Alternobaric vertigo

Faruk ILDIZ[1], Turgut ÖNDER[2], Ahmet DÜNDAR[2]

[1]Aerospace Medicine Center, GMMA, Eskişehir
[2]Dept. of Ear Nose Throat Diseases, GMMA, Ankara-TURKEY

The incidence of alternobahc vertigo (pressure vertigo) which may occur due to pressure changes in the middle ear has been investigated on 100 active Turkish Air Force pilots. In order to find out in what subjects this disorder with negative effects on flight safety is involved, a special questionnaire has been addressed to the pilots and the results statistically evaluated. Considering both the data obtained from questionnaires and the scant literature on the matter, some Information on the aeromedical significance of and preventive measures to be taken for alternobaric vertigo, which is a high risk factor in flight are presented. [Turk J Med Res 1993; 11(3): 151-154]

Key Word: Alternobaric vertigo

For a long time, it is known that sudden and short-term vertigo occurs by enlargement of middle ear gases in respect to changes in atmospheric pressure. However, until now, it could not be possible to verify in which mechanism sudden pressure changes in middle ear stimulate the ampullar receptors in semicircular canals. On the other hand, it is thought that positive pessure in the middle ear had vertigo occur by stimulating vestibular system through intact oval window (4,7).

The incidence of alternobaric vertigo (ABV) is more frequent in divers than the others. Because pressure changes become more efficient in aquatic media,

ABV also occurs amongst the pilots, particularly more frequent in jets with high performance, which have the ability of rapidly rising.

ABV usually seems as involuntary due to increased middle ear pressure during the period of rising or to equalize the negative pressure in the tympanic cavity (valsalva maneuver) as voluntar (3,4).

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Correspondence: Faruk ILDIZ
GMMA, Air and Space Medical Sience Center Department of Ear, Nose, Throat Diseases, Eskisehir-TURKEY

Symptoms generally appear due to an obstruction of Eustachian tube that is responsible of impaired middle ear ventilation. The reason of this obstruction is the moderate congestion and inflammation which result to an upper respiratory infection (1,4).

The history of the pilots are typical. Vertigo suddenly occurs following a forceful Valsalva maneuver which was referred to relieve the feeling of fullness in both ears and ends in a few seconds. As soon as vertigo (one or few) disappears, pilots feel normal. In some cases, vertigo does not vanish totally, lasts as less uncomfortable. In this occasion, from the view of perilymph fistulae has to be investigated (2,6).

The aim of this study is to determine the ABV incidence amongst the pilots in Turkish Air Force and to present the very important knowledge which related to this subject.

MATERIALS AND METHODS

This study consisted of 100 pilots who were admitted to The Gülhane Military Medical Academy, Aerospace Medicine Centre (Eskişehir) for periodic examination. After having modified a questionnarie, which was previously prepared by Lundgren and Malm (9), it has been delivered to the pilots. All pilots have been examined as periodically because they are not allowed to fly when they have any disease which effects middle ear through the Eustachian tube. The responses have been cumulated by face to face interviews.

A. How long did you fly totally?
B. How long did you fly jets?
A. Have you ever had a vertigo during any flight?
B. If yes, do you tell this feeling as more detailed?
C. Did the vertigo effect your flight in a negative manner?
D. How many times have you had vertigo in your flight?
E. How were the atmospheric conditions when you had vertigo?
F. Have you had vertigo while losing altitude or going up?
G. What were your altitude and speed?
H. What kind of plane have you flown?
I. Have you ever had vertigo after landing following any flight?

A. Is there any relation between your vertigo and some factors like heavy smoking, overfeeding, hunger lack of sleep?
B. Were you sick before or after this vertigo ?
C. Did this vertigo have any relation to another disease?
D. How long do not you fly when you get a common cold?
£. Do you have any ear problems when you get a common cold?
F. Have you had any trouble when you just recovered from a common cold?
G. How often do you get common colds annually?
H- Ha ve you ever suffered any E. N. T. opera tion ?
A- What do you do when you have a fullness in your ears on flights?
B. Do you feel any difference in your ears when you perform the maneuver?

RESULTS

The mean age of this study group is 29. Total flight time was 1800 hours, while jet flight time of pilots was 1450 hours in average.

In our centre, some knowledge about the physiology of flight are densely instructed to the pilots during the periodic examinations. For this reason, we observed all the pilots as not unfamiliar to the vertigo. We spent a great attention and also profited from cumulations of experienced pilots to exclude some perception mistakes which can occur during the flights in nights and cloudy weathers. The vertigo which occur due to the efforts to equalize the difference between middle ear and atmospheric pressure were taken into consideration. Thus, of 100 pilots, 12 (12%) were determined as ABV. It was also observed the pilots who previously suffered ABV have never forgotten this experience. Of 12 cases, 8 while going up, 4 losing altitude had vertigo. It was noticed that 10 (83%) of these cases had flown when they had common could. 9 of them had vertigo while trying to equalize the pressure of the ears. The detailed summary of the answers to the questionnaire is presented Table 1.

