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DECOMPRESSION SICKNESS AFTER EXERCISE AT 4,572 m (15,000 FT) -

A CASE REPORT

KV Kumar, Ranjit Kumar, M Akhtar, P Tyagi and N Madan

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Decompression sickness in aviation is usually encountered at altitudes above 9,144 m (30,000 ft). This paper presents a case of bends which occurred at a simulated altitude of 4,572 m (15,000 ft) in a hypobaric chamber following accidental decompression during submaximal treadmill exercise. It is suggested that even moderately severe exercise at low altitudes may predispose healthy subjects breathing air to decompression sickness.

Keywords: post-exercise decompression sickness; accidental decompression; altitude simulator.

DECOMPRESSION sickness (DCS) is described as a series of pathophysiological changes that occur as a result of changes in barometric pressure. Though its occurrence below 5,487m (18,000 ft) is rare, a few such cases have been reported. "Bends" forms the commonest symptom encountered in altitude DCS. A host of environmental and individual factors also influence the onset and progress of the disease (1,6,10). Here, a case of bends which occurred after exercise at a simulated altitude of 4,572 m (15,000 ft) is presented.

Case Report

A 31 years old healthy male (height 165 cm, weight 54 Kg) participated as a test subject for an exercise protocol at 4,572 m in the hypobaric chamber. Ascent to this altitude was made through the airlock chamber at the rate of 915 m per min and the subject was transferred to the main chamber through the airlock. After an initial equalisation period of 45 min, the subject was prepared for the exercise test protocol. He was required to work

on a treadmill placed inside the chamber to a predetermined submaximal target heart rate in stages using the Bruce protocol. Air was being breathed throughout and no preoxygenation had been used. The subject was monitored using on-line ECG recordings, and he started working on the protocol.

Meanwhile the airlock chamber was closed and it separately made a descent to ground level. Immediately, it was noticed that the main chamber had also made a descent to about 1,830 m. There was misting inside the chamber and the descent was found to be due to improper closure of the connecting door between the two chambers. This was immediately closed and the main chamber raised to 4,572 m within a minute or two while the subject was still continuing with the exercise which was completed after three minutes and the chamber lowered gradually to ground level.

After reaching ground level, the subject suddenly felt very warm and started sweating profusely. After 15 min of descent, he complained of mild pain in his left elbow which gradually grew in intensity. He further developed mild dizziness and inco-ordination.

Physical examination revealed the subject to be pale and dazed with mild tremors of the fingers. Reflexes were normal. ECG was within normal limits. Due to technical problems, the hyperbaric chamber could not be operated and the subject was placed on conservative management. He was detained for further observations and managed with 100% oxygen, intravenous fluids and analgesics.

Radiological examination of elbow

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joints did not show any abnormality. Blood tests showed PCV to be 65%. The subject felt better on the second day with less pain in the elbow. PCV was 50% on the third day. He became completely asymptomatic by the fifth day.

Discussion

Altitude DCS is usually not encountered below 9,144 m. Allen (2) described two cases of bends at altitudes of 3,658 m and 5,487 m respectively attributing them to traumatic calcification due to previous injury. Houston (8) reported six cases of bends that occurred at altitudes from 4,877 m to 6,400 m, with visual symptoms in half these cases. Fryer (5) reported a case of bends in a pilot at 5,640 m in an unpressurised aircraft and also reviewed similar cases at low altitudes.

The frequency of bends in altitude DCS has been found to vary from 50 to 80% (1,3). Bends pain has been described as deep, gnawing or boring and difficult to localise. The onset may be gradual or acute and the pain fluctuant. Further, it may occur at altitude or during or after descent (1,3). Severe pain causes loss of muscle power of the extremity involved and may lead to collapse (1). The bends pain may be due to mechanical dislocation of the tissues by the bubbles or may be due to development of bubbles in extravascular tissue spaces - "autochthonous bubbles" (6). Bends pain has been graded, depending on the severity of pain and occurrence of associated symptoms, as follows (3):

Grade 0 - Absence of pain in joints while at rest.

Grade 1 - Detectable pain in one or more joints, waxing and waning at altitude and disappearing on descent.

Grade 2 - Persistent pain at altitude, disappearing on descent.

Grade 3 - Intolerable pain requiring immediate descent.

Grade 4 - Requires treatment and is associated with other autonomic symptoms.

Exercise increases the susceptibility to DCS and the chief mechanism is attributed to the promotion of bubble growth by the accumulated carbon dioxide (7,9,10). Carbon dioxide functions as a facilitator, increasing the rate of bubble growth in the early stages of exposure. Though exercise at altitude promotes bubble growth, the role of exercise during decompression is less clear (10). Hypoxia also contributes to the formation of bubbles. It has been observed that moderate exercise at altitudes between 4,572 m and 6,096 m may even produce loss of consciousness (4).

In the present case, the subject had grade 4 bends - requiring treatment and associated with autonomic symptoms. Recompression would have alleviated the symptoms early, but could not be carried out. The inadvertent descent of the chamber to 1,829 m and immediate ascent to 4,572 m while the subject was undergoing moderately severe exercise breathing air throughout, may have predisposed the individual to bends. However, no such incidence was reported in the same individual in an earlier

test or in nine others who underwent a similar protocol without any mishap. Thus the possibility of encountering DCS even in normal healthy subjects at low altitudes must be kept in mind.

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