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Original research article

Case series of trigonal meningiomas

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ARTICLE INFO

Article history:
Received 15 May 2018
Accepted 10 August 2018
Available online 23 August 2018

Keywords:
Trigonal meningiomas
Intraventricular meningiomas
Surgical approaches
Meningioma
Intraventricular tumours

ABSTRACT

Background: Trigonal meningiomas have unique clinical presentation, unlike those in other areas of brain. Situated deep in the brain, the surgical nuances of this tumour are distinctive. We present our experience with this tumour including a discussion of surgical corridors that may be employed.

Methods: At our centre, 12 trigonal meningiomas were operated over past two decades. A retrospective analysis of case records of these cases was undertaken as regards age, sex clinical presentation, imaging and surgical approach.

Results: Mean time from heralding symptom to presentation was 10.4 months. At presentation, the most commonly encountered symptoms were those of non-localising symptoms attributable to raised ICP. Majority of lesions were more than 6 cm and on left side and the preferred surgical approach was inferior temporo-parietal. Most symptoms were relieved on long-term follow-up except homonymous hemianopia.

Conclusion: The incidence of deficit is low on employing the ''shortest route'' approach, even in the dominant hemisphere and through eloquent area. This may be secondary to possible shift of eloquent area function due to longstanding lesion and may thus be a ''workable'' surgical option, especially in resource-limited centres where such resources as neuronavigation and tractography may be unavailable.

1. Introduction

Although meningiomas form a large share—up to 15%—of intracranial tumours, intraventricular meningiomas are rare and account for only 0.5–3% of meningiomas. Delandsheer (1965) and Nakamura (2003), among others have analysed large case series of these tumours [1,2]. Nakamura, in his case series reported 81.3% of intraventricular meningiomas to be located in lateral ventricle [2]. Several key points underlined by such studies are characteristic delay in presentation, female preponderance, and preferential location in left hemisphere and unique clinic-radiological appearance. The tumour is most commonly located in trigone, which is a triangular region of the ventricle that opens, anteriorly into body of lateral

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https://doi.org/10.1016/j.pjnns.2018.08.005

ventricle and temporal horn, above thalamus and below thalamus, respectively and posteriorly into occipital horn [3]. Various approaches to the tumour have been described, each with own merits and demerits [2–5].

2. Materials and methods

A total of 122 cases of meningiomas were operated at our centre between 1990 and 2013. Of these, 12 were trigonal meningiomas. A retrospective analysis of case files, imaging, outpatient charts as well as postal and electronic communication during follow up was done regarding demography, clinical features, surgical technique and immediate postoperative and long-term outcome.

Following parameters were taken into consideration:

1 Preoperative status
   a. The first symptoms that could be ascribed to this pathology
   b. The symptom that caused the patient to seek medical attention
   c. Deficits at the time of presentation
   d. Radiological parameters
2. Postoperative status (immediate follow up)
   Postoperative assessment was done at 1 week following surgery. This included:
   a. Deficits persisting at the time of follow up
   b. Radiological parameters on CT brain plain and contrast.
3. Postoperative assessment (long-term)
   Postoperative assessments were done at regular intervals. For the purpose of this study, postoperative assessment done at 1 year from surgery was taken into account at which time following parameters were assessed.
   a. Deficits persisting at the time of follow up
   b. Radiological parameters on MRI brain plain and contrast.
   c. Quality of life index.

Institutional Ethical Committee Acceptance:

As this was a retrospective analysis of patient records, no ethical committee acceptance was required.

3. Results

The mean age of presentation was 44.25 years. There was an equal sex distribution among the cases. The time taken from the first symptom that could be ascribed to this pathology to the point of clinical presentation was variable from 6 months to 24 months and the mean duration was 10.4 months (Fig. 1). The most common first symptom was headache (58.3%) followed by memory disturbances (50%) and persistent giddiness (33.3%). Unexplained ipsilateral hearing loss was noted in 2 patients. Social apathy was also noted in 2 (16.6%) of our patients. These patients had disinterest in social events and family interactions. CSF rhinorrhoea was first symptom in one patient. However, one year later, at time of presentation the patient had spontaneous resolution of this symptom. These first symptoms were usually mild and/or transient and hence were usually ignored till the more pressing presenting symptoms came upon.

Among the symptoms that caused the patient to seek medical attention, gradual onset hemiparesis (50%) and visual field defects (25%) were most common in patients who sought medical attention electively, whereas seizures (41. 6%) and altered sensorium (25%) were the most common emergency presentations. Parietal lobe syndromic features were noted in only one patient.

