Automated Auditory Brainstem Responses (AABR)

- Identificazione automatica dell'onda V, a livelli di stimolazione di 35 – 45 dB nHL
- Esaminato un intervallo di latenza (es. 6 - 10 ms) in cui è prevista la comparsa dell'onda
- Procedura statistica (esito *pass* quando la probabilita è > 0.98)

AABR - Vantaggi

- Altissima affidabilità e sensibilità: numero molto basso di falsi negativi e falsi positivi
- Risposte precise e poco influenzabili da fattori esterni

AABR - Limiti

- Costi delle apparecchiature superiori a quelli relativi alle OAE
- Spesso tempi di registrazioni relativamente lunghi (2 - >10 min)
- Maggiore perizia rispetto allo studio OAE (posizionamento corretto elettrodi, ambiente ostile all'acquisizione di potenziali bioelettrici)
- Minore affidabilità a < 32 settimane

Reducing False Positives in Newborn Hearing Screening Program: How and Why

*†‡Hung-Ching Lin, *Min-Tsan Shu, *Kuo-Sheng Lee, *Huang-Yu Lin, and §Grace Lin

Otol Neurotol **28:**788–792, 2007.

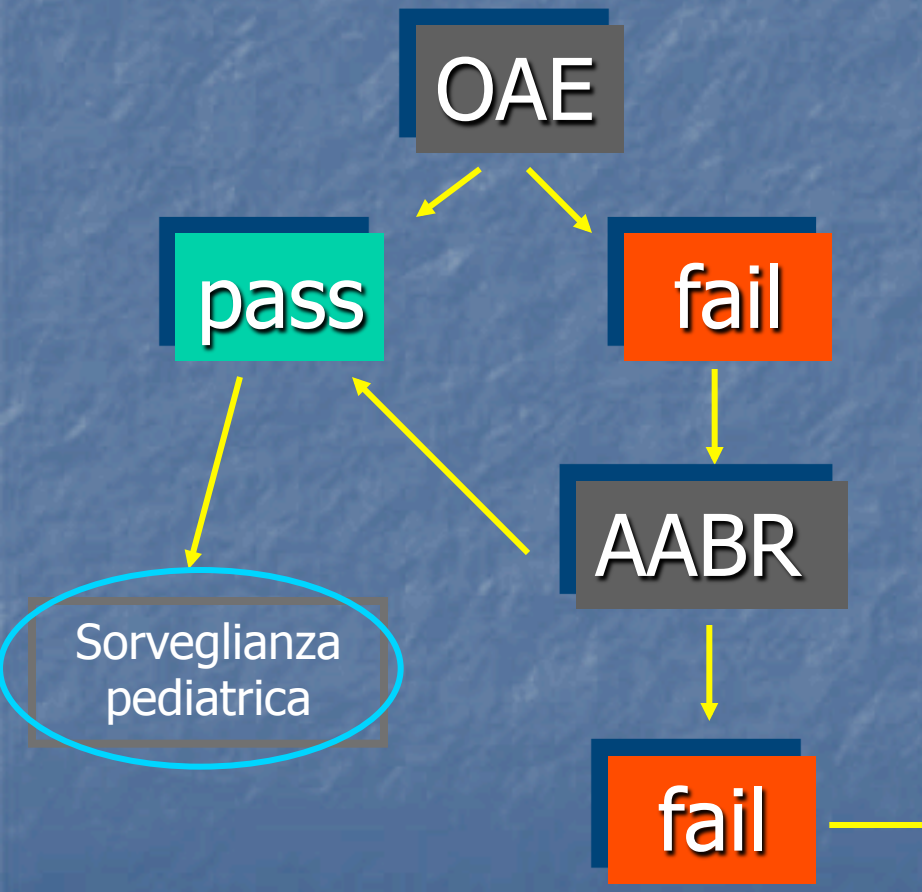
Results: A statistically significant decrease in referral rate was achieved in the group using AABR as screening tools when compared with TEOAE plus AABR and TEOAE alone (0.8 versus 1.6 versus 5.8%). The accurate identification rate of congenital hearing loss was 0.42% in AABR protocol, 0.25% in TEOAE and AABR protocol, and 0.45% in TEOAE protocol, which was not statistically significant. The total direct costs (including predischarge screening and postdischarge follow-up costs) per screening were US $10.04 for the program using TEOAE alone, US $8.60 for TEOAE plus AABR, and US $7.33 for AABR. The intangible cost (parental anxiety) was much higher in the earlier program due to higher referral rate.

