

# NONTRAUMATIC (SPONTANEOUS) CEREBROSPINAL FLUID RHINORRHEA FROM CRIBRIFORM FISTULA ASSOCIATED WITH PRIMARY EMPTY SELLA: REPORT OF TWO CASES AND LITERATURE REVIEW

Basit A. Syed, MS, MCh(SN), FRCSEd

Cerebrospinal fluid (CSF) rhinorrhea is a distinct clinical condition requiring surgery to avoid potential complications, such as meningitis, abscess, and spontaneous pneumocephaly. The condition can be of traumatic or nontraumatic (spontaneous) etiology.<sup>1</sup> The former is more common, and the latter has been considered rare since the first case reported by Miller in 1826.<sup>1,2</sup> Nontraumatic rhinorrhea presents problems of diagnosis and choice of surgical operation. The precise demonstration of fistula is, therefore, of immense importance for a successful surgical outcome. Among the spontaneous group, CSF rhinorrhea occurring in association with primary empty sella (PES) is a recently recognized entity,<sup>3</sup> and Ommaya et al.<sup>1</sup> were the first to report this association.

Most cases of CSF rhinorrhea in association with PES reported in the literature describe a sellar location of the fistulae,<sup>1,4-10</sup> whereas an ethmoid location of the fistulae is rarely reported.<sup>3,10-12</sup> We report two cases of spontaneous CSF rhinorrhea in association with PES, where the CSF leak occurred through the lamina cribrosa, and review the related literature.

## Case Reports

### Case 1

A 34-year-old Saudi woman, married with four children, presented to Dammam Central Hospital in March 1990 with a complaint of persistent watery discharge through the left nostril, which had developed spontaneously six months previously. She gave a history of intermittent bifrontal headache for 4½ years prior to the onset of CSF rhinorrhea. There were no visual symptoms on this occasion, and she denied any history of trauma and meningitis. She had been admitted to hospital four years earlier with a history of headache, blurring of vision and diplopia for two months. Examination at the time had

indicated grade III papilloedema and diplopia in the central field. A CT scan had suggested a benign intracranial hypertension (BIH). The patient was given steroids and diuretics, and she improved over a period of a few weeks, but continued to have intermittent headaches until she developed rhinorrhea.

Upon her present admission, clinical examination revealed an obese female with left nostril watery discharge, left hyposmia, with normal fundi and vision and no other neurologic deficit. Investigations showed that nasal fluid contained 63 mg/dL of glucose, but routine hematologic investigations and serum hormones (T3, T4, TSH, prolactin, FSH, LH, cortisol, and growth hormone) were all within normal limits. Plain skull x-ray revealed mildly enlarged sella turcica. CT scan of the brain revealed normal study with possible empty sella (ES). Post-Omnipaque (NYCOMED) CT cisternography (POCTC) confirmed the partial empty sella (Figure 1). A defect was seen in the left cribriform region, with CSF containing Omnipaque in the defect (Figure 2), suggesting a leak into the ethmoid sinus, but there was no evidence of a leak into the sphenoid sinus (through the sellar floor) or into the frontal sinus.

During the surgery performed in March 1990, the left cribriform region was explored through a left frontal craniotomy, using the intradural approach. A defect 4 mm in diameter was found in the dura and cribriform bone communicating with the ethmoid sinus. A small portion of the brain was found herniating through the defect, which became disengaged on retraction. The bony defect was filled with methyl methacrylate and the dural defect was covered with a free graft of pericranium, which was held in place by a few interrupted sutures. The patient made an uneventful recovery and had no CSF leak in the immediate postoperative period and during subsequent follow-up over a period of about 4½ years.

### Case 2

A 43-year-old Saudi female presented in April 1991 with a complaint of intermittent watery discharge through the right nostril which had lasted for six years and had been continuous for the previous five months. She had a severe bursting headache for one month associated with parosmia, followed by right-sided rhinorrhea. She was treated

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From the Department of Neurosurgery, Dammam Central Hospital, Dammam, Saudi Arabia.

