

12-1-2021

Deafness in NICU babies

Adrienne N. Gennell

Follow this and additional works at: <https://huskiecommons.lib.niu.edu/studentengagement-honorscapstones>

Recommended Citation

Gennell, Adrienne N., "Deafness in NICU babies" (2021). *Honors Capstones*. 374.
<https://huskiecommons.lib.niu.edu/studentengagement-honorscapstones/374>

This Dissertation/Thesis is brought to you for free and open access by the Undergraduate Research & Artistry at Huskie Commons. It has been accepted for inclusion in Honors Capstones by an authorized administrator of Huskie Commons. For more information, please contact jschumacher@niu.edu.

NORTHERN ILLINOIS UNIVERSITY

Deafness in NICU Babies

A Capstone Submitted to the University Honors Program

In Partial Fulfillment of the Requirements of the Baccalaureate Degree with Honors

Department Of Nursing

By Adrienne Gennell

DeKalb, Illinois

May 14, 2022

Abstract:

Babies that require NICU stays after birth face a lot of difficulty due to a variety of reasons. Babies can be admitted to the NICU for problems such as prematurity, hyperbilirubinemia, respiratory or cardiovascular complications, infections, and more. Being admitted to the NICU exposes these babies to certain risk factors that can have long term effects and can lead to complications, such as hearing loss. NICU infants are at double the risk for hearing loss compared to infants that are carried to term, and 24-46% of NICU admissions are diagnosed with hearing loss (Pourarian et al., 2012). I was personally born premature, and I have moderate-to-severe hearing loss. I have been blessed to be able to hear with my hearing aids, and to have the ability to “turn off” my hearing as I please. Some don’t have this luxury due to severe hearing loss due to obstacles faced at birth. This literature analysis is intended to explore the existing research regarding correlation between admissions to the NICU and hearing loss. This data will explore information on the risk factors for hearing loss that NICU patients face and how these risk factors contribute to hearing loss. This analysis will provide a framework for future research to be completed to identify specific links between the NICU and hearing loss, as well as updating practice guidelines to implement appropriate interventions to prevent hearing loss in this high-risk population.

Literature Review:

This study by Stadio et al. aims to identify the prevalence of Sensorineural hearing loss in infants admitted to the NICU. The authors collected data by observing NICU patients and receiving information from their medical records from March to November in 2017. Screening used Transient Evoked Otoacoustic Emissions, and Automated Auditory Brainstem Responses. The infants were evaluated with a pass or refer score. (Stadio et al., 2017). 153 infants were assessed and 12 infants, or 7.8% were found to have moderate to profound sensorineural hearing loss. These infants received a refer score for the Automated Auditory Brainstem Responses screening. Of the 12, 60% were found to have profound hearing loss. Commonalities found in the 12 infants are prematurity, low birth weight, use of ototoxic antibiotics, and cesarean delivery (Stadio et al., 2019). This study did not find a correlation between these commonalities and the prevalence of sensorineural hearing loss in these infants but contributed this possibility to the limitation of a small sample size utilized in this study. The authors of this study recommend close observation of infants admitted to the NICU, and overall hearing screenings for newborns to detect hearing loss prior to 6 months of age.

The study by Pourarian et al. was performed to interpret the prevalence of premature infants having hearing loss related to their stay in the Neonatal Intensive Care Unit. This study collected data using a cross-sectional design that consisted of a year-long observation of premature infants admitted to the NICU in a hospital located in Iran. The population for this study was 124 and information about each infant was collected through questionnaires. Those with a family history or craniofacial malformations were excluded (Pourarian et al., 2012). The infants were tested for hearing loss upon discharge from the NICU and this study showed 17 participants with hearing loss in this study. This study found statistically significant results that

gestational age, oxygen therapy, and antibiotic treatment all play a role in hearing loss for infants. The authors recommend that infants be screened for hearing loss throughout their stay in the NICU, and that unnecessary oxygen and antibiotic treatment be avoided. A limitation identified in this study is the small sample size.

The study by Keihani-Doust et al., strived to determine contributing factors of hearing loss in NICU patients. The population consisted of 325 infants between 6 and 12 months of age with a history of a NICU hospitalization. These patients were seen at the Pediatric Neurology Office at Vali-e-Asr Hospital in Iran. This study was a case-control study that consisted of screening these infants for hearing loss using Otoacoustic Emission and Auditory Brainstem Response tests (Keihani-Doust et al., 2018). The case group were those who had hearing loss, and the control group consisted of infants who did not have hearing loss. 12 infants were found to have hearing loss out of 325 in the population. Compared to the control group, there are higher instances of those with a history of icterus, RDS, and low APGAR scores, showing some possible correlation between these factors and hearing loss. Some limitations include small sample size and data collection at only one facility. Some further recommendations provided by these authors include further research into the correlation of RDS and hearing loss, utilizing Auditory Brainstem Response testing to screen rather than Otoacoustic Emissions testing, and implement hearing screenings regularly especially in patients that present a risk of hearing loss due to the factors determined in this study.

