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Intraventricular Meningioma

A Review of 10 Cases of the National Hospital, Queen Square (1974–1985) with Reference to the Literature

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Summary

Ten patients with histologically verified intraventricular meningiomas were treated between 1974 and 1985. There were eight female and two male patients, ranging in age from 25 to 72 years with a mean age of 45.5 years. Headache and disturbed mentation were the most common presenting symptoms whereas corticospinal disturbance, altered mentation and homonymous hemianopia were the most common signs on formal neurological examiantion. Papilloedema was demonstrable in 50% of cases and evidence of dysphasia was apparent in 60% of patients with lesions affecting their dominant hemisphere. A single instance of drop attack occured in a patient harbouring a third ventricular meningioma.

Computed tomography, with and without contrast enhancement, and angiography were employed in all cases and proved highly sensitive and specific for tumour localisation and tissue diagnosis. In addition, angiography proved invaluable in demonstrating both vascular supply and the effects imposed upon the surrounding cerebral vasculature by tumour mass and hydrocephalus. Nine tumours occured in the lateral ventricular trigone of which 5 were left-sided. A tenth tumour was located in the third ventricle.

Twelve resections were performed in 10 patients. One patient was found to have a highly malignant cystic meningioma which recurred within 10 weeks of the original surgery and proved fatal shortly thereafter. A second patient whose initial resection was subtotal had a recurrence 3 years postoperatively which was totally resected. Lesions were approached most commonly through the posterior middle or posterior inferior temporal gyri. On 3 occasions a right posterior middle frontal gyrus approach was used and in one case a posterior parieto-occipital cortical incision was employed.

Operative mortality was naught. Case mortality was 10% secondary to a highly malignant tumour. Two patients had an excellent result and six patients had a good result. One patient had substantial memory difficulties after removal of a third ventricular tumour via the transfrontal-transventricular approach. Postoperatively one patient required an internalised CSF shunt and another developed small subdural and intraventricular haemorrhages requiring evacuation and external ventricular drainage with good recovery. Pre-existing visual field deficits improved in 2 cases and in one instance a new hemianopic defect was induced by surgery. Homonymous hemianopia was the most common postoperative neurological sign. Mental status and corticospinal signs invariably improved. Two patients required continued anticonvulsant therapy. One patient required intranasal DDAVP as a result of hypothalamic diabetes insipidus which preceded surgery and has not resolved.

Keywords: Meningioma; intraventricular tumour; CT scan; surcical treatment.

Introduction

Meningiomas are relatively common and almost invariably benign tumours accounting for 14–18% of intracranial neoplasms [15, 48]. They are known to occur in a variety of locations throughout the cranial vault and spinal canal where they are intimately associated with dural and leptomeningeal membranes. In contradistinction, meningiomas occuring primarily within the ventricular system and without dural attachment are notably rare. Summarising 313 cases of meningioma from Johns Hopkins and Harvard, Cushing and Eisenhardt [15] reported only 3 cases within the ventricles for an incidence of 1%. Series reported since then [23, 30, 44, 54] have confirmed an incidence of 0.5% to 3%. Our cases are derived from 500 meningiomas for a 2% incidence. Contrasting these figures are the reports of Merten *et al.* [41] and Sano *et al.* [52] confirming a 1–2% incidence of intracranial meningiomas in childhood but demonstrating the relative preponderance of intraventricular meningiomas representing 15.5% of this group. Other series comparing their occurrence relative to other intraventricular tumours are of interest. Zülch [60] in 1955 reviewed 6,000 brain tumours and found the diagnosis of meningioma accounted for 9.8% of the 41 intraventricular tumours described. Kendall [32] repor-

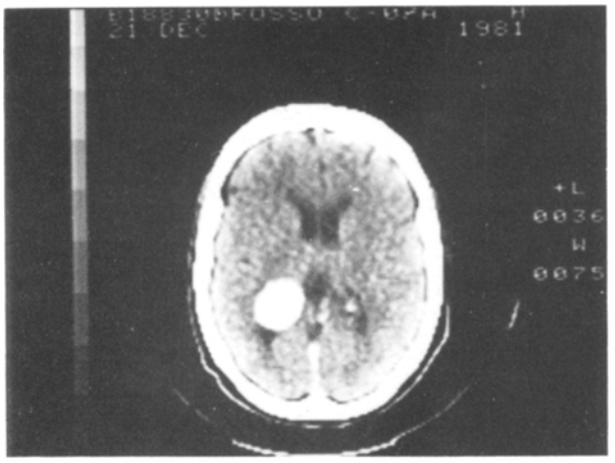

Fig. 1. Enhanced CT illustrating the characteristic appearance of a typical non-macrocystic trigonal meningioma

ted a 14% incidence from amongst 90 histologically verified intraventricular tumours.

