

Cerebrospinal Fluid Rhinorrhea: Causes, Sites, Management and Recurrence

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Abstract. The aim of this study is to report the sites, management and recurrence of rhinorrhea, and to compare our results with those obtained from other centers. The medical records of patients with cerebrospinal fluid rhinorrhea in Otorhinolaryngology, and Head and Neck Surgery Department at King Abdulaziz University Hospital, Jeddah, Saudi Arabia, from January 2003 to May 2011 were retrospectively reviewed. Ten cases of cerebrospinal fluid rhinorrhea were treated during the study period. The most frequent causes were endoscopic sinus surgery (50%), spontaneous (30%) and others (20%). Defects were located at the cerebriiform plate (n = 6), left fronto-ethmoidal area (n = 1), at roof of the left frontal sinus (n = 1), at the junction between the cerebriiform plate and bulla ethmoidalis (n = 1), and at the roof of the sphenoid sinus (n = 1). Patients were followed up for 6 to 24 months. The initial closure was successful in 6 patients; 5 after endoscopic sinus surgery and 1 after conservative treatment. Overall closure rate was 90.0%; 87.5% after endoscopic sinus surgeries. In conclusion, the most frequent cause of cerebrospinal fluid rhinorrhea was endoscopic sinus surgery and the cerebriiform plate was the most common defect location. The overall rate of closure after endoscopic sinus surgery and conservative treatment was high.

Keywords: Cerebrospinal fluid leak, Endoscopic sinus surgery, Rhinorrhea, Recurrence.

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Introduction

Cerebrospinal fluid (CSF) rhinorrhea is leakage of CSF from the intracranial cavity into the nose through an osseous defect at the skull base^[1]. CSF rhinorrhea is categorized as traumatic or non-traumatic (spontaneous) based on etiology^[2]. It can be diagnosed by glucose oxidase test strips, β_2 transferrin, or computerized tomography (CT) of the paranasal sinus (PNS) with intrathecal injection contrast^[3]. Other imaging techniques such as magnetic resonance imaging (MRI), CT cisternography, MR cisternography, and nuclear medicine studies have proved useful in supporting the diagnosis. However, CT scan is the best imaging modality for identifying skull defects associated with CSF rhinorrhea^[4].

Surgical management is appropriate for leaks with iatrogenic and non-traumatic causes. CSF rhinorrhea due to head injury is usually managed conservatively initially, which includes subarachnoid drainage through a lumbar catheter, bed rest, head elevation, stool softeners, and advising the patient to avoid coughing, sneezing, nose blowing and straining. The use of prophylactic antibiotics is controversial^[5]. If the leak does not stop within 7-10 days, surgical management is appropriate. When surgery is indicated, an endoscopic approach is the first line of management. It has a good safety profile and a higher success rate plus and marked, decreased morbidity compared with an intracranial approach^[6].

Very few studies^[7,8] on CSF rhinorrhea have been conducted in Saudi Arabia. At King Abdulaziz University Hospital (KAUH), there are no available data on the etiology, diagnosis and management of this condition. The purpose of our study was to report the sites, management and recurrence of CSF rhinorrhea in the Otorhinolaryngology (ORL) and Head and Neck Surgery Department at KAUH, and to compare our results with those obtained from other centers.

Methodology

A retrospective chart review was performed of the medical records for all patients with CSF rhinorrhea who were treated and followed up in the ORL Department of KAUH, Jeddah, Saudi Arabia, from January 2003 through May 2011. The review included the site, cause, management, and recurrence of the leaks.

All patients had a diagnosis of CSF rhinorrhea that was made based on the clinical presentation of the patient. This included the history and the endoscopic findings that raised the suspicion of a CSK leak in some of the cases. The diagnosis was supported by further examinations preoperatively through computerized tomography of paranasal sinus (CT-PNS), with intrathecal injection of contrast or intraoperatively by observing the sudden gush of CSF from the defect in the suspected area. The site of the defect was documented as digital images in the database of our hospital and as notes in the files of the patients.

