Arq Neuropsiquiatr 2004;62(3-B):827-831

SURGICAL MANAGEMENT OF CEREBROSPINAL FLUID RHINORRHEA UNDER ENDOSCOPIC CONTROL

José Alberto Landeiro[1], Marlo S. Flores[2], Bruno C.R. Lázaro[2], Maria Helena Melo[3]

ABSTRACT - The surgical management of cerebrospinal fluid (CSF) rhinorrhea has changed after the introduction of functional endoscopic sinus surgery.The following three cases illustrate the repair of CSF leaks with the use of rigid endoscope. Two patients had the diagnosis and the site confirmed after intrathecal fluoresceine saline injection. The obliteration of the CSF was achieved with fat free, mucoperichondrial or mucoperiostal free grafts taken from middle or inferior turbinate and kept in place by fibrin glue. Primary closure was achieved in all patients. The repair of the CSF rhinorrhea by endonasal endoscopic surgery is safe, effective and is a valid alternative to the cranial approach.

KEY WORDS: cerebrospinal fluid rhinorrhea, endoscopic surgery, fluoresceine.

Oclusão das fístulas liquóricas nasais sob visão endoscópica

RESUMO - Descrevemos a técnica de oclusão endoscópica por via endonasal de fístula liquórica proveniente do andar anterior em três pacientes. Dois pacientes tiveram o diagnóstico e os orifícios da fístula localizados após injeção intratecal de fluoresceína sódica. A oclusão foi obtida com enxerto de gordura livre, fragmentos de mucopericôndrio septal ou mucoperiósteal retirado do corneto médio ou inferior e selados com o auxílio de cola de fibrina. A cirurgia endoscópica endonasal é técnica segura e eficaz no tratamento da fístula esfeno-etmoidal, constituindo alternativa à abordagem craniana.

PALAVRAS-CHAVE: fístula-liquórica nasal, endoscopia, fluoresceína.

Cerebrospinal fluid (CSF) leak originated from the anterior fossa and sphenoid bone carries significant morbidity when inadequatedly treated, expresses as meningitis, subdural empyema and brain abscess[1,2]. CSF fistulas can be divided in traumatic and non-traumatic: the traumatic group can be divided in accidental and iatrogenic[3]. The non-traumatic group is associated to brain tumors, skull base congeital defects and meningoceles or meningoencephalocles.

Conservative treatment is based on bed rest, lumbar punctures and permanent spinal fluid lumbar drainage. Surgical repair consists of craniotomy or nasal approaches (external and endonasal ethmoidectomy) with the use of an endoscope[1,2,4-10]. The failure rate of the transcranial access can be as high as 40%: the associated morbidity, especially the postoperative anosmia stimulated the surge of alternative methods of treatment[4,11]. Dohlman[5] described in 1948 the first extracranial access consisting of a nasofrontal incision with external ethmoidectomy in order to correct the CSF fistula. The advantages associated with the use of an endoscope - better lightning, magnification of the image and best angle visualization - gives the surgeon a more precise diagnosis and a less invasive method of nasal CSF fistula treatment, giving the endoscopic surgery a status of the method of treatment choice[6-10].

We describe the endonasal endoscopic treatment of three patients with nasal CSF fistula.

METHOD

All the patients undergone a surgery under general anesthesia. The operation was performed with the use of a Karl Stortz rigid endoscope of 0º and 30º with a 4mm diameter. All procedures were performed by the authors.

Preoperative evaluation - Computed tomography (CT) of the brain and nasal sinuses with coronal acquisition were performed in all patients. CT scan with cisternography was also performed in 2 patients and magnetic resonance image (MRI) was performed in 3 patients, including T2 weighted coronal views. Outpatient nasal endoscopy was performed in 3 patients.

Fluorescein was injected in 2 patients under general anesthesia after lumbar puncture with aspiration of

Brazilian Air Force Hospital, Rio de Janeiro RJ, Brazil: [1]M.D, Head of Neurosurgery Clinic, [2]M.D Assistant of Neurosurgery Clinic, [3]M.D, E.N.T Clinic.

