

Cost of Acute Burn Care in Tertiary Burn Care Center

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ABSTRACT

Introduction

Burn injuries are global health problem with majority of the occurring in middle and low-income countries, having major financial impact on the burn victim, their families and society. Treatment of burns is known to be resource intensive. Studies related to cost of burn treatment in developing countries are few.

Objective

To find mean cost of inpatient acute burn care in a tertiary Hospital.

Methodology

A prospective cross-sectional study was conducted after obtaining approval from the Institutional Review Committee. The study was carried out over six months, from July 1 to December 31, 2018, in the Department of Plastic Surgery at Kiritpur Hospital, Kathmandu, Nepal. A total of 42 patients admitted with burn injuries fitting the inclusion criteria were included in this study after obtaining informed consent from the participants' parents or guardians. Demographic data and the history of injury were collected from the participants' guardians, while data related to expenses were gathered from participants' financial sheets. Data were categorized and computed for frequency, mean, and standard deviation. Effect modifiers like age, gender, cause, extent, depth of burn, and wound bacteriology were stratified, and the association with mean cost was calculated using the T-test.

Result

Of the 42 participants in the study, the mean cost per patient was Rs. 132,504.67 (USD 1,174.04). The mean cost per percent of TBSA was Rs. 11,840 (USD 104.40), the cost per day per patient was Rs. 7,009.13 (USD 61.80), and the cost per percent of TBSA per day was Rs. 609.66 (USD 5.38).

Conclusion

The mean cost of medication and equipment was the most expensive component of inpatient acute burn care.

Keyword: - healthcare costs, cost of burn care, burn care, cost analysis, health economics

1. Introduction

Burn injury is a global public health problem, causing an estimated 180,000 deaths a year, with the majority occurring in low and middle income countries.[1] Burns are the second most common injury in rural Nepal, accounting for 5% of disabilities. Nepal is one of the world's least developed countries.[2] The country has limited staff trained in burn care and lacks burn specialist facilities in both urban and rural areas.[3] Published literature on the epidemiology of burns in Nepal is also also limited.[4,5] Treatment of burn is expensive and resource intensive.[6] Management of major burns involves hospital admission, medications, and surgical procedures, which have financial implications. Different studies have shown the financial cost of burn care is deemed to be expensive.

With 25.2% of the population below poverty line, it is important to provide a perspective on the financial aspect to the patient and hospital management.[7]

The rationale of this study is to find out the total expenditure of burn care and the main factors contributing to the cost. The importance of this study is to identify all these.

2. Material and Methods

This cross sectional study was conducted in Department of Burns, Plastic and Reconstructive Surgery, Kathmandu Model Hospital, Phect, Kathmandu, Nepal over six months from 1st July to 31st December 2018 after approval from Institutional Review Committee of the hospital. The sample size of 42 was calculated using the formula : Sample size = $N = 4Z_{\alpha}^2 S^2 / W^2 = 42$ with values taken from Ahachi et al, with confidence level(CL) of 95%, Desired total width of confidence interval (W) of Rs 15000 and standard deviation(S) of Rs 24767.[8] One Nigerian naira was equal to 0.32 Nepalese rupee at the time of sample calculation.

All patients irrespective of age, gender or type of burn, admitted to the hospital for treatment within three days of burn, >15% Total Body Surface Area (TBSA) burn in adults according to Wallace rule on nines, >10 % TBSA burn in child according to Lund and Browder chart, and electrical burn admitted for more than 24 hours were included in the study. Patients with concomitant trauma needing hospitalization in other departments and patients who died during the period of treatment were excluded from the study.

