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MALIGNANT HEADACHE OF HIGH ALTITUDE- HIGH PREVALENCE IN COMBATANTS DEPLOYED AT HIGH ALTITUDE

General Medicine

Krishan Singh — Classified Specialist, Physiology, High Altitude Medical Research Centre, 153 GH, Leh, India.

Santosh Kumar Singh* — Classified Specialist, Medicine, Command Hospital (Northern Command), Udhampur, India. * Corresponding Author

Vishal Jha — Graded Specialist, Medicine, 153 GH, Leh, India.

Rachit Sharma — Graded Specialist, Radiology, 153 GH, Leh, India.

ABSTRACT

BACKGROUND: In the list of various risks the combatants face, adverse living conditions at high altitude apparently find its place at the top. With the paucity of medical facilities available at these locations, cerebral venous thrombosis presenting as a nonspecific symptom like headache can be a tough challenge for the physicians deployed there.

MATERIALS AND METHODS: Combatants deployed at altitude varying from 11000 to 20000 ft and presenting with complaints of headache, nausea and vomiting were taken into study after evaluation at a service hospital which itself is at 11500 ft.

RESULTS: In a period of 4 months, 55 cases of headache were screened and evaluated. 21 of these patients were diagnosed to have Cerebral Venous Thrombosis (CVT).

CONCLUSION: The clinical awareness has to be enhanced so that for the symptoms like headache, nausea and vomiting the diagnosis of CVT should be at the top of the differentials and clinicians should be at their toes to treat it because every combatant is a valuable resource to his country.

KEYWORDS

Acute Mountain Sickness, CVT, HACE, HAPO, Polycythemia

INTRODUCTION

Combatants are deployed in varied environmental conditions, high altitude being one of them. Exposure of personnel by deployment and combat duties at such varied locations leads to stresses at various levels increasing chances of non-combat related mortality and morbidity. It is a challenge in high altitude both in terms of accessibility and logistics. The biggest challenge lies in maintaining a fighting fit predominantly lowlander troop strength at heights above 2700m. The present scenario is associated with implications on combat fitness and operational deployment limitations on one hand and financial implications of lifelong healthcare and disability benefits on the other. Prolonged stay at these locations with rigorous combat duties pose risk to health of personnel to both high altitude related illnesses and conditions common at sea-level which are seen many times frequently at high altitude.

Lowland sojourners going to high altitude can present with some neurological conditions outside the preview of usual definition of altitude sickness.[1] Cerebral venous sinus thrombosis (CVT) is one of such conditions that usually presents with sudden onset headache, vomiting and focal neurological deficits.[2] Dehydration, polycythemia, and vascular spasms at high altitude are the most identified risk factors for thrombosis.[3]High altitude may be an associated condition for cerebral venous thrombosis (CVT), but little is known of CVT at high altitude.[4] CVT has been reported in people who climb to high altitudes ranging from 2500 to 5500 m. Nevertheless, the exact prevalence of CVT at high altitudes is not known, probably because the majority of events involving severe headache at high altitude are interpreted as acute mountain sickness (AMS) or high-altitude cerebral edema (HACE), and brain imaging is not routinely performed.[5]The present study was conducted to address the issue of high prevalence of CVT at high altitude in the soldiers who stay for prolonged duration. In the present study, 55 cases of headache in the soldiers deployed at high altitude of varying altitude were analyzed and how many were diagnosed to have CVT.

MATERIAL AND METHODS

The study was carried out at a hospital located at 11,500 feet. The hospital receives patients from a wide area of mountainous territory, where personnel are working at heights between 11,000 and 20,000 feet and are air evacuated to this hospital for definitive care. 55 cases of headache were analyzed during a period from Dec 2018 to Apr 2019 with mean age 28± 7.2 yrs. Apart from the local inhabitants, who have been living in the region since birth, the population consists of men coming from all over India and serving for short tenures at high altitudes. The vast majority of these have lived all their lives in the plains which provided the subjects for the present study. Apart from the high altitude, the men serving in this area are also exposed to severe cold. Temperatures in winter range between -10°C and - 40°C. The following criteria were taken as a basis for suspicion of CVT: headache, vomiting and seizure. The diagnosis was confirmed radiologically by MRI and MRV. Complete analysis of 55 patients admitted with complaints of headache during winter season at high altitude and how many of them progressed into CVT actually in the soldiers with prolonged duration of stay at high altitude were carried out in our study. All these patients were subjected to clinical evaluation, haemato-biochemical parameters (CBC/LFT/RFT/Urine RE, D dimer) including Neuro-imaging (MRI & MRV)

