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Did we move the cyst? The role of cerebrospinal fluid diversion in the migration of neurocysticercosis

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Review Article

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Abstract

Mobile intraventricular neurocysticercosis (IVNCC) is dangerous because a freely floating cyst can suddenly obstruct cerebrospinal fluid (CSF) pathways. Ventricular cyst migration is recognized, but long-distance movement across compartments is rarely documented and its drivers remain debated. A case of IVNCC initially located in the left lateral ventricle is reported. During revision, acute-phase CT from the outside hospital was obtained and reviewed with neuroradiological input. These images confirmed acute obstructive hydrocephalus and showed the cyst actively crossing the foramen of Monro towards the third ventricle during the acute hydrocephalus-CSF diversion interval. This sequence documented unstable ventricular anatomy during the critical peri-decompression period. A focused narrative case-based review was updated using PubMed/MEDLINE, Embase and Cochrane Library. Twenty-three reports yielded 29 unique published migration events with extractable individual data. Intervention-associated CSF perturbation was temporally related to 15/29 events (51.7%), positional mechanisms to 10/29 (34.5%), spontaneous migration to 3/29 (10.3%) and an indeterminate trigger to 1/29 (3.4%). Operative escape, non-visualization or an empty target was reported in 10/23 (43.5%) cases with operative detail. These proportions are descriptive and not procedural risk estimates. Mobile IVNCC should be regarded as a dynamic obstructive lesion. Urgent CSF diversion remains indicated in acute hydrocephalus, but interval imaging before definitive surgery is advisable whenever feasible.

Introduction

Neurocysticercosis remains the most common parasitic infection of the central nervous system worldwide. Intraventricular neurocysticercosis (IVNCC) represents roughly 10–20% of cases and is one of the most dangerous phenotypes because obstruction may occur abruptly, intermittently and sometimes catastrophically (White et al., 2018; Takayanagui and Haidar, 2022). Fourth ventricular involvement is the most frequent intraventricular location, followed by the third and lateral ventricles (Nash et al., 2018; Mendieta-Barrera et al., 2025).

Unlike many parenchymal and intraventricular lesions, a viable intraventricular cyst may remain non-adherent and behave as a mobile intraluminal body. This mobility explains why some patients present with episodic obstruction, transient hydrocephalus or Brun syndrome, a ball-valve phenomenon classically characterized by sudden headache, vomiting, vertigo and gait instability precipitated by head movement (Torres-Corzo et al., 2006; Shahani et al., 2015; Nash et al., 2018; Baro et al., 2020; Chugh et al., 2021). Migration documented on sequential neuroimaging is also recognized as a confirmatory neuroimaging feature in contemporary diagnostic criteria for neurocysticercosis (Del Brutto et al., 2017).

Most discussions of IVNCC emphasize diagnosis and removal, but less attention has been paid to the mechanics and consequences of the wandering cyst. That gap matters clinically: once a cyst can migrate, it can change the obstructive point, alter the surgical corridor and make the anatomy shown on earlier imaging unreliable. An illustrative case of migrating IVNCC is presented together with a focused case-based review of published migrating ventricular cysts. The aim was not to estimate the incidence of migration after cerebrospinal fluid (CSF) diversion or to assign a single causal trigger to every event, but to clarify how mobile cysts behave during

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acute hydrocephalus, posture changes and CSF pressure perturbation, and to distil practical lessons for surgical planning.

Materials and methods

This study combines an illustrative case report with a focused migration-oriented review of the literature. Case data were obtained from the treating neurosurgical service and were reviewed chronologically using clinical records, serial neuroimaging, operative details and post-operative evolution. After peer review, additional outside-hospital imaging was obtained and reviewed with neuroradiological input. This modified the interpretation of the temporal relationship between cyst migration and external ventricular drainage (EVD) placement: the image sequence documented active cyst relocation during the acute hydrocephalus-CSF diversion interval but did not allow the exact initiating trigger to be assigned.

The original search was performed in PubMed/MEDLINE and supplemented with Embase and the Cochrane Library using terms related to neurocysticercosis, migration, mobility, wandering cysts, ventricular or adjacent CSF spaces, Brun syndrome, EVD, shunt and endoscopy. The review was intentionally designed as a narrative, descriptive case-based synthesis rather than a registered systematic review or meta-analysis, because the aim was to contextualize a rare migratory event and its practical imaging implications rather than to compare interventions or estimate procedural risk.

Reports were included in the pooled migration analysis when they described lesion relocation documented radiologically, inferred intraoperatively or strongly linked to abrupt change in ventricular target localization. Reports that described IVNCC, Brun syndrome, endoscopic outcomes or diagnostic workflows without extractable individual migration events were retained for contextual discussion but were not included in the pooled migration counts. Twenty-three reports were retained for migration-oriented pooled extraction. After reconciliation of probable overlapping institutional case descriptions, these reports yielded 29 unique published migration events with sufficient detail for pooled coding.

Migration events were classified as intervention-associated when they followed an intervention expected to alter CSF pressure gradients or ventricular hydrodynamics, including ventriculostomy, shunting, lumbar puncture, pneumoencephalography or intraoperative/endoscopic irrigation-manipulation. Events were classified as positional when they were clearly posture-dependent, spontaneous when no intervention or positional trigger was evident and unknown when the report described relocation without enough detail for a more confident attribution. Potentially overlapping reports were cross-checked by age, ventricular location, trigger, migration pathway and operative course so that only unique events were counted once.

Because the source literature consists mainly of case reports and small case series, the pooled proportions were treated strictly as descriptive counts within a selected published sample. They were not interpreted as epidemiological risk estimates and were not used to infer procedure-specific causality. The present case was not added to the intervention-associated or spontaneous published-case numerator. After review of the additional images – including a CT from April 2024 that showed interval displacement before any intervention – the case was classified as spontaneous-onset migration with peri-decompression progression/indeterminate. This classification acknowledges the documented spontaneous movement prior to CSF diversion, while also recognizing that the acute-phase sequence did not allow the exact role of pressure-related changes during the EVD period to be determined.