Received 19 December 2003, received in final from 23 March 2004. Accepted 8 May 2004.

Dr. José Alberto Landeiro - Avenida Monsenhor Ascâneo 591/202 - 22621-060 Rio de Janeiro RJ - Brasil. E-mail: jlandeiro@aol.com

10ml of CSF fluid, adding 5% sodium fluorescein in a 0,1ml/kg rate, with a limit rate of 1ml of the solution. Surgery started 30 minutes later, with the head of the patient slightly placed below the heart level.

Surgical techniques - With the patients under general anesthesia, the nasal cavities were infiltrated with a solution of 2% lidocaine and 1:50000 adrenaline. Amoxicilin-clavulanate (500mg) was administered during anesthetic induction and 3 times a day until the 4th postoperative day.

Septoplasty and turbinoplasty were performed in 2 cases because of a difficult operative access, limited by septal deviation and by significant inferior/middle turbinate hypertrophy. When the CSF leak was identified, the adjacent mucosa should be removed with the use of a forceps to expose the dural or the osseous defect with a surgical view of 4mm borders. An anterior ethmoidectomy was performed when a fistula was placed in the cribiform plate or in the superior border of the sphenoid sinus. The surgical graft was composed by septum mucoperichondrial tissue, with its cartilaginous part placed between the dura and the osseous border; at the level of the cribiform plate an additional bone graft taken from the middle turbinate was placed on the nasal face of the leak, given the lack of bone component and the presence of the crista galli. Fibrin glue was utilized in all procedures. After graft positioning, layers of Surgicel and Gelfoam were interposed between the graft and the nasal packing. The purpose of gelfoam is to prevent inadvertent removal of the graft during removal of the nasal packing.

In case of a nasal leak after transnasal resection of a pituitary adenoma, the opening part of the sphenoid sinus should be enlarged, as well as the osseous borders of the sellar dura. A fat graft should be placed inside the sella in the space created after tumor removal and then the mucoperichondrial graft was placed between the dura and the bone, with the cartilaginous face placed upwards, and kept in position with the use of fibrin glue. After graft packing, the sphenoid sinus should be filled with abdominal fat tissue taken from an infraumbilical incision.

Fig 1. CT scan imaging showing a frontoethmoid roof fracture.

CASES

Case 1. A 47-year-old woman underwent a transseptal, transsphenoidal approach to the sella with resection of pituitary microadenoma in Cushing disease. The patient did well for 15 days until she noticed a significant amount of thin white nasal drainage. Conservative measures for 1 week, consisting of bed rest, and lombar subarachnoid drain were unsuccessfull. CT scan of the sellar region and MRI showed a surgical defect in the sellar floor into the sphenoid sinus and pneumocephalus. The patient underwent transnasal transseptal repair of the sphenoidal sinus CSF leak using transnasal endoscopic view. A mucoperichondrial flap was placed underneath the dural tear. A free fat graft from the abdomen was placed over the mucoperichondrial flap filling the sphenoidal sinus and kept in place by fibrin glue. A follow-up at 3 years revealed no signs of CSF leak.

Case 2. A 19-year old man was admitted at hospital with meningitis and right-side CSF rhinorrhea. He had a history of motor vehicle accident 6 months before. He had no additional problems until he was hospitalized. A Ct-scan, MRI and myelocisternogra-

