CASE STUDY

Association Between Cerebrospinal Fluid Leakage and Persistence of Sternberg’s Canal: Coincidence or Cause?∗

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KEYWORDS
Sternberg’s canal; Cerebrospinal fluid leak; Endoscopic nasal surgery

Abstract Endoscopic surgical techniques allow treating various pathological diseases of the cranial base, including cerebrospinal fluid leaks (CSF). These approaches have a high success rate and reduce surgical time and morbidity. However, when they are located in the lateral wall of the sphenoid, the surgery is more complex. In our case, the CSF appeared to be related with a Sternberg’s canal. Predisposing factors were also associated with an extensive unilateral pneumatization of the sinus and benign intracranial hypertension. The closure of the leak was achieved using an endoscopic transethmoidal transpterygoid approach for proper exposition of the lateral wall of the sphenoid. After 5 years of monitoring, the patient has had no more episodes of rhinoliquorhea.

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PALABRAS CLAVE
Canal de Sternberg; Fistula de líquido cefalorraquídeo; Cirugía endoscópica nasal

Asociación entre fistula de líquido cefalorraquídeo y persistencia del canal de Sternberg: ¿coincidencia o causa?

Resumen Las técnicas endoscópicas nasales permiten el tratamiento de diversos procesos patológicos de la base del cráneo, entre las cuales se incluyen las fistulas de líquido cefalorraquideo (LCR). Estos abordajes tienen una elevada tasa de éxitos y reducen el tiempo quirúrgico y la morbilidad. Sin embargo, cuando se localizan en la pared lateral del esfenoides la cirugía es más compleja. En el caso presentado la fistula parece relacionarse con la persistencia del canal de Sternberg. Además como factores predisponentes asociados encontramos la extensa neumatización unilateral del seno así como una hipertensión intracranal benigna. El cierre de la fistula se realizó endoscópicamente mediante un abordaje transetmoidal y transptérygoide para una correcta visualización de la pared lateral del esfenoides. Tras 5 años de seguimiento la paciente no ha vuelto a presentar más episodios de rinoliquorrea.

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Introduction

Rigid endoscopes with different angles have enabled otolaryngologists to use an endonasal approach for multiple diseases and eliminated the need for more radical, external approaches with increased surgical trauma and morbidity. One of the pathological processes of the skull base that has benefited from these techniques is cerebrospinal fluid fistula (CSF), for which higher success rates have been achieved than with open techniques.\(^1\)

This work refers to the closure of a fistula with rhinoliquorrhea of the lateral wall of the sphenoid. Endoscopic surgery has become the preferred technique for this kind of pathology due to its high success rate\(^2\) and reduced operative time and morbidity. However, access to this region is not easy because of the anatomical variations it presents and which pose a surgical challenge. This wall has anatomical elements such as the carotid artery, optic nerve, second branch of the trigeminal nerve or the pterygoid nerve (also known as vidian nerve). In sinuses with considerable pneumatization some of these structures may be prominent, thus exposing them to surgical risks. In other cases they represent very weak areas due to developmental disorders that can cause fissures through which meningoencephalocele or CSF leaks may emerge.

During the neonatal period, 2 ossification centres appear in the sphenoid sinus: anterior and posterior. Sometimes, the posterior part becomes fused in an incomplete manner, leaving a canal without a bony cover known as lateral craniopharyngeal canal or Sternberg canal.\(^3\)\(^-\)\(^5\) It is located in the postero-lateral part of the inferior wall of the sphenoid sinus and is generally located laterally to the maxillary nerve canal or the foramen rotundum. After resorption of the cartilage, the Sternberg canal is only covered by connective tissue, leaving it as the point of least resistance in the skull base.

Its prevalence in adults is controversial, ranging from 0.1\% to 4\%\(^5\)\(^,\)\(^6\) according to published works.

The persistence of this canal can cause CSF leakages and meningoencephalocele, especially when associated with extensive pneumatization and high intracranial pressure.\(^4\)\(^,\)\(^5\)

Clinical Case

The patient was a 53-year-old woman, whose clinical history included a previous intervention by cranial approach due to a schwannoma of the left ninth cranial nerve. The sequelae of this intervention were paralysis of the left tenth cranial nerve and benign intracranial hypertension (a ventriculoperitoneal shunt valve was placed temporarily during the postoperative period). Three months later she received adjuvant radiosurgery treatment due to tumoral persistence.

Sixteen months later, the patient presented a CSF leak in the cribiform plate of the ethmoid, which was closed by an approach through the anterior cranial fossa. After the intervention, she suffered anosmia due to olfactory nerve section.

The patient returned after 6 months follow-up, presenting rhinoliquorrhea associated with benign intracranial hypertension, as well as bacterial meningitis, which responded favourably to antibiotic treatment (cefotaxime and vancomycin). Subsequently, during admission, we requested assessment by our service. The CT scan (Fig. 1) revealed a CSF fistula at the level of the Sternberg canal persistence (in the postero-lateral and inferior parts of the sphenoid). As mentioned previously, this case presented extensive unilateral pneumatization and benign intracranial hypertension as favouring factors. The lesion was closed through a transethmoidal and pterygoid endoscopic approach under general anaesthesia. During surgery we used endoscopes with optics of 30° and 70°. We must also note the need for ample access to the posterior ethmoid in order to open the sphenoid sinus. Therefore, we completed the approach with an expansion of the maxillary sinus, so as to visualise the posterior wall of the sinus (which was resected after cauterization of the sphenopalatine artery) and the bottom of the orbit. This enabled us to reach the pterygoid region of the sphenoid sinus, and we were able to widen the lateral and lower margins of the sphenoid opening using Kerrison clips, a surgical bur and a curette. We exercised caution so as to avoid damaging the pterygoid nerve or the second trigeminal branch. We were able to expose the entire lateral recess of the sphenoid sinus and, after detaching the sinus mucosa, we closed the defect with cartilage, fascia lata and fibrin glue, obliterating the sphenoid sinus with abdominal fat. We also reinstalled the ventriculoperitoneal shunt valve in the same surgical action. Once we verified that the fistula had closed through endoscopic examination, the patient was discharged.

The postoperative MRI scan (Fig. 2) showed how the sinus remained obliterated by fat. After a 5-year follow-up, the patient has suffered no new episodes of rhinoliquorrhea.

Figure 1 Preoperative computed tomography scan showing the bony defect in the left lateral wall of the left sphenoid sinus (arrow 1), as well as the presence of mucosal thickening and a small amount of free intrasinusal fluid due to a CSF leak. Arrow 2 indicates the maxillary nerve canal (V2) and arrow 3 indicates the pterygoid (vidian) nerve canal.
to consider that the dissection of the sphenoid lateral recess should always be conducted in a lateral and inferior direction, with boundaries marked by the pterygoid nerve and superior maxillary nerve. A dissection exceeding these limits would carry the risk of damaging the optic nerve or the carotid artery. Curettage of the sphenoid mucosa should be performed with extreme care in order to avoid leaving any mucosal remnants. We must also bear in mind the correction of predisposing factors such as placement of shunt valves in patients with benign intracranial hypertension.

The presence of a CSF leak located in a highly pneumatized sphenoid sinus should alert about its possible origin in the lateral recess of the sinus. Although uncommon, persistence of the Sternberg craniopharyngeal canal is being increasingly recognized as aetiology in the presence of a spontaneous CSF leak.

**Conflict of Interest**

The authors have no conflicts of interest to declare.

**References**