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Surgical outcome of posterior fossa tumours: a Benha experience

Mohamed Emara, Abd-Elaal Mamdouh and Mohamed M. Elmaghrabi*

Abstract

Background: Posterior fossa brain tumours are one of the most devastating forms of human illnesses which are more common in children. Brainstem compression, herniation and death are the risks with tumours in this critical location.

Objective: To evaluate our results, complications and outcome of posterior fossa tumour surgery in Benha University Hospital.

Patients and methods: A prospective study including 44 patients with posterior fossa tumours were performed at the Neurosurgery Department in Benha University Hospital between the period of March 2015 and October 2018. In each case, diagnosis was made clinically and confirmed radiologically and histo-pathologically.

Results: Out of 44 patients, 28 (63.6%) patients were males and 16 (36.4%) were females. The mean age was 17.5 ± 14.2 years (ranged 2–30 years). This study showed that excellent surgical outcome was observed in 12 cases (27.3%), good in 22 cases (50%) while poor outcome was observed in 10 cases (22.7%). The best outcome is astrocytoma then ependymoma while the worst outcome is metastatic then medulloblastoma which is statistically insignificant.

Conclusion: The surgical treatment of posterior fossa tumours still represents a challenge for neurosurgeons. Our Benha experience shows the accepted results, complications and surgical outcome in relation to previous clinical studies.

Trial registration: IRB#3747. Registered 18 September 2018.

Keywords: Open posterior fossa, Surgical outcome, Tumours

Introduction

Brain tumours of posterior fossa are one of the most serious forms of human illnesses which are common in children. Its critical location leads to brainstem compression and herniation then death [1].

Cushing had reported at the first time a large series of posterior fossa brain tumours. He published information of sixty one patients with mostly fatal outcome of cerebellar medullo-blastoma [2].

Prevalence of posterior fossa tumours in children are more common than in adults. Fifty-four to 70% of all brain tumours in children are present in the posterior fossa but 15–20% in adults. These tumours occur in males than females [3].

Medulloblastoma, ependymomas and pilocytic astrocytomas occur more frequent in childhood. Tumours such as metastatic lesions, lymphomas and hemangioblastoma are more common in adulthood [4]. Intracranial dermoid tumours have a rare percentage of all intracranial tumours, about 0.1–0.7% [5].

The clinical presentation varies according to the tumour site, its biological behaviour and aggressiveness, and its growth rate. Symptoms may be due to focal compression on the cerebellum or brain stem, or from increased intracranial tension [6].

The modern neuroimaging modalities lead to their diagnoses at earlier stages of the disease. Computed tomography (CT) delineates the presence of posterior

* Correspondence: dr_elmaghrabi@yahoo.com; mohamed.almaghreby01@fmed.bu.edu.eg
Department of Neurosurgery, Benha University, 78th elshoban elmoslmin, Benha, Qualiobih, Egypt

fossa tumours in more than 95% of cases, but magnetic resonance imaging (MRI) becomes the procedure of choice in their diagnosis [7].

Objective

The objective of this study is to evaluate our results, complications and outcome of posterior fossa tumour surgery in Benha University Hospital.

Patients and methods

Study design

A prospective clinical cohort study of 44 patients with posterior fossa tumours were performed, and they underwent open surgical excision with or without ventriculo-peritoneal (V-P) shunt. All patients were admitted to the Neurosurgery department in Benha University Hospital between a period of March 2015 and October 2018.

Patient population

Out of 44 patients, 28 patients were males and 16 were females. The mean age was 17.5 $\pm$ 14.2 years, and they were ranged from 2 to 30 years.

Preoperative work-up

All patients underwent routine physical examination; they also received a thorough neurological evaluation. A special neuro-surgical sheet was applied in all cases included in the study to cover all suspects needed. CT as well as MRI, with and without contrast enhancement, was done for all cases before surgery as shown in Fig. 1.

Operative note

Surgery was performed with general anaesthesia, in prone position, using an operating microscope and microsurgical instruments in all studied cases.

