Sri Lakshmi Narayana Institute of Medical Sciences

Date 02/09/2018

From
Dr.R.Venkataramanan,
Professor and Head,
otorhinolaryngology,
SLIMS
Bharath Institute of Higher Education and Research,
Puducherry.

To
The Dean,
SLIMS
Bharath Institute of Higher Education and Research,
Puducherry.

Sub: Permission to conduct value-added course: : Hands on training and an Extensive Discussion on BERA reg.

Dear Sir,

With reference to the subject mentioned above, the department proposes to conduct a value-added course titled: Simulation Based Training In Audiology on Sep 2018 to Dec 2018. We solicit your kind permission for the same.

Kind Regards

Dr.R.Venkataramanan

FOR THE USE OF DEANS OFFICE

Names of Committee members for evaluating the course:
The Dean:
The HOD:
The Expert:

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The committee has discussed about the course and is approved.

Dean

(Sign&Seal)

DEAN
Prof.K.BALAGURUNATHAN,M.S
(General surgeon)
SRI LAKSHMI NARAYANA
INSTITUTE OF MEDICAL SCIENCES
OSUDU PONDICHERRY

Dr. R. VENKATARAMANAN, MS.,
Reg. No: 72549
Professor ENT
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry-605 502.

Subject expert
(Sign &Seal)

Seal & Signature of the HOD
PROFESSOR & HOD
DEPARTMENT OF E.N.T
Sri Lakshmi Narayana Institute Of Medical Sciences
PONDICHERRY - 605 502

OFFICE OF THE DEAN

Sri Lakshmi Narayana Institute of Medical Sciences

OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST,
PUDUCHERRY - 605 502.
[Recognised by Medical Council of India, Ministry of Health letter No. U/12012/249/2005-ME (P -II) dt. 11/07/2011]
[Affliated to Bharath University, Chennai - TN]

Ref. No. SLIMS/Dean Off/VAC/024 **Date:03/09/18**

From
The Dean
Sri Lakshmi Narayana Institute of Medical sciences,
Pondicherry – 605502

To
The Registrar,
Bharath Institute of Higher Education and Research,
Chennai - 600073.

Respected Sir

Sub: Request for permission and approval of Syllabus for certificate course (Value Added course) for the academic year 2018-19 - Reg
Ref: Requesting letter received from Departments

*****

With reference to the above, herewith forwarding the proposed list of Value-added courses for necessary permission and approval of syllabus to conduct the same.

This is for your kind information and needful action.

Thankingyou

Yours faithfully

[DEAN]

DEAN
Prof.K.BALAGURUNATHAN,M.S
(General surgeon)
SRI LAKSHMI NARAYANA
INSTITUTE OF MEDICAL SCIENCES
OSUDU PONDICHERRY

Encl's:

1. Requesting letter received from department
2. Syllabus of thecourse
3. Details of faculty handlingcourse

Sri Lakshmi Narayana Institute of Medical Sciences,

Puducherry

VALUE ADDED COURSE : Hands on training and an Extensive Discussion on BERA

COURSE CO-ORDINATOR DETAILS

Faculty Name: Dr. K.Venkataramanan

Email ID:e n t s l i m s @ g m a i l . c o m

Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed - to - be - University under section 3 of UGC Act 1956)

Ref. No. BHIER/ VAC/B-02 **Date:05.09.2018**

From

The Registrar,
Bharath Institute of Higher Education and Research,
Chennai - 600073.

To

The Dean
Sri Lakshmi Narayana Institute of Medical sciences,
Pondicherry – 605502

Sir / Madam,

Sub: Approval of Syllabus to conduct certificate course (Value Added course) for the academic year 2018-2019 – Reg.

Ref: Ref. No. SLIMS/Dean Off/VAC /024 Dated: 03.09.2018

*****

With reference to the above, it is to inform that the proposal submitted to conduct Value Added Course has been accepted and approved by BIHER, council meeting. List of the VAC are mentioned below for the academic year 2018– 2019. The abstract of the VAC course completion detail should be submitted to the Registrar office.

Thanking you Yours faithfully

REGISTRAR

OFFICE OF THE DEAN

Sri Lakshmi Narayana Institute of Medical Sciences

OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST,
PUDUCHERRY - 605 502.
[Recognised by Medical Council of India, Ministry of Health letter No. U/12012/249/2005-ME (P -II) dt. 11/07/2011]
[Affliated to Bharath University, Chennai - TN]

Circular

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07/09/2018

Sub: Organising Value-added Course: Hands on training and an Extensive Discussion on BERA **reg.**

With reference to the above mentioned subject, it is to bring to your notice that SLIMS,**Bharath Institute of Higher Education and Research**, is organising **"Hands on training and an Extensive Discussion on BERA"**. The course content and registration form is enclosed below.

The application must reach the institution along with all the necessary documents as mentioned. The hard copy of the application should be sent to the institution by registered/ speed post only so as to reach on or before 15/09/2018. Applications received after the mentioned date shall not be entertained under any circumstances.

DEAN

DEAN
Prof.K.BALAGURUNATHAN,M.S
(General surgeon)
SRI LAKSHMI NARAYANA
INSTITUTE OF MEDICAL SCIENCES
OSUDU PONDICHERRY

Encl: Copy of Course content

VALUE ADDED COURSE

1. Name of the programme &Code

Hands on training and an Extensive Discussion on BERA – A value added course for the medical students.
& **ENT 08**

2. Duration &Period

30 hrs & Sep 2018-Dec 2018

3. Information Brochure and Course Content of Value Added Courses

Enclosed as Annexure- I

4. List of students enrolled

Enclosed as Annexure- II

5. Assessment procedures:

Pre test and post test which includes 10 mcqs - *Enclosed as Annexure- III*

6. Certificate model

Enclosed as Annexure- IV

7. No. of times offered during the same year:

1 time Sep 2018- Dec 2018

8. Year of discontinuation:2019

9. Summary report of each program year-wise

Value Added Course- Sep 2018- Dec 2018					
Sl. No	**Course Code**	**Course Name**	**Resource Persons**	**Target Students**	**Strength & Year**
1	ENT 08	Hands on training and an Extensive Discussion on BERA	1.Dr.Venkataramanm 2. Dr. Sreedhar.B	3rd year MBBS students	14 students & 2018

10. Course FeedBack

Enclosed as Annexure- V

RESOURCEPERSON
1. **Dr.K.R.Jothikumar**
2. **Dr. Sreedhar.B**

COORDINATOR
Dr.R.Venkataramanan

COURSE PROPOSAL

1. NAME OF THE PROGRAMME

Hands on training and an ExtensiveDiscussion on BERA– A value added course for the medical students.

2. AIM

Training the students with hands on experience in BERA as an objective audiological test

3. OBJECTIVES

a) To teach the students to connect the electrodes of BERA
b) To teach the students to interpret the BERA waves

4. METHODOLOGY

Students who are interested in participating in value added course are enrolled and the course is conducted for them during the non college hours for a period of 30 hours from Sep 2018 – Dec 2018 . This course is conducted every 6 months.

Course Audience: 3rd year MBBS students

Course Coordinator: Dr.R.Venkataramanan

Course Faculties with Qualification and Designation:

1.Dr.K.R. jothikumar

2.Dr. Sreedhar.B

Schedule followed during the course

No	Topic	Title	Duration	Date and time
1	Hands on training and an Extensive Discussion on BERA	Introduction of Brain Stem Evoked Response Audiometry (BERA)	4 hrs	4pm-6pm(19/9/18),4pm-6pm(25/9/18)
		Principle and method of recording BERA	4 hrs	4pm-6pm(29/9/18),4pm-6pm(4/10/18)
		Latency and amplitude studies of BERA	4 hrs	4pm-6pm(10/10/18),4pm-6pm(15/10/18)
		Clinical uses of BERA	4 hrs	4pm-6pm(19/10/18),4pm-6pm(23/10/18)
		Neurophysiologic basis of BERA	4 hrs	4pm-6pm(29/10/18),4pm-6pm(4/11/18)
		Demonstration of BERA and interpretation of results	5 hrs	4pm-6pm(10/11/18),4pm-7pm(15/11/18)
		Hands on training on BERA lead connection and interpretation of results and DOPS	5 hrs	4pm-6pm(23/11/18),4pm-6pm(3/12/18),4pm-5pm(8/12/18)
		TOTAL	30HRS	

REFERENCE BOOKS: 1) SCOTT BROWN 7th edition

2) ANIRBAN BISWAS 3rd edition

Brainstem Auditory Evoked Potentials

History

Sohmer and Feinmesser

- Signal-averaged ECochG studies

Jewett and co-workers

- Identified the short-latency scalp-recorded AEPs as far- field potentials volume-conducted from the brainstem, described the components and their properties
- Established the Roman numeral labeling of the peaks

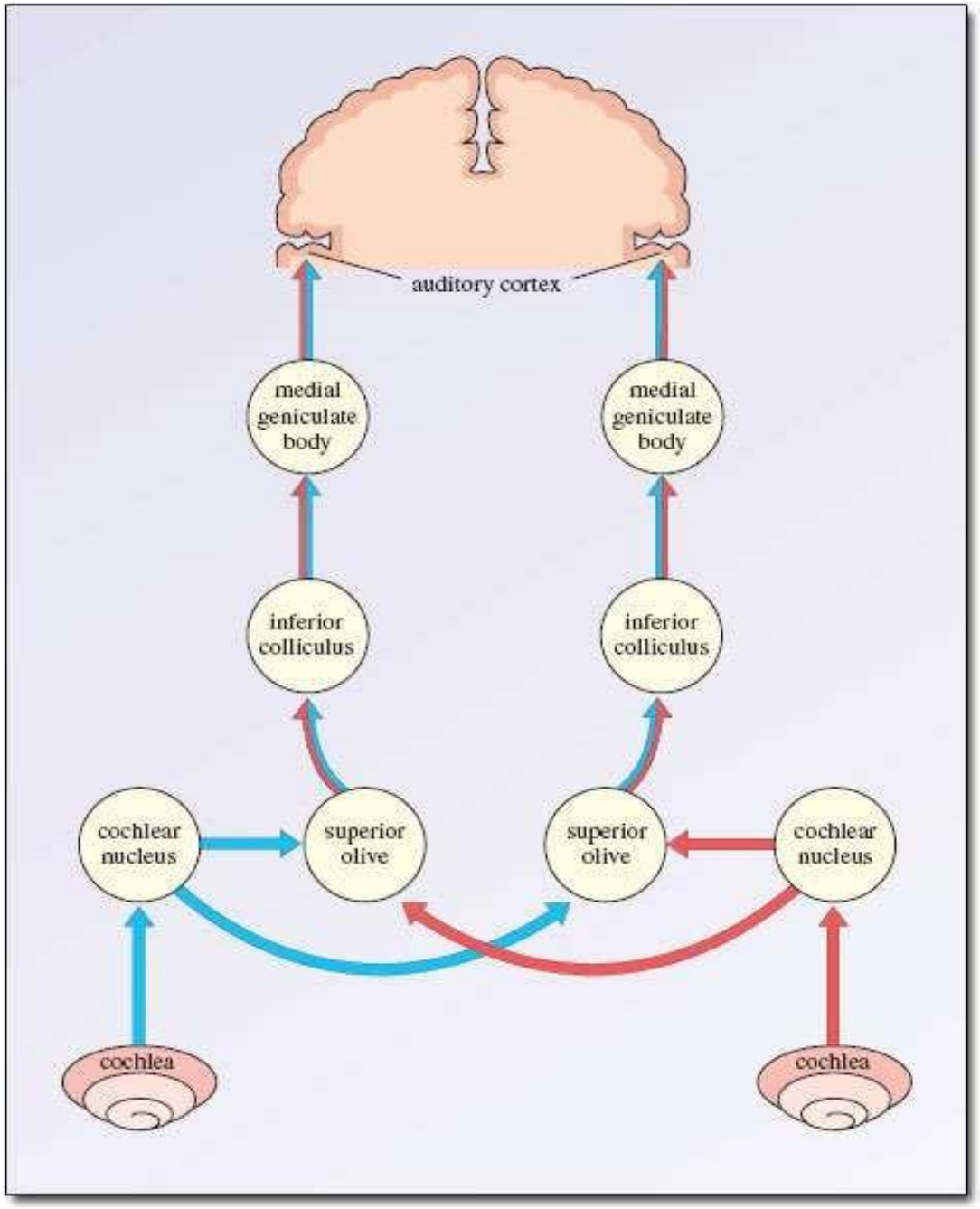
Brainstem Auditory Evoked Potentials

- Following a transient acoustic stimulus, ear and parts of the nervous system generate a series of electrical signals with latencies ranging from milliseconds to hundreds of milliseconds
- Recorded from electrodes placed on the skin
- To evaluate noninvasively the function of the ear and portions of the nervous system activated by the acoustic stimulation

BAEPs

- Generated by an anatomically distinguishable neuronal subsystem for sound localization within the brainstem
- BAEPs can be used only to assess the status of the ear, auditory nerve, and brainstem auditory pathways up through the level of the mesencephalon

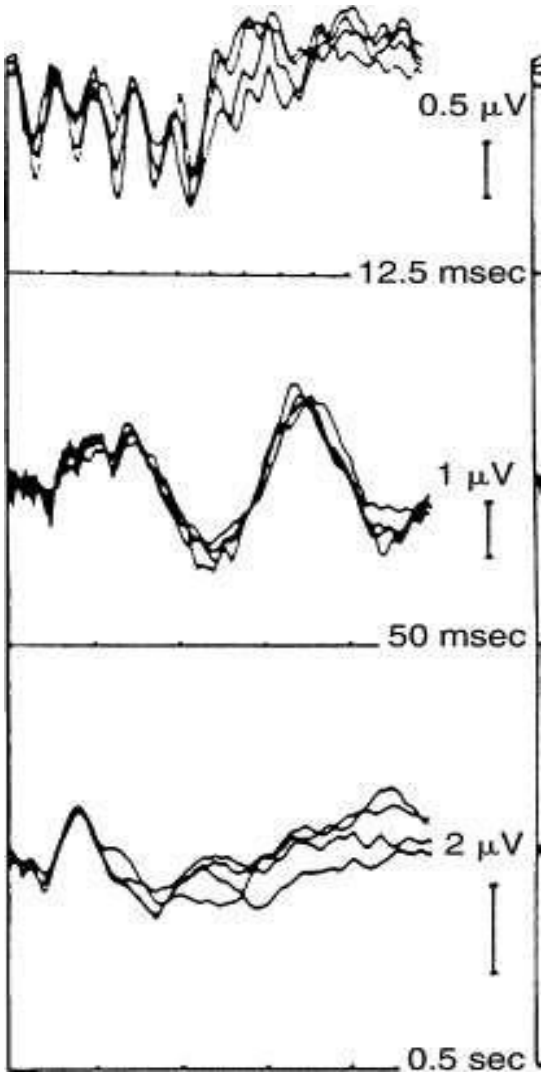
Auditory pathway



BAEPs

- Ascending projections from the cochlear nucleus are bilateral but are more extensive contralaterally than ipsilaterally
- Despite this anatomic asymmetry, the BAEPs appear to reflect predominantly activity in the ipsilateral ascending pathways

- Short-latency components, with latencies of under 10 msec in adults
- Long-latency AEPs, with latencies exceeding 50 msec
- Middle-latency AEPs, with intermediate latencies



- Affected profoundly by the degree to which the subject is

  attending to the stimuli and analyzing stimulus features

  - Used as probes of cognitive processes
  - Their variability, as well as uncertainty about the precise identity of their cortical generators, limits their utility for neurologic diagnosis

Middle-latency AEPs

- Small
- Subject to contamination by myogenic signals
- Variable from subject to subject

Middle- and Long-latency AEP

- generated predominantly by postsynaptic potentials

  within areas of cerebral cortex that are activated by the acoustic stimulus

- affected increasingly by the state of the subject and by anesthesia as their latency increases

Greatest clinical utility because

- Relatively easy to record
- Waveforms and latencies are highly consistent across normal subjects
- Unaffected by the subject's degree of attention to the stimuli and are almost identical in the waking and sleeping states
- Minor differences related to changes in body temperature

Although short-latency AEPs commonly are called brainstem auditory evoked potentials, this term is not completely accurate because the roster of generators

clearly includes the distal (with respect to the brainstem) cochlear nerve and may also include the thalamocortical auditory radiations, neither of which is within the brainstem

Stimulation

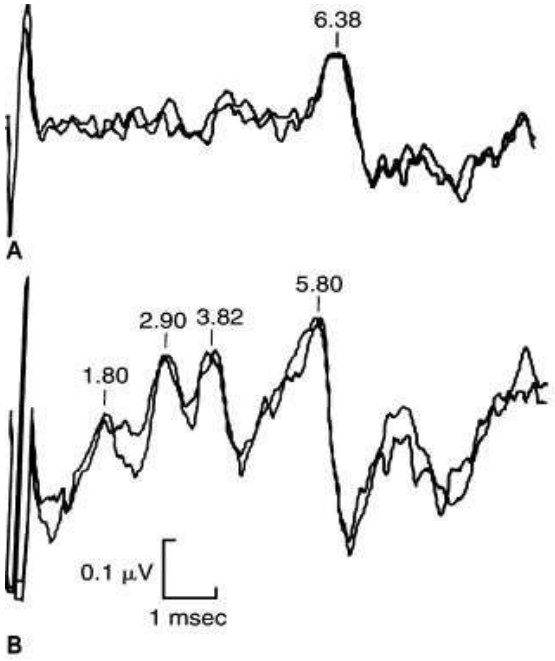
- Brief acoustic click stimuli that are produced by delivering monophasic square pulses of 100-μsec duration to headphones or other electromechanical transducers at a rate of about 10 hz
- A rate of exactly 10 hz or another submultiple of the power line frequency should be avoided because of line frequency artifact
- Stimulus intensity of 60 to 65 db HL is a typical level
- If hearing loss is present, stimulus intensity may be

