Original Research Article

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An Analytical Study on Posterior Fossa Meningiomas: An Institutional Experience

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Abstract

Background: The Posterior fossa meningiomas constitute about 15 to 20% of all types of intracranial meningiomas. They usually become large, while they start producing clinical symptoms, because of their slow and indolent growth. Even though the microsurgical excision is the mainstay of treatment, the tumors's location, encroachment of adjacent neurovascular structures and it's invasive behavior, the surgery still remains challenging.

Material and Methods: This is a prospective clinical study of about 32 cases of posterior fossa meningiomas, operated at " Institute of Neurosurgery, Rajiv Gandhi Government General Hospital & Madras Medical College, Chennai-3"during the period. The incidence, various surgical procedures, postoperative complications & outcome were analysed.

Results: In about 72% of cases, Gross total resection was done. Subtotal excision was done in Petroclival, Jugular foramen with extra cranial extension, Tentorial meningiomas with sinus extension and ventrally placed foramen magnum tumors. Postoperative complications in the form of CSF leak was found in about 12.5% cases and new onset or aggravation of preexisting neurological deficit in about 33% of cases. We had encountered two recurrent cases over a mean follow up of 1 year.

Conclusion: Because of its close proximity to the sinus and adjacent neurovascular structures, posterior fossa meningiomas are very difficult to excise. Judicious use of Microscope, CUSA, intra operative nerve monitor helps in preserving the significant anatomical substrates. The postoperative recovery occurs completely, even though the neurological deterioration is common.

Keywords: Posterior fossa meningioma; Gross total resection; Postoperative complications.

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Introduction

The meningiomas are the neoplastic lesions with benign nature and they constitute to about 15 to 20% of all intracranial tumors. The posterior fossa meningiomas constitute to about 85 to 10% of all intracranial meningiomas.[1] They are usually diagnosed at a larger size, at their time of presentation, since they grow very slowly.

They are classified, based on their locations:

(1) Cerebellar convexity, Lateral Tentorial
(2) Cerebello Pontine Angle
(3) Jugular foramen
(4) Petroclival
(5) Foramen magnum
(6) Unclassified groups (Sekhar & Wright) (Table 1).

Even though, microsurgical excision is the treatment of choice of these tumors, the classical characteristics like Larger size, invasiveness, & adhesion to adjacent neurovascular structures, makes the surgery, very challenging.[2]

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Table 1:

Type	Location	Anatomical Extension
I	Cerebellar convexity. Lateral Tentorial	Tentorium, transverse & sigmoid sinus
II	Cerebello pontine angle	Petrous ridge, Internal auditory canal
II	Jugular foramen	Cerebello medullary angle, Internal Jugular vein,Extra cranial
IV	Petro clival	Upper 2/3rd clivus, cavernous sinus, Meckels cave, Petrouis ridge
V	Foramen magnum	Lower 1/3rd clivus,C1C2 area
VI	Unclassified	Entire clivus, mid and lower clivus and other types.

Aims and Objectives

This is a comprehensive study of different types of Posterior fossa meningiomas, their clinical presentations and to enlighten the technical difficulties encountered during their surgical excision and to discuss about their modes of management.

Materials and Methods

This is a prospective study of about 32 cases of various types of Posterior fossa meningiomas, operated at "Institute of Neurosurgery, Madras Medical College & Rajiv Gandhi Governmengt General Hospital, Chennai-3" from November 2015 to November 2017.

All the patients were investigated by CT Brain, MRI Brain–Plain & Contrast, with MRA and MRV.

The incidence, genderwise distribution,different clinical presentation and the various surgical procedures and their postoperative complications & postsurgical outcome were analysed.

The posterior fossa meningiomas were classified based on "Sekhar and Wright" classification as Type I: Cerebellar convexity, Lateral tentorial. Type II: Cerebello pontine angle, Type III: Jugular Foramen, Type IV: Petroclival, Type V: Foramen magnum, Type VI: Unclassified.[3]

Results

There were about 32 cases of Posterior fossa meningiomas, out of which 24 (75%) patients were females and about 8 patients (25%) were males.

The mean age of presentation was 44 years, with a age range from 18 to 70 years.

