

Endoscopic Carpet Technique for Multiple Diffuse Skull Base Defects Causing Non-Localising CSF Rhinorrhoea

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ABSTRACT

Traumatic cerebrospinal fluid (CSF) rhinorrhoea, often resulting from head injuries, comes with various potential risks, such as recurrent meningitis if not properly managed. For diffuse skull base fractures leading to CSF rhinorrhoea, external approaches like frontal craniotomy for repair are usually practised, but it comes with a high rate of morbidity, like behavioural disorders, intracranial haemorrhage and seizures. Recent advances in endoscopic surgical techniques have revolutionised the treatment of these leaks, providing high closure rates and lower morbidity than traditional open surgery. However, in cases where the leak site is not visualised, endoscopic approach can be a challenge, but not impossible. Through this case report, we want to highlight a novel technique of the endoscopic carpet technique for CSF leak repair in a patient where leakage could not be localised.

Keywords: Traumatic CSF rhinorrhoea, diffuse skull base fracture, Non-localising CSF leakage, Endoscopic carpet technique, fluorescein dye.

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhoea is an uncommon yet clinically important condition involving the abnormal outflow of CSF from the cranial cavity into the nasal passages. It can result from a variety of causes, such as medical or surgical interventions (iatrogenic), trauma or idiopathic.¹ According to a large recent systematic review on the cause of CSF rhinorrhoea it has been found that the leading causes of CSF rhinorrhoea were found to be traumatic events (44%), followed by idiopathic causes (28%), and delayed postoperative or iatrogenic factors (12%).² And anterior skull base fractures comprise of 4% of all head injuries.³ CSF rhinorrhoea, if not managed, can lead to serious intracranial complications. If the initial conservative management fails to prevent CSF leakage, then the surgical approach is the next best line of management in traumatic CSF rhinorrhoea. Among the surgical approaches, the endoscopic approach is more effective and less morbid with a lower rate of complications in comparison with open approaches.

But in a case of multiple skull base fractures, the endoscopic approach can be a challenge to close the CSF leakage. However, in this case report, we have discussed the successful CSF leakage closure by endoscopic approach in a case of non-

localising CSF leakage due to a comminuted fracture of the anterior skull base.

CASE PRESENTATION

An 18-year-old lady presented to our department after two months of sustaining a head injury from a fall from height. Following the injury, she complained of watery discharge from the left nasal cavity which was clear, non-sticky and was not sniffable, beta-2 transferrin analysis confirmed the fluid to be cerebrospinal fluid (CSF). Pre-operative computed

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tomography (CT) of the skull showed multiple fractures of the anterior skull base and associated pneumocephalus (Figure 1).

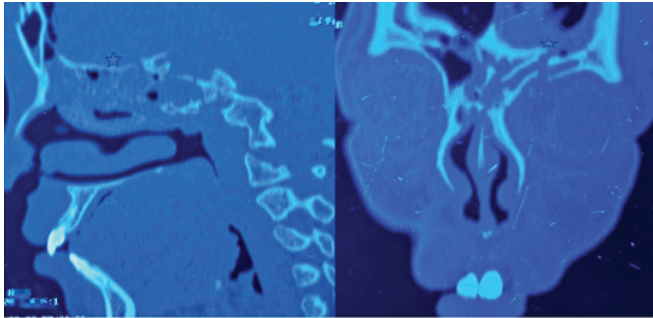


Fig. 1: CT Scan showing fracture (*) of the frontal bone, ethmoid-cribriform plate and sphenoid sinus

Initially, the patient was managed conservatively with acetazolamide for 4 weeks; however, the CSF leak persisted. Prophylactic antibiotics and the pneumococcal vaccine were administered to prevent meningitis. Fundoscopic examination was reported normal; however, no images were provided by the ophthalmologist.

In view of multiple fracture of anterior skull base, an open approach was planned for the CSF leak repair, but the patient declined the procedure. Therefore, an endoscopic CSF leak repair was planned. Under aseptic precautions, a lumbar drain was inserted, and 0.5% fluorescein dye was injected intrathecally. Even after the injection of dye, the site of CSF leak could not be identified. Left middle turbinectomy, anterior ethmoidectomy, and posterior ethmoidectomy were performed. The mucosa over the left anterior skull base was denuded using bipolar cautery.

A left posterior septal artery-based Hadad flap was elevated, and a multilayer carpet repair of the denuded skull base was carried out using, abdominal fat followed by layer of fascia lata graft, Hadad flap, surgical, and tissue glue. The lumbar drain was maintained for 5 postoperative days and then removed.