RESULTS

1.PREVALENCE

During the period from Dec 2018 to Apr 2019, 55 patients with the headache were referred and admitted to the hospital (Table 1) and 21 cases were confirmed to have CVT by neuro-imaging. In that period, the prevalence was 0.4 per 10000 among this group. The majority of patients acquired the disease at the place where they were located but diagnosed at our hospital. The patients affected at higher altitudes were evacuated to the hospital by road or Air. Table 2 gives the altitudes at which the disease occurred. Persons coming from all over India appeared equally liable to the disease.

Table 1. Incidence of CVT in different months

Months	Headache cases	CVT cases
Dec	14	6
Jan	18	7
Feb	13	3
Mar	10	5
Total	**55**	**21**

Table 2. Characteristics of different patients included in the study

Patient Characteristics		No of cases
Age group (Y)	20-30	6
	30-40	10
	40-50	5
Altitude (ft)	9000-12000	8
	12000-15000	4
	15000-18000	8
	>18000	1

Duration at high altitude (months)	1-5	3
	5-10	3
	10-15	7
	15-20	8

2.PREVIOUS EXPERIENCE OF HIGH ALTITUDE

21 patients of CVT in four months could be divided into two groups: those who were entering high altitude for the first time in their lives (06 patients); those who had spent several months at high altitude and were then re-entering after a period of stay in the plains (15 patients). The duration of stay at high altitude in the second group varied between four months and one year five months. Table 2 shows the different durations of stay at high altitude.

3.AGE

Almost half the patients were from thirty to forty years of age. The oldest patient was fifty, and the youngest twenty-one years. The preponderance of younger patients can reflect the exposed population. Table 2 gives the details of age.

4.SYMPTOMATOLOGY

The common symptoms were headache, vomiting and seizure. In addition, all patients complained to a varying extent of one or more of the following symptoms: loss of consciousness, weakness of limbs, blurred vision and giddiness (Table 3).

Table 3. Predominant Symptoms at Presentation in addition to Headache

Symptoms	No of cases
Vomiting	18
Weakness limbs	06
Seizure	12
Loss of consciousness	04
Blurred vision	06
Dizziness	05

5.PHYSICAL SIGNS

(a) Pulse, Blood pressure and SpO2-Three patients had tachycardia, one patient had bradycardia and rest of the patients had heart rate in the normal range. 10 patients had high blood pressure whereas in rest blood pressure was within the normal range.

(b) All of these patients had adequate oxygenation (>90%) at room air at the time of presentation except one patient who h a d concomitant HAPO also.

NEUROLOGICAL EXAMINATION

Out of 21 patients, 6 patients had altered sensorium at the time of presentation while rest of them had normal mental state. 5 of the patients had papilledema on fundus examination at the time of presentation. 4 patients had mild sensory deficit at the time of presentation which has recovered over few days of hospitalization.

RADIOLOGICAL INVESTIGATION

Neuroimaging (MRA and MRV) along with T2W, FLAIR, TIW and GRE sequences were carried out in these patients. MRV along with the basic sequences shows involvement of sinus, superficial cortical veins and deep veins. Figures 1,2,3 & 4 demonstrate few of the basic findings in the patients detected to have CVT. Majority of the patients had the involvement of superior sagittal sinus, followed by transverse, sigmoid and straight sinus. Few of the patients show involvement of cerebral parenchyma in the form of venous hemorrhagic infarct.

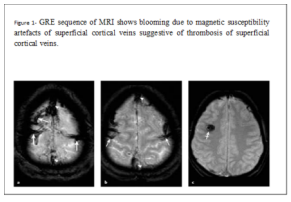

Figure 1- GRE sequence of MRI shows blooming due to magnetic susceptibility artefacts of superficial cortical veins suggestive of thrombosis of superficial cortical veins.

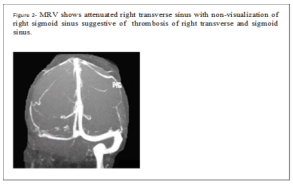

Figure 2- MRV shows attenuated right transverse sinus with non-visualization of right sigmoid sinus suggestive of thrombosis of right transverse and sigmoid sinus.

