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## Original Article

# Histopathological examination of bone debris from reaming of interlocking intra-medullary nail fixation of long bone fractures with concomitant head injury

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## ABSTRACT

**Background/Aim:** The aim of study was to test, for the presence of osteoblasts in the reaming debris of intramedullary nailing of femoral and tibial fracture in patients with and without severe head injury.

**Methods:** Two groups of patients were studied. Group A (n = 32) had long bone fractures in addition to having head injuries. Group B (n = 35) had only long bone fractures. The fractures in the 2 groups of patients was treated by inter medullary nailing. Osteoblasts in the debris of the inter medullary nailing was compared between the 2 groups of patients. **Results:** The results demonstrated that histopathological specimens from reaming debris of fractured femur and tibia in patients with head injury showed osteoblasts in (82.9%) and in (27.5%) of patients with isolated long bone fractures (p < 0.001).

**Conclusion:** Healing indicators in diaphyseal fractures and concomitant head injury confirm fast and adequate healing in these patients and the presence of plenty of osteoblasts in their reaming debris may reflect a proof of accelerated fracture healing environment.

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## 1. Introduction

There is clinical evidence to suggest that fractures heal more rapidly in patients with head injuries. The mechanism underlying this orthopaedic phenomenon is not well understood. The regulation of bone healing after long bone fractures is subtle and involves many pathological processes. Early clinical reports in researching the correlation between

accelerated bone healing and nervous tissue damage in head injuries were inconclusive and demonstrated no evidence of accelerated union or increased callus formation and still, there is a debate, whether this rapidly forming new bone is fracture callus or a variant of heterotopic ossification, a common complication of traumatic brain injury.<sup>1–16</sup>

Other authors in the literature believed that there is evidence to suggest that fractures heal more rapidly in patients

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with co-existing head injury and that this may be due to a factor or factors released into the blood from the head injury site acting to promote fracture repair.<sup>17–25</sup>

The objective of this prospective controlled study was to test, histopathologically the presence of bone forming cells osteoblasts in the reaming debris of intra-medullary nailing of femoral and tibial diaphyseal fracture in patients with and without severe head injury to indicate or not the presence of accelerated bone healing environment at the fracture site with plenty of osteoblasts in patients with severe brain damage. The healing rate, healing time, and the amount of union callus formed in patients with femoral and tibial diaphyseal fractures and concomitant head injuries were compared with those of patients with long bone fractures only. All long bone fractures was fixed by static reamed interlocking intra-medullary nails.<sup>26–31</sup>

## 2. Patients and methods

From 19/09/2011, we started to recruit patients in this prospective controlled study. Patients in the age group of 20–60 years, and without history of chronic ill-health or systemic diseases were included. Patients on permanent medications and therapy for diabetes mellitus, ischaemic heart diseases, chronic renal failure, endocrine diseases, and patients on corticosteroids for bronchial asthma, rheumatoid arthritis, other arthritis, and inflammatory and autoimmune diseases were excluded from the study. The recruited patients were divided into two groups: Group (A) were patients with severe head injuries admitted to the ICU with GCS of 8 or less with diaphyseal femoral or tibia fractures and Group (B) were patients with diaphyseal femoral or tibia fractures only. All the long bone fractures in the two groups of patients have been treated surgically by open or closed reduction and skeletal stabilization by static reamed interlocking intra-medullary nail. The bony debris of intra-medullary reaming of all patients was sent to histopathological examination for osteoblasts.

### 2.1. Statistical analysis

Results were analysed with SPSS for Windows (Version 16). Means and standard deviations were determined. Mean scores between the two groups of patients were compared using chi square and the student t-test.  $p$  value < 0.05 was considered statistically significant.

## 3. Results

32 patients were recruited in group (A) and 35 were recruited in group (B). All patients finished their follow-up until the primary end point of the study of long bone fractures union or nonunion. In group (A) patients, the mean age was 29.7, range (18–39) years. The patients of this group were 30 males (93.75%) and 2 females (6.25%). The accidents in which, these patients were involved were high velocity accidents, with 21 patients (65.62%) have been involved in (RTA), and the remaining 11 (34.38%) have been involved in falling from

height accidents. The mean GCS in this group of patients was 6/15, range (4–8)/15.

35 long bones were fractured in these 32 patients, 26 (74.3%) closed fractures and 9 (25.7%) open fractures. There were 18 (51.4%) fractured shafts of the femur, and 17 (48.6%) fractured shafts of the tibia. All long bone fractures in this group of patients with associated severe head injuries were fixed by static reamed interlocking intra-medullary nail.

The 35 histopathological specimens from the reaming debris of the fractured long bones of femur and tibia in this group showed plenty of osteoblasts in 29 (82.9%), 16 (89%) femur and 13 (76.5%) tibia.

The mean time to union in this group was 6.9, range (5–16) weeks. There were no cases of non-union of long bones in this group. The mean maximal thickness of union bridging callus as shown in X-rays or CT scan was 26.3, range (7–48) mm. The mean healing rate, which is defined as the maximal thickness of union bridging callus in mms as evident in X-rays or CT scan, divided by the time to healing in weeks, was 2.8, range (1.4–8.6) mm/week. (Figs. 1–4).

In group (B) patients, the mean age was 32.4, range (21–47) years. The patients of this group were 30 males (85.71%) and 5 females (14.29%) with ratio of 6:1. The accidents in which, these patients were involved were high velocity accidents, with 29 patients (82.86%) have been involved in (RTA), and the remaining 6 (17.14%) have been involved in falling from height accidents.

There were 40 fractured long bones in 35 patients in group (B), closed in 28 (70%) and open in 12 (30%). Among the 40 fractured long bones in this group, there were 22 (55%) fractured



**Fig. 1 – Showing X-ray of femur with accelerated fracture healing and abundant callus formation in a patient with severe head injury and long bone fracture group (A) patient.**

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