Involved area is painless and charred. Eschar formation occurs.

- FOURTH DEGREE BURNS: injury to the whole skin, subcutaneous tissue, muscles and bones.

Partial thickness burns: first or second degree burns are known as partial thickness burns.

Full thickness burns: third degree or more burns are known as full thickness burns.

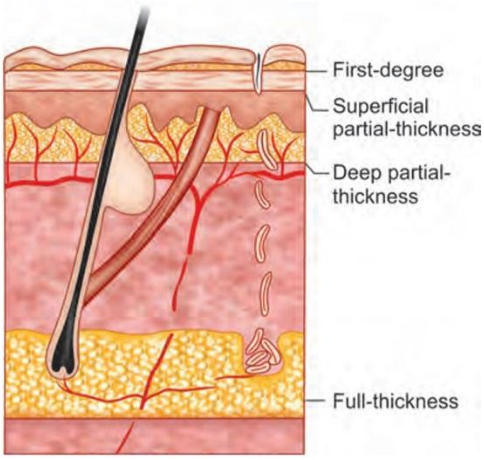
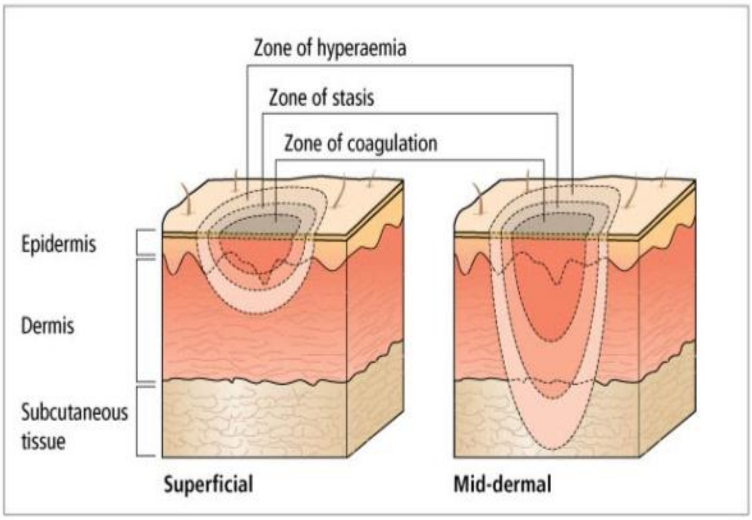


Fig. 1.226: Degrees of burns.



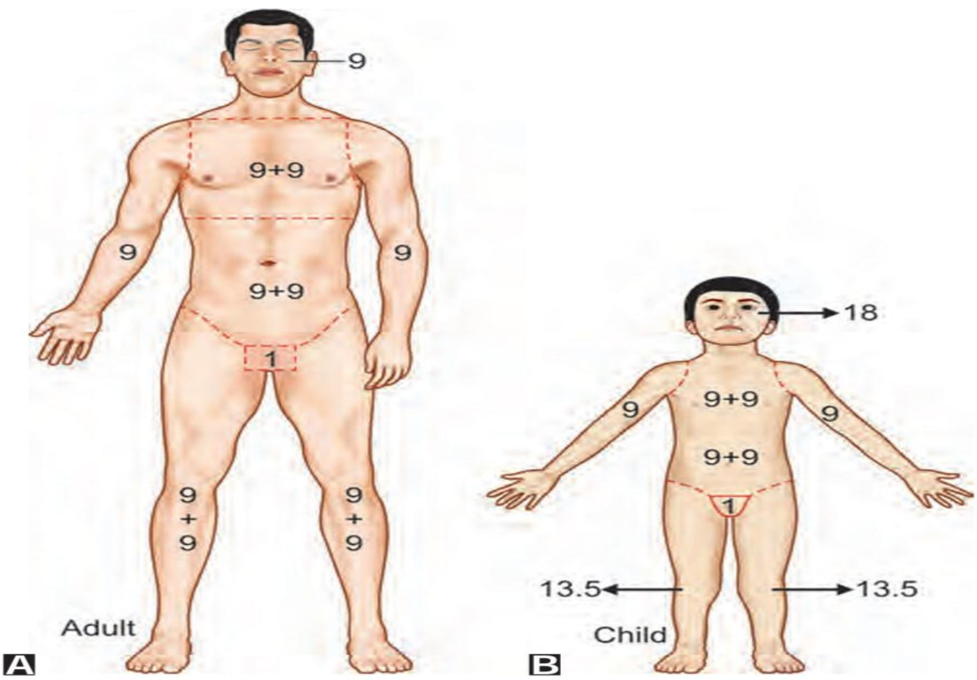
Jackson's burn zones.

JACKSON'S BURN ZONES[2]

Rule of Nine (Wallace's rule of "9") 1951			
	Adults	***Children***	***Infants***
Head and neck	9%	18%	20%
Front of chest and abdominal wall	9 × 2 = 18%	18%	10 × 2 = 20%
Back of chest and abdominal wall	9 × 2 = 18%	18%	10 × 2 = 20%
Lower limb	18 × 2 = 36%	13.5 × 2 = 27%	10 × 2 = 20%
Upper limb	9 × 2 = 18%	18%	10 × 2 = 20%
Perineum	01%	01%	
	100%	**100%**	**100%**

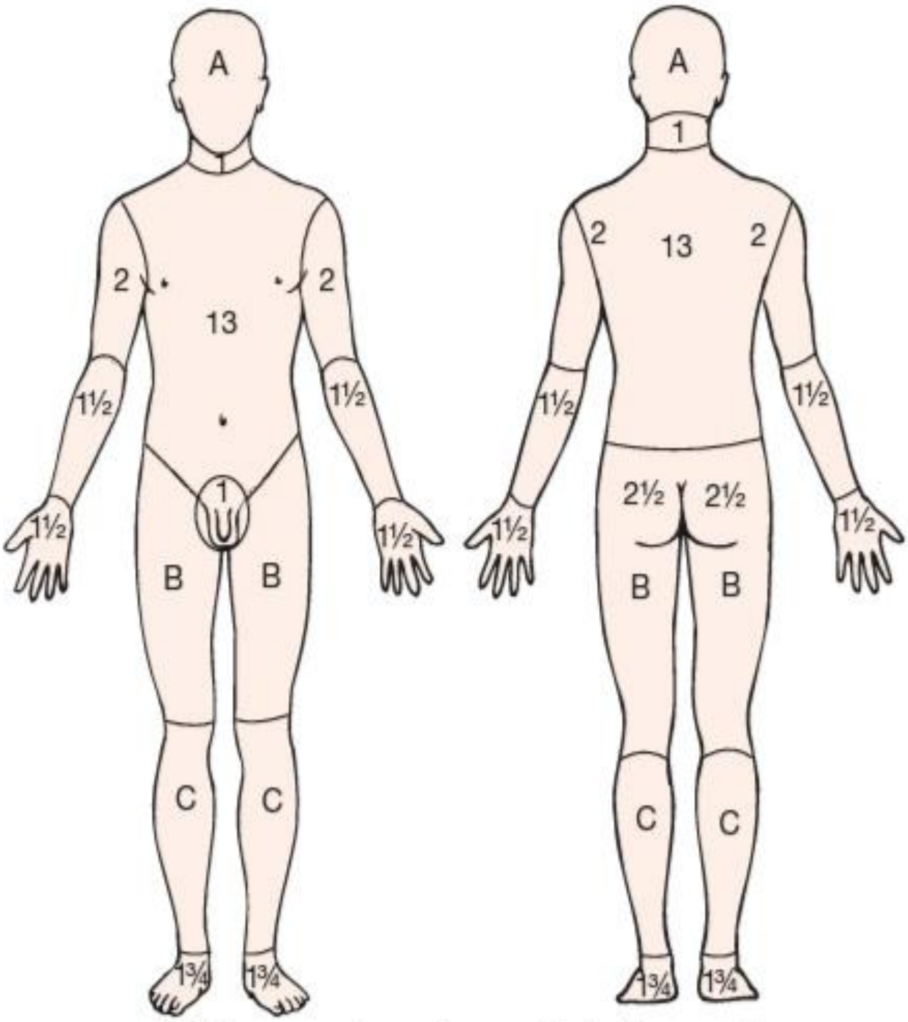
Note: It is head and lower limb percentage which differ in adults and children.

WALLACE'S RULE OF NINE[1]



Figs 1.221A and B: Percentage of burns in (A) Adults; (B) Children

THE LUND AND BROWDER CHART[1]



Relative percentage of area affected by growth

Age in years	0	1	5	10	15	Adult
A Head	9	8	6	5	4	3
B Thigh	2	3	4	4	4	4
C Leg	2	2	3	3	3	3

Figure 41.3 The Lund and Browder chart.

IMMEDIATE CARE OF THE BURNS PATIENT

Things to do at the site of injury:

- Rescuer must make sure his own safety first.
- Burning process must be stopped.
- Primary survey : Airway, Breathing and Circulation.
- Secondary survey: to check for injuries over head, spine, chest, abdomen and extremities.
- Burn wound is cooled down.
- Oxygen is given if available.
- Sitting position if head and neck is involved.
- Limb elevation if limbs are involved.
- Transportation to the hospital as early as possible.

HOSPITALISATION

- Airway
- Breathing

- Circulation
- Disability – neurological status
- Assessment of burns
- Fluid resuscitation

AIRWAY CARE

Burns involving mouth and neck region can lead to laryngeal edema and subsequent airway occlusion between 4 and 24 hrs. Endotracheal intubation must be promptly done if required. Intubation can be very difficult in such cases, so acute cricothyroidotomy can also be planned. The symptoms of respiratory difficulty and laryngeal edema often occur late and can lead to delayed diagnosis.

BREATHING

All patients who have inhaled smoke even for a couple of minutes must be kept under observation. Symptoms include breathlessness, increased respiratory effort, drop in saturation. Signs include patchy consolidation in chest xray. These may take upto 5 days to develop. Treatment includes airway care, humidified oxygen, nebulisation, chest physiotherapy and observation. Patient must be intubated as and when required.

POISONING DUE TO METABOLIC GASES

History of entrapment in a closed space with fire with altered consciousness hints towards metabolic poisoning. Arterial blood gas analysis should be done and metabolic acidosis should be looked for. Treatment is oxygen.

Table 23.2 Symptoms associated with different blood levels of carboxyhaemoglobin.

	Symptom
0–10%	Minimal symptoms (normal level in heavy smokers)
10–20%	Nausea, headache
20–30%	Drowsiness, lethargy
30–40%	Confusion, agitation
40–50%	Coma, respiratory depression
> 50%	Death

Table 23.1 Signs of inhalational injury and indications for intubation.

Signs of inhalational injury
History of flame burns/burns in an enclosed space
Full-thickness/deep dermal burns to the face, neck or upper torso
Singed nasal hair
Carbonaceous sputum/carbon particles in the oropharynx
Indications for intubation
Erythema/swelling of the oropharynx on direct visualization
Change in voice, with hoarseness/harsh cough
Stridor
Dyspnoea

ASSESSMENT OF BURN WOUND

This includes:

1. Assessing size
2. Assessing depth

Size of burn wound must be assessed in percentage of total body surface area involvement. Wallace rule of nine and Lund and Browder charts are used for this assessment.

Depth of burns can be assessed by history where burning material, temperature and duration are important. Capillary filling is present in superficial burns. Deep partial burns do not blanch and have sensation intact to some extent. Full thickness burns are leathery, charry and parchment like.

Bleeding. Test bleeding with a 21-gauge needle:

- brisk bleeding on a superficial prick means superficial/superficial dermal;
- delayed bleeding on a deeper prick means deep dermal;
- no bleeding means full thickness.
- *Sensation.* Test sensation with a needle (as for bleeding):
- pain means a superficial/superficial dermal burn;
- pin can be felt but is not painful means deep dermal;
- no sensation means full thickness.
- *Appearance.* Though obvious, it can be hard to judge burn depth by appearance as the burn is often covered in soot or dirt.
- A red glistening wound that obviously blanches is superficial.
- A paler, drier, but blanching wound is partial thickness.
- A dry, leathery, hard wound is full thickness.

It must be remembered that a burn is a dynamic wound and depth will change depending on the success of resuscitation. Initial estimates need to be reviewed later.

Once the burn's surface area and depth have been estimated, the wound should be washed and any loose skin removed. Any blisters should be deroofed for ease of dressing. The burn should then be dressed. For an acute burn that is to be referred to a burn centre, clingfilm is an ideal dressing as it will cover the wound but not alter the physical appearance of the burn. This allows accurate evaluation by the burn team later on. Flamazine should not be used on a burn that is to be referred as it makesassessment of depth by appearance difficult. Other burns are dressed according to depth.

TABLE 41.2 Causes of burns and their likely depth.

Cause of burn	Probable depth of burn
Scald	Superficial, but with deep dermal patches in the absence of good first aid. Will be deep in a young infant
Fat burns	Deep dermal
Flame burns	Mixed deep dermal and full thickness
Alkali burns, including cement	Often deep dermal or full thickness
Acid burns	Weak concentrations superficial; strong concentrations deep dermal
Electrical contact burn	Full thickness

SUPERFICIAL PARTIAL THICKNESS BURNS

Injury is limited upto the layer of papillary dermis and the deeper layers are unaffected. Blisters are present. Epidermis is destroyed. Dermis appears pink and moist. On blanching, capillary filling is present. Sensations intact. It takes about two weeks to heal. No residual scar. Non surgical treatment.

DEEP PARTIAL THICKNESS BURNS

Deeper parts of the reticular dermis is injured. Epidermis is lost. Underlying dermis does not appear to be moist. Capillary filling is absent on blanching. Sensations are reduced. Healing time is more than three weeks with a hypertrophic scar.

FULL THICKNESS BURNS

Dermis is completely destroyed. Appearance is hard and leathery. Complete anaesthesia of the burn site. No capillary return, no pinprick bleed.

Prognosis

A rough estimate of prognosis can be given by adding the age of the patient to the percentage burn; this gives the percentage mortality.

Inhalational injury increases mortality but it is arguable by how much. A decision should be made about whether resuscitation should be started or whether the patient should just be kept comfortable.

