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Mortality in paediatric burns victims: a retrospective review from 2009 - 2012 in a single centre

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2016
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Title Page

Mortality in Paediatric Burns Victims: A Retrospective Review from 2009 – 2012 in a single centre

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CERTIFICATE OF SUBMISSION FOR EXAMINATION OF MASTERS RESEARCH REPORT / DISSERTATION OR PHD THESIS SIGNED BY HIGHER DEGREES CANDIDATES

Full name	Ben Jugmohan		
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Name	Professor Jerome Loveland		
Department	Paediatric Surgery		
Telephone	0836760004	E-mail	loveland@wol.co.za

List all publications, which you have published in peer-reviewed journals from your postgraduate research report/dissertation/thesis during the course of your studies in the Faculty of Health Sciences (Include authors, year, title of paper, name of journal, volume number and page numbers). This information is mandatory.

Mortality in paediatric burns victims: A retrospective review from 2009 to 2012 in a single centre

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SAMJ February 2016, Vol. 106, No. 2

Pages 189 - 192



Signature of candidate: Date: 31 January 2016

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Abstract

Background. Childhood mortality is high in low- and middle-income countries. Burns are one of the five leading causes of childhood injury mortality in South Africa (SA). While there is an abundance of literature on burns in the developed world, there are far fewer publications dealing with childhood mortality related to burns in Africa and SA.

Objective. To describe the mortality of children admitted to a dedicated paediatric burns unit, and investigate factors contributing to reducing mortality.

Methods. A retrospective review was performed of patients admitted to the Johnson and Johnson Paediatric Burns Unit, Chris Hani Baragwanath Academic Hospital, Johannesburg, SA, between May 2009 and April 2012.

Results. During the study period, 1 372 patients aged ≤10 years old were admitted to the unit. There were 1 089 admissions to the general ward and 283 admissions to the paediatric burns intensive care unit (PBICU). The overall mortality rate was 7.9% and the rate for children admitted to the PBICU 29.3%; 90.8% of deaths occurred in children aged ≤5 years. 89.5% of chidren admitted with an inhalational injury died. No child with a burn injury >60% of total body surface area (TBSA) survived.

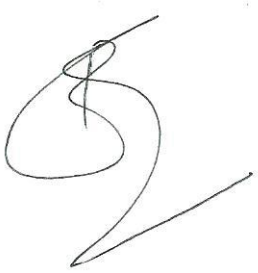
Conclusions. Our overall mortality rate was 7.9%, and the rate declined significantly over the 3-year study period from 11.7% to 5.1%. Age ≤5 years, the presence of inhalational injury, burn injury >30% of TBSA and admission to the PBICU were significant risk factors for mortality.

Acknowledgements

We acknowledge and thank Petra Gaylard and the Wits Donald Gordon Medical Centre for their assistance with our statistical analyses, as well as all members of the paediatric surgical, intensive care and allied medical staff that have had such a positive impact on the outcomes of these children.

Competing interests

The authors declare no competing interests.



Dr Ben Jugmohan **31 January 2016**

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Introductory chapter

The highest rates of childhood mortality are still concentrated in Sub-Saharan Africa. In developed countries the mortality rate for children under five is 1 in 152. In Sub-Saharan Africa the rate is 1 in 9. In 2011, Sub-Saharan Africa and Southern Asia shared 83% of global under 5 deaths (You D et al, 201). In South Africa, in 2007, the childhood mortality rate was 1 in 21 (Nannan N et al, 2012). The Bulletin of the World Health Organisation in 2010 lists burns as one of the top 5 causes of fatal urban injuries in South African children (Burrows S et al, 2010).

Globally, burn related deaths account for about 100000 deaths annually. In South Africa, approximately 1300 children die annually as a result of burns. The highest childhood burn mortality rates are reported in the first three years, with rates thereafter decreasing until adolescence when burn mortality rates start to increase. This concentration of burn mortality and injury amongst infants and toddlers occurs across South Africa's population groups, with the highest rates amongst very young black children. Both male childhood mortality, as well as injury rates, are higher than those for the corresponding female rates (van Niekerk A et al, 2012). Higher incidences of burns amongst young male patients are not limited to South Africa and the developing world. A large European systematic review published in Critical Care in 2010 found a 60% male predominance amongst burn victims less than 16 years old (Brusselaers N et al, 2010).

According to the National Injury Mortality Surveillance System (NIMSS), the childhood mortality rate for burns in South Africa in 2001 was 14.1% with the majority of deaths occurring in children younger than 6 years old. (van Niekerk A et al, 2012).

