A CASE WITH ABNORMAL TONE DECAY AND RECRUITMENT AS MEASURED BY ABLB (AUTO) TEST—TYPICAL OR ATYPICAL?

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Abstract

A case of abnormal tone decay demonstrating recruitment is reported. If we accept that recruitment is an artifact, the findings of this case are typical of ABLB {auto presentation) test. On the other hand, if vie consider that recruitment is a fact the findings of this case are atypical of ABLB test indicating co-existence of the two lesions viz. cochlear and retrocochlear. If we accept that recruitment is an artifact, ABLB {auto) test is not a useful test in differential diagnosis of cochlear Vs. retrocochlear as recruitment measured by ABLB {auto) test is expected in all SN loss cases irrespective of tone decay provided factors like crossover, diplacusis, pulse rate and error of judgement are controlled.

A lot of concern is expressed by many investigators regarding the audiological tests as many cases of confirmed retrocochlear pathology have been reported to have demonstrated cochlear findings. This concern seems to be unwarranted as cochlear findings in retrocochlear pathology cases seem to be expected findings if we consider that recruitment is an artifact and if the results of SI SI test and Bekesy tracings are influenced by tone decay. Some recommendations have been made.

'When the ABLB recruitment test is performed at a frequency where there is marked tone decay, loudness growth with increasing intensity is less than normal. This result has been termed decruitment (Fowler, 1965, Davis and Goodman, 1966) or reverse recruitment (Dix, Hallpike, 1960, Harbert and Young, 1962b) in contrast to recruitment where loudness growth with increasing intensity is greater than normal'. (Green, 1972).

This paper deals with a case of abnormal tone decay demonstrating recruitment as measured using ABLB (Auto) test. Further, theoretical implications are discussed in the light of the hypothesis that recruitment is an artifact (Jagadish, 1970).

Case Report

A 35 year old educated male reported to the Institute with the complaint of hearing loss in the left ear. He reported that he developed hearing loss in the left ear soon after the attack of meningitis about 5 years ago. He did not have symptoms like tinnitus, vertigo, headache, etc.

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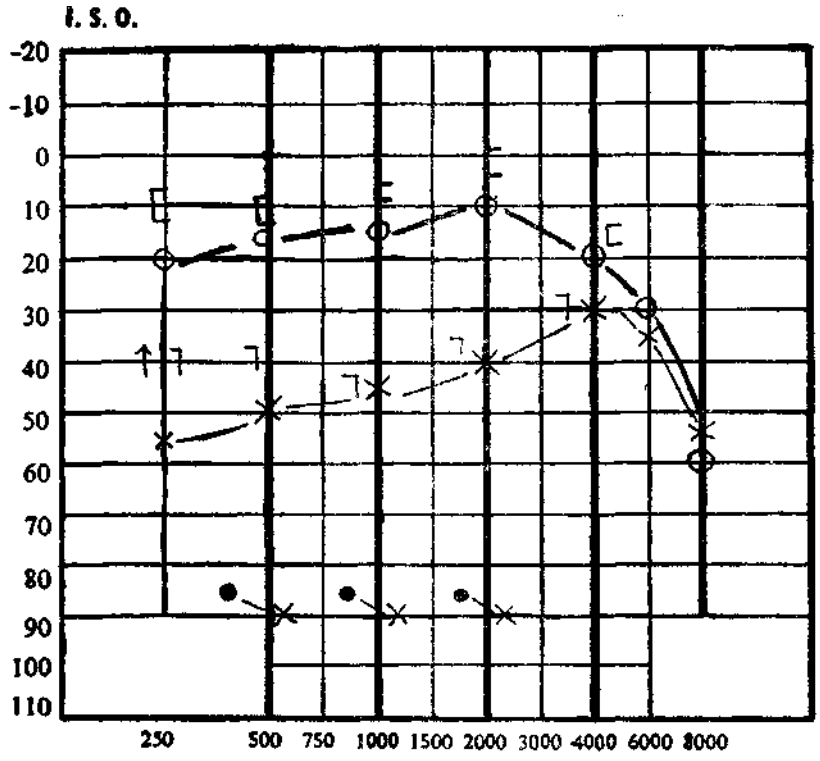
puretone audiometry



Frequency in Hertz

	Right	Left	Aid in Ear Rt	Aid in Ear Lt
3 frequency average	13	45		
S. R.T.	20	50		
Discrimn. (P. B. Max.)	90%	25%		

SPECIAL TESTS

	Eight .Ear				Left Ear			
	500	1000	2000	4000	500	1000	2000	4000
SISI-					100%	100%	100%	10.0% ->
ABLB					"	"	"	
STENGER								
T D T d_B	5	0	10	35	+60	+60	+70	+75 -->

