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Endoscopic endonasal multilayer repair of traumatic ethmoidal roof cerebrospinal fluid rhinorrhea in children

Ahmad A. Ibrahim [a], Emad A. Magdy [a,*], Mohamed Eid [b]

[a] Department of Otorhinolaryngology – Head & Neck Surgery, Faculty of Medicine, Alexandria University, Alexandria, Egypt
[b] Department of Radiology, Faculty of Medicine, Alexandria University, Alexandria, Egypt

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ABSTRACT

Objective: Pediatric traumatic cerebrospinal fluid (CSF) leak is a challenging problem in diagnosis and management. Posttraumatic leaks frequently present by intermittent rhinorrhea or by recurrent attacks of meningitis, which can be the only presenting symptom. The objective of this study is to present our experience in management of pediatric traumatic ethmoidal roof CSF leaks using a multilayer repair technique via an endoscopic approach.

Methods: Ten pediatric patients (aged 4–14 years, six males and four females) presenting with posttraumatic ethmoidal roof CSF rhinorrhea were operated upon between January 2007 and December 2010, using an endoscopic endonasal multilayer repair technique. Preoperative radiological evaluation included both multidetector computed tomography (MDCT) with ultra-thin 1 mm cuts, and magnetic resonance imaging (MRI) high resolution coronal T2-weighted sequence. Intraoperatively, the GE InstaTrak^{TM} 3500 electromagnetic navigation system was used in all cases. Postoperative follow-up was done clinically by regular endoscopic examinations and radiologically by MRI assessment using the same preoperative protocol.

Results: Clinically all patients presented with unilateral intermittent watery rhinorrhea with periods ranging from 5 to 24 months before operation. Seven cases had a history of recurrent meningitis. Defects were confined to ethmoidal roof in all 10 cases (right side in seven and left side in three), and ranged in size from 2 to 7 mm^2 (mean 3.9 ± 1.5 mm^2). Two cases had more than one defect on the same side. All defects were identified preoperatively using our radiological protocol. One case was associated with a meningocele with no brain herniation and another case was associated with a small meningoencephalocele. Mean postoperative hospitalization was 6 days (range 4–8 days). None of our patients developed any intra or postoperative complications or required revision surgery with a 100% success rate after a mean follow-up duration of 29.4 ± 14.4 months (range 12–52 months).

Conclusions: Pediatric posttraumatic CSF leaks involving the ethmoidal roof can be successfully managed via the endonasal endoscopic route using a multilayer repair technique, thus limiting complications associated with external approaches. Preoperative imaging including MDCT and high resolution MRI is of paramount importance for detecting the defect site and for planning surgery.

1. Introduction

CSF rhinorrhea results from an abnormal communication between the subarachnoid space of the cranial and the nasal cavities. Anterior skull base defects in children can be congenital (meningoencephaloceles) or posttraumatic (skull base fractures). Anterior basal meningoencephaloceles are rare, with an incidence of 1:5000 live births [1,2]. Posttraumatic cerebrospinal fluid (CSF) leaks in children are less common than in adults and occur in an incidence of 0.2–0.3% following childhood head trauma. This may be explained by the greater flexibility of skull bones that can lead to absorption of the traumatic shock. However, the incidence is on a rise as a result of increased incidence of road traffic accidents (RTAs). Posttraumatic CSF leaks infrequently cause intermittent rhinorrhea, and the only symptom may be recurrent episodes of meningitis [3].

Early surgical repair is essential to avoid the risk of ascending infection [4]. The surgical approach to CSF leak repair has undergone a major progression. Multiple technical advancements have contributed to this development, but the most important amongst all has been the improvement of endoscopic transnasal

* Corresponding author at: Department of Otorhinolaryngology – Head & Neck Surgery, Faculty of Medicine, Alexandria University, 4 Omar Lotfy Street, Camp Sheizar, Suite: 2, Alexandria 21321, Egypt. Tel.: +20 122 458 8889; fax: +20 3 427 3506.
E-mail address: emad.magdy@yahoo.com (E.A. Magdy).