A Multicenter Evaluation of How Many Infants With Permanent Hearing Loss Pass a Two-Stage Otoacoustic Emissions/Automated Auditory Brainstem Response Newborn Hearing Screening Protocol

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS
2005;116:663-672

Jean L. Johnson, DrPH*; Karl R. White, PhD‡; Judith E. Widen, PhD§; Judith S. Gravel, PhD‖; Michele James, AuD¶; Teresa Kennalley, MA#; Antonia B. Maxon, PhD**; Lynn Spivak, PhD‡‡; Maureen Sullivan-Mahoney, MA§§; Betty R. Vohr, MD‖‖; Yusnita Weirather, MA¶¶; and June Holstrum, PhD##

From the *Center on Disability Studies, University of Hawaii, Honolulu, Hawaii; ‡National Center for Hearing Assessment and Management, Utah State University, Logan, Utah; §University of Kansas Medical Center, Kansas City, Kansas; ‖Albert Einstein College of Medicine and Jacobi Medical Center, Bronx, New York; ¶Arnold Palmer Hospital for Infants and Women, Orlando, Florida; #Via Christi Regional Medical Center, Wichita, Kansas; **New England Center for Hearing Rehabilitation, Hampton, Connecticut; ‡‡Long Island Jewish Medical Center, New Hyde Park, New York; §§Good Samaritan Hospital, Cincinnati, Ohio; ‖‖Women and Infants Hospital, Providence, Rhode Island; ¶¶Kapiolani Medical Center for Women and Infants, Honolulu, Hawaii; and ##EHDI Consultant, Lexington, South Carolina.



Conclusions. If all infants were screened for hearing loss using the 2-stage OAE/A-ABR newborn hearing screening protocol currently used in many hospitals, then ~23% of those with PHL at ~9 months of age would have passed the A-ABR. This happens in part because much of the A-ABR screening equipment in current use was designed to identify infants with moderate or greater hearing loss. Thus, program administrators should be certain that the screening program, equipment, and protocols are designed to identify the type of hearing loss targeted by their program. The results also show the need for continued surveillance of hearing status during childhood. *Pediatrics 2005;116:663–672; hearing loss, hearing screening, efficacy.*

2007 Position Statement (EHDI Programs)

I bambini *pass* ma con fattori di rischio per ipoacusia congenita, ritardata o progressiva devono essere sottoposti almeno una volta a studio diagnostico entro i 24-30 mesi di età

Ipoacusia progressiva o ad insorgenza tardiva

2007 Position Statement (EHDI Programs)

Indicatori di rischio per ipoacusia permanente congenita, a inizio ritardato o progressiva

- Segnalazione dei genitori su funzione uditiva, ritardo linguaggio e sviluppo
- Storia familiare di ipoacusia infantile
- NICU
- ✓ >5 giorni
- ✓ ventilazione assistita
- ✓ ECMO
- ✓ farmaci ototossici o diuretici dell'ansa, iperbilirubinemia con exsanguinotrasfusione