Resuscitation regimens

There is no ideal resuscitation regimen for burns and this is reflected by the continual change in the regimens in favour. It is vital to remember that all the fluid formulae are *only guidelines.* Their success relies on the adjustment of resuscitation against monitored physiological and investigative parameters. The main aim of these resuscitation formulae is to maintain tissue perfusion to the zone of stasis and prevent the burn deepening. This is not as easy as it sounds. Too little fluid will cause hypoperfusion; too much fluid will lead to oedema that will cause tissue hypoxia.There are some important overall concepts about fluid resuscitation in burn patients. The greatest amount of fluid loss occurs in the first 24 h. For the first 8-12 h, there is a general shift of fluid from the intravascular to interstitial fluid compartment. This was thought mainly due to increased capillary permeability but other factors have also been shown to play a role.

This means that any fluid given in this period will rapidly leave the intravascular compartment. Therefore colloids have no advantage over crystalloids in maintaining circulatory volume. Indeed, colloids could exacerbate the situation because they will leak out into the interstitial space, where they will increase the oncotic pressure and increase the flow of fluid from the circulation. Rapid fluid boluses are also of no benefit as a rapid rise in intravascular hydrostatic pressure only drives more fluid out of the circulation.

However, much protein is lost through the burn wound so there is a need to replace this oncotic loss. Therefore some regimens use some colloid after 8 h, when the loss of fluid from the intravascular space is decreasing.

FLUID RESUSCITATION

Principles of fluid resuscitation:

- Intravascular volume should be maintained for adequate circulation and to maintain perfusion of the vital organs such as brain, kidneys and gastrointestinal tract and also to the peripheral tissues and the site of injury.
- Intravenous fluid resuscitation is required in burns more than 10% total body surface area in children and more than 15% total body surface area in adults.
- Oral fluids must be given with added salts.
- Fluid requirement must be in accordance with the standard formula.
- Urine output must be monitored and fluid input to be adjusted accordingly.

PARKLAND'S FORMULA

Total percentage body surface area x weight(kg) x 4 = volume(ml)

This formula calculates the total fluid requirement in the first 24 hours. Half the volume required is given in first 8 hours and the second half is given in subsequent 16 hours.

The various types of fluid used in resuscitaion are:

1). CRYSTALLOIDS

Most common crystalloid used is Ringer's lactate or Hartmann's solution.Crystalliods have been found to be equally effective as colloids in maintaining the intravascular volume. They are leass expensive. Large protein molecules also leak out of damaged capillaries but non burnt capillaries continue to sieve proteins. Maintenance fluid should also be given in children which is dextrose – saline. Maintenance fluid must be given as:

100ml/kg for the first 10 kg for 24 hours

50ml/kg for the next 10 kg

20ml/kg for each kilogram of body weight above 20kg for 24 hours.

HYPERTONIC SALINE

Hypertonic saline increases osmolarity and causes hypernatremia. This retains the water in intracellular space prevents its shift to extracellular spaces. This prevents edema of tissues hence requirement of escharotomies and endotracheal intubation is reduced.

COLLOIDS

Plasma proteins maintain the oncotic pressure and act against the outward capillary hydrostatic pressure that causes capillaryleak. Oncotic pressure maintains the plasma volume. Loss of proteins leads to loss of fluid in extravascular spaces leading to edema. Protein leak through capillaries is very high during the first 12 hours after burns, hence proteins in the form of colloids must be given after 12 hours.

MUIR AND BARCLAY FORMULA (for administration of colloid) percentage of body surface area burnt x weight(kg) x 0.5 = one portion over a period of 4/4/4, 6/6, 12 hours respectively where one portion is given in each period.

MONITORING OF RESUSCITATION

Resuscitaion is monitored by:

- Urine output
- Acid base balance
- Haematocrit

Urine output is the most important factor that should be monitored during resuscitaion. It must be 0.5 – 1 ml/kg/hr. If urine output is less than this then infusion of fluid should be increased by fifty percent. Signs of hypoperfusion must be looked for which are cold and clammy peripheries, tachycardia, restlessness and elevated hematocrit. Presence of these signs indicate inadequate perfusion , at this time a bolus of 10 ml/kg fluid should be administered. If urine output is more than 2 ml/kg/hr, then rate of fluid infusion must be reduced to prevent over resuscitation.

Transinvasive ultrasound can be done in patients with cardiac dysfunction to measure the filling pressure and then fluid infusion for resuscitation can be adjusted accordingly.

Referral to a burn unit

The National Burn Care Review has set guidelines about which patients warrant referral to a burn unit. Burns are divided into complex burns (i.e. those that require specialist intervention) and non-complex burns (i.e. those that do not require immediate admission to a specialist unit). Complex burns should be referred automatically. A burn injury is more likely to be complex if associated with the following.

- Age: under 5 or over 60 years.
- Site: face, hands, perineum or feet (dermal/fullthickness loss) or any flexure (particularly the neck or axilla) or any circumferential dermal or full-thickness burn of the limbs, torso or neck.
- Inhalation injury: any significant injury, excluding pure carbon monoxide poisoning.
- Mechanism of injury:

  a) Chemical injury (> 5% total body surface area);

  b) Exposure to ionizing radiation;

  c) High-pressure steam injury;

d) High-tension electrical injury;

e) Hydrofluoric acid injury (> 1% total body surface area);

f) Suspicion of non-accidental injury.

- Size (dermal/full-thickness loss):

  a) Paediatric (< 16 years old): > 5% total body surface area;

  b) Adult (16 years or over): > 10% total body surface area.

- Coexisting conditions: any serious medical conditions (cardiac dysfunction, immunosuppression, pregnancy) or any associated injuries (fractures, head injuries, crush injuries).

It is better to discuss all cases with the local burn unit as they will eventually be involved in the patient's care.

TREATMENT OF THE BURN WOUND

ESCHAROTOMY

A torniquet effect is produced by full thickness circumferential burns to the limbs. This requires emergency intervention where escharotomy is done. Escharotomy is preferred in mid axial line to avoid injury to nerves and vessels. Blood should be reserved for transfusion as blood loss during eschcarotomy is common.

Features of escharotomy placement:

Upper limb : Mid-axial, anterior to the elbow medially to avoid the ulnar nerve.

Hand : Midline in the digits. Release muscle compartments if tight. Best done in theatre and with an experienced surgeon.

Lower limb : Mid-axial. Posterior to the ankle medially to avoid the saphenous vein Chest : Down the chest lateral to the nipples, across the chest below the clavicle and across the chest at the level of the xiphisternum

General rules :

Extend the wound beyond the deep burn Diathermy any significant bleeding vessels. Apply haemostatic dressing and elevate the limb postoperatively.

Patient at high risk of inhalational injury.

FULL THICKNESS AND DEEP THERMAL BURNS

Most common types of dressings used:

- 1% silver sulfadiazine ointment:

  Is a broad spectrum antibiotic. Effective prophylaxis against gram negative organisms and MRSA.

- 0.5% silver nitrate solution:

  Is a broad spectrum antibiotic used for prophylaxis against gram negative organisms. It is not as effective as 1% SSD. Requires application every 3-4 hours. Black staining seen in skin and clothes around.

- Mafenide acetate ointment:

  5% topical form is used. Application is painful and also leads to metabolic acidosis.

- Serum nitrate, cerium nitrate and silver sulfadiazine :

  very useful in full thickness burns. Boosts cell mediated immunity. Cerium nitrate produces a sterile eschar.

Tulle gras (Jelonet, Bactigras)

The traditional method is to use tulle gras (Jelonet), either plain or containing an antiseptic solution such as chlorhexidine (Bactigras). This is adherent and can be difficult to remove once dried but provides a moist environment for healing. Gauze is placed over these wounds because they tend to exude fluid. The gauze may be changed as it soaks through but the tulle gras is usually left undisturbed for 5 days, unless there is concern about secondary infection.

Retention dressing (Hypafix)

A novel way of dressing burns is to use an adhesive dressing such as Hypafix. This sticks to the wound and prevents any shear forces from disrupting healing. The dressing can be kept clean by showering. Gauze will also be required to absorb the initial exudate. The adhesive in the dressing is oil-based so the application of any kind of oil (typically olive oil) dissolves the adhesive and permits removal of the dressing without disturbing the healing burn.

Interface dressings (Biobrane, Transcyte)

These bind to the raw epidermis and provide a semipermeable membrane that keeps the wound moist but prevents bacterial colonization. Transcyte has added growth factors that can accelerate wound healing. These dressings are only effective on superficial/superficial dermal burns and are expensive.

Topical antibacterial cream (Flamazine)

Topical bacterial creams are a popular way of dressing. Silver sulfadiazine (Flamazine) has good Gram-negative cover and keeps the wound moist and clean. It can be used on its own or with a gauze layer on top. Unfortunately it tends to macerate the wound and can make burn depth assessment difficult. It also requires frequent dressing changes, which can be uncomfortable for the patient.

MANAGEMENT OF SUPERFICIAL PARTIAL THICKNESS WOUNDS AND MIXED DEPTH WOUNDS

The dressing used should be painless, easy to apply, simple to manage, easily available. The correct choice of dressing can make the difference between healing with scar and without scar, requirement for surgical intervention and no surgery.

In a heavily contaminated wound, thorough cleaning must be done preferably under anaesthesia. Dressing with 1% SSD ointment is very effective in such wounds and promotes wound healing.

Exposure is the easiest method for treating superficial wounds. The initial exudate needs to be managed by frequent changes of clean linen around the patient but, after a few days, a dry eschar forms, which then separates as the wound epithelialises. This is often used in hot climates and for small burns on the face. However, this method is painful and requires an intensive amount of nursing support. A variation on this theme is to cover the wound with a permeable wound dressing, such as Mefix®

or Fixamol®. This allows the wounds to dry but, because it is a covering, it avoids the problems of the wound adhering to the sheets and clothes. A similar method of managing these types of burn is to place a Vaseline-impregnated gauze (with or without an antiseptic, such as chlorhexidine) over the wound. An alternative is a fenestrated silicone sheet (e.g. Mepitel®). These can then be backed with swabs to absorb the exudate. The Vaseline gauze or silicone layer is used to prevent the swabs adhering to the wound and reduces the stiffness of the dry eschar, preventing it from cracking so easily. The swabs need to be changed after the first 48 hours as they are often soaked. After that, they can be left for longer.

More interactive dressings include hydrocolloids and biological dressings. Hydrocolloid dressings need to be changed every 3–5 days. They are particularly useful in mixed-depth burns as the high protease levels under the occlusive dressings aid with the debridement of the deeper areas of burn. They also provide a moist environment, which is good for epithelialisation. Duoderm® is a hydrocolloid dressing. There is good evidence for its value in burns. Biological, synthetic (e.g. Biobrane®) and natural (e.g. amniotic membranes) dressings also provide good healing environments and do not need to be changed. They are ideal for one-stop management of superficial burns, being easy to apply and comfortable. However, they will become detached if applied to deep dermal wounds as the eschar needs to separate. They are therefore not as useful in mixed-depth wounds. Early debridement and grafting is the key to effectively treating deep partial- and full-thickness burns in a majority of cases[4].

MAIN PRINCIPLES OF DRESSING FOR BURNS

- Antibacterial dressing is required for full thickness burns which delays colonisation of bacteria prior to surgery.
- Simple dressing is needed for superficial burns.
- Optimum healing environment is required.

ADDITIONAL ASPECTS OF TREATING THE BURNED PATIENT

Analgesia

Acute : Analgesia is a vital part of burns management. Small burns, especially superficial burns, respond well to simple oral analgesia, paracetamol and non-steroidal anti-inflammatory drugs. Topical cooling is especially soothing. Large burns require intravenous opiates.

Intramuscular injections should not be given in acute burns over 10% of TBSA, as absorption is unpredictable and dangerous[5].

Subacute : In patients with large burns, continuous analgesia is required, beginning with infusions and continuing with oral tablets, such as slow-release morphine. Powerful, short-acting analgesia should be administered before dressing changes. Administration may require an anaesthetist, as in the case of general anaesthesia or midazolam and ketamine, or less intensive supervision, as in the case of morphine and nitrous oxide.

Energy balance and nutrition

One of the most important aspects in treating burns patients is nutrition. Any adult with a burn greater than 15% (10% in children) of TBSA has an increased nutritional requirement. All patients with burns of 20% of TBSA or greater should receive a nasogastric tube. (Feeding should start within 6 hours of the injury to reduce gut mucosal damage.)[2] A number of different formulae are available to calculate the energy requirements of patients. Burn injuries are catabolic in the acute episode. Successful management of the patient's energy balance involves a number of strategies. The catabolic drive continues while the wound remains unhealed and, therefore, rapid excision of the burn and stable coverage of the wound are the most significant factors in reversing this. Obligatory energy utilisation must be reduced to a minimum by keeping the patient warm with good environmental control. The excess energy requirements must be provided for and the nutritional balance monitored by measuring weight and nitrogen balance .

Curreri formula[1] :

Age 16–59 years: (25)W + (40)TBSA

Age 60+ years: (20)W + (65)TBSA

Sutherland formula[1] :

Children: 60 kcal/kg + 35 kcal%TBSA

Adults: 20 kcal/kg + 70 kcal%TBSA

Protein needs:

Greatest nitrogen losses between days 5 and 10

20% of kilocalories should be provided by proteins

Davies formula:

Children: 3 g/kg + 1 g%TBSA

Adults: 1 g/kg + 3 g%TBSA

Monitoring and control of infection

Patients with major burns are immunocompromised, having large portals of entry to pathogenic and opportunistic bacteria and fungi via the burn wound. They have compromised local defences in the lungs and gut due to oedema, and usually have monitoring lines and catheters, which themselves represent portals for infection.Control of infection begins with policies on hand-washing and other cross-contamination prevention measures. Bacteriological surveillance of the wound, catheter tips and sputum helps to build a picture of the patient's flora. If there are signs of infection, then further cultures need to be taken and antibiotics started. This is often initially on a best guess basis, hence the usefulness of prior surveillance; close liaison with a bacteriologist is essential. In patients with large burns that remain catabolic, the core temperature is usually reset by the hypothalamus above 37°C. Significant temperatures are those above 38.5°C, but often other signs of infection are more useful to the clinician. These include significant rise or fall in the white cell count, thrombocytosis, increasing signs of catabolism and decreasing clinical status of the patient.[6]

Nursing care

Burns patients require particularly intensive nursing care. Nurses are the primary effectors of many decisions that directly affect healing. Bandaged hands and joints that are stiff and painful need careful coaxing. Personal hygiene, baths and showers all become time-consuming and painful, but are vital parts of the patient's physiotherapy. Their success or failure has a powerful psychological impact on the patient and his or her family.

Physiotherapy

All burns cause swelling, especially burns to the hands. Elevation, splintage and exercise reduce swelling and improve the final outcome. The physiotherapy needs to be started on day 1, so that the message can be reinforced on a daily basis.

