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PAEDIATRIC SURGERY

Paediatric ambulant burn care treatment in a tertiary burn unit

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Background: Burn injuries are a global public health crisis and a significant cause of morbidity and mortality in low- to middle-income countries (LMICs). Sub-Saharan Africa carries an extraordinary burden of burn injuries amongst children under 18 years of age. The purpose of this study was to assess burn wound outcomes, and parental health-seeking behaviour of children managed as outpatient burns.
Methods: A retrospective audit was performed of children presenting with burns to the emergency centre at Red Cross War Memorial Children's Hospital during two seasonal periods. Standard demographics, wound management and outcome were reviewed. Adherence to provincial burn referral was also assessed. Descriptive statistics were performed on information gathered using a standardised questionnaire.
Results: One thousand one hundred and ninety-one (1 191) children with burns were attended to in the study period, 57 (5%) were excluded due to incomplete records. There was a relative increase in the number of patients (158, 32%) in winter/spring compared to summer/autumn. Two hundred and eighty-nine (24%) patients did not warrant admission, and this subgroup cohort was the study's focus of enquiry. Most of these, 157 (54%), were male, and the average age was 32.5 (R 2–153) months. The average TBSA was 2.5% (R 1–8%) and scalds predominated, 252 (87%). Many patients (148, 51%) defaulted follow-up appointments due to transport difficulties and financial constraints.
Conclusion: This study demonstrated similar demographics, burn injury patterns and seasonal variability compared to international literature. Referral criteria were strictly adhered to by referral facilities. Fiscal constraints determine the ability to attend follow-up appointments. Telemedicine programmes have been instituted as a solution.
Keywords: burn outcomes, community management of burns, burn referral criteria, burn admission criteria, telemedicine

Introduction

Burn injuries are a global public health problem with sub-Saharan Africa carrying an extraordinary burden of burn injuries among children under 18. A review of community management of paediatric burns in the Western Cape province of South Africa revealed six factors that adversely influenced preadmission management of burns – lack of first aid, inadequate cooling of the wound, not covering the wound early after the burn injury, poor resuscitation, pain management, and delayed transfer for definitive management. This survey concluded that critical burn wound care would be substantially improved if these factors could be addressed.[1]

All previous reviews from this hospital centred mostly on admission and in-hospital management of patients with burn wounds. However, none addressed the outcome of children discharged from the trauma unit after receiving acute wound care as an outpatient. One previous study revealed a 51% discharge rate but gave no further information on subsequent outcomes.[2]

In this continuum of paediatric burn wound management, some questions remained unanswered, namely why so many children (ages 0–12 years) with burns arriving at a tertiary care centre, Red Cross War Memorial Children's Hospital (RCWMCH), are discharged the same day, and what happened to those children once discharged? If these patients received adequate treatment at community-based facilities, it would decentralise burn care and benefit those receiving care closer to their homes.[1]

This study was performed to determine the outcome of children under 12 years of age with burn injuries referred to a children's hospital and discharged after initial care. The study aimed to assess patient demographics, injury mechanisms, and severity of burn injuries and was performed over two seasonal periods to describe this variability and compare it with anecdotal beliefs that exist around the seasonal variability of burn injury incidence. Importantly, the study attempted to determine the factors influencing health-seeking behaviours and assess the outcomes of those discharged from the trauma unit.

Methods

Study Design

A retrospective study assessed two different overlapping seasonal periods; the summer/autumn from January to May 2016 and the winter/spring from June to October 2016. Information was collected from the trauma unit attendance and burn unit registers and the intensive care unit (ICU) database.

Participants

Inclusion criteria – all children who sustained burn injuries managed at the trauma unit at RCWMCH.

Exclusion criteria – all children older than 13 years old and those who had missing or incomplete medical records

Demographics

Data included patient age, sex, burn mechanism, anatomical site and total body surface area (TBSA) involved, and therapy applied before discharge. Other data collected included parental marital status, total monthly income of the family and living abode distance from the hospital. Inpatient burn unit and ICU admission data were collected to obtain a comprehensive overview of burn patient outcomes.