In our study, all patients were operated via a midline suboccipital approach. The objective of this surgery was to complete microsurgical excision of the tumour unless that tumour was invading the brain stem or attaching important vessels or nervous tissue.

General operative technique [8]:

- Patient position: prone with support to thorax and pelvis. Mayfield system fixes his head except in 3 children (2, 4and 5 years old).
- Skin incision: midline extends from the union to the first cervical vertebra (atlas).
- The suboccipital and paracervical muscles are separated and dissected by diathermy.
- Craniectomy is modified according to the site and size of the tumour.
- The foramen magnum is opened, and posterior arch of atlas may be removed, especially in tumours extended to the cranio-cervical junction.
- Y-shape dural incision is opened with its base upward.
- Bipolar, brain spatula, and self-retaining retractors are used for cortical incision of the cerebellum to expose the tumour.
- Tumours are removed using gentle suction, piece meal, or ultrasonic surgical aspiration.
- The extent of its removal should be weighed with its possible risk of complications, especially if it is adherent to the brainstem.
- After haemostasis, the dura is closed watertight. Dural grafting by periosteum or synthetic dural graft may be needed.

Cases with pathological evidence of malignancy or residual lesions were sent for gamma knife or adjuvant therapy as chemotherapy or radiotherapy.

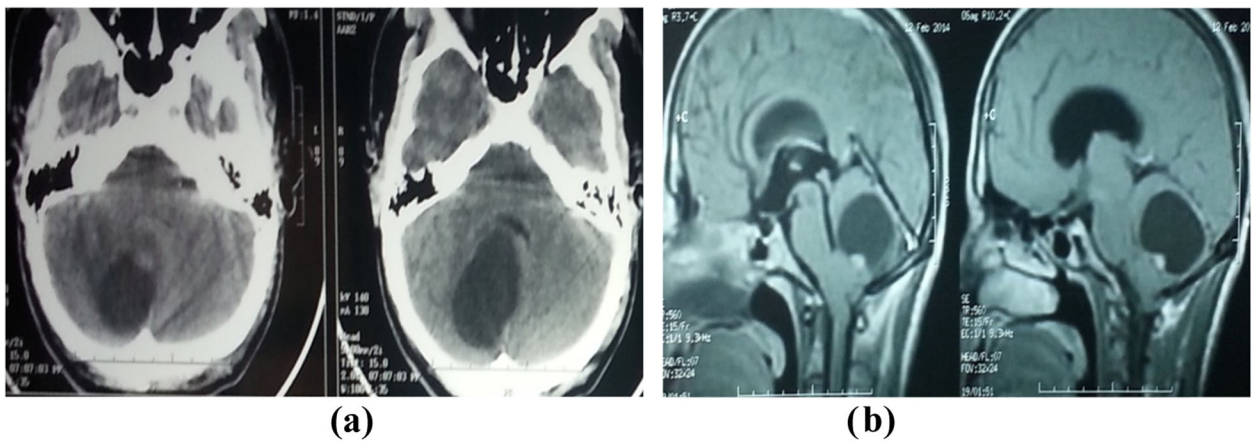

Fig. 1 **a**, **b** Preoperative radiological brain images with contrast for 23-year-old male of posterior fossa space occupying lesion (cystic mass with mural enhanced nodule): **a** CT axial cuts and **b** T1-weighted MRI sagittal cuts

Table 1 Clinical presentation of posterior fossa tumour

Clinical presentations	No.	%
Headache	40	90 .9
Vomiting	34	77.3
Ataxia	10	22.7
Cranial nerve palsy	8	18.2

Postoperative follow-up

Early CT scan was performed to rule out early complications. Patients were followed clinically in our hospital then in outpatient neurosurgery clinic and also radiological through a period of 10 to 28 months (mean 19.12 ± 4.68). CT ± MRI with contrast was done at 3rd to 6th month of postoperative period then 1–2 years later. All intraoperative and postoperative complications were collected and reviewed, to detect any recurrence of the excised tumour.

Final outcome [6] was assessed and typed as excellent, good and poor 3 months after discharge.