MRI, the investigation of choice, was done in all patients except in three where a CT was done. The lesions on MRI were iso- or hypo-intense on T_1 weighted images and hyperintense on T_2 weighted images with diffuse enhancement with contrast. Two patients had signal voids suggestive of peripheral calcification. One meningioma had a variable intensity. Margins of all lesions were well defined, lobulated, except for 2 lesions were the margins were ill-defined. There was thalamic extension with oedema noted in one lesion and one had a temporal lobe extension. The size of the lesion was variable with

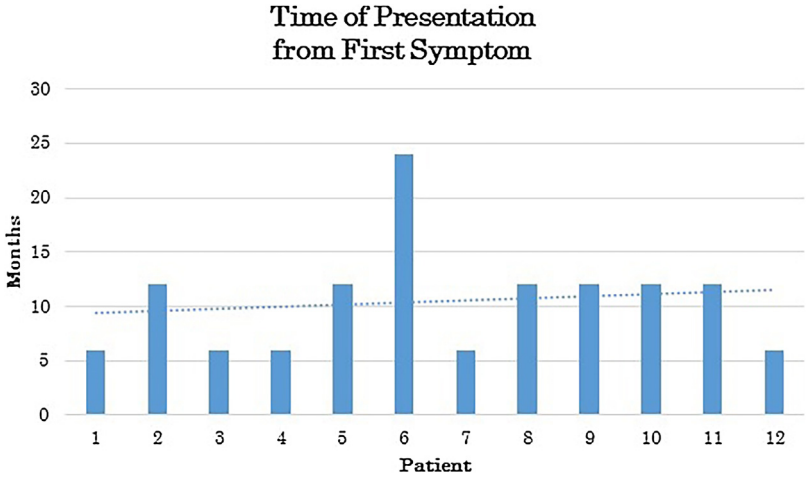

Fig. 1 – Time for presentation from the onset of first symptom.

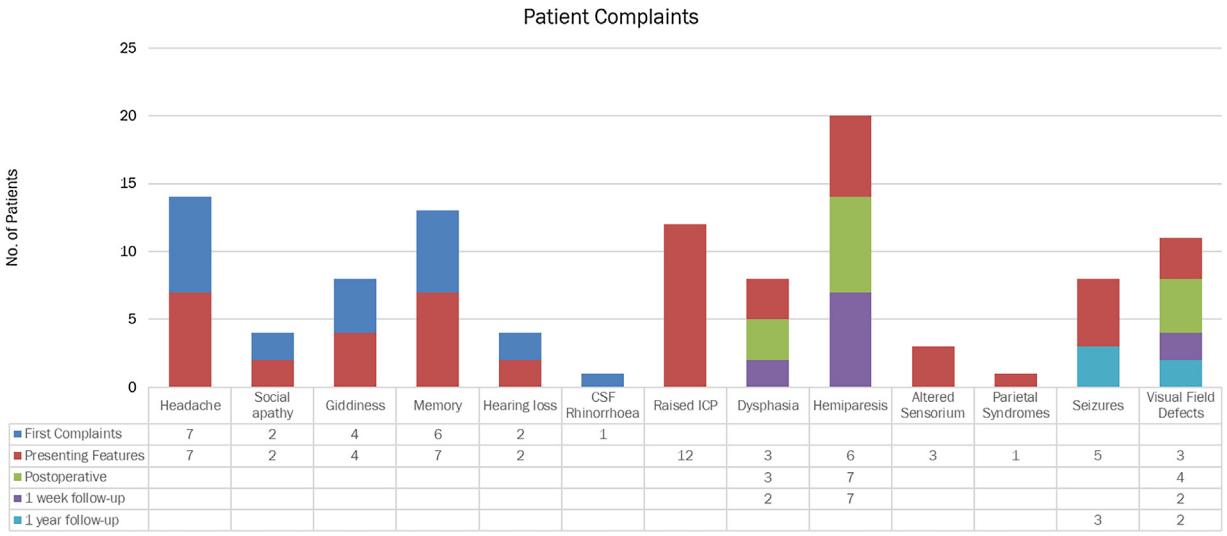

Fig. 2 – Patient complaints, preoperative and postoperative.

58% greater than 6 cm (7 patients), while it was 3–4 cm among remaining. None of the lesions in our series were less than 3 cm. 83.3% (10 of 12) lesions in our series were on left side.