The study performed by Gohari et al., aimed to identify the risk factors for hearing loss that infants face in the Neonatal Intensive Care Unit. This study utilized a cross sectional design in which included a convenience sample of 159 infants admitted to the NICU at Fatemieh and Shahid Beheshti Hospitals in Iran (Gohari et al., 2020). Infants were screened using transient

evoked otoacoustic emission and automated auditory brainstem response tests. Auditory brainstem response tests were also utilized in the event that TEOAE and AABR tests were failed (Gohari et al., 2020). 9 infants were found to have failed both hearing tests and 4 of these infants were found to have sensorineural hearing loss, 4 found with conductive hearing loss, and 1 with auditory neuropathy. Related factors were family history, hyperbilirubinemia requiring exchange transfusion, antibiotics, asphyxia, and APGAR scores less than 5 (Gohari et al., 2019). A limitation found in this study was the small sample size. Future recommendations include the use of both TEOAE and AABR to assess hearing loss in infants, close assessment of those admitted to the NICU and present with any of the determined risk factors, staff and family education about hearing loss in infants (Gohari et al., 2019).

This study by Garinis et al., aims to review the existing research to determine the quality effectiveness of current audiological screening and ototoxicity monitoring in infants admitted to the Neonatal Intensive Care Unit. This study reviews drug related ototoxicity: for example, loop diuretics or aminoglycosides are associated with hearing loss in NICU patients. This can be caused by a variety of reasons such as different levels of ototoxicity that can result from drugs administered to NICU babies, as well as different conditions that contribute to hearing loss such as hyperbilirubinemia (Garinis et al., 2018). Some obstacles with screening for hearing loss in NICU infants are identified in this study. The study found that without a prior hearing test, there is no way to be sure the hearing loss was caused from ototoxic therapy, the aABR screening does not use a high-enough frequency, and the screening is difficult to perform and interpret in premature infants (Garinis et al., 2018). Future recommendations provided by this study include screening infants before and after ototoxic therapy, implementing higher frequency evaluation in the OAE and ABR tests, minimizing the use of ototoxic drugs, minimizing ambient noise in the

NICU setting, prenatal genetic testing for hearing loss, and education for parents and staff on the importance of hearing screening in NICU infants.

This study done by McGrath and Vohr reviews complications, specifically hearing loss, that NICU patients may face regarding aggressive treatments and provides recommendations on the treatment and care of these infants. This study is performed using a review of data compiled from a variety of other studies. The study discusses how premature infants are two times more likely to have hearing loss than infants who are carried to term. To evaluate hearing loss in neonates, guidelines by the American Academy of Pediatrics recommend screening in the first month, however it can be difficult to screen infants prior to 34 weeks due to auditory system immaturity (McGrath & Vohr, 2017). The study also reviews factors that may interfere with the hearing screening of a neonate. These include medical equipment that may be incompatible with hearing screening equipment due to the electromagnetic field, the noise level in the NICU. These things may delay the screening process in infants and therefore delay the implementation of early interventions. Care recommendations provided by this study emphasize the importance of early diagnosis and intervention, as well as providing family support for the family regarding the hearing loss diagnosis of a neonate (McGrath & Vohr, 2017).

Rigg and Rigg discuss the complications of opioid induced hearing loss in infants that are exposed to opioids during pregnancy. This can lead to a condition called Neonatal Abstinence Syndrome. It has been determined that NAS can contribute to initial failed screenings, however it is uncertain if this failed screening is caused by the increased irritability in the infant due to NAS. Infants with NAS may need care in the NICU, which is a risk factor for hearing loss due to noise and treatments provided. NAS is a condition that is treatable and can allow hearing evaluation to occur within the one-month period. It is thought that the misuse of opioids can be

caused by hypoxia that affects the cochlea, and possible vasoconstrictive issues. Patients that misuse opioids are at risk for hearing loss and cognitive dysfunction that may affect speech processing and comprehension. Future recommendations that this study provides are further research on the connection between NAS and hearing loss, as well as research on how opioid use causes hearing loss (Rigg & Rigg, 2020).

