

**EFFECTS OF SEVERE BURN INJURY  
ON TESTICULAR HISTOLOGY AND  
FUNCTION IN SPRAGUE-DAWLEY  
RATS**

**BY**

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**EFFECTS OF SEVERE BURN INJURY  
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RATS**

**THESIS SUBMITTED TO THE SCHOOL OF  
POSTGRADUATE STUDIES, UNIVERSITY OF LAGOS, IN  
FULFILMENT OF THE REQUIREMENT FOR THE AWARD  
OF DOCTOR OF PHILOSOPHY (Ph. D.) IN THE  
DEPARTMENT OF ANATOMY, COLLEGE OF MEDICINE  
OF THE UNIVERSITY OF LAGOS, LAGOS, NIGERIA.**

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**CERTIFICATION**

**THIS IS TO CERTIFY THAT THE THESIS SUBMITTED TO THE  
SCHOOL OF POSTGRADUATE STUDIES UNIVERSITY OF LAGOS  
FOR THE AWARD OF**

**DOCTOR OF PHILOSOPHY (Ph. D.)**

**Is a record of original research carried out by**

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## **DECLARATION**

We hereby declare that the thesis titled “**EFFECTS OF SEVERE BURN INJURY ON TESTICULAR HISTOLOGY AND FUNCTION IN SPRAGUE-DAWLEY RATS**” is a record of original research work carried out by JEW O Peter Imoni in the Department of Anatomy, College of Medicine, University of Lagos, Lagos, Nigeria.

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## **DEDICATION**

I dedicate this work to the almighty God who made everything possible, and to my family: Esther, Anuoluwa, Oghenetega and Oghenetejiri for their love and patience and to Juliet, my sister, for her kindness.

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## **ABSTRACT**

Burns are a common form of trauma, and have a high incidence in many countries. Though the majority of burns are mild, and are treated on an out-patient basis, a significant mortality and morbidity occur from burns. A WHO survey predicting burn mortality up to the year 2020 estimated a global annual death burden of almost 250,000. A full 95% of that number was expected to come from low and medium income countries (LMIC). However, over the past several years, mass burns with devastating consequences have occurred repeatedly from petroleum-related fires in Nigeria, an oil producing country.

Thermal injuries elicit a systemic response involving several body systems especially the cardiovascular, immune, and endocrine systems. Although the initial response involves haemovascular deficits and shock, a multifaceted response follows which involves changing endocrine priorities and alterations in the serum levels of a wide range of cytokines. Suppression of the hypothalamo-pituitary-organ axes is a key finding in the endocrine response to severe burns. There are also changes in several of the body's physiologic parameters. An increasing number of studies have shown that severe burns can damage the mammalian testis and reduce spermatogenesis. Detailed characterization of histologic changes induced in the testis by severe burns is lacking. The mechanisms underlying observed testicular damage are still poorly understood, and in the reviewed literature no strategies for combating it have been put forward.

The problem is largely due to the difficulty of getting testicular tissue from living victims of burns. Consequently, most published studies of the effect of severe burn on the testes have been carried out on tissues obtained at autopsy. This challenge was approached by investigating changes in epididymal semen parameters, anti-oxidant status and the histology of the testis. An

animal model of Sprague-Dawley rats was used for the study. They were exposed to thermal injury across a broad range of burn severity including cases with chronic wounds with delayed healing. The effects of a variety of potential therapies were determined, namely: a balanced FSH/LH preparation, testosterone (T) alone and a combination of FSH/LH and testosterone. Studies of the potential benefits of ascorbic acid (AA), a broad spectrum free radical scavenger on burn-induced changes in testicular histology and function were also carried out. Burn injury caused a significant reduction in sperm density, motility and proportion of morphologically normal spermatozoa ( $P < 0.01$ ). Less dramatic changes occurred in hormone levels though in animals where there was chronic skin wound T level was significantly reduced even at 16 weeks ( $P < 0.05$ ). FSH and LH levels were reduced at 8 weeks. However in cases where the animals were kept for up to 16 weeks their levels were almost normal. Histopathological changes consisted of severe germ cell loss in seminiferous tubules of animals with severe burns. Sloughing of germ cells was also significantly higher in the groups with severe burns. In the case of animals with chronic skin wounds, many tubules had near complete destruction of germ cells leaving only basal cells intact. Burn injury caused severe seminiferous tubular damage, especially germ cell loss ( $p < 0.05$ ). This was matched by significant reduction in sperm density and percentage of histologically intact tubules ( $p < 0.05$ ). Burn injury also increased oxidative stress, with elevated malondialdehyde (MDA) levels ( $p < 0.01$ ) and caused changes in catalase and superoxide dismutase enzyme levels. Treatment with FSH, LH and T did not mitigate the anti-fertility effects of severe burns, whereas ascorbic acid treatment improved sperm parameters and significantly reduced histological evidence of testicular damage. It normalised MDA levels and attenuated changes in the levels of catalase and superoxide dismutase. Ascorbic acid treatment also significantly reduced histological damage to seminiferous tubules.

