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TECHNICAL NOTE - NEUROSURGERY GENERAL

A new technique of endoscopic decompression of suprasellar craniopharyngioma cyst

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Abstract

Introduction Craniopharyngiomas represent a unique management challenge. Aggressive surgical management has traditionally been associated with high rates of morbidity. Modern surgical techniques, and increasing practice of subtotal resection followed by radiosurgery, have reduced morbidity and mortality rates. One cause of postoperative morbidity, and indeed mortality, is aseptic meningitis from spill-out of craniopharyngioma cyst contents. We have developed a surgical technique for the management of large craniopharygngioma cysts extending into the third ventricle, to reduce this risk.

Methods We describe a technique of using an epidural catheter, inserted into the working channel of a neuroendoscope, to decompress the cystic portion of a craniopharyngioma cyst before opening the cyst wall widely, preventing spill-out of large volumes of cyst content into the ventricular system.

Results We have had no cases of aseptic meningitis, nor any complications, from use of the described technique.

Discussion We believe that this is a safe and effective technique of decompression and fenestration of large suprasellar craniopharyngioma cysts that reduces rates of aseptic meningitis and the associated morbidity and mortality from this.

Keywords Craniopharyngioma · Endoscopic · Fenestration · This article is part of the Topical Collection on *Neurosurgery General*

Introduction

Craniopharyngiomas are benign extra-axial epithelial central nervous system tumours of the parasellar region. They arise from remnants of Rathke's pouch, anywhere along the obscured craniopharyngeal duct from Rathke's cleft to the floor of the third ventricle. Craniopharyngiomas account for 1–3% of intracranial tumours [1], with higher incidences in Africa, the Far East and Japan [2]. They have a bimodal age distribution, with one peak of incidence in children between 5 and 14 years and a second in adults between 50 and 75 years of age. There is no sex predilection [3].

Craniopharyngiomas are histologically benign tumours with two subtypes, adamantinomatous (ACP) and papillary (PCP) [4]. The former are more common in children, and more common overall, and the later found more frequently in adults. ACP are typically mixed solid and cystic lesions with visible calcification on conventional imaging and intraoperatively. Cystic fluid contains lipids, cholesterol crystals and proteins; it has a motor-oil-like appearance. There are multiple reports of aseptic meningitis caused by rupture of craniopharyngiomas, either spontaneously or at the time of resection. The inflammatory response can be severe enough to trigger vasospasm, which can lead to death [5]. PCPs are usually solid lesions, which are better circumscribed and rarely calcified. When they are cystic, contents are typically clear [6]. The outcomes of the two, in terms of treatment feasibility (surgery, radiation) and overall survival, are similar.

Craniopharyngiomas, whilst histologically benign, can be the cause of significant morbidity due to mass effect on surrounding structures and their intimate involvement with them. Patients present in a variety of ways. Visual symptoms, endocrine abnormalities and headache are common presentations. Management is multi-disciplinary with involvement from endocrinologists, neurosurgeons, opthalmologists and radiation oncologists. The mainstay of treatment remains surgery, aimed at relieving mass effect, establishing diagnosis and of course to remove as much tumour as possible. Choice of

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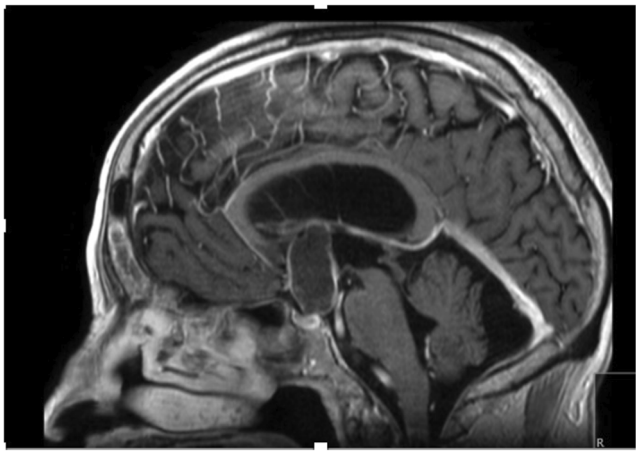

Fig. 1 Cystic craniopharyngioma extending into the third ventricle causing obstructive hydrocephalus

surgical approach depends on the location of the tumour and its associated cyst if present. They include transphenoidal, transcranial and endoscopic transventricular approaches. Purely intrasellar tumours can be removed endonasally, those with lateral or superior extension may require a pterional or interhemispheric approach, while those with extension of cyst into the third ventricle may require approach through the foramen of Monro [7]. Many tumours, particularly those with a large suprasellar cyst extending into the third ventricle, may require a staged surgical approach. First is to tackle the cyst and second the solid component of the tumour. While complete tumour resection is the goal, in many cases, this is not safely achievable, and therefore, some residual tumour capsule is deliberately left to try and avoid excessive morbidity. Radiation treatment is typically offered to those patients who have had partial resection or for those who have recurrent disease [8]. This is now most commonly in the form of radiosurgery [9, 10].