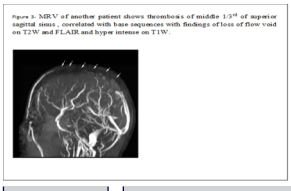

Figure 3- MRV of another patient shows thrombosis of middle 1/3rd of superior sagittal sinus, correlated with base sequences with findings of loss of flow void on T2W and FLAIR and hyper intense on T1W.

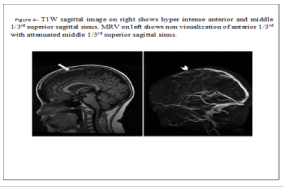

Figure 4- T1W sagittal image on right shows hyper intense anterior and middle 1/3rd superior sagittal sinus. MRV on left shows non visualization of anterior 1/3rd with attenuated middle 1/3rd superior sagittal sinus.

ADDITIONAL INVESTIGATION FINDINGS

3 cases had polycythemia and 1 case had mildly raised D-dimer

DISCUSSION

The main finding of this study is that the incidence of CVT in the combatants deployed at high altitude area is about 3 times higher than the world wide incidence in Plains.[6] The majority of patients presented with severe headaches associated with vomiting as the initial symptom. In some cases, headache was followed by confusion, unconsciousness and focal neurological deficits. The most common symptoms and signs of CVT are headaches, seizures, focal neurological deficits and altered consciousness. Patients may also present with behavioral abnormalities, which can lead to a mistaken diagnosis of psychogenic illness before seizures or signs of intracranial pressure.[7] Diagnosis may be difficult, as some neurological disorders arising at high altitude can mimic CVT, including AMS, HACE, ischemic stroke and intracranial bleeding.[8,9] The 'gold standard' for CVT diagnosis is a combination of MRI to visualize the thrombosed vessel and MR venography (MRV) to detect the non-visualization of the same vessel.[10,11] The first-line treatment is anticoagulation, using either subcutaneous body-weight-adjusted low-molecular weight heparin (LMWH) or dose-adjusted intravenous heparin, with an at least doubled activated partial thromboplastin time. Concomitant intracerebral hemorrhage (ICH) related to CVT is not a contraindication for heparin therapy.[12]

There are myriad of factors which may contribute to CVT at high altitude, including secondary polycythemia, dehydration, cold, hypoxia and thrombophilia, whereas the role of hemoconcentration in high-altitude CVT remains uncertain. One mechanism of thrombosis may be related to low-oxygen tension-induced erythropoiesis. As a consequence, blood viscosity increases with a hematocrit > 60%, resulting in decreased cerebral blood flow and oxygen transport. Polycythemia damages vascular endothelium and activates platelets, accelerating the thrombotic process. However, gradual ascent to an altitude of around 4500m does not appear to alter platelet activation, plasma coagulation or fibrinolysis.[13] Thus, the slowing of cerebral blood flow secondary to cerebral edema could be playing a major pathogenetic role.[14]In contrast to lowlanders, people who live at high altitudes are typically polycythemic, yet are not particularly susceptible to thrombotic events.[15]

It is very difficult to predict who can have thromboembolic events prior to their travel to high altitude. Patients with such events in the past should not return to high altitude. The simple thing which we can do at high altitude is to maintain adequate hydration to these events. Travelers to high altitude can easily get dehydrated due to lack of adequate water intake, as well as due to loss of fluid from vomiting caused by altitude illness and worsened by superadded diarrhea. Patients with Factor V Leiden, if compounded by dehydration, may suffer from thrombosis. Hence, it is important to maintain adequate water intake and try to prevent and if necessary, properly treat diarrhea at high altitude. [16]It is hard to make general recommendations for travel to high altitude due to variations of human response to high altitude and unknown mutations for coagulating factors present in them. In general, it may be best to tell travelers to high altitude with known predisposing factors to thrombosis to take all the precautions to avoid altitude sickness and especially to drink adequate amounts of fluids (2 to 3 L of water per day); importantly, there are no evidence-based guidelines to make firm recommendations.

CONCLUSION

It takes a colossal effort to recruit, train and prepare a combatant and to lose them to ailment like CVT can only be viewed as a despicable loss of a precious resource and is demoralizing to medical fraternity. The occurrence of CVT in combatant who remain at high altitude for prolonged duration is very common and should be suspected whenever individuals present with sudden headache, vomiting and focal neurological defects at high altitude. With this enhanced clinical awareness and the help of radiological techniques such as CT, MRI, and CT or MR angiography, CVT can be reliably diagnosed and properly managed and can reduce morbidity and prevent death.

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