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SHORT COMMUNICATION

Management of intra-operative cerebrospinal fluid leak following endoscopic trans-sphenoidal pituitary surgery

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Abstract

Objective: Cerebrospinal fluid leakage is the most common complication of endoscopic trans-sphenoidal pituitary surgery. However, there is no uniformly accepted way of managing this complication when it occurs intra-operatively. This paper describes a quick, simple technique, involving layered fibrin glue and gelatin sponge, which does not compromise post-operative patient follow up.

Method: Retrospective review of all endoscopic pituitary surgery cases conducted at a single institution since the introduction of this technique in 2002.

Results: A total of 120 endoscopic pituitary operations were performed (96 primary procedures and 24 revisions). All intra-operative cerebrospinal fluid leaks were managed using the described method, with a failure rate of 3.6 per cent. The overall post-operative leakage rate was 1.7 per cent.

Conclusion: This simple, conservative technique avoids the need for further dissection and the use of non-absorbable foreign material, and has a low incidence of post-operative cerebrospinal fluid leakage.

Key words: Pituitary Gland; Endoscopic Surgery; Complications; Cerebrospinal Fluid Leak, Management

Introduction

Cerebrospinal fluid (CSF) leakage is a common complication of endoscopic trans-sphenoidal pituitary surgery, occurring in 14–16 per cent of patients intra-operatively and 4–6 per cent post-operatively.[1] Traditionally, CSF leakage following neurosurgical procedures of the anterior cranial fossa has been repaired using transcranial techniques. However, as endoscopic techniques have evolved to incorporate a wider range of anterior skull base lesions, so too has the ability to deal with the complications that can arise.

Cerebrospinal fluid leakage occurring in the context of endoscopic pituitary surgery also has some unique features that preclude the use of certain repair methods. In particular, underlay grafts in the pituitary fossa have several disadvantages, including post-operative swelling (which can affect residual pituitary function and associated neurovascular and suprasellar structures)[2] and scarring and obliteration of the pituitary fossa (which complicate the interpretation of post-operative scans during patient follow up).

Recognising CSF leakage during the surgical procedure itself is essential. Post-operative CSF rhinorrhoea is associated with an increased incidence of meningitis, while primary intra-operative CSF leakage has no such association.[3] Anecdotally, CSF leaks detected intra-operatively are easier to repair and more likely to respond to conservative measures; however, this may be because, at revision surgery, surgeons are more likely to over-treat a post-operative CSF leak, for fear of complications.

There is no standard technique for sellar repair, although a wide variety of different materials have been used including autologous bone, septal cartilage, middle turbinate MUCOSA, fat and muscle. Fibrin glue is a popular alternative to autologous tissue, and obviates the need for further dissection and subsequent preparation of graft material. Its use in dural repair following craniofacial resection was described by Toma *et al.* over 18 years ago.[4] When fibrin glue is combined with collagen sponge, better rates of repair have been demonstrated.[5]

We describe a method utilising gelatin sponge and fibrin glue in a layered approach, followed by bismuth iodoform paraffin paste packing of the sphenoid sinus. This technique avoids the need for further dissection and subsequent preparation of graft material.

Methods

Surgical technique

Firstly, pre-operative knowledge of the size, extent and type of tumour is important, as large adenomas with para- or suprasellar extension are more likely to leak CSF than other kinds of adenoma, as are other lesions such as meningiomas. Cerebrospinal fluid leaks are also more likely to

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occur during revision procedures. An assessment of the amount of CSF leakage is important, together with an estimation of the size of the defect and other problems such as haemorrhage. The described technique is suitable for small to medium diaphragmatic arachnoid defects; any large defects with more significant CSF leakage are likely to require a more formal repair. If there is significant mucosal bleeding in the sphenoid, 1:10 000 adrenaline-soaked neuropatties can be applied; otherwise, saline-soaked neuropatties should be used when operating within the pituitary fossa itself.

