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Anatomical variations of the floor of the third ventricle and their surgical implications for endoscopic third ventriculostomy

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Abstract

Endoscopic third ventriculostomy (ETV) is an established treatment for obstructive hydrocephalus. Anatomical variations of the floor of the third ventricle (FTV) may significantly influence surgical safety and outcomes. We retrospectively reviewed 53 ETV procedures performed between July 2022 and December 2023. Anatomical variations of the FTV were identified in 11 patients (20.7%), including thinned, partially effaced, thickened or opaque, and ballooning or herniated floors. Recognition of these variations is essential for safe fenestration and optimal outcomes.

Keywords
anatomical variations, third ventricle, endoscopic third ventriculostomy, third ventricular floor

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Introduction

Precise anatomical knowledge is fundamental to safe neurosurgical practice. The third ventricle is a narrow midline cavity surrounded by vital neural and vascular structures.[5] Endoscopic third ventriculostomy, first described by Mixter in 1923, is widely used in the treatment of obstructive hydrocephalus.[6] Anatomical variations of the floor of the third ventricle may obscure surgical landmarks and increase operative risk.[1,7] Despite numerous publications on ETV outcomes, focused analyses of FTV variations remain limited.[2–4]

Materials and Methods

This retrospective observational study was conducted at ABVIMS & Dr. RML Hospital, New Delhi. Fifty-three patients undergoing ETV for non-communicating hydrocephalus were included. Preoperative assessment included NCCT head and MRI brain imaging.[8] All procedures were performed using a rigid Karl Storz LOTTA endoscope. Intraoperative images of the FTV were analyzed and classified according to previously described anatomical variations.[1,3,9]

Results

Anatomical variations of the floor of the third ventricle were identified in 11 of 53 patients (20.7%). A thinned and translucent floor was the

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most frequently observed variation. Partially effaced, thickened or opaque, and ballooning or herniated floors were less common. Similar prevalence rates have been reported in prior endoscopic series.[4,10]

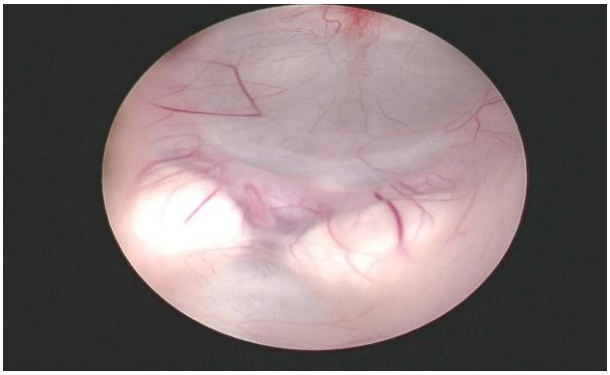

Figure 1. Thinned floor, example 1. The floor is translucent with mamillary bodies, basilar complex, and small blood vessels of the floor clearly visualized. Mamillary bodies are wide apart and laterally placed with a prominent basilar complex.

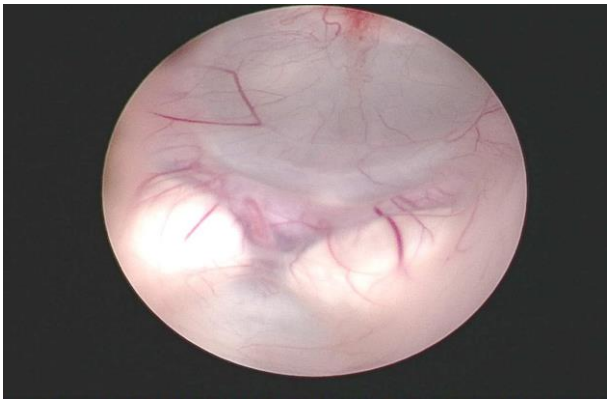

Figure 2. Partially effaced floor, example 1. The floor is partially opaque except for the area immediately anterior to the mamillary bodies, and the basilar complex is not visualized.

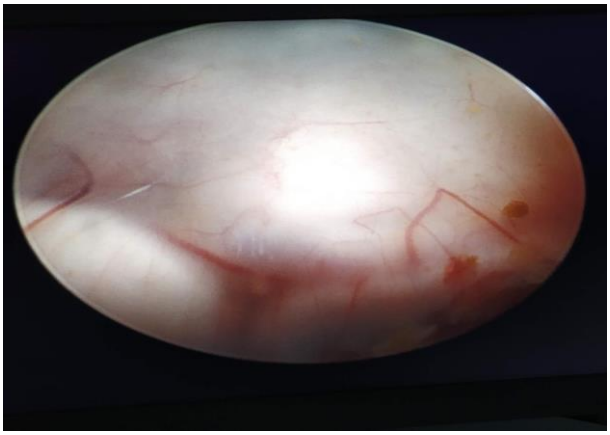

Figure 3. Thickened floor, example 1. The floor is thickened, obscuring the basilar complex with mamillary bodies pushed against each other, with a narrowed third ventricle.

