ORIGINAL ARTICLE

Venous Complication Post Brain Tumor Resection (Avoidance and Management)

Abd Elkafy S. Ibrahim, Adel R. Almelesy, Mostafa M. Abu Elkhair, Mohamed F. El-Abd *

Department of Neurosurgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***Brain tumors can lead to several venous complications during the intraoperative and postoperative stages.***

Aim: ***To assess avoidance and management of venous complications intraoperatively and postoperatively in brain tumor resection.***

Patients and methods: ***This was a prospective and retrospective investigation carried out on twenty cases with brain tumors undergoing surgical treatment at Al-Azhar University hospitals and Damanhour Teaching Hospital from October 2023 to January 2025.***

Results: ***Mean of age was 54.4 ± 11.3, with 30% of cases were males and 70% were females. 70% of cases were menengiomas and 25% were gliomas and 5% were macroadenoma. The most common venous complication encountered was venous infarction 70% then postoperative hematoma 25% then sinus thrombosis 5%.***

Conclusion: ***Venous complications often result from direct injury, long-standing traction, and aggressive cauterization. Postoperative symptoms can range from mild to severe, with neurological deficits being the most common. Venous complications are typically managed conservatively, with 75% of the investigated group improving in follow-up, while 25% have no improvement. Extra-axial tumors are the most common to have venous complications.***

Keywords: Venous Complication; Post Brain Tumor Resection; Management

1. Introduction

Brain tumors can lead to several venous complications during the intraoperative and postoperative stages.[1] One of the most common venous complications that can arise during surgery is venous infarction. A venous infarction happens when the blood flow to the veins is cut off because of prolonged pressure, harsh cauterization, or dehydration. This can damage tissue and cause neurological problems. Venous infarction can be prevented by maintaining adequate venous drainage during surgery.[2]

Another common venous complication during the intraoperative stages is venous air embolism. Venous air embolism happens when air enters the venous system, leading to a decrease in the venous return and a subsequent reduction in blood pressure. This condition can be life-threatening and requires immediate intervention.[3]

The postoperative period is crucial for the case's recovery and requires close monitoring for any venous complications. One of the most common postoperative venous complications is deep vein thrombosis (DVT). DVT happens when a blood clot forms in the deep veins of the legs, causing pain, swelling, and possible pulmonary embolism. Cases that are immobile for extended periods after surgery are at higher risk for DVT and require prophylactic measures like compression stockings and early mobilization.[4]

Postoperative hematoma is another common complication, which can cause any neurological symptom according its site and size. Cerebral venous thrombosis (CVT) also is a common postoperative complication. It causes brain edema and congestion and may lead to infarction.

Accepted 15 June 2025.
Available online 31 July 2025

* Corresponding author at: Neurosurgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: dr.mohamedfakeeh@gmail.com (M. F. El-Abd).

https://doi.org/10.21608/aimj.2025.446670

This study aimed to assess the avoidance and management of venous complications intraoperatively and postoperatively in brain tumor resection.

2. Patients and methods

This was a prospective and retrospective investigation carried out in twenty cases with brain tumors undergoing surgical treatment at Al-Azhar University hospitals and Damanhour Teaching Hospital from October 2023 to January 2025.

Inclusion criteria:

All cases with brain tumors (intra-axial or extra-axial)

Exclusion criteria:

Cases who received chemotherapy and radiotherapy, cases with coagulopathies, and hepatic, cardiac, and diabetic cases with major comorbidities.

Methods:

All patients were subjected to the following:

Complete history taking: personal history, complaint & its period, current history: history of medication sensitivity, previous medical history, and previous surgical history. Physical examinations: General examination to eliminate systemic illnesses. Pre-operative investigation: Routine laboratory examination: complete blood count (CBC), CRP, erythrocyte sedimentation rate, kidney and liver functions, PTT, PT, and international normalized ratio. Radiological examination: CT brain, MRI, MRV.

Pre-operative Sensory and motor Assessment: Pre-operative assessment evaluated basic functions. This assessment is crucial for mapping sensory and motor impairments, guiding surgical planning, and preserving neural function. Postoperative Sensory and motor Assessment: Postoperative assessment evaluated surgical outcomes by comparing pre- and post-surgical function, detecting new deficits, and monitoring recovery.