DISCUSSION

The incidence of ABV was found as 10% amongst the pilots in a study by Melvill Jones in 1957. According to Lundgren and Malm (9) this ratio was 18% in 1966. We determined the ABV incidence for Turkish jet pilots as 12%. Inspite the fact that there is a scant literature on this matter, generally the incidence seems in the range of 10% to 18%.

Statistical analysis of data, obtained from questionnaire form

	Cases with ABV %		Cases without ABV %	
pe nence	12	100	88	100
	9	75		
	3	25		
s				
nd	10	83		
nd	2	16		
oing up	8	66		
ing altitude	4	33		
meters	9	75		
meters	3	25		
meters				
common cold (annually)	10	83	28	37
or more common cold (annually)	10	83	20	51
Jring the common cold	10	83	32	36
to perform Valsalva				
the flight	9	75	35	39
iaptnenoe between the ears in the sition of the pressure	6	50	8	9

Using only face to face interviews, it may seem difficult to detect the existence of a rational vertigo without any objective or subjective test method. However, as it was mentioned previously, the instructions about vertigo for the pilots during regular physiology training, such as an unpleasant sensation and feeling the negative effect of ABV on the flight safety become enough to determine this kind of vertigo. Nevertheless, a few cases hava mentioned that thes felt vertigo dueto ahter causes. Nevertheless, a few cases have mentioned that thes felt vertigo dueto ather causes. These occurred as three dimensional orientation disorders like head movements during the instrumental flight or rotations, long-term rotation movement, long-term linear changing, head movements when the 'G' power increased.

We found a highly significant relation between common cold has been reported as an important etiologic factor in the studies of Jones, Lundgren, Malm, Wicks (7-10). Moreover, in the group with ABV, the incidence of common cold is greater than those without ABV ($p<0.05$).

As it is understood from these statistical result, disintegrating the permeability of the Eustachian tube due to common cold and consequently the difficulty of equalizing the pressure is an important auxiliary factor that causes vertigo.

Dhenin reported that sudden pressure increasing in middle ear would not be an important role in the etiology of ABV, because even every small changes (400 Pa/sec) in atmospheric pressure will cause to appear some symptoms in sensitive individuals. The same author has also mentioned the amount of asymmetry in the pressures of both middle ears which come into existence from the difference of opening pressures both left and right Eustachian tubes an asymmetric response which originates from semicircular canals have important roles in the etiology of ABV (4). We noticed a difference in the pressure equalization of both ears which supported Dhenin hypotheses statistically (<0.01).

Of all cases, 75% has mentioned they have flown with high speed between 0-3000 meters altitude when ABV appeared. Data, obtained from principal textbooks, confirmed our findings (4,5). For this reason, ABV clearly seems to be a potential danger especially for the pilots who fly with F-5 and F-104 planes, which have lower engine power, speed and motion ability. This situation was noticed by the pilots who included this study.

During the alternobaric cabin applications, 150 pilot candidates in 1992, because of pilotage examination, ABV was seen in only two cases, Lundgren and Malm have mentioned the pressure application on ground media has less importance in regards of ABV risks (9).

The treatment of choice for ABV is prevention. For this reason, the pilots should be knowledged about the nature of the event, how it happens and how an important risk it carries.

Although it is instructed the objections of flying in presence of common cold, due to some reasons like career and to provide the continuity of duty, this event can not be hindered. Taking this reality into consideration, the pilots have to be instructed that the ears should not be aired during the elevation and avoid from forceful Valsalva maneuver.

When the ABV occurred, behaviors of pilots were not known. It means we do not know how to get over this event keeping the flight safe when the pilot faced with vertigo. For this reason, we do have any prevention to keep of pilots free from ABV, except giving a continuing training on the subject and stressing the importance of ABV in regards of Aeraspace Medicine to the pilots.

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Orta kulaktaki basınç değişikliği ile ortaya çıkabilen alternobarik vertigonun (basınç vertigosu) Türk Hava Kuvvetlerinde görevli 100 jet pilotunda görülme sıklığı araştırıldı. Uçuş güvenliğini olumsuz yönde etkileyen bu durumun nelerle ilgili olduğunu tesbit etmek amacıyla pilotlara verilen anket formundan alınan sonuçlar istatistiksel olarak değerlendirildi. Gerek anket formundan çıkarılan sonuçlar gerekse bu konu ile ilgili çok az sayıdaki literatür bilgisinin ışığı altında, uçuşta yüksek risk faktörü taşıyan alternobarik vertigonun uçuş hekimliğindeki önemi ve ortaya çıkmaması için gereken önlemler ile ilgili bilgiler sunuldu.
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