

Quantitative MRI Assessment of Parenchymal Injury Following Transcallosal and Endoscopic Approaches to Third Ventricle Colloid Cysts



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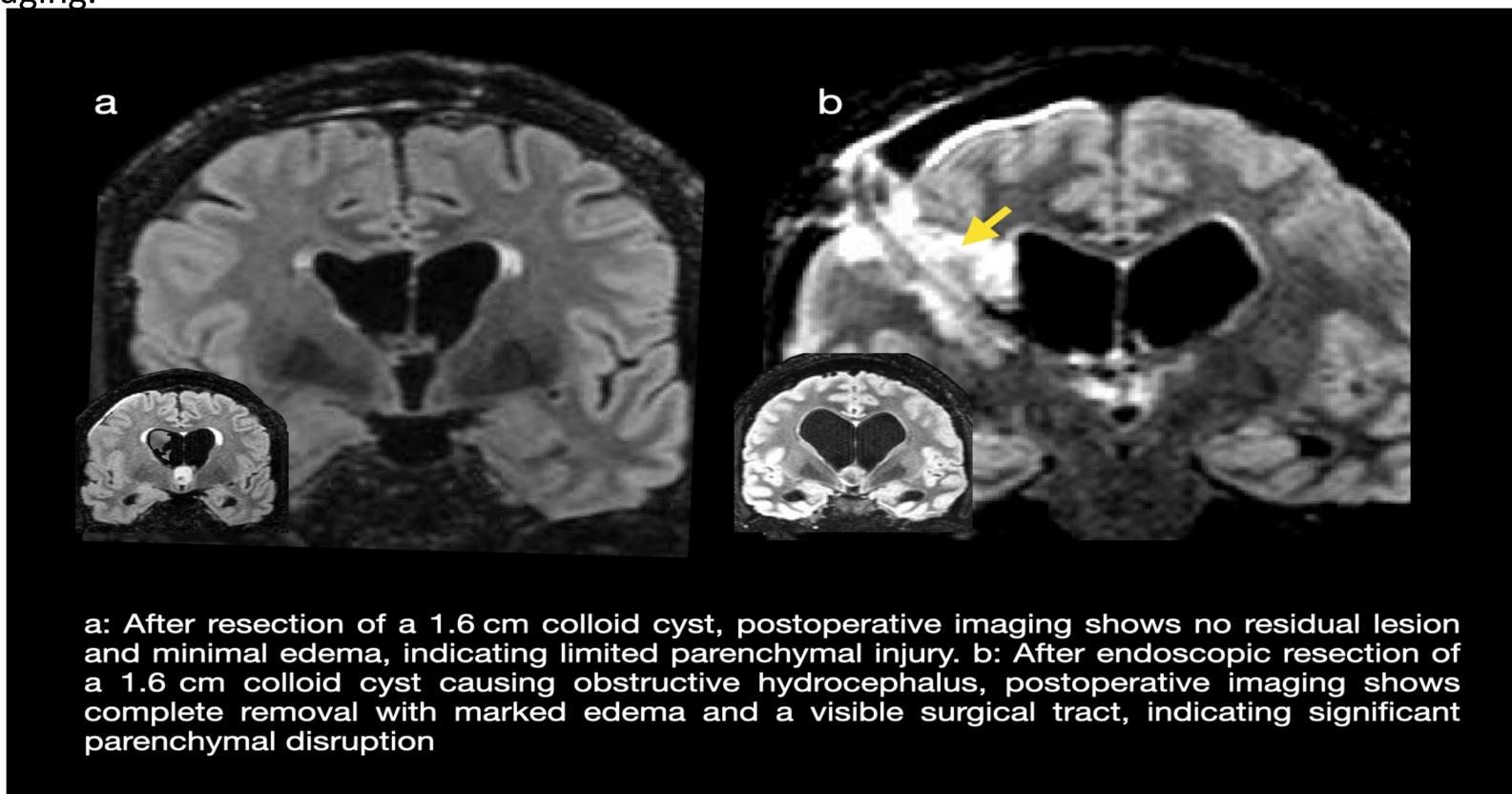


Introduction

Third ventricle colloid cysts (TVCCs) can cause obstructive hydrocephalus and acute neurological deterioration. Both the interhemispheric transcallosal approach (ITA) and the endoscopic approach (EA) are established treatment strategies; however, their relative impact on cerebral parenchyma on postoperative MRI, as well as the evolution of imaging changes from early to late postoperative periods, remain poorly characterized. This study aims to compare early postoperative volumetric MRI findings following ITA and EA for TVCC resection and to determine whether early parenchymal injury persists on late imaging.

Methods and Materials

A retrospective review was conducted of 23 patients (ITA, 13; EA, 10) who underwent both early and late postoperative MRI. Early T2-weighted FLAIR hyperintensity volumes were segmented along the surgical tract; in EA cases, burr-hole tract volume was subtracted. Diffusion restriction was assessed using DWI and ADC sequences. Late MRI was evaluated for gliosis, encephalomalacia, and parenchymal loss. Statistical analyses compared diffusion MRI findings between approaches and assessed correlations between early hyperintensity volumes and late imaging outcomes.



Results

Early hyperintensity volumes were significantly smaller after ITA compared with EA ($349 \pm 218 \text{ mm}^3$ vs. $2952 \pm 2084 \text{ mm}^3$; $p < 0.001$). Diffusion restriction was observed in 7.7% of ITA versus 50% of EA cases ($p = 0.052$). On late MRI, gliosis, encephalomalacia, and parenchymal loss were absent in ITA but present in 50% of EA cases ($p = 0.007$ each). In EA, larger early volumes correlated with gliosis ($p = 0.032$), encephalomalacia, and parenchymal loss ($p = 0.016$ each). Gross total resection was achieved in 92% of ITA versus 50% of EA cases ($p = 0.039$).

Discussion

Early MRI changes were strongly associated with delayed structural findings, underscoring the value of volumetric imaging in characterizing the true parenchymal impact of different surgical corridors. These results highlight that perceived minimal invasiveness may not fully reflect deep tissue effects and support the use of longitudinal MRI metrics when interpreting postoperative injury and guiding quantitative surgical planning and patient counseling.

Conclusions

Compared with ITA, EA was associated with larger early parenchymal injury, with approximately half of cases demonstrating persistent structural abnormalities on late imaging, suggesting a greater risk of lasting tissue damage.