

Neurosurgical Techniques

Endoscopic application of autologous fibrin glue to treat postoperative CSF leak after expanded endonasal approach: Report of two cases



Martina Cappelletti^{a,*}, Andrea Gennaro Ruggeri^a, Filippo Giovannetti^b, Paolo Priore^b, Angelo Pichierri^c, Roberto Delfini^a

^a DPT of Neurology and Psychiatry – Neurosurgery Unit, “Sapienza” University of Rome-Italy, Italy

^b DPT of Odontostomatology Sciences and Maxillo Facial Surgery-Maxillo Facial Unit, “Sapienza” University of Rome-Italy, Italy

^c Neurosurgery, Southmead Hospital North Bristol NHS Trust, Bristol, England, UK

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ABSTRACT

Since the introduction of endoscopic surgery for the treatment of skull base lesions, one of the main issues has been the CSF leak. The implementation of efficient reconstructive techniques has reduced the post-operative CSF leak rate. However, none of the techniques for closure has proved to be totally effective in preventing CSF leakage. We propose a possible solution to this problem.

Two patients underwent surgery for suprasellar meningioma via an expanded endoscopic endonasal approach and subsequently presented post-operative CSF leakage. They were treated via injections of autologous fibrin glue at the patients' bedside. The autologous fibrin glue was obtained using the automated Vivostat® system, that prepares 5 ml of autologous fibrin sealant from 120 ml of the patient's own blood.

In both patients, we obtained the permanent closure of the small defects and the interruption of the leakage.

The application of autologous fibrin glue made it possible to successfully treat these two cases of post-operative CSF leak without the need of a second operation. The advantage of using autologous fibrin glue is probably related to the high biological activity of such material in promoting a faster healing, it might be a solution in selected cases.

1. Introduction

The incidence of post-operative CSF leaks in endoscopic endonasal surgery for anterior skull base meningiomas is, in the recent literature, lower than to 10% [1]. The management of this complication usually consists of endoscopic revision surgery and placement of lumbar spinal drainage, that are effective in the majority of cases [2]. In some rare cases the use of various types of cranial flap might be necessary [3].

Autologous tissues offer some advantages in term of biocompatibility and avoidance of rejection and are usually preferred for reconstruction [4, 5].

Numerous closure techniques (one layer, multilayers and gasket seal) [5, 6] and various materials are used (autologous, heterologous, or synthetic materials) [7–10]. There is agreement in the literature that the use of autologous materials should be preferred, owing to their biocompatibility, lower risk of infection and effectiveness [11, 12]. Despite the improvement of techniques, a risk of CSF leak always exists, not only related to the closure technique used, but also to certain patient characteristics [13, 14]. In the event of CSF leakage, it is

mandatory to use all the techniques available to solve the problem quickly and safely. The application of fibrin glue under endoscopic control or guided by CT scan has been already described [4, 15]. The need to use an easily accessible autologous material and the possibility of using a minimally invasive technique, gave us the idea of repairing two postoperative CSF leaks by means of endoscopic application of autologous fibrin glue [16]. In this study we propose a tricky technique to be included in the armamentarium of endoscopic skull base surgeons, for treating post-operative CSF leak.

2. Case reports

A 40-year-old woman and a 68-year-old obese (BMI > 30) man, were operated by expanded endoscopic endonasal approach for a diaphragma sellae meningioma and for a tuberculum sellae meningioma respectively (Fig. 1; Fig. 2). The approach used in both cases was a transtuberulum transplanum approach to obtain a complete removal via extracapsular dissection of the lesion. In both cases for reconstruction, we used a multilayer technique with autologous fascia

* Corresponding author at: DPT of Neurology and Psychiatry – Neurosurgery Unit, “Sapienza” University of Rome-Italy, Viale del Policlinico 155, 00161 Rome, Italy.
E-mail address: martina.cappelletti@uniroma1.it (M. Cappelletti).