Procedure

In assessing patient outcomes post-discharge, patients were contacted for a voluntary telephonic interview in their home language (English, Afrikaans, Xhosa). A standardised questionnaire of predetermined questions captured critical clinical information to determine whether the parents attended the outpatient clinic, identify barriers experienced when attempting to access care, and the eventual outcome of the child's wound, explicitly asking whether the child required admission to the burns unit for a split skin graft (SSG). During the interview, reasons and circumstances for defaulting follow-up were sought whilst simultaneously interrogating the health-seeking behaviour of caregivers who defaulted on their outpatient appointment when dealing with the non-healing wound.

Data capturing and analysis

Quantitative information from the survey was stored on encrypted deidentified Microsoft Excel spreadsheets. Included in this was the semi-structured interview information on individual encrypted deidentified Microsoft Word documents. Descriptive statistical analysis was performed using t-test assuming equal variance, with 95% confidence intervals.

Results

Participant distribution

One thousand one hundred ninety-one patients with burn injuries were managed in the trauma unit between January to October 2016. Fifty-seven (5%) were excluded from the analysis as the records were incomplete or unavailable, giving a study population of 1 134.

Patient demographics, burn aetiology, burn size, healing time and length of stay are depicted in Table I.

Seasonal variation

According to Western Cape Provincial Referral Guidelines (Table II), of the 1 134 patients with complete records, 1 077 (95%) were appropriately referred to the trauma unit. There was a 32% increase in patient numbers during winter/spring (488 patients in summer/autumn, 646 in winter/spring). There were no statistically significant differences between the two seasonal groups for age ($p = 0.11$), sex ($p = 0.18$), flame burns as a cause ($p = 0.73$) or burn size ($p = 0.75$).

Patient disposal

Fifteen patients (1%) were admitted to the ICU and 830 (70%) to the burn unit (Table I). The rest were discharged from the trauma unit after initial management.

Discharged patients

Two hundred and eighty-nine (24%) patients who were discharged from the trauma unit with a RCWMCH burns outpatient follow-up appointment, of whom 157 (54%) were male, and 132 (46%) were female, with an average age of 32.5 (R 2–153) months. Age categories included – 51 (18%) were under one year of age, 166 (57%) were 1–3 years old, 52 (18%) were 4–5 years old, and 20 (7%) were 6–12 years old. The vast majority, 252 (87%), sustained scalds and had less severe burns than admitted patients (average 3% TBSA for outpatients vs 14.2% TBSA for those admitted). Topical silver-based dressings were commonly used for

Table I: Group composition and demographics

		Trauma discharges		Ward admissions		ICU admissions	
	Total	Jan-May 2016	Jun-Oct 2016	Jan-May 2016	Jun-Oct 2016	Jan-May 2016	Jun-Oct 2016
Number	1134	69M; 48F ($n = 117$)	88M; 84F ($n = 172$)	219M; 143F ($n = 362$)	263M; 205F ($n = 468$)	9M; 0F ($n = 9$)	2M; 4F ($n = 6$)
Age in months (range)		32 (6–144)	33 (2–153)	33 (1–157)	37 (2–160)	33 (1–96)	39 (9–109)
Etiology							
Scalds	792	109 (93.2%)	143 (83%)	254 (70%)	279 (60%)	5 (56%)	2 (33%)
Flame	58	2 (1.7%)	5 (3%)	19 (5%)	26 (5%)	3 (33%)	3 (50%)
Contact	77	6 (5.1%)	23 (13%)	13(4%)	35 (7%)	0	0
Electrical	26	0 (0%)	1 (0.5%)	12 (3%)	12 (3%)	0	1 (17%)
Chemical	3	0	0	3 (1%)	0	0	0
Non-healing	106	0	0	34 (9%)	72 (16%)	0	0
Septic	67	0	0	25 (7%)	42 (8.5%)	0	0
Inhalational	5	0	0	2 (1%)	2 (0.5%)	1 (11%)	0
TBSA % (range)		3.02 (0.5–10)	2.99 (1–16)	8.02 (1–50)	6.66 (1–85)	38.4 (10–70)	26.2 (2–40)
Average Heal time* (days)		13.3 (1–31)	19.0 (3–72)	19.3 (1–34)	22.4 (1–83)	93.3 (49–245)	63 (35–84)
Total length of stay (days)				5.2 (3.9–6.6)	5.1 (4.3–6.2)	32.6 (15–47)	43.8 (20–75)
ICU stay (days)						7.33 (1–28)	4 (1–12)
SSG done (%)		1	5	23	30	85	100

*Heal time is defined as the time from initial burn injury to discharge from the burns unit clinical services.

