Risk Factors for Hearing Loss Following Bacterial Meningitis: Insights from Admission Characteristics

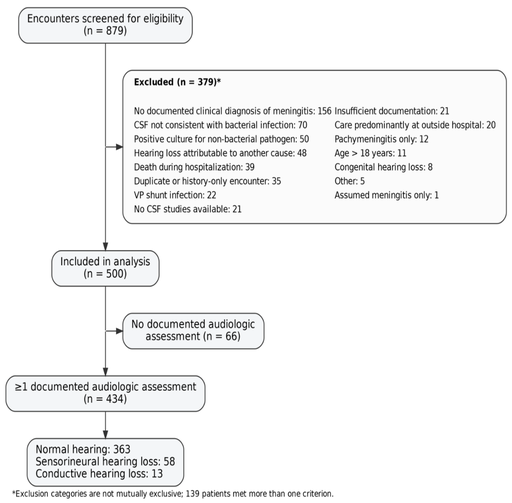
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Background and Objectives

- *Bacterial meningitis is one of the most serious causes of acquired sensorineural hearing loss (SNHL) in children, with incidence rates ranging from 5–43% worldwide[1-3].*
- *Although bacterial meningitis can cause a wide range of long-term neurologic consequences, including seizures, motor impairment, and cognitive delay, hearing loss is both among the most common and one of the most amenable to timely detection and intervention[2,4].*
- *Streptococcus pneumoniae carries the highest risk, with hearing loss occurring in up to 35.9% of cases compared to 23.9% for N. meningitidis[1].*
- *Additional clinical risk factors include prolonged illness duration, cerebrospinal fluid abnormalities, seizures, and low Glasgow Coma Scale at presentation[1].*
- *A previous study at TCH documented hearing loss rates and risk factors over two decades ago, however, no subsequent analysis has evaluated current practice patterns, detection rates, or outcomes in this population.*
- *The goal of this study is to determine the risk factors associated with hearing loss in patients with bacterial meningitis.*

Methods



*Exclusion categories are not mutually exclusive; 139 patients met more than one criterion.

Results

Table 1. Baseline characteristics of the cohort (N = 500)

1.7 mo
Median age
(IQR 0.5–18.4)

58.3%
Male
(n = 292)

22 days
Median stay
(IQR 14–35)