Ethical Consideration:

The information acquired from participants is confidential. The investigation's participants shall remain anonymous in all reports or publications related to this investigation. Prior to the participants' admission to the investigation, the investigation's aim, nature, and risk-benefit evaluation were clarified to them. Informed consent has been acquired.

Statistical Analysis:

All statistical analyses were carried out utilizing Microsoft Excel version 7 (Microsoft Corporation, New York, United States) and SPSS for Windows. SPSS (Statistical Package for the Social Sciences; SPSS Inc., Illinois, USA). The tests utilized comprised descriptive statistics: mean, standard deviation (± SD), and range for parametric numerical data, whereas median and interquartile range (IQR) were applied for non-parametric numerical data. Percentage and frequency of quantitative data. The Student's T-test, paired T-test for categorical data comparison, and Chi-square (x^2) test were all performed, encompassing risk ratio, Fisher's exact test, continuity correction, and linear-by-linear association. P-value: significance level; P-value > 0.05: insignificant (NS); P-value < 0.05: significant (S); P-value < 0.01: highly significant (HS).

3. Results

The mean age was 54.4 ± 11.3; 30% of the investigated group were males and 70% of the investigated group were females (Table 1). Meningiomas were found in 70% of cases, a supra-sellar macroadenoma was found in 5%, and a glioma was found in 25% of cases, (Figure 1).

Table 1. Distribution of baseline characteristics in the investigated group.

	INVESTIGATED GROUP N = 20	
AGE MEAN ± SD	54.4 ± 11.3	
	N	%
SEX		
MALE	6	30
FEMALE	14	70

SD: standard deviation.

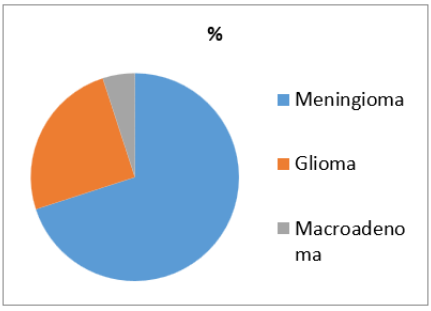

Figure 1. Distribution of Diagnosis in the investigated group.

Direct injury was the most common cause of venous complication in the investigated group and excessive cauterization and long-standing traction come after, (Table 2).

Table 2. Distribution of the cause of venous complications in the investigated group.

	INVESTIGATED GROUP N = 20	
	N	%
CAUSE		
DIRECT INJURY	12	60
EXCESSIVE CAUTERIZATION	4	20
LONG STANDING COMPRESSION	4	20
P-VALUE	0.008	

We found that the most common venous complication was venous infarction then post-operative hematoma then sinus thrombosis, (Table 3).

Table 3. Distribution of Post-operative radiology in the investigated group.

	INVESTIGATED GROUP N = 20	
	N	%
POST-OPERATIVE RADIOLOGY		
SUPERIOR SAGITTAL SINUS THROMBOSIS	1	5
POST-OPERATIVE INTRA-CEREBRAL HEMATOMA	5	25
VENOUS INFARCTION	14	70

Regarding management of venous complications, they are typically managed conservatively, with 75% of the investigated group were improved in follow up while 25% have no improvement, (Table 4).

Table 4. Distribution of management and follow up in the investigated group.

	INVESTIGATED GROUP N = 20	
	N	%
MANAGEMENT		
CONSERVATIVE	17	85
SURGICAL	3	15
P VALUE	≤ 0.001	
FOLLOW UP		
IMPROVED	15	75
NOT IMPROVED	5	25
P VALUE	0.001	

CASE PRESENTATION:

A 65-year-old male presented with headache and blurring of vision unresponsive to analgesics. Preoperative investigations, including CT, MRI, MRV, and routine labs, led to a diagnosis of left posterior parietal parasagittal meningioma. He underwent parietal craniotomy with complete tumor excision, but an unintended laceration of the superior sagittal sinus occurred, managed with compression. Postoperatively, he initially recovered well but developed headache, blurring of vision, and Grade 1 papilledema on day three. MRV revealed superior sagittal sinus thrombosis, which was conservatively managed with low molecular weight heparin. The case showed gradual improvement and became completely symptom-free within two months.

