An Audiometric Survey of Territorial Army Personnel

Maj S E F Folkes
MB, BS, RAMC
Medical Branch, HQ 1 (BR) Corps, BFPO 39

SUMMARY: A cross sectional survey of 581 TA personnel from Wales, the Midlands and Scotland was performed. The aim was to determine their hearing levels, to attempt to relate any degree of noise induced hearing loss detected with military, occupational and leisure noise and to make recommendations to improve the existing Army Hearing Conservation Programme.

Each subject answered a questionnaire, had a clinical examination of each ear and pure tone audiometry.

The hearing acuity of the TA group as a whole was similar to the regulars in the lower H gradings but there was a worrying number of H4/8 (5.6%) who had not been picked up before on routine screening and would probably have been discharged if they were in the Regular Army.

Introduction

Noise induced hearing loss is a recognised hazard in industry as well as in the Army. The terms and patterns of service for Territorial Army (TA), however, are sufficiently different to suggest that data gleaned from studies of the Regular Army do not apply to the TA population. A previous study (Callow C G — unpublished data) of London based TA units indicated that 4% of personnel had undetected hearing defects which would result in medical down-grading to H3 or below. The majority of those surveyed (86%) had little or no occupational noise exposure. However it was not possible to estimate the contribution military service made to hearing loss or the exact proportion of the total noise dose to those with an occupational hazard. The paper recommended that further studies should be done on the TA in a more industrialised part of Britain where there might be more occupational noise exposure. This study was performed as a continuation.

The aims of the study were to determine the hearing levels, assessed by puretone audiometry, of a cross section of soldiers from various TA units and to relate any degree of noise induced hearing loss (NIHL) detected with:

a. Occupation noise exposure.
b. Military noise exposure.
c. Leisure noise exposure.

Method

The population studied consisted of 581 TA personnel from South Wales, the Midlands and Scotland.

The survey consisted of visiting each unit on drill nights or weekends when personnel were involved with administrative tasks, and no military weapons had been fired in the preceding 48 hours. All personnel attending were surveyed. Informed consent was obtained from each individual, they were examined by a medical officer for aural pathology and answered a questionnaire which asked for details of noise exposure in civilian (occupational and recreational) and military environments. Details were obtained of any previous ENT problems requiring treatment.

The audiometry test was explained by a medical assistant trained in audiometry. The equipment used was a Madsen Maico M26 self recording computer audiometer which allows audiometric screening using the Hughes and Westlake method of determining the threshold. The audiometers were in soundproof booths inside a trailer. Any personnel with obvious NIHL or aural pathology requiring treatment were advised to see their own general practitioner (GP).

Results

Questionnaire

Unemployment in the study group was 10.2% the mean age 29.5 years. One hundred and thirty nine (23.9%) of those examined had previous regular service. Eighty nine point two percent of these were in the Army / RM, 7.2% in the RAF and 3.6% in the Royal Navy. Over 60% had served for less than 6 years and 1.6% for over 12 years.

Civilian Noise Exposure

The number of people who work in a noisy environment was ascertained by asking how many had worked for more than 6 months in a job where they had to shout to be heard. This is a crude estimate but implies the noise level >85 dB(A), 24.4% claimed to have worked in a noisy environment. Their hearing grades showed 13.3% were worse than H2H2 the minimum entry standard. To elucidate the occupational noise further enquiries were made about any job held for longer than 6 months where hearing protection was supplied by an employer; 26.9% claimed to have been given hearing protection by their employers, 13 more subjects than those who detailed a noisy environment. This is not surprising since hearing protection and the subjective assessment of a noisy environment may differ
from the actual measured level (ie >90 dB Eq). The proportion wearing hearing protection all of the time was 26.9% and 8.3% admitted to never wearing it, the remaining 64.8% wear protection most/some of the time. The distribution of the type of hearing protection was 59.6% ear muffs, 17.3% earplugs, 12.8% muffs +/-plugs and 2% claimed to use cotton wool only.

Civilian Weapon Exposure

One hundred and seventy subjects claimed to use civilian weapons, 64.7% fired a shotgun and only 8.1% fired a shotgun and air rifle, (6.5% had fired only air rifles, a low risk to hearing). The number of rounds fired varied with 34.1% firing less than 100 rounds but 38.8% had fired over 500, a significant noise dose. The proportion wearing hearing protection was lower than the occupational group with 31.2% always wearing it and 24.7% never using any.