Stimulation

- Stimuli are delivered monaurally
- To prevent contralateral ear stimulation it is masked with continuous white noise at an intensity 30 to 40 dB below that of the BAEP stimulus
- Activate region of the cochlea (base) responding to2,000- to 4,000-Hz sounds

Stimulation at Several Intensities

Differentiate peripheral from neural abnormalities, especially when wave I is not clear



- In Conductive hearing loss,if the stimulus intensity is increased and no coexisting sensorineural hearing loss is present, a normal BAEP will be recorded
- In contrast, BAEPs that are delayed as a result of abnormally slowed neural conduction do not normalize

Rapid Stimulation

- Approximately 10 Hz is used for routine clinical testing
- As the stimulus rate is increased above approximately 10 per sec, component amplitudes decrease and the peaks tend to become less well defined
- Wave V is most resistant to these effects
- More rapid rates may be used to facilitate recordings to measure the wave V threshold

Stimulus clicks according to polarity

Compression click (condensation click)

- If the electrical square pulse causes the diaphragm of the acoustic transducer to move toward the patient's ear

Rarefaction click

- Reversing the polarity of the electrical square pulse
- Generally preferable because BAEP peaks tend to be clearer

Alternative Auditory Stimuli

Stimulation with brief tone pips

- To probe specific parts of the cochlea

Acoustic masking

- Used to obtain frequency-specific information from BAEPs
- Relatively poor signal-to-noise ratios

BAEPs by bone-conducted stimuli

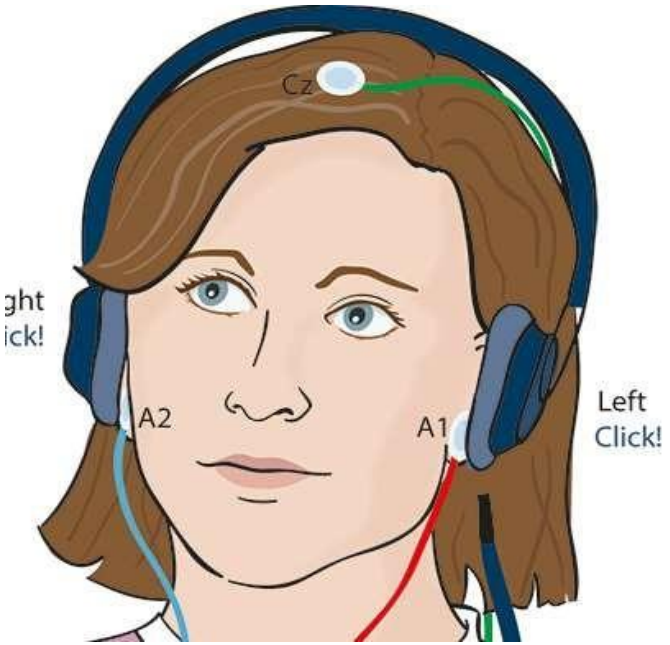
- Most useful in assessing patients who may have conductive hearing losses, such as neonates in whom BAEPs performed with air-conducted stimuli are suggestive of a hearing loss

BAEPs to Electrical Stimuli

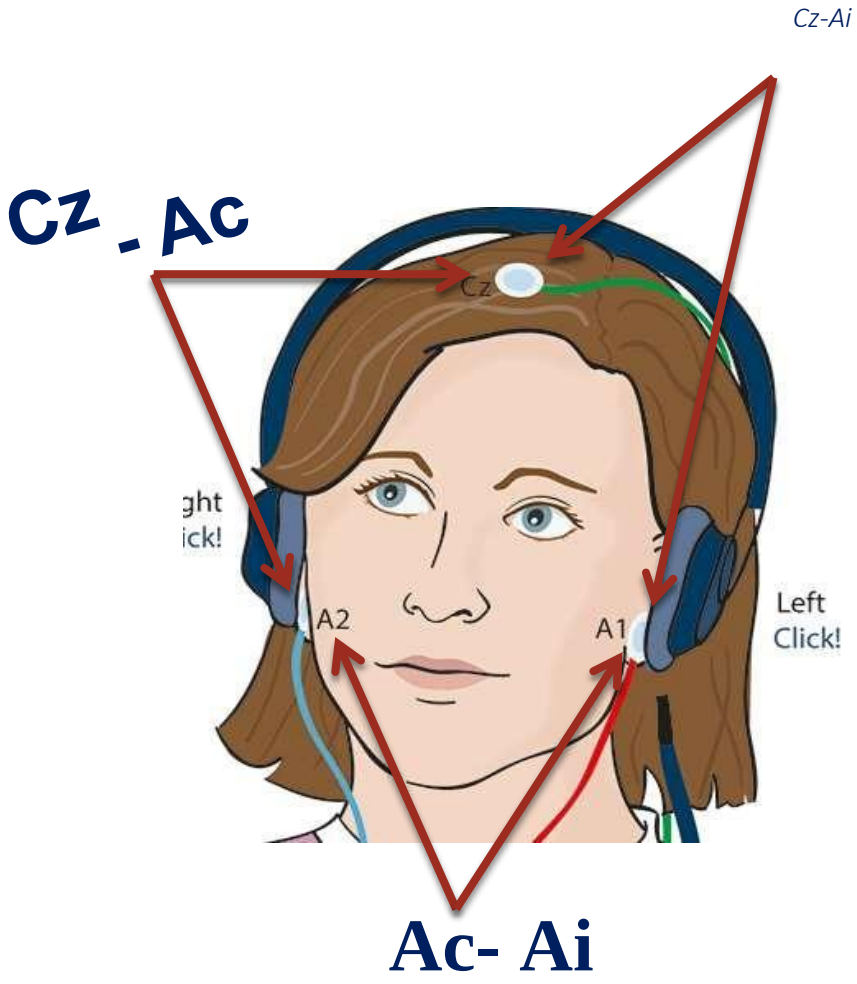
- Electrical stimulation of eighth nerve fibers through the electrodes of a cochlear prosthesis
- Used to assess the proximity of these electrodes to the spiral ganglion during implantation and the adequacy of eighth nerve stimulation during programming of the processor
- Correlate well with auditory outcomes, and may prove to be useful in guiding therapy in young children with questionable auditory nerve integrity

Recording electrodes

- Typically are placed at the vertex (location Cz of the International 10–20 System) and at both ear lobes (Ai and Ac)
- Electrodes at the mastoids (Mi and Mc) may be substituted, although wave I tends to be smaller because of muscle noise



Montages



May assist in the identification of wav

Patient relaxation

- Patients usually are tested while lying comfortably so that their neck musculature is relaxed
- Patients should be requested to let their mouth hang open if the muscles of mastication are tensed
- encouraged to sleep during testing
- If the patient cannot relax sufficiently, sedation can be induced with agents such as chloral hydrate (little or no effect on BAEPs in the usual sedative doses)

- Amplifier filters out all of the delta, theta, alpha, and beta bands of the EEG
- Biologically derived noise in the recordings is derived predominantly from muscle activity
- Therefore, patient relaxation during the recording session is essential to obtain “clean” waveforms with a good signal-to-noise ratio

Data analysis

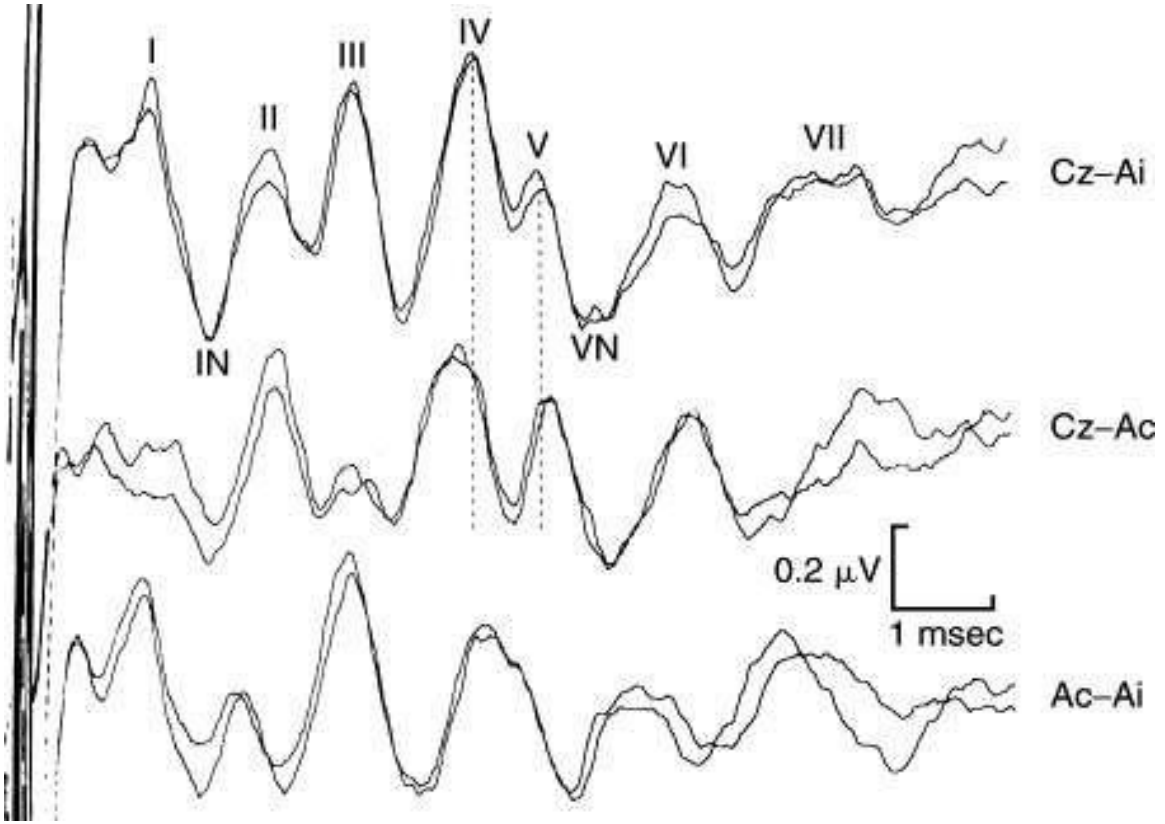
- Data typically are digitized over an epoch duration or analysis time of approximately 10 msec
- Longer analysis time of 15 msec may be required for recording pathologically delayed BAEPs, BAEPs to lowered stimulus intensities (as when recording a latency–intensity study), BAEPs in children, and BAEPs during intraoperative monitoring
- Signal averaging is required for improvement in the signal-to-noise ratio

Waveform Identification

- Cz–Ai BAEP typically is displayed so that positivity at the vertex relative to the stimulated ear is displayed as an upward deflection
- Upward-pointing peaks are labeled with Roman numerals
- Downward-pointing peaks are labeled with the suffix N according to the peak that they follow

- Typically begins with an electrical stimulus artifact that is

synchronous with stimulus production at the transducer



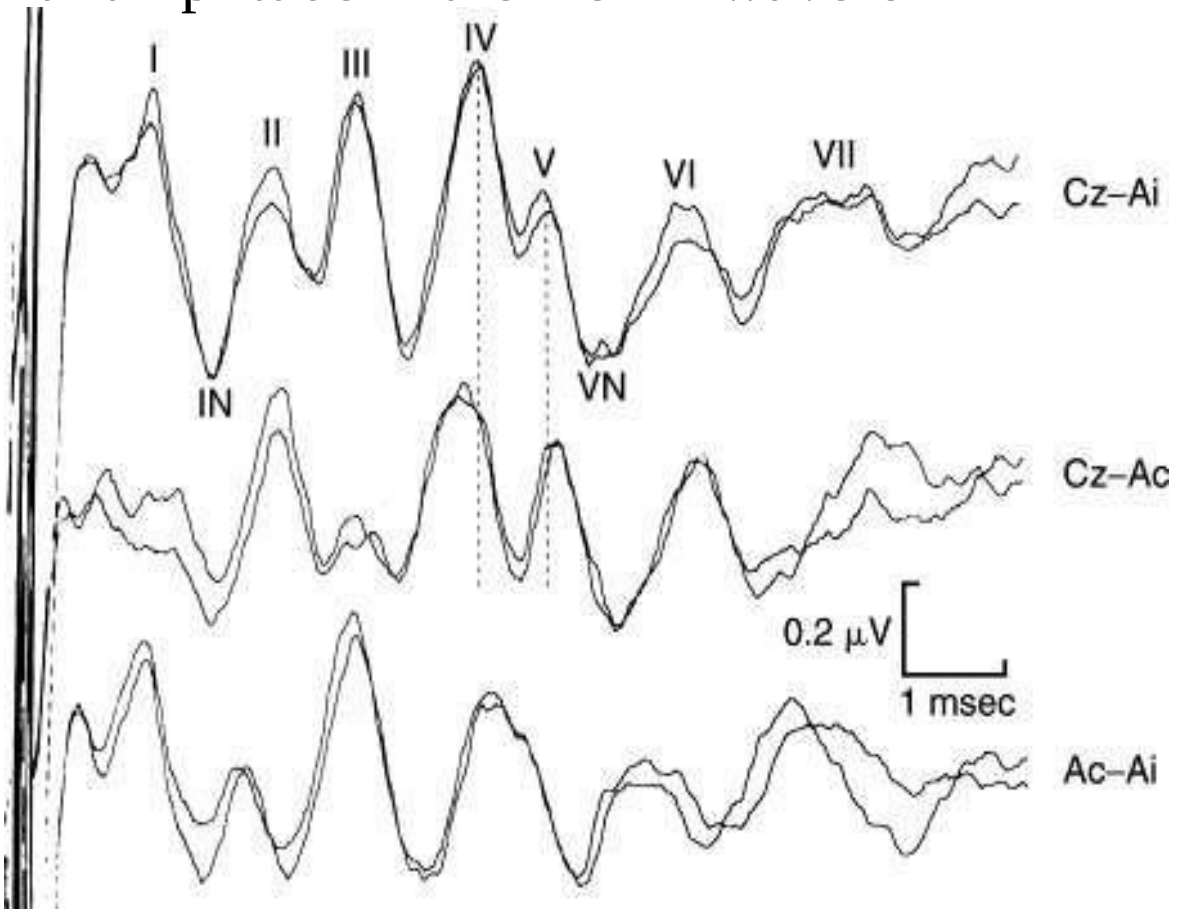
Reducing the Stimulus Artifact

May overlap with wave I and impair the identification and measurement

- Using shielded headphones and headphones with piezoelectric transducers instead of voice coil transducers
- Transducers that are connected to an ear insert by flexible plastic tubing several centimeters in length

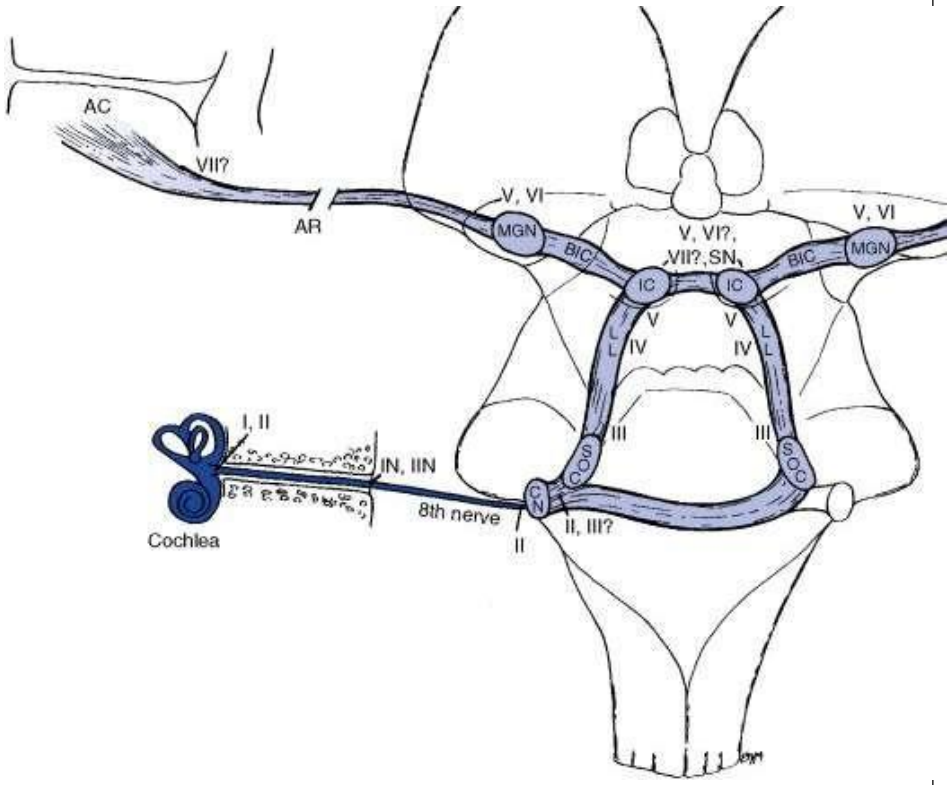
Wave I

- first major upgoing peak of the Cz–Ai BAEP
- upgoing peak of similar amplitude in the Ac–Ai waveform
- markedly attenuated or absent in the Cz–Ac waveform