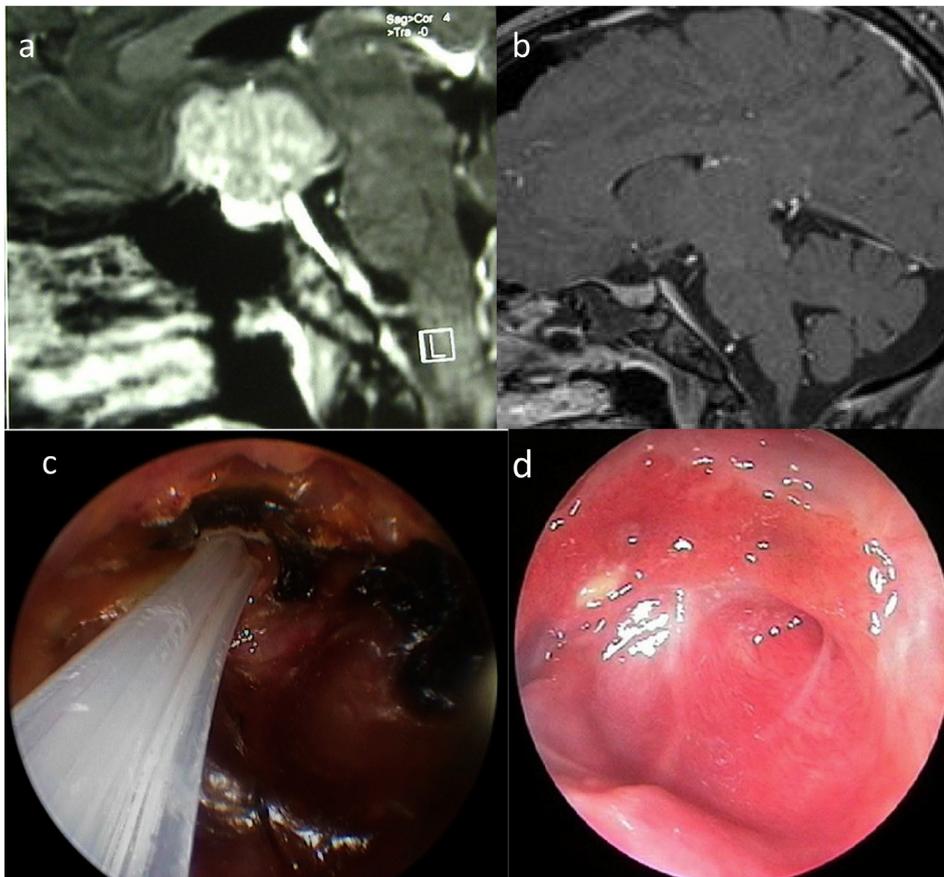


Figure 1. a) first patient pre-operative MRI sagittal view showing suprasellar lesion with homogeneous contrast enhancement b) post-operative MRI sagittal view showing the complete removal of the lesion c) image showing endoscopic application of autologous fibrin glue d) endoscopic control at 3 months follow-up showing absence of any leakage.

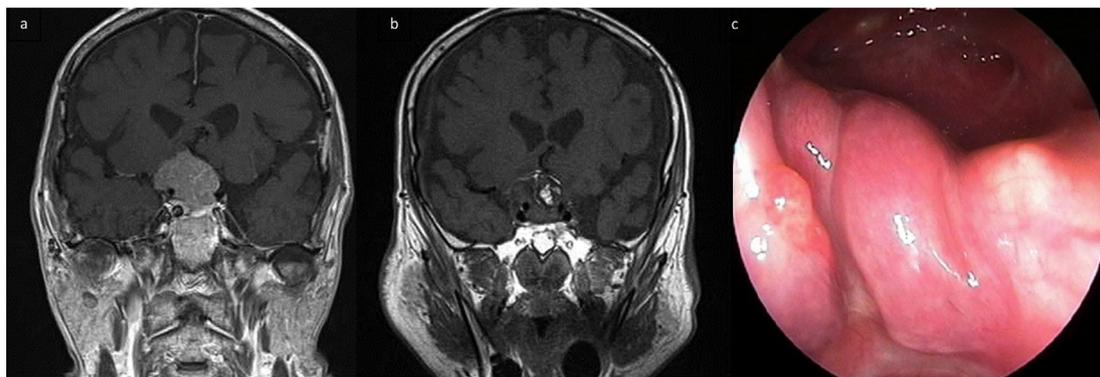


Figure 2. a) pre-operative MRI coronal view showing suprasellar lesion with homogeneous contrast enhancement b) post-operative MRI coronal view showing the complete removal of the lesion c) endoscopic control at 3 months follow-up showing absence of any leakage.

lata, fat and a naso-septal flap. Lumbar drainage was placed at the end of surgery and removed in the first case after 4 days and in the second case after 7 days. CSF sampling was performed every 72 h. A small CSF leak appeared in the first case on the 6th post-operative day in the other on the 8th post-operative day, when the patients started to get up and walk. The leakage was verified in both cases by glucose assay, and confirmed by the β 2-transferrin.

The first patient got up on the 6th postoperative day and presented CSF rhinorrhea. She was explored endoscopically; a small defect was identified in the upper left corner of the nasoseptal flap edge (Fig. 1).

For the second patient an endoscopic endonasal control on the 6th postoperative day, showed no leakage. The lumbar drainage was removed on the 7th post-operative day, the patient got up on the 8th postoperative day. Unfortunately, after a straining maneuver, the patient presented persistent rhinorrhea. We repositioned the CSF lumbar

drainage. An endoscopic control revealed a small leak close to the pedicle of the flap on the left side.

We abstained from a revision surgery and proceeded with the bedside application of autologous fibrin glue under direct endoscopic view.