Table II: RCWMCH burn's unit[1] and PGWC admission and referral

RCWMCH burn unit admission criteria	PGWC referral criteria
Neonates, infants	Age under 2 years
Partial-thickness burns > 10%	Partial-thickness burns > 15 TBSA
Full-thickness burns > 5%	Full-thickness burns > 15 TBSA
Anatomical sites: face, neck, hand, foot, perineum, over major joints, circumferential burns of limbs or chest	Anatomical site: face, hands, genitalia, perineum, major joints, circumferential burns. These burns can also be dealt with at level 1 or 2 but discretion must be used.
Inhalation injury	Inhalation injury requiring ventilation for more than 48 hours
Mechanism of injury: Electric burns Chemical burns Where non-accidental trauma is suspected	Mechanism of injury Exposure to ionising radiation injury High pressure steam injury High tension electrical injury (> 1 000 volts) Hydrofluoric acid injury > 1% TBSA Suspicion of non-accidental burn injury
Concomitant illness Septic burns	Existing comorbidity: Cardiac limitation and/or MI within 5 years Respiratory limitation of exercise Uncontrolled type 1 diabetes Pregnancy Medically or disease induced immune-suppression for any reason Existing psychiatric or suicidal tendencies Suspected drug/alcohol abuse
Associated injuries	Severe associated injuries, e.g. polytrauma and crush syndrome

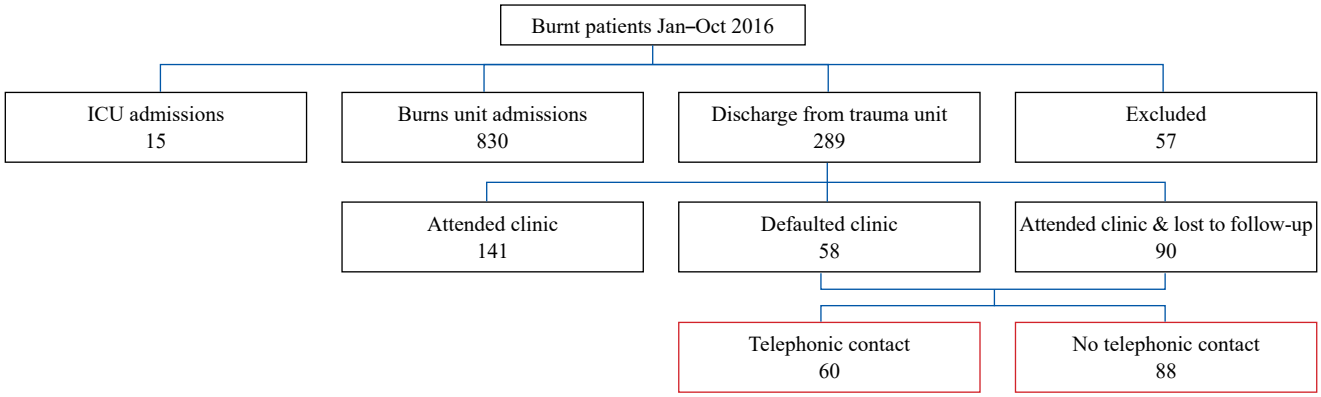

Figure 1:Disposal of patients presenting to RCWMCH trauma unit with burns

those discharged. Other dressings included antiseptic and biological dressings.

Six children were inappropriately discharged from the trauma unit where the protocol was not followed – one low voltage electrical burn and five children with burns exceeding 10% TBSA.

The 289 non-admitted patients were divided into two groups – Group 1: those who attended burns outpatient clinic until completion of wound healing, Group 2: those who attended only once and then defaulted and those who did not attend at all. Group 2 were the main focus of this study. The summary of the patient flow diagram is seen in Figure 1.