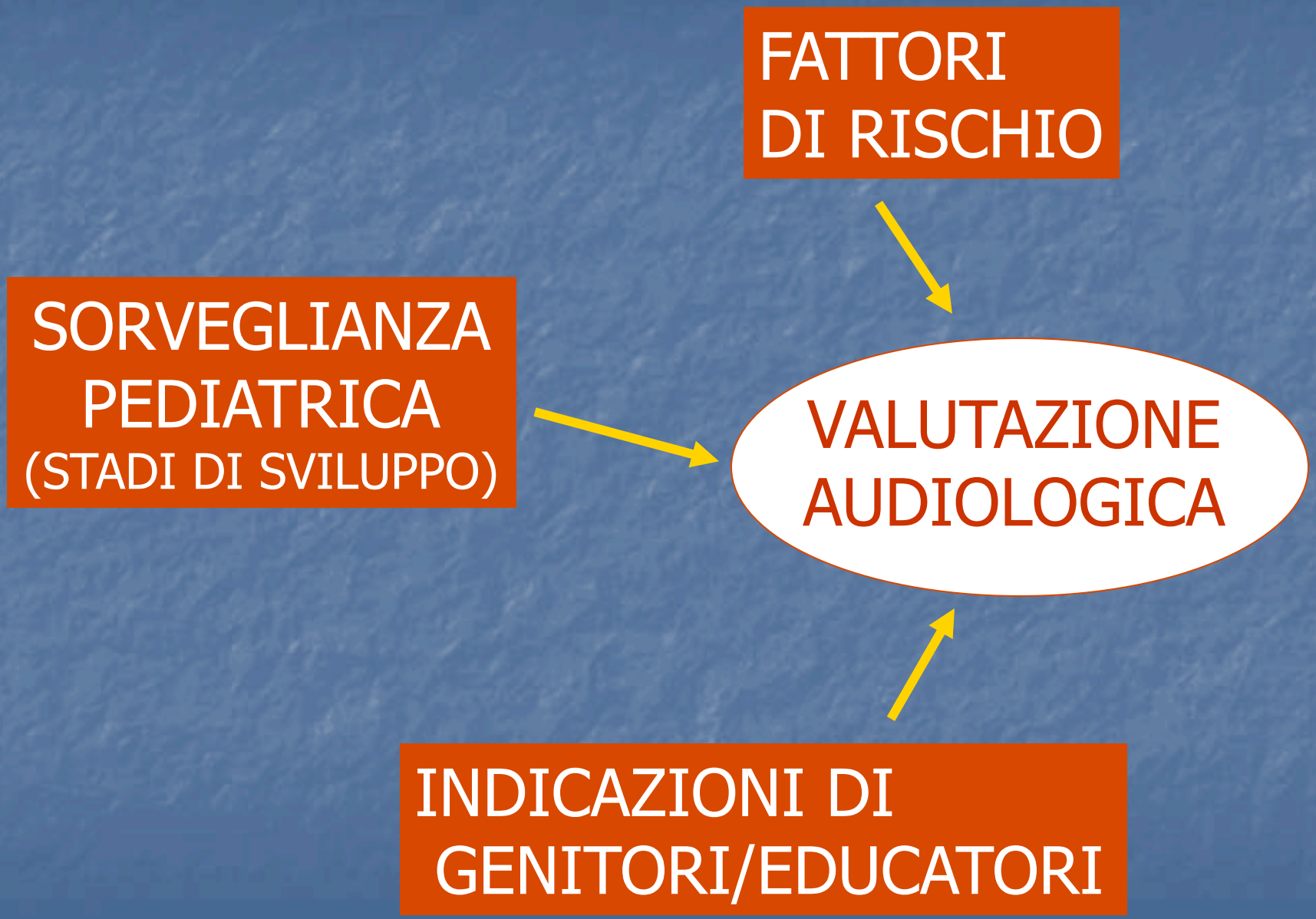
2007 Position Statement (EHDI Programs)

Indicatori di rischio per ipoacusia permanente congenita, a inizio ritardato o progressiva

