European Journal of Medical and Health Sciences
www.ejmed.org

Unusual Case of Acute Subdural Hematoma after Endoscopic Third Ventriculostomy: A Case Report and Comprehensive Literature Review

Jihad Echnin, Nassima Daite, Abdelkedouss Laaidi, Said Hilmani, Khadija Ibahioin, Abdessamad Naja, and Abdelhakim Lakhdar

ABSTRACT

***Background*: Endoscopic third ventriculostomy (ETV) is a valuable treatment for obstructive hydrocephalus, but it is not without complications. We present a rare case of acute subdural hematoma following ETV and provide a literature review on the subject.**

***Case Description*: A 23-year-old patient underwent ETV in 2016 for hydrocephalus, resulting in symptom improvement. Four years later, the patient experienced a recurrence of symptoms and underwent a second ETV. Meningitis developed, causing a decline in neurological status. Imaging revealed a calcified mesencephalic lesion, tri-ventricular hydrocephalus, and an acute right parieto-temporo-occipital subdural hematoma. Surgical evacuation and external ventricular drainage were performed, followed by CSF sterilization and a self-adjusting valve placement.**

***Conclusion*: Excessive CSF loss during ETV may contribute to subdural hematoma. ETV remains the preferred treatment for non-communicating hydrocephalus, and enhanced training and experience can reduce complication rates.**

Keywords: Endoscopic third ventriculostomy (ETV), CSF, Hydrocephalus, acute subdural hematoma.

Submitted : June 9, 2023

Published : July 22, 2023

ISSN: 2593-8339

DOI: 10.24018/ejmed.2023.5.4.1852

J. Echnin*
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.
(e-mail: jijiechnin10@gmail.com)
N. Daite
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
A. Laaidi
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.
S. Hilmani
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.
K. Ibahioin
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.
A. Naja
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.
A. Lakhdar
Department of Neurosurgery, University Hospital Center Ibn Rochd, Casablanca, Morocco.
Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.

****Corresponding Author***

European Journal of Medical and Health Sciences
www.ejmed.org

I. Introduction

Endoscopic third ventriculostomy (ETV) has emerged as a preferred surgical technique for the treatment of obstructive hydrocephalus, offering several advantages over traditional shunt procedures. While ETV has proven to be effective, it is not without its complications. This case report aims to present a rare and unusual case of acute subdural hematoma following ETV and provide a comprehensive review of the existing literature on this subject [1].

II. Case Description

We present the case of a 23-year-old patient who underwent ETV in 2016 for the management of non-communicating hydrocephalus. The initial procedure resulted in significant improvement of the patient's clinical symptoms, including holo-cranial headaches, tremors of the upper limb, and heaviness of the right hemicorpus. However, after four years, the patient experienced a recurrence of symptoms without any recent trauma or anticoagulant use. A control imaging study revealed ventricular dilatation, leading to the decision to perform a second ETV in March 2022.

Unfortunately, the second ETV procedure was complicated by the development of meningitis, which was indicated by a deterioration in the patient's neurological state, including aphasia and heaviness of all four limbs in a febrile context. A brain CT scan was conducted, revealing a calcified mesencephalic lesion, tri-ventricular hydrocephalus, and an acute subdural hematoma in the right parieto-temporo-occipital region. Immediate intervention, including evacuation of the hematoma and external ventricular drainage, was performed to alleviate the patient's condition. Subsequent follow-up brain scans showed regression of the acute right subdural hematoma. Following CSF sterilization, the external drainage was removed, and a ventriculoperitoneal shunt with a self-adjusting valve was implanted during a subsequent operation.

III. Literature Review

Endoscopic third ventriculostomy has gained recognition as the first-line treatment for hydrocephalus resulting from aqueductal stenosis. It offers several advantages over ventriculoperitoneal shunt placement, including reduced infection risk, avoidance of shunt malfunction, and elimination of the need for shunt revisions [2]. However, complications related to ETV have been reported in the literature.

The etiology of subdural hematoma following ETV remains a topic of discussion. One hypothesis suggests that sudden excessive drainage of cerebrospinal fluid during the ventriculostomy procedure may enlarge the subdural space, facilitating the accumulation of subdural fluid [3]. While the exact mechanisms leading to subdural hematoma formation after ETV require further investigation, documented cases suggest potential contributing factors such as bleeding from scalp vessels, damage to cortical vessels, or injury to bridging veins.