Of both groups (n = 289), the average burn size was 2.5% TBSA. The wounds sustained in summer/autumn took an average of 13.3 days to heal, and those sustained in the winter/spring months took 19 days. The upper extremity was the most frequently burnt area, followed by the torso, and the head/neck and lower extremities were affected equally (Figure 2).

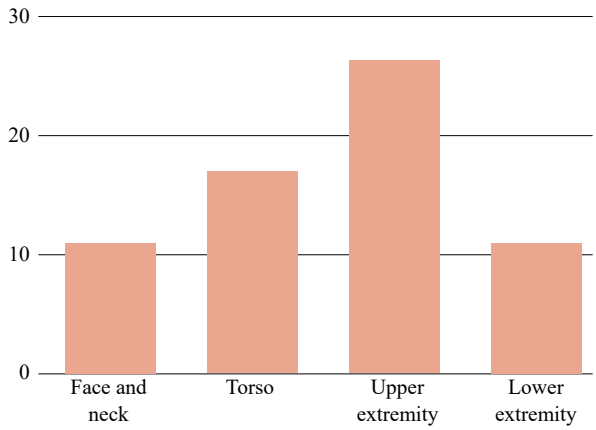

Figure 2: Site of burns in patients referred to community clinics

Discharged attendees

Of the patients in Group 1, 141(49%) attended the outpatient clinic an average of three times (R 1–11) until all wounds were healed. Eleven patients initially discharged from the trauma unit required skin grafting; seven were male, and

Table III: Household income of burn victims (*> ZAR1077/US$69)

Household income (ZAR)		No info	Statistical outliers *n* (%)	Average income (ZAR/≈US$)	Min (ZAR/≈US$)	Max (ZAR/≈US$)	Patients with no income reported	Patients with income above the poverty line*
All trauma discharges (*n* = 289)	Outliers (> ZAR11250/ US$721)	7	20 (7%)	2 429/162	0	11 100/712	95 (34%)	173 (61%)
All trauma defaulters (*n* = 148)	Outliers (> ZAR10832/ US$694)	6	8 (5%)	2 286/147	0	10 000/641	52 (37%)	83 (58%)
Defaulters contacted telephonically (*n* = 60)	Outliers (> ZAR12500/ 801)	1	5 (9%)	2 792/179	0	12 000/769	19 (32%)	27 (46%)

four were female, with an average age of 49.9 (5–146) months. All 11 patients were initially managed with silver-based dressings and no septic burns were reported. The average number of clinic visits was 6.4 (R 3–11), and the average time to wound healing was 39.8 (R 18–72) days – 8 were scalds, 2 heat-contact and 1 flame burn with an average TBSA of 5% (R 1–9%).

Discharged non-attenders

More than half of patients from Group 2, 148 (51%), defaulted their follow-up appointments, either attending once only, 89 (31%) or missing follow-up entirely, 59 (20%). Most (~80%) of these patients originated from catchment areas related to RCWMCH and district hospitals in Cape Town. In comparison, a small proportion originated from regional hospitals in Cape Town (~6%), and a slightly larger proportion (~14%) originated from regional hospitals outside of Cape Town.

Of these 148 patients defaulting follow-up, 60 (41%) were contacted with at least three telephonic calls over one month. Fifty-seven of the sixty contactable patients had healed wounds, one wound was declared septic, and two required SSG. Fifty-six (38%) children received creams and ointments with scar management advice from local clinics, private facilities, and pharmacies. Four parents (3%) used alternative medicine for wound healing. The remaining eighty-eight (59%) patients were unreachable despite multiple telephonic attempts.

Reasons for non-attendance

Two main reasons were identified as contributing to the high number of patients who defaulted on their clinic appointment – transport and financial difficulties. Parents had to travel on average 17.23 km (R 1–144 km) to the nearest health facility. There was a communication breakdown where one parent was not given a follow-up appointment at the outpatient clinic. One parent noted work commitments as the reason for defaulting their appointment whilst another parent had relocated provinces.