The advent of computerised tomography has greatly enhanced our ability to precisely localise these tumours. Combined with angiographic data, a histological diagnosis can be made in all but the most unusual circumstances. In centres where these modalites are readily available they have obviated the need for plain skull films, isotope brain scans and pneumoencephalography. Electroencephalography remains useful in patients presenting with seizures or developing them postoperatively.

Operative mortality has been variably reported between 0 and 50% [4, 19, 23, 31, 39]. Olivecrona [45] reported a 27.7% mortality and case reports since 1971 vary from 0 to 22% [23, 26, 31, 39]. Our series reports no operative mortality and minimal morbidity with most patients showing substantial improvement during the early postoperative and follow-up periods. We attribute this largely to the contributions of the operating microscope, which greatly facilitates meticulous surgical technique, as well as vastly improved imaging techniques which have aided preoperative assessment and planning.

This study documents the results of surgical resection of 10 intraventricular meningiomas presenting to the Gough-Cooper Department of Neurological Surgery in the National Hospital, Queen Square from 1974 to 1985. Comments based upon an extensive review of the literature are made where applicable.

Materials and Methods

Ten patients with intraventricular meningioma have been evaluated and treated in the Academic Department of the National Hospital, Queen Square between 1974 and 1985. Professor Lindsay Symon operated upon all but one case which in turn was operated upon by Professor Valentine Logue. Twelve resective procedures were performed on 10 patients using the operating microscope, microsurgical instrumentation and microtechnique. General anaesthesia was used in all cases and controlled hypotension was judiciously employed as necessitated by the degree of tumour vascularity. All tumours were resected in a piecemeal fashion. Patients routinely received pre- and postoperative antibiotic prophylaxis. None of the cases were complicated by infection. Dexamethasone was routinely used preoperatively and discontinued in the early postoperative period. Anticonvulsant medication was also used prophylactically and in all but 2 cases was discontinued without sequelae after 12 months. Follow-up results are classified into 4 groups:

Group I: Excellent result, no neurological abnormality, uneventful course of life.

Group II: Good result, minimal neurological abnormality, not handicapped in every day life.

Group III: Poor result, distinct neurological abnormality, handicapped in every day life.

Group IV: Death.

Clinical Features

The most common mode of presentation in this series included symptoms related to elevated intracranial pressure. Duration of symptoms prior to hospitalisation varied widely from 2 weeks to 18 years. One reason for this appears to be the non-specific, transitory or episodic nature of many of the complaints. These findings are in agreement with most series reported previously [1, 7, 15, 17, 24].

Table 1 characterises the primary symptoms at presentation. Nine patients complained of headache which was usually intermittent but sometimes progressive. Intensity varied considerably from mild to severe and lateralisation was exceptional with most patients describing a bifrontal or occipital distribution. Disturbed mentation occurred in 5 patients and in-

Table 1. *Symptoms in 10 Patients with Intraventricular Meningioma*

Symptom	No. of cases
Headache	9
Disturbed mentation	5
Gait disturbance	4
Nausea and vomiting	3
Visual disturbance	3
Motor disturbance	3
Drop attack	1*
Excessive thirst	1*
Incontinence	1*

* All occurred in the patient with a third ventricular tumour. In 5 cases symptoms were clearly episodic.

cluded memory disturbance, particularly for recent events, confabulation, mental exhaustion, aggressive behaviour, dullness and decreased verbal output. In one instance irrational and confused behaviour resulted in admission to a mental hospital where diagnostic evaluation revealed a dysphasic patient with a left trigonal tumour. Gait disturbance occurred commonly but was fairly non-specific and often described as a feeling of unsteadiness. Motor disturbances were not profound and were more often described as a sense of uni or bilateral stiffness resulting in a progressive decrease in mobility. Visual disturbances included a single case of progressive visual blurring and 2 cases in which transient episodic visual obscurations were described. In our single case of third ventricular meningioma excessive thirst, incontinence and a drop attack preceded by severe headache, nausea and vomiting were symptoms suggestive of hypothalamic disturbance and intermittent acute hydrocephalus. It should be noted that episodic disturbance of one type or another characterized one half of our patient's initial symptoms.