- Excellent: total tumour excision with no neurological deficit
- Good: subtotal excision with no or reversible neurological deficit or total excision with reversible neurological deficit
- Poor: subtotal or total excision with irreversible neurological deficit

Statistical analysis

The programme used in our study was SPSS version 20. Quantitative data were analysed using mean and standard deviation, while frequency and percentage were used with qualitative data. Fisher's exact test was used to analyse qualitative data. A P value ≤ 0.05 was considered statistically significant (*) while > 0.05 statistically insignificant.

Results

Between March 2015 and October 2018, 44 patients with posterior fossa tumours were operated, 28 (63.6%) patients were males and 16 (36.4%) were females. The mean age was 17.5 ± 14.2 years (ranged 2–30 years).

Table 1 shows that headache is the most common presentation in (90.9%) of cases followed by vomiting (77.3%), then ataxia (22.7%) and cranial nerve palsy (18.2%). V-P shunt was inserted in 30 cases, 68.2%, whom were 19 and 11 cases pre- and postoperative tumour excision respectively.

In our study, the most common complications are as follows: shunt obstruction 8 cases (18.2%), haemorrhage 6 cases (13.6%), cerebrospinal fluid leakage ± pseudomeningocele 6 cases (13.6%), wound infection 4 cases (9.1%), mutism 2 cases (4.55%), cranial nerve palsy 4 cases (9.1%) and seizures 2 cases (4.55%) (Fig. 2).

According to tumour pathology, the most common is astrocytoma (Fig. 3) in 16 cases (36.3%) which its variants are pilocytic and anaplastic in 14 and 2 cases of them respectively, then medulloblastoma 12 cases (27.3%), ependymoma

