

Original Article

Vertigo in aircrew : A case report and review

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Vertigo occurring in flight is a grave emergency and imposes the risk of an aircraft accident with consequent loss of trained manpower. A 30 year old QF1 with 2200 hours flying experience encountered two episodes of vertigo on the ground and subsequently one in the air over a period of one month. Following the attack of vertigo in the air, the aircrew reported to the medical authorities and was subjected to thorough investigations. Though there was complete recovery in this case, the case is being presented to highlight the incidence of such a malady in the air and the need to reemphasize to aircrew the careful exclusion of pre existing disease before flying. The paper discusses the etiology, investigations and aeromedical significance of vertigo. The significance of avoidance of flying by aircrew with conditions like URTI is reiterated.

Keywords: Alternobaric vertigo, aircrew

Sudden incapacitation of the crew member in the primary control of an aircraft is implicated in many mishaps, especially in the high performance fighter aircraft. Incapacitation can be secondary to many factors including loss of consciousness due to acceleration forces, hypoxia leading to unconsciousness and numerous preexisting disease conditions aggravated by the stresses of flying environment. Spatial disorientation in many of its forms can also be suddenly incapacitating. Vertigo and dysequilibrium are significant threat to aerospace safety due to the possibility of sudden onset and incapacitation. One such case which was recently investigated at the Institute of Aerospace Medicine (IAM), Indian Airforce (IAF) has been presented.

Sortie profile

The aircrew reported to his Squadron Medical

Officer with the following description: "I was authorised to undertake instructional sortie with trainee pilot on 19 Feb 97. After necessary briefing, we took off. The take off was uneventful. After reaching the sector, manoeuvres were started as planned. Next in the profile was spin. After attaining the height of 2.3 km, I initiated the spin manoeuvre to the left. Immediately after the uneventful recovery from this spin I checked the parameters and found that we had lost about 0.7 km in 15 s. Recovery from spin was complete. I handed over the aircraft controls to the trainee pilot and asked him to practise straight and level flying as per syllabus. Following this, I did valsalva to clear the fullness of ears. I looked outside to orientate myself in the sector and found that I couldn't focus on the

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objects and felt unsteady. The episode lasted for about 40-50s. Later after recovery, took over the controls myself, asked for immediate rejoin and landed safely. I then realised, had it occurred few seconds earlier during spin, or if I was the only crew in the aircraft, I would not have ever recovered from this manoeuvre. I decided to report to the Squadron Medical Officer".

Medical history of the pilot

History indicated that he had similar episodes prior to the one described above. First episode occurred on ground and the pilot was given excuse from flying duties as he was on medication for common cold. He became vertiginous while he was climbing the stairs, with the feeling of spinning sensation. He could not recollect whether it was clockwise or counter-clockwise but felt unsteady and was not able to balance himself without support. Gradually the severity of attack died down and he recovered completely. The attack persisted for several minutes, however the pilot could not recollect the exact duration of the attack. Twelve days later, the pilot had another episode on ground which was precipitated after performing forceful valsalva. After uneventfully completing the instructional clearance sortie, he felt fullness of both ears and performed valsalva while returning back to crew room, to clear his ears. He suffered from severe vertigo which persisted for a couple of minutes and subsided spontaneously thereafter. Both these episodes were not reported to

Squadron Medical Officer because of apprehension of undergoing a battery of investigations and loss of flying category. Aircrew was in fully flying medical category (A1G1). He used to get frequent attack of common cold. There were multiple cavities in molar teeth with two root canals done. Details of these three episodes of vertigo is shown in table-1.

None of these episodes were accompanied by nausea, vomiting, tinnitus, deafness, toothache or pain in the ear/paranasal sinuses. There was no loss of consciousness. Interestingly, during all these three attacks of vertigo he had concomitant history of upper respiratory tract infection (URTI). The patient remained free of vertiginous attacks since the last episode even after doing forceful valsalva.

Flying experience of the pilot

This aircrew started his flying career at the age of twenty years. After initial flying training in KIRAN and ISKARA he opted for helicopter stream (CHETAK). He has total of 2200 h of accident free flying to his credit. After 2050 h of successful helicopter flying on CHETAK the pilot was selected for FIS and became qualified flying instructor (QFI). While performing duties as QFI in HPT-32 aircraft he, over a period of one month had three episodes of vertigo in air, he reported for aeromedical consultation at Air Force Station, Bihta.