Results

Illustrative case

A 50-year-old woman with neurocysticercosis was followed by a neuroinfectious diseases team after control magnetic resonance imaging (MRI) demonstrated an intraventricular cystic lesion in 2011. In 2023, she was later referred to the Hydrodynamics Unit of the University of Sao Paulo Clinics Hospital after the worsening of ataxia symptoms. At presentation to Neurosurgery, she had epilepsy, an ataxic syndrome and cognitive complaints. MRI dated 10 January 2023 showed a cystic lesion in the body of the left lateral ventricle, and endoscopic excision was recommended. She performed a CT scan dated 30 April 2024, which first showed a subtle migration of the cyst that was initially unnoticed during outpatient follow-up (Figure 1A,B).

Definitive surgery was temporarily deferred because adult neuroendoscopic equipment was unavailable at the treating service. She remained under outpatient follow-up with relative symptomatic stability until August 2025, when she developed sudden severe headache, nausea, vomiting and decreased level of consciousness. At an outside emergency hospital, she was diagnosed with acute hydrocephalus and underwent urgent EVD placement on 14 August 2025. Her neurological status improved, the drain was eventually removed after successful weaning, and she was discharged without a permanent shunt.

Initially, detailed interval imaging from that acute admission had not been available for review. After contacting an external radiology team, the outside-hospital image set was obtained. Review of these images with neuroradiological input suggested that the cyst had already begun to leave its original lateral ventricular location by the time of the acute hydrocephalic episode. Acute CT on 14 August 2025 confirmed obstructive hydrocephalus, with the cyst almost reaching the third ventricle. CT on 15 August 2025 showed the lesion at the foramen of Monro, partly related to the left lateral ventricle and the third ventricle, and imaging on 16 August 2025 was interpreted as consistent with further caudal progression (Figure 2). This sequence documents active peri-decompression migration during the acute hydrocephalus-EVD interval. Critically, retrospective review of a CT scan from April 2024 – obtained 16 months before the acute episode – showed that the cyst had already begun to leave its original lateral ventricular location before any CSF diversion or surgical intervention. This indicates that the migratory process had a spontaneous component that predated the acute decompressive event. However, the sequence during August 2025 does not establish whether the caudal progression was purely a continuation of this spontaneous movement or was modified by the pressure changes surrounding EVD placement. The clinically relevant point is that the cyst location changed during the critical interval between rescue treatment and definitive surgery.

When she returned to our institution in November 2025, she had worsened gait, required support to ambulate and reported memory lapses. Outside hospital MRI dated 29 August 2025 and follow-up MRI dated 22 October 2025 no longer showed the original left lateral ventricular lesion. Instead, a cystic lesion with the same morphology and signal characteristics was seen

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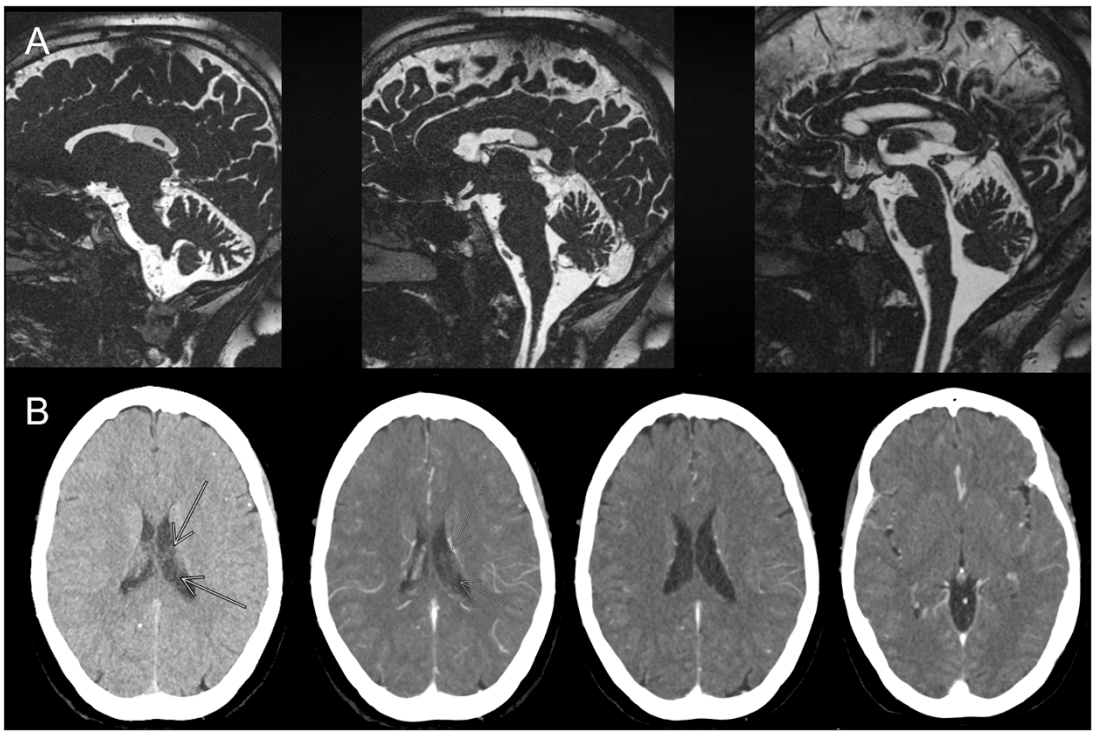


Figure 1. Initial location and earliest evidence of interval migration. MRI in 2023 (A) showed the cystic lesion in the body of the left lateral ventricle. CT in 2024 (B) was retrospectively identified as the first study suggesting migration from the original lateral ventricular position, a change that had not been recognized at the time.

