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Chronic Subdural Haemorrhage from Scuba Diving and Helicopter Flight: A Case Report and Literature Review

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Abstract

Introduction: Here we describe an unusual case of Chronic Subdural Haematoma (CSDH) caused by a combination of scuba diving followed by flying in a helicopter and highlight the previously undocumented risks associated with each of these activities.

Summary of background data: Subdural haematoma (SDH) is characterised by haemorrhage into the spaces surrounding the brain. The incidence of CSDH is higher in the elderly population and frequently traumatic in origin. Other risk factors include anticoagulant use, previous traumatic brain injury, cerebral metastases, aneurysm rupture, chronic alcohol abuse and heavy cocaine use. While case reports describing epidural haematoma secondary to scuba-diving exist, no case reports describing scuba-diving related SDH can be found in the current literature.

Method: A 50 year old male presented to his General Practitioner with a 3 month history of headache, whose onset coincided with a recreational scuba-dive followed by a helicopter flight the following day. Magnetic Resonance Imaging (MRI) scan of his head and neck revealed a large SDH with midline shift and mass effect. Immediate hospitalisation with operative management ensued and the patient made a full recovery. Review of the literature did not reveal any previous cases of SDH caused by either scuba diving or helicopter flight.

Conclusion: Scuba-diving and flying in a helicopter can precipitate SDH. The risk of this is likely to be amplified by a combination of the two activities. SDH can be caused by the pressure changes associated with scuba diving and with helicopter flying. This risk may be amplified by a combination of the two.

Keywords: Subdural haemorrhage; Intracranial haemorrhage; Scuba diving; Helicopter; Altitude; Risk factors

Introduction

Chronic subdural haematomas (CSDH) are known to occur spontaneously in the elderly population with trauma as a leading cause. However, a history of head injury (direct trauma) is absent in 30-50% of the cases [1]. There is a wide range of evidence and literature documenting risk factors for SDH [1-4]. However, there is no literature regarding the development of an SDH due to scuba diving. Additionally, there is no previous evidence to suggest that SDH can occur due to the pressure changes associated with flying in a helicopter as the altitudes achieved were previously deemed physiologically insignificant.

Here we report a case of a patient engaged in both scuba diving and helicopter flight within a 24 h period and subsequently developed a large SDH. We review the literature, causes and mechanisms of this pathology, as well as the current lack of safety warnings regarding these activities.

Case Report

A 50 year old gentleman presented to his GP with a 24 h history of dysarthria and gait disturbance. He received an MRI and was subsequently referred urgently to hospital for ongoing care. Upon further history taking, he had been experiencing headaches intermittently for 3 months. His headaches were global in nature without localization, visual changes and usually resolved with administration of simple analgesia. The patient reported his symptoms started after a scuba dive in which he spent over 2 hours at a depth of 35-45 m using a Nitrox mixture. The patient reported a short episode of dizziness during the dive which would be consistent with nitrogen narcosis. He ascended appropriately at the time and observed a longer than usual decompression time due to the nature of the dive and his underwater symptoms. He reported a mild headache that evening that soon passed.

When asked about other activities undertaken at the time, the patient also reported that he was a commercial helicopter pilot. He admitted to having flown shortly after his dive. The patient was an experienced Dive Master but expressed that he had never been advised that this was a risk previously.

On examination the patient was alert and orientated. There was no evidence of trauma to the head or otherwise. Neurological examination of cranial nerves, upper and lower limbs was unremarkable aside from horizontal gaze nystagmus. His pupils were equal and reactive.

Short term memory was assessed using a three-word recall test and specific questions about times, dates and addresses. The patient

displayed significant deficits in these areas and was unable to recall any of the three words after a 2 minute period.

Magnetic resonance imaging conducted prior to presentation showed a 25 mm left sided fronto-parieto-occipital collection consistent with a subdural haematoma causing a midline shift and significant mass effect (Figure 1).