- Infezioni intrauterine (CMV, herpes, rosolia, sifilide, toxoplasmosi)
- Anomalie craniofacciali o segni suggestivi di sindromi associate a ipoacusia (Usher, Alport, Pendred, etc., etc.)
- Disordini neurodegenerativi (neuropatie, Hunter, etc.)
- Infezioni postnatali (specie herpes, varicella, meningite)
- Trauma cranico
- Chemioterapia

2007 Position Statement (EHDI Programs)

Indipendentemente dai risultati dello screening e dai fattori di rischio, tutti i bambini devono essere sorvegliati periodicamente dal pediatra relativamente al linguaggio e all'udito


FATTORI
DI RISCHIO
SORVEGLIANZA
PEDIATRICA
(STADI DI SVILUPPO)
VALUTAZIONE
AUDIOLOGICA
INDICAZIONI DI
GENITORI/EDUCATORI

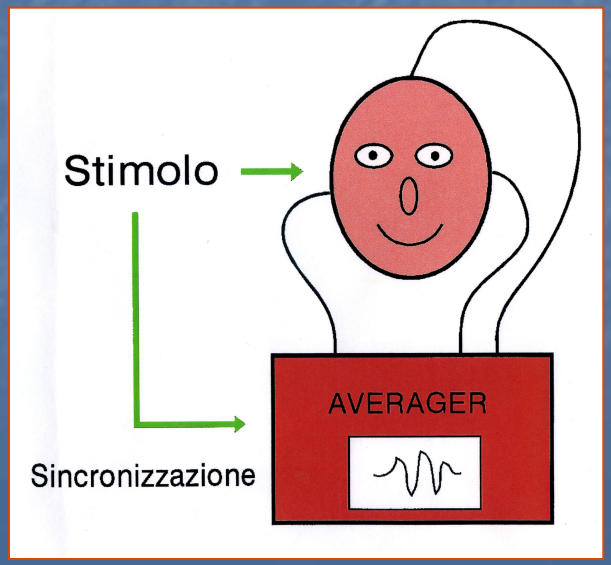
- PRIMA FASE: **SCREENING**
- SECONDA FASE: **DIAGNOSI**
- TERZA FASE: **TRATTAMENTO**

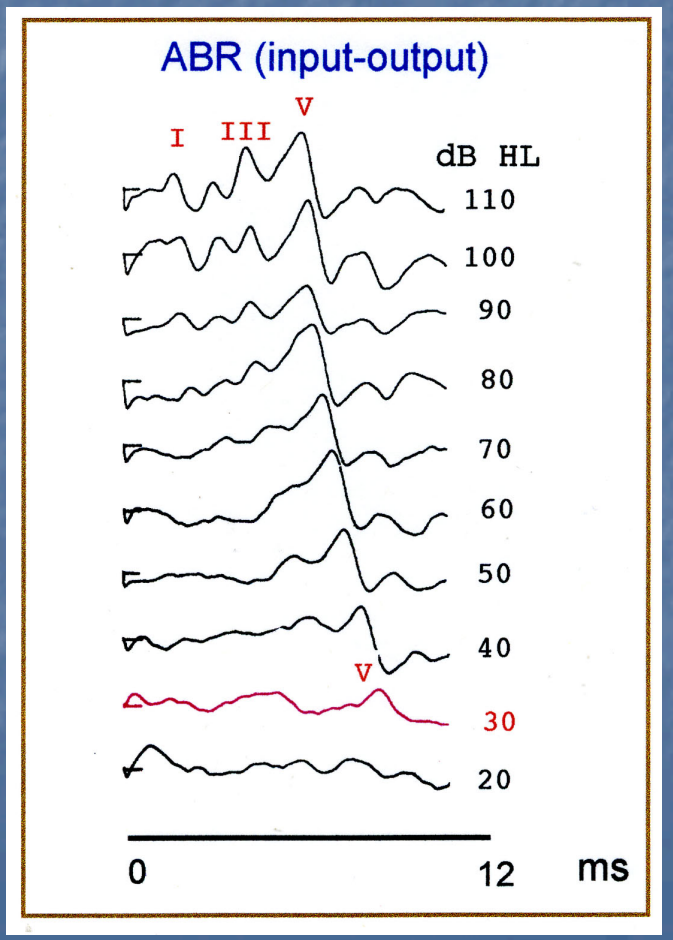
2007 Position Statement (EHDI Programs)