Surgical approach was planned based on the shortest route to the lesion, the side of lesion and the need for early control of feeding choroidal vessel. Among these considerations, the shortest route was usually the first for all patients. However, if inferior temporo-parietal and parieto-occipital route were equidistant to lesion, the parieto-occipital approach was preferred over the temporo-parietal route to avoid speech related complications, especially on the dominant side. Thus, the left sided lesions were approached by both the routes (temporo-parietal, if shorter, parieto-occipital if equidistant). The two right-sided lesions were both approached by inferior temporo-parietal route.

Total resection had been obtained in all patients. The histopathological examination in none of the patients was suggestive of grade II or III meningioma and hence none were subjected to radiation.

New deficits were noted in 2 patients; one developed homonymous hemianopia and the other developed hemiparesis (Fig. 2).

At first week follow-up the deficits with which the patients presented improved to near-normal in 2 patients (16.6%). Some of the preoperative deficits which persisted include hemiparesis (persisted but better in all the 6 as compared to preoperative status and improved in the one new-onset postoperative hemiparesis), dysphasia (persisted but better in the 2 as compared to preoperative status, with complete improvement in the third) and homonymous hemianopia (persisted in 2 patients) (Fig. 2). Post-operative status with reference to type of approach is shown in Fig. 3.

On follow-up at one year, all the patients improved in their deficits with following exceptions

- Hemianopia persisted in 1 pre-operative and 1 post-operative onset patient.
- One patient had persistent seizures requiring 3 anti-convulsants while in 2 patients, anti-convulsants had to be re-instated due to recurrence of seizures.

These results are summarised in Table 1.

At one year follow-up none of the patients had features of recurrence on MRI contrast study. At 5 years, all but 2 patients

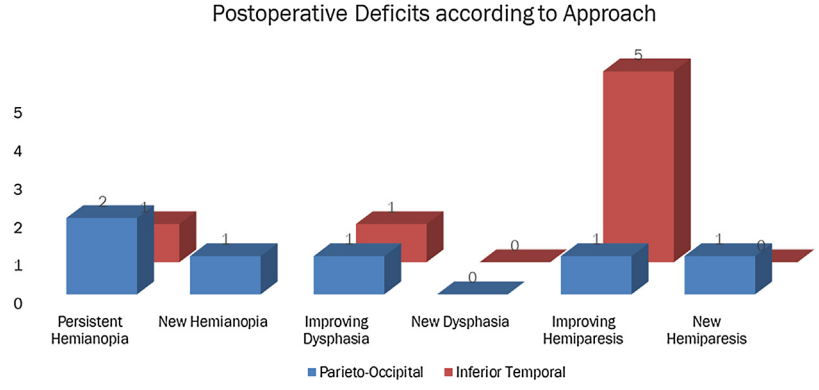

Fig. 3 – Deficits in accordance with the approach.

Table 1 – Summary of patient results.

Age	Mean 44.25 years		
Sex	Male 5		Female 7
Location	Right 2		Left 10
Histopathology			
	Meningotheliomatous 6		
	Fibroblastic 3		
	Transitional 1		
	Psammomatous 1		
	Mixed 1		
Deficits			
	Postoperative	**1 week**	**1 year**
New onset	Hemianopia 1	Persisted	Persisted
	Hemiparesis 1	Improved	Improved
Persisting	Dysphasia 3	Improved 1	Improved all 3
	Seizure none		

were lost to follow-up and hence long-term recurrence could not be determined. However, both these patients did not have features of recurrence.

4. Discussion

Meningiomas of the ventricular system without a meningeal attachment are rare, accounting for 0.5% to 5% of all meningiomas [4]. The mean age of occurrence in our series was 4th decade (44.25%), which was similar to that reported in literature [2,5,6]. Within the ventricular system their distribution is as follows – 77.8% in the trigone, 15.6% in the third ventricle and 6.6% in the fourth ventricle. Shaw, in 1854, and later Cushing and Eisenhardt described the distribution of intraventricular meningiomas [2,6]. Although the most common paediatric meningiomas are intraventricular, there were no paediatric cases in our series [2,4,5]. Similarly, although female preponderance has been reported for these tumours (up to 82%), including in a large series reported by Ma et al., our series had equal male:female ratio, similar to Nakamura et al. [2,4,5,7].

Clinical presentation: Cushing and Eisenhardt's classical 'lateral ventricular syndrome' manifests as [4,8]:

1 Raised ICP symptoms with ipsilateral headache.
2 Contralateral macula sparing homonymous hemianopia.
3 Contralateral sensorimotor paresis or numbness over the trigeminal distribution.
4 Cerebellar involvement.
5 Paralexia in left sided tumours.