Informed consent was obtained from the patients who fulfilled the inclusion criteria. In patients who were unable to consent, consent was taken from the patient's family member or caretaker. All expenses, including medications, procedures, ward charges, and laboratory charges, were available in the hospital expense chart. Data were collected from the expense chart records from the patient's file. The charges listed on the expense file were used for estimating the financial cost. Medications included antibiotics, intravenous fluids, analgesics, dressing materials, nutritional supplements, sutures, surgical knives, surgical blades, and supplementary medications. Surgical procedures included the number and cost of surgeries, dressing changes under anesthesia, bed occupancy, consultation and bedside procedure charges, ECG, oxygen, glucometer, and physiotherapy. Dressing changes without anesthesia included the number and cost of dressing changes in the wards without anesthesia. Laboratory charges included investigations sent during the stay. All data were entered in Nepalese Rupees and converted to U.S. Dollars at the rate of 1 USD = Rs. 113.80 at the time of the study. All data were entered and analyzed in SPSS (Version 20 for Windows, Chicago, IL, USA). Effect modifiers like age, gender, cause of burn, extent of burn, depth of burn, and wound bacteriology were dealt with through stratification. Post-stratification T-tests were applied, and $p < 0.05$ was considered significant.

3. Results

There were 42 patients during the study period. The mean age of patients was 19.6 years, with a range of 1 to 57 years. Most of the patients were younger than 30 years. The largest portion (n=17, 40.5%) belonged to the 15-29 years age group, followed closely by the 0-14 years age group with 16 (38.1%) participants. Participants above 30 years constituted 21.4% as shown in Figure 1. Treating the 15 to 29 years age group was the most expensive, with a mean cost of Rs. 166,683.35 (USD 1476.87), while the comparison of costs between various age groups was not statistically significant, as shown in Table 1.

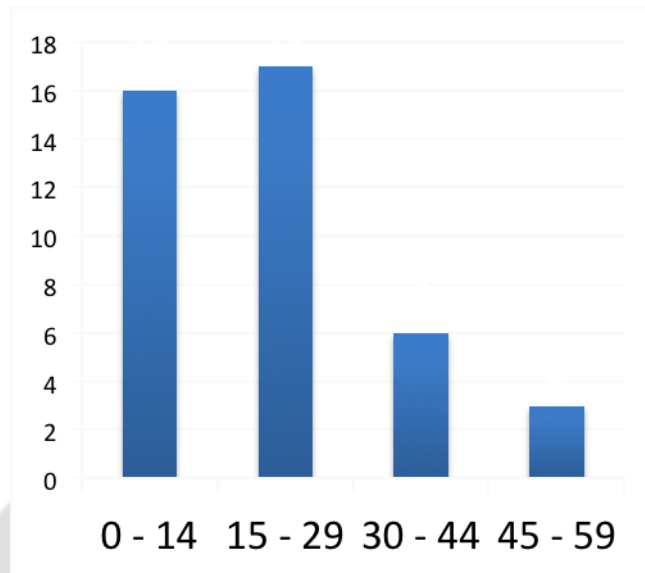


Figure 1. Distribution of participants in age groups

Age group	N	Mean cost Rs. (USD)	SD Rs. (USD)	P value
0-14	16	101,896.25 (902.84)	89,262.91 (790.90)	.519
15-29	17	166,683.35 (1476.87)	185,746.60 (1645.78)	
30-44	6	104,287 (924.02)	53,682.23 (475.64)	
45-59	3	158505.00 (1404.41)	17654.35 (156.42)	

Table 1. Association between age and mean cost

Among the participants, 25 (59.5%) were male and 17 (40.5%) were female. 25 were unmarried (59.5%) and 17 were married (40.5%). While treating male patients was more expensive than treating female patients, it was not statistically significant, as shown in Table 2.

Category	Gender	Mean Rs. (USD)	SD Rs. (USD)	P value
Total inpatient cost	Male	145064.12 (1285.32)	165083.53 (1462.70)	.123
	Female	114034.88 (1010.39)	63589.02 (563.42)	

Table 2: Association between gender and mean cost

Flame burns and electrical burns were the most common causes of burns, with 14 participants (33%) each, followed by scald burns in 13 participants (31%) and chemical burns in one participant (2.4%). Treatment of electrical burns was the most expensive, with a mean cost of Rs. 192,570.50 (USD 1706.24), followed by scald burns, then flame burns. The association of mean cost of treatment and cause of burn was not statistically significant, as shown in Table 3.

