Testing for CMV Following Diagnosis of Hearing Loss: A Guideline for Clinical Practice

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INTRODUCTION

- Cytomegalovirus (CMV) is the most common congenital viral infection affecting infants in the U.S. Each year about 30,000 babies are born with congenital CMV (CDC, 2013).
- 10-15% of babies with congenital CMV have multiple symptoms, including sensorineural hearing loss (SNHL), and of the otherwise asymptomatic babies, 10% develop a SNHL (Kenna, 2013).
- CMV is the leading non-genetic cause of congenital SNHL (Kadambari, 2011).
- CMV is a potentially treatable etiology of hearing loss; therefore diagnosis should occur within the first 3 weeks of life (Kadambari, 2011).
- Currently, Utah is the only state that mandates CMV testing for newborns who fail the newborn hearing screening (Kenna, 2013; Utah Department of Public Health, 2014).
- The Otolaryngology & Communication Enhancement Department at Boston Children's Hospital has created guidelines to increase CMV detection in newborns with hearing loss. Starting in 2009, infants who had suspected or confirmed hearing loss based on diagnostic auditory brainstem response (ABR) testing, were tested for CMV by collecting saliva for shell vial culture. Babies who tested positive for CMV were referred to Infectious Diseases for confirmation of the diagnosis and medical management.

OBJECTIVE

- To review a population of patients who were tested for CMV following a new clinical practice guideline implemented to improve the rate of CMV detection in infants with hearing loss diagnosed via ABR testing.

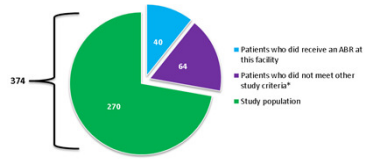
METHODS

- Using an internal tool to query a data warehouse of information from our EMR billing applications, a query of medical records was performed to search for patients with a CMV swab ordered by the Otolaryngology & Communication Enhancement Department between January 2009 and December 2014.
- A retrospective chart review of these patients was then performed to select for patients who had diagnostic ABR testing at our facility.
- Patients were excluded if they were older than 1 year of age at the time of diagnostic ABR, if they had a CMV screening prior to ABR testing or if they had a CMV diagnosis before coming to our facility.
- Records were reviewed to identify 1) the number of patients tested for CMV, 2) the results of the CMV test, 3) the length of time between hearing loss diagnosis at our facility and CMV screening, and 4) difference in time between initial ABR and Infectious Disease Appointment for patients who tested positive for CMV.
- Patients who had positive CMV results were identified. Charts of these patients were reviewed further to identify: 1) if the patients were seen by the Department of Infectious Disease at our facility; 2) if they received any treatment for CMV (i.e. yes/no); 3) each patient's current audiological profile, such as unilateral vs. bilateral hearing loss and audiological interventions, and 4) newborn hearing screening results.

RESULTS

- 374 patients had a CMV swab within the study time frame, and of these patients 334 also had a diagnostic ABR at this facility within the study time frame (Figure 1). All patients who received a CMV swab either had a confirmed or suspected diagnosis of hearing loss.
- Of this population, 270 patients met the inclusion criteria for proposed clinical practice; being less than one year of age, having confirmed or suspected hearing loss, and having had CMV testing after ABR testing and with no prior diagnosis of CMV. Within the 270 patients, 15 patients were found to be positive for CMV (Figure 2).
- A decrease in the average amount of time between initial diagnostic ABR (at our facility) and CMV swab was observed (Figure 3).
- Of the CMV positive patients, those who received a swab on the same day as initial ABR were seen by Infectious Disease sooner (an average of 11.4 days between appointments) than those who were swabbed at a later date other than the initial ABR (an average of 67.5 days between appointments), (Figure 4).

Figure 1: Number of Patients Who Received a CMV Swab as a Result of Hearing Loss Diagnosis Between 2009-2014



*= Other study criteria as noted in Methods section: older than 1 year of age at the time of diagnostic ABR, if they had a CMV screening prior to ABR testing or if they had a CMV diagnosis before coming to our facility.

