

Acute Kidney Injury among Burn Patients in a Tertiary Care in Western Nigeria

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ABSTRACT

Acute Kidney Injury among Burn patients have not been widely described especially in developing countries. The current study is aimed at providing information on the pattern of acute kidney injury. This review focuses on burn aetiologies and Acute kidney Injury (AKI) as seen in different types of burns, peculiar features and mortality pattern at a burns facility in a tertiary hospital unit in South Western Nigeria. This is a 5 year audit of all admissions into the burns unit of the Ladoke Akintola University of Technology Teaching Hospital Osogbo, Osun State, Nigeria from May 1st 2004 to May 1st 2009. The case notes of the patients and admission registers of the unit were the sources of information. A total of 147 patients with different types of burns were admitted during the period under review with age range of 1 to 70 years (mean of 28± 4yrs). There were 84 males and 63 females. Majority (133 or 90.4%) of the patients had thermal burns while 7 (4.8%) had electrical burns, 1(0.7%) had chemical burn. Eighteen (12.2%) of the total patients developed acute kidney injury. All the patients with AKI had various forms and degrees of thermal burns (i.e. flame and scald injury). The average length of hospital stay was 18.3 days while sepsis was a major contributory factor to mortality in 15 of the entire patients with burns. Only 9 (50.0%) of the 18 patients survived bringing the

mortality among the patients with Acute kidney injury to 50.0%. Mortality is high among patients with acute kidney injury in failure at our burns unit despite intensive care. Adequate conservative care with appropriate early referral of patients remains the cornerstone of burn care. Adequate information on preventive strategies of burns should be vigorously pursued

Keywords: *Acute kidney injury, burn patients, Nigeria*

INTRODUCTION

Management of burn injuries poses lots of challenges. This is more so in developing countries where the few available facilities are either not readily affordable or not functioning optimally [1-3]. Burns injuries have been found to be a major cause of morbidity and mortality in children in southeastern Nigeria [4]. Emergency transport services are also not readily available in most parts of the developing countries especially in sub-Sahara Africa [5-7]. The high cost of managing patients in terms of costs of consumables and prolonged hospitalization in a general surgical

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ward or in the few available specialized units in a low resource setting is a major challenge. These account for the high mortality, usually from sepsis and other major complications such as kidney failure [8,9].

A severe burn is a skin injury accompanied by serious systemic illness, with effects on different organs distant from the site of primary injury. It is known that outcome is often affected by patients' age, percentage of total body surface area burned, pre-existing diseases and associated inhalation injury or other traumatic lesions [1]. Mortality is often from multi organ dysfunction syndrome (MODS), and the lungs are among the organs affected (approximately 100%) followed by the kidneys and the gut in that order [1].

Burn present a challenge to both the resources and skills of the clinicians. With poor facilities and inadequate resuscitation of patients, morbidity and mortality tend to rise. Acute renal failure is one of the major complications of burns (especially major burns) in addition to other changes in the morphological and functional status of the kidneys. These include proteinuria, haematuria, extensive tubular damage, alteration in calcium homeostasis, increased renal blood flow, increased mean kidney mass and also derangements in the fluids and electrolytes balances in the body [1].

Burns injuries may be thermal (flame, scald or contact), chemical burn, seen on exposure to strong acid or alkaline products which occurs most often in industrial settings from assaults in developing countries [10] or electrical injuries. Acute renal failure (a subset of the spectrum of acute kidney injury) is defined as an acute deterioration in renal excretory function, with normal sized kidney, an increased echogenicity on ultrasound scan with a serum urea > 10mmol/l and/or a rise in serum creatinine (Scr) by ³ 0.3mg/dl or a percentage increase in Scr of ³ 50% from baseline (using the AKIN criteria) [11,12].

Two distinct clinical patterns of acute renal failure (ARF) in burns patients have been described-early ARF, developing a few hours after injury to the first five days and late ARF which develops after five days. The early variety is said to be due to hypovolemia while the late ARF is often as a complication of septicemia and multiple organ dysfunctions [13]. There have been a paradigm shift over the last decade as most patients seen in several burns centres with acute renal failure tend to present

with the late variety, most likely as a result of nephrotoxic medications prescribed [13].