Category	Cause	Mean Rs.(USD)	SD Rs.(USD)	P value
Total inpatient cost	Flame Burn	79388.07 (730.41)	42192.72 (373.84)	.119
	Scald Burn	117404.85 (1040.25)	94572.72 (837.00)	
	Electric Burn	192570.50 (1706.24)	195183.14 (173.51)	

Table 3: Association of mean cost and cause of burn.

Home was most common site of burn injury involving 30 participants (71.4%), followed by work related in 11 participants (26.2%) and one participant got injured in open field (2.4%), Mean TBSA burn of participant was 16.26% (SD 8.96) with range of 2% to 45%. Treating burn involving 40-49% Total body surface area was most expensive, however association between extend of burn and mean cost was not statistically significant as shown in table 4.

Category	Extend of burn	Mean Rs. (USD)	SD Rs.(USD)	P value
Total inpatient cost	0-9%TBSA	190229.17 (1685.50)	185156.97 (1640.56)	.593
	10-19 %TBSA	117646.11 (1042.39)	135898.53 (1204.11)	
	20-29 %TBSA	85424.75 (756.89)	40671.79 (360.37)	
	30-39 %BSA	200497.00 (1776.47)	.	
	40-49 %TBSA	195844.67 (1735.25)	29807.20 (264.10)	

Table 4: Association of mean cost and with extend of burn

34 of patient sustained second-degree burn (81%) while 8 participants sustained third degree burn (8%). Treating third degree burn (Rs 266229.38 and USD 2358.89) was statistically more expense to treat than second degree burn (Rs 101040.03 and USD 895.25) as shown in table 5.

Category	Depth of burn	Mean Rs. (USD)	SD Rs. (USD)	P value
Total inpatient cost	Second Degree	101040.03 (895.25)	68113.21 (603.51)	.000
	Third Degree	266229.38 (2358.89)	238651.51 (2114.54)	

Table 5: Association between depth of burn and cost of acute burn care.

Mean length of stay in hospital of participant was 19.5 days (SD 16.48) with range of 3 to 86 days. Forty (95.2%) of all participants underwent operative procedure during the study while two (4.8%) participants underwent dressing changes only. Mean number of surgical procedures was 5.48 with range of 1 to maximum of 24 surgical procedures per patient. Mean number of operative procedure was 2.13 (SD 1.87) per participants in 40 patients who underwent operative procedure and mean number of dressing changes under anesthesia was 3.89 (SD 4.25) per participant in 37 patients (Table 6). There was no significant difference in mean cost between mode of treatment

	Type of Management	N	Mean Rs. (USD)	SD Rs. (USD)	P value
Total cost	Operative	40	137972.38 (1222.48)	134282.72 (1189.79)	.337

	Nonoperative	2	23150.50 (205.12)	12119.10 (107.38)	
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Table 6: Association between operative and nonoperative management

Mean Cost of treatment

The mean total inpatient cost of patients enrolled in the study (n=42) was Rs 1,32,504.76 (USD 1174.04). Cost per percentage of TBSA was Rs 11,840.00 (USD 104.40) and cost per patient per day would cost Rs. 7,009.13 (USD 61.80) (Table 7).

Cost of medication was most expensive with mean Rs. 59,964.52

(USD 531.31) and constituted of 44.73% of total cost, followed by cost of surgical procedure, mean cost of surgery was Rs. 30,083.33 (USD 266.55) and constituted 22.90 % of total cost, mean cost of hospitalization Rs. 28,842.86 (USD 255.56) and constituted of 22.06% of total cost. Mean cost of Laboratory investigation charges was Rs. 7,112.17 (USD 63.02) and constituted of 5.15% of total cost. Mean cost of dressing changes in 40 patient who had undergone without anesthesia was Rs. 4542.13 (USD 40.24) as summarized in Table 8 and figure 2.