Wave I

- Arises from at the most distal (i.E., Closest to the cochlea) portion of auditory nerve
- Circumscribed negativity around the stimulated ear
- Appears in Cz–Ai and Ac– Ai recordings but is minimal or absent in Cz–Ac



Cochlear microphonic Vs Wave I

- Visible as a separate peak preceding wave I, especially if the stimulus artifact is small
- Distinguished by reversing the stimulus polarity, which will reverse the polarity of the cochlear microphonic; Wave I may show a latency shift, but will not reverse polarity

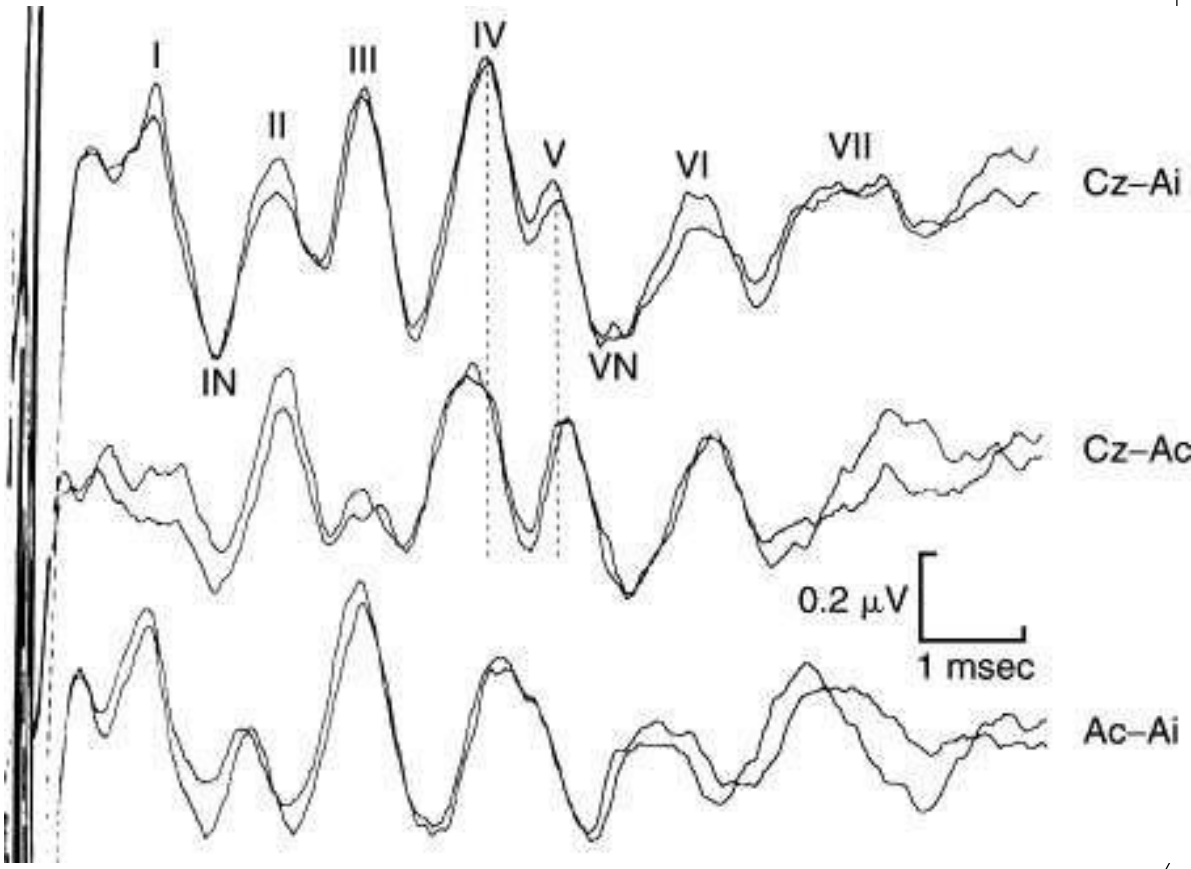
Bifid wave I

- Represents contributions to wave I from different portions of the cochlea
- Earlier of the two peaks, which reflects activation of the base of the cochlea, corresponds to the single wave I that is typically present in the Cz–Ai waveform
- Reversal of stimulus polarity can be used to distinguish a bifid wave I from a cochlear microphonic followed by (a single) wave I

Techniques to obtain a clearer wave I

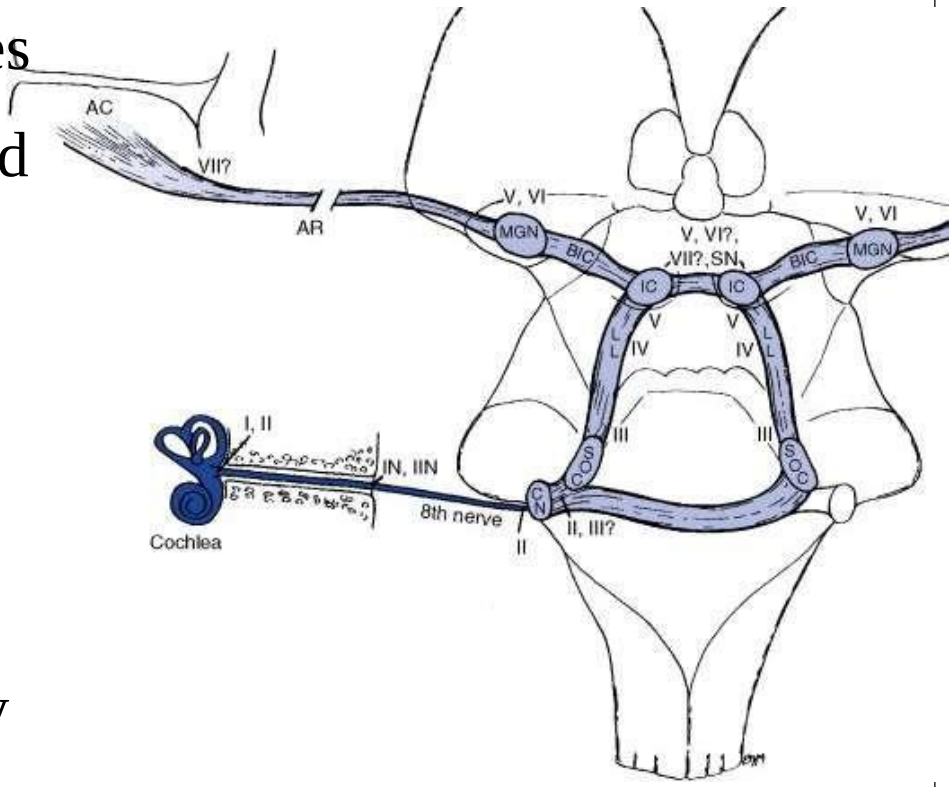
- Electrode within the external auditory canal
- Ac–Ai recording channel can yield a somewhat larger and clearer wave I than that in the standard Cz–Ai recording
- Reduction in the stimulus repetition rate
- Increasing the stimulus intensity

- Present at substantial amplitude in the Cz–Ac channel
- Usually the earliest BAEP component in that waveform



Wave IN

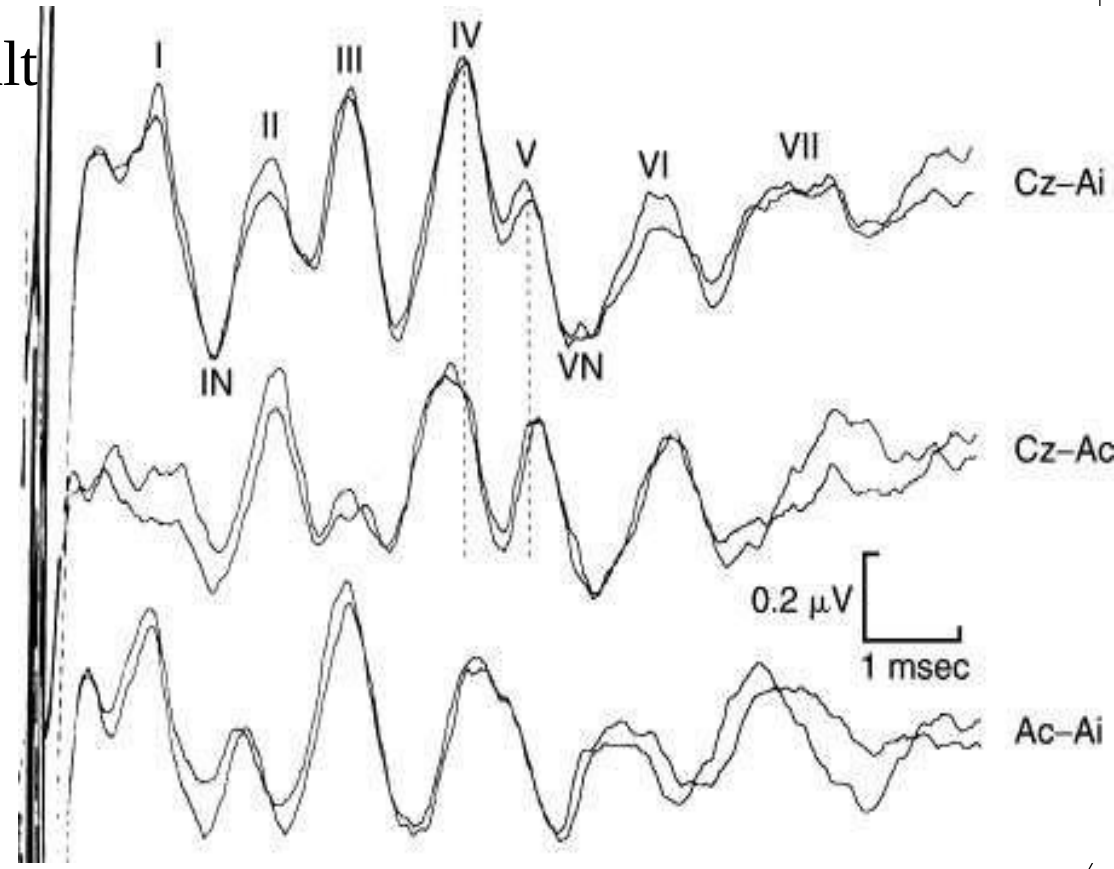
- From auditory nerve as it passes the internal auditory meatus and moves from a nerve encased in bone to one surrounded by cerebrospinal fluid
- Field includes positivity at the mastoid and far-field negativity around the vertex

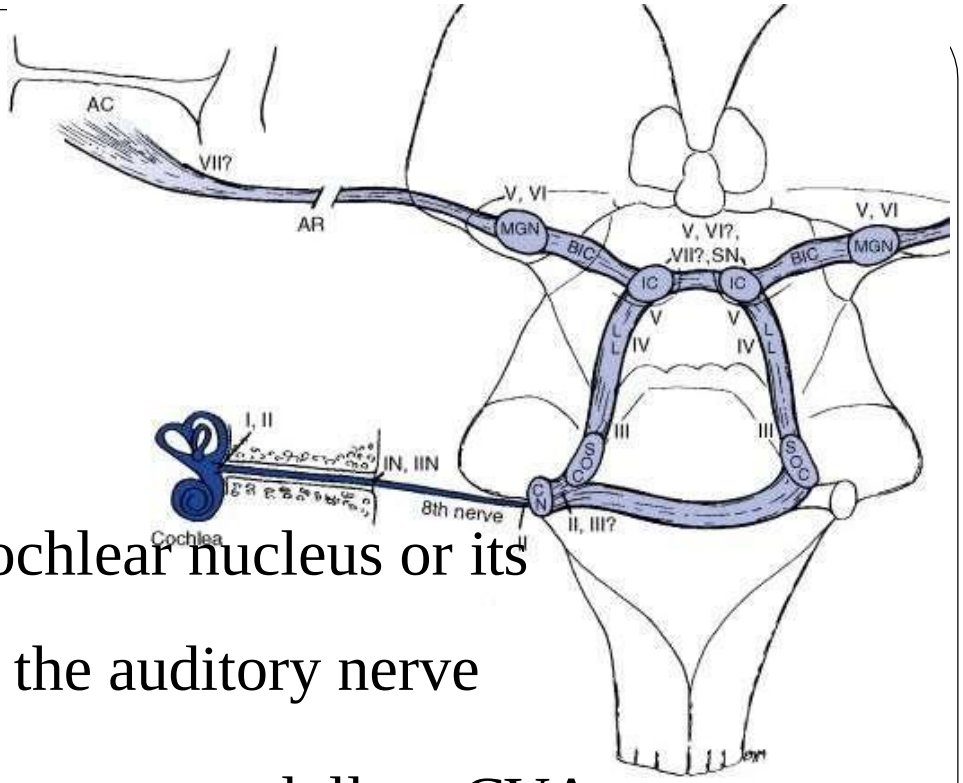


- In contrast to wave I,

Wave II

- First major upward deflection in the Cz–Ac waveform
- Similar amplitude in the Cz–Ai and Cz–Ac channels
- may be small and difficult to identify in some normal subjects





- Arises from two loci

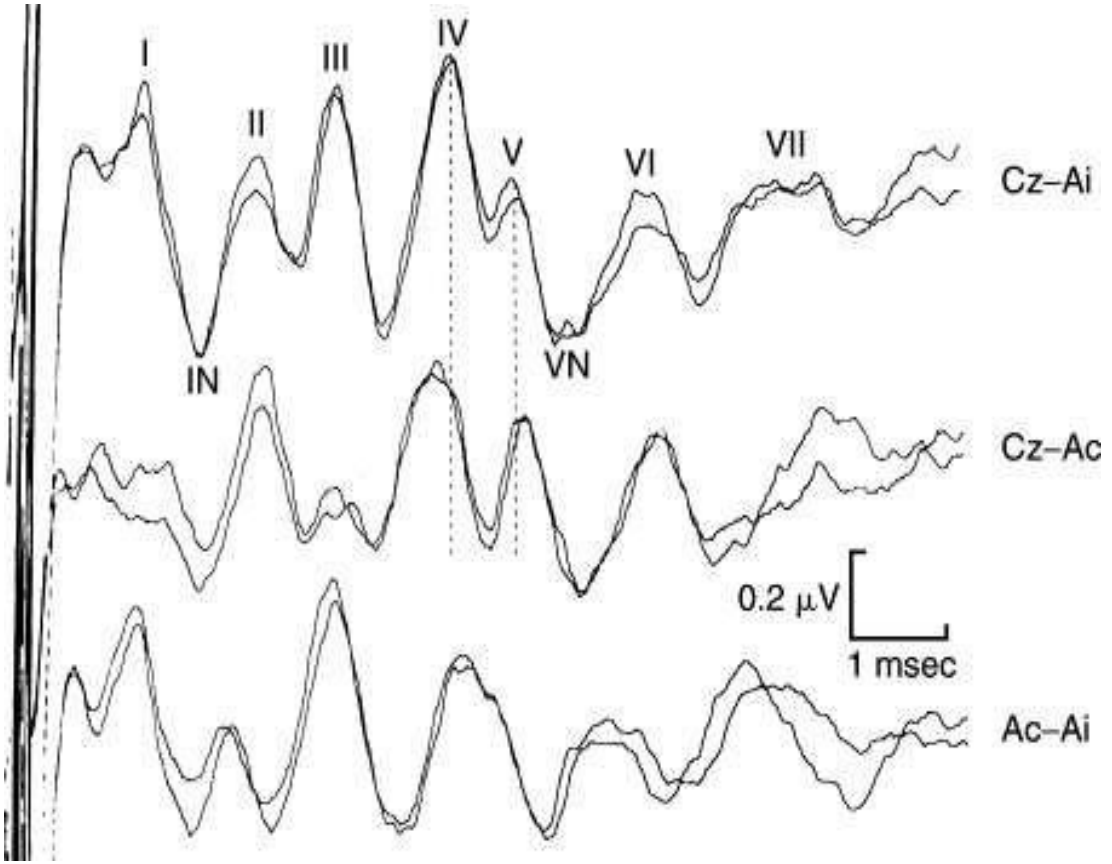
a) distal auditory nerve

b) brainstem, specifically the cochlear nucleus or its outflow and proximal end of the auditory nerve

- Earliest component affected by pontomedullary CVAs involving the cochlear nucleus
- Usually predominant over the dorsal part of the head and a clear wave II in the Cz–Ac waveform