Psychological

A major burn is an overwhelming event, outside the normal experience, which stretches the patient's coping ability, suspends the patient's sense of safety and causes post- traumatic reactions. These are normal and usually self- limiting, receding as the patient heals. The features of this intensity of experience are of intrusive reactions, arousal reactions and avoidance reactions.

Deep dermal and full-thickness burns

Will need surgical intervention. There has been a major change in the way burns are managed in the last 30 years. Initially, there was a reluctance to remove the burn wound early, as this caused additional trauma to the patient and ran the risk of removing tissue that might have healed if left undisturbed. Therefore deep burns were left until 3 weeks when all unhealed areas were excised and skin grafted. However, it was subsequently shown that early removal of the burn wound limited the systemic inflammatory response and improved outcome. In addition, tangential excision allowed burnt tissue to be shaved off in layers, leaving healthy tissue behind. The modern approach to major burns is to remove the burn wound as soon as possible before the patient becomes unwell (< 48 h), resurface the burn and start rehabilitation. This allows faster healing, limits the stress from the burn wound and is associated with improved mortality. The only innovation to this approach is the use of topical agents that bind to damaged proteins in the wound and inhibit the inflammatory response that the burn causes, e.g. cerium nitrate/silver sulfadiazine cream (Flammcerium). It is useful for large burns because it allows staged excision or for burns in the elderly who may need optimizing prior to surgery.

SURGERY FOR THE ACUTE BURN WOUND[7]

Any deep partial-thickness and full-thickness burns, except those that are less than about 4 cm^2, need surgery. Any burn of indeterminate depth should be reassessed after 48 hours. This is because burns that initially appear superficial may well deepen over that time. Delayed microvascular injury is especially common in scalds. The essence of burns surgery is control. First and foremost, the anaesthetist needs good control of the patient. A widebore cannula should be used and the patient's blood pressure must be monitored adequately. If a large excision is considered, then an arterial line (to monitor blood pressure) and a central venous pressure monitor are needed. The anaesthetist also needs measurements and control of the acid–base balance, clotting time and haemoglobin levels. The core temperature of the patient must not drop below 36°C, otherwise clotting irregularities will be compounded. For most burn excisions, subcutaneous injection of a dilute solution of adrenaline 1:1 000 000 or 1:500 000 and tourniquet control are important for controlling blood loss. In deep dermal burns, the top layer of dead dermis is shaved off until punctate bleeding is observed and the dermis can be seen to be free of any small thrombosed vessels. A topical solution of 1:500 000 adrenaline also helps to reduce bleeding, as does the application of the skin graft. The use of a tourniquet during burn excisions in the limbs helps to decrease blood loss and maintain control. Full-thickness burns require full-thickness excision of the skin. In certain circumstances, it is appropriate to go down to the fascia but, in most cases, the burn excision is down to viable fat. Wherever possible, a skin graft should be applied immediately. With very large burns, the use of synthetic dermis or homografts provides temporary stable coverage and will allow complete excision of the wound and thus reduce the burn load on the patient. Postoperative management of these patients obviously requires careful evaluation of fluid balance and levels of haemoglobin. The outer dressings will quickly be soaked through with serum and will need to be changed on a regular basis to reduce the bacterial load within the dressing. Physiotherapy and splints are important in maintaining range of movement and reducing joint contracture. Elevation of the appropriate limbs is important. The hand must be splinted in a position of function after grafting, although the graft needs to be applied in the position of maximal stretch. Knees are best splinted in extension, axillae in abduction. Supervised movement by the physiotherapists, usually under direct vision of any affected joints, should begin after about 5 days.

Delayed reconstruction and scar management

Delayed reconstruction of burn injuries is common for large full-thickness burns. In the early healing period, acute contractures around the eye need particular attention. Eyelids must be grafted at the first sign of difficulty in closing the eyelids, and this must be done before the patient has any symptoms of exposure keratitis. Other areas that require early intervention are any contracture causing significant loss of range of movement of a joint. This is particularly important in the hand and axilla. An established contracture can be treated in a number of ways. Burn alopecia is best treated with tissue expansion of the unburned hair-bearing skin. Tissue expansion is also a useful technique for isolated burns and other areas with adjacent normal skin. Z-plasty is useful where there is a single band and a transposition flap is useful in wider bands of scarring. In areas of circumferential or very broad areas of scarring, the only real treatment is incision and replacement with tissue. By far the best tissue for replacement is from either a full-thickness graft or vascularised tissue as in a free flap. Occasionally, the situation requires the less ideal covering of split skin, possibly with an artificial dermis, such as Integra®. These last two options require prolonged scar management after their use. Hypertrophy of many scars will respond to pressure garments. These need to be worn for a period of 6–18 months. Where it is difficult to apply pressure with pressure garments, or with smaller areas of hypertrophy, silicone patches will speed scar maturation, as will intralesional injection of steroid. Itching and dermatitis in burn scar areas are common. Pharmacological treatment of itch is an essential adjunct to therapy.

MINOR BURNS/OUTPATIENT BURNS

Local burn wound care Blisters Whether to remove blisters or leave them intact has been the subject of much debate. Proponents of blister removal quote laboratory studies that show that blister fluid depresses immune function, slowing down chemotaxis and intracellular killing and also acting as a medium for bacterial growth. Conversely, other authors advocate leaving blisters intact as they form a sterile stratum spongiosum. Leaving a ruptured blister is not advised. Initial cleaning of the burn wound Washing the burn wound with chlorhexidine solution is ideal for this purpose.

Topical agents[13]

For initial management of minor burns that are superficial or partial thickness, dressings with a non-adherent material, such as Vaseline-impregnated gauze or Mepitel are often sufficient. These dressings are left in place for 5 days. These burns, by definition, should be healed after 7–10 days. Various topical creams and ointments have been used for the treatment of minor burns. All published comparative data show no advantage of these agents over petroleum gauze. Silver sulphadiazine (1%) or Flamazine® is the most commonly used topical agent. However, it should be avoided in pregnant women, nursing mothers and infants less than 2 months of age because of the increased possibility of kernicterus in these patients.

Dressing the minor burn wound

The aims of dressing are to decrease wound pain and to protect and isolate the burn wound. The small superficial burn requires Vaseline gauze or another non-adherent dressing, such as Mepitel, as the first layer. Following this, gauze or Kerlix® is wrapped around with sufficient tightness to keep the dressing intact, but not to impede the circulation. This is further wrapped with bandage. It is important to realise that bulkiness of dressings in the minor burn wound depends upon the amount of wound discharge. A special case is burns of the hands where dressings should be minimised so as not to impede mobilisation and physiotherapy. Synthetic burn wound dressings are popular as they: ● decrease pain associated with dressings; ● improve healing times; ● decrease outpatient appointments; ● lower overall costs. Biobrane® is a bilaminar dressing made up of an inner layer of knitted nylon threads coated with porcine collagen and an outer layer of rubberised silicone impervious to gases, but not to fluids and bacteria. Wounds to be dressed with Biobrane should be carefully selected. Burn wounds should be fresh (less than 24 hours), sensate, show capillary blanching and refill. Biobrane should be applied to the wound after removal of all blisters. It should be checked at 48 hours for adherence and any signs of infection. It should be removed if any sign of infection is found. Duoderm® or hydrocolloid dressings are not bulky, help in healing and can be kept in place for 48–72 hours. They provide a moist environment, which helps in re-epithelialisation of the burn wound.

Healing of burn wounds[8]

Burns that are being managed conservatively should be healed within 3 weeks. If there are no signs of re-epithelialisation in this time, the wound requires debridement and grafting.

Infection

Infection in the minor burn should be tackled very aggressively as it is known to convert a superficial burn to a partial-thickness burn and a partial- to a deep partial-thickness burn, respectively. It should be managed using a combination of topical and systemic agents. Debridement and skin grafting should also be considered.

Itching

Most burn patients have itchy wounds. Histamine and various endopeptides are said to be the causative factors of itching. Antihistamines, analgesics, moisturising creams, aloe vera and antibiotics have all been tried with varying degrees of success. Sometimes gabapentin has been used in patients with severe itch. Examples of therapeutic agents described include cyproheptadine, loratidine and topical doxepin cream.

Traumatic blisters

The healed burn wound is prone to getting traumatic blisters because the new epithelium is very fragile. Non-adherent dressings usually suffice; regular moisturisation is also useful in this condition.

NON-THERMAL BURN INJURY

Electrical injuries Electrical injuries are usually divided into low- and high- voltage injuries, the threshold being 1000 v.

Electrical burns [9]

- Low-voltage injuries cause small, localised, deep burns
- They can cause cardiac arrest through pacing interruption without significant direct myocardial damage
- High-voltage injuries damage by flash (external burn) and conduction (internal burn)
- Myocardium may be directly damaged without pacing interruption
- Limbs may need fasciotomies or amputation
- Look for and treat acidosis and myoglobinuria

Low-tension injuries

Low-tension or domestic appliance injuries do not have enough energy to cause destruction to significant amounts of subcutaneous tissues when the current passes through the body. The resistance is too great. The entry and exit points, normally in the fingers, suffer small deep burns; these may cause underlying tendon and nerve damage, but there will be little damage between. The alternating current creates a tetany within the muscles, and thus patients often describe how they were unable to release the device until the power was turned off. The main danger with these injuries is from the alternating current interfering with normal cardiac pacing. This can cause cardiac arrest. The electricity itself does not usually cause significant underlying myocardial damage, so resuscitation, if successful, should be lasting.

High-tension injuries [10]

High-tension electrical injuries can be caused by one of three sources of damage: the flash, the flame and the current itself.

When a high-tension line is earthed, enormous energy is released as the current travels from the line to the earth. It can arc over the patient, causing a flash burn. The extremely rapid heating of the air causes an explosion that often propels the victim backwards. The key here is that the current travelled from the line to the earth directly and not through the patient. The flash, however, can go on to ignite the patient's clothes and so cause a normal flame burn. In accidents with overhead lines, the patient often acts as the conduction rod to earth. In these injuries, there is enough current to cause damage to the subcutaneous tissues and muscles.

The entry and exit points are damaged but, importantly, the current can cause huge amounts of subcutaneous damage between these two points. These can be extremely serious injuries. The damage to the underlying muscles in the affected limb can cause the rapid onset of compartment syndrome. The release of the myoglobins will cause myoglobinuria and subsequent renal dysfunction. Therefore, during the resuscitation of these patients, efforts must be made to maintain a high urine output of up to 2 mL/kg body weight per hour. Severe acidosis is common in large electrical burns and may require boluses of bicarbonate. These patients are also at risk of myocardial damage as a result of direct muscle damage, rather than by interference with cardiac pacing. This gives rise to significant electrocardiogram changes, with raised cardiac enzymes. If there is significant damage, there is rapid onset of heart failure. In the case of a severe injury through a limb, primary amputation is sometimes the most effective management.

Chemical injuries [10]

There are over 70 000 different chemicals in regular use within industry. Occasionally, these cause burns. Ultimately, there are two aspects to a chemical injury. The first is the physical destruction of the skin and the second is any poisoning caused by systemic absorption. The initial management of any chemical injury is copious lavage with water. There are only a handful of chemicals for which water is not helpful, for example phosphorus, which is a component of some military devices, and elemental sodium, which is occasionally present in laboratory explosions. These substances need to be physically removed with forceps; however, it is extremely rare that any medical practitioner will encounter these in his or her lifetime. The more common injuries are caused by either acids or alkalis. Alkalis are usually the more destructive and are especially dangerous if they have come into contact with the eyes. After copious lavage, the next step in the management of any chemical injury is to identify the chemical and its concentration and to elucidate whether there is any underlying threat to the patient's life if absorbed systemically. One acid that is a common cause of acid burns is hydrofluoric acid. Burns affecting the fingers and caused by dilute acid are relatively common. The initial management is with calcium gluconate gel topically; however, severe burns or burns to large areas of the hand can be subsequently treated with Bier's blocks containing calcium gluconate 10% gel. If the patient has been burnt with a concentration greater than 50%, the threat of hypocalcaemia and subsequent arrhythmias then becomes high, and this is an indication for acute early excision. It is best not to split-skin graft these hydrofluoric acid wounds initially, but to do this at a delayed stage.

Ionising radiation injury

These injuries can be divided into groups depending on whether radiation exposure was to the whole body or localised. The management of localised radiation damage is usually conservative until the true extent of the tissue injury is apparent. Should this damage have caused an ulcer, then excision and coverage with vascularised tissue is required. Whole-body radiation causes a large number of symptoms. The dose of radiation either is, or is not, lethal. A patient who has suffered whole-body irradiation and is suffering from acute desquamation of the skin has received a lethal dose of radiation, which can cause a particularly slow and unpleasant death. Non-lethal radiation has a number of systemic effects related to the gut mucosa and immune system dysfunction. Other than giving iodine tablets, the management of these injuries is supportive.

Cold injuries

Cold injuries are principally divided into two types: acute cold injuries from industrial accidents and frostbite. Exposure to liquid nitrogen and other such liquids will cause epidermal and dermal destruction. The tissue is more resistant to cold injury than to heat injury, and the inflammatory reaction is not as marked. The assessment of depth of injury is more difficult, so it is rare to make the decision for surgery early. Frostbite injuries affect the peripheries in cold climates. The initial treatment is with rapid rewarming in a bath at 42°C. The cold injury produces delayed microvascular damage similar to that of cardiac reperfusion injury. The level of damage is difficult to assess, and surgery usually does not play a role in its management, which is conservative, until there is absolute demarcation of the level of injury.

RECENT ADVANCES

Advanced technology, newer drugs and skin substitutes are the major advances in burn care. An intelligent use of these modalities is essential to make an effective case for cost–benefit ratios. The introduction of new modalities needs to be carried out within critically reviewed and controlled clinical protocols, working towards building appropriate clinical evidence.

COMPLICATIONS IN BURN CARE[11]

There are several complications commonly associated with treatment of burn patients. Though not always avoidable, maintaining vigilance for typical complications and using appropriate techniques for prevention may limit the frequency and severity of complications. Ventilator-associated pneumonia, as in all critically ill patients, is a significant problem in burned patients. However, it is so common in patients with inhalation injury that a better nomenclature may be postinjury pneumonia. Unfortunately, commonly used scores in critical illness such as the Clinical Pulmonary Infection Score (CPIS) have not been shown to be reliable in burn patients. Quantitative bronchoscopic cultures in the setting of clinical suspicion of pneumonia should guide treatment of pneumonia. Simple measures such as elevating the head of the bed and maintaining excellent oral hygiene and pulmonary toilet are recommended to help decrease the risk of postinjury pneumonia. There is some question as to whether early tracheostomy decreases infectious morbidity in burn patients and whether it improves long-term outcomes. There do not seem to be any major differences in the rates of pneumonia with early tracheostomy, though there may be reduced development of subglottic stenosis compared with prolonged endotracheal intubation.