Parameters	Cost in Rs. (USD)
Mean	132,504.67 (1174.04)
SD	133,297.90 (1181.07)
Minimum	14,581.00 (129.19)
Maximum	714,981.00 (6334.98)
Cost per percentage of TBSA burn	11,840.00 (104.40)
Cost per day per patient	7,009.13 (61.80)
Cost per percentage of TBSA per day expense	609.66 (5.38)

Table 7: Descriptive statistics of mean inpatient cost (n=42)

Headings	Minimum Rs.(USD)	Maximum Rs. (USD)	Mean Rs. (USD)	SD Rs.(USD)
Total cost of surgery	2100.00 (18.61)	127400.00 (1128.81)	30083.33 (266.55)	25618.49 (226.99)
Total cost of hospitalisation	3070.00 (27.20)	191660.00 (1698.17)	28842.86 (1255.56)	34219.75 (303.20)
Total cost of medications and equipment	5041.00 (44.67)	346702.00 (3071.90)	59964.52 (531.31)	70075.93 (620.90)
Total cost of dressing without anesthesia	300.00 (2.66)	27300.00 (241.89)	4542.13 (40.24)	5302.54 (46.98)
Cost of blood products	785.00 (6.96)	12560.00 (111.29)	2470.25 (21.89)	2428.18 (21.57)
Total laboratory investigation cost	1760.00 (15.59)	21059.00 (186.59)	7112.17 (63.02)	3719.43 (32.96)
Total cost of live donor	24750.00 (219.29)	24750.00 (219.29)	24750.00 (219.29)	.
Total inpatient cost	14581.00 (129.19)	714981.00 (6334.98)	132504.67 (1174.04)	133297.90 (1181.07)

Table 8: Descriptive statistics of inpatient cost and subheadings (n=42)