Majority of the patients had presented with dysfunction of cranial nerves, of which the otological symptoms were most frequent.[4] The other clinical presentations include, headache, cerebellar signs, Brainstem signs. Some patients had presented with signs of increased Intracranial Pressure, at the time of diagnosis.[5]

The Hearing loss/Tinnitus were present in about 17 patients (53%), Headache was the commonest presentation in about 16 patients (50%). The cerebellar compression syndrome in the form of ataxia was seen in about 15 patients (46%).

About 12 patients (37%) had features of Trigeminal anaesthesia/neuralgia and about 10 patients had presented with features of Lower cranial Nerve palsies in the form of Nasal regurgitation, Dysphagia & Dysphonia.[6] The Facial Nerve palsy was present in about 4 patients (12%).

The Diplopia was present in about 3 patients (9%) (Table 2)

Table 2:

Clinical Features	No. of Patients	Percentage
Hearing loss/Tinnitus	17	53%
Headache	16	50%
Ataxia	15	46%
Trigeminal Neuralgia	12	37%
Lower cranial nerve palsy	5	15%
Facial nerve palsy	4	12%
Diplopia	3	9%

The Cerebellopontine angle meningioma was present in about 10 patients (31.2%). All these patients underwent Retromastoid suboccipital craniectomy, where the Gross total excision was done in about 7 patients & subtotal excision was achieved in about 3 patients.

The Petroclival meningioma was present in about 6 patients (18.8%). About 5 patients underwent retromastoid suboccipital craniectomy and 1 patient underwent Transpetrous approach. The tumor was removed in Gross total in about 4 patients and Subtotal excision was done in about 2 patients (Figs. 1 & 2).

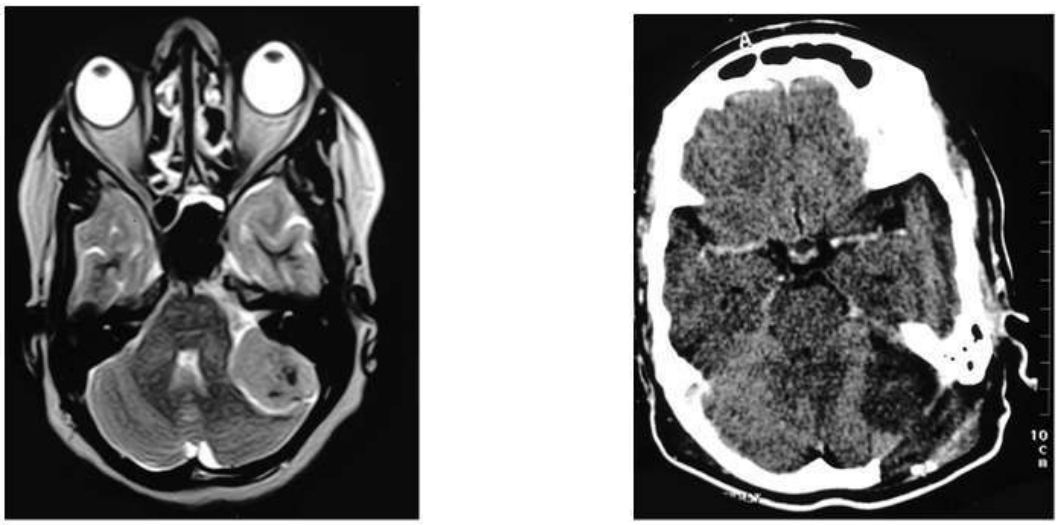

Fig. 1: Left Lateral Petrous Meningioma—Pre-operative & Postoperative Images.

