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Original Research Article

Complications and Mortality Patterns in Burn Patients: A Study of Open and Closed Dressings in General Ward and Burn Unit

Raman Ohary[1], Anil Kushwanshi[2], Shaily Sengar[3]

[1]Associate Professor, Department of Surgery, SRVS Medical College, Shivpuri, M.P
[2]Assistant Professor, Department of Surgery, SRVS Medical College, Shivpuri, M.P.
[3]Assistant Professor, Department of Obstetrics & Gynaecology, SRVS Medical College, Shivpuri, M.P.

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Corresponding author: Dr Shaily Sengar
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Abstract

Background: Burns caused by various sources such as friction, cold, heat, radiation, chemical, or electric sources. However, the majority of burn injuries are caused by heat from hot liquids, solids, or fire. Burn injuries are significant injuries that can result in substantial morbidity and mortality.
Objective: The aim of this study was to investigate the complications and mortality patterns of burn patients with respect to open and closed dressing methods in a general ward or burn unit.
Method: The study was conducted on 764 patients who were admitted to the surgical ward and burn unit of the Department of General Surgery. General and systemic examinations were performed to identify any associated problems. Patients were then categorized into four groups based on the percentage and depth of burn, the body surface involved, and the age of the patient for systemic therapy and local dressing. Selection of patients was done for open or closed dressing. Resuscitation of the patient was done, and the burn wound was treated using open or closed dressing based on specific criteria. Dressing was changed every 3rd or 4th day, and the wound was examined, debrided, and managed accordingly.
Results: The study found that 32.72% of patients had tachycardia, 30.49% had hypotension, and a significant number of patients (17.14%) had cold extremities. Mortality was higher in females than males, with an overall mortality rate of 34.81%. Mortality was higher in the 15-30 years age group (40.80%). Pain persisted for a longer duration (10 days) in patients treated with the exposure method, while it was shorter (8 days) in the group treated with closed dressing. More cases of epithelization (10%) were found in open dressing compared to closed dressing (8.38%). Majority of patients recovered, but a significant number of cases (19.39%) died.
Conclusion: In conclusion, the study found that the open method was superior to the closed dressing method, especially in patients with less extensive burns of extremities. The open method had less pus discharge, less problem of foul odours, early epithelisation, and shorter hospital stay.
Keywords: Burn patterns, Complications, Open and closed dressing.

Introduction

Ever since the evolution of human beings, fire has been an essential part of their daily lives [1]. It is used to prepare meals and to provide warmth, but with this advantage

comes the inevitable risk of burn injuries [2]. With the introduction of gasoline, automobiles, air travel, and bombs in warfare, the threat of burn injuries has increased to a great extent [3]. The use of nuclear weapons has further expanded this threat to a formidable extent.

Burn injuries are significant injuries that can result in substantial morbidity and mortality [2]. They can be caused by various sources such as friction, cold, heat, radiation, chemical, or electric sources. However, the majority of burn injuries are caused by heat from hot liquids, solids, or fire [2]. In the United States, more than 500,000 people seek medical treatment for burn injuries annually, resulting in 40,000 hospitalizations and 4,000 deaths [4]. The annual cost of treating these burns is estimated to be over U.S. $1 billion, not including the indirect costs of disability and rehabilitation [5].

Burn injuries can have devastating consequences that can cause long-term morbidity. The best way to minimize complications is to manage burns in a dedicated burns center with immediate full multidisciplinary involvement [2, 6]. Complications following burn injuries can be early (acute) or long-term (chronic), and they can be either local or systemic [4].

Local complications include burn wound infections, while systemic complications arise as a result of the large inflammatory response produced by the body in response to the burn injury [4]. Following a burn, there is an enormous production of reactive oxygen species (ROS) which is harmful and implicated in inflammation, systemic inflammatory response syndrome, immunosuppression, infection, and sepsis, tissue damage, and multiple organ failure. Systemic effects typically manifest in patients with burns of >25% total body surface area (TBSA), or smaller proportions in children [7].