Practical considerations such as protection of facial skin grafts may influence the decision for tracheostomy placement. One major consideration in deciding whether to perform a tracheostomy has been the presence of eschar at the insertion site, which complicates tracheostomy site care and increases the risk of airway infection. Bedside percutaneous dilatational tracheostomy is a facile method for performing tracheostomy and is reported to be as safe as open tracheostomy in the burn population. Massive resuscitation of burned patients may lead to an abdominal compartment syndrome characterized by increased airway pressures with hypoventilation, and decreased urine output and hemodynamic compromise. Decompressive laparotomy is the standard of care for refractory abdominal compartment syndrome but carries an especially poor prognosis in burn patients. Adjunctive measures such as minimizing fluid, performing torso escharotomies, decreasing tidal volumes, and chemical paralysis should be initiated before resorting to decompressive laparotomy. Patients undergoing massive resuscitation also develop elevated intraocular pressures and may require lateral canthotomy.Deep vein thrombosis (DVT) has been commonly believed to be a rare phenomenon in burned patients, and there is a paucity of controlled studies regarding heparin prophylaxis in this population.

However, recent data show that up to 25% of burn patients develop DVT, and fatal pulmonary emboli have been reported in burn patients. A large retrospective study in patients with routine prophylaxis found DVT in only 0.25% of patients and reported no bleeding complications.Thus, it appears that heparin prophylaxis is safe in burn patients and may help prevent thrombotic complications. Unfortunately, the use of both prophylactic and therapeutic heparin may be associated with heparin-associated thrombocytopenia (HIT). One study of HIT in burn patients showed an incidence of 1.6% in heparinized burn patients. Thrombotic complications included DVT, pulmonary embolus, and even arterial thrombosis requiring limb amputation. Nonheparin anticoagulation for HIT commonly caused bleeding complications requiring transfusion.

Although rare, a high index of suspicion for HIT should be maintained in thrombocytopenic burn patients, particularly if the platelet counts drop at hospital days 7 to 10. Burn patients often require central venous access for fluid resuscitation and hemodynamic monitoring. Because of the anatomic relation of their burns to commonly used access sites, burn patients may be at higher risk for catheter-related bloodstream infections. The 2009 Centers for Disease Control and Prevention National Healthcare Safety Network report indicates that American burn centers have higher infectious complication rates than any other ICUs. Because burn patients may commonly exhibit leukocytosis with a documented bloodstream infection, practice has been to rewire lines over a guide wire and to culture the catheter tip. However, this may increase the risk of catheter-related infections in burned patients, and a new site should be used if at all possible.

REHABILITATION [12]

Rehabilitation is an integral part of the clinical care plan for the burn patient and should be initiated on admission. Immediate and ongoing physical and occupational therapy is mandatory to prevent functional loss. Patients who are unable to actively participate should have passive range of motion done at least twice a day. This includes patients with burns over joints, such as with hand burns. Patients should be taught exercises they can do themselves to maintain full range of motion. Patients with foot and extremity burns should be instructed to walk independently without crutches or other assistive devices to prevent extremity swelling, desensitize the burned areas, and prevent disuse atrophy; when patients are not ambulating, they must elevate the affected extremity to minimize swelling. If postoperative immobilization is used for graft protection, the graft should be evaluated early and at frequent intervals so that active exercise can be resumed at the earliest possible occasion.

The transition to outpatient care should also include physical and occupational therapy, with introduction of exercises designed to accelerate return to activities of daily living as well as specific job-related tasks. Tight-fitting pressure garments provide vascular support in burns that are further along in the healing process. Whether they prevent hypertrophic scar formation has been long debated. However, they do provide vascular support that many patients find more comfortable. Once patients have recovered from their acute burns, many face management of the hypertrophic burn scars. In patients with healed burns or donor sites, hypertrophic scar-related morbidity includes pruritus, erythema, pain, thickened tight skin, and even contractures. Within these scars, there is believed to be an increased inflammatory response that has increased neovascularization, abundant collagen production, and abnormal extracellular matrix structure. Treatment for these scars has included nonsurgical therapies such as compression garments, silicone gel sheeting, massage, physical therapy, and corticosteroid. Surgical excision and scar revision represent more invasive scar management approaches that are often necessary for functional and aesthetic recovery. Laser-based therapies provide addition treatment options for symptomatic hypertrophic scars. Two of the most common ones are the pulsed dye laser (PDL) and the ablative carbon dioxide (CO_2) laser.

The PDL causes photothermolysis of hemoglobin, resulting in coagulative necrosis. It obliterates small capillaries close to the skin and has had success treating congenital, cutaneous vascular malformations. The CO_2 laser has been used for treatment of acne and recently has been gaining increasing acceptance for its use to treat hypertrophic burn scars.It works by ablating microscopic columns of tissue to flatten scars and is also believed to stimulate matrix metalloproteinases and other signaling pathways to induce collagen reorganization. Lasers are believed to help with scar remodeling and collagen reorganization. Outpatient and office-based treatment sessions are tolerated well by most patients. There is wide practice variation on when to start therapy and the number of treatments, but the literature has general support for starting treatment at 6 to 12 months and offering three treatments. More research is needed to determine the full potential of laser therapy to provide burn survivors a less invasive treatment of hypertrophic scars with improved symptoms and quality of life. Psychological rehabilitation is equally important in the burn patient. Depression, posttraumatic stress disorder, concerns about image, and anxiety about returning to society constitute predictable barriers to progress in both the inpatient and outpatient setting. Psychological distress occurs in as many as 34% of burn patients and persists in severity long after discharge.

Despite this, many patients will be able to quickly return to work or school, and goals should be set accordingly. The return to school for pediatric patients is actually very prompt, averaging about 10 days after discharge. However, further study is needed to determine whether attendance and performance suffer despite early re-entry to school.The involvement of clinical psychologists and psychiatrists is invaluable in providing guidance and coping techniques to lessen the significant psychological burden of burn injury.

PREVENTION

Despite many areas of progress in prevention, burns continue to be a common source of injury. Some successful initiatives have included community-based interventions targeting simple home safety measures. Smoke alarms are known to decrease mortality from structural fires, but not all homes are equipped with proper smoke alarms, particularly in low-income households. Mandatory smoke alarm installation via community initiatives can be successful, but seems to be contingent on close long-term follow-up to ensure proper maintenance and function. Regulation of hot water heater temperatures has had some success and may be even more effective in conjunction with community-based programs emphasizing education and in-home inspections.

RADIATION BURNS[12]

Interest in mass burn casualty disaster planning invariably includes a discussion of radiation burns. The 1945 nuclear bombing on Hiroshima and Nagasaki provided several important lessons for healthcare providers. First, the proximity to the detonated bomb directly impacted mortality. The fatality rate at 0.6 miles from ground zero was 86%, decreased to 27% at 0.6 to 1.6 miles, and was 2% for patients 1.6 to 3.1 miles away. Over 122,338 individuals died in Hiroshima, and 68,000 of these deaths occurred in the first 20 days. Of the survivors, 79,130 people were injured and 118,613 remain uninjured. Estimates of the injuries at Hiroshima suggest that 90% of patients had burns, 83% sustained traumatic injuries, and 37% had radiation injuries. The mechanism of the explosion explains how radioactive material is distributed. A 20-kiloton nuclear device generates 180 mph winds 0.8 miles from the epicenter. The explosion results in a direct pressure wave and an indirect wind drag. The direct pressure can destroy windows and buildings, rupture eardrums, and cause pulmonary contusions, pneumothoraces, and hemothoraces. Radiation travels linearly, resulting in varying degree of burns depending on the distance from ground zero and time of exposure. A fireball at detonation sends radioactive material into the air and follows wind patterns settling to the ground in a predictable pattern. Thermal injuries near ground zero result in 100% fatalities due to incineration.Radioactive material results in both acute injury from immediate exposure and more prolonged injury from delayed exposure to radioactive fallout or contamination. When a 10-kiloton nuclear bomb is detonated, people at a distance 0.7 miles from ground zero absorb 4.5 Gy. At 60 days, the medial lethal radiation dose (LD50) is 3.5 Sv; with aggressive medical care, this dose might be doubled to nearly 7 Sv. To put this in context, radiation exposure from a diagnostic CT of the chest or abdomen is 5 mSv, and the average annual background absorbed radiation dose is 3.6 mSv. Radiation is known to impact several organ systems and result in several syndromes based on increasing exposure doses. These syndromes include hematologic (1–8 Sv exposure), gastrointestinal (8–30 Sv exposure), and cardiovascular/neurologic syndromes (>30 Sv exposure), with the latter two being nonsurvivable.After initial evaluation and decontamination by removing clothing, a useful way to estimate exposure is by determining the time to emesis. Patients who do not experience emesis within 4 hours of exposure are unlikely to have severe clinical effects. Emesis within 2 hours suggests a dose of at least 3 Sv, and emesis within 1 hour suggests at least 4 Sv. The hematologic system follows a similar dose-dependent temporal pattern for predicting radiation exposure, mortality, and treatment. These have been determined based on the Armed Forces Radiobiology Research Institute's Biodosimetry Assessment Tool, which can be downloaded from www.afrri.usuhs.mil. The combination of radiation exposure and burn wounds has the potential to increase mortality compared with traditional burns. Early closure of wounds before radiation depletes circulating lymphocytes may be needed for wound healing (which occurs within 48 hours). Also, in radiation injuries combined with burn or trauma, laboratory lymphocyte counts may be unreliable.A significant difference between burn/traumatic injuries and radiation injures is that burn/traumatic injuries can result in higher mortality when not treated within hours. Decontamination and triage are vital to maximize the number of survivors. Initial decontamination requires removal of clothing and washing wounds with water. Irrigation fluid should be collected to prevent radiation spread into the water supply. Work by many professional organizations, including the ABA, has focused on nationwide triage for disasters and will be vital to save as many lives as possible. Yet, it is likely that expectant or comfort care could be offered to more patients than typically seen in civilian hospitals, due to resource availability after the disaster.

FUTURE AREAS OF STUDY[12]

It has long been anecdotally noted that two patients of similar ages and burn size may have very divergent responses to their burn injuries. Attention is being increasingly turned to identifying genetic differences among burn patients and how they affect response to injury. Specific allele variants have been linked with increased mortality in burned patients.It may be that genetic differences may predispose burn patients to severe sepsis, perhaps by downregulating the immune response.The Inflammation and the Host Response to Injury trial was a prospective, multicenter, federally funded study that aimed to define specific genetic pathways that differ in the response to both burns and traumatic injury. Blood and tissue samples from a strictly defined patient population were analyzed using gene arrays to determine whether differential expression in certain genetic pathways affects clinical outcomes. Although data from this study are still being analyzed, some interesting findings suggest that sepsis, trauma, and burn patients share common gene expression patterns, starting early after injury. These genes can upregulate proinflammatory pathways as well as disrupt antigen presentation pathways. A better understanding of these common genomic responses may allow for the targeted treatment of immunologic and signal pathways to help improve patient survival from burn injuries. With the dramatic progress in improving survival following a major burn injury during the twentieth century, understanding and addressing functional and psychological outcomes is critical to the well-being of burn survivors. Since 1993, the National Institute of Disability and Rehabilitation Research has funded four burn model systems to identify long-term sequelae of burn injuries and to develop ways to improve outcomes for survivors. Ongoing outcome studies are crucial for dismantling barriers that our patients face in returning to their communities and to the workplace or to school.

MATERIALS AND METHODS

STUDY SETTING:

This study was conducted in Coimbatore Medical College Hospital from January 2018 to December 2018.

PERIOD OF STUDY:

1 Year

SAMPLE SIZE:

The sample size is 100. By systemic random sampling it is divided into two groups A and B. For patients in group A, dressing was done with 1% Silver sulfadiazine ointment. For patients in group B, dressing was done using povidone iodine oinment for first four days followed by 1% Silver sulfadiazine ointment for the rest of the period.

Patients with burns less than 40 percent admitted in CMCH from January – 2018 to December – 2018 were included in this study.

STUDY DESIGN:

Prospective study

INCLUSION CRITERIA:

- Patients admitted with burns less than 40 percent in department of general surgery, Coimbatore Medical College Hospital during the period of January 2018 – December 2018.

EXCLUSION CRITERIA:

- Patient who are below 18yrs of age
- Patients more than 40 percent of burns.
- Allergy to iodine or silver sulfadiazine.
- Diabetics or any immunocompromised state.

PROCEDURE:

By systemic random sampling patients were divided into two groups A and B. For patients in group A, dressing was done with 1% Silver sulfadiazine ointment. For patients in group B, dressing was done using povidone iodine oinment for first four days followed by 1% Silver sulfadiazine ointment for the rest of the period. Eschar formation and wound healing were compared in the two groups on Day 1, Day 4 and Day 7 and the outcomes were compared and results were concluded.

OUTCOME VARIABLES:

Eschar formation – minimal , absent or present

Wound healing time

Scar – good or bad

MATERIALS USED:1% Silver sulfadiazine ointment and Povidone iodine ointments

- Accidental burns
- Treated with application of povidone iodine ointment for first four days followed by application of silver sulfadiazine ointment.

- Healing wound.
- No eschar formation.