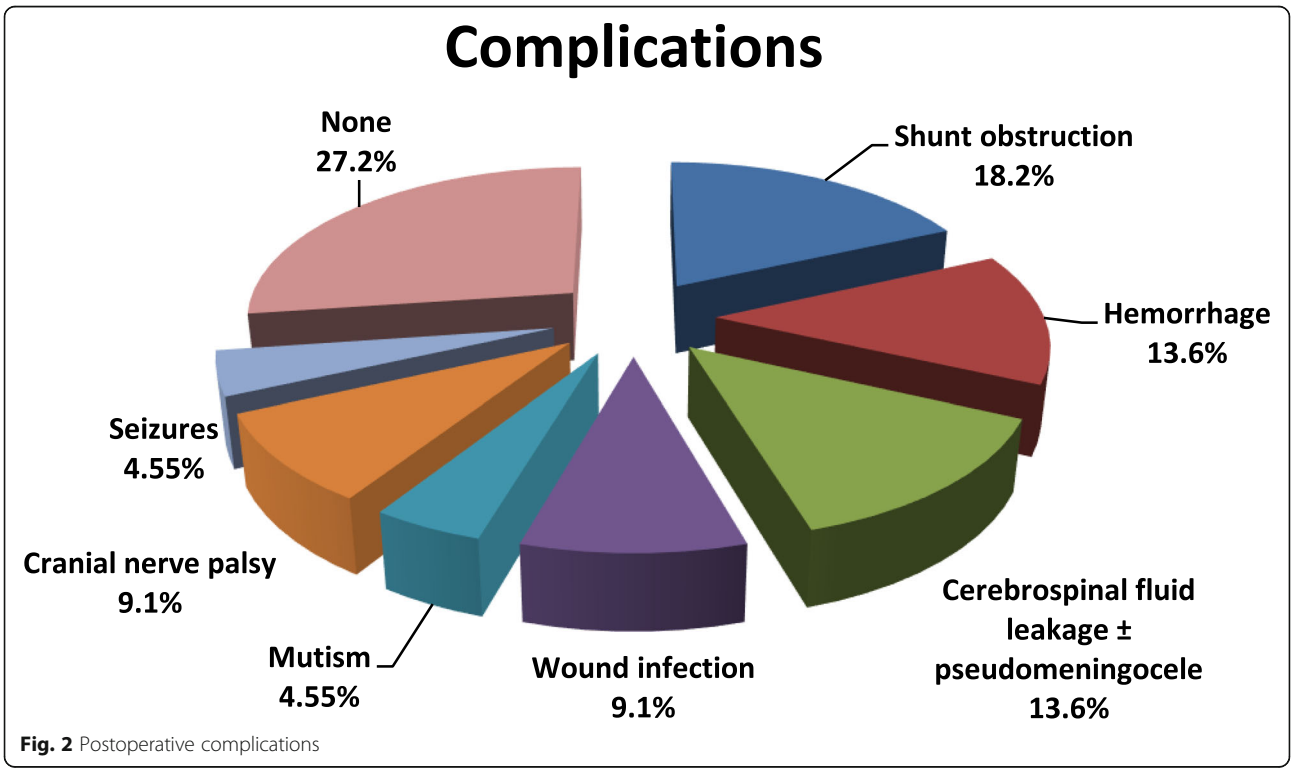

Fig. 2 Postoperative complications

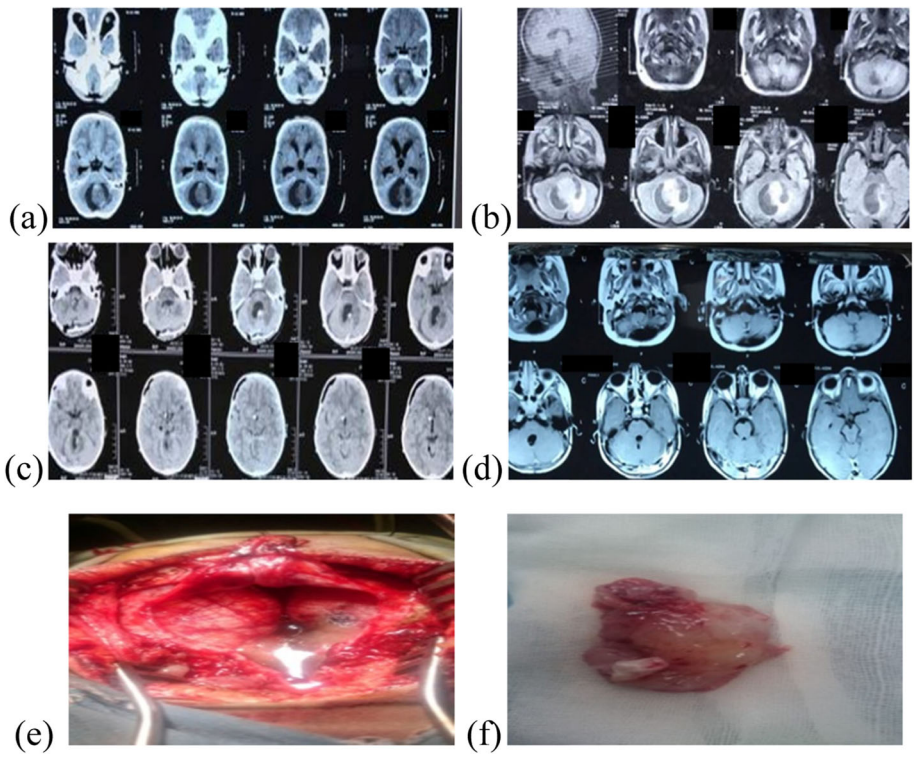

Fig. 3 **a**–**f** Male patient 2 years old of pilocytic astrocytoma. **a** Preoperative CT brain. **b** Preoperative T1-weighted MRI brain axial images. **c** Postoperative CT after 3 months. **d** Postoperative T1-weighted MRI axial images after 6 months. **e** Intraoperative image. **f** Excised solid part of tumour