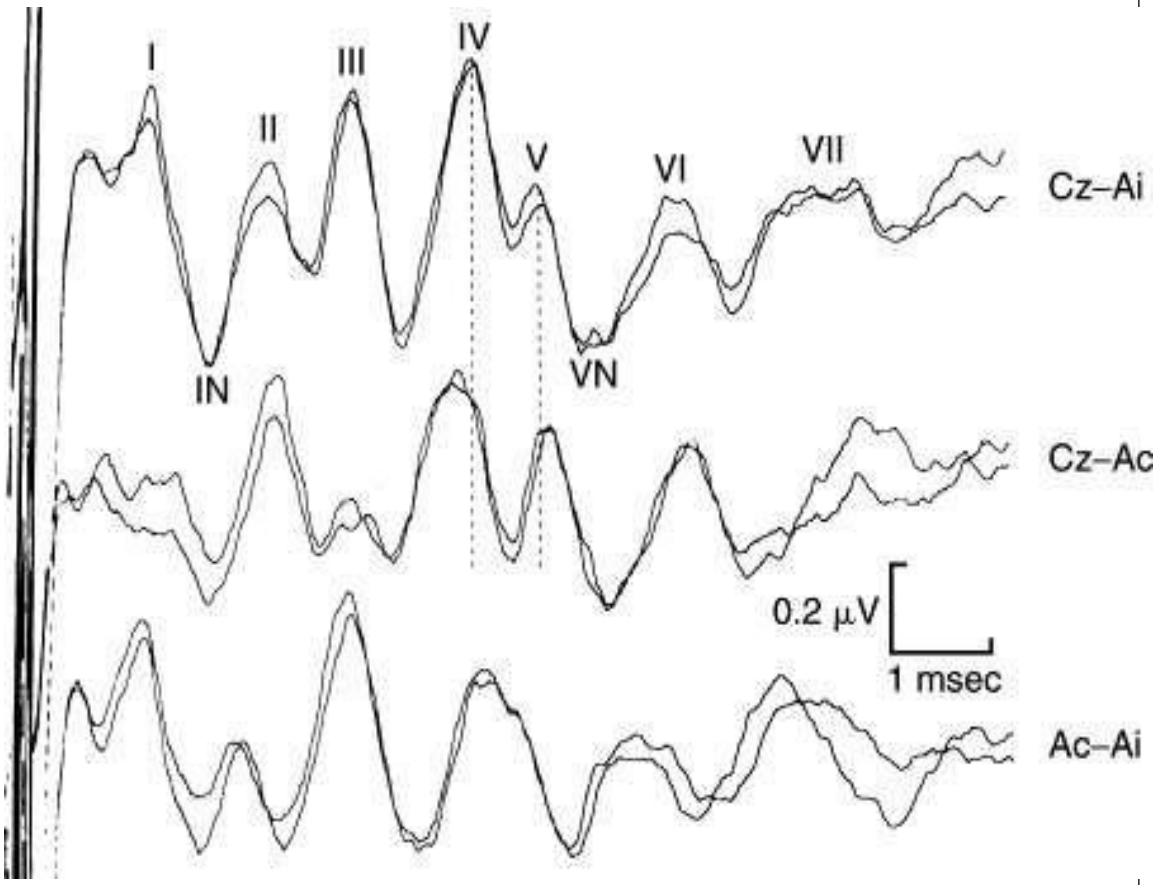
Wave IIN

- Arises from auditory nerve as it passes the internal auditory meatus



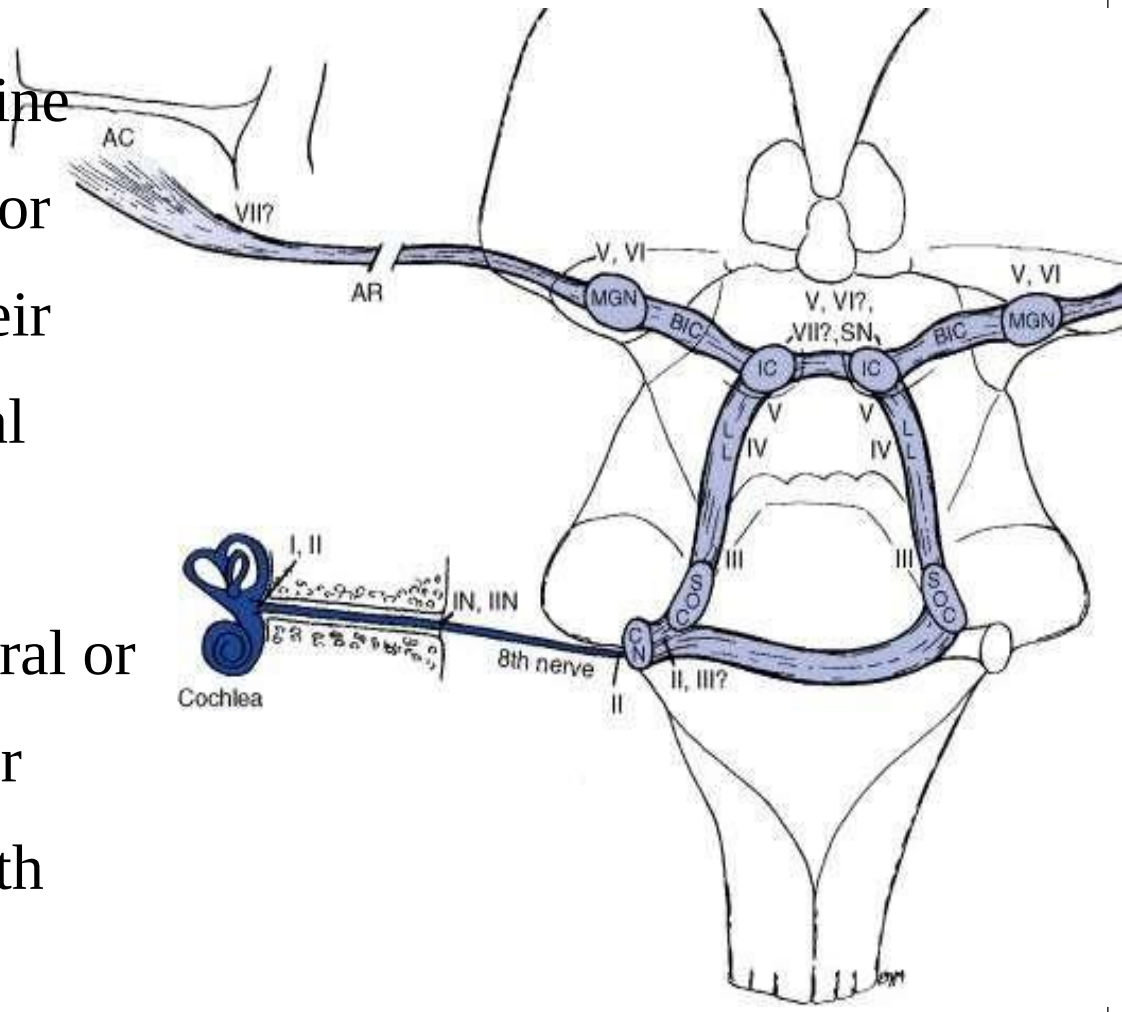
wave III

- usually present in both the Cz–Ai and Ac–Ai channels
- substantially smaller in the Cz–Ac



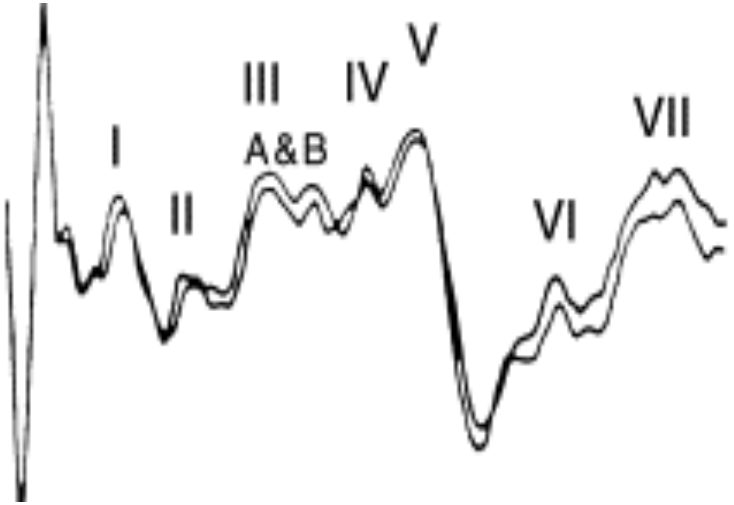
Wave III

- Arises from caudal pontine tegmentum in the superior olivary complexes or their outflow within the lateral lemniscus
- Abnormal either ipsilateral or contralateral to the major pathology in patients with asymmetric lesions



Wave III variants

Bifid wave III



- normal variant

Poorly formed or absent wave II

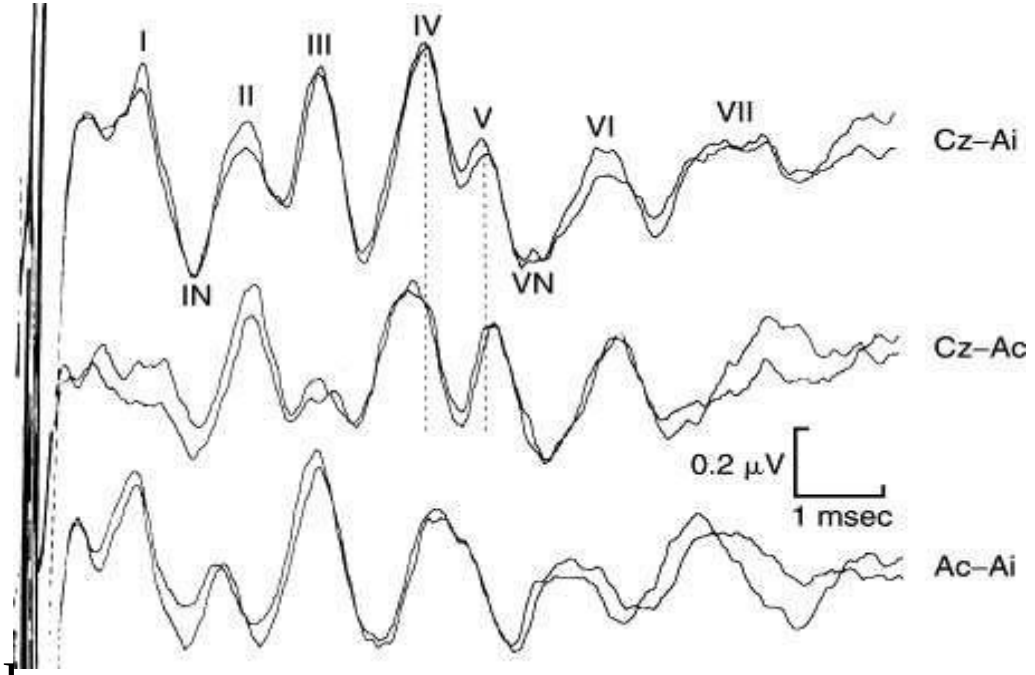
- normal variant in a patient with a clear wave V and a normal I–V interpeak interval

Role of Descending Pathways in BAEPs

- Waves I and II may be quite large or waves II and III are delayed in latency in patients with rostral brainstem pathology
- probably reflects loss of activity in descending inhibitory pathways originating in or traversing the region of the inferior colliculus

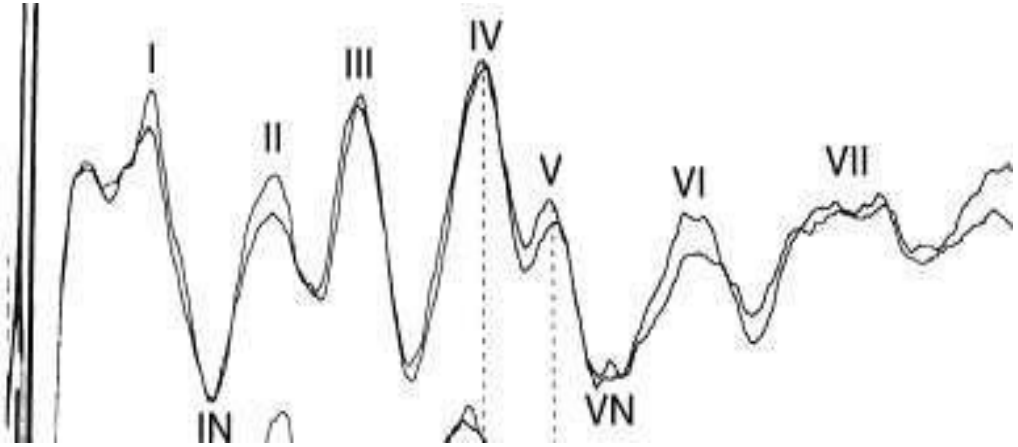
Waves IV and V

- often fused into a IV/V complex
- most prominent component in the BAEP waveform
- morphology varies from one subject to another, and may differ between the two ears in the same

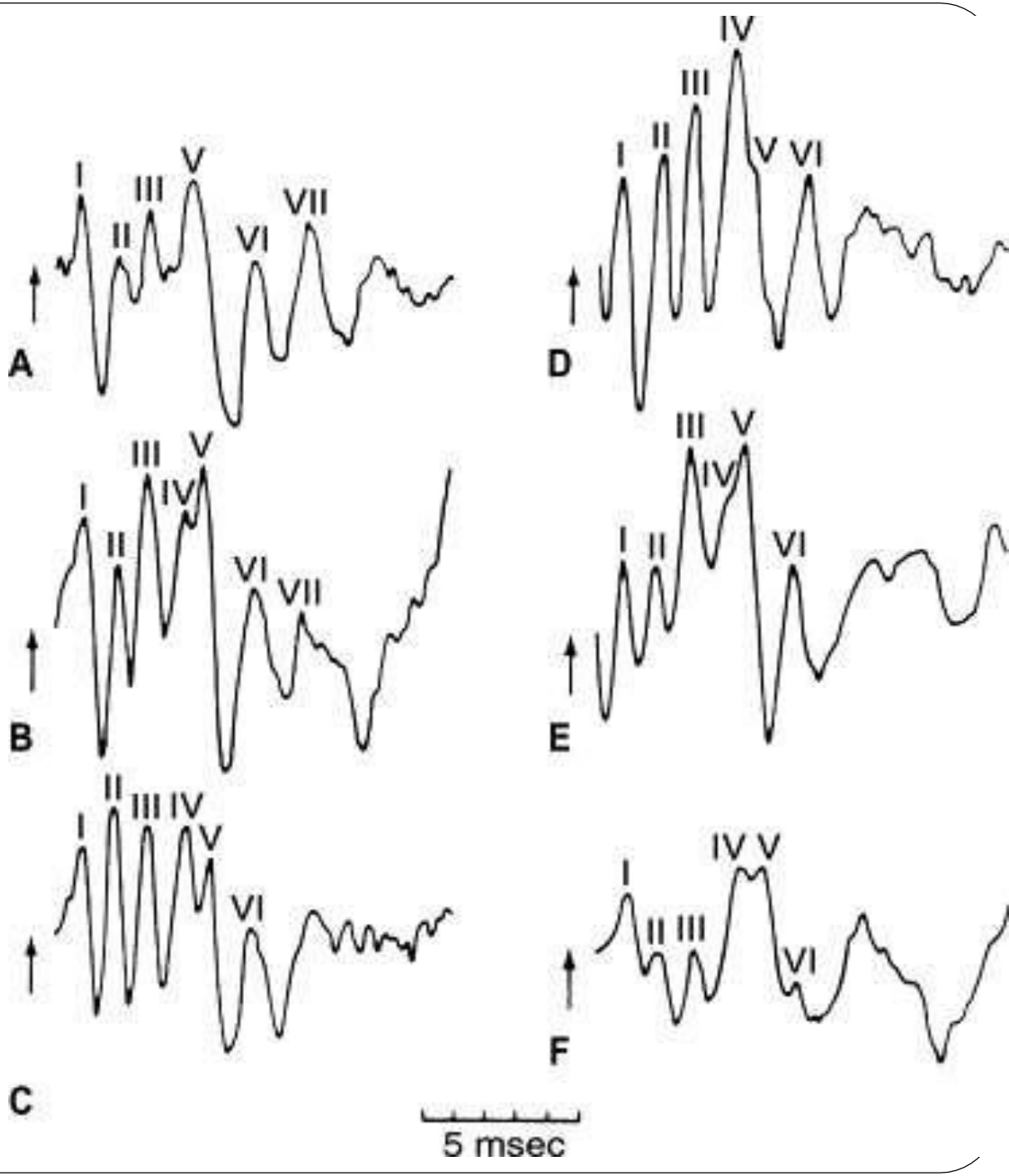


Waves IV and V

- Earliest components that are absent and usually are the earliest that are abnormal in patients with lesions of the midpons, rostral pons, or mesencephalon
- Usually is followed by a large negative deflection that lasts several milliseconds and brings the waveform to a point below the prestimulus b