I bambini che non passano lo screening devono ricevere una valutazione audiologica e medica completa entro i 3 mesi di età in modo da consentire il completamento dell'intervento riabilitativo protesico entro i 6 mesi di età

POTENZIALI EVOCATI UDITIVI DEL TRONCO ENCEFALICO (ABR)

Potenziali bioelettrici generati dalla sincronizzazione della conduzione nervosa lungo delle vie uditive, in risposta a stimoli acustici impulsivi

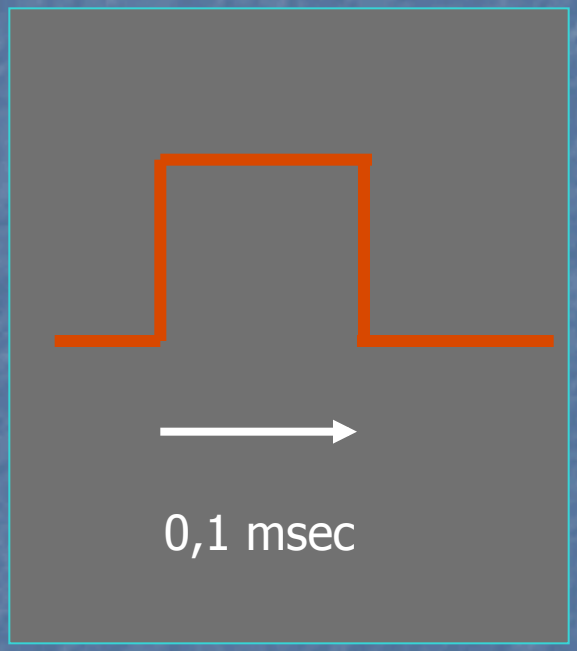




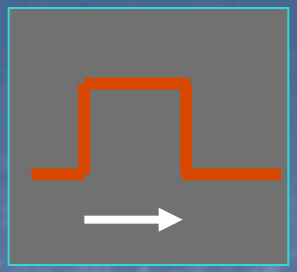
ABR

Stimolazione con click

- Ideale per la sincronizzazione della risposta e per l'analisi delle onde
- Aspecificità in frequenza
- La soglia ABR si correla con la sensibilità uditiva a 2-4 kHz

