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Research Article

**A CROSS-SECTIONAL RESEARCH TO ASSESS THE  
COMMON OCCURRENCE OF VARIOUS EAR RELATED  
COMPLICATIONS AMONG DIVERS****<sup>1</sup>Dr. Rehan Raza Shan, <sup>2</sup>Dr. Mahrukh, <sup>3</sup>DR. Hafiz Muhammad Hammad Amin  
<sup>1</sup>UHS****Article Received:** September 2019    **Accepted:** October 2019    **Published:** November 2019**Abstract:**

**Objective:** The purpose of the research was to conclude the commonness of variant ear complications among divers as well as the contributory elements of these complications.

**Material and Method:** This cross-sectional research was carried out at UHS, Lahore from April 2018 to December 2018. The numbers of divers selected for research were one hundred, selected through successive sampling. The entire enrolled divers were assessed and interviewed followed by preformulated questionnaire by the interviewer.

**Results:** On the whole, the prevalence of ear complication was fifty-four percent including deafness, barotraumas and infections. Those divers having much experience of diving, face additional ear complication with respect to others. It was almost eight percent in those divers having the diving skill of one to eight years, thirty-two percent in nine to sixteen years and almost sixty-six percent in those divers having service experience as a diver for more than sixteen years ( $P < 0.001$ ). There is a relationship between diving experience in years and hearing failure. Prevalence of ear complication was additional in smokers (58%) with respect to nonsmokers (26%) and it was identified as statistically important ( $P < 0.004$ ). Main contributory element to the ear complication includes diving after prolong duration and infection of the upper respiratory tract.

**Conclusion:** Prior to the diver's selection, detailed medical checkup should be conducted for prompt detection and obviation.

**Keywords:** Inner Ear Barotraumas (IEB) and Deafness.

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**INTRODUCTION:**

Diving is a major hazardous factor for inner ear [1]. Inner ear decompression, as well as IEB, developed constant deafness, vertigo and tinnitus. If auditory functionality is only calculated by air conduction, there are the chances that the lingering injury of the middle ear barotraumas, that is a most frequent disaster in diving might affect the findings of ear test [2]. Multiple of the research concerning auditory failure displayed a connection with industrial noise exposure [3]. Barotraumas concerning diving expand or compress gases inside the ear, sinuses, as well as lung, causes several kinds of neurological damages as well as ear barotraumas[4]. The variation in atmospheric pressure underwater may induce psychological transformation that might advance especially challenging symptomatic as well as complication concerning treatment [5]. The prompt and intense variation in pressure may cause injury called barotraumas and damage to tissues because of reduction and expansion of confined air space as an output of such variation in pressure, the maximum happening close to the water surface. Ear infection, as well as respiratory tract, is too dominant [6]. Inner ear injuries are comparatively less moreover can induce critical vertigo, orientation failure, vomiting as well as nausea which induces critical warning to existence underwater. In spite the fact throat, nose as well as ear complications are much common and might be life commentary, it is hard to find fact concerning to bitterness as well as mortality of nose throat and ear complication in diving [7]. A research carried out in Sweden on the complication of ear, nose and throat in diving recorded that forty-six percent of the entire medical complications in saturation diving in the Norwegian zone were concerning to throat, nose and ear issues [7].

The type of survey conducted on navy divers group along with one-hundred and sixty-six Malaysian nondivers was audiometry survey. The finding of the survey displayed that at frequencies of 4 kHz, 6 kHz and 8 kHz, the divers had increased average auditory level as compared to non-divers at their listening level at these particular frequencies seemed to degrade rapidly [8].

Despite the general noticed state of inner as well as middle ear barotraumas in navy divers, there are also proofs of the dangerous and constant development of sensorial listening failure related to diving [9]. The current research might be the initial measure which was taken to know the problem magnitude in Pakistan and the causes responsible for the particular problem. The purpose of the research was to conclude the

commonness of variant ear complications among divers as well as the contributory elements of these complications. The research could also induce understanding among navy divers concerning various diving abnormality associated to ear and their avoidance as well as prompt detection.

