Original Article

IN-FLIGHT BARODONTALGIA AMONG COMMERCIAL AND MILITARY PILOTS OF PAKISTANI ORIGIN.

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Abstract

Background: Barodontalgia is defined as oral pain occurring due to changes in ambient pressure. It can be severe enough to cause inflight incapacitation and has a tendency to go undiagnosed in regular sickbays. There is a large variation in incidence of Barodontalgia in the literature and major fraction of epidemiological data on Barodontalgia has been compiled from military flight simulations. The aim of this study was to document the frequency of in-flight Barodontalgia in Pakistani military and civilian aircrew.

Methods: A cross-sectional study was conducted on (non- patient) civilian as well as military pilots. Subjects were given standardized and anonymous questionnaires to complete regarding demographic and professional characteristics, occurrence of oral pain during flying, character of pain, treatment seeking and recurrence of the pain.

Results: Out of the 100 subjects, 51 responded (response rate of 51%), with mean age 30.31 ± 5.634 Years; 17.6% (09) of these participants (All Civilian) reported at least one event of barodontalgia during their career. A total of 88 %(8/9) of pilots visited their dentists after they had oral pain. The diagnosis rendered by their dental surgeons was always dental pain. None of the patients reported recurrence of the disease or premature mission termination due to dental pain. None of the military Pilots reported a n y e v e n t of Barodontalgia.

Conclusion: Barodontalgia was reported exclusively by commercial pilots, which was of a minor non-recurrent nature and did not disrupt their health or flight routines.

Keywords: Aviation dentistry, human performance barodontalgia, flight safety

Introduction

Ever since the Wright brothers invented the aero plane, flying has only become safer. Aviation sector has expanded with increasing numbers of aircraft, air passengers, pilots and air crew. Dental surgeons encounter Barodontalgia as an emergency (1). Barodontalgia is a dental pain evoked by changes in barometric pressure in an otherwise asymptomatic tooth. Inhospitable flying environment along with ambient pressure changes affects oral & maxillofacial region which might cause pain or trauma affecting air crew, aircraft passengers as well as aviators. It has been shown to adversely affect personnel's operational capability and performance. In some instances, Barodontalgia has been identified as the only cause of an aircrew member suddenly becoming incapacitated, thus hazardously compromising the safety of the affected person as well as others (2).

The incidence of barodontalgia in aircrew has been reported to vary from 0.26% to 49.6% (3,4). It is ranked fifth in the physiological complaints of the trainees, and third as a causative factor of premature cessation of simulation(4). Israel has reported no difference in incidence of Barodontalgia between aircrews of uncompressed helicopters, semi compressed fighter aircraft, and compressed transport aircrafts (8.0%, 9.0%, and 7.0%, respectively) whereas Spanish reports indicate aircrew of compressed aircrafts (5.1%) suffers more than that of uncompressed aircrafts (0.7%) (5).

Barodontalgia has been known to occur across a broad range of altitudes (1). It has no predilection to any age group. Several factors have been hypothesized that make teeth susceptible to barodontalgia such as circulatory disturbances in an abnormal pulp, expansion of trapped air bubbles under a root canal ?lling or against dentin that activates nociceptors; stimulation of nociceptors in the maxillary sinuses, with pain referred to the teeth; and stimulation of nerve endings in a chronically in?amed pulp. Kollman has reported histologic evidence of chronic pulpal in?ammation even when a thin dentin layer covers the pulp, for example, as in a fairly deep cavity preparation. Barodontalgia have been scrutinized for many years, researchers have concluded that pressure gradient is only a contributing factor, not the actual cause of the problem (4).

Despite the rarity of phenomenon, Barodontalgia remained area of interest for dental practitioners for the reason that due to a wide spectrum of attributing factors it is very important to investigate and find the exact underlying cause; but those who tried to look for more relevant data needed to rely on literature from the first world war era due to subsequent loss of interest in this problem till revival of research in last decade of 20th century. Barodontalgia as well as other byproducts of flying remained an issue for concern. As a result Medical and Dental services underwent significant change in delivery of care; in developed countries changes in doctrine/ policy called for emphasis on prevention. Primary focus moved from reactive treatment-oriented approach to more efficient proactive prevention-based system(6).