Systemic complications include burn shock, respiratory complications, orthopedic complications, soft tissue injury, joint contracture, compartment syndrome, skin complications, and multisystem organ dysfunction [4].

Material & Methodology

Study design: Observational study.

Study location: Surgical ward and burn unit, Department of General Surgery, associated with tertiary care teaching hospital

Sampling method: Convenient sampling method

Sample size: The sample size was carried out in 764 patients admitted patients

Inclusion criteria: The study includes patients of burns who were admitted through surgical OPD or casualty Department.

Exclusion criteria: Patients who were discharge or expired within 7 days were excluded under study.

Methodology Upon admission, a preliminary inquiry was conducted to obtain the patient's demographic information such as name, age, sex, religion, occupation, residence cause, and mode of burn injury. General and systemic examinations were performed to identify any associated problems. The extent of the burn was determined using the Lund and Browders chart to calculate the total body surface area affected [8]. The depth of the burn was estimated clinically as superficial or deep. Routine investigations were conducted such as hemoglobin percentage, total leukocyte count, differential leukocyte count, urine analysis, blood sugar, blood urea, and other tests as per indication.

The patients were then categorized into four groups based on the percentage and depth of burn, the body surface involved, and the age of the patient for systemic therapy and local dressing. Selection of patients was done for open or closed dressing. Resuscitation of the

patient was done, and the burn wound was treated using open or closed dressing based on specific criteria. Dressing was changed every 3rd or 4th day, and the wound was examined, debrided, and managed accordingly.

The state of the wound was observed and compared every 3rd day, and pain, eschar removal, pus discharge, granulation-tissue development, and epithelization of the wound were recorded. Complications, if present, were managed accordingly. Patients were discharged when they recovered from the primary shock. Patients with superficial burns involving ≤ 10% of the extremities or face without eye or ear involvement were discharged with continued oral antibiotics, tetanus prophylaxis, and dressing at their residence with advice for follow-up in surgery OPD.

Other patients were discharged on request or if they had facilities for dressing at nearby medical centers or were referred to other centers where primary skin grafting or surgical correction of developing deformities was possible. Patients were encouraged to undergo physiotherapy at their residence and advised for follow-up in OPD.

Results

Table 1: Distribution in relation to the development of parameters of Shock after Burn

Parameter of Shock	Total No. of Patient	(%)
Tachycardia	250	32.72
Hypotension	233	30.49
Cold Extremities	131	17.14
Pulse not Palpable	80	10.47
B.P not recordable	70	9.16
Total	764	100

Table 2: Distribution of Cases According to Mortality in relation to Sex

Sex	Total No. Cases	No. of Death	(%)
Female	480	214	28.01
Male	284	52	6.80
	764	266	34.81

Table 3: Distribution of cases According to Mortality in Relation to Age of Patients

Age	Total no of Cases		Total No. of Death		(%)
	Male	Female	Male	Female	
0-14	85	108	21	36	29.53
15-30	120	267	20	138	40.82
31-45	61	81	7	28	24.64
46-60	16	20	1	10	30.55
>60	02	04	3	2	83.3
	284	480	52	214	

Table 4: Distribution of cases based on the Persistence of Pain after burns in Open and Closed Dressing Method (n=464)

No. of Days pain persisted	Total Cases	Open Dressing		Closed Dressing	
		n	%	n	%
0-3	160	51	22.86	121	50.0
4-6	190	95	42.60	91	37.75
7-9	98	64	28.69	26	10.78
10-12	16	13	5.82	03	1.24
13-15	00	0	00.0	00	0.0
Total	464	223	100	241	100

Table 5: Distribution of cases according to condition of wound on discharge on aspect of open and closed dressing