The characteristic feature of these tumours is its paroxysmal and intermittent nature [2]. The slow growth and compensation or accommodation that takes place due to fluid space, leads to delay in presentation until the tumour attains large size [2,9]. This delay from first symptom ascribable to the lesion to clinical presentation varies from few months to several years. We had a mean interval of 10.4 months. In comparison, Liu et al., and Nakamura et al., reported 15 days to 10 years and 4 days to 2 years respectively, whereas Fornari et al., noted a 36 month interval to presentation [2,5,10].

The majority of symptoms at the time of presentation are usually secondary to raised intracranial pressure, such as headache, vomiting and altered sensorium, in up to 40–70%, CSF flow obstruction or direct compression of brain structures [2]. Sensorimotor deficits, gait ataxia, cognitive impairment are noted very often along with dysphasia, dyscalculia, dyslexia and dysgraphia depending on the side of location of tumour. Visual field deficit and seizures are seen in large tumours [2,4–6].

Headache and memory disturbances was present in over 50% of patients in our study followed by giddiness (33.3%), social apathy and hearing loss, similar to Nakamura et al., who noted a frequency of 38.5% for headache and memory disturbances and of 23% for giddiness [2]. Personality change in patients was noted in 38% of patients by Fornari et al., and in 16.6% of our patients [10].

Clinical presentation, however, in most of these patients was brought on by non-localising features related to raised ICP. This was true of all our patients. In comparison, Nakamura et al., had it in only 23% of lateral ventricular tumours, Liu et al., in nearly 50% and Bertalannffy et al., in 86% of their cases respectively, whereas Menon et al., had it in 66% of their cases [2,4–6]. Homonymous hemianopia was another common presentation which occurs due to the involvement of the optic radiations that lie inferior and lateral to the trigone. This occurs due to direct compression by tumour or localized ventricular enlargement [2,11]. 25% of our patients presented with visual field defects where as it varied from 38% to 46% in literature [2,4,6,10]. Hemiparesis was noted in 50% of patients in our series. This varied in literature from 30% to 50% [2,4,6]. Incidence of seizures was noted in our series to be high at 41.6%. Variable incidence has been noted with Menon et al., and Guidetti et al., reporting up to 25% whereas Fornani et al., and Bertalannffy reporting seizure occurrence in 7–11% respectively [4,6,10,12]. Altered sensorium was another form of emergency presentation, noted in 3 patients in our series.

Radiological features: Magnetic resonance imaging is diagnostic in intraventricular meningiomas. While they are hyper- to iso-intense on T_1W and hyper-intense to cortex

on T_2W images, fibroblastic menigiomas are characteristically hypo-intense on T_2W imaging. They are also diffusely enhancing on contrast imaging. Cystic degeneration and necrosis may be seen [5]. Signal flow voids represent calcification and were noted in periphery in 2 of our cases and diffuse in one patient with psammomatous meningioma. Haemorrhage within an intraventricular meningioma, a rare presentation, was seen in one of our patients. Subarachnoid haemorrhage is a rare manifestation and can mimic an aneurysmal bleed [5,6,13]. These tumours have a left side preponderance which was reflected in our series (83.3%). Magnetic resonance spectroscopy can also be helpful adjunct as it shows a choline peak with suppressed N-acetylaspartate and phosphocreatinine. More significant is an alanine peak with high alanine to phosphocreatinine ratio [13–16].

Angiographic confirmation usually helps identify the feeding vessel. The usual supply to temporal horn tumours is from the anterior choroidal artery whereas posterior and anterior choroidal arteries supply atrial lesions. In our series, only one lesion had angiography done and the predominant feeder was the anterior choroidal artery. Angiography may not be needed in moderate sized lesions but may be helpful in locating the perfusing vessels for surgical localization. The venous drainage of these lesions as noted on angiography is usually into the vein of Galen or through the internal cerebral vein or the basal vein of Rosenthal [12,14].

Surgical approach: A range of approaches have been described for lateral ventricular meningiomas. The key considerations are

- Location of tumour: dominant lobe, eloquent cortex, size of lesion, shortest route, extension into other lobe.
- Tumour factors: size, the extension of lesion beyond the trigone and vascularity.
- Risk avoidance: to speech, visual fields and cognitive function [15].

