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EVALUATING THE OUTCOMES OF BRAIN SURGERY COMPLICATIONS IN PATIENTS

Dr. Salih Adham Salih, Dr. Mukarram Nooraldeen Musarhad, Dr. Sarmad Abdullah Hussein
M.B.Ch.B., F.I.C.M.S. (Neurosurgery) Iraqi Ministry of Health, Kirkuk Health Directorate, Azadi Teaching Hospital, Kirkuk, Iraq

Abstract: Background: Surgery of brain tumors is a reliable predictor for surgical safety and efficacy. After an elective craniotomy of the surgical excision of a brain tumor, patients are frequently admitted to the intensive care unit (ICU) in observation. **Objective:** This study aimed to assess clinical findings related to complications after brain surgery. **Patients and methods:** 80 patients underwent brain tumor surgery and were admitted to the intensive care unit. Their ages ranged between 30-70 years. Data were collected before, during, and after surgery for patients from different hospitals in Iraq for the study period, which ranged from April 12, 2022, to October 25, 2023. Questionnaires were administered to evaluate patients' pain ratings and quality of life. Common brain surgical complications affecting patients after craniotomy for brain tumor surgery have been identified. **Results:** According to craniotomy for brain tumor surgery findings, our outcomes shown males had 56 cases and females had 24 cases. The main locations of brain tumours were temporal, had 31 cases; and frontal had 23 cases; surgery duration was 153.6 ± 24.6 min; anesthesia time was 220 ± 34.86 min; intraoperative bleeding had 2 cases; ICU admission had only one case, length of stay in hospital < 4 days with 62 cases, post-operative had 14 cases, which most factors were infection with 6 cases and cerebrospinal fluid (CSF) leak with 3 cases, the most items improved quality of life at patients were physical functioning with 1.02 ± 0.02, symptoms with 0.62 ± 0.31, and daily activity with 0.85 ± 0.45. **Conclusion:** PONV is just one of the common issues that arise after someone has had a brain operation. Some 20% of them had neurologic deficits that were bad enough to require them staying in an ICU. There are those individuals who may face complications in the aftermath if they, before coming, had motor deficits or bled during surgery.

Key words: Craniotomy Surgery; Postoperative Complications; Quality of Life Assessment; and Brain Tumors.

Introduction

Executive function (EF) is an activity associated with the functioning of the frontal lobes; this region is located in front of the central fissure of the brain [1]; it represents 25 to 33% of the cerebral cortex in humans. The frontal lobe cortex is divided into three areas: motor, premotor, and prefrontal. [2]

The prefrontal cortex is in charge of very complex functions; nowadays, when we refer to them, we call them “executive functions.”; however, not everything is said when we use the term since, in the construction of knowledge and science, there is not always a consensus of what they really are. [3].

Complications following neurosurgery are common. An analysis conducted using the National Surgical Quality Enhancement Program at Pediatrics (NSQIPPeds) database revealed a total morbidity of 10.2%, 30.2%, alongside 38.8% in intracranial shunt placement operations, craniotomies/craniectomies, and intracranial defect repairs, respectively, in a sample of approximately 10,000 neurosurgeries carried out across the United States. In this population, mortality rates in the first thirty days ranged among 0.1 and 1.2%. [4 - 8]

Previously, in an analysis of the same database, Saito et al. found that pediatric neurosurgery had the highest morbidity rate among the different pediatric surgical subspecialties, being the same of 13.6% vs. 2.4% and 7% for orthopedic and general surgery, respectively. [9]

Various factors that could cause problems have been identified, and preventing them reduces the possibility of morbidity and death in elective or emergent neurosurgical procedures. In cases of complications, it is crucial for them to be recognized promptly and treated. [10,11]