The procedure was performed at the patient's bedside, after formal patient consent, using the Karl Storz Telepack display system and an endoscope 4 mm in diameter and 18 cm in length. The monitor was on the left side of the patient. The surgeon was on the right side. No sedation was needed. After disinfection of the nose and nasal cavities with chlorhexidine, the nasal cavity was inspected, removing any crusting, using an aspiration system to remove any soft blood clots and/or nasal secretions as far as the sphenoid sinus cavity. It is very important during inspection maneuvers, to not mobilize the reconstruction materials. The Vivostat® System is on the operator's side. After proper visualization of

the CSF leakage point, with the aid of the sterile spray applicator, the autologous fibrin glue is injected. The procedure was repeated until the CSF leak was resolved.

The Vivostat® System (Vivostat A/S, Allerød, Denmark) is a fully automated system for preparation and application of autologous fibrin. The biochemical process has already been described [17]. The fully automated system prepares 5–6 ml of autologous fibrin sealant from 120 ml of the patient's own blood in 24 min.

Both patients underwent 3 and 2 applications of autologous fibrin glue, respectively, twice a week. This technique was effective in achieving durable repair of these small defects. The patients were discharged without major complications.

For both patients, an endoscopic control at three months showed the perfect re-epithelialization of the naso-septal flap (Fig. 1; Fig. 2) and at 1 year follow-up there was no signs of CSF leak recurrence.

3. Discussion

Numerous efforts have been made to develop techniques and materials able to assure a watertight closure of the osteodural defect in endoscopic skull base surgery. This goal is often difficult to achieve, due to the irregularity, the size and the location of the osteodural defect. The most recent literature shows that the actual risk of meningitis is currently very low, even in the presence of CSF leak [14]. The leakage is usually quickly recognized and treated.

Possible causes of postoperative CSF leak are improper closure technique, high flow/high pressure CSF outflow, mobilization of reconstruction materials, delayed engraftment or ischemia of the pedicled flap, as well as some patient characteristics, like obesity [5, 7, 14].

The reason for the occurrence of CSF leak in a patient in whom the closure was properly performed is not known. Based on our experience, we can say that a displacement of the flap or a late flap engraftment may be responsible. Regarding the latter, we thought about what it would favor a more rapid engraftment of the flap.

The use of biological glue seemed the best solution, as already reported in the literature [19]. The best choice was represented by autologous fibrin glue. It has the significant advantage of being biocompatible and biodegradable, avoiding inflammation, foreign body reactions or extensive fibrosis. It also promotes angiogenesis, local tissue growth and repair [16].

The Vivostat® system has been successfully used in several specialties [17, 18] as well as in neurosurgery [19]. The autologous nature of Vivostat® eliminates the risks of bovine or human-borne contaminants, protecting the patient against viral diseases and it is easy to apply.

We used this technique because the defect was small and CSF outflow was low, so we could avoid another surgical procedure.

We injected the autologous fibrin glue through the site of the leak to arrest it at its origin and to ensure, thanks to its scaffolding effect, re-epithelialization of the flap. Autologous fibrin glue provides a structure similar to the native extracellular matrix containing the cells and promotes the healing process [16, 20]. This approach has the advantage to avoid reoperation and another general anesthesia [4]. Using this technique, we were able to directly view the site of the leak and to apply (under endoscopic visualization) fibrin glue directly to it. Fibrin glue is therefore not only a filling material for the sphenoid sinus, as previously reported, but is an active and precise component of the healing process [16]. Lumbar drainage plays a role in this process because it reduces the CSF pressure and allows proper functioning of the scaffold [7]. The use of autologous fibrin glue makes it possible to use the patient's own blood, to the site of the leak, to obtain the integration of materials [19]. This technique seems to be effective for small defects and in case in which the problem appears to be related to a failure of flap engraftment. We do not have data on larger defects. We can hypothesize that the autologous glue works in the same way as an autologous scaffold to promote engraftment of other materials. Autologous fibrin promotes a biological action, as well as mechanic one like a

sealant. Spinal drainage had the function of promoting this biological activity, reducing the liquor pressure on the reconstruction [21]. Our experience with this technique is clearly limited to a small number of patients. Further studies are doubtlessly required. We believe that in cases of early postoperative CSF leak once problems related to the closure technique used have been ruled out, this approach with autologous fibrin glue represents a good alternative.

The use of autologous fibrin glue in cases of post-operative CSF leak seems to be an effective method for dealing with this complication. The advantage of using autologous material is probably to promote the healing process in less time. Furthermore, this is a safe procedure that can be done at the patients' bedside. The costs for the preparation of autologous fibrin glue are similar to those of commercial glues, but probably the autologous glue has the advantage, thanks to the application system, of reducing waste [22]. It may not be the panacea for coping with CSF leak, but could represent a little trick to use in selected cases.

Patient consent

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

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Conflict of interest

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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