The medical records were reviewed for management, including follow-up visits to assess possible recurrence of CSF rhinorrhea. Patients were managed either conservatively or surgically based on the etiology. Conservative treatment included subarachnoid drainage by using a lumbar catheter, strict bed rest with elevation of the head, use of stool softeners, and advising the patient to avoid coughing, sneezing, blowing of the nose, and straining. All cases of CSF leak requiring surgical intervention were managed initially by a transnasal endoscopic approach.

Results

Clinical Findings

Ten cases (3 males, 7 females) of CSF rhinorrhea were treated during the study period. This includes 5 of 222 (2.3%) patients who underwent 245 endoscopic sinus surgeries (ESS), 3 with spontaneous leaks, 1 with post-craniotomy leak, and 1 following traumatic head injury. Indications for ESS in the 5 patients with post-ESS rhinorrhea were nasal polyposis (n = 2), sinusitis (n = 2), and malignant osteoma (n = 1). The diagnosis of CSF rhinorrhea was made by CT-PNS with intrathecal injection of contrast in 7 cases. In 3 of the 5 cases with post-ESS rhinorrhea, it was done intraoperatively.

Site

The leak in 3 of the 5 patients with post-ESS CSF rhinorrhea was from the cerebriform plate, and from the left fronto-ethmoidal area and at the roof of the left frontal sinus in the other 2 patients (Table 1). In the 3 patients with spontaneous rhinorrhea, the leak was from the junction between the cerebriform plate and bulla ethmoidalis; the roof of the sphenoid plate, and the left cerebriform plate (Table 2, Fig. 1). The leak

was at the right cerebriform plate in the 2 patients with CSF rhinorrhea secondary to head injury and craniotomy.

Table 1. The characteristics of the patients with post ESS rhinorrhea.

Gender	Site	Indication of ESS	Management	Recurrence
Female	Left fronto-ethmoidal area	Chronic sinusitis	Septal flap	No
Male	Roof of the left frontal sinus	Nasal polyposis	Conservative	No
Female	Right cerebriform plate	Fungal sinusitis	Tuboplast facial graft	No
Female	Left cerebriform plate	Nasal polyposis	Temporalis facial	No
Male	Left cerebriform plate	Osteoma	Periosteal elevation	Yes

Table 2. The characteristics of the patients with spontaneous rhinorrhea.

Gender	Site	Management	Recurrence
Female	Right Junction between the cerebriform plate and the bulla ethmoidalis	Conservative	No
Female	Left cerebriform plate	Septal graft with lumbar drain	No
Male	Left roof of sphenoid	Conservative	Yes