The incidence of acute kidney injury in burns patients is said to vary between 0.5% and 30% with mortality as high as 90% -100% [13-15]. Various works have been done on acute renal injury/failure under different settings in Nigeria [16,13], but none have describe the pattern of acute renal dysfunction in burns patients, with anecdotal reports of figures as high as 100% in our environment. We therefore set out to describe this pattern at the burns unit of the LAUTECH Teaching Hospital, Osogbo, Osun State, Nigeria over a 5 year period. The hospital has 200 beds comprising a purposefully built plastic surgery facility encompassing a 6 bed burns unit, a fully functional hemodialysis unit (which offers only intermittent and maintenance HD) and an intensive care unit.

This retrospective study was informed as a result of the rather high mortality pattern in burns patients with acute kidney failure at our facility and the need to explore ways of limiting this rising profile.

MATERIALS AND METHODS

Review of the burn patients admitted over the period of 1st May 2004 to 1st of May 2009 was done. Information obtained from the case files, unit/ward and hospital records include the biodata, clinical and Laboratory data as well as outcome of the treatment. Inclusion criteria for patients with acute renal dysfunction at our centre was based on the history, urine volume, and serial serum laboratory parameters especially serum urea³ 8 mmol/L and serum creatinine ³ 110µmol/L(1.2mg%) or documented oliguria of < 0.5ml/kg/hour for more than 6 hours. It should be noted that while the conventional hemodialysis is the only method of treating renal failure in our centre, most of the patients could not afford this. Septicaemia is defined as a microbiological focus of infection and deterioration of the clinical state evidence by at least one of the following [17]:

- (a) Temperature > 39^oc on two or more occasions,
- (b) Leucocytosis > 10 x 10⁹ /lit,
- (c) Positive blood culture.

Multiple organ system failure was defined as the development of abnormalities affecting one

or more organ systems in a critically ill patient [17].

Intravenous Ringer's lactate was used for resuscitation in volumes according to the Parkland formula (4 mL/kg body weight [BW]/TBSA%), with adjustments for individual variations in hemodynamic variables, aiming at least for a mean of 1ml/kg/hour. Excision of the wounds were rarely done due to the fact that patients had to make fund available for this to be done. Wounds were dressed with either silver sulphadiazine cream or honey till wounds healed by epithelialization or eschar separated and wounds grafted.

Data were analysed using the SPSS for windows statistical package Version 15. Continuous variables were analysed as mean and standard deviation. Non parametric variables were analysed as percentages.

RESULTS

One hundred and forty seven patients (147) presented with burn injuries during the study period. They

consisted of 84 (57.1%) males and 63 (42.9%) females with a mean age of 23.2(±18.8years). Ninety-nine patients (67.3%) presented about an hour after the injuries with the mean number of hours between injuries and presentation at the burn unit being 3.1 (±8.0) hours; a median and modal period of 1.0 hour respectively and variance of 63.6 hours.

Flame was the commonest cause of the injuries in 89 (60.5%) of the patients followed by scald in 44 (29.9%), friction burn in 3 (2.0%), electrical injuries in 7 (4.8%) and chemical in 1 (0.7%).

The mean percentage burn surface was 30.8±24.6%. Ten (6.8%) of the patients had associated suspected inhalation injuries.

Eighteen (12.2%) of the patients developed acute kidney injury and all had various forms and degrees of thermal burns (i.e. flame and scald injury). Table 1

Analysis of the patients with AKI revealed that there were 12 males and 6 females. Their ages ranged between 1.5 years to 62 years, mean of 37 years (±4.5). Ten (55.6%) of the patients had flame burn, 5 (3.1%) had scald injuries, 2 (11.1%) electrical injuries