Ten-year survival rates are quoted at up to 85%. Survival rates in those with partial tumour resection are improved significantly by receiving postoperative radiation treatment [10], quoted as 91.5% and 83.9% at 5- and 10-year follow-ups [9] after radiosurgery. The highest survival rates are in those who have complete tumour resection, but as before, this must be balanced with the morbidity that can be caused by aggressive resection.

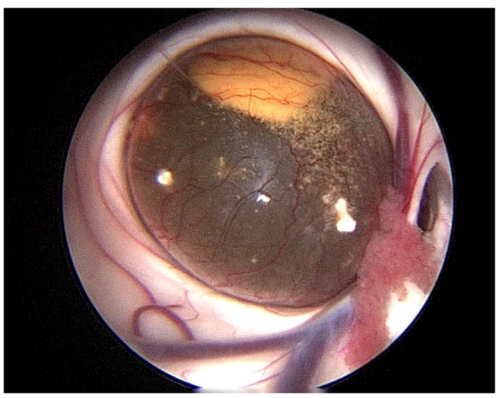

Fig. 2 Craniopharyngioma cyst filling the foramen of Monro

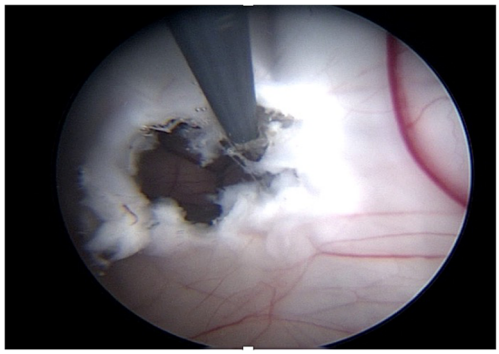

Fig. 3 Fenestration of the septum pellucidum using monopolar cautery

Cystic craniopharyngiomas can present a particular surgical challenge and, as outlined earlier, can require a staged approach. Spill-out of cyst contents into the ventricular system can cause aseptic meningitis, due to cholesterol granules inducing a chemically mediated inflammatory response. This can be severe enough to cause cerebral vasospasm [5] and is certainly thought to be a contributor to postoperative morbidity from craniopharyngioma resection [11]. We describe a surgical technique to minimise cyst content spill-out, and therefore occurrence of aseptic meningitis, in those patients with large suprasellar craniopharyngioma cysts extending into the third ventricle.

Methods and materials

The patients in whom we have used this technique have been those presenting with hydrocephalus secondary to a large craniopharyngioma cyst extending into the third ventricle (Fig. 1). Our strategy for those patients is to firstly manage their hydrocephalus and decompress the cystic portion of their tumour endoscopically, and then to tackle the solid component of the tumour if feasible and indicated at a later stage.

An endoscopic ventricular approach is used. The patient is placed supine and registered to neuronavigation. After preparation and draping, a c-shaped mini-flap incision and burr hole is placed on the coronal suture, as for an endoscopic third ventriculostomy. We place a c-shaped mini-flap incision to ensure that when leaving on Ommaya reservoir, as we do for these cases, it is not directly under the skin incision. After corticotomy a Codman peel-away catheter is inserted to 5 cm, with outflow of CSF confirming entry into the lateral ventricle. The sides of the peel-away are pulled down and stapled

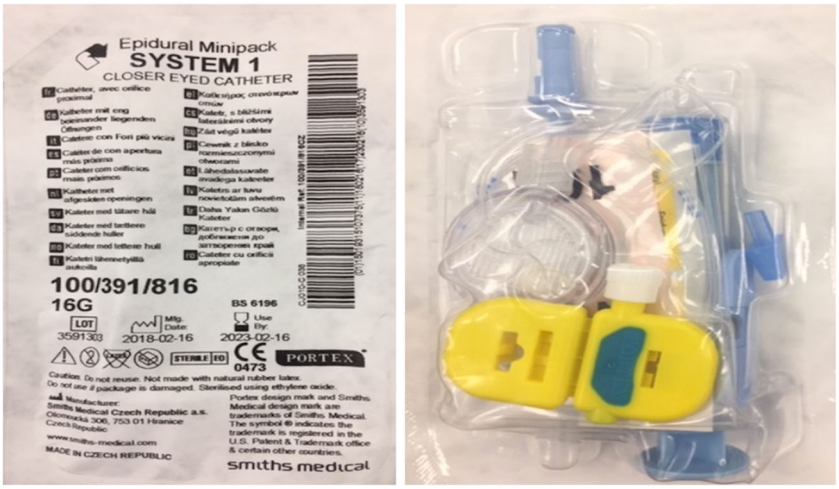

Fig. 4 Epidural closer eyed catheter (Smiths Medical)

to the skin. A rigid neuroendoscope (Karl-Storz Lotte) is inserted into the peel-away, connected to an HD video camera and screen. The ventricular system is navigated, identifying foramen of Monro, craniopharyngioma cyst and septum pellucidum (Fig. 2).