A patch of absorbable haemostatic gelatin sponge (Spongostan Standard $7 \times 5 \times 1$ cm; Ferrrosan, Soeborg, Denmark) is cut to the size of the defect in the anterior pituitary fossa wall, so that the patch just fits over the sellotomy rather than as an underlay. This is immediately fixed with fibrin glue (Tisseel Kit; Baxter AG, Vienna, Austria). Another patch of gelatin sponge is then placed over the fibrin, using support from further pieces of gelatin sponge in the lower part of the sphenoid sinus, below the sellotomy. A further layer of fibrin glue and gelatin sponge is assembled, and the whole construct is then supported by ribbon gauze impregnated with bismuth iodoform paraffin paste. The gauze is layered in the sphenoid sinus, and the distal end is tucked into the middle meatus without obstructing the nasal airway. The pack can then be removed under local anaesthetic in the out-patients department after two weeks. It is important that the entire sellotomy is covered by gelatin sponge and fibrin glue, since bismuth iodoform paraffin paste can irritate any exposed dura, with a theoretical risk of an irritative inflammatory type meningitis. In view of this, special care should be taken when using bismuth iodoform paraffin paste in revision procedures, and in patients who have previously been exposed to this substance.

Case series

A retrospective case-note review was undertaken of consecutive endoscopic pituitary surgery procedures performed at a university hospital tertiary referral centre (University Hospital of North Staffordshire) between January 2002 and May 2008. Data collected included patient demographics, type and size of lesion, and intra-operative and post-operative course (including CSF leakage and any other complications).

Results

A total of 120 endoscopic pituitary operations were performed between January 2002 and May 2008: 96 primary procedures and 24 revisions. A total of 28 intra-operative CSF leaks occurred: 19 in primary procedures (19.8 per cent) and nine in revisions (37.5 per cent). All intra-operative CSF leaks were managed using the described technique, without the need for placement of a lumbar drain.

One CSF leak continued post-operatively, representing a failure rate of 3.6 per cent. This occurred in a 70-year-old man with a non-functioning pituitary macroadenoma and hydrocephalus. A post-operative ventriculoperitoneal shunt was required for the hydrocephalus, and the CSF leak subsequently settled without further surgery.

Another patient had two days of post-operative CSF rhinorrhoea, without any obvious intra-operative CSF leakage. This resolved with bedrest, giving an overall CSF leakage incidence for all procedures of 1.7 per cent.

In addition, bismuth iodoform paraffin paste packing was used routinely in endoscopic trans-sphenoidal pituitary surgery at the University Hospital of North Staffordshire, with or without intra-operative CSF leak. Since 2002, there had been only one documented case of post-operative, culture-negative meningitis in these patients.

Discussion

In our unit, adoption of this simple, conservative approach to intra-operative CSF leakage has been very successful, with no patient requiring a return to theatre. Our overall post-operative leakage incidence (1.7 per cent) compares favourably with other published figures (i.e. 2–6 per cent).[1,5]

Whilst the use of a layered approach to the placing of haemostatic sponge and surgical adhesives is not new,[5,6] the addition of bismuth iodoform paraffin paste packing to support this repair has not previously been described in this context. Our experience parallels the findings of other units that have used surgical adhesives to aid CSF leak repair: in leaks where the arachnoid defect is small, a repair using autologous tissue is unnecessary. The mechanism of healing of the defect without a tissue graft is likely to be analogous to that which occurs in a 'paper-patch myringoplasty', in that the fibrin glue and gelatin sponge provide a substrate for fibroblasts during the proliferative phase of healing. Subsequent endoscopy of the sphenoid sinus in the months following surgery reveals regrowth of sphenoid mucosa over the sellotomy.

A classification system for intra-operative CSF leaks has been suggested by Dusick *et al.*, based on the amount of CSF leakage and the size of the dural defect, as follows: grade one, small leak without obvious diaphragmatic defect; grade two, moderate leak with a definite diaphragmatic defect; and grade three, large diaphragmatic or dural defect.[7] Dusick *et al.* used a graded approach to CSF leak repair, according to the above classification, with a similar layered construction using collagen sponge and titanium mesh, and a single layer of BioGlue® on top of the collagen sponge to reinforce the repair. In grade two leak repairs, an abdominal fat graft was added to the above construct, and in grade three repairs a lumbar drain was inserted for 48 hours.

Whilst grading of the amount of CSF leakage and the extent of the dural defect is important, our experience shows that the addition of titanium mesh and graft material such as abdominal fat to the repair may be unnecessary in grade one and two repairs, if the surgical adhesive is layered instead and the whole construct supported by packing. This avoids the need for further dissection, subsequent preparation of graft material and the use of non-absorbable foreign material. Finally, this technnique is simple to learn and quick and easy to perform, making it suitable for otolaryngological trainees to carry out at the end of a procedure in which they may hitherto have had minimal input.

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