BLAST INJURIES OF THE EAR

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SYNOPSIS

Clinical synopsis and investigations on fourteen patients with blast injuries of the ear successfully treated at the ENT Unit of the University Hospital, Kuala Lumpur, revealed few interesting observations in addition to usual findings. The most outstanding one was the absence of sensorineural deafness, although it has been claimed as one of the most constant features. Conservative management alone was found to be of significant value.

INTRODUCTION

Blast injuries are on the rise in recent years throughout the world. In the past all cases of stimulation deafness, irrespective of cause were included into one category, although hearing loss due to blast, is one of the examples of stimulation deafness. Ruedi and Furrer (1) proposed a classification for stimulation deafness which has been accepted, and according to which blast injuries of the ear are grouped under one well known separate clinical entity. Review of literature revealed variable effects of blast injuries on the ear. The authors have claimed wide variety of possible factors responsible for such differences in their observations. In the present study, besides usual findings, few outstanding features were noticed, which led us to publish this paper.

MATERIAL

A total of 14 cases of blast injuries of the ear, as a result of an explosion which took place in the early morning of the 5th June 1980 at Port Klang, Malaysia are included in this study. 13 cases were referred from General Hospital, Klang after one to two weeks of treatment including management for the injuries sustained in other parts of the body. Single case attended our clinic the same day.

METHOD

The patients were interrogated in detail to obtain accurate information as far as possible about the incident (blast) in relation to their ear problems. The present study will only highlight the effects of blast on the ears. Fortunately, in none of our cases was there history of exposure of ears to previous trauma or disease. After detailed examination in the outpatient clinic of the University Hospital, Kuala Lumpur, the patients were referred to the Audiology Section for routine and some special audiological assessment as and when required. Cases presenting with symptom of vertigo or those who developed it later on, were put to vestibular function tests. Besides this, every case was subjected to pure tone audiometry at three weeks interval for assessing the recovery of deafness. An account was kept of their clinical progress.

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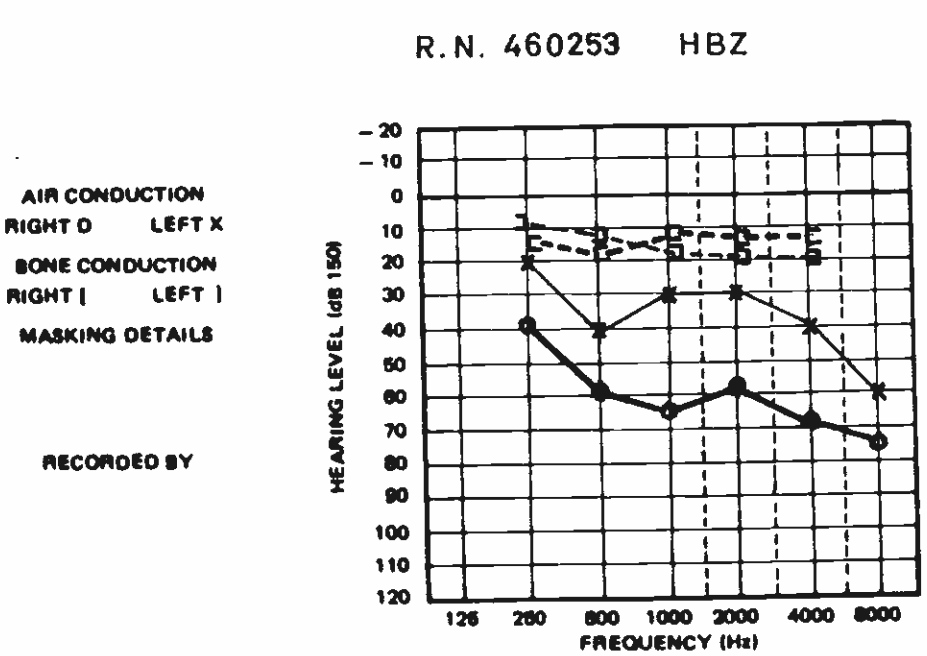

Fig. 1. Audiogram showing bilateral conductive deafness 10 days after explosion.