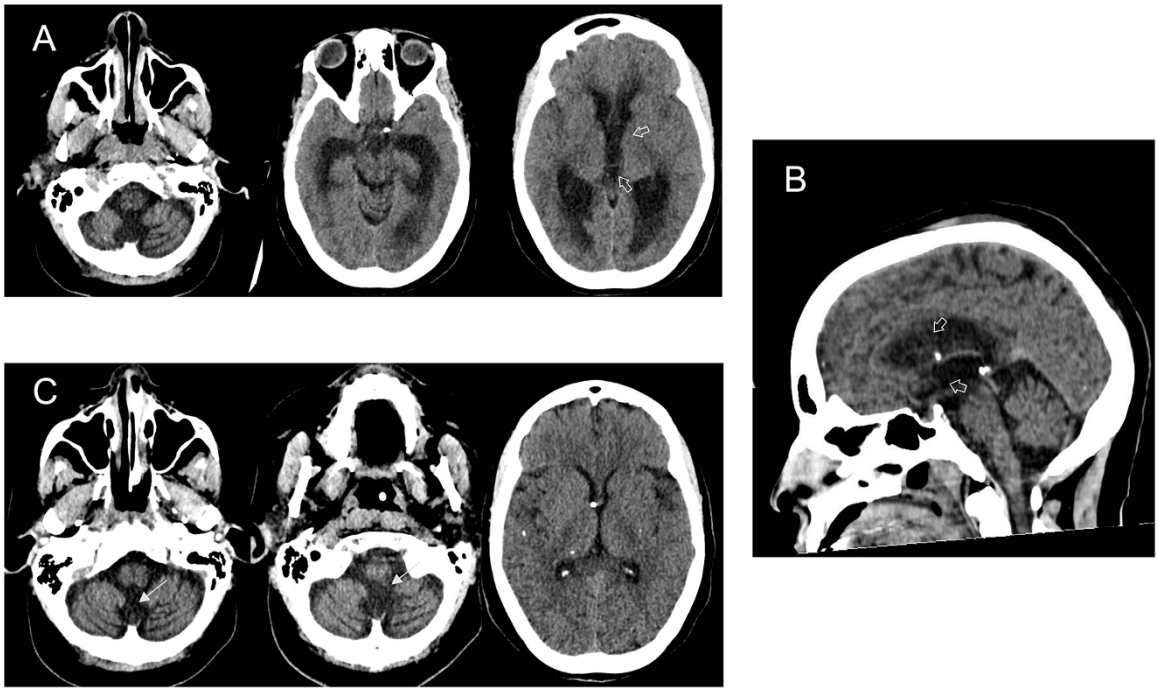


Figure 2. Acute peri-decompression migration. Pre-EVD CT on 14 August 2025 (A) showed acute obstructive hydrocephalus and the cyst passing through the foramen of Monro. First post-EVD CT on 15 August 2025 (B) showed the cyst still crossing the foramen of Monro, partly related to the left lateral ventricle and third ventricle. CT on 16 August 2025 (C), the second post-operative day, showed completion of caudal migration, with the cyst located inferior to the foramen magnum. Together, these images document active migration during the acute hydrocephalus–decompression interval but do not assign a single causal trigger.

at the foramen magnum region, in continuity with the caudal fourth ventricular outlet. Given the disappearance of the original lesion, the acute-phase evidence of transition at the foramen of Monro/third ventricle and the later appearance of an indistinguishable cyst in a caudal CSF space, the most plausible interpretation was transventricular migration through the foramen

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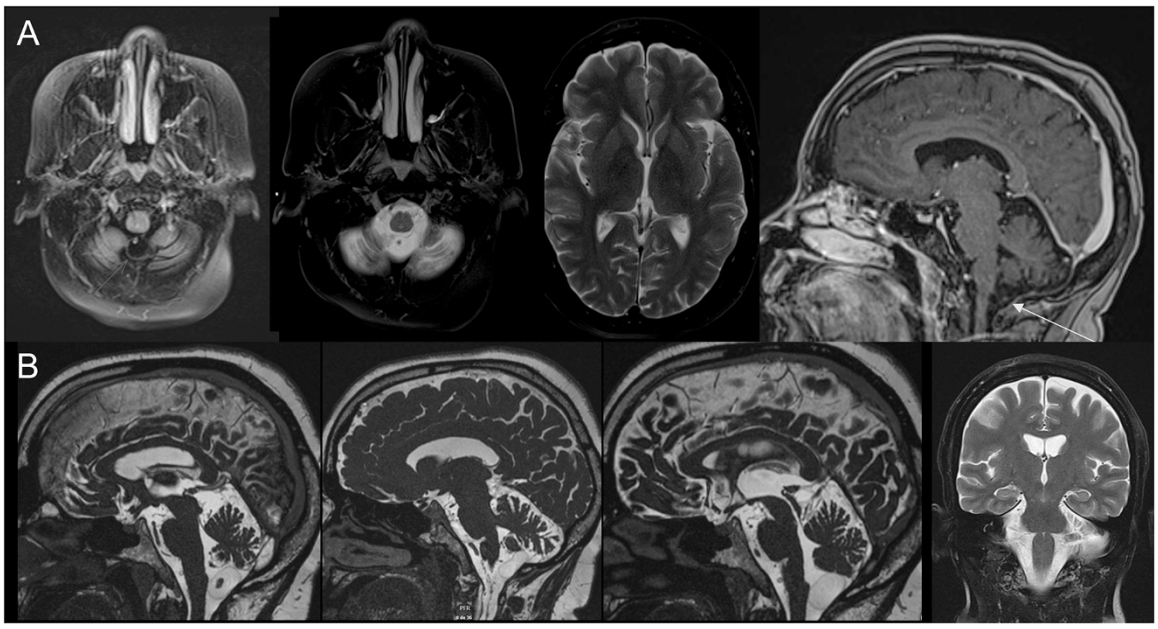


Figure 3. Persistent caudal location after the acute episode. MRI on 29 August 2025 was the first MRI to show the cyst below the foramen magnum. Follow-up MRI in October 2025 showed persistence of the cyst in the same location, with obstruction of cerebrospinal fluid flow at the foramen magnum, defining the final posterior fossa surgical target.