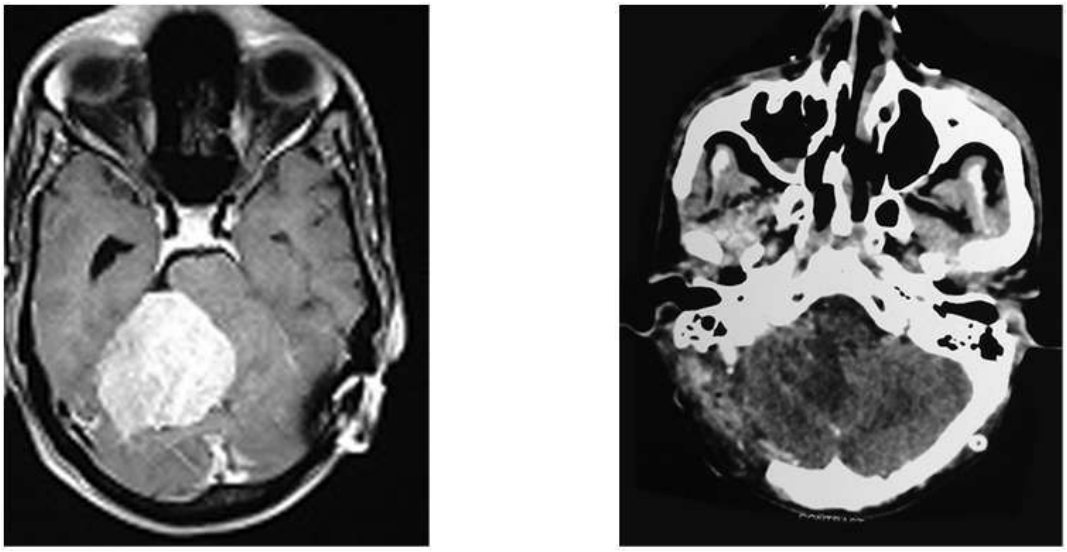

Fig. 2: Right Cerebello Pontine Angle Meningiomas—Pre-operative & Postoperative Images

About 4 patients (12.5%) had Lateral tentorial meningiomas. All these patients underwent Retromastoid craniectomy. Gross total resection was achieved in about 2 patients and Subtotal excision was done in about 2 patients (Fig. 3).

The cerebellar convexity type of meningiomas were present in about 4 patients (12.5%). Sub-occipital craniectomy was done in all the cases and all these patients underwent Gross total excision.

About 2 patients (6.3%) had Jugular foramen meningiomas and all of them underwent retromastoid suboccipital craniectomy. Gross total excision was done in one patient and subtotal excision was done in the another patient.

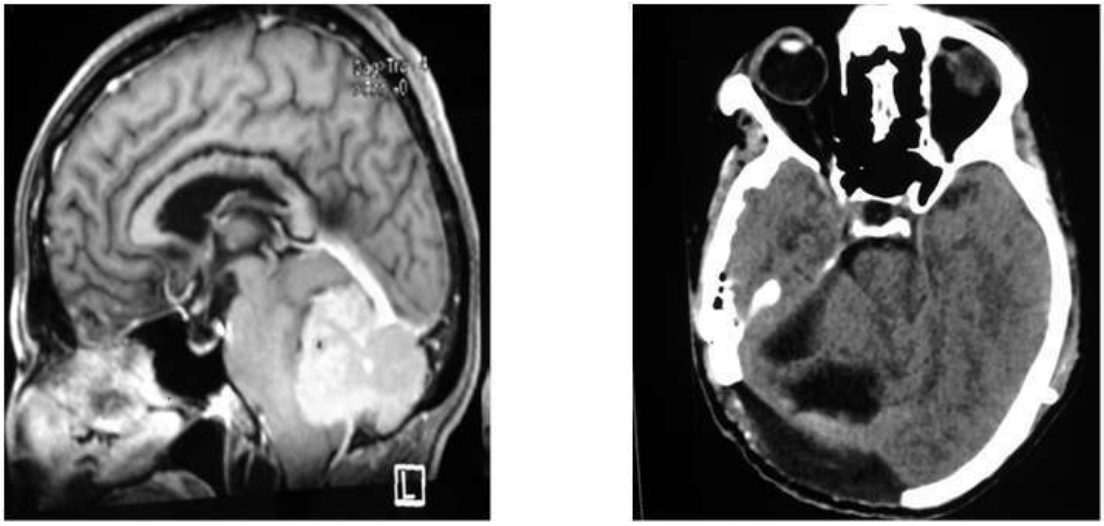

Fig. 3: Right Tentorial Meningioma—Pre-operative & Postoperative Images

The foramen magnum meningiomas were present in about 4 patients (12.5%). Midline suboccipital craniectomy was done in about 3 patients and Far Lateral approach was done in one case. The Gross total excision was done in about 3 patients and one patient underwent Sub total excision (Fig. 4).