Recreational Noise

The other sources of noise asked about were discos, power tools, and machinery. Two hundred and five subjects gave positive answers, 136 (66.3%) claimed to have high exposure at discos and 14 (6.8%) used power tools. These exposures indicated a potential risk.

Weapons used in TA

Five hundred and sixty five of the subjects had a personal weapon, the other 16 were non-combatants or permanent staff who were not issued with weapons for routine use. The SLR was used by 371 and SMG 178. Twenty one point six percent fired less than 100 rounds but 43.7% had fired over 1000 rounds. The use of hearing protection varied with 79.3% always using it and 2.1% never using protection. The split was 33.1% muffs and 45.9% plugs or a combination. Other weapon exposure was wide ranging and included armoured vehicle armament, 84mm Carl Gustav, Wombat and field artillery. Four hundred and thirteen subjects had exposure. However all claimed to have used hearing protection.

To ascertain whether subjects had suffered from temporary threshold shift (TTS) or from tinnitus from weapon noise, questions were asked about short term deafness and buzzing. Two hundred and twenty claimed to have suffered temporary buzzing and 98 from temporary deafness. The buzzing is fairly common after loud noise exposure, however, temporary deafness is indicative of possible susceptibility to long term neural damage.

ENT Pathology

Aural examination revealed 68 subjects with wax; 11 required syringing before audiometry. Seven subjects required advice on treatment. From the questionnaire 82 had previous treatment for otitis media and 98 for wax syringing. One subject had permanent tinnitus and impaired hearing resulting from his work in a metal panel shop (H4H3 grade).

Audiometry Results

The hearing levels were assessed by comparing the distribution of H (hearing) category in the PULHHEEMS classification (1) of those in this TA study group with Callow's previous study of TA personnel, the results are in Table 1. These groups are not statistically different by chi squared test. However, an indication that 5.6% may have an H grading worse than H2 is of concern. Table 2 shows the H grading distribution of those personnel declaring themselves to have worked for more than 6 months in a job where they had to shout to be heard; the chi squared test of significance shows there is a significant difference of $0.001 < p < 0.001$ with 13.3% of those noise exposed groups being graded worse than H2H2 as opposed to 6.1% of the group not exposed to noise.

In order to attempt to unravel the relationship between occupational, military and leisure exposure, 3 noise categories were constructed using the question-

### Table 1

<table>
<thead>
<tr>
<th>H Grade</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ear</td>
<td>407(70.1)</td>
<td>139(23.9)</td>
<td>26(4.5)</td>
<td>9(1.5)</td>
</tr>
<tr>
<td>Right ear</td>
<td>433(74.5)</td>
<td>114(19.6)</td>
<td>29(4.9)</td>
<td>5(1.0)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>H Grading</th>
<th>Absolute frequency</th>
<th>Absolute frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 mths + Noisy job</td>
<td>not in a noisy job</td>
<td></td>
</tr>
<tr>
<td>H1 H1</td>
<td>76(53.1)</td>
<td>299(68.3)</td>
</tr>
<tr>
<td>H1 H2/H2 H1</td>
<td>27(18.4)</td>
<td>69(15.8)</td>
</tr>
<tr>
<td>H2 H2</td>
<td>21(14.7)</td>
<td>43(9.8)</td>
</tr>
<tr>
<td>H1 H3/H3 H1</td>
<td>4(2.8)</td>
<td>5(1.1)</td>
</tr>
<tr>
<td>H2 H3/H3 H2</td>
<td>9(6.3)</td>
<td>8(1.8)</td>
</tr>
<tr>
<td>H3 H3</td>
<td>4(2.8)</td>
<td>4(0.8)</td>
</tr>
<tr>
<td>H4 H1/H1 H4</td>
<td>2(1.4)</td>
<td>3(0.7)</td>
</tr>
<tr>
<td>H4 H2/H2 H4</td>
<td>2(0.5)</td>
<td></td>
</tr>
<tr>
<td>H4 H3/H3 H4</td>
<td>2(0.5)</td>
<td></td>
</tr>
<tr>
<td>H4 H4</td>
<td>3(0.7)</td>
<td></td>
</tr>
</tbody>
</table>

Chi$^2 = 19.26, 0.0001 < p < 0.01$
naire responses, the ordinal scale giving a rough guide to exposure.