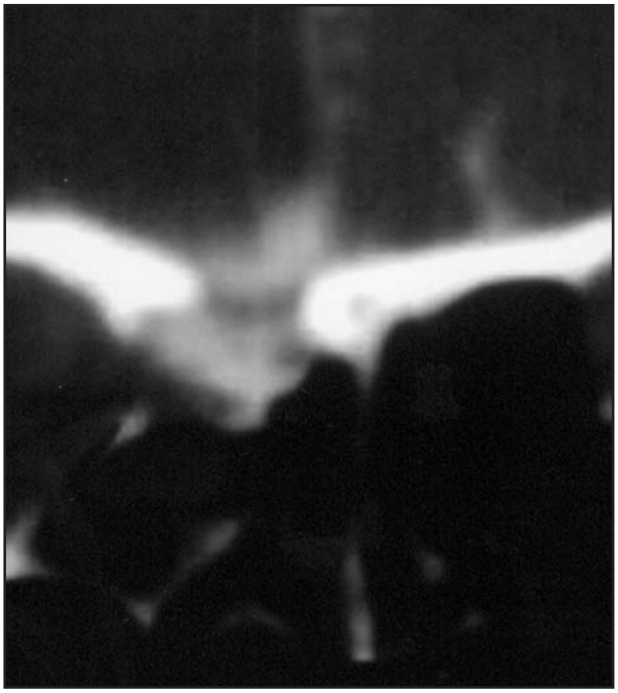

Fig 2. A intratechal contrast CT imaging of a patient with a ethmoid roof fracture.

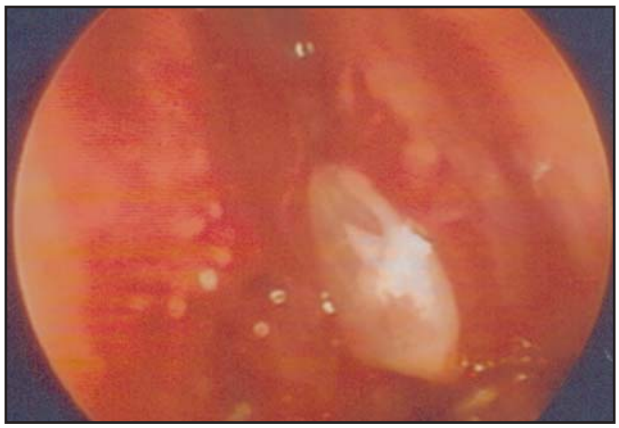

Fig 3. Operative endoscopic view. Fistula site is identified with the CSF coming out from the ethmoid roof.

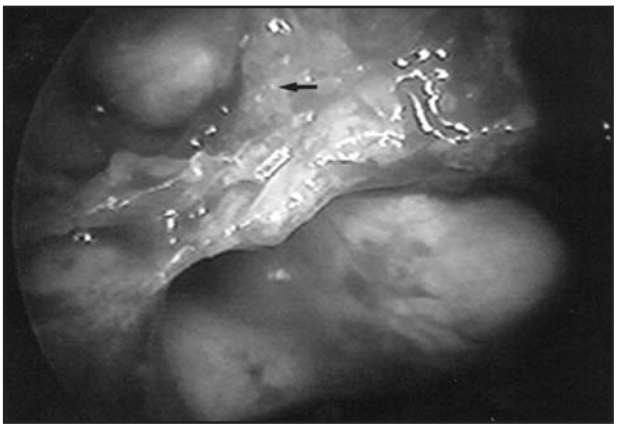

Fig 4.The arrow showing a endoscopic view of the meningocele in a patient with spontaneous CSF leak.

phy suggested a cribform plate defect. The nose was explored endoscopically after administration of intrathecal fluorescein. The site was identified in the sphenoetmoid recess and the defect covered with a free mucoperichondrial flap from the septum. He has been doing well since then (Fig 1,2,3).

Case 3. A 68-year-old woman presented left-side CSF rhinorrhea. The symptons started 3 months prior to hospital admission. She has already submitted a bifrontal craniotomy and a repair dural defects with tensor of fascia lata over the cribform plate. There was no history of trauma or prior endoscopic sinus surgery. A metrizamide CT scan showed a leak of posterior sphenoid sinus. MRI confirmed the site. The leak was identified after fluorescein saline injection and closed after a transseptal transsphenoidal endoscopic approach, with free fat graft, and mucoperichondrial flap taken from middle turbinate and kept in place with fibrin glue (Fig 4).

Postoperative care - After operation, the patients were kept in bedrest with the head elevated; an endonasal endoscopy was performed in the outpatient clinic a month later to check the nasal cavity, healing of the mucosa, graft positioning and to correct possible adherences. Brain and nasal sinuses CT Scan were performed 3 months after surgery in order to verify graft positioning in relation to the spheno-ethmoid tectum. A lumbar drain was unnecessary.