Table 1. Summary of patients with AKI

N0:	Age	Sex	Aetiology	%TB SA	Inhalation	Urea	creatinine	Organism isolated	Out come
1	55	F	Fl	18	nil	10.6	103	Staph/E.coli	Died
2	7	M	Sc	33	nil	6.4	205	-	Died
3	54	F	Fl	58	nil	9.2	-	-	Survived
4	35	M	Fl	36	nil	3.2	129	—	Survived
5	42	M	Fl	66	nil	11.2	116	-	Died
6	62	F	Fl	98	nil	11.2	—	—	Died
7	36	M	Fl	28	nil	5.5	128	klebsiella	Survived
8	3	M	Sc	51	nil	10	82	—	died
9	3	M	Sc	53	nil	11.2	62	—	died
10	9	M	Fl	54	inhalation	22	166	—	died
11	45	M	El	30	nil	9.8	62	—	Survived
12	25	M	Fl	82	inhalation	9	136	-	died
13	25	M	El	15	nil	3.5	145	-	Survived
14	22	F	Fl	64	inhalation	15	102	—	died
15	60	M	TE	96	nil	15	-	klebsiella	Survived
16	55	F	Fl	40	nil	4.2	120	pseudo	Survived
17	1.5	M	Sc	60	nil	16	82	Staph	Survived
18	2.5	F	Sc	15	nil	10.4	125	Staph	Survived

Key: *fl* = flame, *Sc* = scald, *El* = electrical burns, *TE* = Toxic Epidermal Necrolysis syndrome, *M* = male, and *F* = female, % **TBSA** = Percentage total burn surface Area.

and one(5.6%) of the patients had Toxic Epidermal Necrolysis Syndrome (TENS). The body surface area of the Burn injuries ranged between 15 to 96% with a mean of 49.3%. Three (11.1%) of the patients sustained inhalational injuries and died. Patients who had urea of more than 8 mmol/L and or Creatinine of more than 110 were considered as having Acute Kidney Injury and the mean value of urea and creatinine in the patients with AKI were 10.2 and 117.5mmol/L respectively. Six of them had associated wound infections with Staphylococcus aureus alone in 2 patients, Staphylococcus aureus with E.coli in 1 patient, Klebsiella and Pseudomonas infections in 2 other patients

Nine(50.0%) of the patients with AKI died and these included the 3 patients with inhalational injuries.

DISCUSSIONS

Acute renal failure is a common complication seen in patient with burns especially where the initial resuscitation is either not given at all or not adequately given as observed in many patients who presented having been managed in one private hospital or another. Olaitan et al had observed that acute renal failure constituted the greatest (42.8%) cause of death among paediatric age group (21) and 42.1% among adult and children with burns in Enugu, Nigeria [22].

In the profile of the 18 patients with Acute Kidney injury in the current study, most of the patients had various forms of thermal burns and this may suggest that it is likely that the rhabdomyolysis caused by flame injury may have predicted poor survival in this group of patients. The incidence of AKI of 12.2% seen in our unit is comparable to that seen in other centres[23].

The incidence is either relatively low as a result of the aggressive resuscitative measures at presentation, or most of the survivors were those that were earlier managed at another setting before referral.

Five (27.8%) of our patients presented with early renal insufficiency possibly as a result of extent/degree of burns, late and hypovolemia while 13(72.2%) presented with the late variety likely as a result of complication of treatment (nephrotoxic antibiotics) or part of a multiple organ dysfunction syndrome. This in particular is in agreement with similar studies in done in Germany [13].

None of our patients had any form of renal replacement therapy as majority of them had major burns affecting most part of the body coupled with the non availability of continuous renal replacement therapy (CRRT) at both the burns and intensive care units in the hospital. The mortality rate in this study among the patients with acute kidney injuries is 50.0% compared to the overall mortality of 29.9% among all the patients. Essentially, a major burn is still a major cause of acute kidney injury both in developed and developing countries. This especially in developing countries is often complicated by poverty, ignorance, late referrals and management inadequacies most often at the point of first care. Mortality is high as seen in studies done elsewhere especially in the developing countries. Possible reasons may include de-novo increased insensible fluid loss and subsequent poor fluid management; use of nephrotoxic agents (herbal remedies/antibiotics), underlying chronic renal insufficiency and late referral.

Of course the renal status of most of the patients before presentation was unknown. Efforts should be geared towards preventive mechanisms by way of preventive burn hazards. Better equipping of intensive care facilities and easy recognition of features of acute kidney decompensation are important points to note.

Primary care physicians should be educated on the care of burn patients and to refer the patients as early as possible where this is indicated. The health Insurance scheme which is not enjoyed by many Nigerians will be of assistance in ensuring that patients with serious injuries such as burns are well taken care of. This will ultimately reduce the current spate of acute renal injuries and eventual morbidity and mortality among burn patients.

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