Several studies have been conducted to explore the incidence, risk factors, and outcomes associated with subdural hematoma after ETV. Teo *et al*. [4] reported clinically insignificant hemorrhage in 6 out of 55 endoscopic ventriculostomies, while Mohanty *et al.* [5] described a case of acute subdural hematoma following ETV. Navarro *et al.* [6] reported a similar case of acute subdural hematoma in one of their patients. Other studies have documented venous bleeding, arterial bleeding, and bleeding from bridging veins as potential complications of ETV [7].

IV. Discussion

The management of hydrocephalus, particularly in cases of aqueductal stenosis, has significantly advanced with the introduction of endoscopic third ventriculostomy (ETV). ETV offers several advantages over traditional ventriculoperitoneal shunt placement, including a lower risk of infection, avoidance of shunt malfunction, and elimination of the need for shunt revisions. However, as with any surgical procedure, ETV is associated with potential complications, and acute subdural hematoma following ETV is a rare but significant concern.

The etiology of subdural hematoma after ETV remains a subject of discussion. One proposed mechanism suggests that sudden excessive drainage of cerebrospinal fluid (CSF) during the ventriculostomy procedure may enlarge the subdural space, leading to the accumulation of subdural fluid and subsequent hematoma formation. However, further research is needed to fully elucidate the exact mechanisms involved.

In the presented case, the patient initially experienced improvement in their clinical symptoms following the first ETV. However, the recurrence of symptoms after four years prompted the need for a second ETV. This second procedure was complicated by the development of meningitis, which likely contributed to the subsequent acute subdural hematoma. Meningitis can cause meningeal inflammation and increase the vulnerability of blood vessels, potentially leading to bleeding complications.

The management of acute subdural hematoma after ETV requires prompt intervention to alleviate the patient's condition and prevent further neurological deterioration. In this case, evacuation of the hematoma and external ventricular drainage were performed, leading to regression of the acute right subdural hematoma. Subsequent placement of a ventriculoperitoneal shunt with a self-adjusting valve addressed the underlying hydrocephalus.

To date, limited studies have focused specifically on acute subdural hematoma as a complication of ETV. However, various reports have described hemorrhagic complications related to the procedure. Teo *et al*. reported clinically insignificant hemorrhage in 6 out of 55 endoscopic ventriculostomies, suggesting that minor bleeding can occur without significant clinical consequences [4]. Mohanty *et al*. [5] documented a case of acute subdural hematoma following ETV, underscoring the importance of recognizing this rare complication. Navarro *et al.* [6] also reported a similar case of acute subdural hematoma in one of their patients.

In addition to subdural hematoma, other bleeding complications have been reported following ETV. Hopf *et a*l. [7] described cases of venous bleeding, arterial bleeding, and bleeding from bridging veins. These findings highlight the

European Journal of Medical and Health Sciences
www.ejmed.org

need for meticulous surgical technique and careful intraoperative management to minimize the risk of bleeding complications during the procedure.

While ETV is generally considered safe, the occurrence of complications emphasizes the importance of appropriate patient selection and surgeon experience. Factors such as the patient's age, underlying pathology, and the technical aspects of the procedure may contribute to the risk of complications. Preoperative evaluation, including a thorough assessment of the patient's medical history and imaging studies, is essential to identify potential risk factors and ensure appropriate patient selection for ETV.

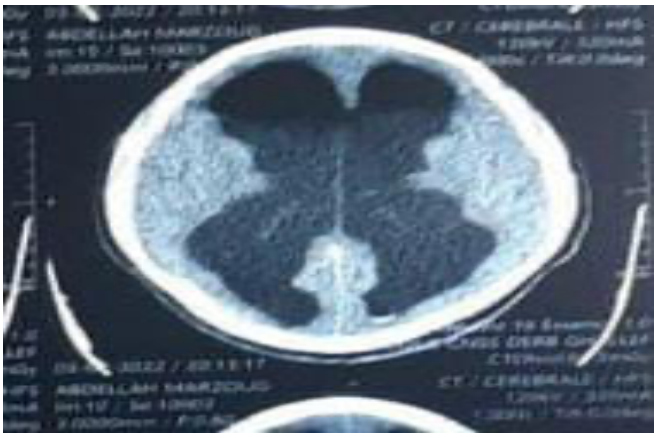

Fig. 1. CT brain showing right side of the ventricles after ETV.