DISCUSSION

Three patients presenting sphenoid and anterior fossa CSF fistula were submitted to endonasal endoscopic approach with excellent results.There were no loss of smell sense in any of the operated patients. The most common cause of nasal leak is traumatic brain injury.Occurring after extracranial or intracranial surgery as transsphenoidal resection for pituitary adenomas, nasal leak can be avoided with appropriate measures, although CSF fistula may occur eventually. Spontaneous CSF fistula formation is rare and its treatment is very hard.

Diagnosis of a flagrant CSF fistula is effected after nasal inspection and performance of laboratory tests of the fluid as glucose measurement. In some cases, there is contamination of the material with blood or other secretions, so the test with beta-2 transferrine becomes mandatory. The sensitive method of the test is as high as 97.7% in a study including 88 patients[12]. In our study the presence of a CSF fistula was revealed based on clinical history and examination, including simple measures like asking the patient to bend down the head. Laboratory confirmation of the CSF fistula with glucose test was performed in 2 patients; B2 transferrine test was not available in our hospital.

Recognition of the exact site of the CSF fistula is a fundamental condition for performing an adequate treatment. Radiographic exams like simple skull X rays are quite ineffective.However it can demonstrate indirect signs like fractures and pneumoencephalus. CT scan demonstrates skull base defects and fractures. CT scan after metrizamide injection is a valuable tool for localizing the CSF fistula site, on the otherside a CSF leak must be present at the moment of the examination; T2 weighted MRI consists of a precise method to indicating the CSF fistula site even when there is no CSF

leak and for diagnosing associated lesions as pseudo meningoceles and pseudomeningoencefaloceles[13,14]. MRI cisternography is a method that does not require intrathecal injection of contrast and may become the method of choice for the evaluation of the CSF fistula. In this study, all the patients were submitted to MR and nasal sinus CT scan in coronal and axial acquisitions. CT scan after metrizamide injection was performed in 2 patients with active CSF leak, revealing precisely the CSF fistula site. In 2 patients, the confirmation of the presence of the fistula was accomplished after intrathecal fluorescein injection and further nasal endoscopy. Intrathecal injection of fluorescein is a widespread method used for indication of the CSF fistula site[15-20]. Reports of extremities weakness, paresthesias and seizures after intrathecal fluorescein injection were described; some authors nowadays recommend the use of intranasal topic fluorescein[21]. Seizures may be related to the total dose and suboccipital fluorescein injection[22]. Complications caused by intrathecal fluorescein injection were not found in any of the patients.

The surgical approach to nasal CSF fistulas consisted of in most cases, in craniotomy. However, this access is associated with anosmia, brain swelling due to retraction and hemorrhage[4] and with a high recurrence rate[11]. Endonasal endoscopic approach for the treatment of CSF fistula has received great support since the pioneering article of Wigand[6]. Papay et al.[7] described the use of a rigid endoscope for the treatment of 4 patients with nasal CSF fistula of the sphenoid and ethmoid bone, occluded with fat, muscle and fascia lata graft. Mattox and Kennedy[8] reported their experience with the use of nasal endoscopy in 5 patients presenting CSF fistula and in 2 patients presenting nasal encephalocele successively treated. Stankiewicz[9] reports the treatment of 6 cases of CSF fistulas in a series of 800 ethmoidectomies: all cases were effectively treated with endoscopy. Lanza et al.[10] reported a study with 36 patients submitted to nasal endoscopy: in 34 patients (94.4%), the occlusion of the CSF fistula was efectively performed in only one procedure. Burns et al.[16] treated 42 patients with CSF fistula, obtaining resolution of the symptoms in 35 patients (85.3%) after one procedure, only 3 patients recquiring a second surgical approach. More recent studies support the use of an endoscope to the treatment of nasal CSF fistulas[21-24].