Occupational noise exposure
0 — No admitted noise exposure work.
1 — Hearing protection provided and used at work.
2 — Hearing protection provided and not used at work or more than 6 months where it was necessary to shout to be heard.

Military noise exposure
0 — No admitted noise exposure from weapons during TA or Regular service.
1 — Small arms firing with use of hearing protection at all times.
2 — Small arms firing without the use of hearing protection and/or support of heavy weapons with the use of hearing protection at all times.
3 — Support or heavy weapons firing without hearing protection.

Leisure Noise exposure
0 — No admitted exposure to loud noise during free time.
1 — Firing of weapons in a civilian setting with hearing protection and/or regular use of noisy power tools and/or regular visits to loud discos.
2 — Firing of weapons in civilian settings without the use of hearing protection.

By comparing the prevalence of 3, 4 and 6 kHz averages for each of the graded exposure in Table 3 there is a gradation of increasing NIHL in the more noisy categories in all divisions. The significance (t test) is most marked for the right ear occupational and military categories, the left ear military categories are marginally significant between 0 & 1 categories and significant between 2 & 3 categories (p 0.005).

These categories are a crude estimate of exposure being reliant upon individual subjective assessment and consistency in reporting answers. However, it gives an indication of potential risk.

Discussion

Noise exposure in the group studied was difficult to predict because of the additional exposure from their occupation as well as the TA. Those subjects who claimed to have worked for more than 6 months in a job where they had to shout to be heard were evidently in a noisy environment but how loud is unclear. Looking at their H gradings compared to the rest of the group, there was a significant difference for the distribution of the gradings. This indicates that there may be a difference in the hearing level of the noise exposed group, but the worst hearing grade (H4/8) predominated in the people who did not have a noisy job. The recreational noise exposure requires further clarification to exhibit any difference. The military noise exposure categories are the easiest to predict and may be related to time served.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Table 3</th>
<th>3, 4 and 6 kHz averages for different exposure categories.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ear</td>
<td>0</td>
<td>12.09 ( T_{-1} ) 0 &amp; 1 \text{p} 0.424</td>
</tr>
<tr>
<td>Right ear</td>
<td>0</td>
<td>9.52 ( T_{-1} ) 0 &amp; 1 \text{p} 0.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Military</th>
<th>Table 4</th>
<th>H grading for worst ear-comparison of three study groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ear</td>
<td>0</td>
<td>7.08 ( T_{-1} ) 0 &amp; 1 \text{p} 0.137</td>
</tr>
<tr>
<td>Right ear</td>
<td>0</td>
<td>2.86 ( T_{-1} ) 0 &amp; 1 \text{p} 0.048</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leisure</th>
<th>Table 4</th>
<th>H grading for worst ear-comparison of three study groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ear</td>
<td>0</td>
<td>14.83 ( T_{-1} ) 0 &amp; 1 \text{p} 0.0002</td>
</tr>
<tr>
<td>Right ear</td>
<td>0</td>
<td>12.11 ( T_{-1} ) 0 &amp; 1 \text{p} 0.001</td>
</tr>
</tbody>
</table>

Looking at the hearing acuity of the group as a whole they appear to be the same in the lower gradings as the regulars, Table 4, using the population from the RA Falklands study (2) and the TA London group. However, there are a worrying number who are H4/8 who would have been discharged if in the regular Army.

Livesey (3) in 1967 showed 30% of a sample of serving regular infantry and 30% of a mixed group of teeth arms personnel were suffering from unrecognised acoustic trauma, with a hearing loss of greater than 30 dB in the 3-6 kHz frequency range. This pattern was little improved by 1980 (4) where 28% of a group of 200 infantry men were found to have similar acoustic trauma. These results show that the Regular Army had a problem which was slowly improving with the AHCP since the mid seventies. The present study shows a smaller percentage with acoustic trauma (6.1% to 13.3%).
This study indicates that the TA have a similar if not worse hearing than their regular counterparts. The AHCP should be implemented more strictly in this group with initial screening on entry and should continue through their TA career, and the results should be centrally collated. There should be more emphasis on hearing protection with issues to the TA paralleling those of the regulars. To establish a baseline, all TA soldiers serving now should have audiometry. At present there is no evidence to suggest when NIHL, if it exists, could have occurred.

REFERENCES
An Audiometric Survey of Territorial Army Personnel

S E F Folkes

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