**METHOD AND MATERIAL:**

This cross-sectional research was carried out at UHS, Lahore from April 2018 to December 2018. The sample size was calculated by utilizing world health organization sample size calculator where the confidence level is ninety-five percent, absolute precession is ten percent and dominance obtained from the literature review was forty-six percent [7]. The sample size was ninety-six. Researcher includes those divers in his research who performing the duty of active diving having age twenty-one to fifty years with one to twenty-seven-year diving experience. Researcher excludes all those navy divers who have acute indicator such as nausea, vertigo, vomiting and dizziness etc. divers with other indications such as discharge of pus from the ear, increase in the hearing limit. Written approval was taken from entire enrolled divers; clinical checkup was carried out including systematic checkup, general physical checkup and ear assessment including pure tone audiometry, and selective tympanometry in few patients. Statistical assessment was conducted by utilizing SPSS software. Average and SD was measured for quantitative facts such as body mass index, age and gender and experienced time period categories. Chisquare examination was utilized to test the importance of qualitative facts P value is less than 0.05 was taken as statistically important.

**RESULTS:**

The numbers of divers enrolled for research are one-hundred with twenty and forty-eight years of minimum and maximum age respectively. The average age of enrolled divers was 31.5 years. The percentage of divers having age twenty-one to thirty years was 34% whereas sixty-two percent divers were between thirty-one to forty years and just four divers were having age between forty-one to fifty years. No diver was identified as overweight after calculation of BMI. BMI was measured in height and weight factors. The ratio of the divers identified as overweight were thirty percent having BMI in between (25 to 29.99). The ratio of divers having ear issues was thirty-three percent as well as thirty-four percent divers have ear complication with normal weight. No connection was identified between Basal metabolic index and ear entanglement =s with (P >0.05).

The entire enrolled divers of the research having experience in between 1.5 to 27 years average skill was twelve years (standard deviation = 5.88). The substantial association was identified between diving skill and ear complication with ( $P < 0.001$ ). The rate of divers having nil ear complication of the ear was eight percent whereas ten percent of divers forget about it and just ten percent remembered about previous ear complication. Ninety-six percent of the divers have been assessed by the specialist within one year whereas just four percent had a final medical assessment for more than one year earlier. Thirty-two percent divers had a record of middle ear squeeze. The ratios of the divers having upper respiratory tract infection were sixty-nine percent. Valsalva manoeuvre was not accurately performed by thirty-one percent divers.

The ratio of the divers experiencing from tinnitus was eight percent among them fifty percent were having an infection of the upper respiratory tract whereas twenty-five percent experienced few related auditory issues. Fifty percent of the divers go to the concerned specialist for medical instruction. Two percents of the divers undergo from vertigo. Both of them had linked

tinnitus, infection of the upper respiratory tract, and also attempt to clear ear forcibly. Indication developed promptly just after dive and ten meters is the utmost depth of the dive. Discharge of pus was recorded in four patients and no diver applied earplug for ear protection while diving.

The ratio of smokers divers were 24% among them greater numbers utilized five to twenty cigarettes routinely. The ear complication was detected in fifty-eight percent of smokers divers however just twenty-six percent of the non-smokers divers have ear complication with ( $P = 0.004$ ).

According to the claim of 35% of diver's co-existing infection of upper respiratory multiple hazards of ear issues. Thirty-percent of the divers has a concern that untrained divers who could not perform Valsalva accurately have a dominance of ear issues, and twenty-seven percent of the divers were not familiar with any specific factor associated with ear issues. Otoscopic evaluation displayed older healed scars in four percent divers. Four percent divers had an aberrant hearing displayed high frequency auditory failure in 4 to 8 kHz frequencies.

**Table – I:** Age and smoking status wise stratification

Age (Years)		Ear Problem	No Ear Problem
Age	1 to 8 Years	2	24.0
	9 to 16 Years	16	34.0
	Above 16 Years	16	8.0
Smoking Status	Smokers	14	10.0
	Non-Smokers	20	56.0