Condition of wound	Open Dressing		Closed Dressing		Total	%
	n	(%)	n	(%)		
Healed	84	27.09	74	23.87	158	58.96
Healthy granulation	44	14.19	51	16.45	95	30.64
Epithelization	31	10.0	26	4.38	57	18.38
Total	159	51.29	151	48.70	310	100.0

Table 6: Distribution of cases according to development of complication in aspect of open and closed dressing

Complication	Open Dressing		Closed Dressing		Total	%
	n	(%)	n	(%)		
Contracture	32	20.77	26	16.88	58	37.66
Hyper-granulation	25	16.23	21	13.63	46	29.87
Infection	17	11.03	13	8.44	30	19.48
Bed sore	10	6.49	8	5.19	18	11.68
Gangrene	1	0.64	1	0.64	2	1.29
Total	85	55.19	69	44.80	154	100.0

Table 7: Distribution on basis of Outcome of patients under study (n = 464)

Outcome	No. of Cases	(%)
Recovered	310	66.81
Expired	90	19.39
DOR	38	8.18

The data in Table 1 indicates that 32.72% of the 764 patients had tachycardia, 30.49% had hypotension, and 17.14% presented with cold extremities at the time of admission. Table 2 shows that a significantly higher mortality rate was observed among females (80.45%) compared to males, with an overall mortality rate of 34.81%. Moreover, the age group of 15-30 years had the highest mortality rate (40.80%) followed by patients over 60 years old (with only six patients admitted). Table 3 reveals that the majority of patients in both groups experienced pain, mainly during the first three days. However, some patients did not report pain while under the influence of analgesics and sedatives.

Table 4 indicates that exposure treatment resulted in pain persisting for 10 days, while closed dressing resulted in pain for eight days. Table 5 shows that open dressing

resulted in more cases of epithelialization (10%) compared to closed dressing (8.38%), and healthy granulation tissue was found in 14.19% and 16.45% of cases, respectively. Table 6 reveals that open dressing led to a higher percentage of epithelialization (55.9%) and hyper-granulation tissue (16.23%) compared to closed dressing (44.80% and 13.63%, respectively). Finally, Table 7 shows that the majority of patients recovered, but 19.39% of cases resulted in death.

Discussion

Burn injuries are traumatic wounds caused by thermal energy or chemical substances that damage the protective covering of the body and the underlying tissues [2]. These injuries are complex and multifaceted, affecting almost all functions of the body depending on the extent of the injury [2]. The severity of the wound ranges from microscopic cellular destruction in first-degree burns to complete coagulation of all skin layers [9].

Burn injuries are catastrophic, causing physical pain and psychological distress to patients, and financial and emotional strain to their families [10]. They are often compared to a parasite that absorbs and releases vital elements such as water, protein, and electrolytes, leading to everlasting disabilities and disfigurement.

Severe shock is a common medical emergency resulting from burns, especially when a larger area of the skin is affected. This shock can lead to death due to several factors, including toxemia caused by the absorption of toxins from the burned surface, loss of function of the absent skin covering, and exhaustion due to the prolonged fight for recovery [11].

Our study found a significant number of burn patients with tachycardia and hypotension upon admission, with some also experiencing cold extremities and unrecordable blood pressure or palpable pulse.

Direct thermal injury causes marked changes in the microcirculation, mainly at the burn site. These changes include increased vascular permeability and microvascular hydrostatic pressure, disrupting the normal capillary barriers separating intravascular and interstitial compartments and leading to rapid equilibrium between these compartments [12]. Burn injuries also cause hypovolemia, with a severe depletion of plasma volume and a marked increase in extracellular fluid. At the cellular level, burn injuries result in the sequestration of enormous amounts of fluid, leading to hypovolemia of burn shock [13].

