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Prevalence and severity of bone loss in burned patients

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ABSTRACT

Often discovered late during the clinical course of burns, bone loss is widely accepted by clinicians as a de facto consequence of burn. Literature on this bone loss is limited and contradictory in details. More insight into the prevalence and magnitude of bone loss may facilitate its prevention. To this end, over a period of two years, we gathered a test group of 34 male patients with at least six-month-old thermal burns and a control group of 50 male members of similar age and geographical background as our test group. All members with any history of metabolic or endocrine disease or ICU admission were excluded from both groups. Using dual energy X-ray absorptiometry (DXA), we measured bone mineral density (BMD), Z-score and T-score in lumbar vertebra, femoral neck, and total femur and compared the results between the two groups. T-test of density scores against total body surface area of burns was performed. We found that the average T-scores, Z-scores and BMDs in the test group were significantly smaller than the averages in the control group ($P < 0.001$); and in the test and the control group, 25.7% and 0% of subjects respectively, had osteoporotic lumbar T-scores. Total femur and femoral neck T-scores exhibited a significant similar pattern with smaller differences across the two groups. The density scores also showed a significant reverse relationship to the total body surface area (TBSA) of burn ($P < 0.003$). Our results indicate that thermal burn victims have lower bone density and higher prevalence of osteoporosis than their healthy counterparts and that this difference is significant enough to justify screening in these patients which requires further longitudinal studies to institute.

1. Introduction

Burns are the fourth most common cause of injury [1] and impose heavy costs on the health care systems worldwide [2]. The clinical course of burn victims is often unsatisfactory especially when the causative mechanism is thermal injury or the TBSA affected is large [3,4]. With advances in resuscitation protocols of acute burn, more patients survive to experience a decline in quality of life caused by later sequela of burns.

Abbreviations: BMD, bone mineral density; BMI, body mass index; IQR, interquartile range; SUMs, Shiraz University of Medical Sciences; TBSA, total body surface area.

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Among these sequela, loss of bone density frequently comes to attention of physicians often long after thermal insult in the setting of highly catabolic patients with high TBSA of burns.

Few researchers have investigated this aspect of burn so our understanding of bone loss has evolved slowly and because the existing body of literature in the arena has mostly targeted children or acutely critical patients with extremes of TBSA, data are insufficient for institution of standard decision making guidelines regarding outpatient care in adults.

There is general consensus among literature that bone loss in burn patients exists and that it is a result of various aspects of the general hypermetabolic state that burn patients experience [5,6]. This bone loss has been corroborated by histological, biochemical and radiological methods in different studies [7–9]; however, in regards to the timeline, severity, susceptibility of anatomical locations and relationship to TBSA data are insufficient and contradictory.

2. Theory

We designed this study to determine the severity and frequency of BMD loss in three commonly tested anatomical locations and delineate its relationship to TBSA in a population of burned patients. The results may help clinicians assess the necessity of BMD measurements in these patients and provide groundwork for longitudinal studies.

3. Material and methods

We recruited our study population from people referring to physical medicine and rehabilitation clinics of Shiraz University of Medical Sciences (SUMs) over a period of two years. To minimize confounding caused by environmental factors, we ensured all members were indigenous to Fars province in Iran and we excluded all individuals with any self-reported history of metabolic, endocrine or other systemic disease or prior ICU admission. After informed consent forms were signed in accordance with guidelines of SUMs research ethics committee, members were referred to Namazi hospital in Shiraz for determination of BMD, Z-score and T-score of lumbar vertebra, femoral neck and total femur. Bone mineral densitometry was performed using the most common technique of dual energy X-ray absorptiometry in all cases.

In this cross-sectional study, participants were assigned to two groups; a test group of thermal burn victims and a control group of individuals without any burn. For our test group, we chose 34 thermal burn victims who at the time of measurements were aged between 22 to 52 years and had burns between 6 to 12 months old. Using clinical records, we obtained TBSA of 21 of these patients. Due to limited information in records, the exact percentage of third or second degree burns that constituted the patient's TBSA could not be determined (first degree burns are not factored into TBSA). We formed our control group by all the male family members who accompanied their test group patient into the clinic, had none of the exclusion criteria mentioned and had no significant age difference to the patient. Fifty individuals with ages ranging from 21 to 35 were selected as our control group (Table 1).

A total of twelve variables existed in our study. To evaluate the data dispersion and between-group difference, univariate analysis of each variable was done and the mean, median, standard deviation and interquartile range were calculated. Bivariate t-test was performed to determine the significance and strength of the statistical relationship between TBSA and other variables.

Using the definition of osteoporosis (T-score ≤ -2.5), osteopenia (T-score between -2.5 and -1) and normal BMD (T-score ≥ -1), we assigned members into three categories

Table 1 – Table of basic demographics of test and control group.

	Test	Control
Age		
Range	22–52	21–35
20–30	15	22
30–40	15	28
40–50	4	0
>50	0	0
BMI		
Range	19.1–23	20–23.8
19–22	31	37
22–24	3	13
TBSA		
Range	5–40	N/A
5–10	8	
10–20	3	
20–30	7	
30–40	3	
Ethnicity	Iranians indigenous to Fars province	Iranians indigenous to Fars province
Gender	Male	Male
Mechanism of burn	Thermal burn	Thermal burn