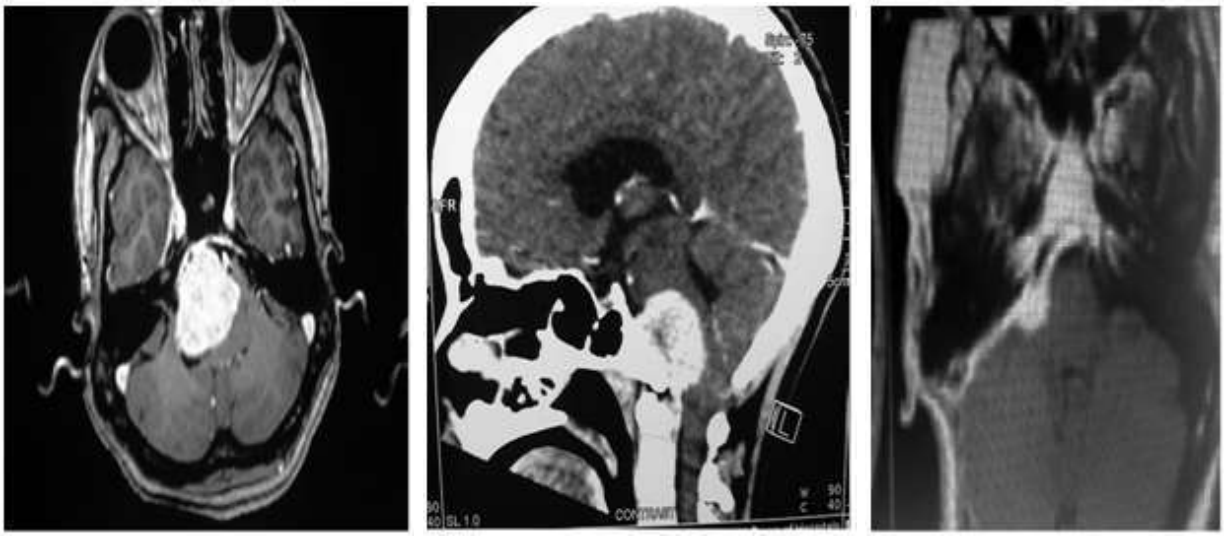

Fig. 4: Ventral Foramen Magnum Meningioma—Pre-operative & Postoperative Images

About 2 patients had "Unclassified" meningiomas. All of them underwent Retromastoid suboccipital craniectomy and Gross total resection could be achieved in all these two cases.

The Gross total excision was maximum in cerebellar convexity group and was minimum in Petroclival group. The Subtotal excision was done due to the tumor adhesiveness to the adjacent neurovascular structures, Brain stem and intrasinus extension (Table 3).

The Postoperative complications were in the form of Pseudomeningocele, CSF leakage, Cranial Nerve dysfunction, sinus thrombosis and long tract signs.

Postoperative Crania nerve dysfunction was found in about 7 cases (21%), which was either, progression of pre-operative dysfunction or new dysfunction. They were very common in the Petroclival meningiomas.

Table 3:

Tumor Location	No. of Cases	Surgical Approaches	Gross Total Excision	Subtotal Excision
CP Angle meningioma	10 (31.2%)	Retromastoid Sub occipital craniectomy	7	3
Petroclival	6 (18.8%)	Retromastoid Sub occipital craniectomy–5 cases, Transpetrous approach–1 case	4	2
Lateral Tentorial	4 (12.5%)	Retromastoid sub occipital craniectomy	2	2
Cerebellar convexity	4 (12.5%)	Suboccipital craniectomy	4	-
Jugular foramen	2(6.3)	Retromastoid suboccipital craniectomy	2	2
Foramen magnum	4 (12.5)	Midline suboccipital craniectomy–5 cases, Far Lateral approach–1 case	3	1
Unclassified	2 (6.3)	Retromastoid suboccipital craniectomy	1	1

CSF leakage was found in about 12.5% of patients.

Postoperative mortality was found in two cases (3.2%) due to sinus thrombosis in one case and in other, due to Aspiration Pneumonitis.

We had encountered 2 cases of recurrences (one Petroclival & one Tentorial meningiomas) over an average follow up of about 6 months.

Discussion

The Posterior fossa meningiomas can be found anywhere in the posterior fossa and the treatment is individualized based on its size, location, growth rate & clinical presentation.[7]

In our study, Cerebello pontine angle meningiomas subgroup was the commonest group (31.4%), followed by the lateral tentorial group and cerebellar types, whereas the classical series of Yasargil, *et al*. about 30% of posterior meningiomas were located in the cerebello pontine angle, and about 20% of meningiomas were located at the Petroclival region.

