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Changes in Copper and Zinc Metabolism after Trauma

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Trauma such as accidental or deliberate injury, and surgical operation is a general pathological condition that produces a response in unrelated metabolic systems. Trauma patients have been shown to have metabolic changes, including increased gluconeogenesis, acute phase protein synthesis, and muscle protein breakdown, and probably changed status of trace minerals such as copper and zinc. This study was carried out to test the hypothesis that trauma patients have changed general metabolism, copper and zinc status, and copper and zinc dependent enzymes. This study examined 19 patients admitted to the surgical intensive care unit and neurosurgical intensive care unit at The Ohio State University Hospital, classified as having trauma; for comparison, 21 controls were recruited who were age and race matched. Trauma patients had increased body temperature and glucose production after injury and decreased hematocrit and hemoglobin. No significant changes in blood urea nitrogen, creatinine, alanine aminotransferase, and aspartate aminotransferase were detected. A number of indices of zinc status, such as plasma zinc or R-value, were significantly decreased 1 day after trauma, and then, returned to normal. The zinc dependent enzyme, 5'-nucleotidase, was significantly increased at 7 and 14 days after trauma, possibly because plasma levels of this enzyme can be elevated by tissue injury. α -D-mannosidase activation by zinc was not affected by trauma insult. The activity and immunoreactive protein levels of ceruloplasmin, the major copper transport protein, was significantly increased 7 and 14 days after trauma. Conversely, erythrocyte superoxide dismutase (SOD) activity and its immunoreactive protein were significantly decreased by trauma. Activity of diamine oxidase, a possible index of copper status, was also decreased after trauma. Thus, this study has demonstrated that trauma insults induce not only the changes in general metabolism, such as body temperature, gluconeogenesis, and iron status, but also the redistribution of trace minerals. Based on the trace mineral results, trauma patients may have a degree of copper and zinc deficiency, or normal copper and zinc status, but abnormal mineral distribution. In addition, this study suggests that plasma zinc and R-value can be good indices for zinc status, and the activity of plasma diamine oxidase can be useful as an index for copper status.