Figure 4. Post-operative views from the suboccipital approach demonstrating cyst extrusion/removal and decompression of the CSF pathways.

of Monro, third ventricle, aqueduct, fourth ventricle and fourth ventricular outlet (Figure 3).

In January 2026, she underwent midline suboccipital craniotomy in the Concorde position for definitive removal. Shortly after dural opening, the cyst extruded spontaneously under pressure (Video 1, Figure 4). Although cyst rupture could not be completely avoided, the capsule was fully removed and brisk CSF egress was observed, suggesting restoration of the natural pathways. She was extubated in the operating room, transferred to the intensive care unit, stepped down to the ward on post-operative day 2 and discharged home on post-operative day 6. A post-operative CSF leak through the subgaleal drain resolved with conservative management over the following days. Her headache improved after surgery.

Pooled review findings

The pooled review identified 29 unique published migration events across 23 reports after duplicate reconciliation (Table 1). Intervention-associated perturbation of CSF dynamics accounted for 15 published events, positional mechanisms for 10, spontaneous mechanisms for 3 and 1 event remained indeterminate. The present case was not added to either the intervention-associated or spontaneous published-case numerator. Instead, it was classified separately as a spontaneous-onset migration with peri-decompression progression/indeterminate event because the acute images documented migration during the hydrocephalus-EVD interval, while a CT from April 2024 provided evidence of spontaneous movement before any intervention.

Operative escape, non-visualization or a surgically empty ventricle was reported in 10/23 (43.5%) cases with operative detail. Permanent shunt placement was reported in 7/24 (29.2%) cases with available shunt outcome data, while clinical resolution or improvement was reported in 20/22 (90.9%) follow-up cases (Table 2). The chronology of the present case is summarized in Table 3.

The Embase and Cochrane update identified additional relevant IVNCC and Brun-syndrome literature, including larger endoscopic cohorts and clinical review series (Torres-Corzo et al., 2006; Shahani et al., 2015; Konar et al., 2020; Xu et al., 2025). These publications strengthened the contextual discussion of mobile cysts, emergent decompression, preoperative imaging and endoscopic management, but they did not provide additional individual inter-compartment migration events meeting the predefined pooled-analysis criteria.

Discussion

Published pattern of migration

The central revision of this manuscript is the distinction between temporal association and causality. The additional outside-hospital images show that the patient had acute obstructive hydrocephalus and that the cyst was actively crossing the foramen of Monro/third

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Table 1. Migration-focused reports included in the literature review

Study	Cases contributed	Main migration-related contribution
Baro et al., 2020	1 case + review	Aqueduct-to-third-ventricle migration after endoscopic CSF diversion; also provides a historical update of wandering IVNCC.
Zee et al., 1980	5	Foundational radiologic paper demonstrating positional mobility, Monro obstruction and 1 intervention-associated third-to-lateral migration after air study/lumbar puncture.
Zee et al., 1984	2	Described ventriculostomy-related third-to-fourth migration and the surgically empty target phenomenon; recommended repeat imaging before surgery.
Kim and Weinberg, 1985	1	Spinal subarachnoid comparator case showing extreme cyst mobility within CSF spaces during myelography and the risk of target escape.
Martinez et al., 1989	2	MRI series in which 2 intraventricular cysts changed position within the lateral ventricle during serial imaging.
Ginier and Poirier, 1992	1	Serial MRI documented lateral-to-third-to-fourth ventricular migration with intermittent hydrocephalus.
Kramer et al., 1992	1	Classic transaqueductal migration captured on MRI, likely precipitated by lumbar puncture and CSF pressure change.
Neal, 1995	1	Posterior third-ventricle cyst migrated preoperatively into the fourth ventricle and changed the planned surgical route.
Bergsneider et al., 2000	1	Illustrated retrograde shunt-associated migration from the posterior fossa towards supratentorial ventricles during endoscopic management.
Wray et al., 2001	1	Cyst mimicked a colloid cyst on imaging, then escaped the expected third-ventricle target and was found on the ventricular floor at surgery.
Thomas and Krishnamoorthy, 2005	1	Short neuroimage report showing migration during MRI acquisition itself.
Araujo et al., 2008	1	Left lateral ventricular cyst later obstructed the third ventricle, illustrating interval migration on serial MRI in a chronic case.
Kotha, 2013	1	Third-ventricle cyst migrated after ventriculostomy, highlighting suction/vacuum effects created by CSF diversion.
Ghosh et al., 2014	1	Paradoxical aqueduct-to-fourth-ventricle migration shortly after EVD placement, with spontaneous relief of obstruction.
Khalid et al., 2016	1	Retrograde fourth-to-foramen of Monro/lateral ventricle migration after VP shunting.
Shah et al., 2017	1	Sequential MRI captured progression from the foramen of Monro to the third and then fourth ventricle.
Rana et al., 2018	1	Intermittent foramen of Monro obstruction with later spontaneous retreat of the cyst and radiologic resolution.
Chugh et al., 2021	1	Brun-syndrome presentation from a lateral ventricular cyst treated endoscopically.
Singh et al., 2023	1	Intraoperative slippage and migration during neuroendoscopy, emphasizing that the lesion can remain mobile even after manipulation.
Agallo-Martinez et al., 2025	1	Third-to-fourth ventricular migration after shunting with subsequent calcification/disappearance under medical follow-up.
Mader et al., 2025	1	Rapid third-to-fourth migration after EVD; strongly reinforces the need for up-to-date preoperative imaging.
Apuzzo et al., 1984	1	Classic surgical series; 1 uniquely extractable lateral-ventricular mobile cyst treated stereotactically was coded, while overlapping migration cases were not double-counted.
Chowdhary et al., 2010	1	Posterior-to-anterior third-ventricle migration after EVD with restoration of CSF flow, symptom relief and definitive endoscopic removal.