One hundred and thirty-three (46%) single mothers were noted in the trauma discharges. Monthly domestic income figures were available for 283 parents. Parents had an average monthly household income of ZAR 2 429. Zero income was reported in 95 (34%) trauma-discharge households (Table III).

Discussion

Local literature on burn care at the regional level hospital showed that 39% of the injuries were minor, 56% were regarded as moderate, and 5% were severe. Just under half of these children were hospitalised.[2] Those admitted to the dedicated burn unit entered a structured treatment programme with an LD50 (lethal dose 50 – burn size in which 50% of patients will die after sustaining a burn of this size) of almost 70% TBSA. The results of in-hospital management have been published in numerous articles.[3-7]

Scalds were the most common mechanism of burn injury. This study found a 32% increase in the number of patients seen in winter/spring than in summer/autumn, highlighting seasonal variability in the number of patients seen in the burn unit at RCWMCH. However, despite this variation in burn injury incidence, there were no statistically significant differences between the two groups regarding age, sex, mechanism of injury, and burn size. The pattern of seasonal variability appears to resemble other sub-Saharan African countries, such as Malawi, which saw approximately 60% increased burn incidence in their cold season.[8] A review from Nigeria indicated that seasonal variation significantly influences the prevalence of burns, with the highest incidence reported during the winter/spring months.[9] This seasonal variation correlates with a study done in Turkey in which the authors noted that burn injuries are observed more frequently during certain seasons and months, most frequently in the months from June to October, because of the habitats of communities, lifestyles, occupations, types of heating, and sociocultural and economic levels.[10]

It was found that 95% of referrals met provincial referral criteria for transfer from the source to the trauma unit, indicating that secondary and primary health centres follow the local health department protocols. These results were similar to previous studies conducted at RCWMCH by Klingberg et al.[11] and Boissin et al.,[12] where it was noted that 94% and 93.4% of patients fulfilled one or more criteria for referral. Klinberg et al.[11] also noted that nearly a third (29%) of the children seen at the trauma unit for burn wounds were treated and discharged the same day.[12] These findings highlight that burn wound care remains centralised in tertiary centres, despite the added cost and resource use. It has been noted that possible reasons for this include insufficient knowledge among primary and secondary level facilities emergency physicians, errors in burn estimation and the lack of resources (dressings and topical solutions) at clinics.[13,14]

Even though most children were referred according to the provincial referral criteria, it was found that a quarter of children with minor burns were discharged from the trauma unit. It was determined that these individual cases while fulfilling the criterion for the referral, such as a burn to the hand or face, could have been treated at primary or secondary healthcare facilities. These findings have led to the re-evaluation of the referral guidelines and the use of an encoded HIPAA (Health Insurance Portability and Accountability Act, which is a US law designed to provide privacy standards to protect patients' medical records and other health information) compliant referral application, explicitly utilising the encrypted WhatsApp's cellular phone-based platform, which puts primary healthcare workers directly in touch with on-call specialists.

Only six children were discharged against protocol stipulations. This clinical error in judgment could be because some junior doctors assessing patients independently in the emergency unit are not fully aware of the admission criteria. This study has improved burn unit protocol distribution, availability on the hospital network via QR codes, and summarised versions available within the trauma unit.

A recent review of the community's primary and secondary-level burn treatment facilities demonstrated that most functioned adequately despite fiscal constraints and a lack of everyday consumables. The review showed that most minor burn injuries could be managed at the primary level, with 75% of patients treated by nurse practitioners.[15] This study, however, presented an unexpected view of ongoing care. Over half of the children discharged from the trauma unit defaulted on follow-up appointments. Lack of transport and financial restrictions were the main reasons for this. Most of the parents were uninsured and relied on state-funded healthcare. Despite low compliance with follow-up, those children that could be followed up demonstrated that wound healing did occur, albeit over some time. Low compliance with follow-up and limited success in contacting parents via telephone are notable limitations of this study. Additional factors contributing to poor follow-up may also impact health-seeking behaviours, but are not demonstratable in this study.