The patient did not have any CSF leak postoperatively. Follow-up evaluations showed no recurrence of leakage and postoperative healing of the skull base mucosa by fibrosis. Postoperative Magnetic Resonance Imaging (MRI) of the brain (Figure 2) demonstrated anterior skull base remodelling with soft-tissue filling the defect, consistent with the graft repair. The patient is on regular follow-up up to 6 months at the time of writing this report.

DISCUSSION

CSF leaks are frequent complications of skull base fractures, occurring five to six times more often in the anterior skull base compared to the middle or posterior skull base.^{4,5} Among these, fractures involving the ethmoid and cribriform plate are the most prevalent.⁶ The increased incidence of ethmoid-cribriform plate fractures is mainly due to the delicate, thin dura covering the cribriform plate and its strong adherence to the underlying bone.

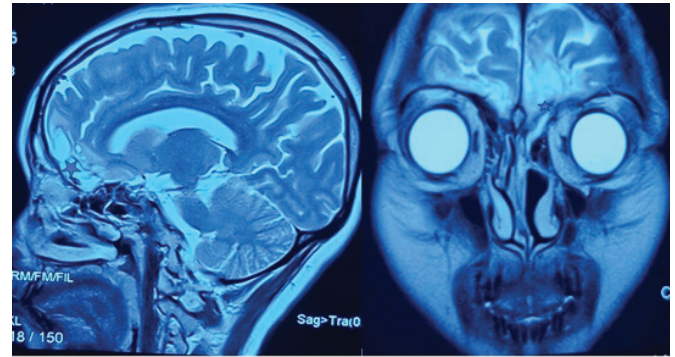


Fig. 2: MRI Brain showing the anterior skull base (*) remodelling with soft-tissue filling the skull base, which is consistent with a graft repair.

Computed Tomography (CT) is the diagnostic modality to identify the cranial and facial fractures.⁷ Archer classified anterior skull base fractures into three classes according to their extent: Class I, involving only the frontal bone/sinus; Class II, involving the ethmoid-cribriform plate; and Class III, involving the sphenoid bone/sinus.⁷ The more the extent of the fracture, the greater the morbidity. In our case, it was a Class III type as it involved the frontal bone/sinus, ethmoid-cribriform plate and sphenoid sinus. Given the significant risk of meningitis in unrepaired CSF rhinorrhoea, ranging around 19%,⁸ prompt diagnosis and management of CSF leaks are essential to minimise long-term complications. Successfully sealing a dural leak can reduce the risk of meningitis. While open approaches were opted earlier for CSF leak repair, it was not without complications like meningitis, altered sensorium, scalp infections and recurrence of CSF leakage. With the advent of endoscopic approaches, it has been found that the complications associated with open approaches were minimal. In a systematic review done by Umana, wherein they compared open and endoscopic approaches for CSF leakage repair, CSF leak recurrence was observed in 32 patients who underwent open surgery, compared to 8 patients who had endoscopic repair. Postoperative complications were reported in 69 patients overall, with the majority occurring in the open surgery group, 67 cases. In contrast, the endoscopic group experienced significantly fewer complications, with only two patients.³ During the repair, it is important to strip off the mucosa to promote fibrosis during postoperative healing, because in CSF leakage repair, we want more fibrosis to occur, unlike in cases of functional sinus surgery, wherein we preserve the mucosa.⁹ Non-localisation of CSF leakage can occur even after the use of intrathecal fluorescein dye injection in up to 26-33% if the leak is intermittent, or the leak is of low volume, or temporarily sealed by tissue, which may prevent CSF which is stained with dye from passing through the defect during examination.^{10,11} However, even in cases of non-visualisation of CSF leakage, skull base mucosa can be denuded and repaired with various techniques, including underlay, overlay, interlay, bath-plug, sandwich, blanket or carpet technique.¹² The denuded mucosa heals by fibrosis and thus will help in CSF leak repair, as it happened in our case as well.

CONCLUSIONS

While conservative medical management remains the first approach for many anterior skull base fractures with CSF leakage, early surgical intervention is required in patients not improving with conservative management and patients develop meningitis. Recently, it has been found that the use of endoscopic techniques is increasing over traditional open surgery, which is mainly due to efficacy and reduced risk of complications and failure.

It has been found that localising CSF leakage can be difficult even if intrathecal fluorescein injection is used. However, even in cases of failure of identification of the defect site, if the mucosa is denuded and repaired in layers, the postoperative healing by fibrosis prevents further CSF leakage, as seen in our case.

Our case study highlights the role of carpet repair after the skull base mucosa is properly denuded in multiple layers in cases where there are multiple skull base fractures, and the actual leakage could not be localised intraoperatively.

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