USAF Dental Services Program 1999 emphasized on prevention and efficient disease management aimed to raise oral health and dental readiness of air force personnel. The Canadian Forces Dental Care Program developed in 1983 revised in 1990, 1992, 1997, and 1999 was aimed at high risk prevention that ultimately resulted in adoption of requirements management (including Selection, Screening, and Reporting, Documentation, Diagnostics, Investigations, prioritization, Planning and Outcome auditing)(6).

Literature search did not reveal any published studies on this topic from Pakistan, thereby resulting in a total gap of knowledge related to this important disease, which has great relevance for the national aviation industry. One cannot decide whether this problem is hampering the smooth operations of flights or that it has been considered in the routine training or health safety protocols of pilots in Pakistan.

The objectives of this study were to estimate the current in-flight incidence of Barodontalgia among Pakistani military aircrew members and commercial crew at selected bases and centers recurrence of Barodontalgia after treatment and Accidents secondary to Barodontalgia.

Methodology

The present survey was conducted at a pre authorized air base and airport in Pakistan on healthy Military and Commercial pilots based on data collected from March 2016 to April 2017. An exclusive questionnaire was designed in English and a pilot test was carried out on five subjects. After minor changes a self-administered questionnaire was administered to 100 subjects with incorporated questions regarding Age, Gender, Type of Flying (Commercial/Fighter), In Flight Pain, Type of Pain, Treatment seeking, Performance limitation and recurrence. Informed consent was obtained from subjects through an information sheet which explained the nature and reason of study. Anonymity was maintained by excluding the names or any other identification. No subjects fewer than 18 years and above 60 years were included. A total of 100 questionnaires were distributed 50 among each category. The collected data were analyzed for descriptive data using the IBM Statistical Package for Social Sciences (SPSS) program version 22.

Results

The response rate was 51%, out of which 31(60.8%) subjects were engaged in civilian commercial flights and 20(39.2%) in military flying (Table 1).

Table 1. Demographic data of military and commercial pilots (n=51).

Variables	Military (n=20)	Commercial (n=31	Total	P value
Gender				
Male	20	23	43	0.013
Female	-	08	08	
Age Groups				
20-30	16	16	36	0.235
31-40	06	12	18	
41-50	0	03	03	
History of Past Dental Treatment				
Yes	09	20	29	0.139
No	11	11	22	
Barodontalgia				
Yes	0	09	09	0.007
No	20	22	42	
Recurrence of Pain				No Statistics
Yes	00	00	00	are
No	20	31	51	Computed

The age of the pilots ranged between 20 and 60 years with the mean age of 30.31 ± 5.63 years. Male subjects were 43 (84.3%) and 08(15.7%) were females. Incidence of Barodontalgia was reported by 09/31(29.03%) of the civilian commercial pilots at least at one point in time during their activities (Figure 1), and was not reported by any of the military pilots, thereby giving a figure of 17.64% of the total subjects. All of the pilots visited their dentists after they had episode of Barodontalgia. No Recurrence of tooth pain after treatment occurred during their practice. No accident/in flight emergency secondary to Barodontalgia was reported by respondents.



Figure 1: Pie chart showing distribution of cases of barodontalgia among commercial personnel (n=32).

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Figure 2: Scatter graph of Number of Flying Hours and Barodontalgia among Commercial pilots (n=31), showing a significant negative linear correlation (r= -0.642, r2 = 0.42, p<0.001).

Discussion

This pioneer study was conducted to document the incidence of barodontalgia among civilian and military pilots in Pakistan at selected air base and airport. Considering the size of population in other studies such as that of Fleury et al(7), Kollman et al(4), and Gonzalez Santiago(8) the present sample may seem small, but this is because it was conducted in one single airbase and airport. A positive aspect of the study is that the obtained results are from real flights whereas most of the other studies have results obtained from flight stimulations.