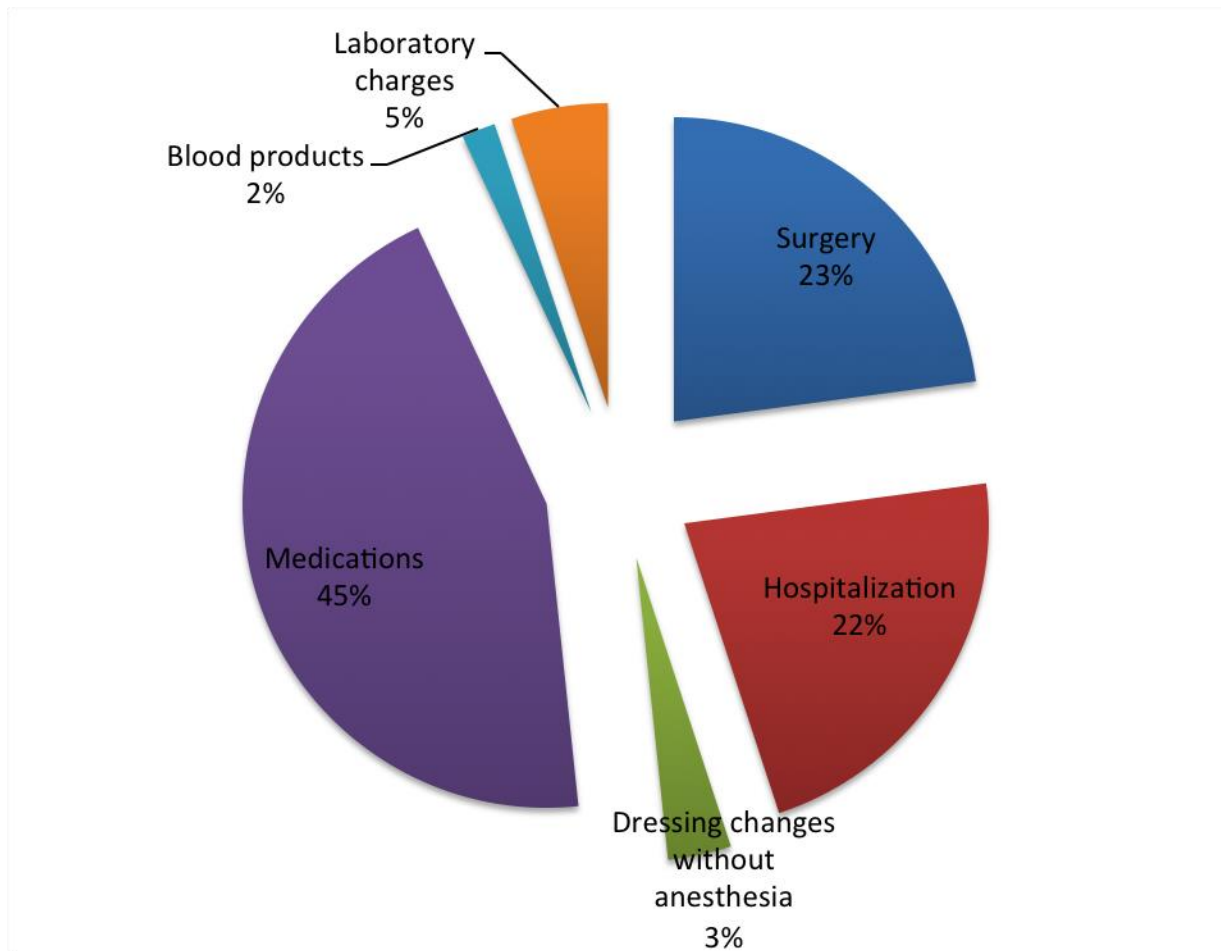


Figure 2: Pie chart demonstrating proportions of inpatient cost in acute burn care

4. Discussion

Management of burn injury in low-income country like Nepal is always challenging due to constraints in infrastructure, financial and technical capabilities. The overall outcome of burn and economic cost of burn in these parts of the world has not been studied extensively and are difficult to compare to that of middle and high-income countries. The cost of acute burn care has been studied here, but interpretation and comparison to other cost studies, mostly in high-income countries, can be difficult where care benefits plentiful resources, generous monitoring and clinical care.

Our study shows that mean age of the participants of the study was 19.60 years and 78.1% of patients below 30 years old. The 15 -29 age group was the most commonly affected, similar to findings from other studies. Males were more affected than female overall. Similarly, Tripathee et al stated that males were more affected in young and adolescent age group, while females were more affected were in adult and older age groups.[5] The mean cost of treatment did not vary significantly according to the patient's age, in contrast to studies done in Netherland and South Africa, where cost increased with age.[2,9,10] Treating male patients was more expensive than female patients, but there was no statistical significant difference between gender groups in total cost, similar to studies done in South Africa and Iran.[11,12] Most participants in the study were unmarried, reflecting the young age group.