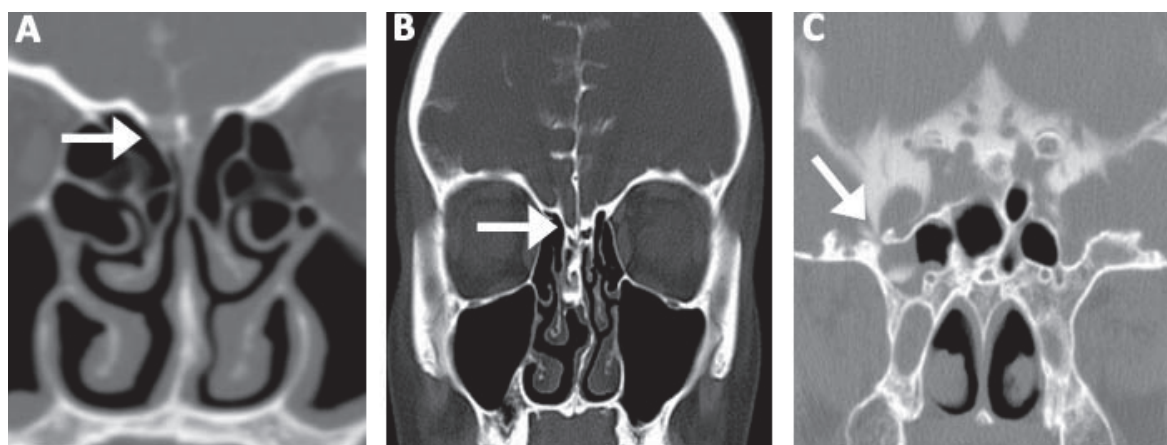


Fig. 1. A computerized tomography of the paranasal sinus with intrathecal injection of contrast in patients with spontaneous cerebrospinal fluid rhinorrhea: The arrow heads show the defect sites. A) Leak seen in the right nasal cavity at the junction between the cerebriform plate and the bulla ethmoidalis. B) Leakage of contrast through the anterior part of the left cerebriform plate adjacent to the medial surface of the vertical attachment of the middle turbinate. C) A bony defect noticed at the roof of the right sphenoid with traces of contrast seen within the sinus.

Management and Recurrence

Patients were followed up for 6 to 24 months (median 15 months). They were managed initially either endoscopically (n = 7) or conservatively (n = 3). Of the 10 patients treated, 4 had a recurrence of the leak; 3 after surgical treatment and 1 after conservative treatment.

In the patients who had post-ESS rhinorrhea, the defect closed after conservative management in 1 case, and in 4 cases, it was closed endoscopically using appropriate autografts (Table 1). The patient with osteoma experienced a recurrence of the leak after 1 month. Among the 3 patients with spontaneous CSF rhinorrhea, 1 case was successfully treated endoscopically by septal graft with lumbar drain, and the other 2 were managed conservatively. One of the latter had a recurrence of the leak after 3 months, which was subsequently repaired surgically (Table 2). The patient with CSF rhinorrhea secondary to head injury required 3 additional endoscopic repair procedures over a period of 18 months, which were not successful, and the patient was transferred to another hospital. The patient with a leak secondary to post-craniotomy was managed initially by surgical intervention (septal graft and lumbar drain), but the leak recurred after 2 weeks. The recurrence was successfully managed endoscopically after placement of tragus cartilage graft.

Two of 3 patients treated conservatively required surgical repair of the leak when conservative management failed. The leak did not recur after a single surgical intervention in each of the 2 cases. Regarding the site, 3 patients who experienced a recurrence had a leak at the cerebriform plate, and 1 had a defect at the roof of the sphenoid.

The initial closure was successful in 6 patients; 5 after ESS and 1 after conservative treatment. Overall closure was achieved in 9 patients; 7 after ESS and 2 after conservative treatment. Endoscopic repair failed in 1 patient.

Discussion

Most cases (90%) of CSF leak are due to trauma, with approximately 80% of the cases manifesting as rhinorrhea. CSF leaks secondary to skull base fractures occur as a complication in 1-3% of closed head injuries^[1]. Post-traumatic CSF leaks that arise surgically or due to iatrogenic defects are usually caused by various surgical procedures including ESS,

otologic surgery, septoplasty, transnasal resection of tumors of the pituitary gland, or other skull base surgeries. Spontaneous CSF leaks are considered a distinct entity, and are reported to be rare^[9]. The most common causes of the CSF rhinorrhea in our department were ESS (50%), spontaneous (30%), and others (20%). The incidence of CSF rhinorrhea at 2.3% as a complication of ESS in our department is consistent with that reported in the literature^[10]. This low incidence observed over the past eight years is because of the emergence of better imaging techniques, and the availability of necessary equipment as well as surgeons who have experience in performing endoscopic surgeries.

It is important to accurately identify the site and source of CSF leak and provide appropriate treatment as to avoid complications such as meningitis and low-pressure headaches^[1]. The diagnosis lies greatly on the clinical presentation of the patient. The symptoms are non-specific and patients generally present with clear unilateral rhinorrhea, which is increased by performing Valsalva maneuvers. In one of the algorithms designed for the diagnosis of CSF rhinorrhea, some authors^[3] suggested confirming or excluding the presence of CSF rhinorrhea by means of an immunoelectrophoretic study of the fluid for beta-2 transferrin or, where available, beta-trace protein, before performing imaging studies. Unfortunately, neither test is currently available at our hospital. In our series, the site of the leak was accurately identified by CT-PNS with intrathecal injection of contrast in 7 cases. This technique is more advantageous than conventional CT scans as it gives a more accurate localization of the leak. In addition, it has a reported sensitivity of 92% and a specificity of 100%^[4].