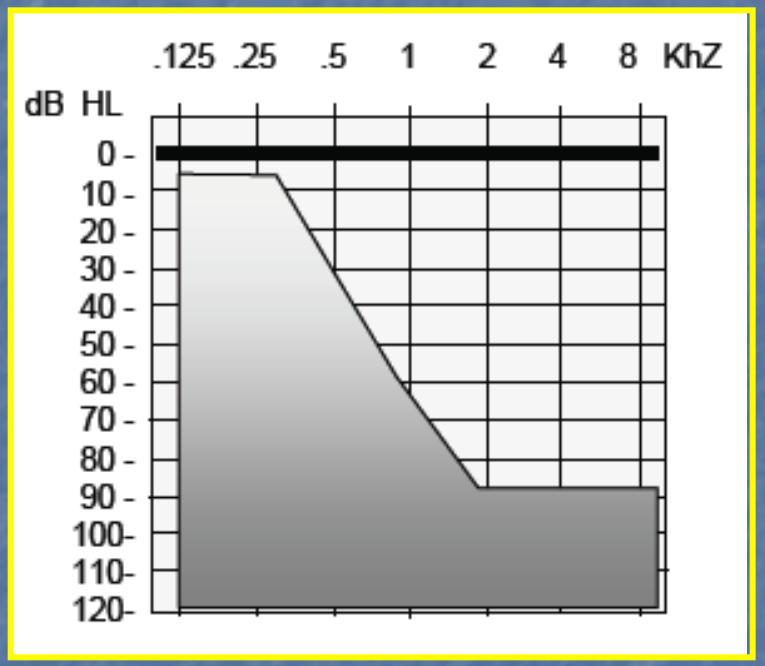


ABR



Stimolazione con click

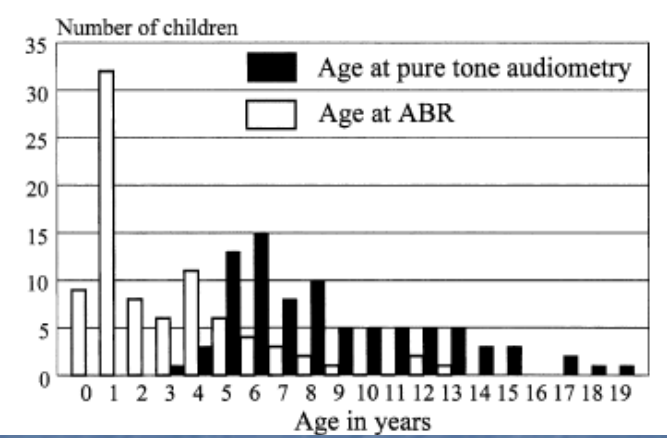
- Onda V sempre assente con soglia > 85-90 dB HL a 2-4 kHz
- Non valutabile la soglia sulle frequenze medio-gravi



Comparison between audiometric and ABR thresholds in children. Contradictory findings

Timo I. Marttila · Jukka O. Karikoski

Eur Arch Otorhinolaryngol (2006) 263: 399–403



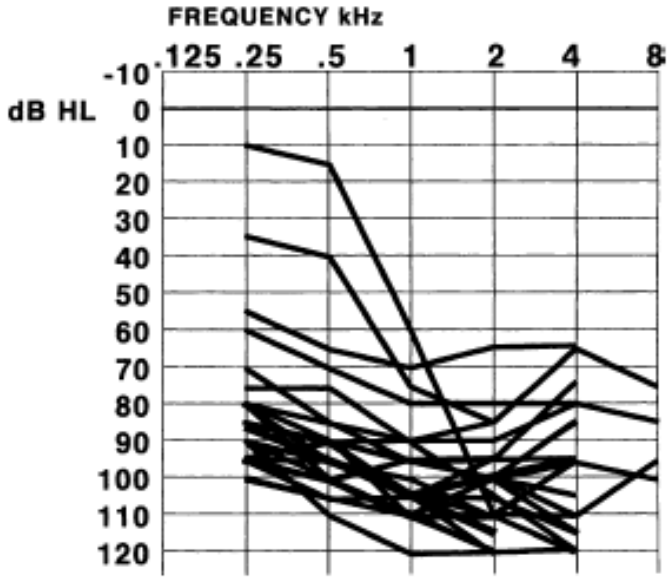


Fig. 3 Summary audiogram representing the conclusive hearing level thresholds with no identifiable auditory brain stem response in 29 children

Audiometrically, 65.9% of the children with no response on ABR had hearing, and in 34.5% of these, the hearing loss was sloping. The median PTA (2–4 kHz) was 102 dB and the range from 65 to 120 dB. The accuracy of ABR is reasonably ineffective, because it overestimates the hearing loss in moderate and severe impairments. The absence of ABR indicates a significant hearing loss, but PTAs (2–4 kHz) as good as 65 dB were still found. Thus, a lack of response to click stimuli does not directly suggest none-viable residual hearing.