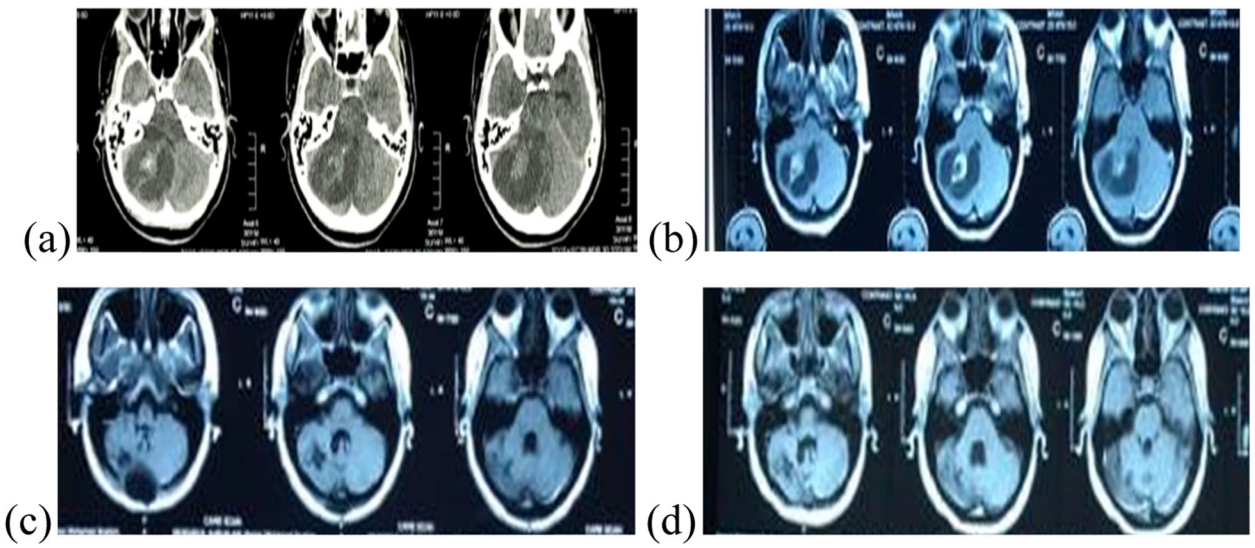

Fig. 4 **a**–**d** Female patient 30 years old of ganglioglioma. **a** Preoperative CT brain. **b** Preoperative T1-weighted MRI brain axial views with gadolinium. **c**, **d** Postoperative T1-weighted MRI axial views with gadolinium after 3 and 6 months respectively