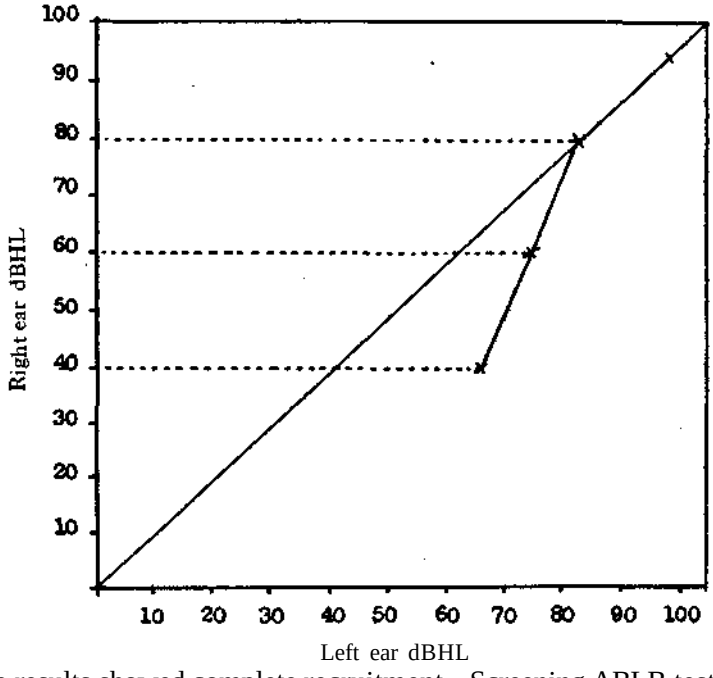
ENT findings were normal except for hearing loss in the left ear. The detailed hearing evaluation is given below. Audiogram was taken using Arphi Model IV audiometer calibrated to ISO (1964) in a sound treated room. Audiometer was previously calibrated using B and K equipment.

Pure-tone audiometry: The audiogram showed Left ear—S.N. loss (moderate) Right ear—high frequency loss.

Speech audiometry showed very poor speech discrimination in the left ear (25 per cent). Right ear had 90 per cent discrimination. Speech discrimination testing was done through live voice testing using English PB list standardized by Swarnalatha (1972) for Indian population. While testing the left ear, masking was used in the right ear.

Complete ABLB test was administered at 1000 Hz using automatic presentation of tones. The rate of pulse was 1/sec.

Freq	1 KHz	(Hearing levels for equal loudness)
Rt.	Lt.	
40 dB	65 dB	
60 dB	75 dB	
80 dB	80 dB	
100 dB	100 dB	



The results showed complete recruitment. Screening ABLB test was administered using automatic presentation (1 pulse/sec). The intensity of the tone was varied in the right ear until the subject reported equal loudness (the tones alternated between the ears). This test was done at 500 Hz, 1000 Hz and 2000 Hz tones. The results showed recruitment at all these frequencies.

500 Hz		1000 Hz		2000 Hz	
Rt.	Lt.	Rt.	Lt.	Rt.	Lt.
85 dB	90 dB	85 dB	90 dB	85 dB	90 dB

Carhart's TDT

(TDT) Tone decay test was administered at all the frequencies (500 Hz to 4 KHz) in both the ears. Marked tone decay was observed at all the frequencies in the left ear. Tone decay was negative in the right ear at all the frequencies except at 4 KHz.

Tone Decay in dB

Freq.	Rt.	Lt. (with appropriate noise in the right ear)	Lt. (without noise in the right ear)
500Hz	5	>60 dB	>60 dB
lOOOHz	0	>60 ,,	>60 „
2000Hz	10	>70 „	>70 „
4000Hz	35	>75 „	>75 „

Tone decay was more than 60 dB at all the frequencies in the left ear even when masking noise was not used in the right ear. The tone decay test was repeated thrice on different days and the results were found to be consistent.

SISI Test was 100 per cent in the left ear at all the frequencies from 500 Hz to 4 KHz. Modified SISI test was administered—the tones were presented at 70 dB HL or higher level for audibility.

The subject detected 1 dB increments but the tone was fading.

Thus false SISI+ve was observed. Appropriate masking noise was used in the right ear.

Impedance Audiometry was done using Madsen impedance bridge (Z0 70). There was no reflex in the left ear even at 120 dB HL (tones were presented to the left ear and probe tip was inserted to the right ear). There was reflex in the right ear (tones to right ear and probe tip to left ear).

