Incorporating the Scores of Term-Equivalent Age Brain MRI of Preterm Infants in Clinical Practice

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Background and Aim

- Despite advances in maternal and neonatal care, preterm infants remain at risk for adverse long-term neurodevelopmental outcomes.
- MRI is more sensitive than cranial ultrasound at detecting white matter injury and is increasingly being used to define preterm brain injury.
- Translating MRI findings into prognostic outcome, however, remains challenging.
- This study aimed to improve the interpretation and clinical utility of term-equivalent age (TEA) MRIs of preterm infants by providing the clinical team with individualized MRI reports based on a previously published scoring system.

Methods

Clinical Practice:

- This study was conducted at the Brigham and Women's Hospital, Boston.
- In our center, all infants born <28 weeks or <32 weeks with additional risk factors undergo an MRI at TEA.
- While results are reported by specialized neuroradiologists, the medical providers are the ones responsible for the interpretation of these scans and subsequent communication with parents.

MRIs:

- MRIs were scored using a previously published scoring system.
- Individualized reports using evidence-based outcomes were sent to providers within 24-48 hours of the MRI.

Surveys:

- Prior to the intervention, we anonymously surveyed medical providers.
- Survey included questions about the knowledge and confidence in interpreting TEA MRIs, prediction of outcome and conveying results to parents.
- Following the intervention, providers were surveyed again to determine whether they found the reports helpful.

Results

- Nine medical providers were included in the initial survey
  - Two-thirds were only slightly or not confident in interpreting the MRI clinical report and how the injury related to outcome, and in conveying the results of the MRI to parents.
- During the 4-month period, 14 reports were formulated and sent to caregivers.
- Following the intervention, all providers reported that the intervention was helpful and allowed for "better, more cohesive plans with families" and improved ability to interpret findings of brain growth more quantitatively and integrate this information in clinical care

Example of report sent to providers

Kidokoro Score:

White Matter Score:	3 (mild)
Cortical Grey Matter Score:	4 (severe)
Deep Grey Matter Score:	0 (normal)
Cerebellum Score:	2 (moderate)
= Global Brain abnormality Score:	9 (moderate)

Measures of overall brain growth:

Biparietal width	1 (mild)
Interhemispheric distance	1 (mild)

Overall Impression:
This infant has a global score of 9. Neurology consult is recommended due to severe cortical grey matter score and infant should be followed up in the Neurodevelopmental clinic as increased global score is associated with poor gross motor, cognitive and fine motor outcome.

Subdivisions:

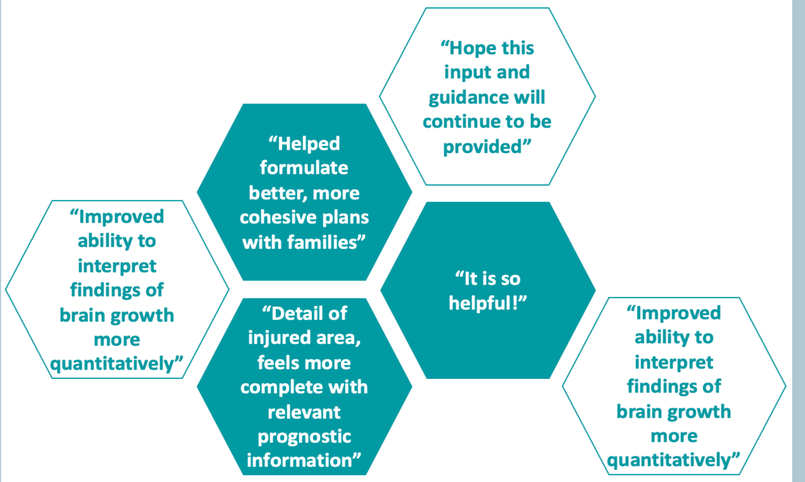
Mild white matter abnormalities are predominantly associated with motor impairment and delayed cognitive development but also associated with poor attention and slower processing speeds

Cerebellar abnormalities are associated with poor motor outcome as well as cognitive and attention difficulties.

Brain Growth:

Consultation with Dietician is recommended to ensure optimization of calorie and protein intake

Survey following intervention: feedback from providers



Conclusions

- To date, MRI scoring systems have predominantly been used in research settings.
- Its use in this clinical setting was feasible and provided an objective, quantifiable assessment of brain growth and injury in preterm infants allowing for individualized reports and subsequently targeted interventions and follow-up.

References

1. Cheong, J. L., et al. Have outcomes following extremely preterm birth improved over time? Seminars in Fetal and Neonatal Medicine, 25(3), 101114.
2. Inder TE, et al. White matter injury in the premature infant: a comparison between serial cranial sonographic and MR findings at term. AJNR American journal of neuroradiology. 2003;24(5):805-9.
3. Natarajan N, et al. Challenges in neurologic prognostication after neonatal brain injury. Semin Perinatol. 2017 Mar;41(2):117-123. doi: 10.1053/j.semperi.2016.11.008. Epub 2017 Jan 28. PMID: 28139254.
4. Hinojosa-Rodríguez M, et al. Clinical neuroimaging in the preterm infant: Diagnosis and prognosis. Neuroimage Clin. 2017 Aug 14;16:355-368. doi: 10.1016/j.nicl.2017.08.015. PMID: 28861337; PMCID: PMC5568883.
5. Kidokoro H, et al. New MR imaging assessment tool to define brain abnormalities in very preterm infants at term. AJNR Am J Neuroradiol. 2013 Nov-Dec;34(11):2208-14. doi: 10.3174/ajnr.A3521. Epub 2013 Apr 25. PMID: 23620070; PMCID: PMC4163698.