CSF, cerebrospinal fluid; EVD, external ventricular drainage; IVNCC, intraventricular neurocysticercosis; LP, lumbar puncture; VP, ventriculoperitoneal. Newly identified cohort/Brun-syndrome reports without extractable individual migration events were retained for contextual discussion but were not added to this pooled migration table.

ventricular region during the period in which rescue CSF diversion was required. The retrospective identification of cyst displacement on a CT scan from April 2024 – well before any CSF diversion – provides evidence that migration had a spontaneous component in this patient. However, this does not exclude the possibility that the acute hydrodynamic changes associated with EVD placement influenced the timing or trajectory of the subsequent caudal progression. The images from August 2025 document active relocation during the peri-decompression period but lack the temporal resolution to determine the exact contribution of each factor. The most defensible interpretation is therefore peri-decompression migration: active anatomical instability during the acute hydrocephalus-EVD interval, with evidence of a spontaneous baseline that may have been modulated by acute pressure changes.

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Table 2. Summary of the pooled review of published migrating ventricular neurocysticercosis cases

Variable	Published cases	Comment
Cases with extractable individual data	29	Present case not included in this column
Intervention-associated trigger	15/29 (51.7%)	Temporal association with CSF diversion, lumbar puncture, air study or intraoperative/endoscopic manipulation in published reports
Positional trigger	10/29 (34.5%)	Includes posture- or movement-related movements
Spontaneous trigger	3/29 (10.3%)	No clear intervention or positional trigger in published reports
Unknown trigger	1/29 (3.4%)	Insufficient detail in report
Explicitly reported Brun syndrome	6/29 (20.7%)	Present case was Brun-spectrum but not classically documented
Operative escape/non-visualization/empty target	10/23 (43.5%)	Among cases with operative detail
Need for permanent shunt	7/24 (29.2%)	Among cases with reported shunt outcomes
Clinical resolution/improvement	20/22 (90.9%)	Among cases with reported outcomes

These counts are descriptive and should not be interpreted as incidence estimates or procedure-specific causal risk estimates. The present case was not included in the published trigger proportions. It was classified separately as peri-decompression/indeterminate because migration was documented during the acute hydrocephalus-EVD interval, but the exact causal trigger could not be assigned.

Table 3. Chronology of the present case

Date/period	Key finding or event	Clinical relevance
2011 MRI	No cyst identified in the later involved ventricular/foramen magnum pathway.	Baseline comparison before later IVNCC detection.
10 January 2023 MRI	Cystic lesion in the body of the left lateral ventricle.	Initial documented location; endoscopic removal was recommended.
2024 CT	First imaging study to suggest interval migration from the original left lateral ventricular position.	Earliest evidence that migration had begun before the acute hydrocephalus/EVD episode.
14 August 2025 CT, pre-EVD	Acute obstructive hydrocephalus; cyst passing through the foramen of Monro.	Shows migration/obstruction before rescue CSF diversion; argues against EVD as the initiating trigger.
15 August 2025 CT, first post-EVD imaging	Cyst still passing through the foramen of Monro, partly related to the left lateral ventricle and third ventricle.	Documents ongoing transition during the peri-decompression interval.
16 August 2025 CT, post-operative day 2	Cyst completed caudal migration and was located inferior to the foramen magnum.	Demonstrates rapid final relocation during the acute hydrocephalus–decompression period.
29 August 2025 MRI	First MRI showing the cyst below the foramen magnum.	Confirms caudal location after the acute episode.
October 2025 MRI	Cyst remained below the foramen magnum, with obstruction of CSF flow at the foramen magnum.	Shows persistent caudal obstruction and defines the definitive surgical target.
January 2026 surgery	Midline suboccipital craniotomy; cyst removed.	Definitive treatment adapted to updated anatomy.
Post-operative course	Headache improved; discharged home on post-operative day 6.	Clinical improvement after removal.

CT, computed tomography; EVD, external ventricular drainage; ICU, intensive care unit; MRI, magnetic resonance imaging.

This interpretation preserves the main clinical lesson while avoiding an unsupported causal claim. Mobile IVNCC behaves as a dynamic obstructive lesion: it may move spontaneously, after posture changes, during imaging, around CSF diversion or during surgery. In the present patient, the exact trigger cannot be assigned with certainty, but the location changed during the clinically decisive interval between deterioration, decompression and definitive treatment. In the broader descriptive literature assembled from case reports, trigger categories cannot be converted into procedure-specific risk estimates. They can, however, identify recurrent patterns that matter to surgical planning.

Large series and recent reviews emphasize that unattached ventricular cysts may present with abrupt obstructive symptoms, transient deterioration or head-movement-dependent phenomena, and that surgical planning becomes more complex when cyst mobility is suspected (Apuzzo et al., 1984; Nash et al., 2018; Baro et al., 2020; Hamamoto Filho et al., 2024; Mendieta-Barrera et al., 2025). Recent endoscopic cohorts also reinforce the importance of high-quality preoperative localization and systematic imaging, including 3D heavily T2-weighted sequences, when ventricular or subarachnoid cysts may be difficult to visualize on conventional imaging (Konar et al., 2020; Xu et al., 2025).

