The correlation between preoperative T2 Cube sequence and intraoperative findings in redo endoscopic third ventriculostomy

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BACKGROUND

- There is limited literature assessing the efficacy of endoscopic third ventriculostomy (ETV) using non-invasive methods.
- A potential method for assessing ETV stoma patency is by flow-sensitive magnetic resonance image (MRI) sequences coupled with high resolution T2 (CISS/FIESTA); the former useful for demonstrating flow whilst the latter better at delineating anatomy and thus the stoma.
- We have been using high resolution MRI 3D T2 fast spin echo (T2 Cube) sequences to demonstrate flow voids in clinical practice and we were able to detect flow in a catheter phantom low fidelity model.
- We present our study evaluating the T2 Cube sequence coupled with CISS/FIESTA as a non-invasive method for investigating ETV stoma patency in children, by correlating MRI findings with redo ETV intraoperative findings.

METHODS

- Retrospective data analysis (clinical, operative and imaging records) of paediatric patients who underwent ETVs between September 2014 and April 2019 at King's College Hospital.
- Patients who then underwent redo ETV with pre-operative MRI flow sequences (T2 Cube) were selected.
- The following variables were recorded from imaging: presence of flow through the stoma on T2 Cube sequence in addition to visualisation of stoma and adhesions on CISS/FIESTA sequence.
- The presence or absence of CSF flow through the ETV stoma was then correlated with the redo ETV intraoperative findings (open vs closed stoma).
- Statistical analysis was performed using the χ^2-Test.

RESULTS

- Of 65 patients that underwent ETV in the time period, 16 patients (13M:3F) met the inclusion criteria. The average age at initial ETV was 6.8 years.
- There was a significant correlation between the assessment of CSF flow through the primary stoma with T2 cube sequences and intraoperative patency assessment ($p<0.05$).

		Intraoperative Findings		
		Patent	Closed	Total
T2 Cube Sequence	Flow	4	1	5
	No flow	0	11	11
	Total	4	12	16

Table 1: *Patency scores of ETV assessed using MRI CISS , T2 cube sequence and intraoperative assessment.*

- MRI CISS/FIESTA sequences demonstrated a defect in the third ventricular floor in 4 cases and intraoperative assessment confirmed patency in two of the cases.
- Adhesions identified on CISS/FIESTA images were confirmed in 62% of the cases in the intraoperative assessment.

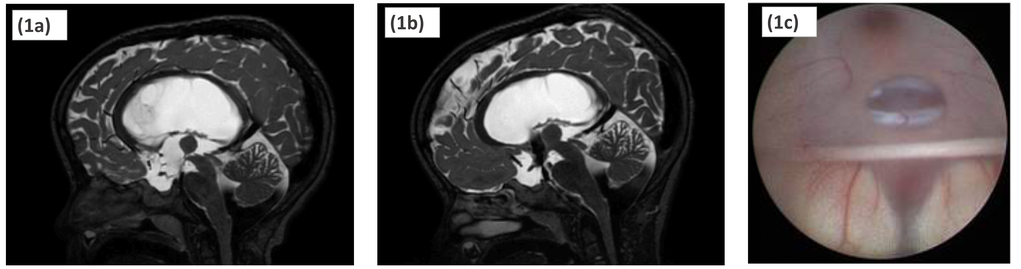

Figure 1: (a)) *Pre-ETV T2 Cube MRI demonstrating no flow through the ETV.* ***(b)*** *Post-ETV T2 Cube MRI demonstrating flow through a patent ETV* ***(c)*** *Intraoperative endoscopic visualisation of the previous ETV stoma blocked by a thin membrane. Patient with obstructive hydrocephalus from large massa intermedia.*

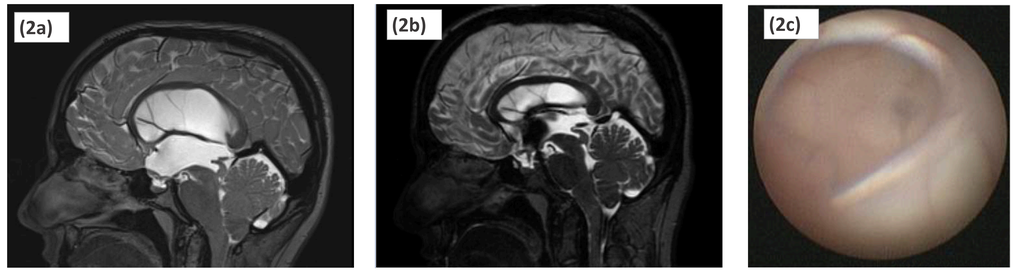

Figure 2: (a)) *Pre-ETV T2 Cube MRI demonstrating no flow through the ETV.* ***(b)*** *Post-ETV T2 Cube MRI demonstrating flow through a patent ETV* ***(c)*** *Intraoperative endoscopic visualisation of the previous ETV stoma through foramen of Monro blocked by a thin membrane. Patient with NF1 and aqueductal obstruction.*

CONCLUSION

This cohort study demonstrates that the T2 high resolution 3D FSE sequence is able to accurately detect CSF flow through the third ventricle floor post-ETV and determine ETV patency. Further studies are necessary to characterise the efficacy of the T2 cube sequence in quantifying flow. This may form the basis of non-invasive assessment of ETV patency in clinical practice and may even apply to shunt patency assessment.