

# Sensorineural hearing loss in patients with coronary artery bypass surgery

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## Abstract

**Background:** This study is planned to obtain a better understanding of the correlation between sudden sensorineural hearing loss and cardiopulmonary bypass. There are many causes for sudden hearing loss which include infectious, circulatory, inner ear problems like meniere's disease, neoplastic, traumatic, metabolic, neurologic, immunologic, toxic, cochlear, idiopathic (unknown cause) and other causes. One of the less common cause is surgery include cardiopulmonary bypass procedures.

**Materials and Methods:** This study is a self controlled clinical trial on 105 patients that was carried out in chamran Hospital, Esfahan, Iran. Participants were including all those patients undergoing coronary artery bypass surgery in the hospital who fell under the criteria for inclusion. Patients underwent audiometric testing at our hospital on three or two different occasions during the course of this study, Initially before the procedure to test the baseline hearing capacity; then two week after the procedure to assess any changes in hearing ability following the surgery. Data analysis performed by co-variance analysis.

**Results:** In our study the changes in the threshold of hearing in frequency of 1000 in right ear and in frequencies of 2000 and 4000 in left ear were significant, but this changes were about 2-3 db and were not noticeable. The difference in degree of SNHL, before and after surgery in different frequencies were been shown.

**Conclusion:** As loss of the patients with symptomatic sensory neural hearing loss in this study, It isn't commanded the routin auditory assessment pre and post surgery was been done.

**Key Words:** Coronary artery bypass grafting, deafness, sensorineural hearing loss, surgery

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## INTRODUCTION

Sudden sensorineural hearing loss (SNHL) is routinely encountered by the otolaryngologist. The causes are varied and often clarifiable. One of the less frequent etiologies is surgery. Apart from otological surgeries, SNHL has also been known to happen after non-otological operations under general anesthesia.<sup>[1]</sup>

In a study showed an elevated susceptibility in males

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to the development of high tone loss. Based on the preponderance of males, with high incidence of basilar artery atherosclerosis, perfusion failure and the frequent prolonged pump times seems to be the most causes for the rare cases of hearing loss following cardiopulmonary bypass surgery.<sup>[2]</sup>

This study shows that open heart surgery using cardiopulmonary bypass can lead to significant post-operative changes in hearing levels at some frequencies.<sup>[3]</sup>

Hearing loss is a rarely recognized as a phenomenon. It happens more than most anesthesiologists suspect.<sup>[4]</sup>

In a study on 37 patients undergoing coronary artery bypass grafting (CABG) with or without extracorporeal circulation, hearing threshold changes were recognized in 9 Group 1 patients (45%) and 3 Group 2 patients (17.65%). The difference between the groups was significant ( $P = 0.0426$ ).<sup>[5]</sup>

Sensorineural hearing loss is an extremely common disorder with a spectrum of effect ranging from an almost undetectable degree of disability to profound alteration in the ability to function in society.

One of the less common etiologies is surgery include cardiopulmonary bypass procedures the first report of this kind was made by Arenberg (1972)<sup>[6]</sup> who reported sudden unilateral deafness immediately following cardiopulmonary bypass.

Plasse *et al.*<sup>[7,8]</sup> evaluated 7000 patients and found the incidence of SNHL with aortocoronary bypass surgery to be 1 in 1000 (0.1%). In Walsteds study this phenomena was reported rare.<sup>[9]</sup> Systematic surgical revision is one of the method of identifying some of underlying cause of SNHL.

Microembolic phenomena (fat, air or particulate thrombi),<sup>[10]</sup> peri operative hypotension or perfusion failure,<sup>[2]</sup> hyper coagulable states,<sup>[11]</sup> and ototoxic drug usage<sup>[10]</sup> are some of the better recognized causes. The present study was designed to study hearing threshold change after CABG surgery.

In other study on 65 patients in Iran, Comparison of Pre -and Post-operative audiometry findings suggested no significant change in hearing for all frequencies in both ears. Difference in Hearing threshold in the right ear (at 4000 HZ) and in the left ear (at 2000 HZ) was meaningful ( $P = 0.027$ ,  $P = 0.004$ ).Hearing threshold differences at all frequencies and in both ears were less in women rather than men, the meaningful difference was only for the frequency of 1000HZ (in the right ear)

( $P = 0.03$ ) and 4000 HZ (in the left ear) ( $P = 0.034$ ).<sup>[14]</sup>

## MATERIALS AND METHODS

This is a self controlled clinical trial with consecutive sampling that is carried out in Chamran hospital, Esfahan, Iran.