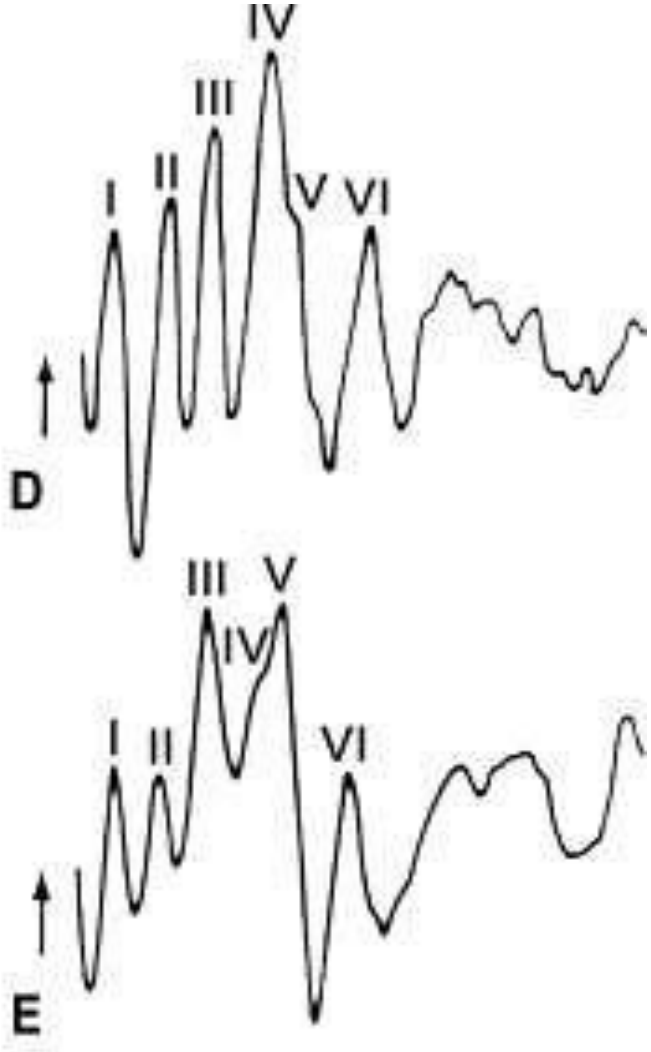


Various IV/V complex morphologies in Cz–Ai waveforms recorded in normal subjects



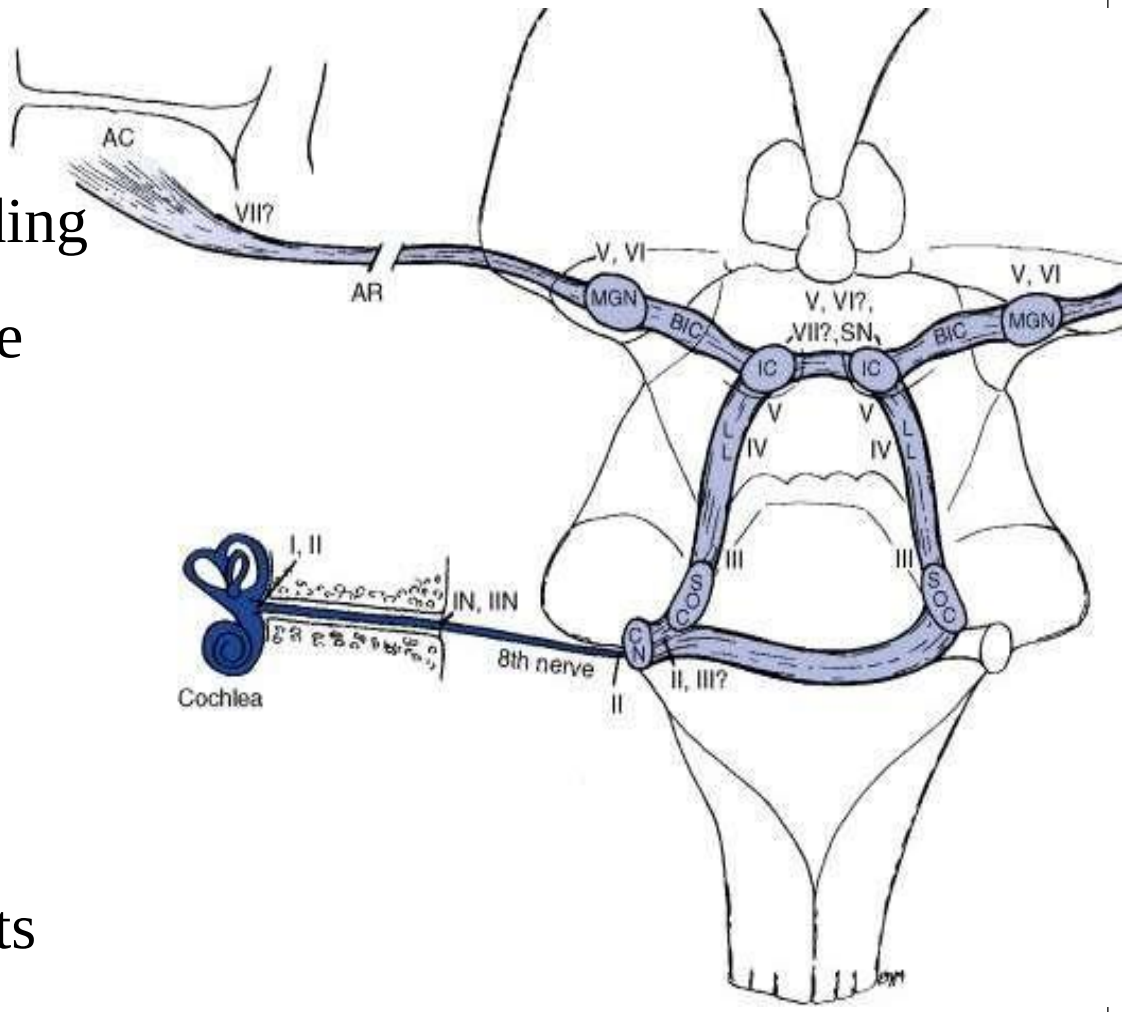
Totally fused IV/V complex Vs single wave IV or V

- Complex has a “base” that is greater than 1.5 msec in duration, whereas the width of a single wave is less than 1.5 msec



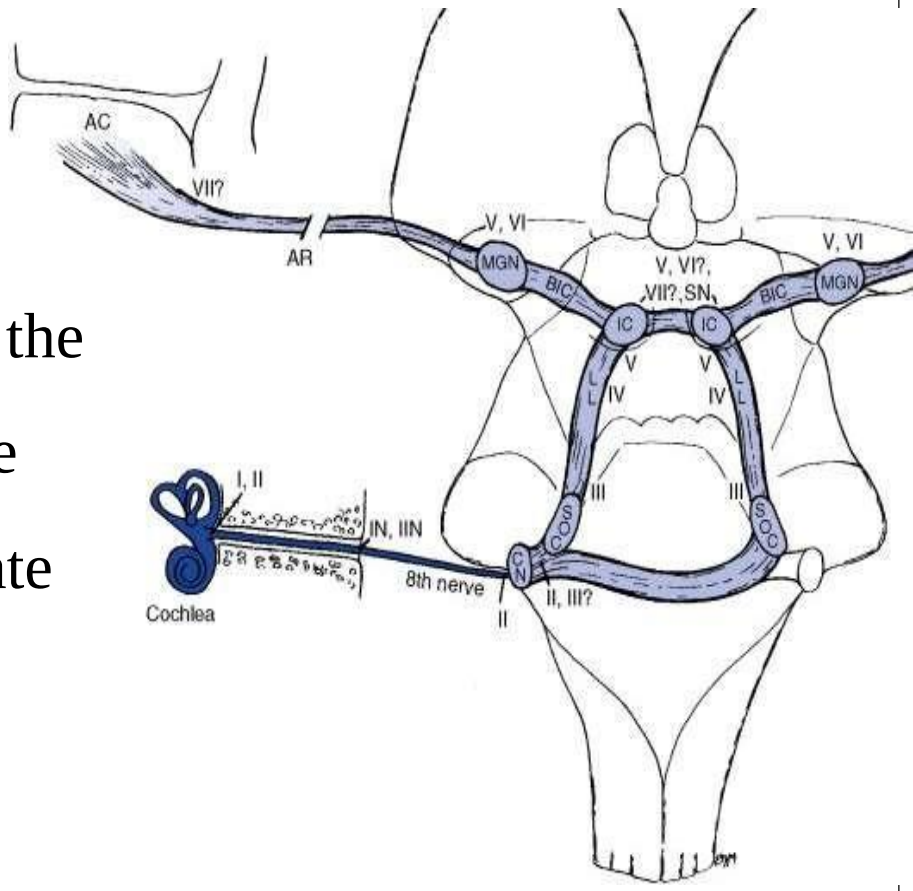
Wave IV

- Reflect activity predominantly in ascending auditory fibers within the dorsal and rostral pons, caudal to the inferior colliculus
- Affected by tumors or cerebrovascular accidents of the midpons



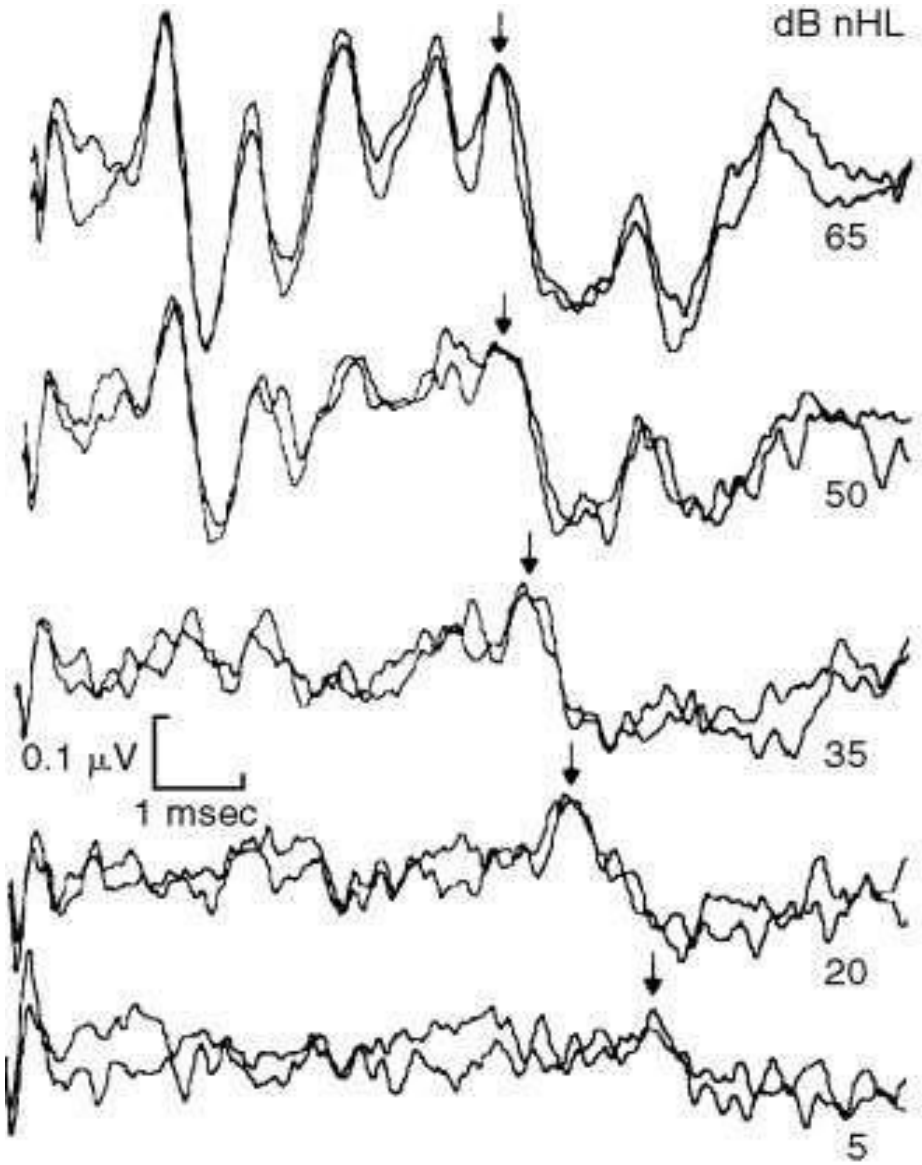
or rostral pons

- Arises at the level of the mesencephalon, either from the inferior colliculus itself or, from the fibers in the rostral portion of the lateral lemniscus as they terminate in the inferior colliculus
- Intracranial data suggest C/L mesencephalon but clinically associated most often with ipsilateral pathology



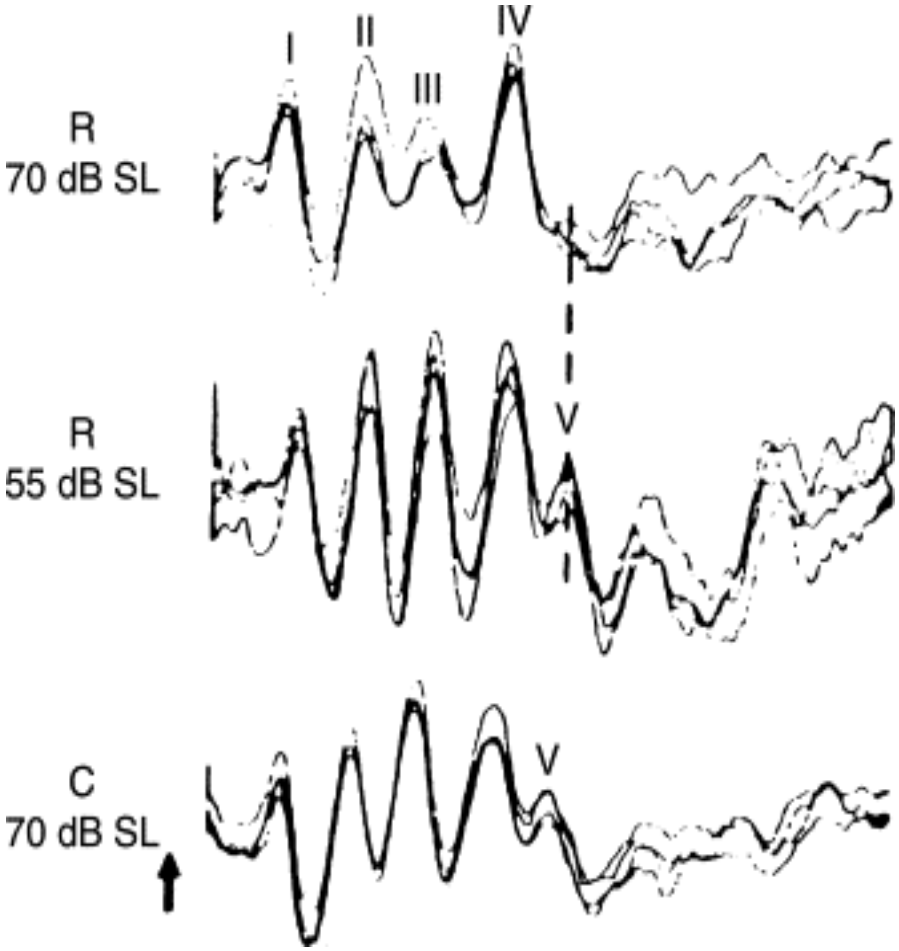
Wave IV *vs* V

- Wave V most resistant to the effects of decreasing stimulus intensity or increasing stimulus rate
- If either of these stimulus modifications is performed progressively until only one component remains, that peak can be identified as wave V



Wave V identification

- Occasionally, wave V may be present following stimulation with one click polarity but not the other
- Therefore, recording a BAEP with the opposite stimulus polarity may be useful if wave V is not identifiable with the standard laboratory

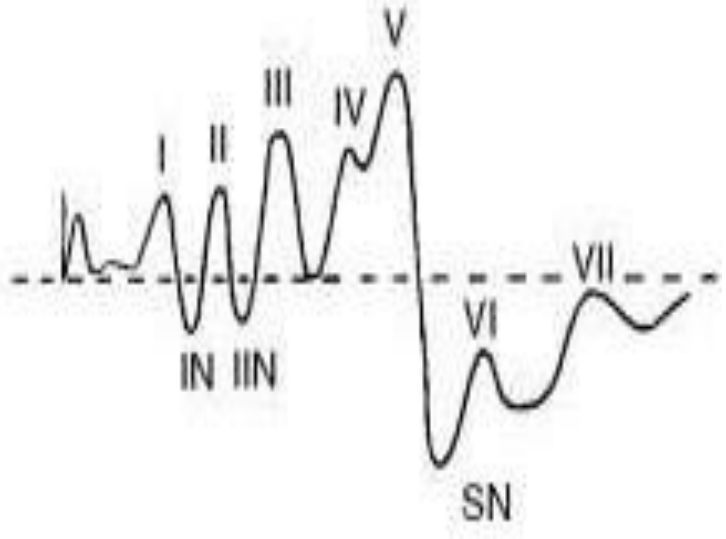


Differential affection of waves IV and V

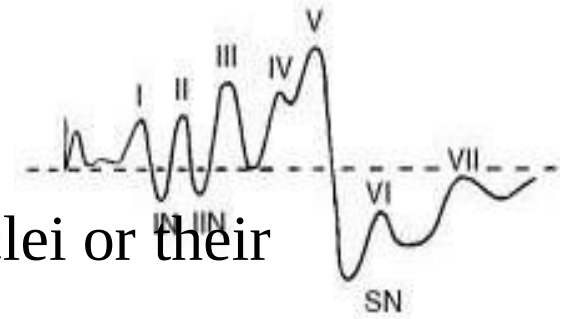
- Multilevel demyelination
- Brainstem infarct
- Small brainstem hemorrhage in the lateral lemniscus

Wave VN

- Downward deflection following wave V(slow negativity (SN)
- Typically wider than the positive components and the earlier negative peaks
- Reflects postsynaptic potentials within brainstem auditory nuclei, primarily the inferior colliculus



