Glomerular filtration rate estimates decrease during high altitude expedition but increase with Lake Louise acute mountain sickness scores


AIM: Acute mountain sickness (AMS) can result in pulmonary and cerebral oedema with overperfusion of microvascular beds, elevated hydrostatic capillary pressure, capillary leakage and consequent oedema as pathogenetic mechanisms. Data on changes in glomerular filtration rate (GFR) at altitudes above 5000 m are very limited. METHODS: Thirty-four healthy mountaineers, who were randomized to two acclimatization protocols, undertook an expedition on Muztagh Ata Mountain (7549 m) in China. Tests were performed at five altitudes: Zurich pre-expedition (PE, 450 m), base camp (BC, 4497 m), Camp 1 (C1, 5533 m), Camp 2 (C2, 6265 m) and Camp 3 (C3, 6865 m). Cystatin C- and creatinine-based (Mayo Clinic quadratic equation) GFR estimates (eGFR) were assessed together with Lake Louise AMS score and other tests. RESULTS: eGFR significantly decreased from PE to BC (P < 0.01). However, when analysing at changes between BC and C3, only cystatin C-based estimates indicated a significant decrease in GFR (P = 0.02). There was a linear decrease in eGFR from PE to C3, with a decrease of approx. 3.1 mL min\(^{-1}\) 1.73 m\(^{-2}\) per 1000 m increase in altitude. No differences between eGFR of the two groups with different acclimatization protocols could be observed. There was a significant association between eGFR and haematocrit (P = 0.01), whereas no significant association between eGFR and aldosterone, renin and brain natriuretic peptide could be observed. Finally, higher AMS scores were significantly associated with higher eGFR (P = 0.01). CONCLUSIONS: Renal function declines when ascending from low to high altitude. Cystatin C-based eGFR decreases during ascent in high altitude expedition but increases with AMS scores. For individuals with eGFR <40 mL min\(^{-1}\) 1.73 m\(^{-2}\), caution may be necessary when planning trips to high altitude above 4500 m above sea level.

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