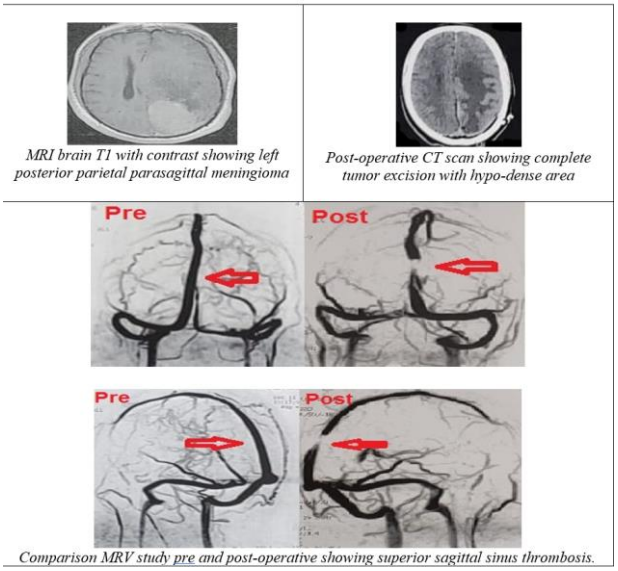

Figure 2. Shows case one.

4. Discussion

The current study demonstrated that the mean age of the investigated cases was 54.4 ± 11.3 years. Thirty percent of the investigated cases were males, and seventy percent of the investigated group were females.

The outcomes of this study were supported by Sughrue et al.,[5] who aimed to determine the frequency, risk factors, and result of venous infarction following meningioma operation. They reported that 705 cases undergoing craniotomy for resection of a histologically proven meningioma have been enrolled in their investigation; the mean age of the investigated cases was 53 ± 0.6 years, and 68% were female.

Also, Cai et al.,[6] who aimed to evaluate risk factors influencing cerebral venous infarction following brain tumor resection, reported that 1127 cases with brain tumors who had resection were included in their research; there were 724 (64.2%) women and 403 (35.8%) men.

Regarding the distribution of diagnoses in the investigated group, our results showed that 25% of cases had para-sagittal meningioma, 10% of cases had convexity meningioma, 5% had petroclival meningioma, 15% had sphenoid ridge meningioma, 5% had supra-sellar macroadenoma, 5% had cerebellopontine angle meningioma, and 25% had glioma.

This came in concordance with Zeng et al.,[7] who reported that among 25 cases, the tumor types involved 11 (44%) meningiomas and 7 (28%) gliomas.

Concerning the distribution of complications in our investigated group, our results showed that 2 cases (10%) had superior sagittal sinus injury, 12 cases (60%) had cortical vein, 3 cases (15%) had Sylvian vein, 1 case (5%) had internal cerebral vein, 1 case (5%) had cavernous sinus injury, and 1 case (5%) had petrosal vein; 60% had direct injury, 20% had excessive cauterization, and 20% had long-standing compression.

The results of the current study were matched with Ali et al.,[8] who reported that among 30 cases, there was 1 (3.3%) case that had cavernous site injury.

In the present study, regarding the distribution of postoperative symptoms, our results showed that 5% of the investigated group had headaches and drowsiness, 15% had DLC and hemiparesis, 5% had hemiparesis and aphasia, 15% had frontal manifestations, 30% had hemiparesis, 5% had loss of vision and DCL, 20% were asymptomatic, and 5% had DCL and facial palsy.[9]

The findings of the present study contradict those of Lonjaret et al.,[10] who indicated that postoperative nausea and vomiting (PONV) was the most prevalent postoperative complication, occurring in 42 (25%) cases. Twenty-six

cases (16%) had at least one neurologic complication: 12 (7%) cases presented with a new motor deficiency, 10 (6%) experienced a deterioration of consciousness, 6 (4%) had dysphasia, and 2 (1%) suffered from seizures. Twenty-two cases (85%) experienced neurologic complications within the initial two hours post-surgery.