Dynamic obstruction and the Brun spectrum

The revised image sequence also strengthens, rather than weakens, the interpretation of a Brun-spectrum event. The acute hydrocephalus was plausibly caused by migration-driven

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obstruction at a narrow CSF pathway during a period of active cyst relocation. Classic Brun syndrome requires clear position-dependent symptoms, which were not formally documented during the outside-hospital deterioration. Even so, the clinical sequence – sudden decompensation, acute obstructive hydrocephalus, interval movement from the lateral ventricle to the foramen of Monro/third ventricle and later caudal relocation – is consistent with migration-driven ball-valve obstruction.

This is aligned with a series of patients with third- or fourth-ventricular cysts presenting with intermittent intracranial hypertension and Brun syndrome, in which mobile deformable lesions can obstruct CSF pathways abruptly and may require urgent neurosurgical treatment (Torres-Corzo et al., 2006; Shahani et al., 2015; Chugh et al., 2021). Thus, the case should be read less as proof of an iatrogenic trigger and more as a warning that a viable ventricular cyst can make ventricular anatomy unstable over a short interval.

Pressure gradients versus gravity

Gravity undoubtedly contributes to some migrations. Many positional cases occur during imaging, head turning, prone positioning or progressive descent towards the fourth ventricle (Zee et al., 1980; Kim and Weinberg, 1985; Martinez et al., 1989; Kramer et al., 1992; Thomas and Krishnamoorthy, 2005; Shah et al., 2017; Baro et al., 2020). However, gravity alone is insufficient to explain all reported movements. The literature includes paradoxical or retrograde displacement after shunting, ventriculostomy, lumbar puncture or intraoperative manipulation (Kramer et al., 1992; Bergsneider et al., 2000; Ghosh et al., 2014; Khalid et al., 2016).

For this reason, the revised interpretation is broader and stronger than either a purely iatrogenic or purely spontaneous explanation. The present case does not prove that CSF diversion caused migration, but it also illustrates why spontaneous descent alone may be an incomplete model for mobile ventricular cysts during acute obstruction and decompression. The literature shows that CSF-altering procedures can coincide with or precede cyst relocation in selected reports. Gravity, posture, obstruction, ventricular compliance, narrow anatomical corridors and pressure gradients may interact to reshape the path of least resistance. The relevant clinical risk is therefore not a single causal mechanism, but the possibility that the cyst's location at definitive surgery may differ from the location shown on earlier imaging.

Surgical implications

The operative lesson remains direct: a mobile IVNCC lesion is a moving target. Once migration is part of the differential, the surgeon should localize the cyst as close as feasible to definitive treatment, particularly after acute deterioration, CSF diversion, failed endoscopy or clinical change. Historical and contemporary reports have repeatedly underscored this point by showing clinically relevant interval migration between diagnostic imaging and surgery (Zee et al., 1984; Neal, 1995; Wray et al., 2001; Mader et al., 2025). The present case now provides a more granular version of the same message, because acute-phase CT narrowed the migratory interval and showed that the obstructive anatomy had already changed during the rescue period.

Management decisions should also reflect ventricular level and accessibility. Current guidelines and contemporary reviews support neuroendoscopic removal as the preferred strategy for most lateral and third ventricular cysts and, in experienced hands, for selected fourth ventricular lesions as well (Apuzzo et al., 1984; White et al., 2018; Hamamoto Filho et al., 2024; Mendieta-Barrera et al., 2025; Xu et al., 2025). Yet once a lesion has descended to the caudal fourth ventricle or foramen magnum region, the most rational corridor may shift to a posterior fossa approach. In the present case, suboccipital surgery was not a failure of endoscopy; it was an adaptation to anatomy that had already changed.

Temporary CSF diversion should not be withheld when acute hydrocephalus or impending herniation is present. Even if CSF diversion can contribute to cyst relocation in some circumstances, the immediate risk of untreated intracranial hypertension exceeds that theoretical or technical concern. Reports of emergent IVNCC and Brun syndrome similarly emphasize that ventricular drainage or shunting may be necessary to stabilize the patient before definitive treatment (Shahani et al., 2015). The practical recommendation is therefore not to avoid necessary diversion and not to change emergency conduct but to pair decompression with hydrodynamic surveillance: repeat CT or MRI should be considered between rescue decompression and definitive surgery whenever feasible, because the cyst may have moved before, during or after the decompressive step.

Resource availability must also be acknowledged. High-resolution MRI may not be available in every emergency setting, and cost-effectiveness has not been studied. In lower-resource environments, a pragmatic approach may be to obtain at least a repeat non-contrast CT immediately before definitive surgery when MRI is unavailable, particularly when symptoms, ventricular calibre or operative planning no longer match the original scan.

Limitations

This report has limitations. First, although the newly obtained acute-phase CT images substantially reduce temporal uncertainty, they still do not provide continuous frame-by-frame documentation of the entire migratory route. The route from lateral ventricle to foramen magnum remains reconstructed from serial imaging and anatomy rather than directly filmed or captured in every compartment.

Second, the review is a focused narrative case-based synthesis rather than a registered systematic review. A formal systematic review was not the aim because the manuscript describes and contextualizes a rare migratory event rather than comparing diagnostic or therapeutic strategies. Although the search was updated using PubMed/MEDLINE, Embase and the Cochrane Library, the evidence base consists mainly of case reports and small series. It is vulnerable to publication bias, selective reporting, heterogeneous terminology and retrospective trigger classification. Third, the pooled numbers should not be read as risk estimates: there is no denominator of all IVNCC patients treated with EVD, shunt, lumbar puncture or endoscopy, and no comparator group of patients without CSF diversion. Fourth, many reports come from tertiary centres with advanced imaging and endoscopic expertise, which may limit generalizability.