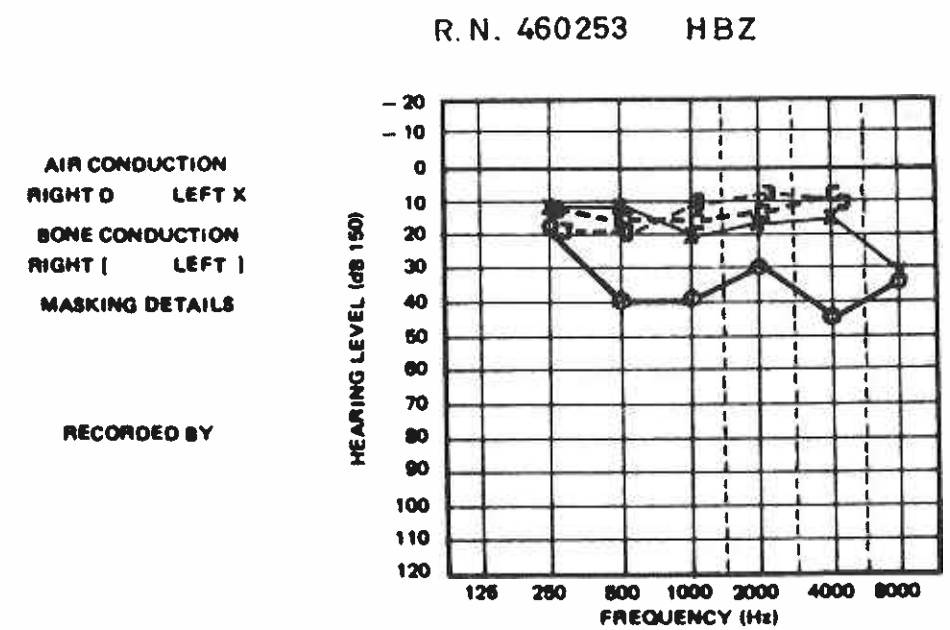

Fig. 2. Audiogram showing complete restoration of hearing in left ear and partial in right after 3 weeks.

Table 4 — The Distribution of Type of Deafness In 28 Ears

	No. of Ears	Conductive Deafness	Mixed Deafness	Sensori-Neural Deafness	Functional Deafness	Normal Hearing
Present Series 1980	28	17 (60.9%)	8 (28.5%)	Nil	Nil	3 (10.7%)
Singh et al 1968	146	13 (8.9%)	40 (27.3%)	81 (55.6%)	12 (8.3%)	Nil

Table 5 — Analysis of Degree of Deafness Among 28 Ears

Series	No. Of Cases	Deafness				
		Mild	Moderate	Severe	No Deafness	Perforation
Present (1980)	28	32.2%	39.3%	17.8%	10.7%	60.9%
Singh et al (1968)	33	39%	34%	27%	Nil	29%

well established. The variations are possibly due to differences in durations of seeking medical attention.

Singh et al (4) did not observe tinnitus even in a single case possibly because all cases were reviewed 10-20 days after the injury. Kerr et al (2) observed tinnitus in most of their cases as most of them reported immediately for treatment. However, they have also mentioned that tinnitus is usual but does not last long. Mawson (6) reported that tinnitus may become permanent feature among these cases although in very few patients. The presence of tinnitus in our series is equivocal. Kerr et al (2) noticed that vertigo was a rare finding although Korkis (7) reported vertigo among 67.71% of his cases Deafness is a definite symptom among all the cases in all the reports.

(3) Clinical Features

Perforation with blood stained margin was the common finding among the cases of present series amounting to 60.9% of cases as also described by Singh et al (4) and Kerr et al (2). Presence of hyperaemia in the posterior part of tympanic membrane and along the handle of malleus which is characteristic of trauma was observed in only two of our cases. This sign did help us to differentiate between blast injury and body injury in both of our cases. Korkis (8) described its presence in two ears as they presented with yellowish discharge. This Observation has been labelled as complication by Singh et al (4) and Kerr et al (2). None of our cases showed presence of explosive debris on otoscopic exmaination as claimed by Merwin et al (5) and Kerr et al (2). Absence of such a finding is an indication that distance was greater from the site of explosion as compared to other reports.

(4) Deafness

Deafness has always been a constant feature among cases of blast injuries of the ear. However, they may differ as regards in type and degree.

(A) type of Deafness:

In the present study the absence of permanent pure sensori-neural deafness was another outstanding feature, contradictory to the findings of all other authors, since presence of sensori-neural deafness is a common and characteristic feature among cases of blast injuries of the ear. Contrary to others observations, pure conductive deafness was detected among 60.9% of cases (Figures No. 1 and 3) followed by mixed deafness in 28.5% of cases (Figure 5). The various postulates for the absence of sensori-neural deafness can be as follows:-

(i) Rupture of drum has been correctly claimed as a protection to inner ear by various authors except Kerr et al (2) where they have concluded that tympanic membrane does not protect the internal ear.