	250Hz	500Hz	IK	2K	4K	
Right ear reflex THs	90dB	90dB	85dB	90dB	lOOdB	
Left ear reflex THs	NR	NR	NR	NR	NR	NR=Norea$_e$xatl20dB

Discussion

Test results typical of cochlear and retrocochlear lesions show presence and absence of recruitment respectively when measured using ABLB test (Newby. 1965). As many cases of surgically confirmed retrocochlear pathology cases have been reported to have demonstrated recruitment, Jerger (1961), rightly recommends that the presence or absence of recruitment should not be considered in deciding the site of lesion. He feels that the other tests may be more accurate for detecting the site of lesion than the tests for recruitment. Further, he mentions that from

the standpoint of planning for rehabilitation procedure, if not for purposes of medical diagnosis, it is important to ascertain whether or not a patient with a sensorineural loss does have recruitment (as reported by Newby, 1965).

The reported case here exhibits both recruitment and abnormal tone decay. If we accept that recruitment is an artifiact (Jagadish, 1970), the findings of this case are typical of ABLB (Auto presentation) test (Vyasamurthy, 1972). On the other hand, if we consider that recruitment is a fact the findings of this case are atypical of ABLB test. Which one is true? To solve this mystery let me place all the relevant facts we have before us.

Many investigators (Johnson, 1965, Shapiro and Naunton, 1967, Katinsky, S, 1972) have reported the presence of recruitment (as measured by ABLB), high SISI score and II Bekesy tracing in surgically confirmed retrocochlear pathology cases. These investigators have tried to explain the presence of cochlear findings in confirmed retrocochlear pathology cases in terms of predominance of cochlear findings when both the lesions co-exist or as atypical findings.

Dix and Hallpike (1960) suggest that the tumor might interfere with the cochlear blood supply thus creating a secondary cochlear lesion. To support this they have cited examples of two cases who showed absence of recruitment after the removal of the tumor.

Jerger and Waller (1962) suggest tht the audiological signs change with the progression of a lesion. In support of this they report a case whose speech discrimination became poorer and Bekesy tracings changed from I and II and III over a period of time.

Johnson (1965) suggests that the site and size of the tumor influence the audiological findings. However Shapiro and Naunton's (1967) findings are not in agreement with Johnson's observation.

Thus the observation of cochlear findings in some confirmed retrocochlear pathology cases is explained on the basis of the co-existence of the two lesions, progression of the lesion and site and size of the tumor.

It is not clearly known why the cochlear findings should predominate over retrocochlear findings when both the lesions co-exist. In the absence of correct explanation, it would be better to explain the presence of recruitment, high SISI score and II Bekesy tracings in confirmed retrocochlear pathology cases in terms of the influence of tone decay on the three tests' results. When recruitment is measured using ABLB (auto) test, tone decay seems to have no influence and hence recruitment may be expected even with abnormal tone decay when ABLB (auto) is administered indicating that recruitment is typical in cases with abnormal tone decay.

Now it appears that ABLB test is not useful in differentiating cochlear Vs. retrocochlear lesion as recruitment is expected in both the lesions. Jerger has suggested that the presence or absence of recruitment should not be considered to decide the site of lesion and that the information regarding the presence or absence

Sf recruitment obtained by ABLB test would help in recommending amplific-- tion in the use of hearing aids to the cases. The latter suggestion goes against ABLB test as recruitment is expected in all the SN loss cases if recruitment is considered as an artifact. Further, if recruitment is a fact it becomes a problem to decide whether the present case has recruitment or not. The reason is that h- has demonstrated recruitment to ABLB (auto) test but not to acoustic reflex threshold test. Which test should be considered to decide whether the case has recruitment or not? The only solution to this question is to accept that recruitment is an artifact and that the presence of recruitment as measured by ABLB (auto) is typical of cases having cochlear and/or retrocochlear lesion.

The above discussion brings forth several questions to be answered.

1. Why is 'recruitment' absent in some VIII nerve lesion cases?
2. Why do some cases of VIII nerve lesion get high SISI score?
3. Why do some cases of VIII nerve lesion get low SISI score?

The absence of recruitment in surgically confirmed retrocochlear pathology cases may be explained on the basis of the method of administration of ABLB test. As manual method of administration is also in practice the cases who have reported to have demonstrated no recruitment might have been tested with ABLB test using manual method (Manual method may allow the tones to fade). Another probable explanation is that the loudness matching is subjective and the results may be influenced by factors like diplacusis, tinnitus, crossover and other unknown factors.