Multidisciplinary care and cooperation between nurses, anesthesiologists, intensivists, and neurosurgeons are critical for the optimal postoperative management of neurosurgical patients [12]. The main neurosurgeries that require monitoring in a critical care unit are brain tumor resection, craniofacial malformation reconstruction, vascular malformation surgery, epilepsy surgery, and skull trauma [13 - 15]. Patients may require admission to the PICU before surgery for stabilization (treatment of seizure status, neuroendocrine alterations, acute hydrocephalus, presence of cerebral hemorrhage) [16]. In most cases, admission occurs in the postoperative stage for monitoring and surveillance of possible neurological, respiratory, or hydroelectrolytic complications. [17]

Only a smaller percentage of neurosurgical patients require that the stay in the PICU be extended for more than 24 hours [18]. Piastra et al. reported a median stay in intensive care of 24 hours in a sample of 352 pediatric patients; 6.8% had more than 100 hours of stay, and only 2% had more than 200 hours. [19]

Most patients require and receive only observation rather than active treatments during their stay in the PICU [20]. That is why, due to the shortage of critical care beds, some centers admit postneurosurgical patients, hemodynamically stable and without the need for mechanical respiratory assistance (MRA) in intermediate care units (ICNT) [21]. This area, with adequate staff to carry out frequent clinical evaluation but without the extensive monitoring and life support means available in the ICU, is an appropriate option for neurosurgical postoperative management. [22]

Magnetic Resonance Imaging (MRI) was established as a promising diagnostic tool in the early 80s. Soon, it was recognized as a superior imaging modality in the diagnosis of various pathologies and as a guiding method in certain interventions [23]. Aspiration biopsies were the first interventional procedure performed by MRI in 1986 [24]. In 1988, van Sonnenberg et al. they described a new system for performing biopsies and drains using guided MRI. The first MRI therapies were performed in 1992 by Cline et al. and Matsumoto et al. Currently, the applications and indications for MRI interventions are increasing at a constant rate. [25]

Patients and methods

"It was a cross-sectional survey carried out in Baghdad hospitals from 12th April 2023 until 25th October 2024. All 80 individuals aged over 30 years old with craniotomy for brain tumor surgery (emergency or elective) were enrolled in this study. However, only those below 30 years old where not part of the study is held into the ICU".

Demographic data, preoperative neurological assessment and treatment, tumor diagnosis and site, mass effect on CT scan, intraoperative data (e.g., duration of anesthesia and surgery, type of anesthesia, their posture, type, and number of fluids given, blood loss, among others) were documented within the first 24 hours.

They gave patients sufentanil, propofol, and Cisatracurium for anaesthesia induction. However, in the case of emergency procedures (total intravenous anaesthesia), sevoflurane and sufentanil were used for anaesthesia maintenance.

To modify mechanical ventilation for end-tidal oxygen and carbon dioxide concentrations between 30 and 35 mmHg as well as ensuring arterial oxygen saturation above 95%, we aimed at achieving the same. Before becoming unconscious before surgery, patients for awake surgery were anesthetized with propofol, sufentanil, or remifentanil in order to allow them to breathe spontaneously by using an oxygen face mask with a flow rate between 6 and 8 L/min, thus maintaining arterial oxygen saturation above 95%.

Ephedrine was given to all patients during surgery in order to keep their mean arterial pressure (MAP) over 65 mmHg. Neosynephrine, also known as norepinephrine, was administered when ephedrine failed. To prevent hypothermia during anesthesia, a warming blanket was used.

Droperidol, as well as ondansetron, were used to treat PONV during the postoperative phase. If steroids were administered before to surgery, they were maintained during the perioperative period. Methylprednisolone at 2 mg/kg was used at the start of the surgery, even in patients who had not previously received steroids and was maintained in the postoperative period.

Anticonvulsants (levetiracetam at 1 g twice a day) were administered the day before surgery and maintained for seven days, with the exception of posterior fossa tumors. If the patient was already on anticonvulsants, these continued in the same dosage. Acetaminophen as well as tramadol were used 30 minutes before the conclusion of the procedure and maintained thereafter.