RESULTS

Table 1: Distribution of dressing types among study participants

Dressing types	Frequency	Percentage (%)
PI+SSD	52	52.0
SSD	48	48.0
Total	100	100.0

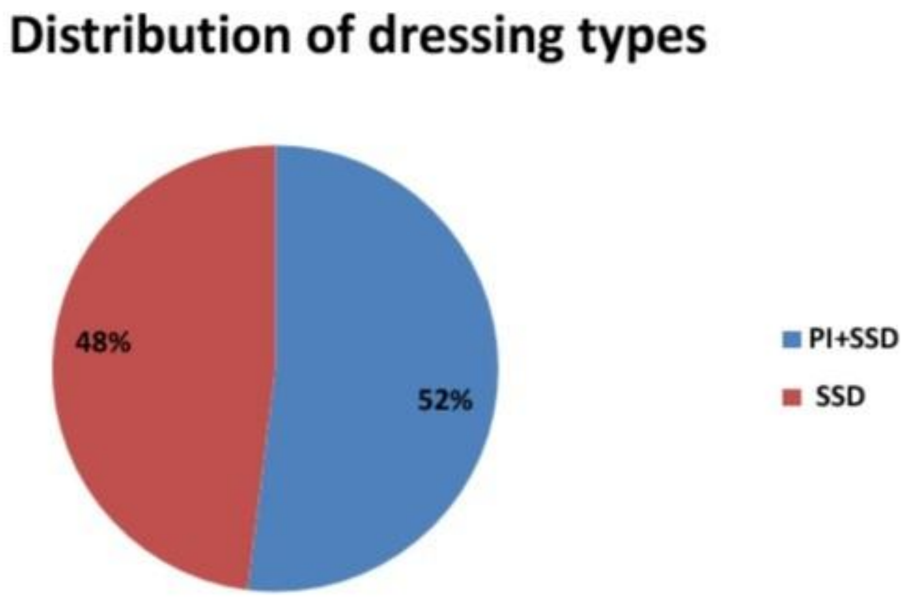


Table 2: Mean age of dressing types among the study group

	Dressing types	N	Mean	SD	P value
AGE	**PI+SSD**	52	39.65	15.463	.853
	SSD	48	40.17	11.808	

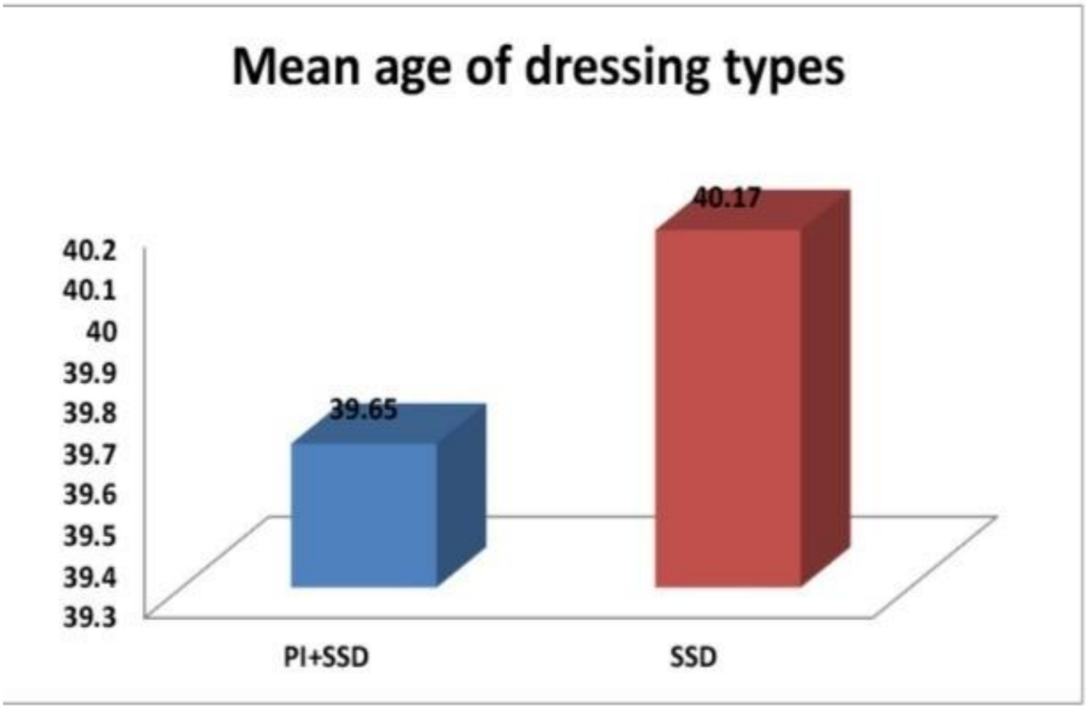


Table 3: Gender distribution of study group

Gender	Dressing types		P Value
	PI+SSD	SSD	
Male	36(65.5%)	19(34.5%)	.003*
Female	16(35.6%)	29(64.4%)	

***P- Value is <0.05 and it is statistically significant**

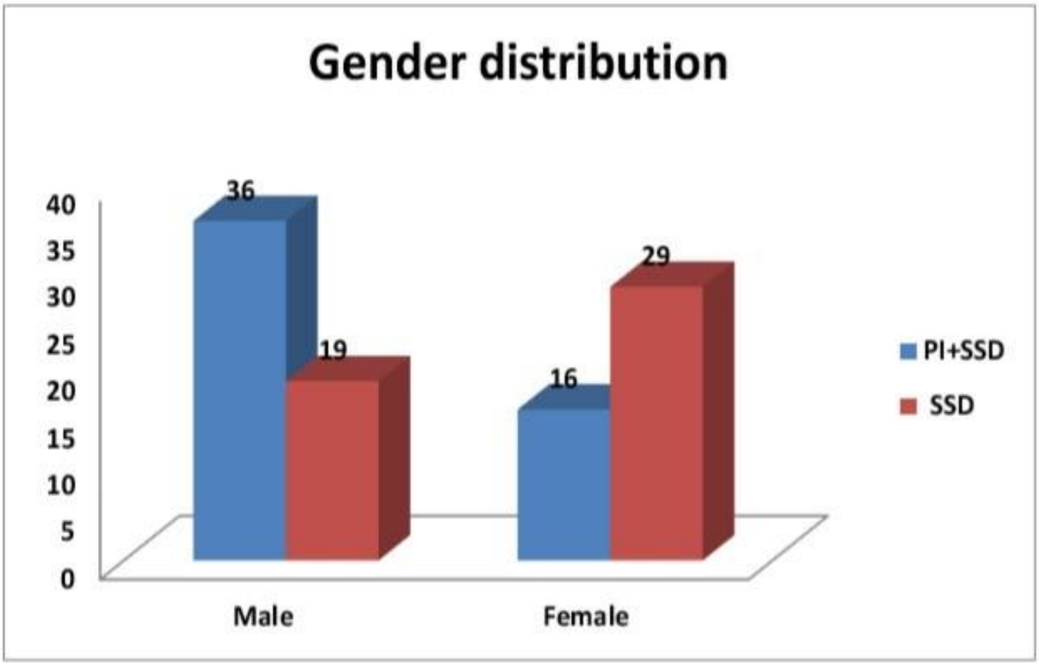


Table 4: Mode of injury distribution of study group

Dressing types	Mode of injury		**P Value**
	Accidental	**Suicidal**	
PI+SSD	42(80.8%)	10(19.2%)	.217
SSD	43(89.6%)	5(10.4%)	

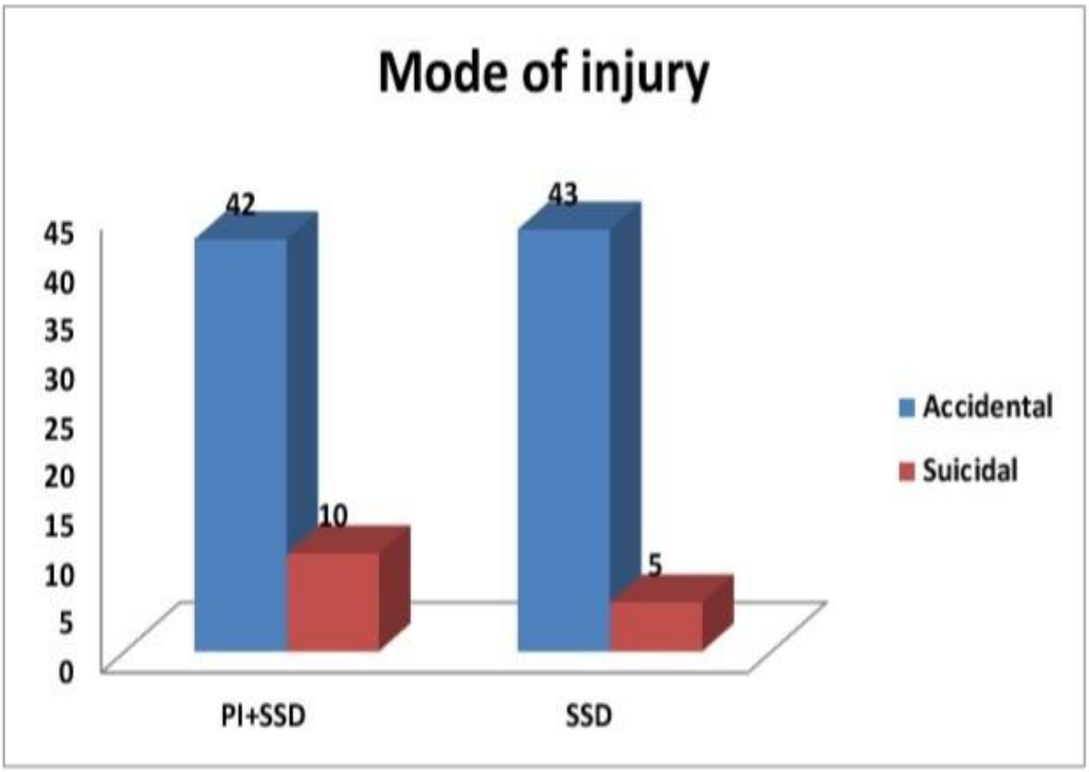


Table 5: Mean B.UREA (mg/dl) of dressing types among the study group

	Dressing types	N	Mean	SD	P value
B.UREA(mg/dl) DAY 1	**PI+SSD**	52	39.481	12.3009	.771
	SSD	48	40.167	11.1151	
B.UREA(mg/dl) DAY 4	**PI+SSD**	52	29.846	7.7823	.021*
	SSD	48	33.833	9.1264	

*P- Value is <0.05 and it is statistically significant

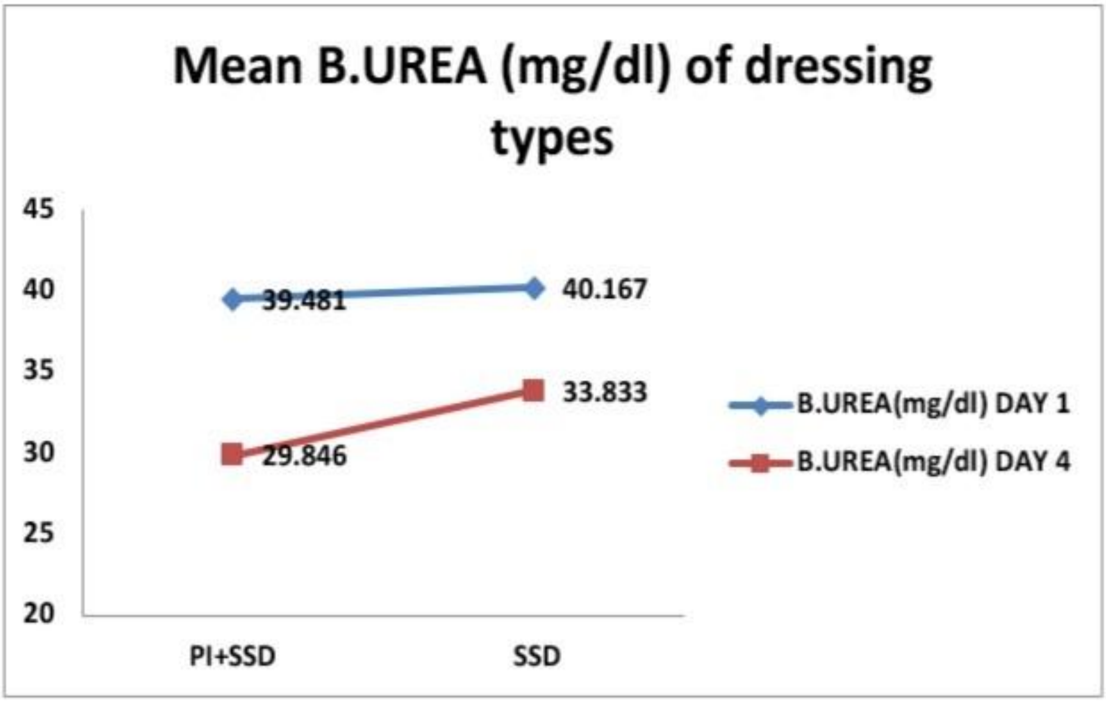


Table 6: Mean S.Creatinine (mg/dl) of dressing types among the study group

	Dressing types	N	Mean	SD	P value
S.Creatinine(mg/dl) DAY 1	**PI+SSD**	52	1.390	.2724	.824
	SSD	48	1.402	.2488	
S.Creatinine(mg/dl) DAY 4	**PI+SSD**	52	1.013	.1772	.075
	SSD	48	1.742	2.9105	

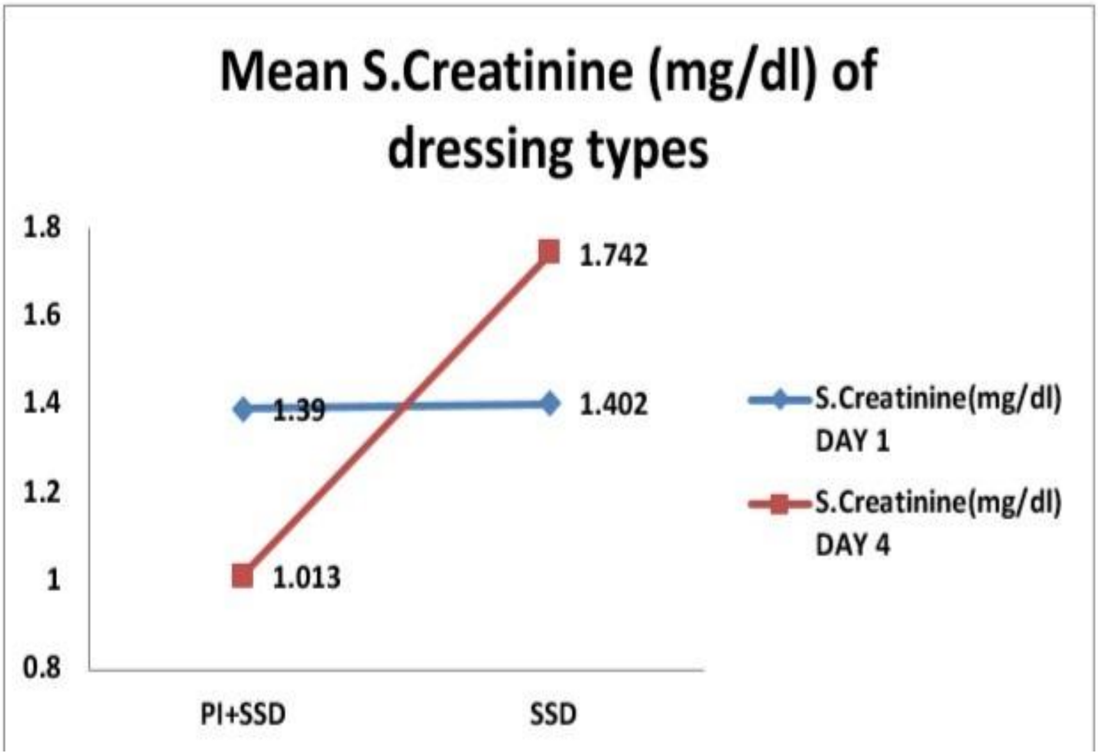


Table 7: Mean SGOT (IU/L) of dressing types among the study group

	Dressing types	N	Mean	SD	P value
SGOT(IU/L) DAY 1	**PI+SSD**	52	59.346	16.1584	.629
	SSD	48	60.896	15.8090	
SGOT(IU/L) DAY 4	**PI+SSD**	52	37.288	5.3370	.006*
	SSD	48	41.813	10.2140	