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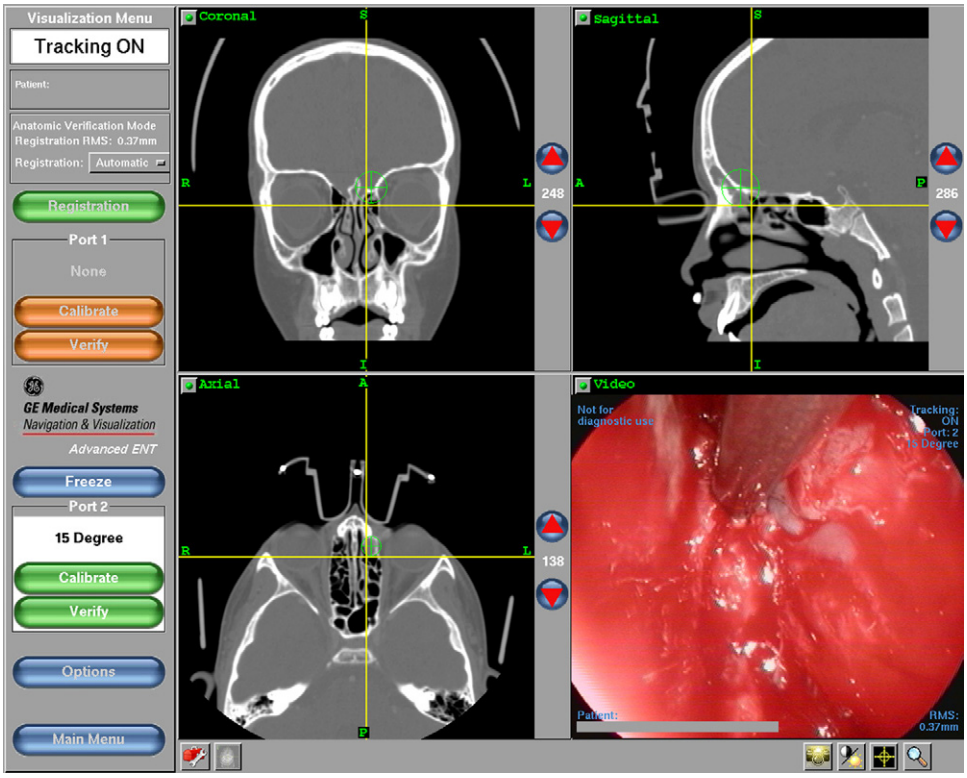

Fig. 1. Intraoperative snap shot of the GE InstaTrak™ 3500 electromagnetic navigation system screen showing precise localization of the working point via yellow cross hairlines on preoperative coronal, sagittal and axial CT scans as well as a real-time video monitor image. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)

surgeries. This has changed the primary approach used for repair of an anterior skull base fistula from intracranial craniotomy to endoscopic extracranial repair with a high success rate and decreased morbidity [5,6].

In this article, we report our results on 10 children with accidental posttraumatic anterior skull base defects following various head traumas, associated with CSF leaks in which all repairs were performed using an endoscopic endonasal multilayer technique.

2. Patients and methods

2.1. Ethical considerations

A retrospective study was conducted, after the approval of the Institutional Review Board (IRB) of Alexandria University Hospital, on the charts of 10 children with posttraumatic anterior skull base defects managed using the endoscopic endonasal approach at the Department of Otorhinolaryngology – Head & Neck Surgery, Alexandria Main University Hospital, from January 2007 to December 2010. An informed consent from all the patients' parents was taken prior to surgery and after they were fully informed about the details of the surgical procedure.

2.2. Diagnosis and preoperative evaluation

Careful history and complete otorhinolaryngological examination including endoscopic nasal examination (using a Karl Storz 2.7 mm 0° rigid nasal endoscope in young children and a 4 mm 0° endoscope in older children) was performed in all cases to establish the diagnosis. A thorough physical examination to assess the patient's general condition and to exclude any other associated lesions was also done prior to commencement of the surgical procedure.

Diagnostic preoperative evaluation included laboratory tests, especially Beta-2-transferrin and beta trace protein detection in fluid samples collected from the nose [7]. After endoscopic evaluation, radiological imaging studies to localize the defect in the form of multidetector computed tomography (MDCT) with ultra-thin 1 mm cuts, bone and soft tissue settings, with multiplanar reconstruction, and magnetic resonance imaging (MRI) high resolution coronal T2-weighted sequence "Constructive Interference Steady State (CISS), MR cisternography" were done. Complete

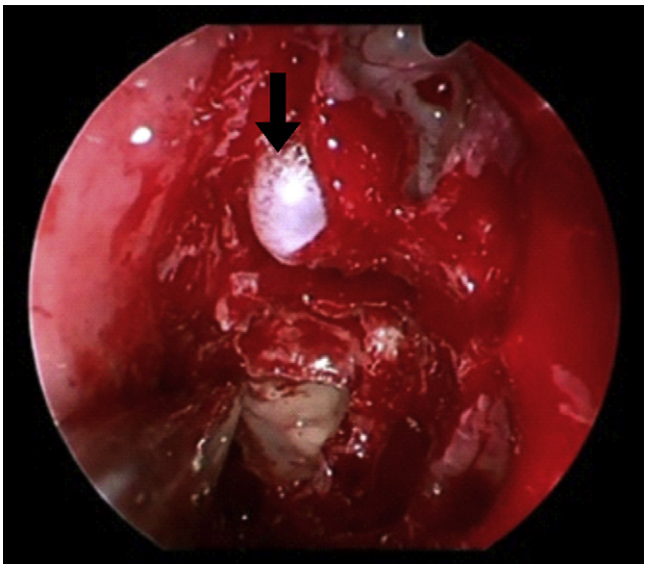

Fig. 2. Intraoperative endoscopic view showing a small meningocele (black arrow) protruding from a left skull base defect located at the lateral lamella of the cribriform plate at the level of the anterior ethmoidal canal.