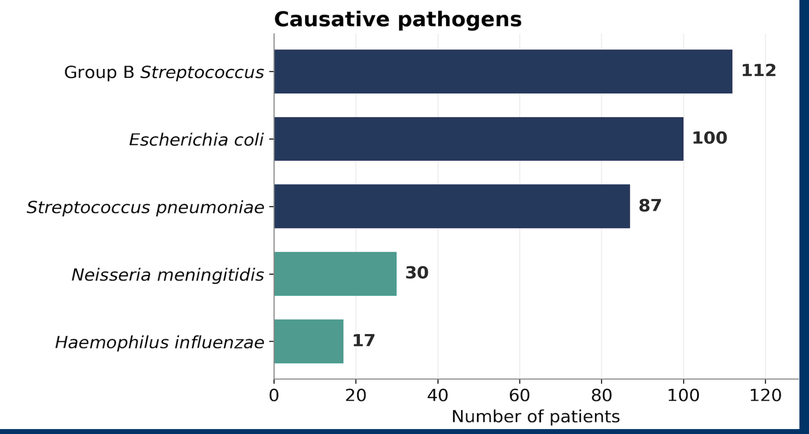


Table 2. Sensorineural hearing loss by causative pathogen

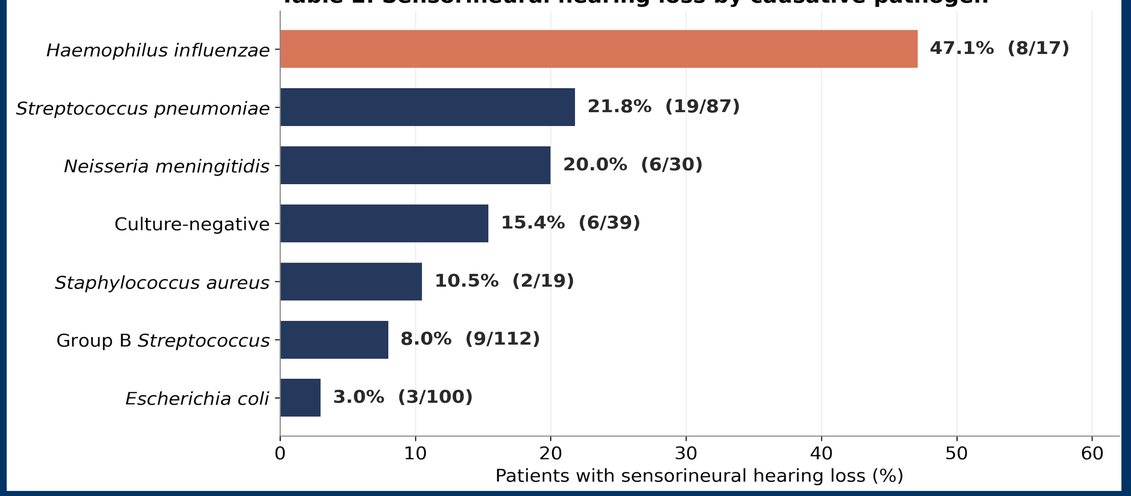
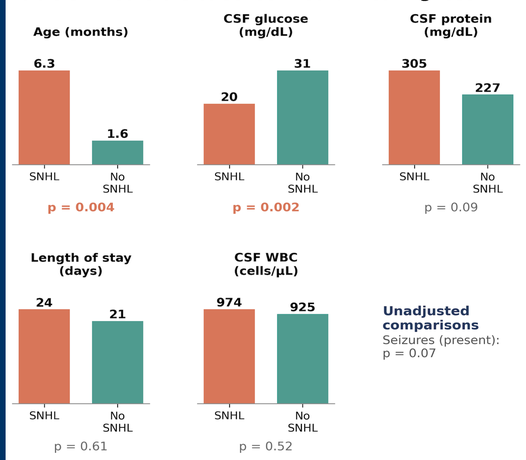
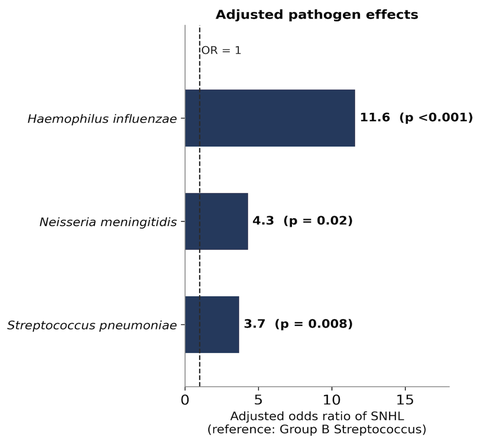


Table 3. Predictors of sensorineural hearing loss





Also adjusted: age OR 1.00 (p = 0.87); CSF glucose OR 0.98 (p = 0.02)

Conclusion

- *On unadjusted comparison, children who developed SNHL had markedly lower CSF glucose (median 20 vs 31 mg/dL; p=0.002) and were older (median 6.3 vs 1.6 months; p=0.004); CSF protein was higher without reaching significance (305 vs 227 mg/dL; p=0.09), as were seizures (p=0.07), while length of hospital stay and CSF white-cell count did not differ.*
- *In a multivariable logistic model, however, the apparent age effect disappeared entirely once causative organism was included (p=0.87). Pathogen was the dominant independent predictor: relative to GBS, chosen due to it being the most prevalent organism, the adjusted odds of SNHL were substantially elevated for H.influenzae (OR 11.6), N.meningitidis (OR 4.3), and S.pneumoniae (OR 3.7; all p<0.05).*
- *Low CSF glucose remained independently associated (OR 0.98 per mg/dL; p=0.02), whereas CSF protein did not.*
- *The unadjusted age association thus reflected confounding by organism rather than an effect of age itself: neonates disproportionately had lower-risk GBS and E.coli disease, while higher-risk organisms clustered in older infants.*

Limitations

- *Data comes from a single institution retrospective study and may not be generalizable to other setting.*
- *Full audiometric data is unavailable, given a substantial number of children had no documented audiologic assessment, and fewer than half consistently attended recommended outpatient audiology.*

References

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2. Rusinowska B, Tybulczuk B. A review of hearing impairment due to bacterial meningitis in children: importance of early diagnosis and treatment. J Hear Sci. 2023;13(1):9–16. doi:10.17430/jhs/162073.
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4. WHO guidelines on meningitis diagnosis, treatment and care. Geneva: World Health Organization; 2025.

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