In order to improve and maintain patient contact and quality aftercare, the burn unit at RCWMCH has now instituted a telemedicine programme that improves communication and empowers parents.[16] This programme uses encrypted WhatsApp messenger with community up clinic and secondary hospital doctors and nurses who follow on children post-discharge from the tertiary unit. Detailed dressing information, burn diagrams, and dressings for two weeks are supplied, as is the mobile number of a senior clinician. The visual consultations provided cost-effective advice and eliminated the inconvenience and cost of frequent visits and long journeys without compromising patient care and outcome. Parent-assisted telemedicine care for burns is not isolated to developing countries. A study by Garcia et al.[17] showed that wounds treated at home by parents and reviewed by clinicians via telemedicine healed faster than those in hospital – mean 11.6 (4.7) days vs standard therapy 14.3 (5.4) days (p = 0.03). Furthermore, adherence to completion of therapy was 80% vs 64% with standard clinician face-to-face review.[17] A study by Redlick et al.[18] showed patient satisfaction with teleconsultations; patients noted that this was more economical and time-efficient than in-person visits. A systematic review from Garcia et al.[19] highlighted that telehealth allows better perception of triage, more accurate estimation of the TBSA, and resuscitation measures in the management of acute burns, and the implementation of telehealth should be specifically adapted to each territory. Hayavi-Haghighi et al., however, challenged the use of telemedicine emphasising that the concept faces challenges, such as the impossibility of the physical examination of patients and technological difficulties that are associated with this method of delivering definitive burn care.[20] Hendriks et al.[21] noted that patients who developed contractures reported significantly greater disability and lower quality of life. To reduce the risk of burn scar contractures, timely access to safe burn care must be enhanced in low-income countries. Telemedicine could support healthcare providers by facilitating early identification of burn wounds in difficult areas, allowing for timely referrals to specialised clinics.[21]

In addition, parents, after appropriate education, are empowered to make dressing changes themselves at home. Clinical evaluation of the wound progress is done via telecommunication. This intervention has proven successful in managing wounds to complete healing at home in most patients and appropriate selection, thus limiting hospital attendance of those requiring operative intervention. Parents have expressed satisfaction with this review process regarding the outcome, financial implications, and commuting difficulties.[22] With the new Protection of Personal Information Act (POPIA) in South Africa, our institution has moved to the cell phone-based VULA referral application, which is entirely POPIA compliant.

Thus far, the burn team has instituted multiple initiatives, including alterations to the burn referral criteria, initiation of referrals via a designated secure application, and telemedicine on WhatsApp and subsequent VULA platform with parental consent. We have noticed that these initiatives have appeared to have improved compliance and decreased the burden on the trauma and burn units. A recent Cochrane database systematic review on dressings for superficial and partial thickness burn wounds highlighted that silver sulphadiazine (SSD) was consistently associated with poorer healing outcomes than biosynthetic (skin substitute) dressings, silver-containing dressings and silicon-coated dressings, and that burns treated with hydrogel dressings appear to heal more quickly than those treated with usual care, but further prospective studies are needed.[23]

Discharge instructions to the parents could not be ascertained retrospectively; thus, an information sheet, translated into several languages, has been introduced detailing all aspects of the patient's burn injury, including the depth, the TBSA, topical dressing applied on discharge and what other dressings would be required on a daily/weekly basis.

This study has significant limitations in the retrospective nature of its design. Telephonic follow-up frequency was low despite several attempts at contacting patients. The authors feel the interventions resulting from these findings have significantly impacted and improved service delivery and patient compliance.

Conclusion

Burn wound injuries and their associated impact on lower socioeconomic status households remain prevalent in

sub-Saharan Africa. This study demonstrated similar demographics, mechanism of injury, TBSA as seen in the literature and highlighted the effect of seasonal variation on the incidence of burn injuries in our setting. The results showed a high rate of unnecessary burn referrals to a tertiary care centre, with one-quarter of patients referred to the trauma unit being discharged back to community-level treatment centres or burn outpatient visits on the same day. Within this group, there is a high rate of non-compliance that is attributed to a lack of financial resources needed to leave work and make the journey to the hospital.

Conflict of interest

The authors declare no conflict of interest.

Ethical approval

Study approval granted by the Human Research Ethics Committee (HREC) of the Faculty of Health Sciences, University of Cape Town, HREC: 278/2017.

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