The graft can be positioned in an inlay form (between the dura and the skull base) or in an onlay form (on the nasal site of the leak). Indication for performing the onlay technique takes place when there is risk of damaging nerves and blood vessels during the dural detachment or during the intradural graft attachment. In our series, we performed the inlay technique in all of our cases. Some studies report that the form of graft positioning is not a critical factor in predicting success of the procedure[6-8,25].

A great number of techniques and materials have been used for CSF leak occlusion, including autologous material as abdominal fat, nasal septum mucosa, bone, fascia lata and muscle grafts[6-9,18,22,26]. The graft can be attached with fibrin glue, haemostatic sponges or vaseline gauzes[23,24,27]. However, it appears that the location, size, techniques and materials used do not interfere directly with the success of the procedure[25]. A critical aspect of the procedure is an adequate resection of the mucosa around the bone defect in order to permit the complete graft attachment. In our series, the graft, consisted of nasal septum cartilage and middle turbinate bone was fixed with fibrin glue. In cases of CSF fistula occurring after transsphenoidal resection of a pituitary tumor, we used abdominal fat to obliterate the sella and the sphenoid sinus, after intra dural cartilage placement. Perioperative antibiotics were given while nasal packing and intradural lumbar drain were in place. Some authors still recommend the routine use of a lumbar drain[28], although recent studies suggest it should not be routinely performed[20]. Although the size of the fistula act as a limiting factor for its complete occlusion, in our cases it was not relevant for the success of the procedure.

Contraindications to the endoscopic treatment of CSF fistulas include the presence of an intracranial lesion; a fracture of the posterior wall of the frontal sinus; lateral extensions of the frontal and sphenoidal sinus, and CSF rhinorrhea from a temporal bone defect[24,25].

Pioneering studies of Cappabianca et al[29], Jho and Alfieri[30] brought new perspectives to the neurosurgical endonasal endoscopic treatment of CSF fistula. Given the excellent rate of success of the endoscopic treatment of CSF fistula, low morbidity rate and the possibility of performing more than one procedure using the same approach and technique, this model of treatment is becoming the method of choice for surgical repair of CSF fistula.

CONCLUSION

We reported cases of 3 patients presenting CSF fistula of the anterior fossa and sphenoid effectively treated with endonasal endoscopy, using an 0º and 30º endoscope: occlusion was obtained with fat, mucoperichondrium or mucosa removed from the septum, middle or inferior nasal turbinate.There were no complications related to this technique.In our cases the transnasal endoscopic technique provided magnificent visualization and facilitated precise graft placement