Since, these tumors are diagnosed very late, due to its slow growth, Cranial nerve palsy and the gait disturbances are the most common clinical presentation.[8] Trigeminal nerves and the Vestibulocochlear nerves are commonly affected.[9] Few patients present with signs of increased intracranial pressure due to hydrocephalus.

MRI Brain is the major contributing factor in Pre-operative surgical planning, based on its site of origin & anatomical extensions. The involvement of skull bone is better delineated by CT Brain.

MR Angiography, clearly dictates the tumor extension to the venous sinuses, venous anatomy, jugular bulb size, anatomy of superior and inferior petrosal sinuses & extension of the tumor to the adjacent arteries.[10]

Even though it has been stated for a longer period, that the pre operative embolization, often shrinks the tumor and makes it softer, less vascular, we did not perform pre operative embolization in any of our cases.[11]

The posterior fossa meningiomas can be managed by

(1) Observation

(2) Surgery

(3) Radiotherapy

(4) Combination of Surgery and Radiotherapy.[12]

If the tumor is a small one & if the patient is asymptomatic, Periodical Observation can be tried with interval MRI scans. Planning of surgical treatment would be judicious, if the lesion shows significant growth, i.e. growth rate more than couple of millimeters in 6 month interval.[13]

Surgical treatment remains the main stay of treatment in patients with tumor size larger than 3 cms diameter with neurological symptoms.[14] It is very important that the successful removal of these types of meningiomas, include adequate bony exposure, early eradication of arterial feeders, adequate tumor debulking and maintenance of arachnoid plane.

The Retromastoid retrosigmoid suboccipital craniectomy was the commonly used surgical approach in our series, as in other series.[15] This is

a most familiar approach, the surgeon finds the posterior & laterally engulfed or displaced cranial nerves and the brainstem in the way to the tumor and he has to work through the narrow fissure left between the tentorium and cranial nerves.

However, because of the large size and lateral extension, the exposure of the tumor is good and allows complete removal of the tumor.[16]

The Pre-sigmoid approach is an optimal surgical procedure for Petroclival and Pre-meatal Cerebello pontine meningiomas, as it allows the surgeon to work approximately 2 cm closer to the tumor.[17] But, as per the recent literature, the radical surgical treatment by Pre-sigmoid approach is almost equivalent to the conventional Retromastoid Suboccipital Craniectomy.

The Postoperative complications are relatively higher in patients, who got operated with Petro clival meningiomas.[18] Hakuba *et al*. had reported 17% mortality and new neurological deficit in 83% cases, Mayberg and Symorn had reported 9% mortality with 50% permanent morbidity rates.[19]

Sekhar *et al*. had achieved complete tumor removal in about 73% cases with operative mortality in about 4% cases (19%). On comparison to other series, in our series, the rate of complete excision and postoperative neurological deficit were better with Cerebellopontine meningiomas in comparison to Petroclival meningiomas. In our series, we had achieved gross total resection in about 72% of cases with postoperative new or aggravation of existing neurological deficit in about 33% cases.

Moreover, in our series, the subtotal excision were more in Petroclival, Jugular foramen lesions with extra cranial extension, Tentorial meningiomas with intra sinus extension and anteriorly placed foramen magnum meningiomas (Fig. 5).

The Postoperative complications are relatively higher in the patients with Petroclival meningiomas, constituting to about 55 to 80% (20%). Hakuba *et*