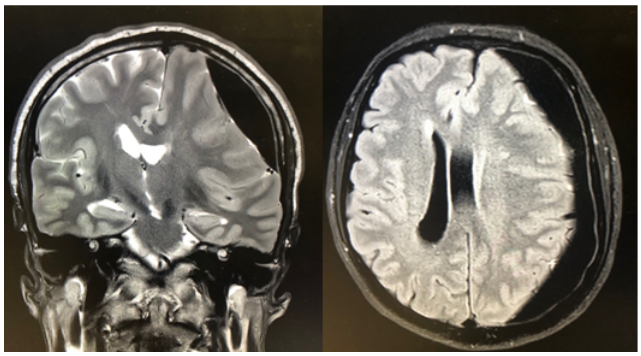

Figure 1: Coronal and sagital images of patient MRI on day of admission.

A neurosurgeon was consulted and advised for semi-urgent surgery. The patient was consented and underwent surgery for evacuation of SDH via burr hole and insertion of a subdural drain. The surgery was uncomplicated and the patient recovered without issue. He was treated with antiepileptic medications and required no further surgery or interventions.

Follow up imaging was performed at 3 months and showed complete resolution of the SDH and minimal residual space. He experienced no further neurological symptoms and his headaches had resolved. He had not attempted further scuba diving.

Discussion

Acute subdural haematomas generally occur in younger adults, after a major trauma, often causing concurrent structural brain injury, and present within 72 hours [2]. In contrast, CSDHs often occur in the elderly after a minor injury without any damage to the underlying brain, and usually there is a period of weeks to months before it becomes clinically evident [3]. Risk factors include cerebral atrophy, anticoagulation medications, bleeding diathesis, epilepsy and renal dialysis and dehydration causing intracranial hypotension. Rarer causes include cerebral artery aneurysms and excessive cocaine use [2].

Literature review of PubMed, Google Scholar and ScienceDirect found no documented cases of Chronic or Acute SDH related to scuba diving or helicopter flight. A case report from 2002 by Hida et al illustrated a single case of epidural haematoma in the thoracic spine caused by scuba diving at a depth of 10 m [5]. A case published by Tremolizzo et al in 2012 reported a similar presentation with spinal epidural haematoma in a 25 year old male who had been free diving to a depth of 15-25 m [6]. MRI scans of the brain in both these patients were clear without any intracranial haemorrhage. This pattern of injury is thought to be due to obstruction of the epidural vertebral venous system during times of increased pressure i.e. scuba diving [7].

There is well documented risk of pneumocephalus due to diving. Reported by Goldman in 1986, changes in pressure even during well prepared dives can have significant effects on a closed system such as the cranium [8]. A point of concern when conducting this review is that in the medical questionnaire provided by the Professional Association of Diving instructors (PADI), there is no mention of previous intracranial haemorrhage, or neurosurgery, though mention is made of aneurysms and pneumocephalus [9]. In this questionnaire there are questions regarding seizures, blackouts, loss of consciousness and headaches or migraines.

There is also no firm literature regarding helicopter flights post diving. Divers Alert Network (DAN) has an official statement regarding flying which details an 18 hour surface interval. However, this is based on airplane flights with pressurised cabins [10]. Cabins of commercial airplanes are pressurised to ~12 psi which is lower than sea level pressure of 14.5 psi. Helicopters do not possess pressurised cabins but it was previously thought that the lower altitudes (2000-2400 feet) were not of significant risk. However, Bessereau et al. found that during medical retrieval flights, endotracheal tube cuff pressures underwent significant changes, even at low altitudes [11]. This is further confirmed by Brandstrom et al. in 2017 who measured intracranial pressures of post craniotomy patients during air retrievals. It was found that there was a significant rise in intracranial pressures during transport even in patients with minimal volumes of pneumocephalus pre-transport. While this study focussed on expansion of air, it remains significant in that it demonstrated increased ICP even at low altitude [12].

Conclusion

After evaluating this case and literature review, we would like to conclude scuba diving is a risk factor for development of a SDH, even when proper diving protocols and decompression stops are employed. Furthermore, we would like to conclude that flying in a helicopter after diving, even at low altitudes, may have adverse effects on the cerebrovascular system and should only be undertaken if absolutely necessary.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Conflict of Interest

All authors have none to declare.

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