Table 2 lists the case frequency of a variety of clinical signs apparent on initial neurological examination. Corticospinal disturbances were detected in 9 patients and varied from frank spastic hemiparesis to mild hyperreflexia or an extensor plantar response. Evidence of disturbed mentation was quantifiable using formal psychometric testing. These methods demonstrated a definite impairment in verbal performance and intellectual function in all cases with altered mental status as an initial complaint. An additional 3 patients without specific mental performance complaints were found to be at least mildly impaired. In one instance of a male with a right-sided trigonal tumour, psychometry revealed a bright average verbal I.Q. and a very defective performance I.Q. Poor spatial and perceptual integration were readily identifiable and proved quite consistent with a tumour compressing the non-dominant temporoparietal region. This technique was also useful for postoperative follow-up. Homonymous hemianopia was the most common ophthalmological finding and occurred in 7 patients preoperatively. Papilloedema was noted in 5 patients of which 4 had headaches. Although dysphasia was only apparent in 3 patients its actual frequency in dominant hemisphere lesions was 60%. Two of these patients were right-handed with left trigonal tumours.

Table 2. *Signs in 10 Patients with Intraventricular Meningioma*

Sign	No. of cases
Corticospinal disturbance	9
Disturbed mentatation	8
Homonymous hemianopia	7
Papilloedema	5
Dysphasia	3*
Parietal spatial disturbance	1**
Parietal sensory disturbance	1
Hypothalamic disturbance	1***
Ataxia	1

* 60% of patients with dominant hemisphere tumours.
** 25% of non-dominant parietal tumours.
*** Evidenced by diabetes insipidus and hypernatraemia.

The third patient had a right trigonal tumour. It is of some interest that the latter case was that of a female who was always left-handed presumably as a result of mild cerebral palsy with congenital right hemiparesis and a decorticate right upper extremity posture. Hypothalamic disturbance as evidenced by increased thirst, incontinence perhaps secondary to polyuria, and hypernatraemia were apparent in our case of third ventricular tumour.

We are in agreement with other authors as to the non-specificity of clinical signs and symptoms associated with these tumours. It appears likely however, that these patients will present with at least 2 or more of the signs and symptoms listed in Tables 1 and 2. Although this clinical picture may not suggest either a histological diagnosis or even a precise anatomical localisation, it is likely to alert the astute clinician of an ongoing intracranial disturbance warranting further diagnostic investigation.

Diagnostic Investigation

On October 23, 1918, Walter Dandy [16] performed the first ventriculogram on a patient presenting with evidence of intracranial hypertension. An intraventricular tumour was discovered and eventually identified as a meningioma. Since then a variety of ancillary investigations have been employed to aid diagnosis. In our series skull roentgenograms characteristically revealed evidence of chronic elevation of intracranial pressure with thinning of the lamina dura and erosion of the dorsum sellae and planum sphenoidal. Isotope brain scan proved highly sensitive to blood brain barrier breakdown, tumour vascularity and therefore anatomical localisation, however it was not instrumental in narrowing the differential diagnosis. Electroencephalography typically provided correct lateralizing data and also revealed characteristic frontal

Table 3. *CT Features of Intraventricular Meningioma*

Finding	No. of cases
Well-circumscribed mass	10
Deep, lateral trigonal location	9
Increased attenuation relative to brain	9
Marked homogeneous contrast enhancement	9
Almost invariably solid	9
Punctate calcification	5
Rim of peritumoural oedema	3

intermittent rhythmic delta activity (FIRDA) indicative of a deep cerebral disturbance.

Unenhanced and enhanced computed tomography is currently the safest, most expeditious and certainly the most accurate modality for diagnosing these tumours [38]. It was performed in all of our cases and proved 100% sensitive for tumour anatomy and location and 90% specific for histological diagnosis. In one instance the exceedingly uncommon occurrence of a macrocystic meningioma within the ventricular system led to a misdiagnosis of malignant glioma. The literature also comments upon this common error when dealing with one of these rare lesions [46]. Table 3 lists the CT features characteristic of the intraventricular meningiomas in our series. They are in agreement with those enumerated by Kendall *et al.* [32].