Wave VI

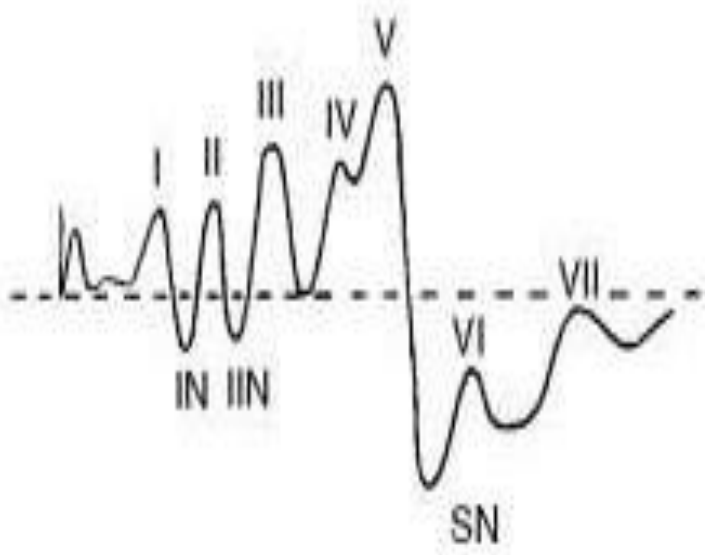


- Generation within the medial geniculate nuclei or their outflow tracts
- Absent in Cz–Ai and Cz–Ac recordings in some normal individuals
- Abnormalities in patients with tumors of the rostral midbrain and caudal thalamus at the level of the medical geniculate nucleus and the brachium of the inferior colliculus

BAEPs cannot be used to assess the status of the

Wave VII

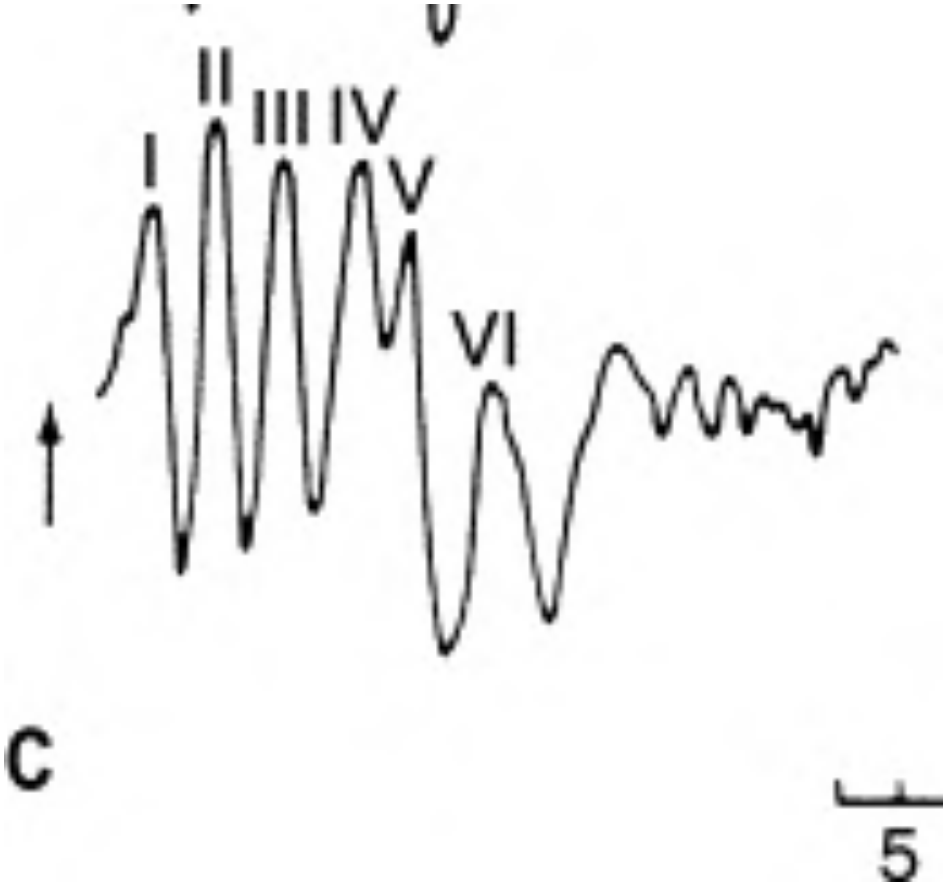
- Often absent in conventionally recorded normal BAEPs
- Generation near the auditory cortex, predominantly contralaterally
- Does not provide clinically useful information about the status of the auditory pathways



Wave V latency measurement

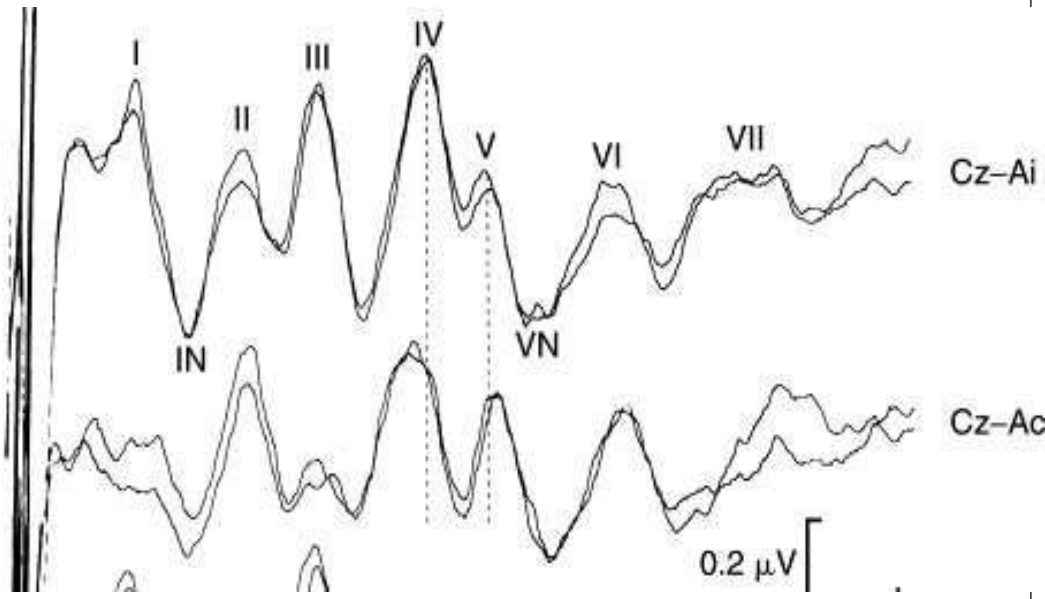
- Should be taken from the

second subcomponent of the IV/V complex, even if this is not the highest peak (in contrast to the amplitude measurement, which is taken from the highest point in the complex)



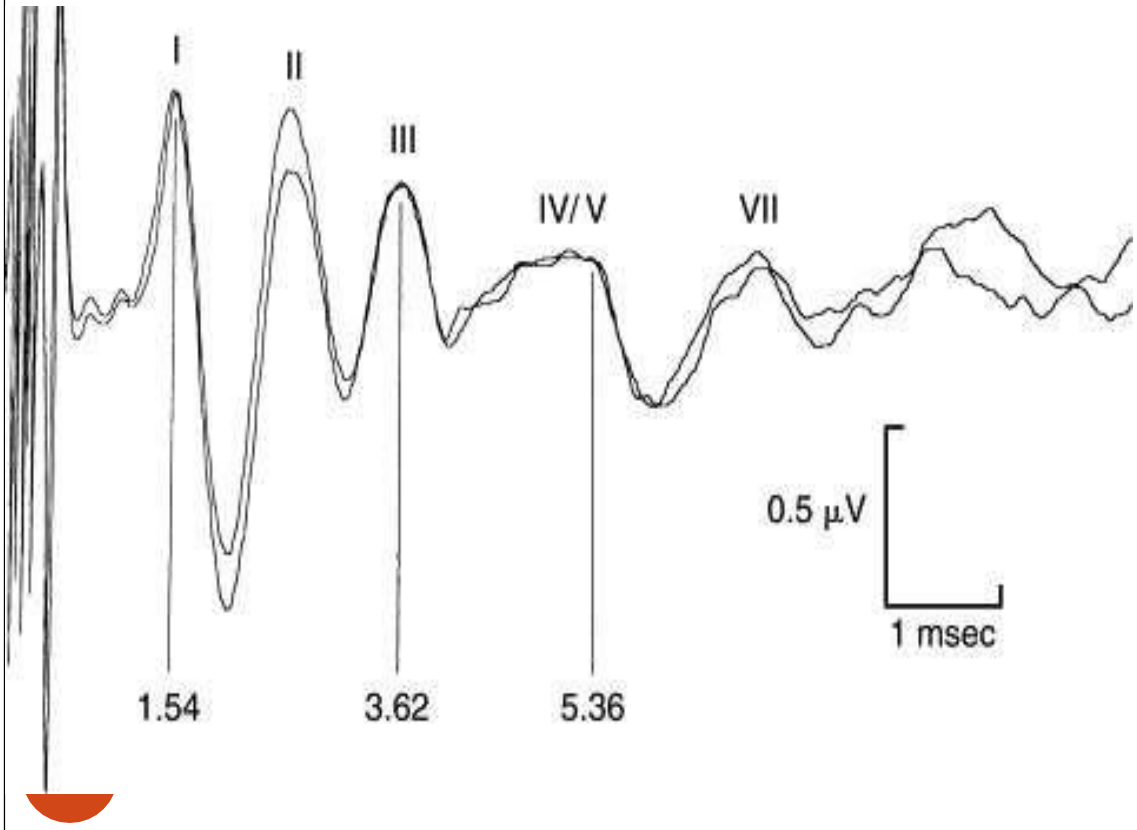
Wave V latency measurement

- Measurement in a Cz–Ac
- Overlapping peaks are separated more clearly because the latency of wave IV is typically earlier, and that of wave V is later, than in the Cz–Ai waveform



IV/V:I amplitude ratio

- With respect to the most negative point that follows it in the waveform (I to IN and IV/V to VN), and their ratio is



27-year-old woman with probable multiple sclerosis

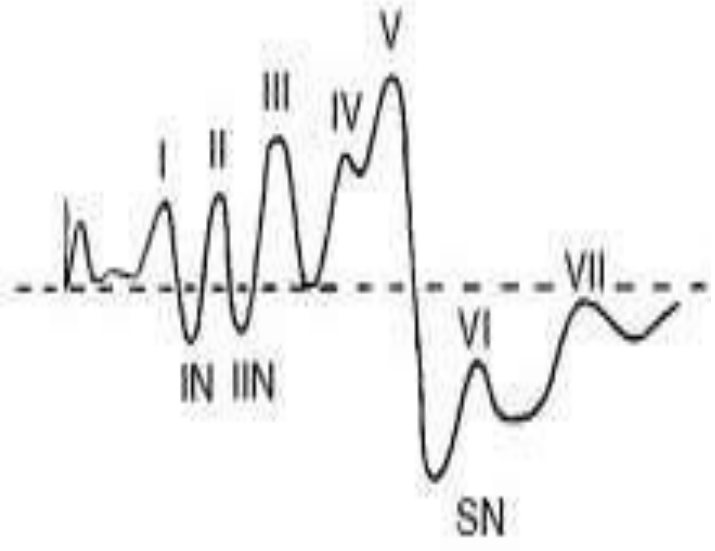
IV/V:I amplitude ratio is 0.28; all absolute latencies and interpeak intervals are normal

Clinical interpretation of BAEPs

- Waves II, IV, VI, and VII are sometimes not identifiable in normal individuals, and their peak latencies display more interindividual variability
- Amplitude measurements of the individual components are also highly variable
- Ratio between the amplitude of the IV/V complex and that of wave I has proved to be a clinically useful measure

Clinical interpretation of BAEP

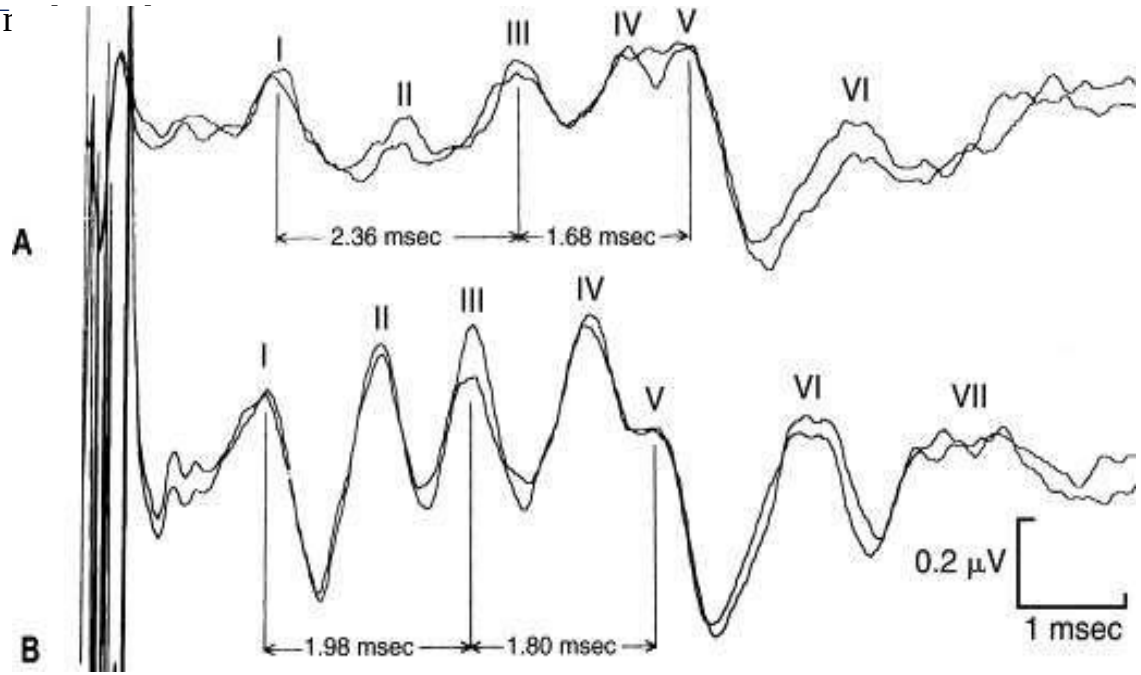
- Identification of waveforms - Presence or absence of waves I, III, and V
- Latencies of waves I, III, and V
- I–III, III–V, and I–V interpeak interv
- Right-left differences of these values
- IV/V:I amplitude ratios



Measurement of right-left differences

- Increases test sensitivity because the intersubject variability of these measures is less than that of the absolute component latencies and interpeak intervals

23-year-old man with left-sided acoustic neuroma I–III, III–V, and I–V interpeak intervals are within normal limits bilaterally, but the right-left differences are abnormally large



Clinical interpretation of BAEPs

Peripheral transmission time (PTT)

- Latency of wave I

Central transmission time (CTT)

- I–V interpeak interval

Normative Data

- Control data should have been acquired under the same conditions used to test the patient, including the polarity, rate, and intensity of the stimulus and the filter settings used for data recording
- Limits of the normal range are typically set at 2.5 or 3 standard deviations from the mean of normally distributed data
- I–V and III–V interpeak intervals are, on average, shorter in women than in men

Normative Data

Latency (ms)

Interpeak intervals

I-III=2.06 III-V=1.96 I-V=4.02

- Wave I=1.50
- Wave III=3.57
- Wave V=5.53

Delay Versus Absence of Components

- Evoked potentials represent the summated activity of large populations of neurons firing in synchrony
- Delay - If delayed uniformly, a delayed evoked potential component will result
- Absence - If the delay is nonuniform due to temporal dispersion
- Either delay or absence of a BAEP peak indicate dysfunction, but not necessarily complete loss of activity, in a part of the infratentorial auditory pathways

Criteria for retrocochlear dysfunction

- Absence of all BAEP waves I through V unexplained by extreme hearing loss determined by formal audiometric testing.
- Absence of all waves following waves I, II, or III.
- Abnormal prolongation of I-III, III-V. and I-V interpeak intervals
- Abnormal diminution of the IV-V/I amplitude ratio, especially when accompanied by other abnormalities.
- Abnormally increased differences between the two ears (interaural differences) when not explained by unilateral or asymmetric middle and/or ear dysfunction determined by appropriate audiometric tests.