Prior to decompressing the cyst, we perform fenestration of the septum pellucidum, so that if long-term CSF diversion is required, this can be by means of a unilateral, rather than bilateral, shunt (Fig. 3).

Following this, we insert an epidural catheter (Fig. 4) into the working channel of the neuroendoscope towards the craniopharyngioma cyst (Fig. 5).

The catheter is small, and semi-rigid, and can be used to fenestrate the cyst wall without spill-out of contents. If the cyst wall proves too firm, which has not been our experience, then monopolar cautery can be used to one point on the cyst wall, prior to advancement of the epidural catheter into the cyst. Gentle suction via a 10-ml syringe is used to aspirate the cyst contents and decompress the cyst (Fig. 6).

Once the cyst has been decompressed, the fenestration is widened using bipolar cautery. The neuroendoscope is removed along with the peel-away, and a pre-measured and set up Ommaya reservoir and catheter are inserted into the craniopharyngioma cyst. We have found that with wide fenestration of the craniopharyngioma cyst, good placement of the initial burr hole, and careful measurement of the catheter and reservoir being inserted, the Ommaya catheter has been consistently placed within the cyst cavity even though this part is blind.

If there is concern with regard to ongoing hydrocephalus, we leave an external ventricular drain in the ventricle, which is left patent until the CSF clears and is then removed.

Results

Since adopting this technique, we have had no cases of chemical meningitis, have achieved complete collapse of the cyst on all postoperative imaging and have had no additional complications. Patient demographics and outcomes in those whom we have used this technique are outlined in Table 1.

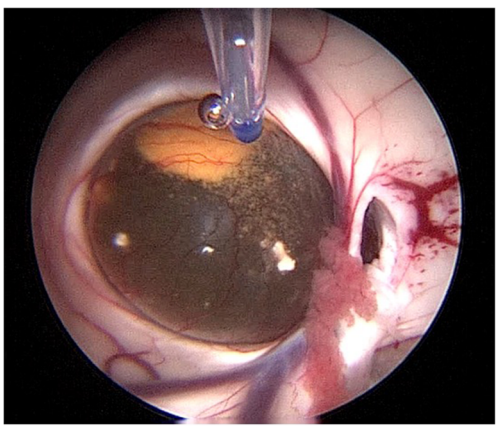

Fig. 5 Endoscopic view of the epidural catheter approaching the craniopharyngioma cyst

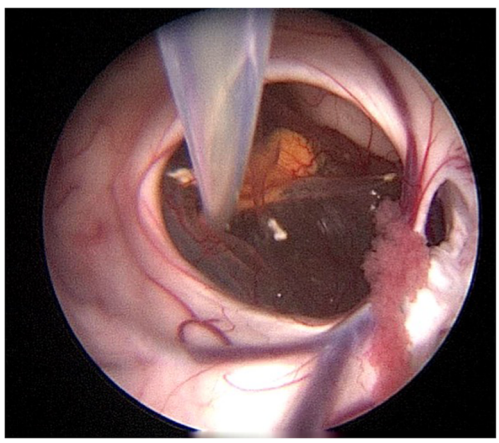

Fig. 6 Decompression of the craniopharyngioma cyst with epidural catheter and gentle aspiration

Table 1 Summary of cases on which technique has been used and outcomes

Age	Sex	Surgical indication	Cyst decompression achieved?	Postoperative chemical meningitis	Early (< 6-month cyst recurrence)	Need for CSF diversion
36	M	Large suprasellar craniopharyngioma cyst	Yes	No	No	No
72	M	Large suprasellar craniopharyngioma cyst	Yes	No	No	No
17	F	Large suprasellar craniopharyngioma cyst	Yes	No	No	No
21	M	Large suprasellar craniopharyngioma cyst	Yes	No	No	No

Discussion

Craniopharyngiomas often present a management challenge, with surgical management often carrying a burden of associated morbidity. Modern surgical techniques and equipment have improved this, as well as the frequently employed combination of subtotal resection followed by radiosurgery [9]. We believe the technique we have described for the management of the cystic portion of craniopharyngiomas, where they extend into the third ventricle is effective, safe and lowers the morbidity associated with aseptic meningitis from spill-out of cyst content into the ventricular system.

Conclusion

We would recommend the use of the described technique for management of the cystic portion of suprasellar craniopharyngiomas, where surgical decompression is indicated. It is certainly the technique we now employ for all such cases.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Informed consent was obtained from all individual participants included in the study.

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