Severe Facial Edema at High Altitude

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We present a complication associated with high altitude of unusual severity. Pronounced facial edema developed in a 27-year-old woman during a trek to Kilimanjaro, Tanzania. The development of facial edema has previously been documented in visitors unaccustomed to high altitude. The possible pathophysiological mechanisms are discussed, and the importance of adhering to recommended ascent rates is emphasized for all high-altitude treks.

Case Report

A 27-year-old English woman, with no previous exposure to high altitude (>2,500 m), developed severe facial edema at approximately 4,000 m above sea level, on a trip to the summit of Mount Kilimanjaro, Tanzania, the highest mountain in Africa. Prior to the ascent, she had flown from the UK into Nairobi, Kenya (1,624 m). On the day after arrival in Tanzania, a designated, recognized route was used, with one night spent at each of the following altitudes: 1,500, 3,000, 3,840, and 3,900 m. On leaving camp at 3,900 m, minor swelling of her forehead and the back of her hands was noted by her traveling companions. That night camp was made at 3,965 m. The following morning (day 5) the swelling had worsened; she was also suffering from headache, nausea, and loss of appetite, sufficient to prevent continuation of the ascent. As a result, the group immediately descended to the camp at 1,500 m, where the symptoms of acute mountain sickness (AMS) soon disappeared and the swelling resolved after 2 days. Throughout the ascent, she had been well hydrated, drinking at least the recommended 2 to 3 L of water per day. Her past medical history was unremarkable. Twenty-four hours before begin-

ning the ascent, she had taken acetazolamide (AZ) 250 mg bid, but discontinued following advice from the manager of the tour company, to prevent the known association of diuresis. AZ has been used in the prevention and treatment of AMS (Figure 1).1

Discussion

AMS is a symptom complex, comprising headache and at least one other symptom, after recent ascent to high altitude. The Lake Louise scoring system can be used to quantify AMS, although it is most useful as a research tool. The spectrum of symptoms, ranging from mild to life threatening,2 is associated with faster rates of ascent. Peripheral edema (including facial swelling) is not a symptom of AMS, although it can occur with AMS. Several case studies have been published, with the incidence of peripheral edema varying from 25% to 100%.3-5 In previous cases, the degree of edema was relatively minor.

It is apparent from the literature that these symptoms are common in newcomers to high altitude. Indeed, by definition, AMS is pathological and does not occur in acclimatized individuals. The pathophysiological cause remains unclear, although both hypoxia and exercise have been suggested. Symptoms of AMS have an inverse correlation with arterial oxygen saturation levels. Hypoxia is known to cause pulmonary edema directly by increasing microvascular permeability6 and indirectly via mediators such as eicosanoids.7 A later paper by Williams and colleagues8 looked at the effect of low-level hill walking on fluid homeostasis in subjects acclimatized to sea level; this showed that even at low

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altitude (1,100 m), where there is no hypoxia, facial edema occurred in all subjects by day 5. Significant sodium retention (peaking on day 5) was associated with modest water retention, resulting in considerable increases in plasma and interstitial fluid volumes at the expense of the intracellular compartment. Additional investigation showed that these shifts in fluid balance were due to activation of the renin-aldosterone system during exercise.

AMS symptom scores show a direct correlation with aldosterone levels and an inverse relationship with sodium levels. That is, those who develop AMS have higher aldosterone levels, retain more sodium, and tend to have an antidiuresis; both the subject with AMS and the subject exercising at low altitude are in similar states of positive fluid balance. This increase in extracellular fluid volume in turn results in the dependant and periorbital edema often seen in patients with AMS. It is these shifts in fluid balance that are responsible for the symptoms of AMS, possibly caused by mild cerebral edema.

Hackett and colleagues showed that relative hypoventilation is associated with AMS; subjects with vital capacities relatively small for their body size were more likely to have lower arterial saturations and to have increased AMS symptoms at high altitude.

AZ has a well-known indication in the prevention of AMS, but this is an unlicensed use in the UK. The optimum AZ dose is unknown; 250 mg is most commonly used, and there is evidence that it is effective at this dose. Concerns about potential diuresis and consequent dehydration are incorrect and represent poor advice from the tour manager. Had AZ administration been continued, the edema may have been entirely prevented or at least been ameliorated.

Conclusions

This short report serves to illustrate the potential severity of swelling associated with ascent to altitude. It is important to note that peripheral edema does not, in itself, mandate immediate descent; it will resolve on descent or acclimatization. The symptoms of AMS, if severe, will necessitate abortion of ascent, as in this case. Symptoms of AMS are related to the rate of ascent, with gradual acclimatization to altitude reducing the relative risk. The ascent profile outlined in the introduction exceeds the recommended rate of 300 m a day, once over 3,000 m, with a rest day every 2 to 3 days. Despite the subject of this case report traveling with a reputable company, the ascent was still too rapid. It is beholden on the individual to insist on a more conservative route, and to allow sufficient time, for acclimatization. We recommend that additional studies are conducted to consider the effect of exercise at altitude on fluid balance.

The subject of this case report has given written informed consent.

Declaration of Interests

The authors state that they have no conflicts of interest.

References