Angiography was performed in all cases and technique varied from injection of 1 carotid to performing a 4-vessel study. Most authors are in agreement as to the wisdom of performing at least ipsilateral vertebral as well as carotid injections [23, 32, 38]. The rationale for this derives from the fact that most tumours obtain their vascular supply from both anterior and posterior choroidal circulations and, in rare instances, are supplied solely by the choroidal or thalamoperforating branches of the posterior circulation. Table 4 lists the most characteristic angiographic findings in our series.

Table 4. *Angiographic Features of Intraventricular Meningioma*

Finding	No. of cases
No evidence of external carotid supply	10
Neovascular blush	9
Anterior choroidal artery supply	9
Evidence of hydrocephalus	9
Venous drainage into the Galenic system directly or via the basal vein of Rosenthal	8
Inferior displacement of the posterior cerebral artery	5
Inferior displacement of the internal cerebral vein	4
Distortion of the Sylvian triangle	3
Medial posterior choroidal supply	3
Lateral posterior choroidal supply	3
Partial supply by lenticulostriate or thalamo-perforating vessels	3

Neurosurgical Approach

A variety of surgical approaches can be employed depending largely upon the surgeon's personal experience. Choice of the best approach depends upon the careful analysis of imaging results, particularly the arterial and venous anatomy. This is best accomplished using conventional as well as stereoscopic views. Essentially the optimal approach is that which affords superior anatomical exposure of the tumour and its vascular supply. Of equal importance is to achieve exposure with minimal disruption and retraction of immediately surrounding, functionally normal cerebral tissue. Preoperative antibiotics, corticosteroids and anticonvulsants were used in all cases. The operating microscope was used routinely and all tumours were removed in a piecemeal fashion with early visualisation and interruption of the primary vascular feeders. Our preferred approach traverses the posterior middle or inferior temporal gyrus when tumours are trigonal and the posterior middle frontal gyrus for third ventricular lesions.

Under general anaesthesia the patient is placed in a standard or modified park bench position. A scalp flap in the mid-temporal area is created by a curvilinear incision extending from in front of the ear upwards toward the superior temporal line and downwards to a point 2 or 3 cm behind the asterion. A five burr hole temporal flap is turned and using the ronguer a subtemporal decompression is performed in order to expose the floor of the middle temporal fossa and anterior aspect of the lateral sinus. The dura is incised in a triradiate fashion and a ventricular needle is passed into the posterior aspect of the middle temporal gyrus. This serves both as a probe for determining the relationship of the tumour to the ventricular cavity and as a means of decompressing any existing hydrocephalus. Alternatively, preoperative internal CSF shunting or external ventricular drainage may be employed for decompression. Once in contact with the tumour the needle probe acts as a useful guide for dissection by introducing narrow forceps into its tract. A linear cortical incision is made and self-retaining retraction is

used to gently spread the incision as we proceed inwards. The considerable size these tumours attain often proves a hindrance to immediate clipping of their vascular pedicle. A combination of mild hypotension and loop diathermy will provide a well-controlled internal decompression and vastly expedite exposure. In our experience most tumours have a vascular supply emanating from both anterior and posterior choroidal arteries. Of note is the observation that posterior choroidal supply is often derived from multiple small branches and appears secondary in comparison with the commonly occurring large, tortuous and single anterior choroidal branch. Taking this into account the initial tumour exenteration is following by clipping of the anterior choroidal pedicle. The microscope is of greatest use in facilitating the medial dissection of the tumour where it may be adherent to the choroidal fissure, posterior cerebral artery and brain stem. At this juncture the multiple small posterior choroidal contributions are carefully exposed and clipped. With further debulking the medially running draining veins come into view and are clipped en route. The remaining tumour is then excised and the anaesthetist is asked to elevate the blood pressure to its normal preoperative level. A period of observation for any potential breach in haemostasis is followed by dural closure, bone flap replacement and scalp suturing in 2 layers. Continuous subgaleal suction is carried out for 48 hours postoperatively.

