MRI as a Predictor of Hearing loss in Children Receiving Chemotherapy

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Introduction

- Platinum-based therapies are commonly utilized as first-line treatments despite associations with permanent, dose-dependent ototoxic effects, including hearing loss, for pediatric brain tumors.
- Magnetic Resonance Imaging (MRI) is a possible tool for early identification of patients at risk for hearing loss due to cochlear signal changes.
- This study presents the first longitudinal investigation of MRI signal changes and hearing outcomes in pediatric patients undergoing chemotherapy for intracranial neoplasm.

Methods

- Retrospective chart review of patients receiving treatment for intracranial neoplasms and underwent serial MRI and audiologic exams at Children's National Hospital between 2000-2019 (n=29)
- Demographics, clinical characteristics (imaging and audiometric data), and treatment course collected
- Timeline of initial cochlear signal abnormality (T2 FLAIR hyperintensity) and audiometric data assessed for possible temporal relationship between cochlear changes (mild vs moderate/severe) on MRI and hearing loss

Results

- Median age at diagnosis was 8 years
- Hearing loss was diagnosed in 26 (89.7%) of the patients, with 19 (73.1%) being noted on MRI imaging changes prior to diagnosis.
- Median time to developing hearing loss from initial MRI change was 20 weeks
- Degree of MRI change did not differ significantly when correlated with the severity of (p=0.83) or time to hearing loss (p=0.99).

Table 1: Demographic data summary

Variables		N= 29
Age at dx (year)	Median [IQR]	**8.0 [7.0, 10.0]**
Sex, n (%)	Male	15 (51.7)
	Female	14 (48.3)
Tumor type, n (%)	Ependymoma	1 (3.4)
	Anaplastic ependymoma	1 (3.4)
	Posterior Fossa Ependymoma	1 (3.4)
	Craniopharyngioma	1 (3.4)
	Medulloblastoma	**25 (86.2)**
Stage of disease, n (%)	Localized	24 (82.8)
	Metastasized	5 (17.2)
Hearing loss, n (%)		**26 (89.7)**
MRI change before HL, n (%)		**19 (73.1)**
Cisplatin, n (%)		27 (93.1)
Radiation, n (%)		29 (100.0)

Figure 1: Intracochlear MRI changes in a patient who developed bilateral sensorineural hearing loss

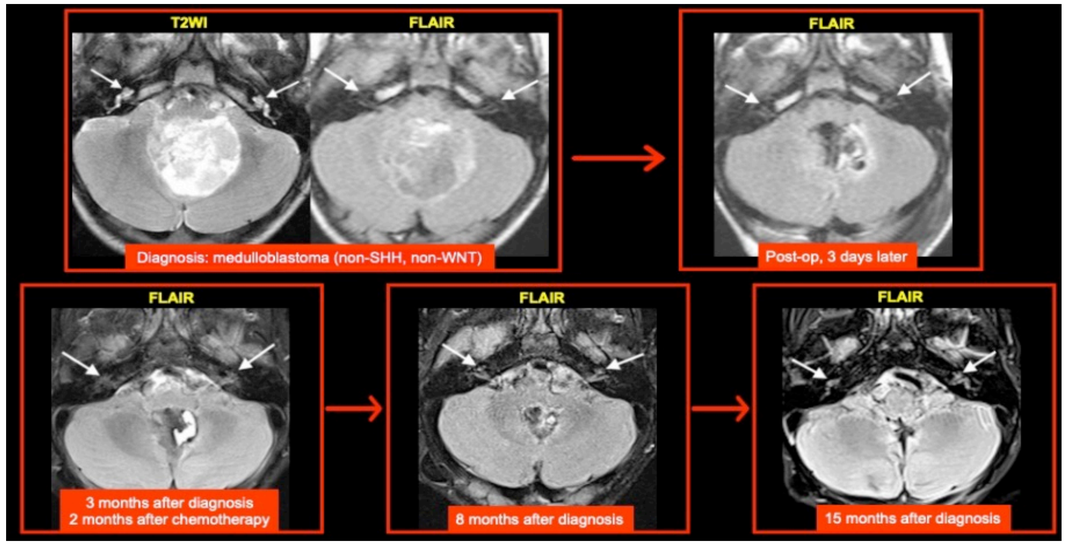

Figure 1: Axial T2WI (A) and T2 FLAIR image (B) through the posterior fossa show a heterogenous midline mass consistent with a medulloblastoma. Note normal intracochlear signal: hyperintense on T2WI (A) and hypointense on T2 FLAIR (B) (arrows). Three days later, an axial T2 FLAIR (C) shows acute postoperative changes from interval gross total tumor resection; cochlear signal remains normal and unchanged (arrows). Three months later (and 2 months after chemotherapy initiation), an axial T2 FLAIR image (D) shows subtle increase in cochlear signal compared to the pre-treatment studies (arrows). Axial T2 FLAIR images at 8 months (E) and 15 months (F) after diagnosis demonstrate progressively increasing cochlear signal hyperintensity in this patient that developed bilateral mild to moderate bilateral SNHL from 5000 to 8000 hz.

Figure 2: Radiographic changes and hearing loss-free survival

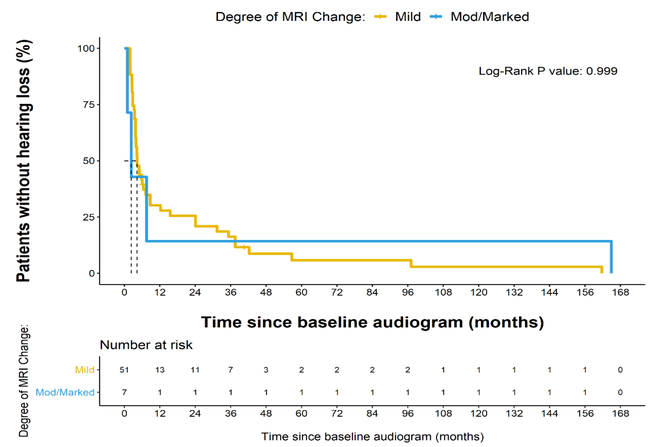

Figure 2: Of the 29 patients in our cohort, 88% had mild MRI change and 12% had moderate/severe change. No significant differences when hearing loss was stratified by degree of MRI change (p = 0.999)

Conclusions

- Therapy for intracranial neoplasms often involves ototoxic agents and early detection of hearing loss is critical to proper management.
- Ability to correlate radiologic findings with risk of hearing loss offers a potential screening option for at risk patients with MRI as a standard component of treatment surveillance