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SHORT COMMUNICATION

VARIATIONS IN PLASMA TRACE-ELEMENTS CONCENTRATION DURING FRACTURE HEALING IN DOGS

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Abstract : The study was conducted on healthy Mongrel dogs. Fracture of Radius Ulna was inflicted with wire-saw. Subsequently repair was carried out using bone plates. Plasma Zinc concentrations decreased significantly from control values of 317.71 to 294.92 μg/dl at day one post-operatively and the values reached basal levels by 21st day. The concentrations of plasma Copper, Cobalt and Iron continued to decrease during the post-operative period. However, Manganese concentration increased significantly during the corresponding post operative period. Results indicate withdrawl of minerals from body reserves during bone repair.

Key words : bone fracture trace-elements dog

INTRODUCTION

The concentration of number of inorganic elements, such as Zinc, Copper and Iron in the plasma and liver is altered during various types of injuries and their subsequent repair (1). These trace-elements play an important role in various metabolic processes in the body. It is thus of interest to study alterations in the plasma concentrations of various trace-elements during fracture-healing. The present study deals with changes in the concentrations of Zinc, Copper, Cobalt, Manganese and Iron in blood plasma of dogs during repair of fracture.

METHODS

The study was conducted on 18 healthy Mongrel dogs of 2 to 4 years of age, weighing between 12 to 18 kg, maintained under uniform management conditions. A transverse midshaft fracture of Radius Ulna of the left fore-limb was carried out with the help of a wire-saw and subsequently this fracture was repaired with use of three different types of bone plates viz. steel bone plate, baffalo--horn plate and camel bone plate. Each such group comprised of six animals. The blood samples from these dogs were collected under aseptic conditions in heparinized vials on 0, 1, 7, 15 and 21 days post-operatively. Blood plasma was separated by centrifugation at 2000 g for 30 minutes, acid digested with triple acid (Nitric acid: perchloric acid and Sulphuric acid in ratio of 10:3:1), and the digesta processed for estimations of various trace elements, as per method of Ludmilla (2), by the use of atomic absorption spectrophotometer. The results thus obtained were subjected to statistical analysis as per method of Snedecor and Cochran (3).

RESULTS AND DISCUSSION

The results of the present investigation are presented in Tables I and II.

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TABLE I : Alterations in trace-elements concentration (μg/dl) in blood plasma during fracture healing in dogs.

Days Post-operative	*Zinc*	*Copper*	*Cobalt*	*Manganese*	*Iron*
0	313.71[a] ±30.56	231.44[b] ±21.59	3.66[a] ±0.36	107.54[a] ±7.04	522.83[b] ±3.46
1	294.92[a] ±33.70	230.98[b] ±24.15	3.86[a] ±0.41	124.02[ab] ±11.43	476.86[ab] ±27.17
7	296.14[a] ±25.10	174.28[ab] ±14.50	3.49[a] ±0.36	118.55[ab] ±8.82	464.06[a] ±3.87
15	367.89[a] ±26.91	217.64[b] ±16.14	3.56[a] ±0.31	144.59[c] ±7.54	438.44[a] ±36.64
21	312.82[a] ±31.12	152.55[a] ±12.42	2.31[a] ±0.27	132.42[bc] ±8.55	412.41[a] ±30.40
Mean ±S.E.	317.09 ±11.90	201.37 ±14.36	3.37 ±0.24	125.42 ±5.60	462.84 ±16.64

Values with different superscripts differ significantly ($P<0.05$) among different groups.

The plasma zinc concentration was 313.71±30.56 μg/dl before the creation of fracture and decreased subsequently on day 1 and 7, before attaining a maximum level on day 15 post-operatively and returning to pre-operative levels by day 21 (Table I). Beisel and Perkarek (4) have also observed reduced plasma zinc values in cases of surgical trauma, possible explanation for this decrease in plasma Zinc concentration, immediately after operation, could be due to flux of Zinc from plasma to liver in acute inflammatory conditions (1).

The plasma Copper and Cobalt concentrations which increased immediately after fracture also followed a declining trend during later stages of fracture healing and reaching basal values on day 21 post-operative. Low levels of Copper and Cobalt during third week post-operatively, indicate their utilization in healing processes. On comparison of the ratios between the plasma concentrations of Zinc and Copper (Table II), it was observed that the increase in Copper concentration as compared with that of Zinc was proportionately higher in the early stages of healing, than in the later stages.

TABLE II : Changes in Zinc and Copper ratio during fracture healing.

Days post-operative	*Ratio* Zn : Cu
0	1 : 0.74
1	1 : 0.78
7	1 : 0.58
15	1 : 0.59
21	1 : 0.59

The plasma concentrations of Manganese which were 107.54±7.04 μg/dl before production of fracture, subsequently increased to a maximum of 144.59±7.54 μg/dl on day 15 post-operatively.

However, the plasma concentration of Iron were initially high but showed gradual decline, reaching lowest levels of 412.41 μg/dl during third week post-operatively. The comparisons between the use of different types of bone plates for repair revealed that stainless steel and buffalo-horn bone plates resulted in equally good healing processes, but the use of camel bone plates produced severe antigenic reaction three days post-operatively. However, by the 21 day the healing processes was similar in all groups.

These significant changes in the plasma levels

of various trace-elements indicate the withdrawl of these minerals from body reserves, thus emphasizing the importance of trace-elements suplementation during the early post-operation periods.

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