REFERENCES

1. Samii M, Draf W: Surgery of the skull base. Berlin: Springer Verlag, 1989:114-229.
2. Bernal-Sprekelsen M, Bleda Vasquez C, Carrau RL. Ascending meningitis secondary to traumatic cerebrospinal fluid leaks.Am J Rhinol 2000;4: 257-259.
3. Ommaya AK. Cerebrospinal fluid rhinorrhea. Neurology 1964;15:106-113
4. Aarabi B, Leibrock LG. Neurosurgical approaches to cerebrospinal fluid rhinorrhea.Ear Nose Throat 1992;71:300-305.
5. Dohlman G. Spontaneous cerebrospinal rhinorrhea. Acta Otolaryngol (Stockh)1948;67(Suppl):20-23.
6. Wigand ME. Transnasal ethmoidectomy under endoscopic control. Rhinology 1981;19:7-15.
7. Papay FA, Maggiano H, Dominguez S, Hassenbusch SJ, Levine HL, Lavertu P. Rigid endoscopic repair of paranasal sinus cerebrospinal fluid fistulas.Laryngoscope 1989;99:1195-1201.
8. Mattox DE, Kennedy DW. Endoscopic management of cerebrospinal fluid leaks and cephaloceles.Laryngoscope 1990;100:857-862.
9. Stankiewcz JA. Cerebrospinal fluid fistula and endoscopic sinus surgery. Laryngoscope 1991;101:250-256.
10. Lanza DC, O·Brien DA, Kennedy DW. Endoscopic repair of cerebrospinal fluid fistulae and encephaloceles.Laryngoscope 1996;106:1119- 1124.
11. Park J, Strelzow V, Friedman W. Current management of cerebrospinal fluid rhinorrhea. Laryngoscope 1983;93:1294-1300
12. Oberascher G. A modern concept of cerebrospinal fluid diagnosis in oto-and rhinorrhea. Rhinology 1988;26:89-103.
13. Eljamel MS, Pidgeon CN. Localization of inactive cerebrospinal fluif fistulas. J Neurosurg 1995;83:795-798.
14. Gupta V, Goyal M, Gaikwad, Sharma A. MR evaluation of CSF fistulae. Acta Radiol 1997;38:603-609.
15. RF Wetmore, Duhaine AC, Klausner RD. Endoscopic repair of traumatic CSF rhinorrhea in a pediatric patient. Int J Pediatr Otorhinolaryngol 1996; 36:109-115.
16. Burns JA, Dodson EE, Gross CW. Transnasal endoscopic repair of cranionasal fistulae: a refined technique with long-term follow-up. Laryngoscope 1996;106:1080-1083.
17. Hughes RG, Jones NS, Robertson IJ. The endoscopic treatment of cerebrospinal fluid rhinorrhea: the Nottingham experience. J Laryngol Otol 1997,111:125-128.
18. Wormald PJ, McDonogh M."Bath-plug" technique for the endoscopic management of cerebrospinal fluids leaks. J Laryngol Otol 1997;111:1042-1046.
19. Nallet E, Dech Ph, Bezzo A, Le Lievre G, Peynegre R, Coste A. La chirurgie endonasal sous guidage endoscopique dans le traitment des fuites de LCR spontanées ou post-tramatiques.An Otolaryngol Chir Cervicofac 1998;115:222-227.
20. Cassiano RR, Jassir D. Endoscopic cerebrospinal fluid rhinorrhea repair: is a lumbar drain necessary? Otolaryngol Head Neck Surg.1999;121:745-750.
21. Jones ME, Reino T, Gnoy A, Guillory S, Wackim P, Lawson W. Identification of intranasal cerebrospinal fluid leaks by topic application with fluorescein dye.Am J Rhinol 2000;14:93-96.
22. Schmerber S, Righini CH, Lavieille JP, Passagia JG, Reyt E. Endonasal endoscopic closure of cerebrospinal fluid rhinorrhea. Skull Base 2001;11:47-58.
23. Bachert C, Verhaeghe B, van Cawenberge P, Daele J. Endoscopic endonasal surgery (EES) in skull base repairs and CSF leakage.Acta Otorhinolaryngol Belg 2000; 54:179-189.
24. Bibas AG, Skia B, Hickey SA. Transnasal endoscopic repair of cerebrospinal fluid rhinorrhoea. Br J Neurosurg 2000;14:49-52.
25. Zweig JL, Carrau RL, Celin SE, et al. Endoscopic repair of cerebrospinal fluid leaks to the sinonasal tract: predictors of success. Otolaryngol Head Neck Surg 2000; 123:195-201.
26. Marks SC. Middle turbinate graft for repair of cerebral spinal fluid leaks.Am J Rhinol 1998;12: 417-419.
27. Van Velthoven V, Clarici G, Awer LM. Fibrin tissue adhesive sealant for prevention of CSF leakage following transsphenoidal microsurgery. Acta Neurochir(Wien) 1991;109:26-29.
28. McCoy G. Cerebrospinal rhinorrhea: a comprehensive review and a definition of the responsibility of the rhinologist in the diagnosis aand the treatment. Laryngoscope 1963;73:1125-1157.
29. Cappabianca P, Alfieri A, de Divitiis E. Endoscopic endonasal transsphenoidal to the sella: towards functional endoscopic pituitary surgery. Minim Invas Neurosurg 1998;41:66-73.
30. Jho HD, Alfieri A. Endoscopic endonasal pituitary surgery: evolution of surgicaltechnique and equipment in 150 operations. Minim Invas Neurosurg 2001; 44:1-12.