MEE/OME an underestimated hearing condition and diagnostic challenge after NHS - Wideband Tympanometry

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Diagnosing the conductive part of a hearing loss after the NHS

- International and German best practice guidelines after the national implementation of the UNHS:

- Still problems in the assessment of conductive losses exist:
  - German guideline on bone conduction ABR are still missing
  - more experience in air-conduction and bone-conduction hearing thresholds estimations through BOA with babies under six months of age are needed
  - the ear microscopic assessment of the middle ear status in babies stays difficult
  - tympanogram results can be inconclusive
  - masking problems in case of bilateral conductive losses
International and German best practice guidelines after the national implementation of the UNHS

ASHA, Guidelines for the Audiologic Assessment of Children From Birth to 5 Years of Age (2004)

Positionspapier des Berufsverbandes Deutscher Hörgeschädigtenpädagogen zur Qualitätssicherung in der Pädagogischen Audiologie (2015)

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Case history:
- Down Syndrom
- NHS: Right: pass (several times)  
  Left: fail including AABR
- Cold already several times at 4 month

First appointment with 4½ months for further hearing assessment:
- anew cold with rhinorrhea
- Ear microscopy: very narrow ear canals, a reliable evaluation of 
  the eardrum is not possible
- Tympanometry: 226Hz: Right: normal,  
  1000Hz and Wideband-Tymp.: bilateral flat curve
- Click-ABR: Left: 30, 40, 50dB no potentials
Concl.: middle ear effusion (MEE) on both sides, with normal NHS 
  on right side  
  → „Watch and wait“ + control in 3 months

Control with 8 months:
- another 2 colds in the meantime
- Ear microscopy: ear canals still very narrow, no ear wax, 
  reliable eardrum evaluation not possible
- Tympanogram: 226Hz and 1000Hz: flat curve on both 
  sides
- Subjective audiometry:  
  - does not understand VRA
  - freefield BOA: hearing reactions for warble tones 500- 
    4000Hz at 60-70dB, music at 45dB
  - BC-BOA: 500Hz/20dB, 1000Hz/15dB, 4000Hz/20dB
Concl. + next steps:
• bilateral MEE
• with narrow ear canals grommets still not possible
• suggesting hearing aid fitting
• as child is reacting in a moderate loudness range, the parents decide against hearing aids
• next control in 6 months

Case example: questions and considerations

Diagnostic and treatment approach:
• Do you agree with our management of the case?
• If the initial NHS would have failed on both sides:
  – full diagnostic ABR with BC and AC?
  – "watch and wait", because of MEE effusion? For how long?
If the ear canal had been wide enough to provide grommets:
• Who will do the surgery for grommets with a baby of less than 9 kg (or if the child with Down syndrome had additional heard problems)?
• How do you ensure that the ENT surgeon himself examines the child before the surgery to decide, whether he is able to put grommets in the eardrum?
• Is it advisable to do further ABR testing in the same general anaethesia together with the grommets surgery? Who can provide both at the same time?
MEE and underestimated cause of conductive hearing losses in babies

prevalence CHL and MEE in babies:
- Healthy newborns: 1.7 per 100 (RIHAP, White et al., 1993)
- Babies at risk (neonatal intensive care unit): 3.6 per 100 (RIHAP, White et al., 1993)

The better the quality of the NHS is (few technical and organizational errors), the more the referral rate (e.g. 4%) will reflect the sum of permanent SNHL (e.g. 0.2%) and temporary CHL (e.g. 3.8%)

prevalence of CHL and MEE with 3 months [Paradise et al., 1997]: 15% - 33%

58% of the babies showing MEE in their first 48 hours of life continue to have chronic otitis media during their 1st year of life: CHL > 25 dB at 9 months of age [Doyle et al., 2004]

MEE is a common condition in the target population of babies, who failed NHS
Diagnostic procedures for the assessment of CHL and OME

**ear microscopy**

With babies the evaluation of the eardrum and the middle ear is limited:

- the view of the eardrum is more tangential as the eardrum has a more horizontal position
- narrow ear canal up to ear canal stenosis
- collapsing ear canal
- ear hair and earwax
- resistance of the child
- sorrowful and anxious parents

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**Tympanometry**

Tympanometry limitations:

- unrest and crying of the child
- very narrow and short ear canal
- soft ear canal walls

→ With babies younger than 6 month:
  - 226Hz tympanometry is not sufficient
  - 1000Hz tympanometry or
  - averaged wideband tympanometry

- problems sealing the probe
- inconclusive results or curves altered by artifacts
- discrepancies between otoscopy- tympanometry-paracentesis
226Hz, 1000Hz + averaged wideband tympanometry

4½ months

226Hz, 1000Hz + averaged wideband tympanometry
3D wideband tympanogram, absorbance

5 months

226Hz, 1000Hz + averaged wideband tympanometry
3D wideband tympanogram, absorbance
Wideband Tympanometry - Publications


- Prieve BA1, Feeney MP, Stenfelt S, Shahnaz N, "Prediction of conductive hearing loss using wideband acoustic immittance" Ear Hear. 2013 Jul;34 Suppl 1:54S-59S.


Diagnostic procedures for the assessment of CHL and MEE

**Bone conduction ABR**

Limitations:
- max. up to 50dB measurable (click)
- with a bone conductor a click is no longer a click
- Calibration problems:
  - size of the skull is much smaller
  - fontanelle, open sutures
  - placement of the bone conductor
  - controlling the contact-pressure of the bone conductor
- increased stimulus artifact

Some solutions:
- chirp instead of click
- trying to find age-related calibration values for providing age-related correction values
- Consequent use of bone conduction ABR, whenever necessary, leads to more experience

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Diagnostic procedures for the assessment of CHL and MEE

**BC- and AC- BOA** for the hearing threshold estimation of babies

- BC-BOA with an appropriate headband is feasible with many babies

Actual discussions with audiologist from Belgium and France:
- normal hearing babies show bone conduction reaction-thresholds at 20-30dB\(_{HL}\)
- for babies with a moderate or severe hearing loss their reaction threshold comes up to their hearing threshold (K. Kerkhofs, Brüssel; V. Vandenbroek, Brügge)
- even for babies of less than 6 months of age “conditioned hearing reactions” are achievable through a visual-social-emotional rewarding scheme (M. Delaroche, Bordeaux)
Summary

MEE and CHL are a very common condition in babies being assessed after a failed NHS assessment.

Any MEE and CHL has a decisive influence on the results of any OAE or AC threshold testing.

With babies, the assessment of MEE and CHL is by far not easy.

If the removal of MEE and the conductive component may significantly improve the hearing threshold of the child, this information has a decisive influence on the counseling process of the caregivers.

If the diagnosis of a MEE or CHL is wrong, this may significantly postpone the correct diagnosis and the rehabilitation process.

Therefore a combination of all available diagnostic options is necessary to rule out or verify a MEE:

- Anamnesis, like:
  - history of infections (cold)
  - NICU
  - nasal tube feeding

- ENT examination including ear microscopy

- Tympanometry:
  - 1000 Hz tympanometry
  - or (even better) averaged wideband tympanometry

- BC measurement:
  - ABR
  - Subjective BOA
Thank you for listening!