Address reprint requests and correspondence to Dr. Syed: Department of Neurosurgery, Dammam Central Hospital, P.O. Box 63391, Dammam 31516, Saudi Arabia.

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FIGURE 1. Post-Omnipaque CT cisternography (POCTC). Coronal section through sella sphenoid region, showing empty sella filled with contrast. There is no leakage of contrast into the sphenoid sinus. Some mucosal thickening is seen (case 1).

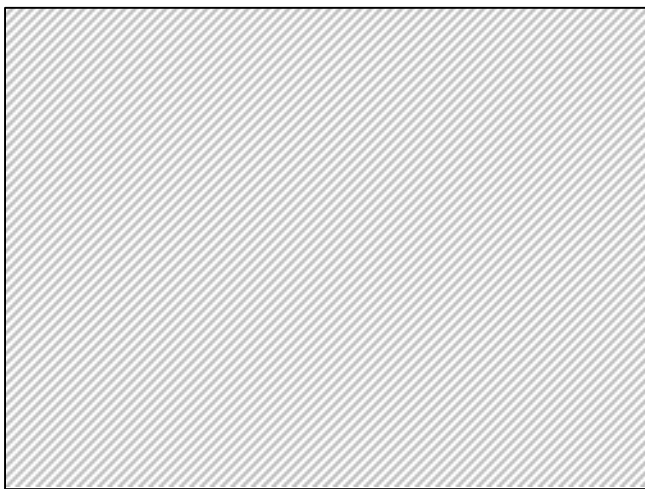


FIGURE 2. POCTC. Coronal section through ethmoid region showing a breach in the left ethmoid bone and the contrast filling (trickling through) the defect (arrow) (case 1).

conservatively as a case of allergic rhinitis in Kuwait and the rhinorrhea subsided in 25 days. The rhinorrhea had been intermittent since then, occurring about 3-5 times a year, and lasting for 1-3 weeks each time. However, in the previous five months, the rhinorrhea had been persistent and profuse, and two months prior to this admission, the patient had suffered from meningitis, from which she recovered upon prompt therapy. She had been admitted previously under a neurophysician, with a history of hemicranial headaches of six months' duration. She had no neurologic deficit but had papilloedema. She was investigated and diagnosed with BIH and PES syndrome. She had a history of hypertension since 1984 and was on Tenormin 100 mg/day.

Clinical examination revealed a moderately obese lady, with a blood pressure of 140/90 mm Hg, right anosmia, right nostril watery discharge, especially on sitting from

supine position. She had normal ocular fundi and vision and no other neurologic deficit. Investigations revealed glucose content of nasal fluid to be 78 mg/dL. Serum hormones (T3, T4, TSH, FSH, LH, prolactin, ACTH, cortisol, GH) were within normal limits. Skull x-rays revealed symmetrically enlarged sella. Brain CT scan and sella revealed an empty sella with brain atrophy. POCTC revealed partial ES, pituitary gland in the posterior part of the sella, and defect in the right lamina cribrosa, with leakage of Omnipaque-mixed CSF through the defect. There was no evidence of CSF leak through the sellar floor to the sphenoid sinus or to the frontal sinus.

The right cribriform area was explored through a right frontal craniotomy by the intradural approach. It revealed two funnel-shaped defects in the dura and bone in the right cribriform plate, 4 and 3 mm in maximum size, tucked with a small amount of herniated brain. The defects were filled with methyl methacrylate and covered with free pericranial graft, which was kept in place with a few sutures. Postoperatively, the patient had had no CSF leak at the time of her last follow-up in March 1998, seven years later.