Figure 2: Study Population

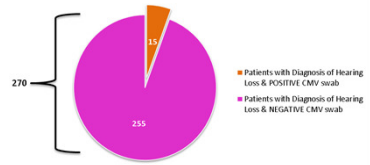


Figure 3: Average Difference in Date Between Hearing loss Diagnosis via ABR and CMV Swab in Days

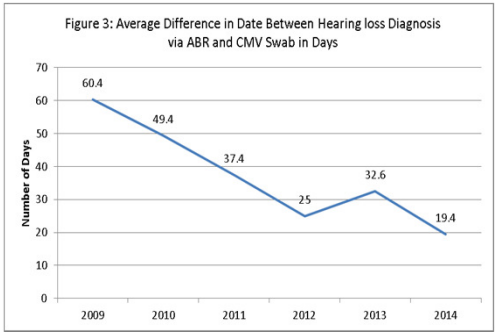
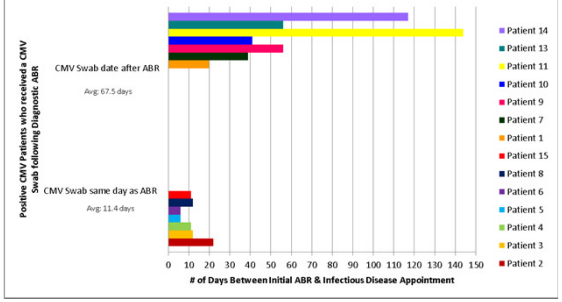


Figure 4: Timeline of Initial ABR to Infectious Disease Appointment for Positive CMV Patients*



*Patients in legend correspond with Positive CMV patients in Case Study section (see above). Bar colors used to display the difference in days between the initial ABR and appointment with Infectious Disease for each patient. NOTE: Patient 12 not depicted on this figure due to patient referral for out of state care.

CMV Positive Patients – CASE STUDY

Patient	Newborn Hearing Screening Results	Appointment w/ Infectious Disease Dept.	Received Treatment by Infectious Disease	Bilateral, Unilateral, or Ear Not Specified Hearing Loss*	Degree of Hearing Loss (R/L)*	Audiological Interventions
1	Bilateral Refer	Yes	No	Bilateral	Mild to moderate	Loss to follow up**
2	Bilateral Refer	Yes	No	Bilateral	Profound	Bilateral CIs
3	Refer Right	Yes	Yes	Bilateral	Normal sloping to moderate	Bilateral HAs
4	Bilateral Refer	Yes	Yes	Bilateral	Profound	Bilateral CIs
5	Bilateral Refer	Yes	Yes	Unilateral	Mild	Monitoring
6	Refer Right	Yes	Yes	Unilateral	Moderate to moderately-severe	HA pending
7	Bilateral Refer	Yes	No	Bilateral	Profound	Bilateral HAs
8	Bilateral Refer	Yes	Yes	Bilateral	Mild/Moderate	Monitoring
9	Bilateral Refer	Yes	Yes	Bilateral	Moderately-severe to profound/Mild to moderately-severe	Bilateral HAs
10	Refer Left	Yes	Yes	Not Specified	Mild	Bilateral HAs
11	Refer Left	Yes	Yes	Unilateral	Mild to moderate	Monitoring
12**	Refer Left	Unknown	Unknown	Bilateral	Mild to moderate	
13	Refer Right	Yes	Yes	Unilateral	Mild (Stenotic ear canal w/ normal masked bone conduction)	Monitoring
14	Inconclusive	Yes	Yes	Unilateral	Moderate	Monitoring
15	Unknown	Yes	No	Not Specified	Mild	Bilateral HAs

*Based on most recent comprehensive results
**Patient from out of state referred for care at another facility

DISCUSSION

- Overall, this study suggests that of the patients who were tested for CMV following the guideline for clinical practice, there was earlier detection of CMV in infants with hearing loss diagnosed via ABR and earlier establishment for potential treatment with Infectious Disease.
- Patient chart review revealed several potential limitations:
  - A delay in time between hearing loss diagnosis and CMV swab may be a result of patients needing to undergo multiple ABR tests to obtain the appropriate patient sleep state and/or complete comprehensive test, or because patients with complex medical needs may not have been seen for testing until medically stable.
  - In our study, the CMV positive patient population was limited to those who had CMV swab completed at our facility, and excluded those who came to Otolaryngology with a confirmed CMV diagnosis.
  - Further research may include: 1) a review of newborn hearing screening referral population to determine the number of patients tested for CMV after referral on the newborn hearing screen and hearing loss diagnosis via ABR, 2) benefit of earlier treatment in regards to degree of hearing loss, 3) outcome comparison of babies swabbed for CMV immediately following referral on newborn hearing screening at the birth hospital vs. swab following hearing loss diagnosis at follow up ABR, and 4) rationale behind universal newborn CMV screening.
- We acknowledge the significance of this proposed clinical practice guideline in providing the need for further knowledge and innovative universal care by professionals for this patient population.

REFERENCES

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ICI Institute for Community Inclusion
promoting the inclusion of people with disabilities