The proportion of pilots (Civilian and Military) at selected bases that have already experienced barodontalgia was 17.64% collectively. However, the data showed that there was a higher incidence of barodontalgia in commercial pilots (29.03%) as compared to military pilots (0%). The results are consistent with some previous studies such as Rai et al (9) who determined prevalence rate of 20.6% in Indian origin commercial pilots, whereas Laval Meunier et al (10) estimated barodontalgia in 59.5% of French commercial pilots. The reason for increased prevalence of phenomenon among commercial pilots might be that it is assumed that commercial pilots are usually subjected to less rapid maneuvers and extreme situations than their military counterparts; it is assumed that they are less vulnerable to the pathologic consequences of rapid pressure (13).

In this study, no case of barodontalgia was reported among military pilots, which is in accordance with some past studies. In a study Kollman et al (4) recorded incidence of 0.26% in German air force crew whereas in a research conducted by Gonzalez et al (8) among Spanish in-flight personnel who underwent the obligatory official examination at the Straits Air Command Hospital estimated 0.3-2.6% prevalence of barodontalgia. Cumhar Sipahi and colleagues has reported 0.003% prevalence among four air base pilots of the Turkish air force (12). The results were divergent from other studies done by Wadha Al-Hajri and Ebtissam Al-Mad who computed it to be 49.6% among pilots in Saudi Arabia and Kuwait (3). Khawalde MA figured that 10.49% of the Jordanian air force pilots had experienced barodontalgia at least once during their activities (13).

The discrepancies between studies may be due to the definition of barodontalgia used in questionnaires, sample size variation, genetics, differences in inclusion and exclusion criteria, or differences in cultural and ethnic backgrounds. Kollmann(4) has advocated for greater incidence than that actually estimated since there are patients who do not report small incidents of barotraumas for fear of refusal of flying certificates and compromises in career. Although during the present study it was noted that all pilots undergo pre-flight checks, and regular dental screenings, the real difference in groups is in relation with performance of dental prevention programs in pilots and air crew members.

Questions regarding pain, its characteristics and premature landings

due to it were made. Kennebeck R(10) has reported oral pain to be the third causative factor for premature mission cessation amongst personnel of USAF where as in all 13.5% of the cases reported by Laval-Meunier et al(14) the participants reported that their oral pain had a significant effect on ?ight safety. On contrary in the present study no accident/premature landing due to pain was reported but the description of pain is more of academic interest than clinical relevance; this finding agrees with the assertion made by Seone et al (15) who stated that pain could be incapacitating for patients. This involves a special risk in situations with a single crew member or in a situation where due to the characteristic of mission, atmospheric conditions, ground relief and landing is not possible. This issue may justify the establishment of systematic and recurrent prevention programs and strict directives for dental care. Another justification for it is the prospective study of Sipahi et al. (12) who have reported a low frequency of barodontalgia as result of the close medical and dental follow-up that the pilots received in that study. Systematic check-ups were performed before every ?ight and the pilots having dental problems detected were not allowed to ?y. This con?rms the critical role of dental prevention programs in the prevention of barodontalgia.

The most important piece of information was perhaps in all the cases once toothache was treated it never recurred, whereas recurrence rate of 16.4% was reported by Wadha Al-Hajri & Ebtissam Al-Mad(3) and 10.2% by Rai(9) and colleagues; this difference points to optimal standards of care in both military and commercial industry. It could also reflect the underlying cause as being tooth disease rather than atmospheric or flying conditions. This would also agree with the fact that military pilots have more stringent and regular dental checkups and a strict fitness criteria thereby having healthier oral health.

Conclusion

Barodontalgia was reported exclusively by commercial pilots, which was of a minor non-recurrent nature and did not disrupt their health or flight routines.

Recommendations

Dental Surgeons should be well informed of barodontalgia and use of preventive measures (check-ups, prophylactic scaling and oral hygiene education). It is recommended that more studies specific to air flight centers be performed to estimate the full extent of the problem, the factors affecting the incidence and translate the preventive measures into practice; furthermore to improve the understanding of barodontalgia, its pathogenesis, prevention and treatment. The implementation of large prospective cohorts is necessary for long-term follow-up of the participants. Finally, before researchers can provide tools to predict barodontalgia, thorough periodic clinical and radiographic oral and dental examinations are necessary to reduce the occurrence of barodontalgia in pilots and crewmembers.

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