### Discussion

“Empty sella” (ES) is a radiological term, and implies either a normal-sized or enlarged sella turcica, partly or totally filled with CSF, as seen on CT or magnetic resonance imaging (MRI) scans. It reveals herniation of the subarachnoid space into the sella turcica through an incompetent diaphragma sellae, with displacement/compression of the pituitary gland, leading to an empty appearance of the sella. The term ES was first introduced by Busch in 1951.<sup>13</sup> The radiological diagnosis does not mean a pathological situation in every instance. Many patients present without specific symptoms and diagnosis is made by chance. Empty sella syndrome (ESS) is the pathological variant of a radiologically verified empty sella. Primary empty sella (PES) is an idiopathic form of an ES, which occurs in the absence of prior pituitary operation or radiotherapy, or medication such as bromocriptin. Secondary empty sella (SES) occurs as a result of surgical resection or irradiation of sellar contents. In over 80% of cases, ESS occurs in women, the majority of them in the fifth decade, and 78%-90% of these patients have been described as obese and multiparous, and 31% as hypertensive.<sup>7</sup> In this study, the first patient had a mildly enlarged sella, whereas the second patient had significantly enlarged sella turcica.

PES can result from congenitally deficient diaphragma sellae, resulting in intrasellar subarachnoid herniation,<sup>1,14</sup> from raised intracranial pressure (ICP)<sup>7,8,11</sup> in 10%-11% of cases of BIH,<sup>7,11,14,15</sup> spontaneous infarction of pituitary adenoma,<sup>16</sup> postpartum pituitary necrosis, pituitary hypertrophy, and subsequent involution.<sup>14</sup>

Increased ICP is frequently noted in patients with PES, and many authors consider this to be a significant

TABLE 1. Case reports of spontaneous CSF rhinorrhea through ethmoid fistula associated with primary empty sella.

Authors	Age/ Sex	Duration of leak	Site Nose	Olfactory function	H/O meningitis	Cause of ES	Sellar size	CSF pressure	POCTC	Operation	Defects noted at surgery	Leak free follow-up
Perani et al. <sup>3</sup>	51/M	3 years 5 months	?B/L	anosmia	nil	–	enlarged	normal	fistula not demonstrated; contrast + in nostril	transcranial fascia lata graft altrophic olf.	nil	1 year
	42/F	2 years	left	–	yes	–	–	normal	do	do	nil	6 months
	42/F	1 year 4 months	right	normal	nil	–	–	normal	do	do	nil	15 months
Carmel <sup>17</sup>	62/F	4 weeks	right	hyposmia right > left	nil	head- ache	enlarged	–	no POCTC defect in cribriform	transcranial acrylic, muscle and pericranial graft	yes, in dura and bone	5 years
Moschini et al. <sup>12</sup>	50/F	8 months	left	–	nil	–	enlarged	–	fistulous tract in ethmoid	transethmoidal repair	–	–
Scott and Redmond <sup>10</sup>	39/F	11 years	left	nil	nil	–	–	normal	defect in left cribriform	TC extrad. fascia lata and muscle	nil	11 months
Basit (present report)	34/F	6 months	left	hyposmia left	nil	BIH	enlarged	not checked	fistulous tract in left ethmoid	transcranial intradural; acrylic pericranial graft	yes, in dura and bone	4 ½ years
	43/F	6 years	right	anosmia right	yes	BIH	do	do	fistulous tract in right ethmoid	do	do	7 years

BIH=benign intracranial hypertension; ES=empty sella; Olf.=olfactory bulb; POCTC=post-Omnipaque CT cisternography; B/L=bilateral;TC=transcranial.

contributory factor in the development of ES.<sup>7,11,14,15</sup> Continuous monitoring has revealed instances of intermittently raised ICP in patients with primary ESS, with no overt symptoms of raised ICP.<sup>5</sup> In some patients, however, monitoring has not shown evidence of raised ICP.<sup>8</sup> The latter group could represent burnt-out BIH, although it is likely that normal CSF pulsation occasionally cause subarachnoid herniation through deficient diaphragma sellae and subsequent remodelling of the sella.