High SISI scores in surgically confirmed retrocochlear pathology cases may be considered as false SISI+ve. Usually false SISI+ve occurs if there is abnormal tone decay. (Owens, 1965, Jerger, 1955, Hughes, 1968). The present case also exhibited 100 per cent SISI score (false SISI+ve) at all the frequencies in the poorer ear when modified SI SI test (Young and Harbert, 1967) was administered. True SISI+ve may also result in retrocochlear pathology cases. This may be explained on the basis of absence of tone decay. It is known that when the energy reaching the cochlea is about 60 dB all the ears respond to 1 dB increments. When modified SISI test is administered to a case with retrocochlear pathology having no tone decay, high SISI score can be expected as the energy reaching the cochlea is not reduced.

Low SISI scores or negative SISI test in surgically confirmed retrocochlear pathology cases may be explained on the basis of marked tone decay (Young and Harbert, 1967). If the tone decay is very rapid 5 second interval between pulses may not be sufficient for recovery (Green, 1972). Hence 1 dB pips are not heard. Another probable explanation is that the author has observed in some SN loss cases neither tone decay nor SISI+ve indicating that SISI test or TDT is not a fool-proof test. Therefore -ve SISI in retrocochlear pathology cases may be considered as a failure of the test.

The above explanations indicate that the subject's performance on SISI test is affected by tone decay.

With the above explanations it may be inferred that the observation of cochlear findings (recruitment, II Bekesy tracings,+ve SISI test and -ve TDT) in surgically confirmed retrocochlear pathology cases is due to the influence of tone decay i.e., the absence of marked tone decay or presence of mild or moderate decay or no tone decay. Now a question arises—if the above statement is true, how is it negative tone decay test results have been observed in confirmed retrocochlear pathology cases? Those who believe that the observation of cochlear findings in confirmed retrocochlear pathology cases is due to the predominance of cochlear findings when both the lesions co-exist might answer the question on the same lines i.e., predominance of cochlear findings. Shall we accept it? I am afraid not. This is because of the fact that it would be difficult to explain the arrest of abnormal tone decay on the basis of the co-existence of both the lesions. How can cochlear lesion arrest tone decay if it exists? In fact, Matkin's (1965) report shows that when both the lesions co-exist the retrocochlear findings predominate indicating that ifthere is abnormal tone decay it will be observed even when both the lesions co-exist. So, it appears that the absence of marked tone decay in surgically confirmed retrocochlear pathology cases may be due to the insensitivity of the test in identifying retrocochlear pathology cases.

To sum up, it may be stated that ABLB test (auto) is not a useful test in differential diagnosis of cochlear Vs. retrocochlear pathology. Neither is it useful in providing information regarding the use of amplification in hearing aids as recruitment may be an artifact. A lot of concern is expressed by many investigators regarding the audiological tests as many cases of surgically confirmed retrocochlear pathology have been reported to have demonstrated cochlear findings. This concern seems to be unwarranted as cochlear findings in retrocochlear pathology cases seem to be expected findings if the recruitment is an artifact and if the SISI test results and Bekesy tracings are influenced by tone decay. As ABLB test is not useful in differential diagnosis of cochlear Vs. retrocochlear and as SISI scores and Bekesy tracings are influenced by tone decay it would be better not to rely on them and thereby wrong diagnosis can be averted. Tests like tone decay, Acoustic reflex threshold measurement, LDT (50 per cent reflex decay time) and speech audiometry incorporating ipsilateral masking seem to be very useful in differential diagnosis of cochlear Vs. retrocochlear lesion. Negative results of these four tests do not rule out retrocochlear pathology. However positive results suggest a high index of suspicion about retrocochlear pathology.

In the light of the above discussion, it appears that it would be very important to have sufficient data on the following:

1. Observation of negative SISI test (modified SISI test) in surgically confirmed retrocochlear pathology cases having no tone decay. With this we can infer that SISI test is not influenced by tone decay.

2. Observation of absence of recruitment (as measured by ABLB auto) in surgically confirmed retrocochlear pathology cases having abnormal tone decay taking full account of the factors like error of judgment, crossover, tinnitus, diplacusis and pulse rate. With this we can infer that recruitment is a fact.
3. Observation of absence of Acoustic reflex in typical moderate or moderately severe SN loss cases having no tone decay or observation of elevated acoustic reflex thresholds in surgically confirmed retrocochlear pathology cases having no tone decay.

The above data would enable us to know whether cochlear findings in retrocochlear pathology cases are due to the influence of tone decay or art due to the co-existence of both the lesions viz. cochlear and retrocochlear. Further, they may throw light on the subject of 'recruitment'.

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