To alleviate discomfort after waking, morphine had been given. Antithrombotic prophylaxis in heparin with a low molecular weight was administered 48 hours after surgery, per local norms. Patients were awakened early following the operation and extubated at the operating room or post-anesthesia care unit (the PACU) as soon as they were stable.

Patients with intracranial hypertension were sedated, intubated, and transported to the ICU following a CT scan. CT scans are suggested in situations with sudden motor impairments, dysphasia, seizures, and loss of consciousness, as defined by a drop in a Glasgow coma score in more than 2. All operations have been evaluated of hospital mortality.

Results

Table 1: Basic and demographic characteristics of patients with brain tumors.

Characteristics	Number of patients [80]	Percentage [%]
Age		
30 – 40	26	32.5%
41 – 50	33	41.25%
60 – 70	21	26.25%
Sex		
Male	56	70%
Female	24	30%
BMI, Kg/m2		
< 20.5	16	20%
20.5 – 24.9	40	50%
> 24.9	24	30%
ASA, %		
I	8	10%
II	32	40%
III	40	50%
Smoking status		
Yes	48	60%
No	32	40%
Comorbidities		
Hypertension	64	80%
Diabetes	36	45%
Asthma	20	25%
High cholesterol	48	60%
Heart failure	12	15%
Anemia	8	10%
Symptoms		

Headaches	45	56.25%
seizures	40	50%
Changes in vision	25	31.25%
Difficulty with balance and coordination	16	20%
Changes in personality or behavior	23	28.75%
Memory problems	6	7.5%
Weakness or numbness in the limbs.	9	11.25%
Education status		
Primary school	12	15%
Secondary school	16	20%
College/university graduated	52	65%
Working status		
Working	48	60%
Non - working	32	40%
Income status		
< 800	32	40%
801 – 1000	20	25%
1001- 1200	12	15%
> 1200	16	20%

Table 2: Distribution type of tumours on patients.

Types of tumours	Number of patients [80]	Percentage [%]
Meningioma	22	27.5%
Malignant glioma	25	31.25%
Brain metastasis	10	12.5%
Cavernous angioma	7	8.75%
Pituitary adenoma	4	5%
Unknown	12	15%

Table 3: Identify the main locations of brain tumours.

Locations	Number of patients [80]	Percentage [%]
Frontal	23	28.75%
Temporal	31	38.75%
Parietal	7	8.75%
Occipital	8	10%
Posterior fossa	8	10%
Intrasellar	0	0%
Intraventricular	3	3.75%

Table 4: Enrol clinical outcomes associated with patients in preoperative neurologic assessment.

Items	Number of patients [80]	Percentage [%]
Motor deficit	17	21.25%
Dysphasia	11	13.75%
Seizure	20	25%
Trouble of consciousness	6	7.5%
Cerebellar syndrome	3	3.75%

Headache	7	8.75%
Cranial nerve	4	5%
Normal examination	12	15%

Table 5: Intraoperative and postoperative outcomes.

Characteristics	Number of patients [N=80]	Percentage [%]
Surgery duration, min	153.6 ± 24.6	
Anesthesia time, min	220 ± 34.86	
Type of anaesthesia, n (%)		
General anaesthesia	80 (100%)	
Fluids (mL)		
Crystalloids	1000 [1000 – 1600]	
Colloids	0 [0 – 600]	
Use of ephedrine (mg),	0 [0 – 6]	
Intraoperative bleeding, n [%]		
Yes	2	2.5%
No	78	97.5%
Blood loss, mL	720.16 ± 45.65	
ICU admission		
Yes	1	1.25%
No	79	98.75%
Length of stay in hospital, days		
< 4 days	62	77.5%
> 4 days	18	22.5%
Pain		
Yes	10	12.5%
No	70	87.5%
Respiratory, n (%)		
Yes	0	0%
No	80	100%
Hyperthermia		
Yes	1	1.25%
No	79	98.75%
Metabolic, n (%)	**8**	**10%**
Hyperglycaemia	6	7.5%
Diabetes insipidus	2	2.5%
Dysnatraemia	0	0%
Haemodynamic, n (%)	11	13.75%
Bradycardia (<45 b/min)	3	3.75%
Arterial hypertension (MAP >110 mmHg)	7	8.75%
Arterial hypotension (MAP <60 mmHg)	1	1.25%
Myocardial ischaemia	0	0%
Mortality rate		
Yes	0	0%
No	80	100%

Table 6: Postoperative complications.