Moreover, ongoing training and experience in performing ETV are crucial for surgeons to develop the necessary skills and competence to minimize complications. Simulation-based training on cadavers or virtual reality platforms can provide a safe and controlled environment for surgeons to practice the procedure and enhance their technical proficiency.

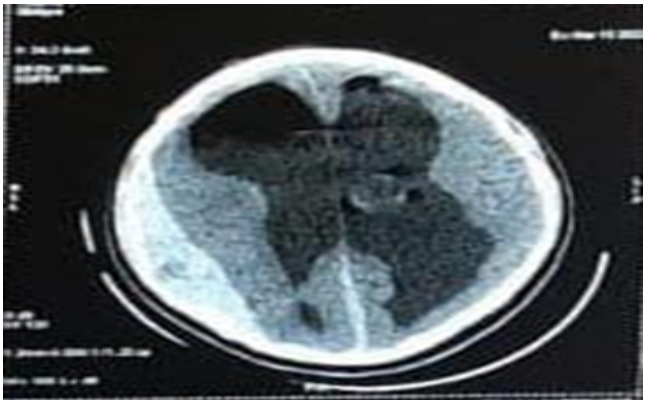

Fig. 2. CT brain showing right side acute subdural hemorrhage, with compression of the ipsilateral ventricle.

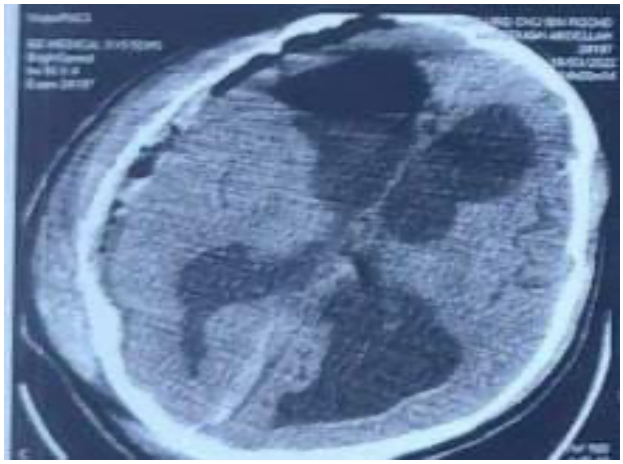

Fig. 3. CT brain showing the postoperative aspect after surgery.

TABLE I: COMPLICATIONS OF ENDOSCOPIC THIRD VENTRICULOSTOMY [1]

Intraoperative	N (%)	Early postoperative (<1 month)	N (%)	Late postoperative (>1month)	N (%)
Bleeding	3 (1.7)	CSF leak	9 (5.2)	Restenosis of ETV stoma	6 (3.4)
Abandon	2 (1.1)	Ventriculitis	2 (1.1)		
Bradycardia	1 (0.5)	Subdural fluid collection	2 (1.1)		
		Restenosis of ETV stoma	2 (1.1)		
		Death	2 (1.1)		

TABLE II: SUBDURAL COLLECTIONS REPORTED IN THE LITERATURE

Author	Age and sex	Cause of hydrocephalus	Type of subdural collection	Site	Surgical evacuation
[5]	30 years, Male	Aquedectal sylvius	Acute subdural hematoma	Left Symptomatic	Yes
[2]	20 years, Male	Aquedectal sylvius	Chronic subdural hematoma	Right	Yes
[2]	25 d, Male	Aquedectal sylvius	Not communicated	Bilateral	No

TABLE III: SUMMARY OF PATIENTS WHO UNDERWENT ETV /COMPLICATIONS [8]

Procedure No	Patient age (years). Sex	Cause of hydrocephalus	Complication	Outcome
3	60.M	Tumor	Wound infection, meningitis, ventriculitis, septic multiorgan failure	Death
9	65.M	Tumor	herniation syndrome w/ decrease in level of consciousness, confusion	Transient deficit, permanent confusion
13	42.M	Tumor	Venous hemorrhage, procedure abandoned, increase in confusion	Successful ETV 14 days later, transient confusion
20	29.F	Tumor	Herniation syndrome w/decrease in level of consciousness	Transient deficit
30	63.M	Tumor	Severe SAH from torn basilar perforating artery	Death
33	60.M	Tumor	Venous hemorrhage,tiny asymptomatic thalamus contusion	Successful ETV after irrigation

TABLE III: SUMMARY OF PATIENTS WHO UNDERWENT ETV /COMPLICATIONS [8]

