

## Original Research

# Noise Induced Hearing Loss in Indian Railway Loco Pilots: Are We Aware?

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## ABSTRACT

### Background

Rail engine drivers are known as loco pilots. Rail engines produce noise of around 100 dB. Loco pilots are continuously exposed to such loud noise as a result of their occupation. Hence, hearing ability is at jeopardy due to their occupation.

### Objective

To assess noise induced hearing loss in Indian loco pilots by pure tone audiometry (PTA).

### Methods

A cross sectional study which included 30 loco pilots and 50 control subjects. All were between 40-50 years. Hearing assessment was done by PTA after fulfilling inclusion and exclusion criteria. All the data was statically analyzed using SPSS software version 21. The level of significance  $p < 0.05$  was considered as significant.

### Results

The mean age of loco pilots was  $44.6 \pm 2.9$  years (Mean  $\pm$  2SD) and of control was  $42.8 \pm 2.1$  years (Mean  $\pm$  2SD). The mean pure tone average in loco pilots was  $31.5 \pm 5.5$  dB in right ear and  $30.5 \pm 6.8$  dB in left ear. Thus, loco pilot group was having mild hearing impairment. On comparing both ears threshold in the groups, the difference was statically significant ( $p$  value  $< 0.01$ ) and Pearson correlation was  $> 0.9$ .

### Conclusion

Our study shows mild hearing impairment in loco pilots. There is positive correlation between hearing loss and occupation. They are at more risk of hearing loss as compared to normal population attributable to their occupation. Safeguarding their hearing ability is a challenge.

### Keywords

Train drivers; Loco pilots; Noise Induced Hearing Loss (NIHL); Pure Tone Audiometry (PTA); Audiometric Notch.

## INTRODUCTION

Noise is acoustically formed up of several sound waves with anarchically distributed amplitude and phase ratios leading to an unpleasant sensation.<sup>1</sup> Constant exposure to loud noise results in outer hair cell damage, chiefly the basal turn of cochlea.<sup>2</sup> Worldwide, 16% of the disabling hearing loss in adults is attributable to occupational noise ranging from 7% to 21%.<sup>3</sup> Noise Induced Hearing

Loss (NIHL) is defined as partial or complete hearing in one or both ears as the result of employment. Various studies have been performed for occupational noise over textile, printing, mining etc. Indian railways are considered to be the transport lifeline of India. Loco pilots are the individuals who run these engines. These engines are notorious for their loud noise. Loco pilots are continuously exposed to such loud noise daily for many years.<sup>4</sup> There lacks studies in India which unleashes the occupational noise hazards

among railway loco pilots. The aim of current study is to assess the NIHL in railway loco pilots by Pure Tone Audiometry (PTA).

## MATERIAL AND METHODS

Present research was a cross sectional study which involved 30 loco pilots. It was conducted near railway station for the ease of loco pilots. Following criteria was used for study.

### Inclusion criteria:

1. Loco pilot age should be between 40-50 years.
2. Tympanic membranes were normal on examination.
3. Minimum 10 years of active service experience.

### Exclusion Criteria:

1. History of ear discharge or ear surgery.
2. Should not have used any ear protection while driving engine.
3. Subjects suffering from any systemic illness e.g. diabetes mellitus, hypertension.
4. Subjects that were not giving consent.

The subjects were informed about the study and consent was obtained. Study was conducted at a well equipped audiology centre near railway station. It was done for convenience of loco pilots as to least effect their resting hours. Complete history was taken and thorough otolaryngology examination was being done. PTA was performed after 6 hours of rest following journey in order to obtain best possible audiological thresholds and omit confounding factors. All subjects were assessed by single trained audiologist in a double chamber audiometry room fulfilling ANSI (American National Standard Institution) 1999 guidelines. Subjects underwent PTA by modified Hughson Westlake method.<sup>5</sup> It was performed by Hortmann Audiometer PA444 audiometer. Air and bone conduction thresholds were recorded from the frequency of 500 to 8000 Hz for both the ears and wherever necessary masking was done. Pure tone average is taken as average of pure tone thresholds at 500, 1000, 2000 and 4000 Hz frequency.<sup>6</sup>

Although, we were not having any baseline audiogram but loco pilots undergo strict medical examination while joining railway services. Moreover, they undergo periodic medical examination at regular interval as per railway policy.<sup>7</sup> So, we considered them to be having normal hearing thresholds while joining railway services.

