Case report

Clinical and radiological features in a patient with acute decompressive illness

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Introduction

Decompression illness (DCI) is caused by intra or extra-vascular air bubbles that are formed as a result of rapid reduction in ambient pressure i.e. decompression[1]. Severe DCI is a known complication among scuba divers that can lead to neurological injury and death[2,3]. It is suggested that any new symptom arising shortly after an event of decompression should be considered as possible DCI. Since brain and spinal cord are the most commonly reported sites of grievous injury, neurologists' role is imperative in proper evaluation and management of DCI. We report a professional scuba diver who developed clinical and radiological manifestations of DCI leading to long term disability following acute decompression and critically analyze the available facilities for managing these patients in Sri Lanka.

Case report

A 41 year old male was transferred from Trincomalee with weakness of both lower limbs, transient visual blurring and reduced level of consciousness of three days. He was a healthy, professional scuba diver with more than 20 years of experience in deep sea diving.

On the day of onset, he had dived 45 meters (140 feet) deep in Kalmunai sea, an unusual but not an unprecedented depth by his standards, and has had rather a long 'bottom time' in order to catch certain ornamental fish. As a consequence he had to expedite his ascent and has resurfaced within 20 minutes. Immediately on emerging he experienced dizziness, dim vision and weakness of legs and suspected having DCI owing to his own similar past experiences and opted for the usual resort of the circumstance, which was in-water re-compression (IWR). However this was delayed by about an hour until a trained person was found to dive alongside him and then IWR was carried-out at 30 meters (100 feet) depth. Despite 5-6 hours of IWR no improvement was noted and he was re-surfaced gradually and transferred in a passenger van in a semiconscious state, to Naval Hospital Trincomalee for hyperbaric oxygen (HBO) treatment, 9 hours after the onset. Ten hours of HBO was given in the recompression chamber and on 3rd day he was transferred to NHSL for neuro imaging.

On admission GCS was 15 and he had a sensory level at T-4 with grade 1 lower limb power and sphincter involvement. Basic hematology was normal except for grossly elevated D-dimer level (9000ng/ml). The 2D echocardiography and bubble contrast study didn't show evidence of intra-cardiac shunt. Magnetic resonance imaging (MRI) of brain revealed B/L cerebral and thalamic hyper-intensities in T2W and flare images, which were suggestive of ischemia (Figure 1). The MR angiogram of brain was normal. Cervical and thoracic spine MRI showed hyper-intensity in T2 images indicating ischemic or hypoxic changes and there were no radiological evidence of spinal cord compression.

In hospital he was given oxygen, IV fluids and though evidence is lacking, high dose IV steroids and anti-coagulation. In view of the severe disability, he was transferred to a long term rehabilitation care facility.

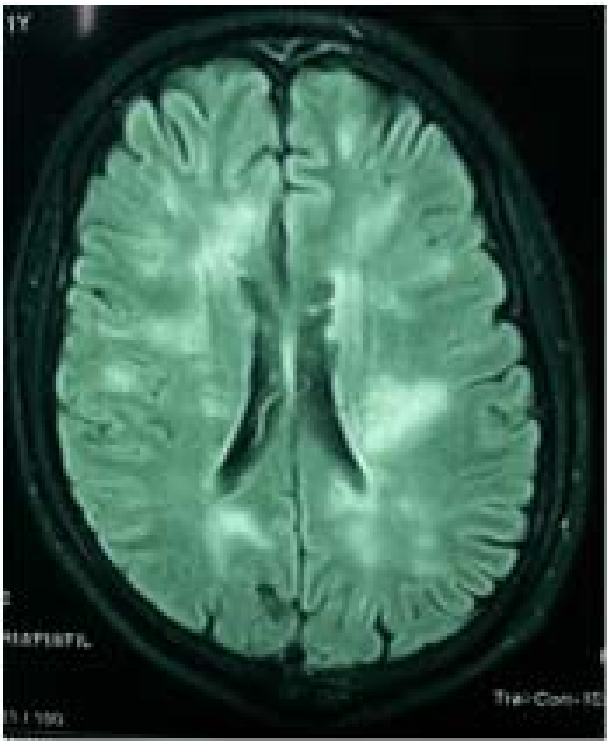

Figure 1. Widespread hyper-intensities seen on MRI brain.