The optic radiation fibres originate from the lateral geniculate body and course over the roof and lateral wall of the temporal horn and along the inferolateral aspect of the atrium [3,11]. Hence field defects in the form of a homonymous hemianopia or a quadrantonopia as a result of injury to this location during surgery commonly occurs. The tumour may itself grow to invade the parenchyma or compress the parenchyma against the cortical surface with tumour lying just under it. Majority of these lesions are firm and moderately vascular.

Though the optimal trajectory for these tumours remain controversial, the approaches commonly employed are as following [7]:

- Trans-parietal
- Trans-temporal
- Interhemispheric parieto-occipital precuneus
- Endoscopic

The parieto-occipital approach can either be high convexity approach or a more lateral/inferior parietal approach. The approach, even more so the inferior parietal approach, is suited very often as it is the thinnest region overlying the trigone and hence the lesion. However, in the inferior parietal approach the visual fibres would be damaged and retraction injury to the angular gyrus may cause apraxia, agraphia, alexia and Gerstmann's syndrome in the dominant hemisphere, and impairment of retention of visual memory or spatial perception in the non-dominant hemisphere besides sensorimotor deficits and seizure.

The higher parieto-occipital approach follows a cranio-caudal direction away and parallel to the occipital radiation avoiding visual field deficits. Early control of feeding vessels is not possible in this route, and adequate de-bulking of tumour is needed to gain visual access to the vascular pedicle. Attempts to control feeding vessel earlier, may result in undesirable brain retraction and its sequelae [7,8,15,17]. In our study, even the high parieto-occipital approach was associated with one (8.3%) incidence of homonymous hemianopia which may have been due to surfacing of the lesion and consequent splaying of the visual fibres.

The most suitable approach to reach the pedicle first, would be through the temporal horn. It is even more fitting where there is a trapped temporal horn or hydrocephalus. The retraction is less and access is easier. Tumours which are moderate sized and confined to the ventricle, especially in the antero-inferior portion of the trigone or those extending into the posterior third of the temporal horn are often suited for this approach. Approach related injury to the visual fibres resulting in inferior quadrantonopia can be avoided if the dissection is parallel to the white fibre tracts. Another peril would be speech related disturbances like anomia and sensory aphasias of various types in the dominant hemisphere [7]. Whereas in the non-dominant, it would be disturbances in emotional speech recognition. The approaches would be via the middle or inferior temporal gyrus or via the posterior sylvian or superior temporal sulcus whichever is wider. An approach through the inferior temporal lobe/collateral sulcus is less damaging but carries risk of temporal lobe retraction injury and injury to the vein of Labbe [2,8–1015,18].

In medium or small sized tumours in the dominant side, an interhemispheric-precuneus-transcortical approach or a superior transparietal approach would be suitable which being behind and medial to sensori-motor cortex avoids speech disturbances. On the non-dominant side, an inferior temporo-parietal approach can be used with less risk of speech disturbance and early control of tumour feeder. In especially medium and small sized tumours these approaches, with aided frameless stereotaxy, can be used to secure a safe trajectory [2,8,17].

Functional MRI and tractography have been accepted as present standard of care. Functional MRI rests on the principle that blood flow to a specific region of brain is coupled to its activity, whereas tractography uses diffusion-weighted data to generate 3D models of fibre tracts of brain [19,20]. Thus, where available, these studies may help in delineating the eloquent areas of brain and visualising how the fibre tracts are oriented with respect to the tumour and the chosen trajectory which may then be optimised to minimise deficits. Awake craniotomy may also help in keeping deficits, such as dysphasia, to minimum.

5. Conclusion

Trigonal meningiomas are rare tumours with delayed clinical presentation. Usually they present with features of raised intra cranial pressure which occurs much later than the initial herald symptom which are usually ignored by the patient. Various authors have cited preferences regarding surgical approach but what remains a common denominator is that the shortest route to the tumour would be the first choice. We found the incidence of deficit is low even in the dominant hemisphere and even through eloquent area, with the ''shortest route'' approach. This may be secondary to possible shift of eloquent area function due to long-standing lesion. While we agree with role of functional MRI in these patients as standard of care, and the number of patients is not large to draw statistically strong conclusions, the evidence from our series leads us to believe that the shortest route may be a ''workable'' surgical option especially in resource-limited centres where such resources as neuronavigation and tractography may be unavailable and/or referral to a suitably equipped centre may not be feasible.

Funding

None declared.

Conflict of interest

None declared.

Acknowledgement

None declared.

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