(ii) Explosion in an open place as was the case in our series, may be the other feasible factor due to which impact was not severe enough to cause inner ear damage (2). It has also been mentioned in the recent reports that a much smaller force is needed to traumatize the middle ear than the inner ear (9).

(B) Degree of Deafness:

The observation on the degree of deafness was more or less same as that of Singh et al (4). The only change was that instead of mild deafness being number one, in our series moderate deafness was first in order of frequency. Severe degree of deafness was seen among few cases only.

Terter et al (10) reported four typical audio-metric patterns in patients with sensori-neural hearing loss following blast injury. In our series there was predominance of conductive and mixed deafness and total absence of sensori-neural deafness did not allow us to go into detailed study of audiometric configurations, although few cases did show dip at higher frequencies as mentioned by them.

(5) Treatment and Follow-Up

All the cases were given a trial of conservative treatment in-

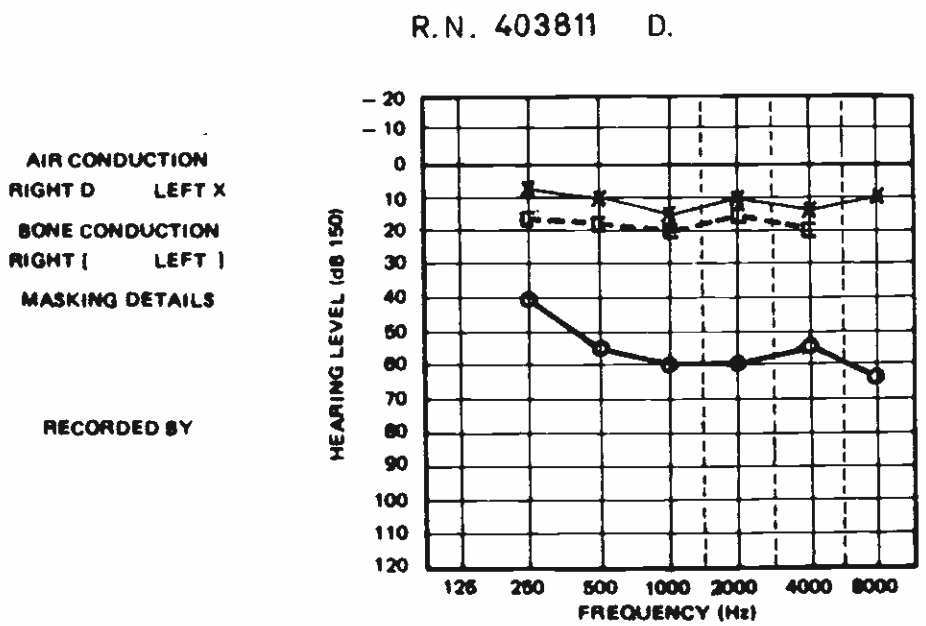

Fig. 3. Audiogram showing conductive deafness right ear after 12 days of explosion. Left ear normal.

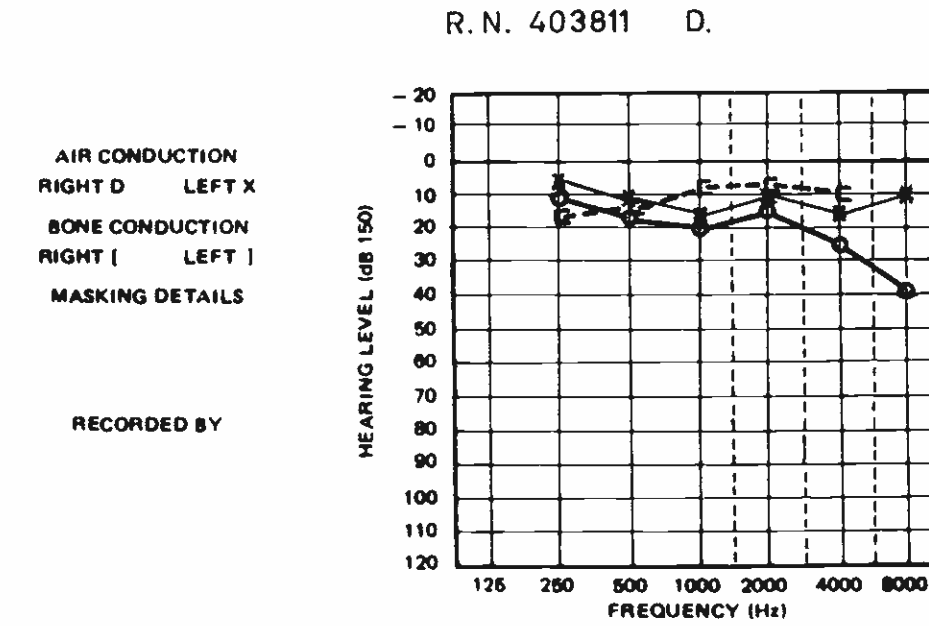

Fig. 4. Audiogram showing complete recovery deafness in speech frequencies and adequate in high frequencies.