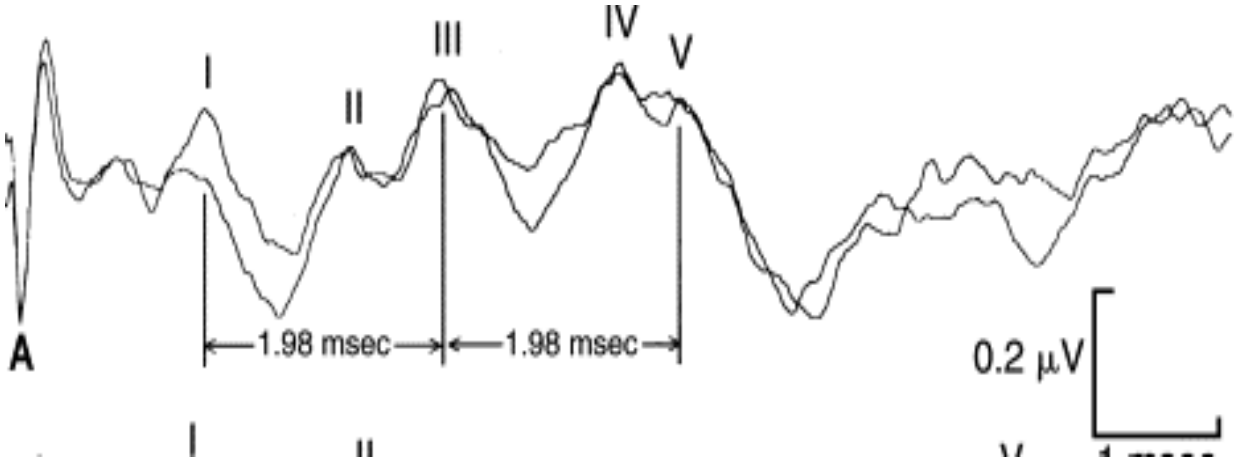
Obtaining formal audiometric testing in patients undergoing

Abnormalities of Wave I

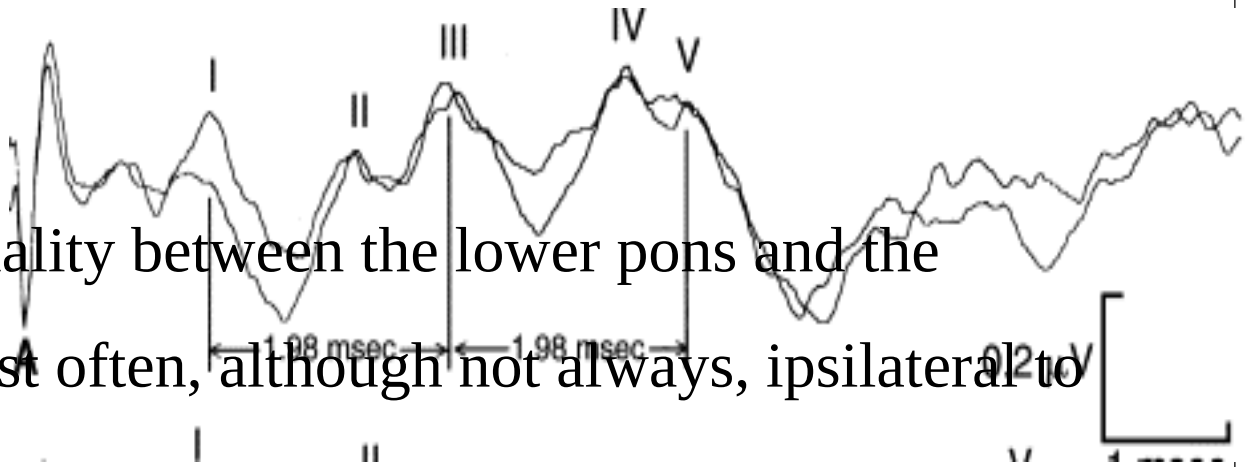
- Reflect peripheral auditory dysfunction, either conductive or cochlear, or pathology involving the most distal portion of the eighth nerve
- Poorly formed or absent wave I but a clear wave V may reflect high-frequency hearing loss.
- May reflect intracranial pathology because the cochlea receives its blood supply from the intracranial circulation via the internal auditory artery

Abnormalities of the I–III Interpeak Interval

- Prolongation reflects an abnormality within the neural auditory pathways between the distal eighth nerve on the stimulated side and the lower pons
- Seen in acoustic neuromas, demyelinating disease, brainstem tumors, or vascular lesions of the brainstem



Abnormalities of the III–V Interpeak Interval



- Reflects an abnormality between the lower pons and the mesencephalon most often, although not always, ipsilateral to the lesion
- Prolongation not an abnormality if the I–V interpeak interval is normal.
- Seen in a variety of disease processes involving the brainstem, including demyelination, tumor, and vascular disease

Abnormalities of the IV/V:I Amplitude Ratio

- Reflects dysfunction within the auditory pathways between the distal eighth nerve and the mesencephalon
- False increase in ratio in
- Decreasing the stimulus intensity
- Suboptimal placement of the Ai recording electrode (may decrease the amplitude of wave I)

BAEPs and Hearing Loss

- can detect subtle neuronal dysfunction that is not clinically apparent on the neurologic and audiologic examination
- Relatively insensitive to isolated low-frequency hearing losses

Central pattern

- CTT (I–V interpeak interval) is prolonged

Peripheral pattern

- Wave I is delayed

A single waveform may contain both abnormalities

Classification of Hearing Loss

Clinical Classification	Location of Pathology	BAEP Classification
Conductive hearing loss	External or middle ear	**Peripheral hearing loss**
Sensorineural hearing loss	Inner ear (cochlea)	
	Eighth nerve or brainstem (retrocochlear)	**”Central” hearing loss**

Latency–intensity curves

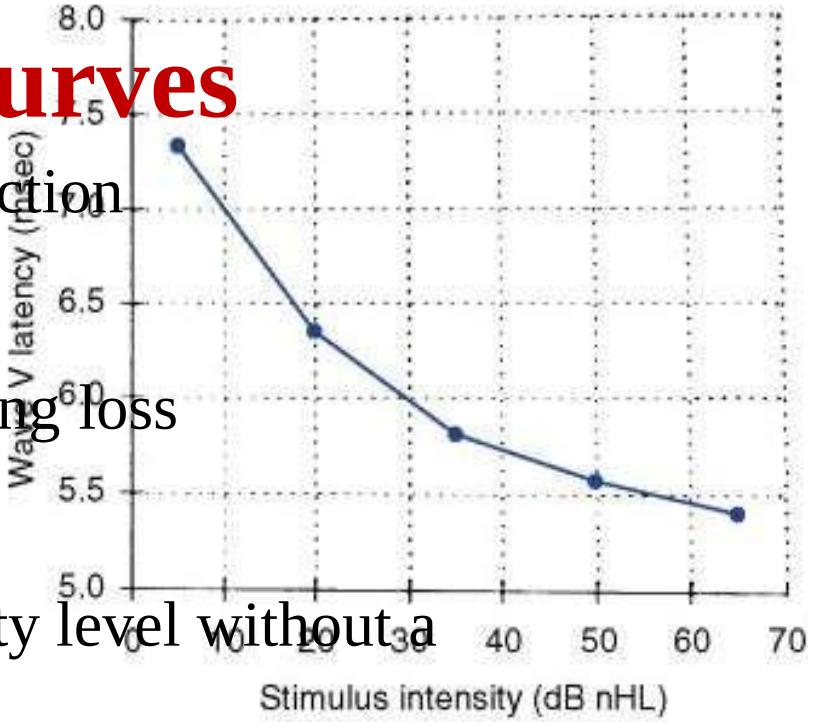
- Latency of wave V graphed as a function of stimulus intensity
- may help to classify a patient's hearing loss

Conductive hearing loss

- Shift of the curve to a higher intensity level without a change in its shape

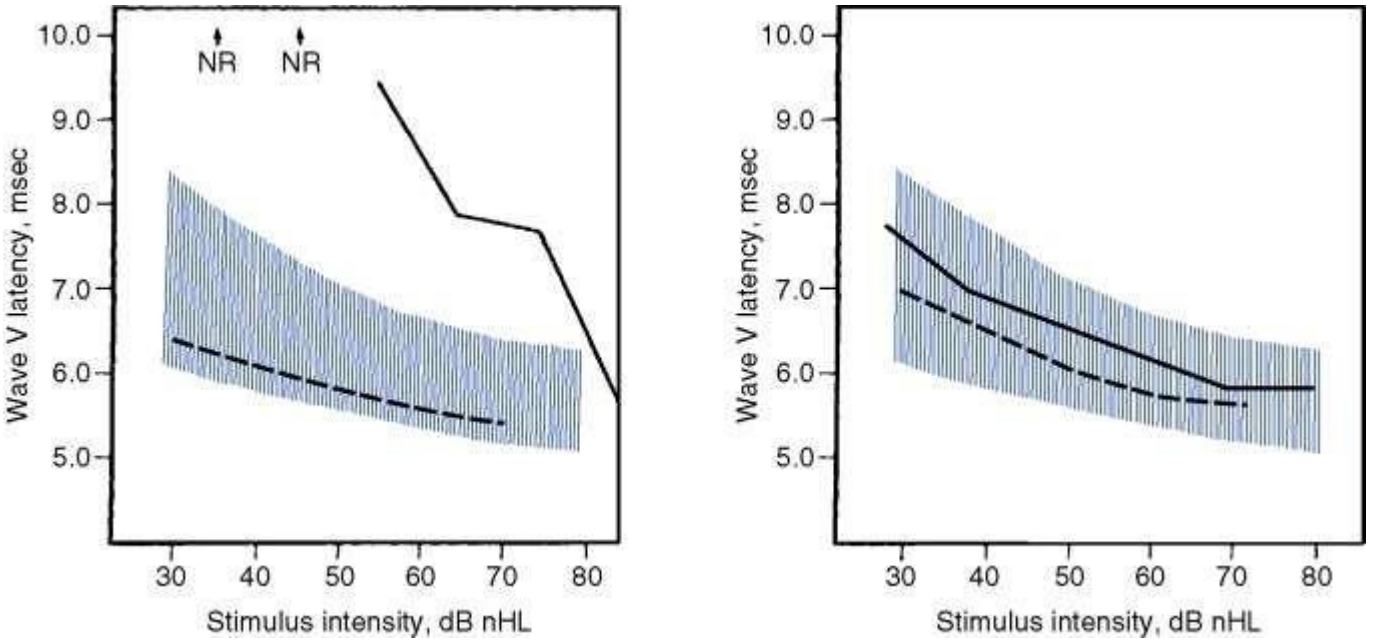
Sensorineural hearing loss

- Change in the shape of the curve with an increased slope



- May increase the sensitivity of BAEPs for detecting small

acoustic neuromas



Latency–intensity curves stimulation recorded before and after surgery in left-sided intracanalicular acoustic neuroma

BAEPs abnormal but normal hearing

- Unilateral brainstem lesions because the ascending projections from each ear are bilateral
- Lesions of subsystem involved in sound localization sparing other portions of the brainstem auditory pathways
- Absence of a component may reflect temporal dispersion rather than conduction block, so hearing may even be present when there is no identifiable wave V

BAEPs and functional hearing loss

- Abnormal BAEP study demonstrates the existence of pathology within the auditory system
- Normal study does not prove that the symptoms are psychogenic
- If they maintain a degree of tension in their cranial and neck muscles, the EMG activity picked up by the recording electrodes may be sufficient to prevent recording of an interpretable BAEP study

- Abnormal BAEPs in more than 95 % with acoustic neuromas
- Abnormal BAEPs is less in patients with small (less than 1 cm) tumors
- Small, intracanalicular tumors in whom BAEPs to standard high-intensity stimuli are normal, latency– intensity studies may reveal abnormal cochlear function resulting from compression of the internal auditory artery

Typically originate from the distal vestibular nerve at the vestibular ganglion, and the auditory portion of the nerve may be unaffected early in the course of the disease.

↓ As it enlarges, compress the auditory nerve Prolongation of the I–III interpeak interval

↓

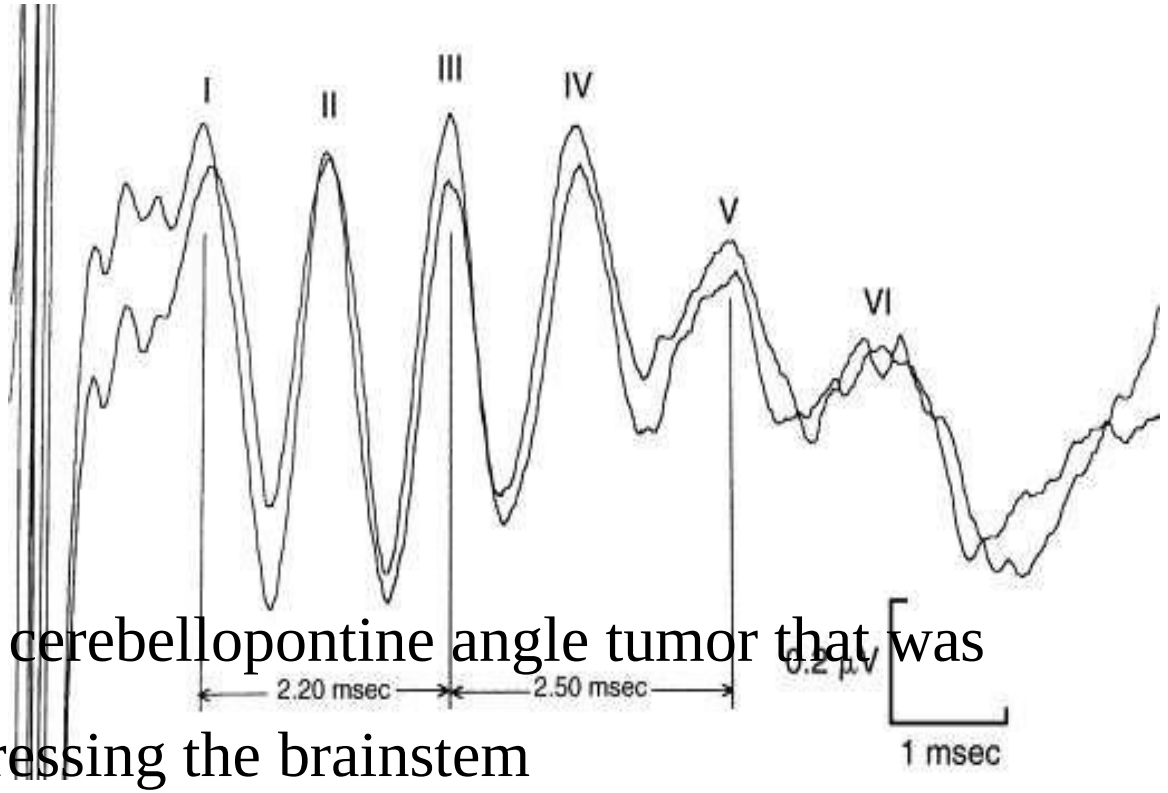
Complete eradication of wave III and subsequent BAEP components

- Wave II may be relatively spared, a reflection of the contribution to that component originating in the distal eighth nerve
- Wave I may become delayed as the degree of cochlear ischemia increases

BAEP in Large Acoustic Neuroma

- Infarction of the cochlea may cause elimination of all BAEPs
- Prolongation of the III–V interpeak interval in response to stimulation of the ear contralateral to the tumor due to compression of brainstem

BAEP in Large Acoustic Neuroma



- Large cerebellopontine angle tumor that was compressing the brainstem
- I–V and III–V interpeak intervals are both abnormally prolonged

BAEP in Other Posterior Fossa Tumors

- Almost always abnormal in brainstem gliomas and other intrinsic brainstem tumors except that within the medulla
- Abnormalities in the I–III or III–V interpeak interval, or a combination of both
- Serial recordings may show deterioration of the BAEPs because of tumor growth
- Response to treatment can be demonstrated as an improvement in conduction within the brainstem auditory pathways

BAEP in Cerebrovascular Disease

- Usually normal in medullary infarcts or lesions confined to the basis pontis, cerebral peduncles, and cerebellar hemispheres
- Presence of BAEP abnormalities is associated with an adverse clinical outcome
- Abnormalities in the I–III or III–V interpeak interval, or a combination of both, may be seen
- If a cochlear stroke accompanies the brainstem stroke, all BAEP components will be absent following stimulation

BAEP in vertebrobasilar TIA

- Abnormalities present in most cases
- Findings tend to resolve over time
- Yield lower if recorded after more than a week
- Persistent BAEP changes may represent small infarcts that are clinically silent

BAEP in Demyelinating Disease

- Can demonstrate a residual abnormality related to a prior symptom that has cleared
- Abnormality rate higher in definite MS and with brainstem lesion.
- Abnormalities in the I–III and/or III–V interpeak interval
- Abnormally small IV/V:I amplitude ratio in the presence of normal component latencies and interpeak intervals
- Prolongations of the PTT (wave I latency) without any otologic cause

BAEP in MS

VIIIn fibers are ensheathed along most of their lengths by

central-type myelin, produced by oligodendrocytes unlike other CNs which have Schwann cells