The cerebriform plate is reported as the most common site of CSF leaks, followed by the anterior ethmoid roof, and sphenoid and frontal sinus^[4,5,9-11]. Post-traumatic CSF leaks are reported to occur in these areas of the anterior skull base, where the dura mater is strictly adherent to the bone^[4]. Most leaks (70%) in our patients also occurred at the cerebriform plate.

The recurrence of CSF rhinorrhea in our series was 40%; 75% after ESS. Other authors^[10] reported a lower recurrence rate (9%) following endoscopic repair of CSF leaks. The relatively very high rate of recurrence of CSF rhinorrhea post-ESS in our series is probably due to our small sample size. However, the overall success rate was 90%;

87.5% post ESS, which is consistent with the results of another report⁸ from a hospital in Riyadh, Saudi Arabia. The overall successful closure following endoscopic repair in their study was 83%. In other studies conducted abroad^[12,13], the reported closure rates are higher, ranging between 95-100%, reflecting the high success rate of endoscopic surgery.

The low number of traumatic CSF rhinorrhea cases in this series reflects that our hospital is not a trauma center. Successful closure of the defect in the patient with traumatic CSF following head injury despite three additionally surgical revisions was not achieved. Therefore, more studies are recommended and to be conducted in a recognizable trauma center in Saudi Arabia, to find out the incidence of traumatic CSF rhinorrhea due to head injuries and the appropriate management.

Conclusion

The most frequent cause of CSF rhinorrhea in our department was ESS, and the cerebriiform plate was the most common defect location. CT-PNS with intrathecal injection is the best diagnostic modality that is currently available at our hospital. Regarding management, spontaneous leaks can be managed successfully by conservative measures, while surgery should be reserved for refractory cases. The high overall rate of closure in this study shows that the transnasal endoscopic approach is a safe and an effective technique for the surgical treatment of CSF rhinorrhea.

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سيلان السائل النخاعي من الأنف: أسبابه ومواقعه وطرق علاجه وتكرار حدوثه

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المستخلص. الهدف من هذا البحث هو التعرف على أسباب، مواقع، طرق علاج، تجدد حدوث سيلان السائل النخاعي من الأنف ومقارنة النتائج التي توصلنا إليها بمراكز أخرى. وقد تم هذا البحث عن طريق دراسة استيعادية للسجلات الطبية للمرضى المصابين بسيلان السائل النخاعي من الأنف في قسم الأنف والأذن والحنجرة بجامعة الملك عبدالعزيز بجدة. وأوضحت النتائج أنه تم معالجة عشر حالات من سيلان السائل النخاعي من الأنف خلال فترة البحث، وأن الأسباب الأكثر شيوعاً هي جراحة الجيوب الأنفية بالمنظار (٥٠٪)، عفوي (٣٠٪) وأسباب أخرى (٢٠٪). واتضح أن مواقع الإصابة كانت الصفيحة المصفوية في ست حالات، الجبهي الغربالي للجهة اليسرى في حالة واحدة، سقف الجيب الأنفي الجبهي في الجهة اليسرى، عند التقاء الصفيحة المصفوية والفقاعة الغربالية وفي الحالة الأخيرة كانت الإصابة على سقف الجيب الوتدي. واستمرت متابعة الحالات لمدة ستة أشهر إلى أربعة وعشرين شهراً. وتم معالجة السيلان بنجاح في ستة حالات عن طريق التدخل الجراحي بواسطة المنظار وأن نسبة نجاح العلاج بصفة عامة ٩٠٪ وأظهرت الدراسة أن العلاج الجراحي

للجيوب الأنفية عن طريق المنظار هو السبب الأكثر شيوعاً للإصابة وأن الصفيحة المصفوية هي المنطقة الأكثر إصابة وأن نسبة النجاح عن طريق التدخل الجراحي بواسطة المنظار وعن طريق المعالجة المحافظة عالية.