Effect of Long-Term Hyperbaric Stress on Ammonia Metabolism in Humans

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A significant increase in blood urea was found in 11 U.S. Navy divers during 8 d of air saturation hyperbaric exposure. Similar increases in blood urea have been found in animals that convulsed during hyperbaric oxygen exposure. Therefore, it is suggested that careful attention be given to blood ammonia and urea levels in humans during long-term hyperbaric exposure.

MATERIALS AND METHODS

Adult male U. S. Navy divers, 11 in groups of three or four each, were exposed to hyperbaric air for 8 d using a 10 × 30 ft steel hyperbaric chamber maintained at the Naval Submarine Medical Research Laboratory. The saturation pressure was 2.8 ATA, equivalent to 60 feet of sea water (FSW), with daily, 8-h excursions starting at 10 a.m. to 4.0 ATA, equivalent to 100 FSW. These excursions did not require decompression on return to 60 FSW. A recirculation atmosphere control system was employed utilizing nitrogen-oxygen mixtures as the principal breathing media. The opinions and assertions contained herein are the private ones of the writers and are not to be construed as officially reflecting the views of the Navy Department, the Naval Submarine Medical Research Laboratory, or the Naval Service at large.

RESULTS AND DISCUSSION

Fig. 1 shows the means and S.E.M. for blood urea level (in mg/100 ml) across the three test conditions (pre-dive, dive, and post-dive). The analysis of variance showed that significant differences occurred across these blood urea means (F = 14.58; df = 2,3; p<0.01).
gest that careful attention should be given to changes in blood ammonia and urea in humans during long-term hyperbaric exposure.

However, monitoring blood levels of ammonia and urea during hyperbaric exposure entails many operational and technical problems, e.g. sending a phlebotomist to depth, blood loss, time-consuming chemical assay, etc. A speedy noninvasive measure requiring small sample volumes would be preferred. The analysis of parotid gland excretion of urea using the electrode method of Renfro and Patel (11) may provide such a method.

Kopstein and Wrong (9) have shown that the urea concentration in saliva from the parotid duct is positively correlated with plasma urea concentration. In fact, parotid urea has an average urea concentration of 86% of the plasma concentration. Therefore, subsequent studies will investigate parotid urea excretion during hyperbaric exposure in relation to the plasma concentration.

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REFERENCES