For the control population, we selected 50 random patients from otolaryngology OPD of a tertiary care hospital. These subjects presented with other than ear problems. The subjects were excluded if they were involved in noisy occupation. They all were selected between 40-50 years of age to avoid age as confounding factor. They were also assessed by PTA under similar conditions.

All the data was compiled and statically analyzed using Statistical Package for Social Sciences (SPSS) software version 21. Univariate and bivariate analysis was carried using student t test. Chi square test was used for categorical variables. The data repre-

sented in study is represented as mean±standard deviation (SD). The level of significance  $p < 0.05$  was considered as significant.

## RESULTS

There were 30 loco pilots included in study. All subjects were male and between 40-50 years. This age group was taken as they were having enough driving experience and were below expected presbycusis age group. The mean age of subjects was  $44.6 \pm 2.9$  years (Mean±2 SD). All were having driving experience for more than 10 years. They were having average experience of  $16.8 \pm 2.4$  years. The pure tone thresholds of this group are stated in table -1.

**Table 1. Pure Tone Thresholds in Loco Pilot Group**

Frequency (Hz)	Thresholds in right ear (dB) Mean±SD	Thresholds in left ear (dB) Mean±SD
500	26±4.6	24±4.2
1000	28±5.6	26±6.8
1500	32±4.7	35±4.2
2000	34±6.8	33±4.7
4000	38±5.8	39±7.1
6000	44±10.1	42±9.2
8000	49±8.6	47±7.9

There were 50 subjects in control group. All were male between 40-50 years of age and were having normal ear examination. All subjects were not involved in noisy occupation. The mean age of subjects was  $42.8 \pm 2.1$  years (Mean±2 SD). The pure tone thresholds of this group are stated in table -2.

**Table 2. Pure Tone Thresholds in Control Group**

Frequency (Hz)	Thresholds in right ear (dB) Mean±SD	Thresholds in left ear (dB) Mean±SD
500	10±2.8	9±2.1
1000	12±3.8	11±1.8
1500	12±2.6	13±2.9
2000	13±3.4	12±2.8
4000	14±2.9	15±2.1
6000	16±3.2	15±3.4
8000	15±2.1	16±2.5

The mean pure tone average in control group was  $12.3 \pm 1.7$  dB in right ear and  $11.8 \pm 2.5$  dB in left ear. Whereas mean pure tone average in loco pilots was  $31.5 \pm 5.5$  dB in right ear and  $30.5 \pm 6.8$  dB in left ear. As per the criteria stated by WHO for hearing impairment in table -3, the loco pilot group was having mild hearing impairment.<sup>8</sup> However, the changes at 6000 Hz and 8000 Hz were quite significant from rest of the frequencies.

**Table 3. WHO Criteria for Hearing Impairment**

Pure Tone Average(dB)	Degree of Hearing Impairment
0-25	Not Significant
26-40	Mild
41-55	Moderate
56-70	Moderately Severe
71-90	Severe
>91	Profound

Audiometric notch is defined as a sudden dip followed up by sudden rise of hearing thresholds at a particular frequency. In our study, audiogram of sixteen subjects showed audiometric notch two being at 2 kHz, six at 4 kHz and eight at 6 kHz.

The data of each ear was compared in both the groups. On comparing the right ear thresholds in both the groups, the difference was statically significant ( $p$  value < 0.01) and Pearson correlation was 0.920. Similarly, on comparing the left ear thresholds in both the groups, the difference was statically significant ( $p$  value < 0.01) and Pearson correlation was 0.972. Therefore, Pearson correlation implies positive correlation between noise exposure and hearing loss in loco pilot group.