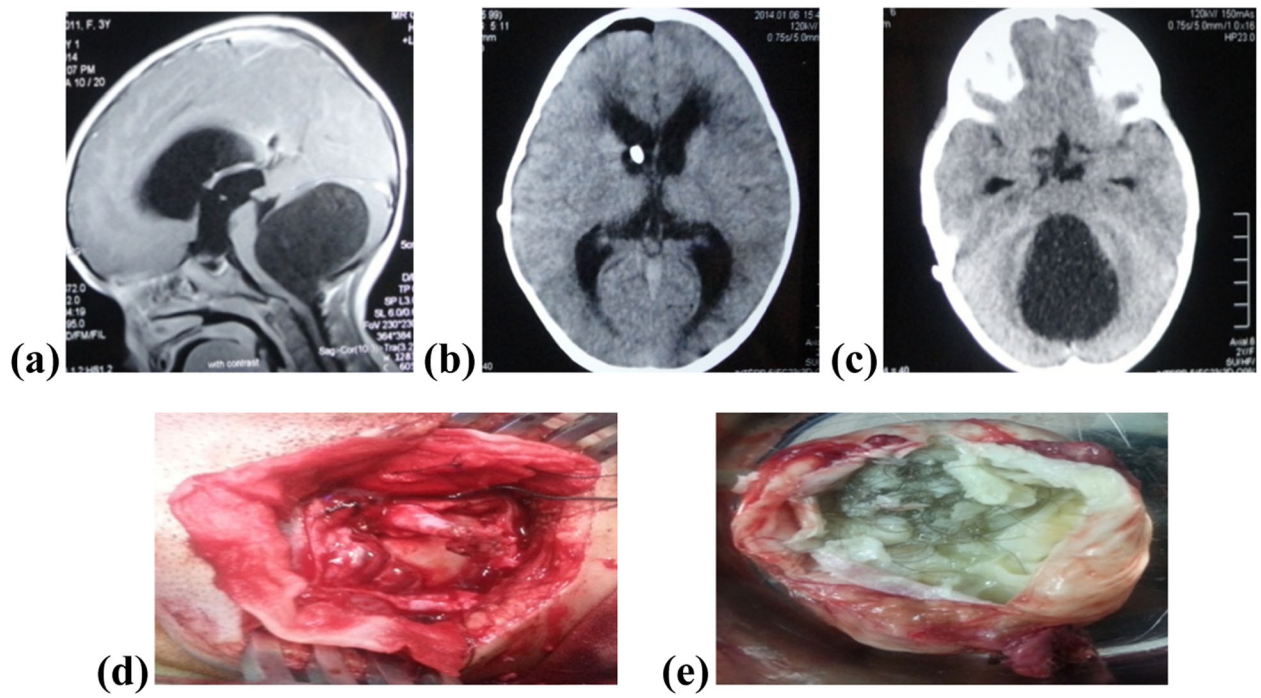

Fig. 5 **a**–**e** Female patient 3 years old of dermoid cyst (congenital benign tumour). **a** Preoperative T1-weighted MRI brain sagittal view with gadolinium. **b**, **c** Preoperative V-P shunt insertion CT brain axial cuts. **d** Intraoperative image of skin to dura after posterior fossa craniectomy. **e** Complete excision of cyst and opening it to show its content

10 cases (22.7%), metastatic tumour 4 cases (9.1%), ganglioglioma (Fig. 4) one case (2.3%) and also dermoid tumour (Fig. 5) one case (2.3%). Table 2 shows the incidence of shunt insertion with each tumour pathology.

Surgical outcome in this study shows that it is excellent in 12 cases (27.3%) and good in 22 cases (50.0%) while poor outcome is observed in 10 cases (22.7%) (Table 3).

Table 4 shows that outcome of different posterior fossa tumours is best in astrocytoma (excellent 56.25% and good 37.5%), then ependymoma (excellent 10% and good 70%) while the worst outcome is metastatic (poor 50%), then medulloblastoma (poor 41.7%) which is statistically insignificant.

During follow-up period, recurrence occurred in 4 patients (9.1%, 3 medulloblastoma and one ependymoma). Three patients died (6.8%), two metastatic tumours (10 and 15 months postoperative) and one recurrent medulloblastoma with sudden arrest 12 months postoperatively.

Table 2 The incidence of shunt insertion

Tumour pathology	No. (%)
Astrocytoma	10/16 (62.5%)
Medulloblastoma	10/12 (83.33%)
Ependymoma	7/10 (70.0%)
Metastatic	3/4 (75.0%)
Ganglioglioma	0/1 (0%)
Dermoid	0/1 (0%)

Discussion

One of the most common brain tumours is posterior fossa tumours which is the commonest site of primary intracranial tumours in paediatric age group [3].

In our study, we found that headache and vomiting were found to be the primary presenting symptoms in 90.9% and 77.3%, respectively, of patients with a posterior fossa tumour.

The study of Jiang et al., published in 2016 including 67 patients, found that the most common clinical presentation were symptoms of increased intracranial tension as nausea or vomiting (69%), headache (29%) and cerebellar dysfunction such as ataxia and diplopia in 45% and 3% of patients, respectively [9]. In another study of 45 patients in 2016, the most common symptoms were headache (51%), nausea ± vomiting (36%) visual disturbance (18%), and gait disturbance (18%) [10].

Table 3 The surgical outcome

Outcome	No.	%
Excellent	12	27.3
Good	22	50.0
Poor	10	22.7

Table 4 Outcome of different types of posterior fossa brain tumours

Outcome	Astrocytoma	Medulloblastoma	Ependymoma	Metastatic	Ganglioglioma	Dermoid
Excellent	9(56.25%)	1(8.3%)	1(10%)	1(25%)	0(0%)	0(0%)
Good	6(37.5%)	6(50.0%)	7(70%)	1(25%)	1(100%)	1(100%)
Poor	1(6.25)	5(41.7%)	2(20%)	2(50%)	0(0%)	0(0%)
Total	16	12	10	4	1	1
FET = 10.33, $P = 0.41$						

We needed, in our study, to insert a V-P shunt in 30 cases (68.2%) either pre or post to tumour excision, and the shunts were revised in 8 cases (18.2%).

