RISK FACTOR SCREENING FOR PERMANENT HEARING LOSS IN ONTARIO

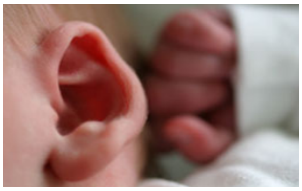
AN INTRODUCTION FOR OTOLARYNGOLOGISTS

Newborn Screening Ontario (NSO)

- Newborn Screening Ontario is the provincial program that coordinates dried blood spot testing for a variety of rare but treatable diseases.
- NSO also provides support regarding the standardization, quality assurance, and accessibility of point of care screening for Critical Congenital Heart Disease for infants in Ontario.

NEWBORN SCREENING ONTARIO
DÉPISTAGE NÉONATAL ONTARIO

The Infant Hearing Program (IHP)



- The Infant Hearing Program is a provincial program that identifies infants with permanent hearing loss and provides services to these children and their families to support language and early literacy development so they are ready to start school.
- IHP services also include monitoring for those infants born at risk of early childhood hearing loss.

Ontario

NSO and the IHP have partnered to offer **risk factor screening for permanent hearing loss (PHL)**, which will improve the detection of infants at risk for childhood PHL and introduce an etiologic focus to hearing loss identification.

Risk Factor Screening

Newborn Blood Spot Screening

Testing for rare, treatable diseases:

- Metabolic Diseases
- Endocrine Diseases
- Sickle Cell Disease
- Cystic Fibrosis
- Severe Combined Immune Deficiency

Hearing Screening

Audiometric screening

PASS
Risk factor dependent surveillance

REFER
Auditory brainstem response testing and risk factor dependent surveillance

NEW

Parental consent obtained by IHP to test dried blood spot

NSO tests for hearing loss risk factors (July 2019)

1. Genetic factors

- Only mutations in genes associated with a high risk of congenital or childhood onset (before age 6) PHL will be screened.
- Genes : DFNB1 (GJB2 and GJB6) and DFNB4 (SLC26A4)
- Only infants with two mutations in one of the genes tested will be reported as screen positive (autosomal recessive inheritance).
- Audiologic assessment by an IHP audiologist is required.
- **Infants with confirmed PHL will be referred to Otolaryngology.**
- Carrier status is not routinely reported but is available upon request. This information may help guide plans for further genetic testing/consultation in infants with confirmed PHL.

2. Cytomegalovirus (CMV)

- Testing for viral DNA is done using real-time PCR.
- If CMV is detected, there is a high likelihood of cCMV infection.
- Evaluation including confirmation of infection by a pediatrician is required.
- If an infant is symptomatic, an urgent referral to Infectious Diseases will be made for treatment decision-making.
- Audiologic assessment and surveillance by an IHP audiologist is required.
- **Infants with confirmed PHL will be referred to Otolaryngology.**

Genetic Risk Factors

~60% of childhood PHL has a genetic cause

GJB2/6	15%
SLC26A4	12%
Other genetic causes (combined)	34%
CMV	25%
Other environmental causes (combined)	14%

- **GJB2, GJB6 and SLC26A4 are the loci accounting for the largest proportion of non-syndromic genetic PHL.**

Genes screened by NSO:

LOCUS	GENE	PROTEIN
DFNB1	GJB2	Connexin-26
DFNB1	GJB6	Connexin-30
DFNB4	SLC26A4	Pendrin

*** Only selected mutations associated with a high risk for PHL at birth or by age 6 will be tested. Please visit the NSO website for a list of mutations tested.**

Congenital CMV (cCMV)

cCMV and PHL:

cCMV accounts for up to **25%** of PHL in children

An infant with cCMV can pass their IHP hearing screen at birth and still be at risk to develop CMV-related PHL in childhood.

~10% of infants are symptomatic at birth, with features that can be subtle and difficult to recognize

Risk for PHL:

cCMV-associated PHL can:

- be congenital or late onset
- affect one or both ears
- affect some or all pitches
- be mild to profound
- be progressive and/or fluctuating

Referrals to Otolaryngology

Infants with PHL

Screen Negative

- A negative risk factor screening result does not rule out cCMV or a genetic cause of PHL.
- Carrier results are not routinely reported but are available upon request from NSO and may help guide plans for further genetic testing and/or consultation.

Genetic Risk Factor Screen Positive

- Infants with two mutations in GJB2/6 will only be referred to ENT if PHL is confirmed.
- Infants with two mutations in SLC26A4 will be referred to ENT regardless of hearing status due to the associated presence of enlarged vestibular aqueduct.
- Consider CMV screening for these infants as dual etiologies are possible.

CMV Screen Positive

- CMV-related PHL is variable in presentation and can be asymmetric and progressive.
- Consider evaluation for other potential causes as dual and overlapping etiologies are possible.