Complications	Number of patients [N=80]	Percentage [%]
Infection	6	7.5%
Bleeding	0	0%
Swelling	1	1.25%
Cognitive changes	1	1.25%
Seizures	1	1.25%
Motor deficits	2	2.5%
Cerebrospinal fluid (CSF) leak	3	3.75%
Total	**14**	**17.5%**

Table 7: Assessment of quality of life of patients after craniotomy for brain tumor surgery by EORTC QLQ-C30 questionnaire.

Items	Scores
Physical functioning	1.02 ± 0.02
Psychological functioning	0.97 ± 0.31
Emotional functioning	1.22 ± 0.14
Social functioning	1.16 ± 0.10
Symptoms [fatigue, pain, and nausea]	0.62 ± 0.31
Daily activity	0.85 ± 0.45

Discussion

According to Manninen et al., in research carried out, it was determined that the most frequent immediate postoperative complication was PONV, experienced by 40% of patients. Nevertheless, none of those surveyed had been treated effectively with 5-HT3 receptor antagonists [26].

In the case of the third strongest hypotheses, neurological complications precede cardiovascular ones. Bradycardia/hypotension follows hypertension, that is the most common cardiovascular complication. 6% suffer acute pain [27]. Often post, craniotomy pain severity is underestimated, and usually, a multimodal approach is used to keep it under control. [28]

Within the first day following the operation, no signs of respiratory issues were seen, which is remarkable. The most severe issues arise from brain disorders. Only two cases among those examined in our study group of patients with epilepsy occurred during postoperative seizures following this type of surgery. Supratentorial neurosurgery hardly causes early seizure manifestations post-surgery. Medicating everyone following surgery with antiepileptic drugs is considered unnecessary [29].

Metabolic disorders or brain haematomas are not associated with seizures. The risk of having a post-operative seizure is higher in epileptic patients that are known even if they have been given anticonvulsants as a prophylactic while on pre-procedure drugs. Therefore, these people should be more carefully followed up on by their doctors. [30]

Tumors usually cause postoperative brain hematomas (particularly meningiomas), and there is significant hemorrhage in addition to some coagulation abnormalities. This deteriorates most patients because of a disorder in blood coagulation subsequent to operative intervention, though this may be seen later on in the case of brain hematoma patients [31].

For tumor removal from the cranium, it is unclear who should be admitted to the ICU. Just a few patients need to stay in intensive care for a long time after they have had an operation to remove a brain tumor. Those undergoing prolonged operations with substantial loss of blood and heavy anaesthetic risk need to be admitted to the postoperative ICU [32].

In their research, Hanak et al. found that only diabetic patients or older people had reasons to be treated at the average ICU level after a planned craniotomy. Notably, postoperative problems could be associated with operations longer than 4 hours, lateral decubitus during surgery, and, in most cases, inability to extubate successfully while still in the theatre, as per their findings. Rhondali et al. also observed that operations that exceeded 4 hours, the patient's lateral decubitus during surgery, and failure to successfully extubate in the operating room were among other reasons for postoperative problems most times. [33,34]

Conclusion

Postoperative issues, including PONV, are common after brain tumor surgery. Furthermore, 20% of patients had a neurological problem that probably substantiated an intensive care unit postoperative stay in early identification. A lack of preoperative motor deficits and intraoperative hemorrhage seemed to predict postoperative neurological complications. Finally, patients can show challenges after ICU discharge, particularly those having fossa posterior surgery, indicating that ICU admission may be prolonged in this type of surgery.

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