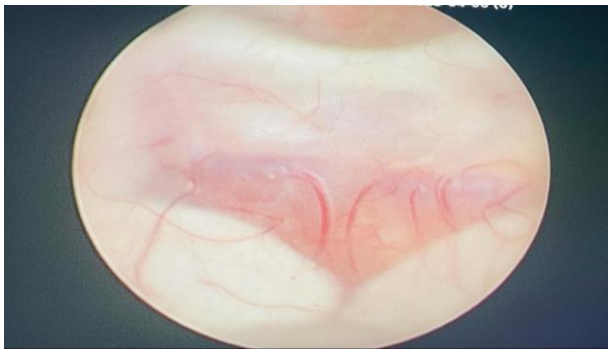

Figure 4. Thinned floor, example 2. The floor is transparent with clearly visualised mamillary bodies, basilar complex and dorsum sellae with a prominent basilar complex. The infundibular recess appears to be dilated.

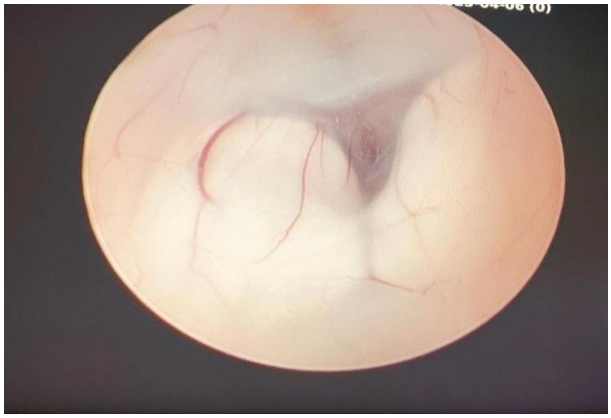

Figure 5. Partially effaced floor, example 2. Small prepontine interval with Dorsum sellae very close to the mamillary bodies with visible basilar tip in the intermammillary space.

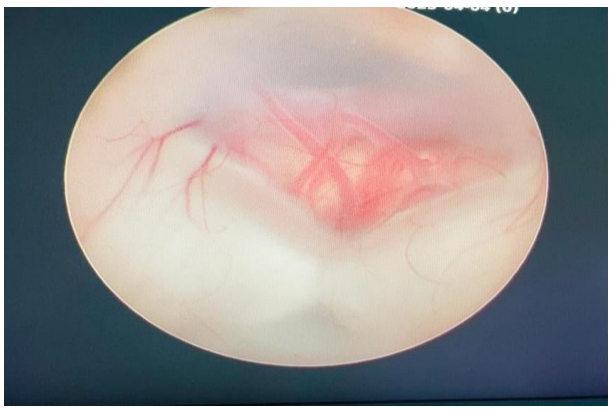

Figure 6. Thinned floor, example 3. The floor is transparent with clearly visualised mamillary bodies, basilar complex

and small vessels of the floor. The basilar bifurcation is seen between the mamillary bodies.

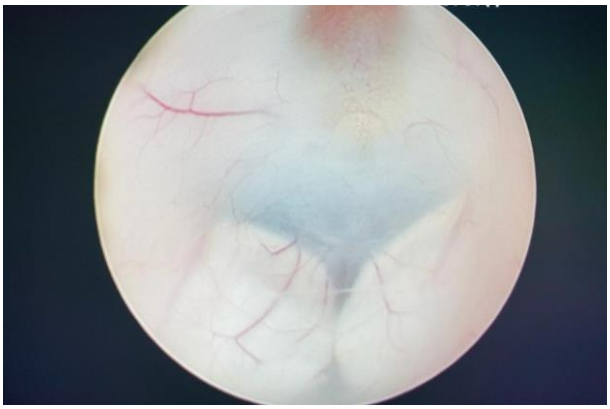

Figure 7. Partially effaced floor, example 3. The floor is partially opaque except for the area over and anterior to the mamillary bodies. The basilar tip cannot be visualised. The pigmentation of the infundibular recess seems to extend up to the floor of the third ventricle

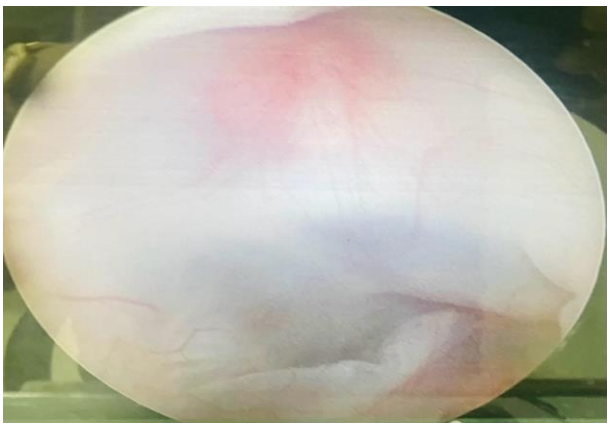

Figure 8. Ballooning / herniating floor, example 1. The floor of the third ventricle is so effaced and stretched that it folds on to itself with a visible basilar tip and dorsum sellae, with pigmentation of the infundibular recess extending up to the floor of the third ventricle.