Results

There was no operative mortality in performing 12 resections upon 10 patients. One case mortality occurred in the setting of a highly aggressive malignant meningioma which recurred during convalescence. In another patient a subtotal resection was complicated by a postoperative subdural haematoma and intraventricular haemorrhage. This patient was critically ill and required tracheostomy, haematoma evacuation and external ventricular drainage. She was nurtured to good recovery, had a recurrence 3 years later and subsequently underwent complete resection without complication. Two patients continue to require anticonvulsant therapy. One of these had a seizure disorder since 18 years preoperatively. Eight patients discontinued their anticonvulsants 12 months postoperatively without sequelae. The most common neurological deficit on follow-up was a visual field disturbance. Headache, corticospinal dysfunction, impaired mentation and papilloedema invariably resolved. Two cases of homonymous field defect resolved or improved. One new hemianopia was introduced and in one patient memory was worse postoperatively. Eight patients of nine survivors are leading normal acive lives. Adhering to the previously mentioned outcome scale we have 2 patients in group I (excellent), 6 patients in group II (good) with visual field defects only, 1 patient in group III (poor) with impaired memory and diabetes insipidus and 1 patient in group IV (death).

Discussion

History and Tumour Location

The first description of an intraventricular meningioma has been attributed to Shaw [53] who in 1854 described an encapsulated fibrous tumour occurring in the right trigone. A left trigonal tumour was reported by MacDowell [37] in 1881. Cushing and Eisenhardt [15] reported a case of third ventricular meningioma and commented on a case from Earnest Sachs who reported a "plexus type" meningioma of the fourth ventricle. In addition, they enumerated 11 personal cases of macrocystic meningioma and commented upon an unpublished case of Dr. T. I. Hoen's which described the only case of macrocystic intraventricular meningioma reported in the literature until now. In 1965 Delanheer [20] summarised the literature concerning lateral ventricular meningiomas, then 175 cases in total. Owing to the efforts of a number of authors since that time we have found the current total of trigonal meningiomas to approximate 319 cases [4, 11, 22, 23, 25, 26, 28, 31—33, 38, 41, 52, 57]. Markwalder [39] and Cabezudo [8] summarized 60 cases of third ventricular meningioma reported up to 1981. To

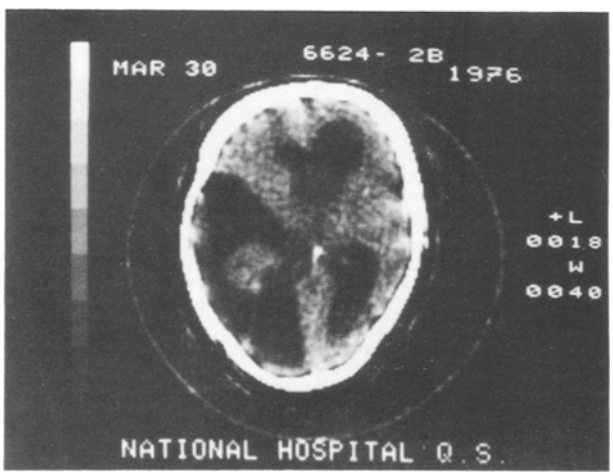

Fig. 2. Unenhanced CT scan of patient showing a huge peripheral extratumoural cyst corresponding to type 3 as defined by Nauta *et al.* [43]

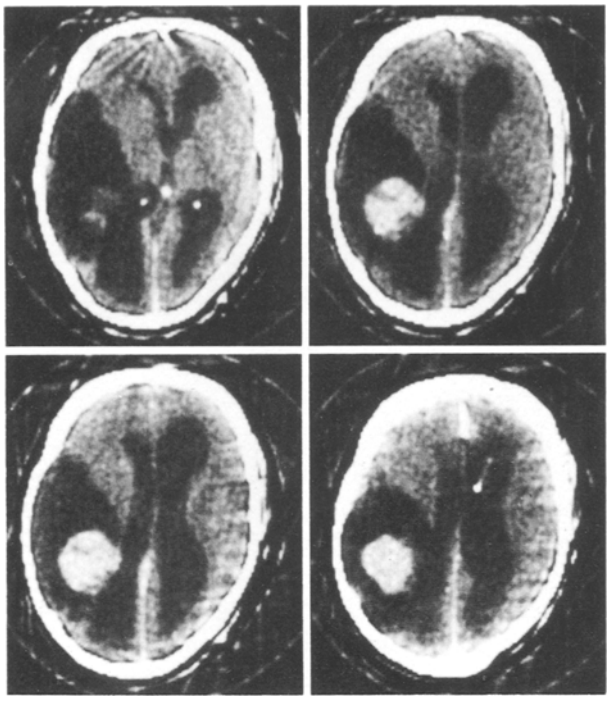

Fig. 3. Enhanced CT scan of the same patient showing marked homogeneous enhancement of a trigonal tumour

