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# Burn severity and post-burn infertility in men

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ABSTRACT

Burn wounds are a common cause of much morbidity and misery, especially in low- and medium-income countries. A number of studies show that severe burns cause infertility from poor sperm production.

The pathways leading to such infertility are not well understood, and it is not known how the severity of injury affects this post-burn infertility (PBI). We evaluated the relationship between sperm parameters and indices of burn severity, such as burn surface area and depth in 19 adults.

Total sperm counts ranged from 0 to 160 million/ml, with a mean of 19.58 $\pm$ 7.52 million/ml. About 60% of the subjects had total counts of 20 million/ml or less, falling into the clinically oligospermic range. We found only a weak correlation between infertility and both burn depth and burn surface area. There was, however, a fairly strong positive correlation between infertility and length of time between injury and participation in the study. The correlation coefficient was 0.560. Our findings suggest that PBI is progressive and not predicted by TBSA. Any measures to control it should be started early and be applied to burn patients across a wide range of clinical severity.

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Severe burns occur with high frequency in developing countries. Many of the factors implicated such as high population density, poor housing and illiteracy, are problems of underdevelopment and urban poverty [1–3]. In Nigeria, a major oil-producing country with infrastructural problems, petroleum-related fires such as those from contaminated or carelessly stored products, vandalised pipelines and exploding tankers have become a regular source of mass misery and mortality. In the World Health Organization (WHO) surveys, low- and medium-income countries accounted for up to a total of 95% of the 238,000 annual global burden of deaths from thermal injury [2].

Thermal injuries elicit a local and systemic response. The local response results from the direct consequence of application of heat to tissues. In the local effect, burns produce coagulative necrosis of tissue and a variable degree of vascular damage in the area adjoining the injury. Local inflammatory response to burn injury is immediate. The systemic response however is multifaceted and takes several hours or days to develop [4]. The extent of these responses depend on various factors, including the total body surface area (TBSA) involved, age of the patient, depth of tissue involved and the presence or absence of co-morbidity such as inhalation injury. The speed of onset of resuscitation and the appropriateness of these measures are equally critical determinants of treatment outcomes, especially in major burns [5,6].

Marked changes occur in the endocrine system post burn. These include a malfunction in the hypothalamic–pituitary–organ axes [7,8].

Severe burns elicit a systemic response triggered by various inflammatory and growth-promoting cytokines, such as tumour necrosis factor, interleukin-1 and interleukin-2, and

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several low-molecular-weight compounds released from degranulating platelets and mast cells [9–11]. Jeschke et al. have established that the inflammatory response is still active 2 years after burn [4].

These products elicit a hypermetabolic state, predominantly catabolic, at least in the initial stages, which cause major disruptions in normal physiology. Resting energy consumption levels rise by as much as 130–150% and remain elevated for several months [4].

Although much progress has been made in reducing mortality from burns over the last several years, a huge morbidity burden still exists. In the long term, nearly every system including the nervous, respiratory and digestive systems are affected [12]. It has been known for some time now that infertility is one of the long-term sequelae of severe burn [13].

Much is yet to be understood about post-burn infertility however, and the mechanisms by which testicular damage occurs are yet to be fully elucidated. A number of studies have examined the correlation between TBSA and burn pathology, with varied findings [14]. Parment et al., for instance, found no correlation between TBSA and immunosuppression in burn patients [15].

However, in an extensive review of the literature, it was difficult to find studies on how burn-related factors such as burn depth and surface area, for instance, correlated with sperm parameters. This study was carried out to bridge this knowledge gap and highlight these aspects of burn morbidity.

## 1. Materials and methods

### 1.1. *Materials*

A cohort of 19 adult male patients who recovered from burn, undergoing follow-up care in our burn clinics and satisfied specific criteria were recruited into this study. Informed consent was obtained from all entrants, and the study was approved by the ethical review committee of the college hospital.

Exclusion criteria were a history of significant genitourinary tract infection prior to or during the burns management; burn injury involving the perineum; a pre-burn history of metabolic diseases including diabetes mellitus and goitre; previous history of infertility in a married couple irrespective of the cause and history of childhood mumps or tuberculosis, past or present.

### 1.2. *Methods*

This is a prospective, blinded study of burn factors and semen parameters in adult male patients treated for major burn injuries at the Lagos State University Teaching Hospital in Lagos, Nigeria, between January 2006 and December 2007.

Time intervals were determined from the patient case notes. Burn surface area was calculated by the Wallace rule and depth by clinical assessment. They were recorded at the time of admission.

Serial semen samples were collected after 1 week's abstinence from sexual activity by masturbation at monthly intervals over a period of 4 months and analysed within 30 min in the same laboratory by an experienced but blinded investigator. The procedure applied followed current WHO guidelines for analysing human semen. The result for each patient was taken as the mean of these four measurements.

Samples were analysed for total sperm count, progressive motility and abnormal sperm rate.

#### 1.2.1. *Statistics*

The epidemiological data collated and analysed included age of patients, aetiology of burns, percentage of TBSA involved, burn depth, interval between the time of injury and onset of treatment as well as the time from injury to onset of study. The data were analysed for correlation between variables by the Fischer's exact test, Spearman's rank correlation coefficient and for intra-variable differences by the Pearson's chi-square test in a two-tailed analysis. The data were analysed using SPSS program (SPSS Inc., Chicago, IL, USA).

## 2. Results

### 2.1. *Demographics*

Nineteen adult males satisfied the inclusion criteria and were recruited into the study. Their ages ranged between 25 and 53 years (mean: 35 years). Injury caused by flame was the most common, accounting for over half (57.9%) of the numbers, followed by electricity (15%). About 50% had burns in the trunk region, followed by limbs (30%).

Of the 19 patients, 16 (about 80%) sustained major burns, that is, area burned exceeded 20% of TBSA. The extent of injury ranged from 13% to 60% of TBSA with an overall mean of $33.11 \pm 13.14\%$. Thirteen (68.4%) sustained full-thickness burn depth while six (31.6%) sustained partial thickness burns (Table 1).

The distribution of the injury shows that 10 (about 50%) patients had burns in the trunk, followed by burns on limbs (30%) and face (15%). Time lapse from injury to onset of treatment ranged from 6 to 48 h. Treatment had begun within 24 h of injury in about 80% of the subjects (Table 1). Time from injury to onset of study ranged from 1 to 12 months (Table 1).

#### 2.1.1. *Sperm parameters*

Sperm parameters were clearly suppressed. Total sperm counts ranged from 0 to 160 million/ml, with a mean of $19.58 \pm 7.52$ million/ml. About 60% of the subjects had total counts of 20 million/ml or less, falling into the clinically oligospermic range (Table 2).

Progressive motility ranged between 0 and 80% (Table 3).

Abnormal sperm rate ranged from 10% to 95%. The majority of abnormal cells (66%) had oblong, swollen,

**Table 1 – Patient demographics.**

| | |
|---|---|
| Age (years) | $34.68 \pm 0.68$ |
| Time to admission (h) | $82.00 \pm 2.54$ |
| 3rd degree (%) | 68 |
| TBSA (%) | $33.11 \pm 13.64$ |

Data presents mean ± SEM or percentages.

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