OBSERVATIONS AND DISCUSSION

Blast injuries of the ear were uncommon although known in the past. Stimulation deafness as a result of blast is more frequently seen than described. Reports on the subject are very few and limited to certain countries. In the present study 14 cases were included who sustained blast injuries of the ear. A detailed analysis of various observations made on these fourteen cases are given below along with discussion:—

(1) Effect of blast on the ear in relation to distance and the role of protective measures:—

Table 1 — Analysis of 14 cases

Distance in feet from the blast	Profession	No. of cases	No. of cases with protective devices	No. of cases with perforations	No. of cases with deafness
400	Fireman	11	11	11	11
800	Sailor	1	Nil	Nil	1
1,000	Officeman	2	Nil	1	2
	Total	14	11(78.5%)	12(85.7%)	14(100%)

In the present study the most outstanding feature observed was distance between individuals and the blast which was exceptionally high, minimum being 400 feet and the maximum about 1,000 feet, as compare to the reported maximum distance to be only about 100 feet (2). All the persons working nearer the blast (400 feet away) sustained injuries to the ear in one form or the other as has also been claimed by other authors. The other interesting feature of note in our series was contradictory to the usual saying that the ears fitted with protective measures receives less damage as compare to the people working without such measures. All the 11 cases having helmets on their head covering the ears, presented with perforations of drum and deafness. The possible explanation put forward can be either the head gears were not properly tied or blast was too forceful to overcome the protection. Robin (3) laid emphasis on the tight fit or an efficient sealing of the ear. However, Singh et al (4) claimed that a much simpler baffle type of ear covers are enough to provide adequate protection against the effect of blast on the ears. Observations with regards to the ear facing the site of blast being more affected than the one opposite it, were in confirmity with the statements made by Singh et al (4), Kerr et al (2), Merwin et al (5).

(2) Symptomatology:—

Mode of presentation among these cases is fairly

Table 2 — Analysis of Symptoms

	Duration for seeking medical attention	Immediate	10-20 days	Immediate	1-2 weeks
	Symptoms	Korkis Series (1946)	Singh et al (1968)	Kerr et al (1975)	Present Series (1980)
1.	Deafness	Common	All cases	All cases	100%
2.	Tinnitus	Rare	Non	All cases	71.4%
3.	Giddiness	67.71%	None	Limited Cases	7.1%
4.	Pain Ear	Few cases	Few cases	Few cases	7.1%

Table 3 — Analysis of Clinical Features

	Findings	Korkis (1946)	Singh et al Series (1968)	Kerr et al Series (1975)	Merwin et al (1980)	Present Series (1980)
1.	Perforation	Usual	Good number of cases	Common	Usual	60.9% (17 ears)
2.	Hyperaemia	Well described diagnostic feature	Described	Described	—	7.1% (2 ears)
3.	Infection	—	Mentioned	Mentioned	Mentioned	7.1% (2 ears)
4.	Contusion of tympanic membrane	—	Mentioned	—	—	10.7% (3 ears)

