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## Bone healing, hormonal bioassay and growth factors measurement in patients with long bone fractures and concomitant acute traumatic spinal cord injuries

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**Aim:** The aim of the study was to test the effect of acute traumatic spinal cord injury of quadriplegia or paraplegia on bone healing in patients with associated long bone fractures and to investigate the molecular and cellular events of the underlying mechanism for a possible acceleration.

**Methods:** Bone healing indicators of long bone fractures, hormonal bioassay for parathyroid hormone, growth hormone, corticosteroids, noradrenaline, adrenaline, leptin hormone, and growth factors measurement for Insulin like growth factor II (IGF-II), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), Activin-A, and cytokine Interleukin I (I-L-1), in the patients' blood were calculated for 21 patients with spinal cord injuries and associated long bone fractures (Group B) in prospective controlled study and compared to 20 patients with only spinal cord injuries (Group A), and 30 patients with only long bone fractures (Group C).

**Results:** The study results showed that the mean time of bone union in group B was 6.3, range (3.7-7.5) 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 CT scan was 29, range (10-48) mm. The mean healing rate was 4.7, range (2.6-7.5) mm/week, versus 6 (16.7%) went into atrophic non-union, with the mean healing time 22.5, range (14-42) weeks, the mean maximal thickness of union callus 8, range (2-20) mm, and the mean healing rate 0.41, range (0.25-1) mm/week in group C. The study showed statistically higher levels of parathyroid hormone and growth hormone ( $p < 0.005$ ) and normal corticosteroids levels. Patients with long bone fractures only showed consistent and statistically significant higher level of noradrenaline and adrenaline hormones compared to patients with spinal cord injury alone or associated with long bone fractures ( $p < 0.001$ ). Leptin hormone showed statistically significant consistent decrease in patients with spinal cord injury and concomitant long bone fractures compared to healthy subjects ( $p < 0.001$ ). It also showed statistically significant higher levels of growth factors like PDGF, VEGF, Activin-A, and cytokine I-L-1, along the 3 weeks of follow-up ( $P > 0.005$ ). I-IGF-II showed statistically significant subnormal level along the whole follow-up period in the same patients ( $P > 0.005$ ).

**Conclusions:** We concluded that long bone fractures in spinal cord injury patients heal more expectedly, faster, and with exuberant and florid callus formation. We can also conclude that bone healing has a central neuronal regulation and a combined neuro-hormonal mechanism with inhibition of the sympathetic nervous system is a possible cause of accelerated healing of long bone fractures in patients with associated spinal cord injury and growth factors like IGF-II, PDGF, VEGF, Activin-A, and cytokine I-L-I have roles as mediators, in molecular events and as byproducts of the aforementioned mechanism.

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