The participants had almost equal number of flame, electric and scald burns overall. Scald burns were the most common cause of burns in children, especially in villages due to lack of supervision, playfulness and curiosity. Electric and flame burns equally affected adults, whereas most studies in South Asia state that flame burn is common among the adults while scald burn was common among the children. Electric burn was most common cause of burn in male as most of the injury occurred in work related activity. While flame burn was most common cause in female gender as women are more involved in day to day activity in home like cooking in open fire wearing loose flammable clothes like saree and shawls, which can easily catch fire. The study included any electric burn needing further management and excluded minor flame and scald burn which might have affect the higher proportion of electric burn compared to other studies.[10,13] Treatment of electric burn was the more expensive compared to treating other causes of burn but there was no statistically significant difference between the cause of burn and total inpatient cost, in contrast to other studies where treating flame burn was more expensive. The electric burn which were sustained in work related job where sustained high voltage electric injury, therefore sustained deeper injury and worse infections and needed more number of surgeries, dressing and longer length of hospital stay.[9,11,14] Home is considered a safe place, but incase of burn most of the most occurred at home children and women were more susceptible to scald and flame burn injury at home while adults males were more susceptible to work related electric burn injury which is similar to findings in studies done in our part of the world.[13] Mean TBSA burn area was 16.26% TBSA similar to other studies with range of 2% to 45%, and most of the patients were affected with 10-19% TBSA burn, the study excluded any patients who died during the course of treatment who might have had higher TBSA burn and minor burn are treated in outpatient clinic.[15] In this study there was no significant difference between total cost and extend of burn injury as compared to other studies where the total cost increased as % TBSA increased.[9,11-14] In this study, most of the electric burn which is more expensive and had higher cost related to all aspects total cost were <20% while higher % TBSA had flame and scald burn which less expensive to treat. Most of the patients suffered from flame and scald and had second degree burn because of thermal injury causes damage from out-in immediate attention from pain and protective nature to get away from offending might have while patients with third degree burn resulted from electric and chemical burn because nature of chemical causing burn and susceptibility of deeper tissues to damage from electric injury than the skin surface. Treating third degree burn was more expensive than second degree burn which increases number of surgeries, dressing changes and with it cost of medications, equipment, laboratory and blood products. It shows results which is similar to other studies done in China, Italy and Turkey comparing cost and depth of burn.[16-18] Cost of medication was most expensive component of inpatient burn care consisting of 44.73% of total cost. Similarly, patil et al explained cost of medication was higher in patients burn when compared to non-burn group of patients, while in Canada, Malawi, Nigeria, Turkey, explained most of expenses were on analgesics, sedatives and antibiotics.[15,16,18-20] 95.2% of patients included in the study undergone operative management which was more expensive than patients who were managed non-operatively but there was not statistical difference between the two. Second-degree and deeper burn were treated by excision and graft or flaps when necessary for soft tissue coverage and each patient underwent multiple dressing changes under anesthesia and operative procedure. Cost of surgery was 22.90% similarly to study done by Ter Meulen et al, but more than study by Gallaher et al in Malawi.[11,19] Cost of hospital stay was one of the important component of total cost of inpatient burn care with 22.06% of total cost, with mean length of hospital stay of 19.5 days. Cost of bed occupancy was most important contributing factor for cost of hospital stay. In contrast, to studies done in Malawi, South Africa, Iran and India where the proportion of cost of hospital to that of total cost was higher ranging from 30-70%.[6,12,19] Laboratory and Blood products contributed 5.16% and 1.8% respectively to total cost. In contrast, Ahuja et al stated that investigation charges consisted of 11.56%, Gallaher et al; 9.1%, Patil et al; 31% of total cost.[6,19,21] While Patil et al reported that cost of blood products were higher in burn patients compared to non-burn patients, participants spent USD 21.73 per patient which was higher than studies done in China, Turkey, India.[6,16,18,21] As per this study, mean cost per patient Rs. was 132,504.67 (USD 1174.04), which less expensive than North American, European country except Greece, but one of the most expensive in Asia and more expensive than study on in Africa; Malawi. Cost per day per patient Rs. 7,009.13 (USD 61.80) one of least expensive, study done by Gallaher et al in Malawi was only less expensive at USD 24 per patient per day. Mean cost per percentage TBSA per patient was Rs. 11,840.00 (USD 104.40), which is less expensive than studies done in Australia, Brazil and UK. Cost per percentage TBSA per day was Rs. 609.66 (USD 5.38), which more expensive that studies done in Iran and Malawi, where cost per percent of TBSA per patient per day was USD 2.2 and 2.65 respectively. Only major burns and those who survived were included in the study and all of the supplies, investigations, procedures had to payed which might have contributed to higher cost as Anami et al and koljonen et al stated that mean cost of surviving patient was higher than cost of non surviving patients and Mashreky et al stated in the study that most of cost including hospital services, consultation fee, medicine were provided for free.[6,10-12,14,16,21,22]

4. CONCLUSIONS

Burn is a public health problem in our part of the world with 85 % of the burn injuries occurring in this region. There are large differences in cost of burn care around the world. Population characteristics and different care protocols might have led to such differences. While mean cost here in our center was cheaper than most middle and high-income countries but expensive compared to other low income countries. The most expensive component of the inpatient acute burn care was cost of medication constituting mostly of dressing material and equipment. Treating electric burn injury was more expensive and cost to treatment had significant association with depth of the burn.

5. ACKNOWLEDGEMENT

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BIOGRAPHIES (Not Essential)



Dr. Piyush Giri is a highly skilled Burn, Plastic, and Reconstructive Microsurgeon with extensive experience in treating severe burn injuries, complex wound care, and intricate reconstructive procedures. After earning their medical degree from College of Physicians and Surgeons, Dr. Piyush completed specialized training in plastic and reconstructive surgery, followed by a fellowship in microsurgery. Known for their meticulous surgical technique and compassionate patient care, Dr. Piyush has significantly improved the quality of life for countless patients, restoring both function and aesthetics. They are also an active contributor to medical research and education, committed to advancing the field of reconstructive microsurgery.