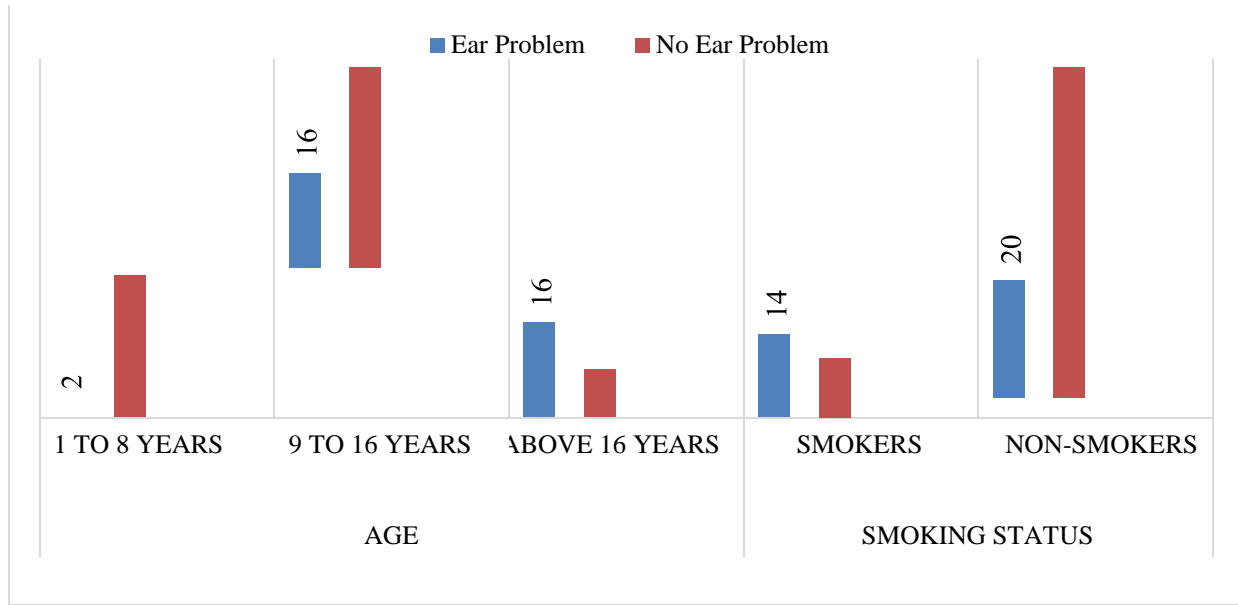
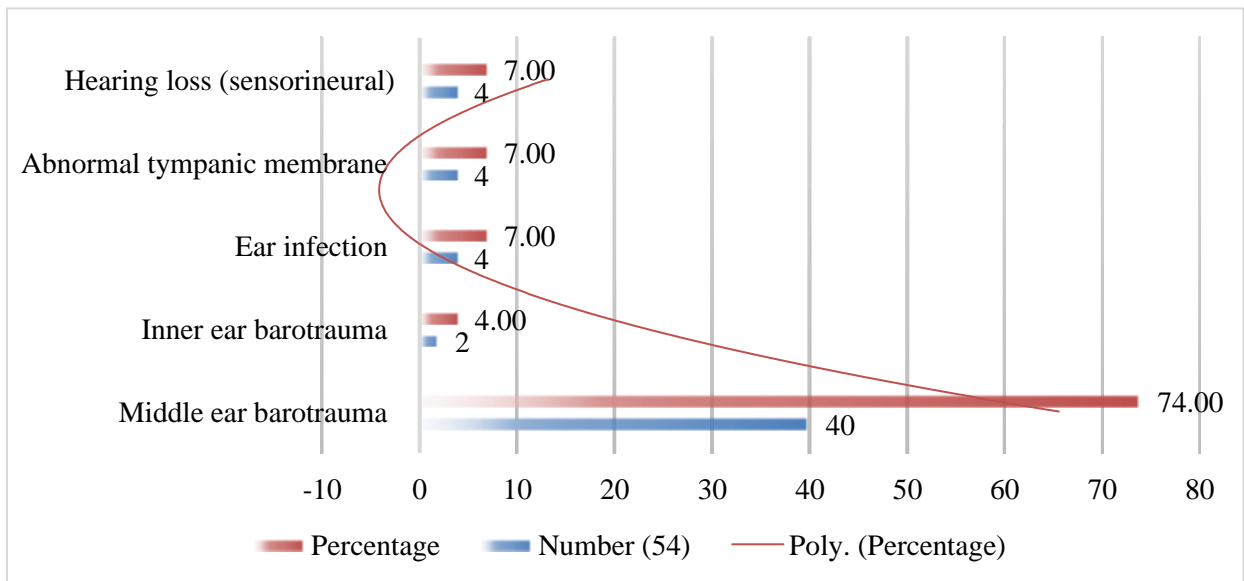