↓

In MS vulnerable to demyelination along most of its length

↓

Abnormalities of the I–III interpeak interval

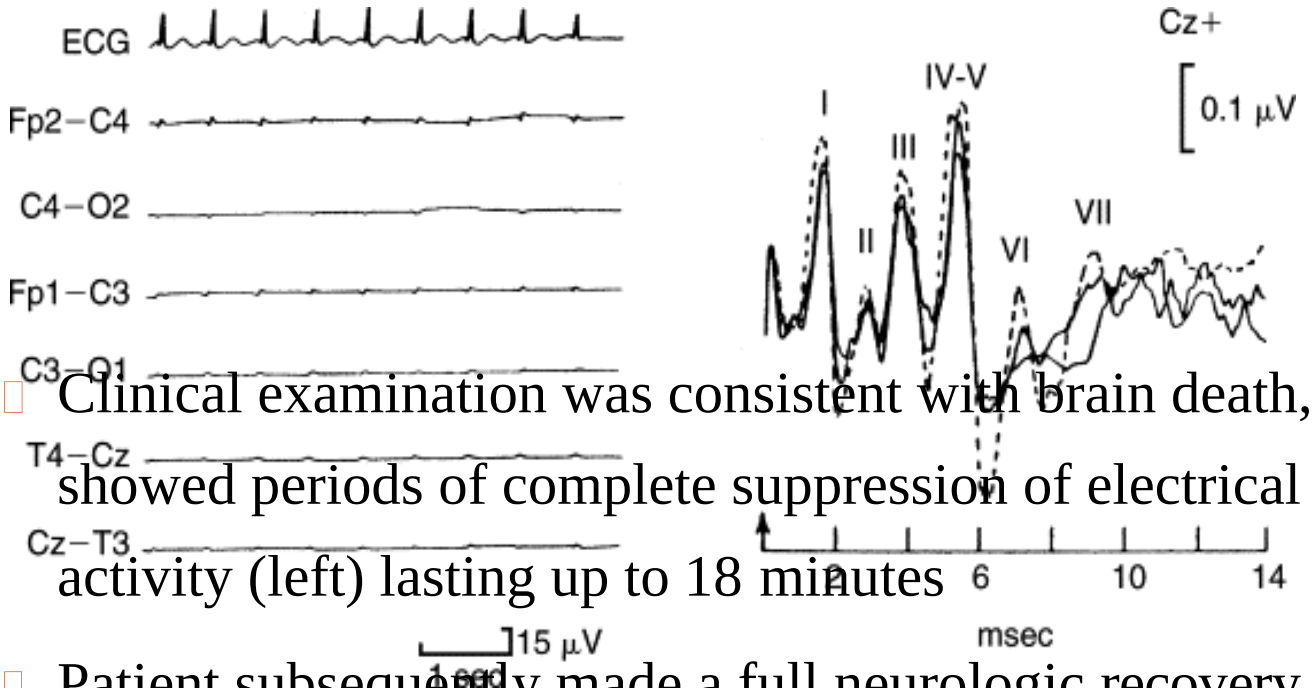
BAEP in Coma

- Markedly abnormal BAEPs are likely to have poor neurologic outcomes attributable to the brainstem damage
- Typically normal in patients with coma caused entirely by supratentorial disease
- May deteriorate subsequently because of transtentorial herniation
- Abnormal BAEPs in patients with supratentorial infarctions or hemorrhages are correlated with poor

BAEP in Coma

- Normal-appearing BAEPs in a patient whose examination shows widespread brainstem dysfunction should prompt suspicion of a metabolic etiology such as a drug overdose
- BAEPs are highly resistant to central nervous system depressant drugs

BAEP in drug overdose



35-year-old woman who was comatose following a mixed drug overdose

- Clinical examination was consistent with brain death, and the EEG showed periods of complete suppression of electrical cerebral activity (left) lasting up to 18 minutes
- Patient subsequently made a full neurologic recovery, and her EEG became normal

BAEP in Locked-in syndrome

- BAEPs may be either normal or abnormal, depending on

  the extent to which the lesion extends outside the ventral pons and involves the auditory pathways

BAEP in brain death

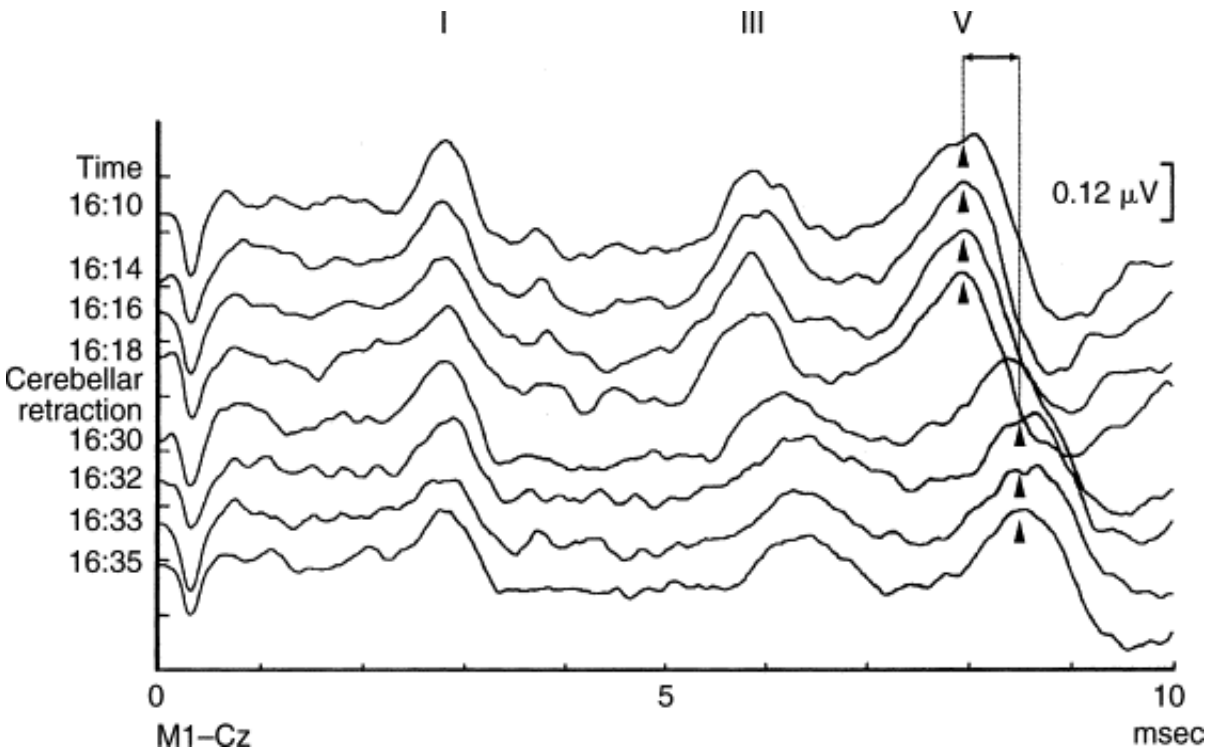
- Contains no identifiable components, or consists of wave I alone, or contains only a wave I followed by a wave IN
- Rarely, waves II and IIN may also be present and reflect the contribution to these components from the auditory nerve
- Although consistent with brain death, negative BAEP cannot be used as evidence that the brainstem is nonfunctional

Intra operative BAEP monitoring

- esp during surgery in the cerebellopontine angle with the goal of preserving auditory nerve function
- bulky earphone replaced by a small insertable earphone
- faster stimulation rate typically about 30 Hz compared with 10 Hz which allows more rapid signal acquisition
- Stable, robust BAEPs are recorded readily in the presence of general anesthetic agents

Intra operative BAEP monitoring

- During surgical manipulation threatening the auditory nerve, a loss of wave V amplitude of 50 percent or more or an increase in wave V latency by 0.5 msec generally is recognized as a potentially important alteration, particularly when it occurs suddenly



BAEPs in infants and children

- To detect and measure hearing loss in children who cannot be tested behaviorally
- To evaluate the auditory brainstem pathways in children who may have neurologic problems
- Requires close cooperation between audiologists and neurologists because it is impossible to interpret these responses correctly without paying careful attention to both the ear and the brain.

ANNEXURE 2
BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH
SLIMS

1	U15MB287	GAYATHRI .M
2	U15MB288	GOGUL SUGAN. K
3	U15MB289	GOKULA KRISHNAN. E
4	U15MB290	GOWTHAM. M .R
5	U15MB291	GOWTHAM.S
6	U15MB292	HARIHARAN.S
7	U15MB293	HARINI .L
8	U15MB294	ILAMATHI.S
9	U15MB295	ILAYARAJA .B.U
10	U15MB296	JAMZER. J
11	U15MB297	JANARTHANAM. M
12	U15MB298	JANISHA MARAGATHA J P
13	U15MB299	JAWATH. S
14	U15MB300	JAYA AKSHAIY. J

ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: Brainstem evoked response audiometry **(ENT08)**
STUDENT NAME:
UNIVERSITY NO:

1.Earliest age for doing BERA
a. In utero b. At birth
c. 3 months d. 6months

2.BERA is most accurate at;
a.28wk b.30 wk
c.32wk d.34wk

3.True about BERA findings in acoustic neuroma
a.Latency of waveV increased in the affected ear
b.Latency of wave I increased in the affected ear
c.No waves on BERA
d. No change in BERA

4.Brainstrem evoked response audiometry true is:
a.Can differentiate cochlear and retrocochlear lesion
b.cannot differentiate the site of lesion in sensorineural hearing loss
c.. Can differentiate barbiturate poisionong from other causes of coma
d.As a screening procedure for infants

5.In normal adult, waveV is generated from
a. cochlear nucleus b. superior olivary complex
c. Lateral lemniscus d. Inferior colliculus

6. To distinguish between cochlear and post cochlear damage
The test is done
a.BERA b.Impedance audiometry
c.Pure tone audiometry d.All of the above

7. which is the investigation of choice in assessing hearing loss in infants
a) Impedance audiometry b)BERA
c) Free field audiometry d) behavior audiometry

8) A 6month old child developed labrinthintis following meningitis

a)BERA b)Impedance audiometry
c)Pure tone audiometry d) OAE

9) screening test for neonate in ICU
a)Distortion product OAE b) OAE
c) BERA d) Impedance audiometry

10. objective method of hearing test
a) tuning fork test b) Pure tone audiometry
c) Speech audiometry d) BERA

PRE TEST

5.In normal adult, waveV is generated from

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c) BERA d) Impedance audiometry

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ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: Brainstem evoked response audiometry **(ENT08)**

STUDENT NAME: Jawath-S

UNIVERSITY NO: U15MB299

4

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ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: Brainstem evoked response audiometry **(ENT08)**

STUDENT NAME: Hariharan.S

UNIVERSITY NO: U15MB292.

2

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d.As a screening procedure for infants

POST TEST

5.In normal adult, waveV is generated from

a. cochlear nucleus b. superior olivary complex

c. Lateral lemniscus d. Inferior colliculus

6. To distinguish between cochlear and post cochlear damage

The test is done

a.BERA b.Impedance audiometry

c.Pure tone audiometry d.All of the above

7. which is the investigation of choice in assessing hearing loss in infants

a) Impedance audiometry b)BERA

c) Free field audiometry d) behavior audiometry

8) A 6month old child developed labrinthintis following meningitis

a)BERA b)Impedance audiometry

c)Pure tone audiometry d) OAE

9) screening test for neonate in ICU

a)Distortion product OAE b) OAE

c) BERA d) Impedance audiometry

10. objective method of hearing test

a) tuning fork test b) Pure tone audiometry

c) Speech audiometry d) BERA

10

ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: Brainstem evoked response audiometry **(ENT08)**

STUDENT NAME: Harisharan .S

UNIVERSITY NO: U15MB292.

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c. 3 months d. 6months

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6. To distinguish between cochlear and post cochlear damage

The test is done

a.BERA b.Impedance audiometry

c.Pure tone audiometry d.All of the above

7. which is the investigation of choice in assessing hearing loss in infants

a) Impedance audiometry b)BERA

c) Free field audiometry d) behavior audiometry

8) A 6month old child developed labrinthintis following meningitis

a)BERA b)Impedance audiometry

c)Pure tone audiometry d) OAE

9) screening test for neonate in ICU

a)Distortion product OAE b) OAE

c) BERA d) Impedance audiometry

10. objective method of hearing test

a) tuning fork test b) Pure tone audiometry

c) Speech audiometry d) BERA

8

ANNEXURE 3

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

PUDUCHERRY

TOPIC: Brainstem evoked response audiometry **(ENT08)**

STUDENT NAME: Jawath .S

UNIVERSITY NO: U1SMB299.

1.Earliest age for doing BERA

a. In utero b. At birth

c. 3 months d. 6months

2.BERA is most accurate at;

a.28wk b.30 wk

c.32wk d.34wk

3.True about BERA findings in acoustic neuroma

a.Latency of waveV increased in the affected ear

b.Latency of wave I increased in the affected ear

c.No waves on BERA

d. No change in BERA

4.Brainstrem evoked response audiometry true is:

a.Can differentiate cochlear and retrocochlear lesion

b.cannot differentiate the site of lesion in sensorineural hearing loss

c.. Can differentiate barbiturate poisionong from other causes of coma

d.As a screening procedure for infants

ANNEXURE 4

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that _____ has actively participated in the Value Added Course on Hands on training and an Extensive Discussion on BERA held during Sep 2018 – Dec 2018 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

Dr.K.R. Jothikumar
RESOURCE PERSON

Dr.R.Venkataramanan
COORDINATOR

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that Dr.Harini.L (U15MB293) has actively participated in the Value Added Course on Hands on training and an Extensive Discussion on BERA held during Sep 2018 – Dec 2018 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

Dr.K.R. Jothikumar
RESOURCE PERSON

Dr.R.Venkataramanan
COORDINATOR

Annexure 5
Course/Training Feedback Form
Student Feedback Form

Course Name: Hands on training and an ExtensiveDiscussion on BERA

Subject Code: **ENT08**

Name of Student: _____ Roll No.: _____

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear					
2	Course contents met with your expectations					
3	Lecturer sequence was well planned					
4	Lectures were clear and easy to understand					
5	Teaching aids were effective					
6	Instructors encourage interaction and were helpful					
7	The level of the course					
8	Overall rating of the course	1	2	3	4	5

**** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory***

Suggestions if any:

Annexure 5

Course/Training Feedback Form

Student Feedback Form

Course Name: Hands on training and an ExtensiveDiscussion on BERA

Subject Code: **ENT08**

Name of Student: HARIHARAN. S Roll No.: 015HB292

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear	✓				
2	Course contents met with your expectations		✓			
3	Lecturer sequence was well planned		✓			
4	Lectures were clear and easy to understand	✓				
5	Teaching aids were effective		✓			
6	Instructors encourage interaction and were helpful			✓		
7	The level of the course				✓	
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory*

Suggestions if any:

Excellent

Annexure 5

Course/Training Feedback Form

Student Feedback Form

Course Name: Hands on training and an ExtensiveDiscussion on BERA

Subject Code: **ENT08**

Name of Student: L. HARINI Roll No.: 1SMB293

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

SL NO	Particulars	1	2	3	4	5
1	Objective of the course is clear		✓			
2	Course contents met with your expectations			✓		
3	Lecturer sequence was well planned				✓	
4	Lectures were clear and easy to understand			✓		
5	Teaching aids were effective				✓	
6	Instructors encourage interaction and were helpful			✓		
7	The level of the course				✓	
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory*

Suggestions if any:

Satisfactory

ANNEXURE 6

Date : 15/12/2018

From
Dr.Venkataramanan.R,
Dept of Otorhinolaryngology,
SLIMS
Bharath Institute of Higher Education and Research,
Puducherry.

Through Proper Channel

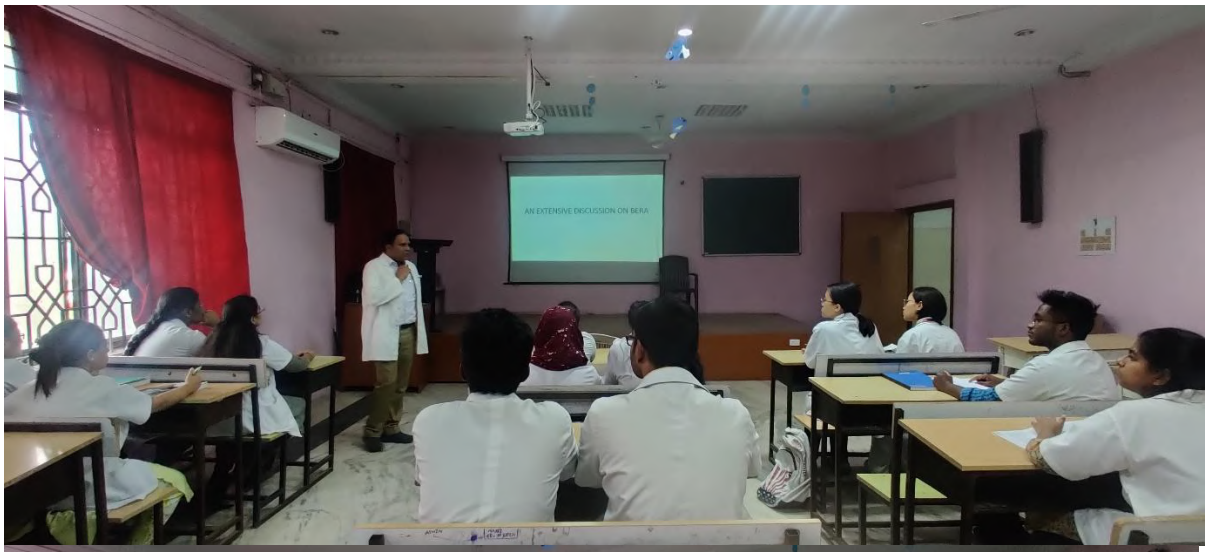
To
The Dean,
SLIMS,
Bharath Institute of Higher Education and Research,
Puducherry.

Sub: Completion of value-added course: Hands on training and an ExtensiveDiscussion on BERA reg.

Dear Sir,

With reference to the subject mentioned above, the department has conducted thevalue-added course titled:**Hands on training and an Extensive Discussion on BERA**on Sep 2018 to Dec2018. We solicit your kind action to send certificates for the participants, that is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.

Kind Regards
Dr.K.R.Jothikumar
<HOD Sign and Seal>


AN EXTENSIVE DISCUSSION ON BERA


AN EXTENSIVE DISCUSSION ON BERA


AN EXTENSIVE DISCUSSION ON BERA