## DISCUSSION

Railways are said to be the transport lifeline of India. Loco pilots are the individuals who are running this lifeline. There are approximately 82000 sanctioned posts of loco pilots in Indian railways as per 2012 data.<sup>7</sup> This involves a huge section of qualified people involved in the occupation. There is noise level of approximately 100 dB in railway engines.<sup>7</sup> There lacks studies over train drivers occupational hazard in India. However, research has been carried out in western countries.

Continuous noise of 100 dB can lead to significant hearing impairment. Study conducted in a pharmaceutical company which had noise exposure of 100-105 dB found significant NIHL amongst workers.<sup>9</sup> National Institute of Miner's Health carried out studies over mines and found prevalence of 12.8% hearing loss amongst employees.<sup>10</sup> In our study, we found mild hearing impairment in loco pilots due to continuous exposure of 100 dB noise in engines.

Lie A et al conducted a study over hearing status in Norwegian train drivers and conductors and found that there were no significant hearing loss in test group as compared to control group.<sup>11</sup> Study conducted by Clark WW et al also showed no significant hazardous noise exposure.<sup>12</sup> In our study, we found mild hearing impairment in loco pilots and significant hearing impairment as compared to control group. This may be attributable to the fact that Norway railway engines produce noise of 70-80 dB which is lower as compared to Indian engines which produce 100 dB noise.

Moreover, Indian railways have not worked upon noise and vibration reduction in engines. Most of the Norway drivers are not having a hectic schedule for duties. Whereas, loco pilots in India are overburdened with 10 hours duty at a stretch followed by a rest of 12 hours six days a week.<sup>7</sup>

Waghmare S et al conducted a cross sectional study over 60 loco pilots for evaluating NIHL.<sup>13</sup> They used Brain Stem Evoked Response Audiometry (BERA) as a tool for assessment. They found mild to profound sensorineural hearing loss in loco pilots which were directly proportional to their service tenure. This study has many similarities with our study. First, both studies are from India. Therefore, working conditions and noise exposure are almost similar. Second, the sample chosen in both the studies were having similar age group and a minimum experience of 10 years. Third, both studies demonstrate hearing loss in loco pilots. However, BERA was the tool used by the Waghmare S et al. BERA is an objective tool for hearing assessment but it does not depict the actual hearing loss at a particular frequency. PTA was used as an assessment tool in our study because it is the best and cheapest tool which can accurately assess hearing loss by subjective method.

In our study, audiogram of sixteen subjects showed audiometric notch two being at 2 kHz, six at 4 kHz and eight at 6 kHz. Conventionally, it has been described at 4 kHz.<sup>14</sup> However, recent studies have come up with different observations. Our observation is also favoured by Nair S et al study.<sup>15</sup> They performed audiometric analysis of Indian Air Force (IAF) personnel at an operational IAF base. A large proportion of personnel presented with audiometric notch at 6 kHz (57.3%) as compared to 4 kHz (34.3%)

Therefore, present study shows mild hearing impairment in loco pilots as an occupational hazard and a significant hearing loss as compared to control population. Moreover, our study depicts strong positive correlation between their occupation and hearing loss. Extensive research has been done over aviation industry which involves less number of employees as compared to railways. Study over railway employees is the need of the hour as it involves a huge population and is Indian transport lifeline. The sample size of this study is small and it cannot be generalized for whole Indian railways. NIHL amongst loco pilots merits an extensive research as our study might be tip of iceberg. Further, research can be carried out over large sample group and possibility of NIHL prevention amongst them.

## CONCLUSION

Noise is hazardous industrial pollutant leading to hearing loss in loco pilots. Our study shows mild impairment in loco pilots whose working experience was more than 10 years. There is positive correlation between hearing loss and occupation. They are at more risk of hearing loss as compared to normal population attributable to their occupation. Audiometric notch is commonly seen at 4 kHz and 6 kHz in loco pilots. Safeguarding their hearing ability is a challenge.

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