Robert et al. found that permanent cerebrospinal fluid diversion was needed in 33% of patients [10]. In another study, V-P shunt was inserted in 53% of patients [1].

In our study, the surgical complications were haemorrhage in 13.6% of our cases which was resolved spontaneously without need for surgery, and lower cranial nerve palsy (bulbar) occurred in 9.1% of cases (three improved partially and the fourth need tracheotomy).

A study of Islam et al. [11] of 32 patients concluded that cerebrospinal fluid leakage was the most common complication which occurred in 26.7% of cases followed by pseudomeningocele in 23.5% of cases. In a study of Charles and Morgan [12], 121 patients had complication rate of 19% with a single case mortality. An uneventful postoperative period in 31% of cases and only 19% had neurological complications at long-term [13].

Astrocytoma was the most common pathology in our study, and a rare dermoid tumour was present in one case.

In 66 patients' study, medulloblastoma (29.26%) and pilocytic astrocytoma (29.26%) were the common posterior fossa brain tumours [14]. A case study was represented a rare intracranial dermoid tumour with its uncommon location in the posterior fossa [5].

In our study, excellent surgical outcome was observed in 12 cases (27.3%), good in 22 cases (50.0%), while poor outcome was observed in 10 cases (22.7%).

In Shaikh et al.'s study [14], 66 patients concluded the surgical outcome into good in 77% of their studied group while poor outcome (moderately disable, not to perform daily activities independently or have neurological deficit) in 23% [14].

In our study, the best outcome is astrocytoma then ependymoma while the worst outcome is metastatic then (poor 41.7%).

In other study, the best outcome was ependymoma in then astrocytoma. As in our study, the worst outcome was metastatic then medulloblastoma [14].

Recurrence in our study occurred in 9.1% of patients, 3 medulloblastoma and one ependymoma. Three patients died (6.8%).

Recurrence in Shaikh et al.'s study occurred in 8.33% of patients, 2 medulloblastoma. Two cases (4.87%) died [14]. In another study, only one case mortality was detected, 0.83% [12]. The latest study, 2018, had 6.7% death rate [8].

Conclusion

Surgical treatment of posterior fossa tumours still represents a challenge for neurosurgeons. As a result of clinical trials, the survival and outcome for patients with posterior fossa tumours have improved considerably over the last 20 years.

Our Benha experience shows the accepted results, complications and surgical outcome in relation to previous clinical studies.

Abbreviations

CT: Computerized tomography; MRI: Magnetic resonance imaging; V-P: Ventriculo-peritoneal

Acknowledgements

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Authors' contributions

Mohamed Emara, Abd-Elaal Mamdouh and Mohamed Elmaghrabi performed the clinical part of the study, analysed the data and wrote with meticulous revision the paper. All authors read and approved

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Availability of data and materials

The data supporting our findings can be found with the corresponding author and can be contacted through the following e-mails: dr_elmaghrabi@yahoo.com, mohamed.almaghreby01@fmed.bu.edu.eg

Ethics approval and consent to participate

This research accepted by Research Ethics Committee (REC) of Faculty of Medicine, Benha University (chairman: Prof/ Ibrahim El-Gendy).
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. A written informed consent was obtained from each parent of participants after explaining all steps of this study.
The reference number of the ethics approval from the ethics committee is as follows:
F10, date: December 12, 2018. For any details, please contact responsible person: Professor Dr. Nermeen Adly, telephone: +201000071033, e-mail: nmadly1@hotmail.com.

Consent for publication

Available, it was obtained from adult patients and parents of children of the studied group.

Competing interests
The authors declare that they have no conflict of interest.

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