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Discussion

The scuba divers carry their own air cylinders underwater and breathe air at a higher atmospheric pressure for a longer duration. The gas solubility increases at greater pressure according to Henry's law and inert gases, mainly nitrogen gets absorbed in to the tissues. The gas solubility decreases during ascent and as a result bubbles are formed in tissues and if no sufficient time is given for "off gassing" via lungs, those bubbles can cause mechanical and biochemical disruptions leading to tissue damage. Therefore dives must always be preplanned with a controlled rate of ascent and compulsory "decompression stops" in order to allow gas to leave the system. This phenomenon can also be seen when an unpressurized air craft is flying up and when a worker is coming out from a pressurized mine or a caisson.

Decompression Illness takes two major forms; type 1 involving muscles, joints and skin causing so called *'bends'* and type 2 affecting the CNS, respiratory or cardiovascular systems which could be life threatening[4]. Spinal cord injury usually arises from DCI as a result of nitrogen bubbles obstructing spinal venous plexus[5] and cerebral involvement is mostly due to arterial gas embolism[6].

This patient had clinical and radiological evidence of both cerebral and spinal involvement of DCI. Despite significant ischemic insult to brain, he regained full consciousness within a short period but the spinal cord syndrome poorly recovered regardless of IWR and HBO. The definitive treatment of DCI is HBO therapy which involves placing the patient in a pressurized chamber where he breathes pure HBO i.e. oxygen at pressure excess of 1 atmosphere[7]. In Sri Lanka HBO therapyis available only at Naval Hospital Trincomalee. Water recompression as practiced here involves the incapacitated diver being taken down with a fresh air cylinder to various depths and durations until the diver feels adequate relief of symptoms. It is not a recommended practice but cannot be completely dejected due to the local situation where access and gaining admittance to the only centre with HBO facility in Sri Lanka is difficult[8]. Prompt HBO treatment gives the best chance of complete recovery, but Fonseka *et al* reported two cases of type 2 DCI with neurological deficits recovering from recompression therapy even after four and five days after injury[8].

Conclusion

In Sri Lanka scuba diving is becoming an admired recreational activity and also there is a population of professional scuba divers who daily dive the deep sea. There are risks involved with it thus certain governing regulations do exist. It is imperative to follow standard diving protocols, as DCI is always preventable by correct diving practices. Being an island nation, raising awareness among health care workers regarding management of DCI and upgrading country's HBO facilities with more than one center can help not only to minimize DCI related disability but also Sri Lanka to become a diving hub in South Asia with state of the art treatment centers for managing diving related medical problems.

References

1. Decompression illness. Richard D Vann, Frank K Butler, Simon J Mitchell, Richard E Moon. *The Lancet* 2010; **377**: 153-64.
2. Melamed Y, Shupak A, Bitterman H. Medical problems associated with underwater diving. *New England Journal of Medicine* 1992; **326**: 30-5.
3. Clenney TL, Lassen LF. Recreational scuba diving injuries. *American Family Physician* 1996; **53**: 1761-6.
4. Divers Alert Network. http://dan.org/medical/dictionary.asp. *The Neurologist* 2002; **8**: 186-202.
5. Newton HB. Neurologic complications of scuba diving. *American Family Physician* 2001; **63**: 2211-18.
6. Greer HD, Massey EW. Neurologic injury from undersea diving. *Neurology Clinics* 1992; **10**: 1031-45.
7. SLMA guide to management of decompressive sickness. 2013: 1-13.
8. Fonseka MMD, Ekanayake L, de Silva PH. Decompression sickness: recovery after delayed recompression. *Ceylon Medical Journal* 1995; **40**: 37-8.