Studies have shown that edema fluid in the burn wound is isotonic with respect to plasma and contains protein in the same proportion as that found in blood. The post-burn period is characterized by rapid edema formation due to dilatation of resistance vessels, increased extravascular osmotic activity due to thermal injury products, and increased microvascular permeability to macromolecules. Burn injuries are life-threatening, imperilling life at the moment of injury and during the rapidly occurring and overlapping periods of shock, toxemia, and infection.

Table 8: The following reports are of various workers.

Name	Year	Place	Mortality %
Hockmouth [14]	1963	Toronto	31.4
Modi [15]	1971	Rewa	32.1
Bajpai [16]	1982	Rewa	29.3
Jha [17]	1972	Rewa	37.0

Sudhir Kumar [18]	2000	Rewa	24.64
Raja Tiwari [19]	2007	Rewa	36.02
Present Study			34.81

In this investigation, it was observed a mortality rate of 36.02% in cases of thermal injury, which is consistent with previous studies by Hockmouth (1963) [14], Modi (1971) [15], and Jha (1972) [17] from the same region, reporting death rates ranging from 31.4% to 37%. Patients with over 40% total body surface area burnt had a higher risk of mortality, with most of them dying within three weeks after the injury. However, only one patient with more than 40% burn survived up to seven weeks due to careful initial resuscitation and the absence of deep burns, but ultimately died. The primary cause of morbidity and mortality after thermal injury remained to be burn wound infection, which can be prevented by prompt wound closure and protection from bacterial contamination [20].

We evaluated 464 patients with burn injuries in this study and found that 171 (36.88%) developed complications during their hospital stay. Contracture was the most common complication observed in 65 patients, affecting mainly the neck and axillary regions. Hyperactive granulation was observed in 95 burn patients, while severe infections and septicemia were seen in 33 patients with deep burns or poor general condition. Two patients who had electric burns developed gangrene in their fingers and hand, and 20 patients who had longer hospital stays and were physically inactive developed bedsore.

Out of the 464 patients, 310 (66.81%) recovered from their burn injuries. At the time of discharge, 158 patients' burn wounds were healed, while healthy granulation tissue was seen in 95 patients. Epithelialization was observed in the burn wounds of 57 cases. The recovery of burn patients depended on various factors, such as age, sex, cause and mode of injury, percentage and depth of burn, and the affected body part. The duration between burn injury and hospitalization was also found to influence the recovery period. Proper first aid received at home, health center or PHC with or without fluid and antibiotic therapy was also seen to influence wound healing. Patients' faith in the treating team, as well as the moral, economic, and physical support from their families, were additional factors affecting wound healing during the course of treatment [21].

Conclusion

The study revealed an overall mortality rate of 34.81% among burn patients, with the highest mortality rate observed in the age group of 15 to 30 years (40.82%). Females had a significantly higher mortality rate (80.45%) than males. Patients with more than 60% of burnt body surface area had a mortality rate of almost 100%. The closed dressing method was found to provide earlier pain relief (within 6 days) compared to the open dressing method, which resulted in more pronounced pain, with the potential to persist for up to 9 days. The open dressing method was superior to the closed method, particularly in patients with less extensive burns of the extremities, especially in children who cannot be easily controlled in cradles, as well as superficial to deep burns involving the front, back, and chest. Facial burns were treated with the exposure method to facilitate the care of eyes, ears, and nose. The open method had fewer problems with pus discharge, foul odors, early epithelialization, and shorter hospital stays. The simplicity of care and lack of need for frequent dressing changes, especially in extensive burns, was an advantage. The open

method was also found to be suitable for mass casualties, where limited manpower is a concern. The closed dressing method prevented cross-contamination, the need for temperature regulation and isolation, decreased pain and suffering for the patient, and was quite comfortable. It also decreased heat loss, wound desiccation, and had a self-debriding effect, making it useful in a setup. Physiotherapy was observed to be more effective in the exposure method, and involving attendants in caring for patients helped to develop a sense of responsibility, moral support, and promote self-mobilization, cleaning, and performing routine work earlier.

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