Literature Review

In the past 25 years there has been a plethora of literature published about various aspects of burns. Several decades ago, burns greater than 80% of total body surface area were considered uniformly fatal, particularly in the elderly and very young children. With improvements in resuscitation, intensive care and the understanding of the pathophysiology of burns, the mortality has significantly improved. In 1998, the Shriners institute reported a mortality of 33% for massive burns (total body surface area > 80%) in patients aged 6 months to 17 years. They cited lower age, larger burn size, presence of inhalation injury, delayed intravenous access, lower admission haematocrit, lower base deficit on admission, higher serum osmolarity at arrival, sepsis, inotropic support requirement, platelet count <20 000, and ventilator dependency as significant predictors of mortality (Wolf SE et al 1997). The same institute, in 2001, showed that children under the age of 3 have an increased mortality risk whether or not they have an inhalational burn injury in addition to their external burn injury (Barrow RE et al, 2001). The hypothesis that very young children are at increased risk was further backed up by a large multicentre study in 2006. Published in *Shock*, 12000 children from 43 burn centres across the USA were reviewed. The authors concluded that there was strong evidence that when comparing children based on burn injuries of similar size and aetiology, children younger than 4 years are at substantial risk of death as compared with older children (Thombs BD, 2006).

In contrast, a large prospective study published in 2013 showed that below the age of 15, age actually had a positive prognostic value (Karimi H et al, 2013). The authors also developed a score which they believe can accurately be used to predict

mortality. The score called the P-Baux score [TBSA – age + (18 x R)], applicable to patients younger than 15 years of age, subtracts age from the total body surface area burnt. ‘R’ represents a coefficient dependent on the presence of inhalation injury. A score of 1 is assigned for the presence of inhalation injury and 0 for the absence of inhalation injury. Scores from 50 upwards were associated with a progressive increase in mortality (Karimi H et al, 2013).

In 2009, authors from The Shriners Hospital for Children in Texas, USA published a review spanning 20 years. They reviewed the mortality of 5260 patients admitted from 1989 – 2009. Their mortality rate was 2.7% (145 patients). 144 of the patients that demised underwent an autopsy. The leading causes of death over 20 years were sepsis (47%), respiratory failure (29%), anoxic brain injury (16%), and shock (8%). Interestingly from 1989 to 1999, sepsis accounted for 35% of deaths but increased to 54% from 1999 to 2009. They attributed this increase in deaths due to sepsis, to improvements in resuscitation and wound care leading to many more patients surviving the acute phase of their burn injury (Williams FN et al, 2009). A systematic review from 12 countries across the East Mediterranean showed a mortality of 5 – 37% for children aged 0 – 4. They frequently found the mortality to be above 20%, in certain countries (Othman N et al, 2010). The authors do not comment on the causes of mortality.

Literature from developing countries and South Africa in particular, is scarce in comparison to the developed world. The literature that has been published reflects a different picture to that of the developed world, which represents the ideals that we aspire to. The burn and plastic surgery unit in Lagos, Nigeria studied 298 children who sustained burns between 2004 and 2008. The mortality rate was 29.9%. The

leading causes of death (by autopsy) were asphyxia in 48.27% of cases, multiple organ dysfunctions in 27.59% and septicaemia in 13.79% (Fadeyibi IO et al, 2008). In South Africa, authors from Edendale, Pietermaritzburg concluded that large burns are fatal in their hands (Allorto NL et al, 2009). The Karolinska institute from Stockholm, Sweden examined fatal burns in Mpumalanga from 2007 – 2008. They concluded that fatal burn injuries were strongly related to living conditions and lifestyle (Blom L et al, 2011).

The Johnson and Johnson Paediatric Burns Unit at the Chris Hani Baragwanath Academic Hospital in Johannesburg, South Africa was opened in 1995. The unit admits approximately 450 patients per year (Dr L Doedens – personal correspondence). Prior to 2009, the unit (including the paediatric burns intensive care unit), was run primarily by surgeons. For the surgeons managing the unit, burns was one of several key areas that they were expected to manage. 2009 heralded the introduction of paediatric intensivists to the paediatric burns unit. The paediatric intensivists form part of the multi-disciplinary team managing the paediatric burns patients. In addition, they oversee all children admitted to the paediatric burns intensive care unit as well complicated medical cases in the general paediatric burns ward.

The differences in mortality rates between countries such as the USA and countries in Africa, is clear. At the Chris Hani Baragwanath Hospital, the time from injury to presentation at the hospital of many of the paediatric burns victims is perceived to be prolonged. The reasons vary from socio-economic related problems to inter-centre

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Appendices

Approved protocol

Title

Mortality in Paediatric Burns Victims: A retrospective review from 2009 – 2012 in a single centre.