These limitations do not invalidate the practical observation, but they define its level of inference. The data do not prove that EVD causes migration, and the present case should not be used to claim a purely spontaneous mechanism either. The clinically useful conclusion is more precise: mobile IVNCC can change location during the same interval in which patients deteriorate, are decompressed and are prepared for definitive surgery. The exact trigger may remain uncertain, but the moving anatomy is the operative problem.

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Conclusions

Mobile IVNCC should be conceptualized as a dynamic obstructive lesion rather than a static ventricular cyst. In the present case, a CT scan from April 2024 documented spontaneous migration before any intervention, and the newly reviewed outside-hospital images showed active cyst progression during the acute hydrocephalus-CSF diversion interval. EVD was a necessary life-saving response to hydrocephalus; although the April 2024 CT confirms a spontaneous onset, the limited temporal resolution of the acute images does not allow us to determine whether the EVD modified the trajectory or speed of the caudal progression. The broader lesson remains hydrodynamic and surgical: in mobile IVNCC, ventricular anatomy may change rapidly before, during or after decompression. Urgent CSF diversion remains indicated when hydrocephalus is present, and repeat interval imaging before definitive surgery should be strongly considered whenever feasible.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0031182026102649.

Data availability statement. All data supporting this manuscript are contained within the manuscript and tables derived from the reviewed reports.

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Ethical standards. Written informed consent for publication was obtained from the patient.

References

Agallo-Martinez AA, Juarez-Ortiz P, Carrillo-Mezo R and Fleury A (2025) Intraventricular neurocysticercosis: An atypical presentation of a little-known and poorly understood disease - a case report. *Parasitology International* **109**, 103108. https://doi.org/10.1016/j.parint.2025.103108.

Apuzzo MLJ, Dobkin WR, Zee CS, Chan JC, Giannotta SL and Weiss MH (1984) Surgical considerations in treatment of intraventricular cysticercosis. An analysis of 45 cases. *Journal of Neurosurgery* **60**(2), 400–407. https://doi.org/10.3171/jns.1984.60.2.0400.

Araujo ALE, Rodrigues RS, Marchiori E, Pinheiro RA, Flores M, Alves JRD and Gasparetto EL (2008) Migrating intraventricular cysticercosis: Magnetic resonance imaging findings. *Arquivos de Neuro-Psiquiatria* **66**(1), 111–113. https://doi.org/10.1590/S0004-282X2008000100031.

Baro V, Anglani M, Martinolli F, Landi A, D'avella D and Denaro L (2020) The rolling cyst: Migrating intraventricular neurocysticercosis - a case-based update. *Child's Nervous System* **36**(4), 669–677. https://doi.org/10.1007/s00381-020-04505-w.

Bergsneider M, Holly LT, Lee JH, King WA and Frazee JG (2000) Endoscopic management of cysticercal cysts within the lateral and third ventricles. *Journal of Neurosurgery* **92**(1), 14–23. https://doi.org/10.3171/jns.2000.92.1.0014.

Chowdhary A, Abel TJ, Gabikian P and Britz GW (2010) Resolution of acute hydrocephalus and migration of neurocysticercosis cyst with external ventricular drainage. *Case Reports in Medicine* **2010**, 245259. https://doi.org/10.1155/2010/245259.

Chugh A, Gotecha S, Punia P, Raghu V, Patil A and Kotecha M (2021) Neuroendoscopic management of lateral ventricular neurocysticercosis presenting as Brun's syndrome. *Journal of Pediatric Neurosciences* **16**(4), 311–314. https://doi.org/10.4103/jpn.JPN_196_20.

Del Brutto OH, Nash TE, White AC, Rajshekhar V, Wilkins PP, Singh G, Vasquez CM, Salgado P, Gilman RH and Garcia HH (2017) Revised diagnostic criteria for neurocysticercosis. *Journal of the Neurological Sciences* **372**, 202–210. https://doi.org/10.1016/j.jns.2016.11.045.

Ghosh S, Al-khalili R, Liu JK and Slasky SE (2014) Paradoxical migrating cyst: An unusual presentation of intraventricular neurocysticercosis with a coincidental pituitary adenoma. *Journal of Clinical Neuroscience* **21**(6), 1066–1068. https://doi.org/10.1016/j.jocn.2013.10.010.

Ginier BL and Poirier VC (1992) MR imaging of intraventricular cysticercosis. *American Journal of Neuroradiology* **13**, 1247–1248.

Hamamoto Filho PT, Norcia LF, Fleury A and Zanini MA (2024) Current role of surgery in the treatment of neurocysticercosis. *Pathogens* **13**(3), 218. https://doi.org/10.3390/pathogens13030218.

Khalid S, Obaid A, Sharma RM, Mahmood A and Narayanasamy S (2016) Intraventricular migration of an isolated fourth ventricular cysticercus following cerebrospinal fluid shunting. *Surgical Neurology International* **7**(40), S952–S954. https://doi.org/10.4103/2152-7806.195232.

Kim KS and Weinberg PE (1985) Spinal cysticercosis. *Surgical Neurology* **24**(1), 80–82. https://doi.org/10.1016/0090-3019(85)90070-9

Konar S, Kandregula S, Sashidhar A, Prabhuraj AR, Saini J, Shukla D, Srinivas D, Indira Devi B, Somanna S and Arimappamagan A (2020) Endoscopic intervention for intraventricular neurocysticercal cyst: Challenges and outcome analysis from a single institute experience. *Clinical Neurology and Neurosurgery* **198**, 106179. https://doi.org/10.1016/j.clineuro.2020.106179.