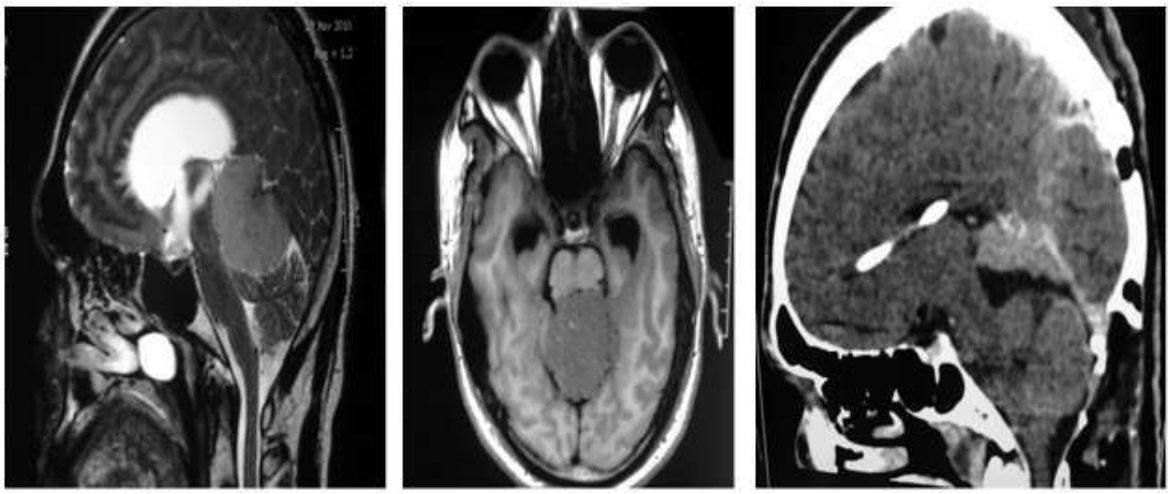

Fig. 5: Tentorial Meningioma—Pre-operative & Postoperative Images Showing Residual Lesion

al. had reported about 17% mortality and new neurological deficit in about 83% cases (21%).

Mayberg and Symon had reported the mortality & morbidity rates as 9% and 50%, respectively (22%).

Sekhar *et al*. had achieved complete tumor removal in about 73% of cases with operative mortality in about 4% of cases.

The rate of complete excision and postoperative neurological deficit were better with Cerebello nponting angle meningioma in comparison to Petroclival meningioma (23), as in other series.

In our series, we had achieved gross total excision in about 72% of cases with new or aggravation of existing neurological deficits in about 33% of patients.

In our series, the percentage of subtotal excision were more in Petroclival, Jugular foramen lesions with extra cranial extension, tentorial lesions with intra sinus extension and ventral foramen magnum meningiomas.

Even though, the subtotal excision carries lesser complication rates, the chances of recurrent growth are very common.[24] Recently, many centres

recommend subtotal resection for old patients or when there are factors defying complete removal.[25]

The rate of recurrence was five to ten times higher in patients with subtotal or partial excision compared from radical excision.[26] In Couldwell *et al*. series, in which gross total excision was in 69% of the patients, 13% had documented recurrence or progression over 2 year follow up.[27] In our series, we had two recurrent cases over an average follow up of 1 year. The recurrent cases were seen in petroclival and tentorial subgroups (Table 4).

Table 4:

Literature Studies	No. of Cases	Gross Total Resection (%)	CSF Leak (%)	Overall Complications (%)	Mortality (%)
Roberti *et al.*	161	57	13.6	41	2.5
Saleh *et al.*	40	97	5	54	2.5
Lobato *et al.*	80	62.5	2.5	67.5	6.2
Cudlip *et al.*	52	84	4	54	11
Symon *et al.*	73	78	4	72	9
Our Studies	32	72	12.5	45	3.2

There are certain significant factors influencing the possibility of radical and safe resection, like tumor-vascular relationships, tumor consistency, vascularity and the integrity of arachnoid plane between the tumor and brainstem.

Levine *et al*. had proposed a grading system, which predicts the likelihood of complete resection, which includes the vessels encasement and the number of cranial nerves involved.[28]

Adjuvant radiotherapy is considered to be the secondary modality of treatment in patients, who underwent subtotal resection, since they have higher chances of tumor recurrence.

Stereotactic Radiosurgery (SRS), provides a highly focused, single fraction radiosurgery, confined to the tumor, thereby reducing the incidence of complications that are associated with fractionated radiotherapy. The SRS, effectively prevents tumor progression, prolongs the interval to recurrence and improves the survival rates.[29]

Taylor *et al*. had determined a 10 year progression free survival rate in cases of subtotal, gross total and subtotal plus radiosurgery subgroups of meningioma and found that recurrence was very high in subtotal subgroup but was same in gross total and subtotal plus radiosurgery subgroups. In this way, the surgeon can remove the bulk of the tumor and the residual lesion can be treated with radiosurgery, but the benefit is limited as tumor volumes increases.

Conclusion

The Posterior fossa meningiomas are very difficult to excise and still remains a challenge to the operating surgeon, because of its close proximity to the adjacent vessels, sinuses and cranial nerves.

The use of microscope, CUSA, helps in gross total or subtotal removal, preserving the surrounding important anatomical substrates.

Despite of aggravation of postoperative neurological deficits, recovery occurs completely after total removal, thus increasing the recurrence free period and thereby improving the outcome.

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