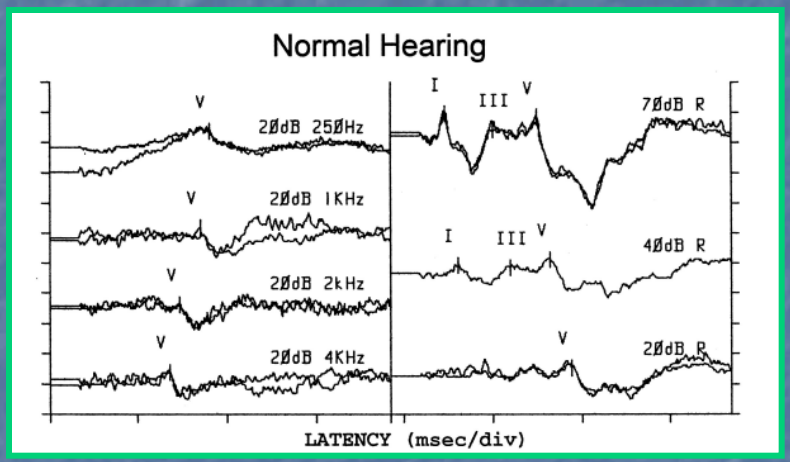
Although the median of PTA (2–4 kHz, dB HL) hearing loss in children with negative ABR is quite poor, one should be cautious in rating the hearing loss as severe to profound prima facie.

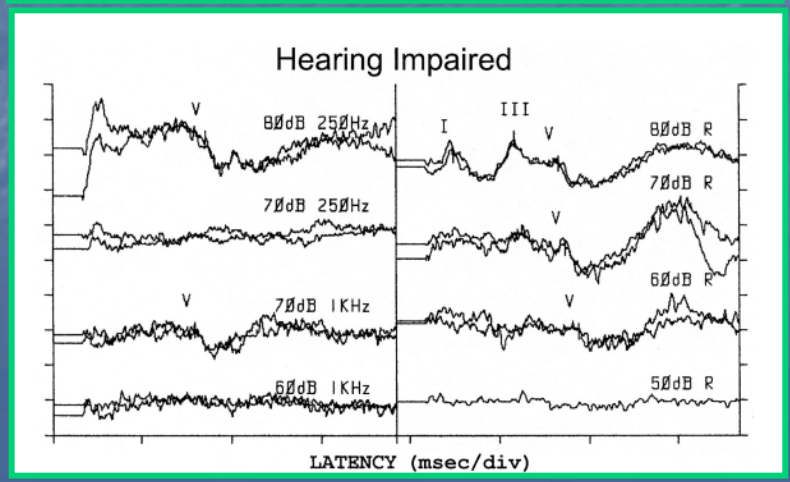
Using a Combination of Click- and Tone Burst–Evoked Auditory Brain Stem Response Measurements to Estimate Pure-Tone Thresholds

Michael P. Gorga, Tiffany A. Johnson, Jan R. Kaminski, Kathryn L. Beauchaine, Cassie A. Garner, and Stephen T. Neely

(Ear & Hearing 2006;27;60–74)

Results: Correlation was 0.94 between click-evoked ABR thresholds and the average pure-tone threshold at 2 and 4 kHz. Correlations exceeded 0.92 between ABR thresholds for the 250-Hz tone burst and low-frequency behavioral thresholds (250 Hz, 500 Hz, and the average pure-tone thresholds at 250 and 500 Hz). Similar or higher correlations were observed when ABR thresholds at other frequencies were compared with the pure-tone thresholds at corresponding frequencies. Differences between ABR and behavioral threshold depended on behavioral threshold, with ABR thresholds overestimating behavioral threshold in cases of normal hearing and underestimating behavioral threshold in cases of hearing loss.





La necessità di sincronizzare la risposta delle fibre nervose uditive

1. limita la specificità in frequenza dell'indagine ABR 
2. rende il sistema generatore particolarmente sensibile ad agenti che possono indurre una desincronizzazione, quali l'ipossia, l'iperbilirubinemia, la neuropatia uditiva (ridotta affidabilità nella stima di soglia)