*P- Value is <0.05 and it is statistically significant

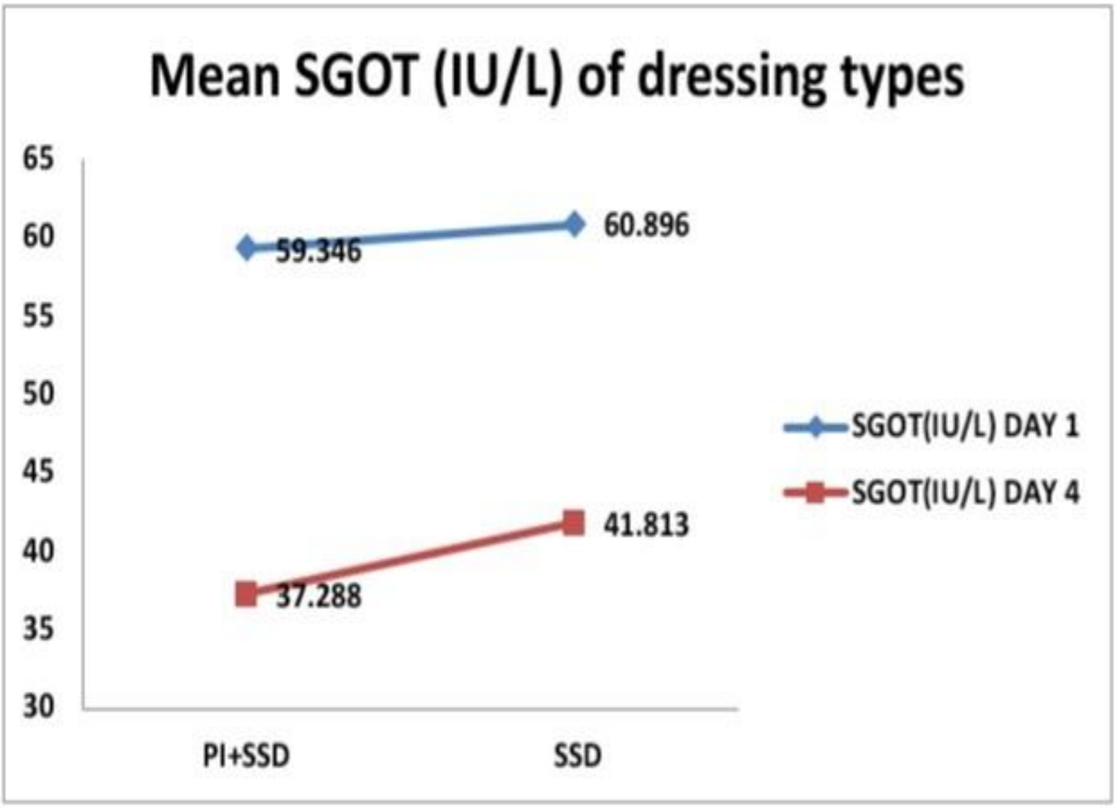


Table 8: Mean SGPT (IU/L) of dressing types among the study group

	Dressing types	*N*	*Mean*	*SD*	*P value*
SGPT(IU/L) DAY 1	***PI+SSD***	*52*	*62.327*	*16.8473*	*.689*
	SSD	*48*	*63.625*	*15.3424*	
SGPT(IU/L) DAY 4	***PI+SSD***	*52*	*36.673*	*5.4259*	*.003**
	SSD	*48*	*41.583*	*9.6576*	

*P- Value is <0.05 and it is statistically significant

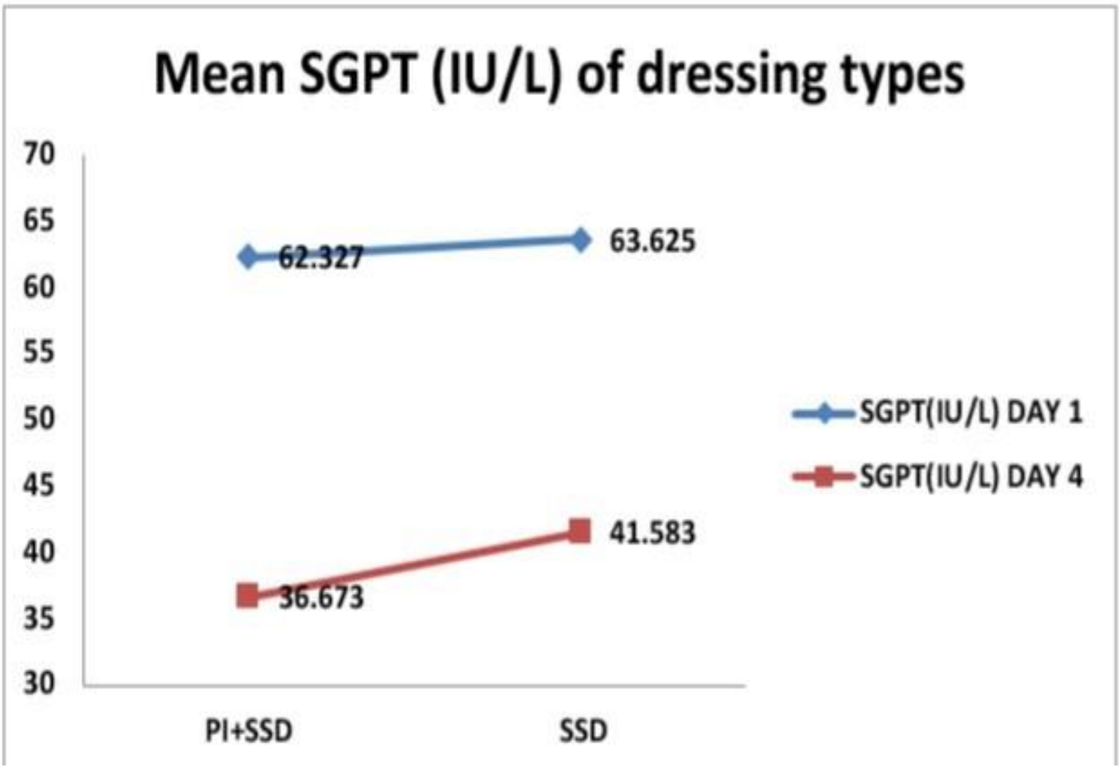


Table 9: Mean ALP (IU/L) of dressing types among the study group

	Dressing types	N	Mean	SD	P value
ALP(IU/L) DAY 1	**PI+SSD**	52	103.212	30.0896	**.**434
	SSD	48	108.083	31.9433	
ALP(IU/L) DAY 4	**PI+SSD**	52	81.558	13.8612	.112
	SSD	48	86.063	14.2148	

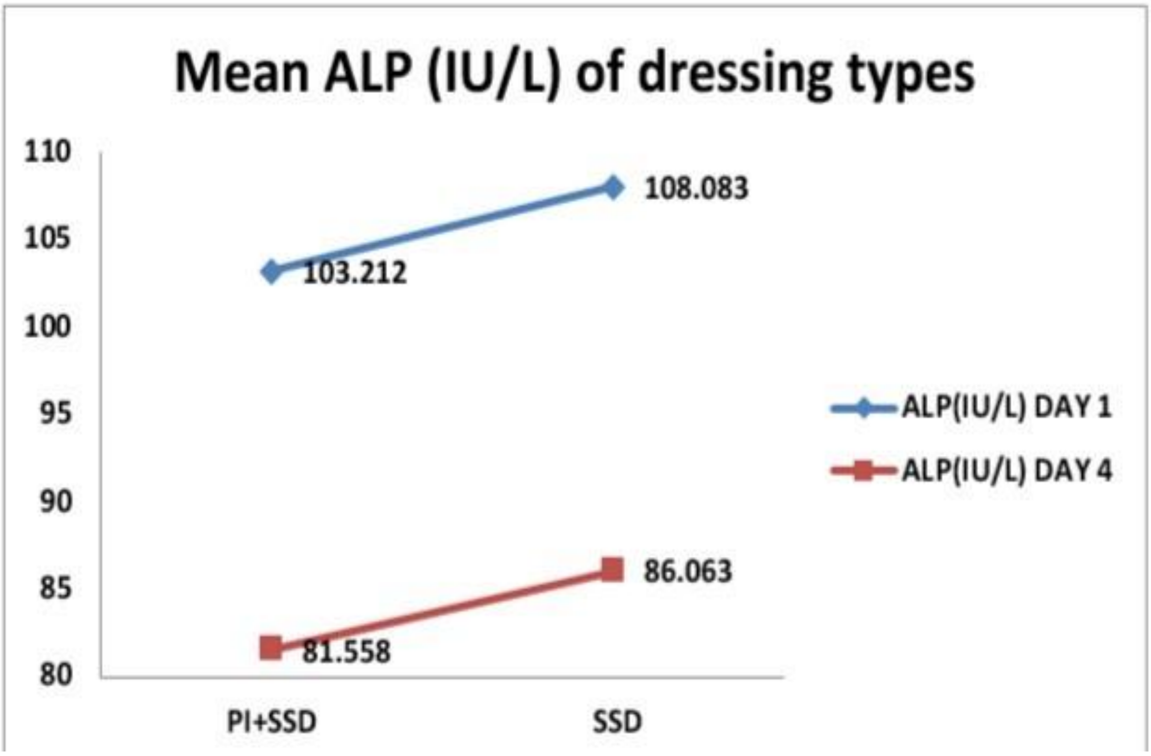


Table 10: Eschar distribution of dressing types among study group

Dressing types	Eschar distribution			P Value
	MINIMAL	NO	PRESENT	
PI+SSD	45(86.5%)	3(5.8%)	4(7.7%)	.000*
SSD	15(31.3%)	1(2.1%)	32(66.7%)	

***P- Value is <0.05 and it is statistically significant**

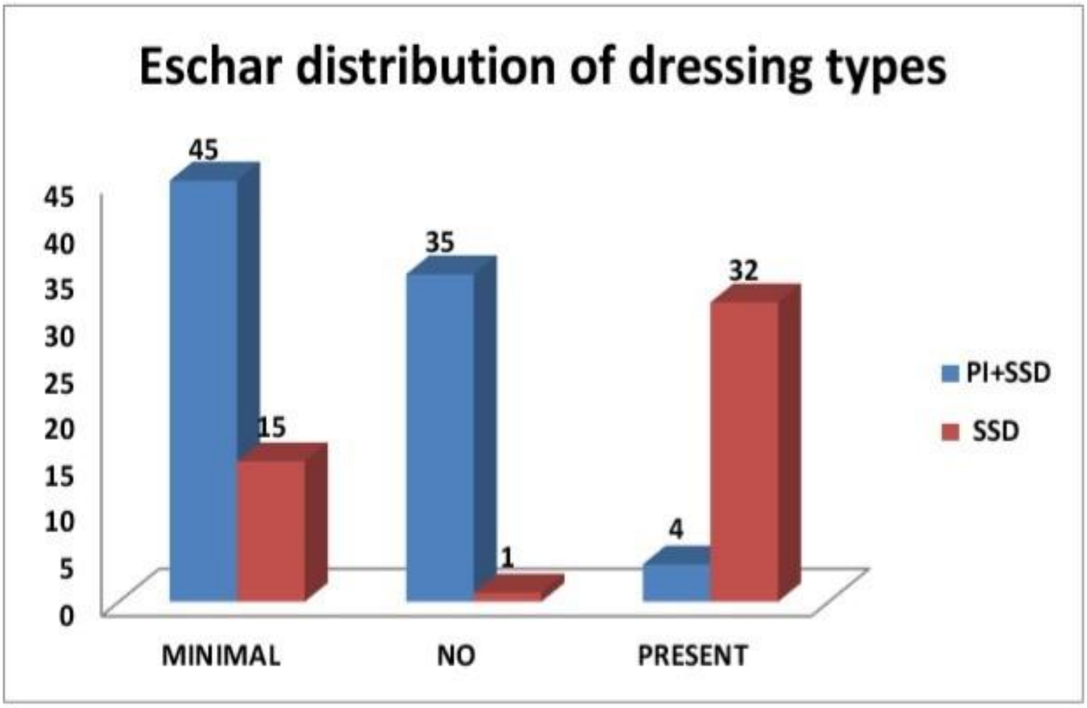


Table 11: Scar distribution of dressing types among study group

Dressing types	Scar distribution		P Value
	BAD	**GOOD**	
PI+SSD	3(5.8%)	49(94.2%)	.000*
SSD	33(68.8%)	15(31.3%)	