Altered CSF dynamics have been implicated as a cause of PES.<sup>14</sup> Considering the presentation of our patients and their earlier diagnosis of BIH, it is likely that in both cases PES occurred as a result of BIH. Although CSF rhinorrhea in association with PES is reported to occur in 9.7% of cases,<sup>7</sup> the review of the literature revealed a report of 58 cases of CSF rhinorrhea in association with PES. In 51 of these cases, rhinorrhea occurred through the sellar floor into the sphenoid sinus,<sup>1,4-10,15</sup> and has been attributed to herniation of the pia arachnoid through an incomplete diaphragma sellae, either because of raised ICP or of constant CSF pulsations, eventually resulting in remodelling or erosion of the sellar bone and CSF leak through the sphenoid sinus. Only six cases of PES with CSF leak through the ethmoid fistula<sup>3,10,12,17</sup> have been described in the literature. In this study, both cases of PES had CSF leak through cribriform defects via the ethmoid sinus, as demonstrated by post-Omnipaque CT cisternography and confirmed at surgery. Some parameters of these cases are shown in the Table 1.

It is of interest to note that there has been one case report of PES associated with CSF leak through a defect in the middle cranial fossa via the sphenoid sinus.<sup>18</sup> The ethmoid location of the fistulae in our cases suggest that the

primary pathology, i.e., BIH, is perhaps responsible for causing both the PES and the production of ethmoid erosion leading to fistula formation. The other possible explanation could be that a congenital anomaly of diaphragma sellae and cribriform area co-existed, and either because of raised ICP or alteration in CSF dynamics, resulted in the formation of PES and atrophy at the cribriform area. The latter gave way earlier, resulting in an ethmoid fistula.

Fluorescein dyes,<sup>19</sup> radioisotopes,<sup>20</sup> metrizamide digital video subtraction fluoroscopic cisternography,<sup>21</sup> and contrast CT cisternography,<sup>20,22,23</sup> have all been used to determine the location of CSF leak. The latter, however, has proved invaluable, and is the test of choice. In both our cases, POCTC clearly demonstrated the site of fistula. Recently, MRI (T<sub>2</sub>-weighted, high-resolution images) has been reported to give better localization in inactive CSF fistulas.<sup>24</sup>

Nonoperative measures such as bed rest with elevation of head end of bed, avoiding coughing, blowing of nose and straining, use of stool softeners, medication to decrease CSF production (acetazolamide), and modest fluid restriction, may all be instituted. However, non-traumatic fistulae does not respond to treatment. Occasionally, CSF drainage by repeated lumbar puncture, external lumbar CSF drainage, or percutaneous lumboperitoneal shunt may close the fistula in selected cases having raised ICP or communicating hydrocephalus. Drainage should not be too rapid, since overdrainage may lead to herniation or severe pneumocephalus or both. There is also a potential risk of introducing micro-organisms through the dural defect by these drainage techniques.<sup>2</sup> Surgical closure is the treatment of choice for these cases, as conservative measures are

usually not effective. This is important in order to avoid potential complications such as meningitis, abscess, and spontaneous pneumocephaly. Various approaches, including intracranial,<sup>3,22,25</sup> extracranial,<sup>25-27</sup> endoscopic,<sup>28</sup> and percutaneous,<sup>9</sup> have been used to repair the CSF fistulae. One can achieve good results by choosing the appropriate procedure based on the type and location of the fistula, and by the familiarity of the procedure of the treating surgeon.

Various materials have been used to close the defect. The bone defect can be closed with bone wax, wire mesh (titanium), methyl methacrylate, or a piece of autologous bone graft. The dural defect can be covered with materials such as fascia lata, temporal fascia, pericranium, flax flap, muscle patch, fat, mucoperiosteal flap, gelatin sponge, dura patch or Lyodura. Autologous material avoids reactions associated with foreign substances. These grafts can be kept in place by sutures, use of tissue adhesive or fibrin glue.<sup>2,17</sup> In our two cases, the transcranial intradural approach was used, and the defects were visualized directly under the microscope. Methyl methacrylate was used to fill the bony defects, and pericranial graft was used to repair the dural defect with successful outcome.

The CSF rhinorrhea in association with PES can result from fistula located in: 1) the sella via sphenoid, the most common cause; 2) the cribriform area via ethmoid, in rare instances; and 3) the middle fossa via sphenoid, very rarely (single case report). Therefore, it is of immense importance to document the location of the fistula prior to surgery by radiological means, due to its surgical indication for a successful surgical outcome.

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