Kotha VK (2013) Migration of intraventricular neurocysticercus after ventriculostomy. *Asian Journal of Neurosurgery* **8**(01), 54–56. https://doi.org/10.4103/1793-5482.110282.

Kramer J, Carrazana EJ, Cosgrove GR, Kleefield J and Edelman RR (1992) Transaqueductal migration of a neurocysticercus cyst: Case report. *Journal of Neurosurgery* **77**(6), 956–958. https://doi.org/10.3171/jns.1992.77.6.0956.

Mader JP, Zekavaty S, Yang J, Rossi R, Thompson C and Mahmoud SY (2025) Highlighting the importance of preoperative imaging in neurocysticercosis: A case report of rapid cysticercus cyst migration from the third to the fourth ventricle. *Cureus* **17**, e83527. https://doi.org/10.7759/cureus.83527.

Martinez HR, Rangel-Guerra R, Elizondo G, Gonzalez J, Todd LE, Ancer J and Prakash SS (1989) MR imaging in neurocysticercosis: A study of 56 cases. *American Journal of Neuroradiology* **10**, 1011–1019.

Mendieta-Barrera CD, Punukollu A, Rios-hurtado C, De Nigris Vasconcellos F, Garcia-Torrico F, Salolin-Vargas VP, Mamani-Julian K, Valderrama CEV, Rivera-Hurtado L, Ballesteros-Herrera D, Tripathi M, Torres-Corzo JG and Ghaffari-Rafi A (2025) Neuroendoscopic management of intraventricular neurocysticercosis: A systematic review and meta-analysis. *Clinical Neurology and Neurosurgery* **254**, 108953. https://doi.org/10.1016/j.clineuro.2025.108953.

Nash TE, Ware JM and Mahanty S (2018) Intraventricular neurocysticercosis: Experience and long-term outcome from a tertiary referral center in the United States. *American Journal of Tropical Medicine and Hygiene* **98**(6), 1755–1762. https://doi.org/10.4269/ajtmh.18-0085.

Neal JH (1995) An endoscopic approach to cysticercosis cysts of the posterior third ventricle. *Neurosurgery* **36**(5), 1040–1043. https://doi.org/10.1227/00006123-199505000-00026.

Rana S, Prasad A, Brar R, Rathore DS and Dwivedi A (2018) Caught in the act: Migrating intraventricular neurocysticercosis causing intermittent unilateral hydrocephalus due to foramen of Monro obstruction. *Acta Neurologica Belgica* **118**(3), 509–511. https://doi.org/10.1007/s13760-017-0831-6.

https://doi.org/10.1017/S0031182026102649 Published online by Cambridge University Press

Shah A, Vutha R, Sankhe S and Goel A (2017) Transventricular migration of neurocysticercosis. *World Neurosurgery* **105**, 1043.e11–1043.e13. https://doi.org/10.1016/j.wneu.2017.07.003.

Shahani L, Garnes ND and Mejia R (2015) Intraventricular Taenia solium cysts presenting with Bruns syndrome and indications for emergent neurosurgery. *American Journal of Tropical Medicine and Hygiene* **92**(6), 1261–1264. https://doi.org/10.4269/ajtmh.14-0842.

Singh DK, Sharma PK, Singh N and Chand V (2023) Intraventricular migration of fourth ventricular neurocysticercosis: An unusual complication during endoscopic surgery. *BMJ Case Reports* **16**(6), e255813. https://doi.org/10.1136/bcr-2023-255813.

Takayanagui OM and Haidar TM (2022) Update on the diagnosis and management of neurocysticercosis. *Arquivos de Neuro-Psiquiatria* **80**(5 suppl 1), 296–306. https://doi.org/10.1590/0004-282X-ANP-2022-S115.

Thomas B and Krishnamoorthy T (2005) Migrating intraventricular cysticercus during MRI. *Neurology* **65**(8), 1321. https://doi.org/10.1212/01.wnl.0000182296.59409.38.

Torres-Corzo J, Rodriguez-della Vecchia R and Rangel-Castilla L (2006) Bruns syndrome caused by intraventricular neurocysticercosis treated using flexible endoscopy. *Journal of Neurosurgery* **104**, 746–748.

White AC, Jr, Coyle CM, Rajshekhar V, Singh G, Hauser WA, Mohanty A, Garcia HH and Nash TE (2018) Diagnosis and treatment of neurocysticercosis: 2017 clinical practice guidelines by the Infectious Diseases Society of America (IDSA) and the American Society of Tropical Medicine and Hygiene (ASTMH). *Clinical Infectious Diseases* **66**(8), e49–e75. https://doi.org/10.1093/cid/ciy157.

Wray SD, Ellis TL and Bianco S (2001) Migratory neurocysticercosis mimicking a third ventricular colloid cyst. Case report. *Journal of Neurosurgery* **95**(1), 122–123. https://doi.org/10.3171/jns.2001.95.1.0122.

Xu X, Zhang J, Guo Z, Xiong R, Lang S, Gan Z and Chen X (2025) Endoscopic management of intraventricular and subarachnoid neurocysticercosis: Technical workflow and clinical outcome. *Neurosurgical Focus* **59**(5), E5. https://doi.org/10.3171/2025.8.FOCUS25686.

Zee CS, Segall HD, Apuzzo MLJ, Ahmadi J and Dobkin WR (1984) Intraventricular cysticercal cysts: Further neuroradiologic observations and neurosurgical implications. *American Journal of Neuroradiology* **5**, 727–730.

Zee CS, Segall HD, Miller C, Tsai FV, Teal JS, Hieshima G, Ahmadi J and Halls J (1980) Unusual neuroradiological features of intracranial cysticercosis. *Radiology* **137**(2), 397–407. https://doi.org/10.1148/radiology.137.2.6968919.

https://doi.org/10.1017/S0031182026102649 Published online by Cambridge University Press