*P- Value is <0.05 and it is statistically significant

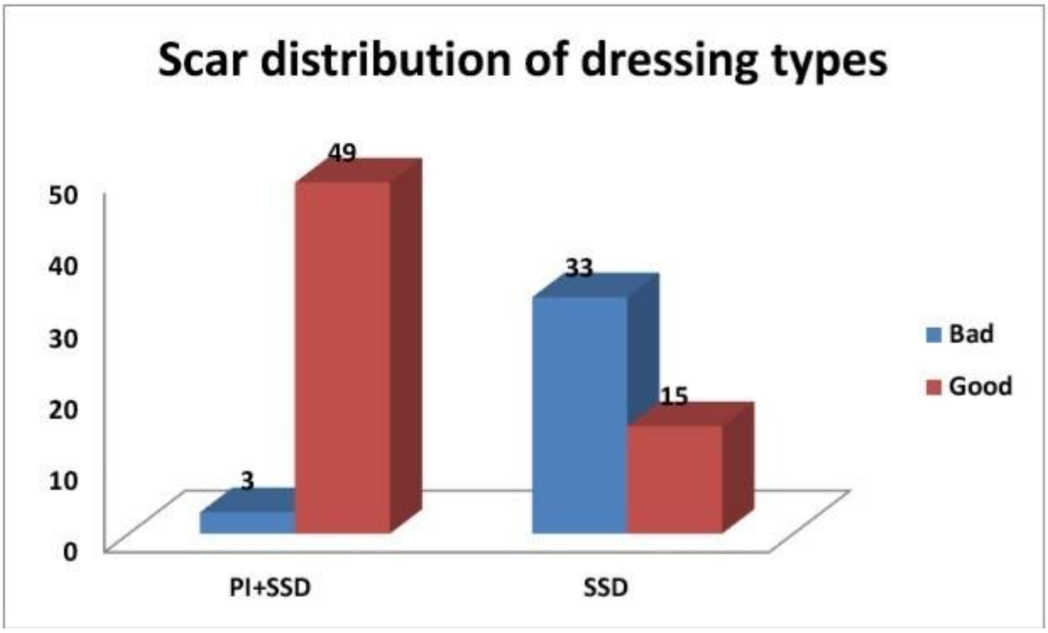
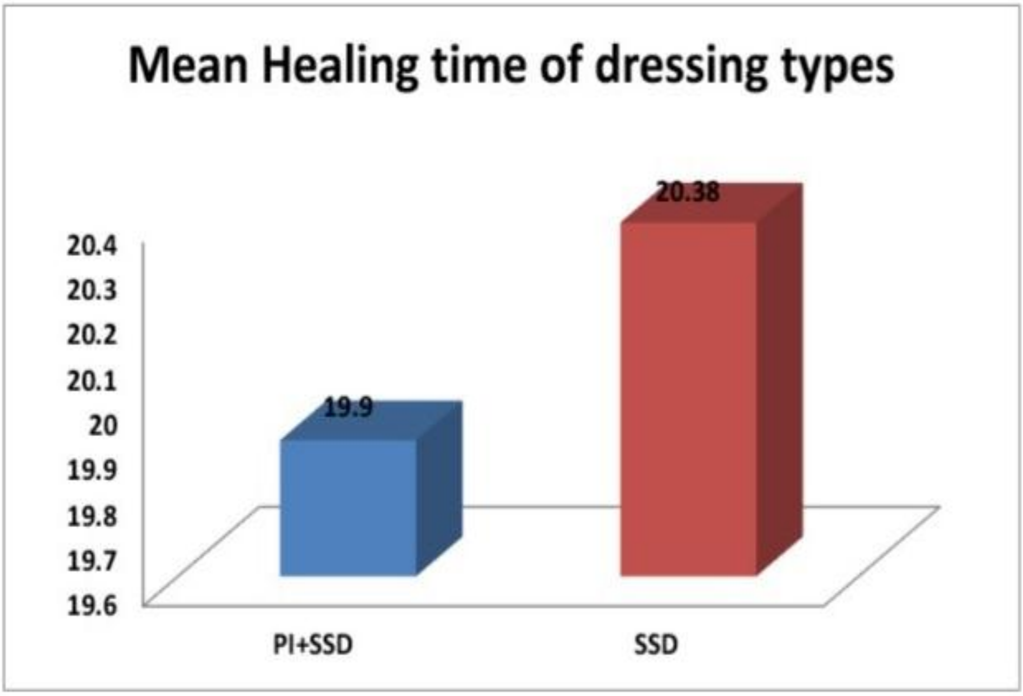


Table 12: Mean Healing time of dressing types among the study group

	Dressing types	N	Mean	SD	P value
Healing time	**PI+SSD**	52	19.90	7.019	.734
	SSD	48	20.38	6.812	



DISCUSSION

During burns due to thermal injury, most important factor leading to tissue damage are the oxygen free radicals. These may cause local as well as distant tissue damage and multiple organ failures.

In normal body state there exists a balance between oxygen free radicals and free radical scavengers in the body whereas in any stress or injury these harmful free radicals outnumber the scavengers and this increases the susceptibility to free radical injury.

The level of these free radicals in the plasma of patients with burns increases in the first few hours , reaching peak level in day 2 post burn i.e., during the inflammatory phase of wound healing and then declining. So antioxidants must be applied in this period to target the oxygen free radicals.

Table 1 shows the distribution of dressing types in among 100 patients.52 of them were treated with povidone iodine ointment application for first 4 days followed by 1% silver sulfadiazine ointment for the rest of the healing period. 48 of them were treated with 1% silver sulfadiazine ointment throughout.

Table 2 shows the mean age of the patients which was 39.65 for PI+SSD group while it was 40.17 with standard deviation for SSD group.

Table 3 shows gender distribution of study group. In PI+SSD group 65.5% were males 35.6% were female. In SSD group 34.5% were males and 64.4% were females.

Table 4 shows mode of injury in the study group. In PI+SSD 80.8% were accidental burns while 19.2% were suicidal burns. In SSD group 89.6% were accidental burns while 10.4% were suicidal burns.

Table 5, 6, 7, 8 and 9 oxidative stress parameters which are liver and renal function tests have been studied which are elevated in the first few hours and then started to decline on Day 4.

Table 10 shows the eschar formation in the two dressing type groups. In PI+SSD group eschar was present in 7.7% absent in 5.8% and minimal in 86.5% patients. In SSD group eschar was present in 66.7% absent in 2.1% and minimal in 31.3% patients.

Table 11 shows scar types in the two groups. In PI+SSD group 94.2% had good scar and 5.8% had bad scar after healing. In SSD group 31.3% had good scar and 68.8% had bad scar after healing.

Table 12 shows the mean healing time in the two groups. In PI+SSD, mean healing time was 19.90 days while in SSD group it was 20.38 days.

CONCLUSION

The treatment of burn patients with topical antioxidants like povidone iodine ointment for the first four days post burns followed by 1% silver sulfadiazine ointment as compared to application of 1% silver sulfadiazine ointment alone reduced the incidence of eschar formation from 66.7% to 7.7%.

Healing time required is almost the same .

Scar is better with the use of antioxidants topically

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ANNEXURES

PATIENT PROFORMA

Name	DOA	Case No.
Age	DOS	I.p.No.
Sex	DOD	

Address Occupation:

Chief Complaints :

Mode of burns

Date

Time and Place

Past history

Personal history

Family history

Treatment history

EXAMINATION:

GENERAL EXAMINATION

Pallor/Pedal edema/icterus/cyanosis/clubbing/

Lymphadenopathy

SYSTEMIC EXAMINATION

CNS:

CVS:

RS :

P/A:

PERCENTAGE OF BURNS

EXAMINATION OF WOUND

INVESTIGATIONS:

Complete blood count

Blood urea on Day 1 and 4

Serum creatinine on Day 1 and 4

Liver function tests on Day 1 and 4

MANAGEMENT:

POST OPERATIVE COURSE:

FOLLOW UP:

PATIENT CONSENT FORM

STUDY TITLE: **—**COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS

STUDY CENTRE:

Coimbatore Medical College Hospital, Coimbatore.

PARTICIPANT NAME: AGE/SEX:

I.P. NO :

I confirm that I have understood the purpose of treatment and procedure for the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my satisfaction.

I have been explained about the possible complications that may occur during the interventional procedure. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving any reason.

I understand that the investigator, regulatory authorities and the ethics committee will not need my permission to look at my health records both in respect to the current study and any further research that may be conducted in relation to it, even if I withdraw from the study. I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from the study.

I hereby consent to participate in this study of , **COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS.** ,

Date: Signature of the patient & Name

Place:

Signature of the investigator & Name

ஒப்புதல் படிவம்

பெயர் :
வயது / பாலினம் :
முகவரி :

அரசு கோவை மருத்துவக் கல்லூரி மருத்துவமனையில் பொது அறுவை சிகிச்சை பிரிவில் பட்ட மேற்படிப்பு பயிலும் மாணவன் **மரு. அன்கிட்** அவர்கள் மேற்கொள்ளும் **"COMPARATIVE STUDY IN EFFECTIVENESS OF TOPICAL POVIDONE IODINE WITH SILVER SULFADIAZINE OINTMENT AND ONLY SILVER SULFADIAZINE OINTMENT IN THE MANAGEMENT OF BURNS"** குறித்த ஆய்வில் செய்முறை மற்றும் அனைத்து விபரங்களையும் கேட்டுக் கொண்டு எனது சந்தேகங்களை தெளிவுப்படுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

எனது மகன்/மகள் இந்த ஆய்வில் கலந்து கொள்ள முழு சம்மமத்துடனும், சுய சிந்தனையுடனும் சம்மதிக்கிறேன்.

இந்து ஆய்வில் என்னுடைய மகன்/மகளின் விபரங்கள் பாதுகாக்கப்படுவதுடன் இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்விலிருந்து நான் விலிகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம் : பெற்றோரின் கையொப்பம்

நாள் :

MASTER CHART

S.No.	NAME	AGE	SEX	IP No.	TYPE OF BURNS	MODE	%BSA	TYPE OF DRESSING	B.UREA(mg/dl)DAY 1	B.UREA(mg/dl)DAY 4	S.Creatinine(mg/dl) DAY 1	S.Creatinine(mg/dl) DAY 4	SGOT(IU/L)DAY 1	SGOT(IU/L)DAY 4	SGPT(IU/L)DAY 1	SGPT(IU/L)DAY 4	ALP(IU/L)DAY 1	ALP(IU/L)DAY 4	ESCHAR	SCAR	HEALING TIME
1	ARUKKANI	50	FEMALE	49186	Flame	Suicidal	35-38	PI+SSD	52	36	1.8	1.1	67	38	78	35	224	113	MINIMAL	GOOD	25 DAYS
2	KANAMMAL	54	FEMALE	50668	Flame	Accidental	30-35	SSD	58	52	1.9	1.4	78	56	87	58	234	110	PRESENT	BAD	28DAYS
3	LAKSHMI	21	FEMALE	52925	Flame	Accidental	30-35	PI+SSD	63	40	1.7	1.2	87	34	88	32	192	98	MINIMAL	GOOD	25 DAYS
4	RAMATHAL	65	FEMALE	53096	Flame	Accidental	25-30	PI+SSD	48	28	1.5	1	64	32	73	30	156	88	MINIMAL	GOOD	20 DAYS
5	NAGAMMAL	32	FEMALE	54119	Scald	Accidental	10	PI+SSD	28	22	1.1	0.8	38	30	40	36	119	90	NO	GOOD	10DAYS
6	BALU	57	MALE	54123	Scald	Accidental	5	PI+SSD	22	18	0.8	0.7	32	30	28	26	78	67	NO	GOOD	7DAYS
7	KUMARAN	39	MALE	54650	Flame	Accidental	20-25	SSD	42	36	1.6	1.1	48	32	50	30	148	88	MINIMAL	BAD	20 DAYS
8	MAHALAKSHMI	23	FEMALE	55044	Scald	Accidental	20-30	PI+SSD	46	32	1.7	1.2	64	38	76	32	144	92	MINIMAL	GOOD	20 DAYS
9	MONIDEVI	25	FEMALE	55448	Flame	Accidental	30-35	SSD	60	52	1.9	1.7	90	82	88	68	152	98	PRESENT	BAD	30DAYS
10	PRAKASH	37	MALE	56155	Scald	Accidental	20-25	PI+SSD	48	36	1.3	0.9	84	44	78	42	124	82	MINIMAL	GOOD	25 DAYS
11	KAVITHA	28	FEMALE	56914	Flame	Accidental	20-25	PI+SSD	52	38	1.5	1.1	70	36	66	32	112	76	MINIMAL	GOOD	21DAYS
12	BASKARAN	60	MALE	57383	Flame	Accidental	25-30	SSD	56	44	1.7	1.3	98	44	86	42	154	112	PRESENT	BAD	30DAYS
13	JEEVANATHAM	31	MALE	57415	Flame	Accidental	20-25	SSD	50	42	1.5	1.3	84	42	78	36	114	78	PRESENT	BAD	25 DAYS
14	NANJUKUTTY	85	MALE	60137	Flame	Suicidal	30-35	PI+SSD	64	40	1.9	1.2	88	44	76	40	134	96	PRESENT	BAD	30DAYS
15	JOTHIMANI	20	FEMALE	25742	Flame	Accidental	30-35	PI+SSD	59	43	1.7	1.3	70	34	76	32	110	72	MINIMAL	GOOD	28DAYS
16	MALLIKA	35	FEMALE	27848	Flame	Suicidal	25-30	SSD	50	42	1.6	1.3	66	30	72	34	102	88	PRESENT	BAD	25 DAYS
17	KANISHKA	15	FEMALE	31469	Flame	Accidental	30-35	PI+SSD	54	39	1.7	1.2	74	38	82	44	116	78	MINIMAL	GOOD	30DAYS
18	VASANTHI	42	FEMALE	32634	Scald	Accidental	35-38	SSD	58	50	1.8	16	92	56	88	54	144	102	PRESENT	BAD	30DAYS
19	SANGEETHA	24	FEMALE	33609	Flame	Accidental	30-35	SSD	60	48	1.9	1.5	89	65	87	66	204	116	PRESENT	BAD	28DAYS
20	DEIVANNAI	69	FEMALE	34468	Flame	Accidental	20-25	PI+SSD	44	32	1.4	1	66	30	54	36	98	78	MINIMAL	GOOD	21DAYS
21	SRIRENGAMA	70	FEMALE	34524	Scald	Accidental	15-20	SSD	42	36	1.3	1.1	62	34	66	32	90	76	MINIMAL	GOOD	15DAYS
22	BAGIYAM	62	FEMALE	34831	Flame	Accidental	15-20	PI+SSD	40	28	1.4	0.9	76	30	86	32	94	82	MINIMAL	GOOD	15DAYS
23	DURAISAMY	71	MALE	34887	Flame	Accidental	15-20	PI+SSD	37	30	1.3	1	60	42	66	36	88	70	MINIMAL	GOOD	20 DAYS
24	PRIYA	20	FEMALE	38499	Flame	Accidental	20-25	PI+SSD	44	32	1.3	1	78	34	86	40	118	86	MINIMAL	GOOD	25 DAYS
25	SENTHILKUMAR	38	MALE	39089	Scald	Accidental	5	PI+SSD	28	24	1	0.8	44	40	42	36	66	60	NO	GOOD	10DAYS