Table 1

S. No.	Date of occurrence	Duration	Place	Precipitating factor	Associated ailments
1	27 Jan 97	several min	on ground	not recollected	URTI
2	08 Feb 97	2-3 min	on ground	valsalva	URTI
3	19 Feb 97	40-50 sec	in air	rapid descend followed by valsalva	URTI with sinusitis

Evaluation of the Case

a) Evaluation at periphery (Feb 97): A thirty year old average built pilot, with height of 171 cm and weight 71 kg. BP and pulse were unremarkable. Throat was found to be congested and there was tenderness over left frontal sinus. Remainder of general and systemic examination were WNL. Neuropsychiatric examination revealed well balanced and highly motivated pilot. Routine blood test including blood sugar and serum cholesterol WNL. X-ray PNS did not reveal any positive finding.

b) Evaluation at IAM (Apr 97): Audiogram revealed mild high tone loss 45 dB at 4 KHZ and above-WNL. Caloric stimulation of vestibular system revealed normal and equal response bilaterally and duplicated the vertiginous symptoms. Altitude chamber tests did not produce any symptoms. Since no ENT abnormality was detected, he was further investigated to find out any systemic contributory cause of vertigo. ECG (resting and post exercise) was WNL. EEG revealed normal awake record. Head up tilt-70° response was normal. CT scan brain showed enlargement of left jugular foramen. However there was no cortical erosion or sclerosis. This was considered to be a normal variant. X ray cervical spine in neutral, flexion, extension and open mouth view was taken which showed posterior osteophytes at C5 with reduced disc space C5-C6. findings were consistent with cervical spondylosis.

Disposal of the case

After third episode of vertigo which occurred during flight, patient was treated for URTI and sinusitis. He was not permitted to fly till investigated thoroughly at IAM. After complete investigations no definite cause of vertigo could be detected. During

period of investigation even after repeated valsalva, he remained asymptomatic. Findings on CT scan and X-ray cervical spine were considered non-contributory. Two of the attacks of vertigo were precipitated by valsalva and there was a significant history of URTI during all the episodes. Keeping in view the history and clinical investigations aircrew was placed in low medical category A3G2 (T-24). He was considered temporarily unfit for instructional duties, but fit to fly helicopters with experienced pilot, was reviewed along with executive report in Oct. 97. He was awarded A2G2 (T-24).

Scientific background

Regardless of its causes vertigo is always an undesirable experience for an aviator. Vertigo has been assumed to be due to central nervous system pathology, oculomotor disorders, malfunction of the vestibular apparatus either perilymph or its central connections, Acoustic Neuromas or of vascular origin. The vertigo of varying degree occurs in a syndrome associated with 'fatigue on rest' headache, blurred vision, nausea, tension and irritability which is due to locally asymptomatic unerupted impacted teeth [1]. One fifth of the cases of vertigo may be of psychogenic origin [2]. Ildiz brought out that vertigo in aircrew can also be caused by tullio phenomenon [3].

In the year 1896, Alt found out association of positive pressure in the middle ear with Caisson workers, but in flying environment vertigo was recognised only in 1937 [4]. Vinacke 1948 [5] made an attempt to define Aviator's Vertigo by conducting interviews with pilots. Aternobaric vertigo is relatively a new term being first used by Lundgren in 1965. Earlier it was called by John [6] as pressure vertigo. There are few references in literature

related to Alternobaric Vertigo (ABV). It may be an unimportant cause of vertigo in an average man on street, but it is very real and not uncommon occupational hazard among flyers. Studies of John in 1957 indicated the incidence of ABV as 10% whereas Lundgren and Malm's survey in 1966 [7] found it to be 17%. This trend supports the view of Wicks [8] who concluded that with the increasing capabilities of aircraft to attain faster rate of ascent or descent, the incidence of ABV may be on the rise. The incidence of this entity in IAF is not known. Rao et al [9] has presented similar case of vertigo who was diagnosed early and after giving adequate definitive therapy was reflighted.