Ben Jugmohan

Student number 831554

MMed General Surgery

Supervisors

1. Professor JA Loveland – Head of Paediatric Surgery, Chris Hani Baragwanath Hospital.
2. Dr Linda Doedens – Senior Consultant, Paediatric Critical Care Unit, Chris Hani Baragwanath Hospital

Introduction

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The differences in mortality rates between countries such as the USA and countries in Africa, is clear. At the Chris Hani Baragwanath Hospital, the time from injury to presentation at the hospital of many of the paediatric burns victims is prolonged. The reasons vary from socio-economic related problems to inter-centre transfer time. This factor alone may significantly negatively impact on the mortality rate of the patients at this centre.

Therefore, I intend to investigate the mortality of children with burns injuries admitted to the paediatric burns unit at Chris Hani Baragwanath Academic Hospital. The mortality rates will be subdivided into groups according to age and total body surface

area. The causes of mortality, including factors such as delayed time to presentation will be examined. Predictors of mortality will also be examined.

Study Objectives

1. To calculate the mortality rate of children (including age and gender specific standardised mortality rates) admitted to the Chris Hani Baragwanath Johnson & Johnson Paediatric Burns Unit from 2009 – 2012
2. To compare the mortality rate of children admitted to the Chris Hani Baragwanath Johnson & Johnson Paediatric Burns Unit from 2009 – 2012 to studies of a similar nature
3. To describe possible reasons for differences in mortality rates between children aged admitted to the Chris Hani Baragwanath Johnson & Johnson Paediatric Burns Unit from 2009 – 2012 and other studies of a similar nature
4. To investigate the leading causes of death in children, admitted to the Chris Hani Baragwanath Johnson & Johnson Paediatric Burns Unit from 2009 – 2012
5. To describe recommendations that may decrease mortality at the Chris Hani Baragwanath Johnson & Johnson Paediatric Burns Unit

Methods

a. Design – a retrospective review

b. Site of study – The Chris Hani Baragwanath Hospital Johnson & Johnson Paediatric Burns Unit

c. Study population – children admitted to the Chris Hani Baragwanath Hospital Johnson & Johnson Paediatric Burns Unit from 2009 – 2012

d. Sampling

   i. Inclusion criteria – age 0 – 10

   ii. Exclusion criteria – elective re-admissions for reconstructive procedures. This represents a group of patients that have overcome the acute phase of their burns injury. The mortality of this group of patients is extremely low and If considered may give a falsely decrease the overall mortality rate

e. Data Sheet

Study participant number ☐

Age (years): 0 - 1 ☐ 1 - 2 ☐ 2 - 3 ☐ 3 - 4 ☐

4 - 5 ☐ 5 - 10 ☐

Actual Age (years and months):

Gender: male ☐ female ☐

Total Body Surface Area Burnt (%)

0 – 10 ☐ 11 – 20 ☐ 21 – 30 ☐ 31 – 40 ☐

41 – 50 ☐ 51 – 60 ☐ > 60 ☐

Actual Total Body Surface Area Burnt (%):

Mechanism of injury: Flame ☐ Water ☐ Other ☐

Inhalation injury: yes ☐ no ☐

Time from injury to treatment (hrs): 0 – 8 ☐ 8 – 16 ☐ > 16 ☐

Survivor: Discharged after ☐ days

Cause of death: sepsis ☐ organ failure ☐

respiratory (inhalation injury) ☐

Time to death (days):

f. Data collection: Data will be collected retrospectively. Patient files from patients admitted to the paediatric burns unit from 2009 to 2013 will be analysed. Information will be collected directly from patient files. The cause of death of the patients will be determined by analysing data and events prior to death. E.g blood cultures, renal function tests, ventilator settings. The data will then be captured onto excel spreadsheets according to the headings of the different subgroups.
g. Pilot study: no pilot study will be undertaken
h. Sources of bias: no sources of bias

Data Analysis

The crude mortality rate and standardised mortality rate for each subgroup will be calculated using the formula:

(Number of patients deceased ÷ Number of patients admitted) × 100 [children < 6 years old]

And for each standardisation group e.g. children aged 1 – 2 with burns 10 – 20% Total body surface area, using a specific variant of the above equation.

The differences in crude mortality rate and standardised mortality rates obtained will be compared directly to published literature.

Ethics

The data will be collected retrospectively from patient files and stored in a data bank.

Timing (2013 – 2014)

Process	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
Project idea	X						
Literature review	X						
Preparing protocol	X						
Protocol deadline		21/8					
Protocol assessment			11/9				
Ethics application	31/7						
Collecting data			X				
Data analysis				X	X		
Writing up – report				X	X		
Report submission						X	

Writing up - paper		X	X

Funding

The project will be funded personally. The costs to be considered include:

- Transport (from home to Chris Hani Baragwanath Hospital and to Charlotte Maxeke Johannesburg General Hospital)
- Electrical/data – email, internet, electricity, data
- Stationery – pens, paper, photocopying, ink

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