Regarding the distribution of postoperative radiology in our investigated group, we found that venous infarction (70%) was the most common finding among cases, postoperative intra-cerebral hematoma (25%), and superior sagittal sinus thrombosis (5%). 85% of cases had conservative management, while 15% of them had surgical management; 75% had improved follow-up, while 25% had non-improved follow-up.

The results of the current study contrast with Sughrue et al.,[5] who reported that the overall rate of venous infarction was 2.0%.

Additionally, Wu et al.,[11] reported that the frequency of hemorrhagic cerebrovascular incidents was 38% (35/93). Of the 93 cases involving venous injury, 61 have been treated conservatively, resulting in a favorable prognosis for 95.1% (58/61) of these cases. Surgical intervention yielded a favorable prognosis in 32 cases, representing 62.5% (20/32).

Moreover, Jang et al.,[12] aimed to assess predictive characteristics associated with symptomatic venous infarction following meningioma operation. They observed that the frequency of venous infarction was 6.8% for large meningiomas (size not less than four centimeters), whereas it decreased to 1.2% for small meningiomas (size less than four centimeters).

4. Conclusion

Venous complications often result from direct injury, long-standing traction, and aggressive cauterization. Postoperative symptoms can range from mild to severe, with neurological deficits being the most common. Venous complications are typically managed conservatively, with 75% of the investigated group improving in follow-up, while 25% have no improvement. Extra-axial tumors are the most common among the investigated group.

So, to avoid venous complications we recommend pre-operative MRV to study relevant venous anatomy, avoid long standing brain retraction, internal debulking of large tumor may help to minimize brain retraction, don't use cauterization as a first step to control venous injury instead use surgical or gel foam and cotton patty, cortical incision along sulcus may be beneficial in large tumor in some cases.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Shi S, Cheng J, Chen H, et al. Preoperative and intraoperative predictors of deep venous thrombosis in adult patients undergoing craniotomy for brain tumors: A Chinese single-center, retrospective study. Thromb Res. 2020; 196: 245-250.
2. Alvis-Miranda HR, Milena Castellar-Leones S, Alcala-Cerra G, et al. Cerebral sinus venous thrombosis. J Neurosci Rural Pract. 2013; 4(4): 427-438.
3. Tufegdzic B, Lamperti M, Siyam A, et al. Air-embolism in the semi-sitting position for craniotomy: A narrative review with emphasis on a single centers experience. Clin Neurol Neurosurg. 2021; 209: 106904.
4. Bircher A, Chowdhury A. Current DVT prophylaxis: a review. Orthopaedics and trauma. 2020 Jun 1; 34(3): 161-7.
5. Sughrue ME, Rutkowski MJ, Shangari G, et al. Incidence, risk factors, and outcome of venous infarction after meningioma surgery in 705 patients. J Clin Neurosci. 2011; 18(5): 628-632.
6. Cai Q, Wang S, Zheng M. Risk factors influencing cerebral venous infarction after meningioma resection. BMC Neurol. 2022; 22(1): 259.
7. Zeng M, Li Z, Xia C, et al. Postoperative epidural hematoma as a rare complication after intracranial tumor resection: a case series report and causes analysis. Chin Neurosurg J. 2024; 10(1): 7.
8. Ali AK, Elayoty AE, Elserry TH, et al. Visual outcome predictors after surgical excision of meningiomas compressing the optochiasmatic complex. Egyptian Journal of Neurosurgery. 2020 Dec; 35:1-6.
9. Chaichana KL, Pendleton C, Jackson C, et al. Deep venous thrombosis and pulmonary embolisms in adult patients undergoing craniotomy for brain tumors. Neurol Res. 2013;35(2):206-211.
10. Lonjaret L, Guyonnet M, Berard E, et al. Postoperative complications after craniotomy for brain tumor surgery. Anaesthesia Critical Care & Pain Medicine. 2017; 36(4): 213–218.
11. Wu Y, Tian Q, Wang S, et al. Hemorrhagic cerebral venous infarction after vein injury during intraoperative lesion resection: incidence, hemorrhagic stages, risk factors and prognosis. Front Neurol. 2024; 15: 1371184.
12. Jang WY, Jung S, Jung TY, et al. Predictive factors related to symptomatic venous infarction after meningioma surgery. Br J Neurosurg. 2012; 26(5): 705-709.