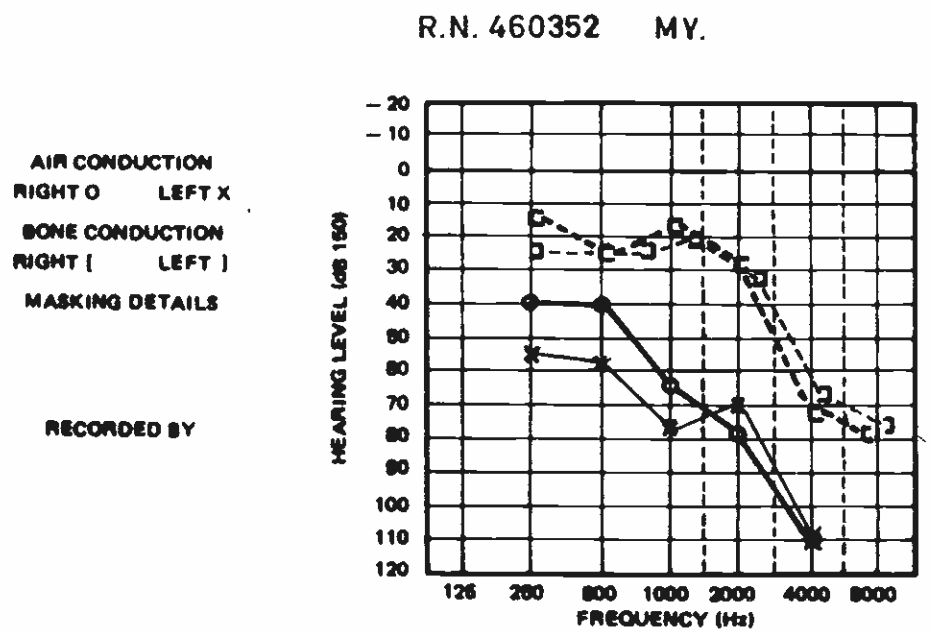

Fig. 5. Audiogram in case of bilateral mixed deafness after 10 days of explosion.

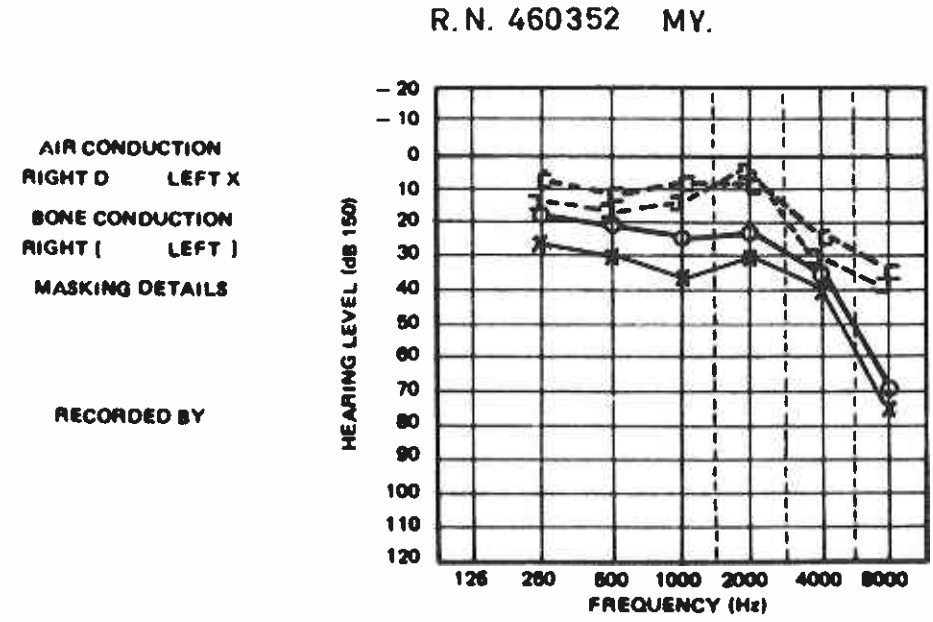

Fig. 6. Audiogram showing remarkable improvement in deafness in speech frequencies as compare to higher frequencies after 6 weeks.

spite of the fact that most of them attended our clinic after having received emergency treatment for some time but at non-specialist centre. To our surprise, the results were very encouraging as all the perforations healed within 4-6 weeks time although 2 cases presented with infected middle ear. With this little experience we can say that if cases can be followed up regularly, the conservative method should be the treatment of choice among these cases, as have also been claimed by Kerr et al (2) and Singh et al (4). We are not in a position to comment on those cases who received medical attention within few hours only. However, Merwin et at (5) have advocated immediate micro care of the perforations with better results. The deafness also improved adequately within 3 months time. The improvement in deafness was true copy as described in the literature. All cases showed first improvement in speech frequencies and later on in high frequencies (Figures 2, 4 and 6). None of the cases in our series turned as handicapped individual although they sustained blast injuries to their ears.

CONCLUSIONS

1. Distance between individual and the place of blast can be high, e.g., 400 to 1,000 feet.
2. Blast in an open place does cause trauma but less severe especially to inner ear.
3. Protective devices can only be of use if they seal the ear efficiently.
4. Perforation is always seen in pars tensa.
5. Rupture of tympanic membrane definitely protects the inner ear.
6. Complete absence of permanent pure sensori-neural hearing loss as a result of blast was an outstanding and unique finding in our series.
7. Vertigo is rarely seen among these cases.
8. Deafness irrespective of its variety tends to improve in due course of time in most of the cases.
9. Improvement in deafness is first seen in speech frequencies followed by improvement in higher frequencies.
10. Conservative treatment under specialist care should still be considered as treatment of choice.

ACKNOWLEDGEMENT

We are thankful to the Director, University Hospital for allowing us to publish the hospital records and thanks to Mrs Lee, departmental secretary for typing the manuscript.

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