this we would add our own and a case from Wakai *et al.*[58] from 1984 for a total of 62. Tsuboi *et al.*[56] summarised 15 cases occurring in the fourth ventricle to which we can add 4 from the literature[8, 9, 25, 33] bringing the total to 19. Parisi *et al.*[46] recently reviewed the world literature on macrocystic meningiomas and found 58 cases none of which were intraventricular. Further perusal of the literature revealed 4 additional cases[15] to which we are adding 2 of our own. In short we have been able to identify 400 cases of intraventricular meningioma in the world literature to date. Of these, 80% have occurred in the lateral ventricular trigone, 15% in the third ventricle and 5% in the fourth ventricle. Not surprisingly, less than 1% of these tumours are reported as being macrocystic.

Gender and Age Factors

Past experience with meningiomas has made apparent a propensity for occurrence in female patients[15, 45, 48, 50]. This observation is not disputed by our small series where 8 out of 10 patients are female. The literature on intraventricular meningiomas varies widely in reporting from 41% to as high as 82% representation by females[4, 10, 19, 23, 31, 33, 38, 39, 57]. Values on either extreme can be expected from small series. A personal review of Delandsheer's[20] collection of 175 cases and 130 additional cases since 1965 where gender was reported yields a 62% representation by females. Information concerning third and fourth ventricular tumours is necessarily scanty but reports to date suggest a 54% female[8, 39] and 59% female[10, 33, 56] preponderance respectively. The mean ages corresponding to these locations are 28.7 years and 35.7 years respectively. The mean age reported for lateral ventricular tumours varied from 20 to 50 years. Our figure of 45.7 years conforms with the expected. Kendall[32] of this institution provided information useful in the differential diagnosis of intraventricular tumours. He found the mean ages at presentation were for choroid plexus carcinoma (less than 3 years), choroid plexus papilloma (5.2 years), glioma (18.5 years) and colloid cyst (42.3 years).

Sidedness

The sidedness of lateral ventricular meningiomas has occasioned considerable controversy in the past. Once again, it would be prudent to adhere to cummulative data rather than individual reports. Combining the pre-1965 series[20] with those reported since[4, 19, 23, 26, 31, 33, 38] we have accrued 285 cases where sidedness is reported. Clearly 168 of the tumours occurred in the left trigone yielding a 59% left-sided preponderance. Table 5 summarises the aforementioned figures.

Table 5. *Cummulative Data on 400 Intraventricular Meningiomas from 1854 to Present* *

Parameter	Lateral ventricle	Third ventricle	Fourth ventricle
Mean age	35.9 years **	28.7 years	35.7 years
Gender	62% female	54% female	59% female
Sidedness	59% left	NA	NA
Location	319 (80%)	62 (15%)	19 (5%)

* Ref. no. 4, 8–11, 20, 22, 23, 25, 26, 29, 31–33, 38, 39, 41, 49, 52, 56–58.

** Ref. no. 4, 20, 26, 28, 31, 34, 38 (305 cases).

Signs and Symptoms

The principal clinical features produced by intraventricular meningiomas regardless of their location are related to increased intracranial pressure. These tumours often grow to an enormous size before they are discovered and referred to a neurosurgeon. This fact is reflected in the duration of illness prior to presentation which was 18 years in one of our cases. Changes in the

cranial vault indicative of chronic intracranial hypertension lend credence to the indolent growth of these neoplasms which allow the surrounding cerebral tissue, blood and CSF volume to accommodate gradually in accordance with the Monro-Kellie hypothesis. Once compensatory compliance is exceeded clinical decompensation occurs. This process can occur rather abruptly in the setting of an acute obstructive hydrocephalus secondary to the ball-valve phenomenon which Dandy proposed [17]. This particular set of circumstances results in acute severe headache, vomiting, loss of consciousness and, in some, coma or sudden death. Chronic hydrocephalus accounts for intellectual blunting and gait unsteadiness.

In 1938 Cushing and Eisenhardt [15] described in their classical manuscript a lateral ventricular syndrome characterised by:

1. Elevated intracranial pressure with headaches lateralising to the side of the tumour.
2. Homonymous hemianopia with macular bisection.
3. Contralateral sensorimotor deficit with emphasis on impaired sensation, occasionally in the trigeminal distribution.
4. Cerebellar symptoms in more than half the cases.
5. Exacerbation of preexisting "paralexia" postoperatively in most cases of tumour localized to the dominant hemisphere.