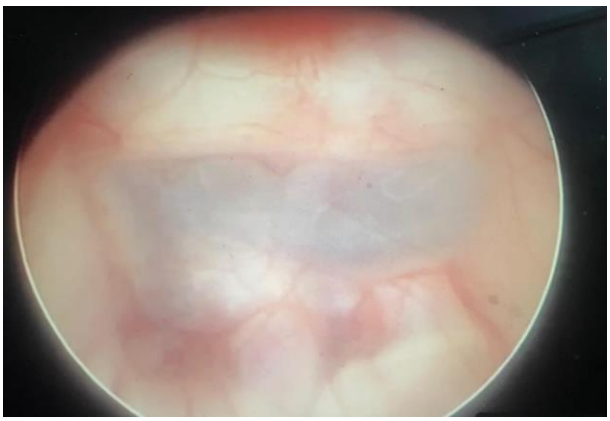

Figure 9. Partially effaced floor, example 4. Mamillary bodies are deficient with an effaced floor, with visible basilar bifurcation and dorsum sellae, with pigmentation of the infundibular recess extending up to the floor of the third ventricle.

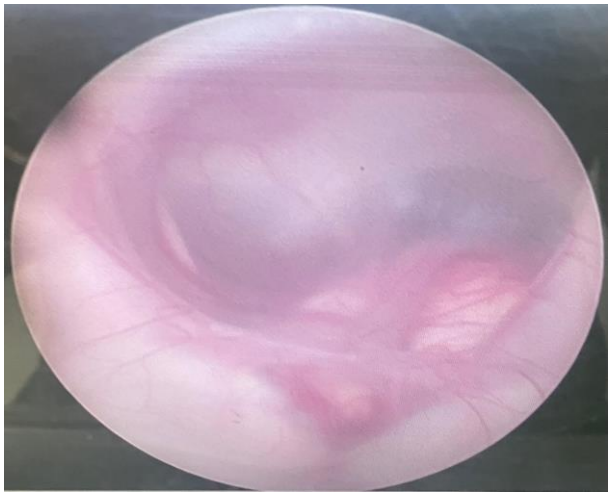

Figure 10. Thinned floor, example 4. Completely transparent floor with clearly visualised mamillary bodies, prominent basilar bifurcation and basilar artery running along the pons and right oculomotor nerve are visualised.

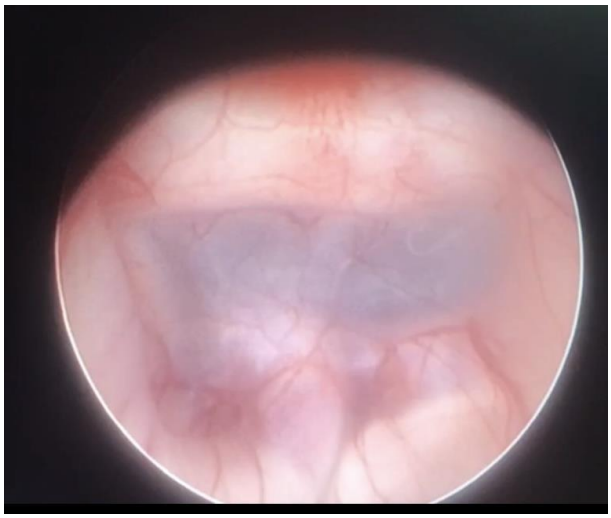

Figure 11. Thinned floor, example 5
Transparent floor with prominent basilar bifurcation visualised in the intermammillary space with clearly visible mamillary bodies and dorsum sellae.

Discussion

Anatomical variations of the FTV are frequently encountered in patients with hydrocephalus and may significantly influence the technical difficulty and safety of ETV. A thinned floor, typically observed

in chronic hydrocephalus, is considered favourable due to clear visualisation of the basilar artery and its perforators.[1,4] In contrast, a thickened or opaque floor obscures vascular landmarks and increases the risk of hypothalamic or vascular injury.[3,7] Partial effacement and ballooning of the FTV further complicate identification of a safe fenestration zone.[2,11]

Conclusion

Anatomical variations of the floor of the third ventricle are common in patients undergoing endoscopic third ventriculostomy. Accurate recognition of these variations, combined with careful preoperative imaging and meticulous surgical technique, is essential to minimize complications and optimize outcomes. Larger studies are required to better correlate specific anatomical variations with surgical success.[1–4]

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