All patients undergoing CABG in a 6 months period from late months of 1386 to early months of 1387.The persons were be given consent and can comply with the testing were introduced in study. They have been taken by consecutive sampling.

### Exclusion criteria in this study

1. Those who don't give consent.
2. Those that have a previous history of ear surgery, meniere's disease, vertebra basilar migraine.
3. Those that infected with Herpes zoster and herpes simplex in pri operative period. Two audiograms have been done for objective assessment of patients and one questionnaire has been filled from interviewing of the patients, for subjective analyses. The first audiogram has been done pre-operatively to assess the baseline level of a subject's hearing. The second audiogram has been done after the procedure, after two week. The History of prior hearing loss, ear disease, ear surgery, known ototoxic medication usage, tinnitus, vertigo, family history of hearing loss, noise exposure, neurological disease, diabetes, hyperlipidemia, hypertension and hypotension were evaluated The mean of data calculated With

**Table 1: The changes in threshold of hearing, before and after surgery, in different frequencies in both ears**

4000	2000	1000	500	250	F(Hz)
32.1	19.6	14.2	12.8	15.1	Right pre-op
33.5	20.9	15.9	14.8	16.5	Right post-op
2.9	19.7	14.9	13.7	14.9	Left pre-op
35.4	20.3	15.8	15.2	16.2	Left post-op

**Table 2: The difference of prevalent of patient with SNHL, before and after surgery in different frequencies**

With out hearing loss Post-op	With out hearing loss Pre-op	With hearing loss Post-op	With hearing loss Pre-op	F(Hz)
40	37	60	63	250
37	32	63	68	500
36	35	64	65	1000
47	44	53	56	2000
79	74	21	26	4000
35	29	65	71	250
31	28	69	72	500
35	29	65	71	1000
48	44	52	56	2000
75	74	25	26	4000

covariant analyses. Data analysis then carried out by Spss-15.

## RESULTS

In this study 105 patients were participated but five patients were exclude because they didn't give consent, (87 male, 13 female) The mean age of patients were 59.93.the mean time of connection to the pump was 85 minute.32 patients had DM in their history and 54 patients were hypertensive.48 patients had HLP in their past history. The changes in threshold of hearing, before and after surgery, in different frequencies in both ears have been demonstrated in Table 1. The difference in threshold of hearing in frequencies of 250 HZ, 500 HZ were significant. Also in frequency of 1000 HZ in right ear and in frequency of 4000 HZ in left ear it is significant. We considered the level of bone conduction threshold of below 20 db to be SNHL. The difference in degree of SNHL, before and after surgery in different frequencies have been demonstrated in Table 2. Although the frequencies of patient with SNHL have been increased, after CABG, but this is not statistically significant. Other variables such as age, coincident disease (HTN, DM, HLP), time of connection to the pump, had no significant effect on threshold of hearing in this patients.

## DISCUSSION

In a study by Plasse and *et al.*, The prevalence of SNHL after CABG was 1%.,<sup>[7]</sup> In other studies, prevalence of %15 have been reported.<sup>[2]</sup> In Millen *et al.*, the significant correlation between CABG and SNHL especially in high frequencies was reported.<sup>[12]</sup> In our study, the changes in the threshold of hearing in frequencies of 250 and 500 in both ears were significant and in frequency of 1000 in right ear and in frequencies of 4000 in left ear were significant. But this changes, about (2-3), were not noticeable and sever SNHL wasn't seen. In our study against millen *et al.* studies, noticeable changes were not detected in threshold of bone conduction. Doan *et al.* in their studies showed that there is not any meaningful association between CABG and SNHL.<sup>[13]</sup> In early 20<sup>th</sup> century, primary reports about SNHL after CABG were because of surgical and anesthesia techniques, today's, these techniques don't make any changes on threshold of hearing of patients. In spite of the primary reports about SNHL after CABG<sup>[7,10,12]</sup> today's, because of improvement in surgical and anesthesia techniques, CABG doesn't make any noticeable change on threshold of hearing of patients.

## CONCLUSION

The present study is planned to achieve a better understanding of the relationship between

cardiopulmonary bypass and sudden SNHL. Although, hearing loss can happen post nonotologic operations, the incidence is very low that can be due to the resolve in surgical and anesthesia methods. The factors include age, HTN, DM, HLP, time of connection to the pump, general anesthesia, micro emboli, drug ototoxicity, are as risk factor for changes in hearing threshold. As loss of the patients with symptomatic sensory neural hearing loss in this study, we don't comment that routin auditory assessment pre and post surgery was been done.

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