Table – II: Stratification of Ear problems

Ear Problems	Number (54)	Percentage
Middle ear barotrauma	40	74.00
Inner ear barotrauma	2	4.00
Ear infection	4	7.00
Abnormal tympanic membrane	4	7.00
Hearing loss (sensorineural)	4	7.00



**DISCUSSION:**

The age of the enrolled divers for research was thirty-one to forty-eight years with thirty-one year of average age. Nil divers were identified as fat or underweight. Just thirty percent of the divers having a broad metabolic index of 25 to 29.99, however in additional research conducted on Australian divers identified forty-seven percent of the divers as overweight. In the current research, 1.5 to 27 years was the minimum and maximum duration of service as a diver. Twelve years is the average service as divers. With respect to diving skill, twenty-six percent of the divers were in one to eight years category, fifty percent were between nine to six years and twenty-four percent were more than sixteen years category. Distribution of various ear complication among these groups was eight, thirty-two, and sixty-seven percent respectively with (P-value <0.05). Our composed information assists the facts that the ear complications are much frequent in unskilled divers who might not accomplish Valsalva manoeuvre accurately or inexperienced diver's respiratory mucosa function are decreasing steering to respiratory congestion.

In current research, fifty-eight percent of the smoker's divers had the previous record of ear complication whereas twenty-eight percent of nonsmoker's divers had the same ear complication history.

This assists the evidence already concluded in former literature. Smoking adversely affects the respiratory mucosa where its play important role in ciliary movement dimensions as well as secretion retentiveness. This magnifies the risk of infection of the respiratory tract as well as Eustachian tube barriers which is a major factor of ear complication concerning to divers.

Eighty percent of the divers profess that there was no earlier record of ear complication whereas ten percent of divers did not recall it and just ten percent memorize it. Thirty-two percent of the divers in the current research had the previous record of middle ear squeeze, whereas one additional research conducted on the limited state as well as Australian divers it was approximately fifty-two percent [11]. Indication of barotraumas of the middle ear appeared in 80% divers. Moreover, no diver displayed any symptom of the rupture of the tympanic membrane. The ratio of the tympanic membrane rupture and ear barotraumas in the research conducted in the USA as well as Australian divers were (54%).

An ear issue was identified in fifty-four percent of the divers. In one additional research performed on UK

divers, the middle ear infection prevalence was 37.3% [12]. Earplug for protection of ear while diving was not utilized by any diver. Otorhinolaryngologic assessment displayed alders healed scars in four percent divers. Some of them were having the previous record of pus discharge from ears. These were results which verified infection of the middle ear in divers. These two divers also have experience of dysfunction of Eustachian tube. Four percents of the divers had an aberrant audiometry displaying high frequency auditory failure in 4 KHz to 8 KHz frequencies that is an indication of sensorial deafness. There was nil former record of any additional ear issue as well as nil divers were overweight as well as smokers among four percent of these divers.

This obviously indicates that there is a correlation between diving experience in the year and sensorial hearing failure. These findings were coherent with one additional research result [13]. A research performed on Malaysians navy divers displayed that insidious development. High-frequency sensorial failure could be connected with diving. In that research the divers had risen in average auditory level at 4KHz, 6KHz and 8KHz frequencies as compare to non divers, moreover, their auditory level assumes to be deteriorated promptly on these frequencies [14]. One additional follow the research on low as well as high exposure divers displayed the connection between left ear auditory failure of 6000 Hz to 8000 Hz frequencies and total diving years [15-17]. The hearing failure evaluation displayed a number of factors and might be associated with securing lesser inner ear barotraumas [18].

**CONCLUSION:**

The current research is might be the initial measure which was taken to know the complication magnitude in Pakistan and the cause's responsible for the particular problems. Prior to the diver's selection, detailed medical checkup should be conducted for prompt detection and obviation.

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