Yasmeen et al. discusses the effects of noise levels in the NICU and during transport. This study is done by assessing transported infants in Scotland over an 18-month period. The research began with a pilot study to determine the efficiency of DPOAE hearing testing on the premature infants and was successful. After this, the DPOAE screening was completed before and after transporting, and measuring the noise level the infants are exposed to during transport. A frequency analysis was then done to determine that the transport of neonatal infant does not appear to affect hearing loss. It is discussed that transporting the infant in an incubator may be helpful in reducing noise exposure compared to transporting without one. The study also discusses that although no cases of hearing loss were identified in this study, measures should still be taken to reduce noise levels in the NICU setting as it is still a concern for this vulnerable population.

Discussion:

The first four studies discussed in this literature review (Stadio et al., Pourarian et al., Keihani-Doust et al., and Gohari et al) found results that identify NICU admissions as a risk factor for hearing loss. These studies found that there are a variety of factors that contribute to hearing loss in babies admitted to the NICU. Stadio et al. found that prematurity, low birth weight, use of ototoxic antibiotics, and cesarean delivery contribute to hearing loss in these infants. Pourarian et al. found that gestational age, oxygen therapy, and antibiotic treatment all

play a role in hearing loss for infants. Keihani-Doust et al. found that there are higher instances of those with a history of icterus, RDS, and low APGAR scores, showing some possible correlation between these factors and hearing loss. Gohari et al. found that related factors between prematurity and hearing loss are family history, hyperbilirubinemia requiring exchange transfusion, antibiotics, asphyxia, and APGAR scores less than 5. Garinis et al. discussed the effects of ototoxic medications such as loop diuretics and aminoglycosides to hearing loss in this population. McGrath & Vohr discuss the importance of early diagnosis and intervention. Rigg & Rigg identifies opioid misuse and NAS as a contributor to hearing loss. Finally, Yasmeen et al. found that neonatal transport does not directly cause hearing loss in their population, however noise control measures should continue in the NICU setting.

Summary/Conclusion:

NICU infants face a great deal of adversity not only during their stay in the NICU, but there can possibly be long-term effects from being admitted to the NICU. This literature review analyzed the correlation between NICU admissions and hearing loss. Having the knowledge of this correlation, contributing factors, and recommendations for the future help healthcare professionals understand the connection between the NICU and hearing loss. By studying the connection between NICU admissions and hearing loss, practice guidelines for neonatal intensive care units regarding hearing evaluations and intervention may be updated to further prevent hearing loss in NICU admits. This literature review provides education that can be beneficial as it provides supporting data that NICU admissions are at a higher risk of hearing loss. Contributing factors are identified and future recommendations are provided. Future research should be done to investigate possible interventions that can be implemented into neonatal intensive care units to prevent hearing loss. This information can help change how care

is provided in the NICU setting to implement interventions that help prevent hearing loss in this population.

References

- American Speech-Language-Hearing Association. (2015). Effects of Hearing Loss on Development. *Audiology Information Series*.
<https://www.asha.org/siteassets/uploadedFiles/AIS-Hearing-Loss-Development-Effects.pdf>
- Garinis, A. (2017). Monitoring neonates for ototoxicity. *International Journal of Audiology*, 57:54-61. DOI: 10.1080/14992027.2017.1339130
- Gohari, N. (2020). The prevalence of hearing loss in infants hospitalized in the neonatal intensive care units. *Auditory and Vestibular Research*, 29(4):197-203.
- Keihani-Doust, Z. (2018). Risk Factors for Hearing Loss and Its Prevalence in Neonates Older than 6 Months with History of Hospitalization in Intensive Care Unit. *Iranian Journal of Child Neurology*, 12(4):153-161.
- March of Dimes. (2019). Long Term Health Effects of Premature Birth. *March of Dimes*.
<https://www.marchofdimes.org/complications/long-term-health-effects-of-premature-birth.aspx>
- McGrath & Vohr. (2017). Ear Care for the Most Vulnerable Infants. *All Ears on Audiology*, 20-23.
- Pourarian, S., et al. (2012). Prevalence of Hearing Loss in Newborns Admitted to Neonatal Intensive Care Unit. *The Iranian Journal of Otorhinolaryngology*, 3(24).
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3846223/pdf/ijo-24-129.pdf>

Riggs & Riggs. (2020). Opioid-Induced Hearing Loss and Neonatal Abstinence Syndrome: Clinical Considerations for Audiologists and Recommendations for Future Research. *American Journal of Audiology*, 29: 701-709.

Stadio, A. D., et al. (2019). Sensorineural Hearing Loss in Newborns Hospitalized in Neonatal Intensive Care Unit: An Observational Study. *The International Tinnitus Journal*, 23(1)
DOI: 10.5935/0946-5448.20190006

Yasmeen et al. (2020). Exposure To Noise During Neonatal Transport and its Impact On Hearing. *Original Research*, 16(6): 249-252.