Procedure No	Patient age (years). Sex	Cause of hydrocephalus	Complication	Outcome
37	9.M	Aqueductal stenosis	Oculomotor palsy	Permanent deficit
40			Loss of thirst, diabetes insipidus	Transient loss of thirst, permanent diabetes insipidus
41	3.M	Tumor	CSF leak	Transient deficit, shunt required
47	60.M	IVH	decrease in level of consciousness, meningitis	Transient deficit
58	0,25.M	Aqueductal stenosis	Bilat subdural collection	Asymptomatic, shunt required
61	66.F	Aqueductal stenosis	Partial oculomotor palsy	Transient deficit
66	25.M	Unknown (comm)	Meningitis	Transient deficit
72	17.M	Aqueductal stenosis	CSF leak	Transient deficit, shunt required
76	2.M	Unknown (comm)	Meningitis	Transient deficit, shunt required
78	59.F	Tumor	Increase in confusion	Transient deficit
82	9.M	Tumor	Meningitis, CSF leak	Transient deficit
84	13.M	Aqueductal stenosis	Bilat subdural collection	Asymptomatic, shunt required
106	3.M	Dandy-walker variant	Contusion of fornix	Asymptomatic
116	71.M	Cerebellar hematoma	Hemorrhage in cortical puncture channel	Asymptomatic
120	59.M	Unknown (comm)	Venous hemorrhage	Successful ETV after irrigation, asymptomatic
128	66.M	Unknown (comm)	Unilat subdural collection	Asymptomatic
167	19.M	Aqueductal stenosis	oculomotor palsy	Transient deficit
193	0,08.F	Aqueductal stenosis	Intraventricular metal dust from abraded trocar	Asymptomatic

*one patient is represented by two procedures (procedure 37 and 40) in all other cases in which complications occurred only one procedure was performed.
Abbreviation: Comm=communicating hydrocephalus.

V. CONCLUSION

In conclusion, this case report emphasizes the importance of recognizing and addressing rare complications, such as acute subdural hematoma, following ETV. Understanding the etiology, risk factors, and management strategies for this complication is crucial for optimizing patient outcomes and minimizing adverse events. Continued research, including additional case reports and larger studies, is necessary to further enhance our understanding of this rare complication and refine the management strategies for patients undergoing ETV.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to Mohamed DAGHI (Faculty of Medicine and pharmacy of Casablanca) for his invaluable assistance and guidance in the preparation of this article. His constructive feedback and thoughtful suggestions have been instrumental in shaping the final version.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Erşahin Y, Arslan D. Complications of endoscopic third ventriculostomy. *Childs Nerv Syst ChNS Off J Int Soc Pediatr Neurosurg*. 2008;24(8):943-8.
[2] Gondar R, Rogers A, Momjian S. Subdural hematoma after endoscopic third ventriculostomy: Struggling against the Laplace law. *Neurochirurgie*. 2015;61(5):347-51.
[3] Sgaramella E, Sotgiu S, Crotti FM. Overdrainage after endoscopic third ventriculostomy: an unusual case of chronic subdural hematoma--case report and review of the literature. *Minim Invasive Neurosurg MIN*. 2003;46(6):354-6.
[4] Salah M, Elhuseny AY, Youssef EM. Endoscopic third ventriculostomy for the management of hydrocephalus secondary to posterior fossa tumors: A retrospective study. *Surg Neurol Int.* 2022;13:65.
[5] Mohanty A, Anandh B, Reddy MS, Sastry KVR. Contralateral massive acute subdural collection after endoscopic third ventriculostomy – A case report. *Minim Invasive Neurosurg*. 1997;40(2):59-61.
[6] Shen W, Syed HR, Gandhoke G, Garcia R, Pundy T, Tomita T. Endoscopic third ventriculostomy in children with a fiber optic neuroendoscopy. *Childs Nerv Syst.* 2018;34(5):837-44.
[7] Endoscopic third ventriculostomy: outcome analysis of 100 consecutive procedures - *PubMed* [Internet]. [cité 3 juin 2023]. Disponible sur: https://pubmed.ncbi.nlm.nih.gov/10201305/.
[8] Aygok GA, Rekate HL, éditeurs. *Hydrocephalus: Selected Papers from the International Workshop in Crete*, 2010 [Internet]. Vienna: Springer; 2012 [cité 3 juin 2023]. (Acta Neurochirurgica Supplementum; vol. 113). Disponible sur: https://link.springer.com/10.1007/978-3-7091-0923-6.