26	PRASANTH	18	MALE	39162	Scald	Accidental	10	SSD	30	26	1.1	1	50	34	48	36	70	66	NO	GOOD	10DAYS
27	THIYAGU	16	MALE	40038	Flame	Accidental	10-15	SSD	32	30	1.2	1	66	42	70	44	88	76	MINIMAL	GOOD	15DAYS
28	SRIPRIYA	30	FEMALE	41301	Flame	Accidental	10-15	PI+SSD	30	24	1.4	1	78	38	82	40	90	84	MINIMAL	GOOD	15DAYS
29	MONISHA	34	FEMALE	41729	Scald	Accidental	5-10	PI+SSD	22	20	1.1	1	40	38	42	37	86	70	MINIMAL	GOOD	10DAYS
30	MURUGESAN	35	MALE	43067	Flame	Accidental	20-25	SSD	30	28	1.2	1	56	42	60	44	88	76	PRESENT	BAD	25 DAYS
31	SABARNISHA	39	FEMALE	43248	Flame	Accidental	15-20	PI+SSD	32	26	1.4	0.9	50	39	47	37	76	66	MINIMAL	GOOD	10DAYS
32	AMMASAI	70	FEMALE	44652	Flame	Accidental	5-10	PI+SSD	28	24	1.1	0.8	34	30	38	28	79	70	MINIMAL	GOOD	10DAYS
33	RAMARAJ	65	MALE	44321	Flame	Accidental	15-20	SSD	42	32	1.4	1.1	58	42	64	38	124	78	PRESENT	BAD	15DAYS
34	AYYAPPAN	62	MALE	11324	Flame	Accidental	25-30	PI+SSD	46	34	1.6	1	68	36	78	34	102	98	MINIMAL	GOOD	25 DAYS
35	MEENA	37	FEMALE	9680	Scald	Accidental	10-15	PI+SSD	20	17	1	0.7	32	30	34	26	70	66	MINIMAL	GOOD	10DAYS
36	MURUGAN	42	MALE	10344	Flame	Accidental	15-20	SSD	32	28	1.3	1.1	66	32	58	34	87	74	MINIMAL	GOOD	15DAYS
37	KATHAMUTHU	55	MALE	11969	Flame	Accidental	20-25	SSD	46	38	1.4	1.3	78	44	82	46	98	87	PRESENT	BAD	15DAYS
38	KAVITHA	28	FEMALE	12625	Flame	Accidental	30-35	PI+SSD	52	38	1.6	1.1	89	42	87	39	129	104	MINIMAL	GOOD	30DAYS
39	SARAVANAN	32	MALE	12709	Flame	Accidental	35-38	PI+SSD	58	42	1.9	1.2	78	49	88	47	143	112	PRESENT	BAD	30DAYS
40	SUBBANA	42	MALE	13020	Flame	Accidental	25-30	SSD	44	40	1.6	1.4	66	50	76	56	120	98	PRESENT	BAD	25 DAYS
41	SIVARAJ	45	MALE	15057	Flame	Accidental	10-15	SSD	28	22	1.2	1	38	30	36	29	74	68	PRESENT	BAD	15DAYS
42	CHINNAMANI	40	MALE	15988	Flame	Accidental	15-20	SSD	33	30	1.3	1	68	40	59	38	94	88	PRESENT	BAD	15DAYS
43	SANTHAMANI	32	FEMALE	16865	Flame	Accidental	20-25	PI+SSD	31	27	1.4	0.8	66	32	58	38	86	73	MINIMAL	GOOD	25 DAYS
44	BALAJI	14	MALE	17432	Scald	Accidental	15-20	PI+SSD	36	29	1.4	0.7	70	40	68	38	106	78	MINIMAL	GOOD	15DAYS
45	PALANISAMY	34	MALE	17887	Flame	Accidental	5-10	SSD	20	18	1	0.9	68	42	70	38	98	86	MINIMAL	GOOD	10DAYS
46	PACHAIAMMAL	45	FEMALE	18231	Flame	Accidental	15-20	PI+SSD	28	22	1.3	0.8	66	32	72	36	86	80	MINIMAL	GOOD	15DAYS
47	VIJAYA	32	FEMALE	18954	Flame	Accidental	25-30	SSD	44	40	1.6	1.4	76	48	88	50	126	104	PRESENT	BAD	28DAYS
48	KANAGAMANI	33	FEMALE	19456	Scald	Accidental	10-15	PI+SSD	26	20	1	0.8	38	36	40	32	76	66	MINIMAL	GOOD	25 DAYS
49	RAMU	45	MALE	19765	Flame	Accidental	15-20	SSD	34	30	1.3	1.1	68	34	72	40	88	78	PRESENT	BAD	21DAYS
50	SELVI	36	FEMALE	20786	Flame	Accidental	15-20	SSD	38	32	1.5	1.3	78	52	82	44	92	79	PRESENT	BAD	20 DAYS
51	ANTONY	32	MALE	21456	Flame	Accidental	25-30	PI+SSD	40	34	1.4	1.1	64	34	70	38	86	78	MINIMAL	GOOD	25 DAYS
52	MAHESWARI	30	FEMALE	22345	Flame	Accidental	20-25	SSD	38	32	1.3	1	50	32	54	30	86	72	PRESENT	BAD	20 DAYS
53	VANITHA	25	FEMALE	22678	Flame	Accidental	15-20	PI+SSD	24	20	1.1	0.9	40	32	46	34	92	68	MINIMAL	GOOD	15DAYS
54	KRISHNAVEL	44	MALE	22986	Flame	Accidental	10-15	PI+SSD	26	22	1.1	0.8	42	36	48	36	76	70	MINIMAL	GOOD	10DAYS
55	SOUNDARYA	27	FEMALE	23450	Scald	Accidental	5	SSD	18	16	1	0.9	36	30	34	28	88	82	MINIMAL	GOOD	7DAYS
56	SUNITHA	34	FEMALE	23765	Flame	Accidental	15-20	SSD	32	28	1.2	0.9	42	36	44	30	89	76	PRESENT	BAD	15DAYS
57	NANDHINI	29	FEMALE	23985	Flame	Accidental	20-25	PI+SSD	30	26	1.3	1.1	60	44	76	38	78	72	MINIMAL	GOOD	20 DAYS

58	SWETHA	19	FEMALE	24561	Scald	Accidental	10-15	PI+SSD	30	24	1.3	1.1	38	34	44	36	88	76	MINIMAL	GOOD	15DAYS
59	KUPPURAJ	36	MALE	24786	Flame	Accidental	15-20	SSD	32	28	1.4	1.3	56	44	58	39	98	89	PRESENT	BAD	20 DAYS
60	NARASIMAN	44	MALE	25664	Flame	Suicidal	30-35	SSD	59	46	1.8	1.6	68	50	76	48	144	108	PRESENT	BAD	30DAYS
61	SURESH	34	MALE	25889	Flame	Accidental	25-30	PI+SSD	40	32	1.6	1.1	56	39	58	34	88	79	MINIMAL	GOOD	25 DAYS
62	VIMALA	55	FEMALE	25991	Scald	Accidental	15-20	SSD	36	30	1.4	1.2	56	42	62	40	102	98	PRESENT	BAD	20 DAYS
63	TAMILARASI	42	FEMALE	26129	Flame	Accidental	10-15	PI+SSD	26	18	1.1	0.8	38	32	40	36	64	60	MINIMAL	GOOD	15DAYS
64	STEPHEN	22	MALE	26347	Flame	Accidental	15-20	SSD	32	30	1.4	1.3	54	42	58	44	86	70	PRESENT	BAD	15DAYS
65	RAKKAMMAL	45	FEMALE	26745	Flame	Accidental	5-10	SSD	26	20	1.1	0.6	32	30	39	35	80	74	MINIMAL	GOOD	10DAYS
66	KUMARI	34	FEMALE	27809	Flame	Accidental	10-15	PI+SSD	30	27	1.2	0.9	42	38	44	36	92	76	MINIMAL	GOOD	10DAYS
67	USHA	32	FEMALE	29780	Flame	Accidental	5-10	PI+SSD	27	21	1.1	0.8	48	36	44	32	78	64	MINIMAL	GOOD	10DAYS
68	RANI	44	FEMALE	29965	Scald	Accidental	25-30	SSD	36	32	1.4	1.2	63	45	76	50	124	88	PRESENT	BAD	25 DAYS
69	MAYANDI	56	MALE	30176	Flame	Accidental	10-15	PI+SSD	30	22	1.1	0.9	42	34	48	30	98	88	PRESENT	GOOD	15DAYS
70	MAHENDRAN	45	MALE	30235	Flame	Accidental	30-35	SSD	50	42	1.5	1.3	76	55	73	57	115	102	PRESENT	BAD	30DAYS
71	SANTHOSH	34	MALE	30435	Flame	Accidental	20-25	SSD	42	38	1.1	1	46	39	52	37	88	76	PRESENT	BAD	25 DAYS
72	MANJULA	36	FEMALE	30678	Flame	Suicidal	30-35	PI+SSD	54	39	1.8	1.2	66	39	72	42	112	98	MINIMAL	GOOD	30DAYS
73	ARUL	28	MALE	30876	Flame	Accidental	15-20	SSD	44	36	1.3	0.9	56	38	49	32	87	76	MINIMAL	GOOD	20 DAYS
74	RAJA	44	MALE	30987	Flame	Accidental	10-15	PI+SSD	28	22	1.2	1	44	34	46	32	89	67	MINIMAL	GOOD	21DAYS
75	SEKAR	38	MALE	31654	Scald	Accidental	30-35	SSD	56	48	1.7	15	66	50	72	56	143	122	PRESENT	BAD	30DAYS
76	KALPANA	32	FEMALE	31768	Flame	Suicidal	25-30	PI+SSD	42	35	1.4	1.1	54	38	60	42	102	98	MINIMAL	GOOD	25 DAYS
77	ARUMUGAM	65	MALE	31782	Flame	Accidental	30-35	SSD	56	36	1.6	1.3	58	36	56	40	110	96	PRESENT	BAD	30 DAYS
78	Bhuvaneshwari	42	FEMALE	31899	Flame	Accidental	20-25	PI+SSD	52	30	1.7	1.2	50	34	60	38	90	94	MINIMAL	GOOD	21 DAYS
79	FATHIMA	47	FEMALE	31987	Flame	Suicidal	35-38	PI+SSD	59	42	1.6	1.1	62	32	64	30	106	96	MINIMAL	GOOD	25 DAYS
80	MANIYAMMAL	50	FEMALE	32012	Flame	Accidental	20-25	SSD	40	36	1.4	1.3	56	38	62	32	114	92	MINIMAL	GOOD	21DAYS
81	JAYASELVI	36	FEMALE	32567	Flame	Suicidal	30-35	PI+SSD	56	43	1.7	1.4	65	42	69	46	113	98	MINIMAL	GOOD	30DAYS
82	VINAYAGAM	32	MALE	33127	Flame	Accidental	20-25	SSD	44	36	1.5	1.2	54	38	60	40	98	77	PRESENT	BAD	25 DAYS
83	SELVAM	40	MALE	33675	Flame	Accidental	15-20	SSD	40	30	1.2	0.9	56	38	60	36	88	67	MINIMAL	GOOD	20 DAYS
84	RADHIKA	30	FEMALE	33870	Flame	Suicidal	35-38	PI+SSD	56	46	1.8	1.4	86	45	90	46	142	112	MINIMAL	GOOD	21DAYS
85	MAYILATHAL	46	FEMALE	34256	Flame	Accidental	10-15	SSD	33	21	1.3	1	58	37	59	36	87	67	MINIMAL	GOOD	15DAYS
86	NAVEEN	25	MALE	34890	Scald	Accidental	5-10	SSD	22	17	1.1	0.8	36	30	37	34	77	65	MINIMAL	GOOD	10DAYS
87	GEETHA	29	FEMALE	35127	Flame	Suicidal	25-30	PI+SSD	44	31	1.5	1.2	56	34	60	37	98	76	MINIMAL	GOOD	20 DAYS
88	ANGAMMA	46	FEMALE	35654	Flame	Accidental	15-20	SSD	37	32	1.3	1.1	47	37	54	39	104	88	PRESENT	BAD	15DAYS
89	MARATHAL	52	FEMALE	35976	Flame	Accidental	15-20	PI+SSD	40	35	1.2	1	56	39	53	37	76	59	MINIMAL	GOOD	20 DAYS

90	BADHRAN	42	MALE	40016	Flame	Accidental	10-15	SSD	36	29	1.2	0.7	46	33	53	42	85	76	MINIMAL	GOOD	15DAYS
91	ARUMUGAM	44	MALE	41523	Scald	Accidental	15-20	PI+SSD	32	25	1.1	1	52	42	59	36	95	86	MINIMAL	GOOD	20DAYS
92	CHITRA	35	FEMALE	45289	Flame	Suicidal	20-25	PI+SSD	35	30	1.5	1.2	72	46	69	39	102	78	MINIMAL	GOOD	20DAYS
93	JAYAKODI	45	FEMALE	46587	Flame	Suicidal	5-10	SSD	22	20	1	0.9	39	35	42	38	88	76	MINIMAL	GOOD	10DAYS
94	SEENIVASAN	47	MALE	49856	flame	Accidental	30-35	PI+SSD	44	36	1.6	1.1	75	48	78	52	114	89	PRESENT	BAD	30DAYS
95	RAJAGOPAL	48	MALE	50147	scald	Accidental	25-30	SSD	40	36	1.4	1.2	56	40	64	39	102	88	PRESENT	BAD	20DAYS
96	PANDIAN	45	MALE	52458	Flame	Suicidal	35-38	SSD	52	44	1.8	1.6	78	58	82	48	119	101	PRESENT	BAD	30DAYS
97	RAMAYEE	52	FEMALE	52965	Scald	suicidal	10-15	PI+SSD	24	19	1	0.9	42	39	45	38	78	75	MINIMAL	GOOD	10DAYS
98	ANNAMALAI	36	MALE	53698	Flame	Accidental	15-20	SSD	32	29	1.1	0.8	39	35	42	33	85	82	MINIMAL	GOOD	15DAYS
99	MURUGAYEE	41	FEMALE	55748	Scald	Suicidal	20-25	SSD	44	36	1.5	1.3	56	46	69	56	112	97	PRESENT	BAD	25DAYS
100	DANDAPANI	40	MALE	55965	Flame	Accidental	30-35	PI+SSD	46	32	1.6	1.2	65	52	69	49	108	89	MINIMAL	GOOD	30DAYS

PI : Povidone Iodine

SSD : Silver Sulfa diazine