They also described 4 cases in which sensorineural hearing loss was a feature and suggested compression of the corpora quadrigemina as a possible aetiology. A single case of third ventricular meningioma was described in that treatise (Annie M., case # 289). This young lady presented with a hypothalamic syndrome which included adiposity, amenorrhea, spells of hypersomnia and polydipsia. She also developed progressive visual failure and was found to have frank papilloedema. A review by Ladenheim [34] of 50 cases of lateral ventricular meningioma noted a 13% occurrence of hypothalamo-hypophyseal dysfunction. Gassel [24] also emphasised the episodic or paroxysmal nature of symptoms occurring in 55% and noted that postural exacerbations were neither uncommon nor limited to those rare cases of third ventricular tumours. Patients presenting with hypertonic cerebellar convulsions [3] and Parkinsonism [58] are described.

Diagnosis

The diagnosis of intraventricular meningioma is readily confirmed by computed tomography and angiography. Current recommendations include pre- and postcontrast CT scans in addition to ipsilateral carotid and vertebral injections. Stereoscopic angiographic imaging provides the surgeon with three-dimensional visualisation of the relevant vasculature.

Operative Approach

Approaching the tumour via a curvilinear temporoparietal incision was advocated by Cushing [15] in 1938. Busch [7] reported on the utility of a transfrontal approach. Olivecrona [45] stated a preference for a posterior middle temporal gyrus approach recommended previously by De la Torre [19]. In 1960 Cramer [13] alluded to the merits of a posterior parieto-occipital incision but this technique was actually championed by Fornari *et al.* [23] in their 1981 series. Kempe and Blaylock [31] advocated an approach through the posterior corpus callosum and splenium. Jun and Nutik [28] in 1985 recommended modification of the transcallosal approach. They proposed that partial sectioning of the splenium from the right side would facilitate preservation of ventrally located interhemispheric visual association fibres thus reducing the risk of a visual-verbal disconnection syndrome.

Our personal experience favours the posterior middle temporal gyrus and posterior middle frontal gyrus in approaching trigonal and third ventricular tumours respectively. The exceedingly rare fourth ventricular tumour can be managed employing a trapezoidal posterior fossa craniectomy and trans-vermian approach to the ventricle. Although the lateral temporoparietal incision provides best access to the tumour, the blood supply is much less accessible and postoperative language deficits occur not infrequently. The posterior transcallosal incision is useful to approach tumours occupying the middle body of both lateral ventricles but alexia without agraphia has been reported by Levin [36] in a case in which the splenium was incised from the left side. A posterior inferior temporal gyrus incision offers adequate vascular and tumour access but is likely to damage Meyer's loop resulting at least in a quadrantanopia. A new hemianopic defect was induced in one of our patients approached in this manner. Occipital corticotomy or lobectomy offer good trigonal exposure, poor vascular access, a definite congruous homonymous hemianopia, and dyslexia if carried too far anteriorly. The posterior middle frontal and posterior middle temporal approaches in our opinion offer exemplary exposure of anterior and posterior lateral tumours respectively. In addition superior access is gained to the anterior choroidal artery and very good access to both anterior and

posterior choroidal circulations is afforded by the latter. Postoperative visual field deficits are minimized as the incision parallels the visual projection fibres, however language deficits remain a possibility with left-sided tumours.

Neuropathology

In accordance with the currently accepted criterea [6, 12, 50] our cases have been histologically verified as being meningiomas of the meningotheliomatous (5), angiomatous (3), fibroblastic (1) and malignant (1) varieties. The latter tumour was grossly cystic on CT scan and intra-operatively was found to contain xantho-haemorrhagic fluid. (Compare Fig. 1 with Figs. 2 and 3).

Comment

The literature provides ample evidence of the precipitous fall in morbidity and mortality associated with these rare tumours and their management [23, 27, 31, 39]. Markwalder *et al.* [39] reported an overall mortality of 50% for third ventricular meningiomas but noted a drop to 0% mortality in the 6 cases presenting since 1973. The advent of computed tomography and improved angiographic techniques allow for an earlier and more precise diagnosis. Operative microscopy and microsurgical technique have had a decidedly significant influence as have improved neuroanaesthetic techniques. Whether magnetic resonance imaging, laser microsurgery or the ultrasonic aspirator will make similar contributions to the management of these tumours remains to be determined.

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