Eidelman [1] in his paper discussed four cases where he found vertigo to be of dental origin. Lawrence [10] concluded that the most common contributory factor for ABV is URTI or the sequel of chronic inflammation. It has been found that 70% of the cases of ABV are associated with URTI whereas the rest may require a higher pressure differential than the normal between the middle ear and ambient to open the eustachian tube and vent out gases to ambient. Studies of Lundgren [7] have suggested that explosive increase in middle ear pressure is much more likely to increase both the severity and frequency of symptoms. Wicks [8] has reported seven cases from USAFSAM who were discharged with the diagnosis of ABV and has discussed the common characteristics of these cases. From operational point of view it is pertinent to note from his review of these cases that all seven of them received waiver after evaluation. Brown 1971 [11] has reviewed the experience the USAFSAM with vertiginous patients. In all the cases that were reviewed, the duration of attack rarely exceeded 30 seconds. Only one case where it lasted for several minutes, pilot was found to be hyperventilating. Benson [12, 13] has also brought out that if the at-

tack is mild it may persist for a longer period. It was noticed from the review of cases from literature that vertigo nearly always occurring when there some hesitancy or difficulty in clearing the ear.

Most widely accepted theory for the causation of ABV is stimulation of the endolymph through the oval window by movement of the foot plate of the stapes due to sudden pressure rise in the middle ear space. Normally expanding air in the middle ear space readily escapes due to the action of the eustachian tube as one way valve favouring flow of air from the middle ear to the nasopharynx. If any difficulty in releasing this pressure then significant pressure is created in the middle ear leading to the symptoms. The dominant symptoms of vertigo strongly suggest that the ampullary receptors of semicircular canal rather than the maculae are stimulated.

Discussion

This patient, a qualified flying instructor reported to squadron medical officer after getting an attack of vertigo in air subsequent to two on ground, when he realized that it could have compromised flight safety. Two episode were not reported due to fear of loss of flying category. It is therefore important on the part of the squadron officers to develop such kind of rapport with aircrew so that they consider him as a personal physician and can confidently come forward with such ailments which could prove potentially life threatening during flight.

It is pertinent to note that all the three episodes were associated with URTI and two of these were precipitated with forceful Valsalva. This case thus exhibits what is considered as the most common contributory factor to ABV, i.e., URTI. The symp-

ptoms can occur either with gradual rise of pressure in the middle ear as in case of flying or sudden rise while performing Valsalva even on ground thus adding to diagnostic dilemma if history is not elicited properly. In the literature reviewed it was found that cases are almost always associated with common cold or URTI [8, 10, 11]. This indicates that vertigo is a potential complication of URTI and it should remind every aircrew and medical officer of the admonition "Do not fly with a cold". The danger of ABV is that it occurs suddenly at critical time of flight and stays for sufficiently longer time to endanger safety of the mission.

Any case who suffers from vertigo in air needs thorough evaluation to rule out any organic cause as vertigo induced by certain alteration in the air pressure within the middle ear may represent a combination of physiologic response with the pathologic process. The absence of objective findings does not preclude the existence of a true vertiginous disorder. This has a special importance in aerospace medicine, where the problem of malingering and psychogenic disorders as a result of hazards of flying have peculiar significance. In no other clinical disorder is the medical history more important than in the evaluation of vertigo and dizziness. Luxon [14] in his review has described a simple methodical approach for accurate diagnosis and management of vertigo.

On caloric stimulation in this case symptoms of vertigo were reproduced. It can thus be said that pilot experienced symptoms of vestibular end organ stimulation during episode [10, 13]. Symptoms did not recur even after repeated valsalva on ground. It was presumed that cervical spondylosis in this case was a coincidental finding and did not contribute towards causation of symptoms. Any such case reporting for evaluation should be thoroughly

investigated at the first instance so that the final diagnosis could be arrived at and necessary waiver in case of ABV may be considered after required observation.

The treatment of alternobaric vertigo is preventive. Also avoidance of flying during common cold and URTI which can produce nasopharyngeal congestion with difficulty in ventilating the middle ear, is very important. When an aircrew is flying after recovering from episode of URTI he should be advised to equilibrated pressure in the middle ear in small instalments frequently rather than allowing greater pressure build up. This can help preventing the episodes of such vertigo.

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