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Cerebrospinal fluid fistula after endoscopic transsphenoidal surgery

Experience in a spanish center

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ABSTRACT

Background: Postoperative cerebrospinal fluid (CSF) fistula is the most serious complication after transsphenoidal surgery. **Objective:** To analyze the incidence of CSF fistula after endoscopic transsphenoidal surgery for tumor removal in sellar region; to discuss associated factors and methods used for sellar closure. **Method:** Retrospective study of 67 patients (73 surgeries) operated via transsphenoidal endoscopy at Hospital Vall D'Hebron and Hospital Clinic of the Universidad de Barcelona, Spain. The data collected included: age, sex, hospitalization stay, suprasellar extension of the lesion, type of tumor, evidence of intraoperative CSF fistula, complications of postoperative CSF fistula, previous surgery and radiotherapy. **Results:** Six patients (8.2%) had postoperative CSF fistula, and their average hospitalization was 5 days longer with resulting complications: two of whom had pneumoencephalus and two with meningitis. No association was found between the data collected and postoperative CSF fistula. **Conclusion:** The rate of CSF fistula after endoscopic transsphenoidal surgery from the present study is contained within the literature. Unlike other reports, no association between the variables and postoperative CSF fistula was found in this report.

Key words: cerebrospinal rhinorrhea, endoscopy, pituitary neoplasms.

Fístula liquórica após cirurgia transesfenoidal endoscópica: experiência de um centro espanhol

RESUMO

A fístula liquórica pós-operatória é a complicação mais séria após cirurgia transesfenoidal. **Objetivo:** Analisar a incidência de fístula liquórica após cirurgia endoscópica transesfenoidal para remoção de tumores selares, discutir fatores associados e método utilizado para fechamento selar. **Método:** Estudo retrospectivo de 67 pacientes (73 cirurgias) operados via endoscopia transesfenoidal no Hospital Vall D'Hebron e Hospital Clínic da Universidad de Barcelona, Espanha. Os dados coletados foram: idade, sexo, dias de internação, extensão supra-selar da lesão, tipo de tumor, evidência de fístula liquórica intra-operatória, complicações da fístula liquórica pós-operatória, cirurgia e radioterapia prévias. **Resultados:** Seis pacientes (8.2%) tiveram fístula liquórica pós-operatória. Nestes a média de internação hospitalar foi 5 dias maior e tendo complicações decorrentes: dois com pneumoencéfalo e dois com meningite. Não se encontrou associação entre os dados coletados e fístula liquórica pós-operatória. **Conclusão:** A taxa de fistula liquórica após cirurgia transesfenoidal endoscópica do presente estudo está dentro da literatura. Ao contrário de outros relatos, nesta pesquisa não foi encontrada associação entre as variáveis e fístula liquórica pós-operatória.

Palavras-chave: endoscopia, neoplasias hipofisárias, rinorreia de líquido cefalorraquidiano.

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The transsphenoidal surgery is safe and effective for removing pituitary adenomas[1,2]. Schloffer and Harvey Cushing proposed a transseptal transsphenoidal approach to the pituitary gland in the beginning of 1900s. After removing the tumor, a strategy is needed to avoid the postoperative cerebrospinal fluid (CSF) fistula and related complications like meningitis, abscess, subdural hematoma and pneumoencephalus[3,4].

The postoperative CSF fistula remains the most serious complication after transsphenoidal surgery[5]. The first successful surgical treatment for CSF rhinorrhea was reported by Dandy in 1926 via frontal craniotomy.

The objective of this study is to analyze the incidence of CSF fistula after transsphenoidal endoscopic surgery to remove tumors in sellar region; to discuss factors associated with their presence, as well as to explain a method used for sellar closure.

METHOD

Retrospective study of 67 patients (73 surgeries) operated via transsphenoidal endoscopy in Hospital Vall D'Hebron and Hospital Clinic of the Universidad de Barcelona, Spain by Dr Enseñat between 2004 and 2008. The endonasal endoscopic approach to sella was utilized for pituitary adenomas, Rathke's cleft cyst and craniopharyngioma. Data collected included age, sex, hospitalization stay, suprasellar extension, type of tumor, evidence of intraoperative CSF fistula, postoperative complications of CSF fistula, previous surgery and radiotherapy. The following material and method were used for closure in transsphenoidal endoscopies to remove tumors: [1] Independent or not of having intraoperative CSF fistula: Inlay technique - dural substitute and fibrin glue; [2] When postoperative CSF fistula occurs, reintervention with: Inlay technique - intrasellar dural substitute and fat followed by fibrin glue + Onlay technique - fat in the sphenoid sinus and fibrin glue; [3] If fistula persists: nasoseptal flap, associated with lumbar spinal drainage for 5 days.

RESULTS

Out of 67 patients who underwent 73 surgical interventions through this technique, six patients (8.2%) presented postoperative CSF fistula, and were monitored in general for up to 1 year. The number of postendoscopic CSF fistula per year was: 2004: two, 2005: one, 2006: one, 2007: one, 2008: one. Hospitalization stay of the postoperative CSF fistula patients ranged from 4 to 23 days with a mean of 12 days. CSF fistula was observed immediately postoperative and up to 5 days following surgery. Of the patients who showed postoperative CSF fistula: two developed pneumoencephalus (Fig 1) and two with meningitis, one of them having concomitant meningitis and pneumoencephalus; three previously having transsphenoidal surgery. A defect of the sellar diaphragm was evident in one case in the intraoperative (Fig 2).

Fig 1. Patient who had acromegaly disease and developed postoperative CSF fistula. Hypodense area in sellar, temporal pole and brainstem regions corresponding to pneumoencephalus.

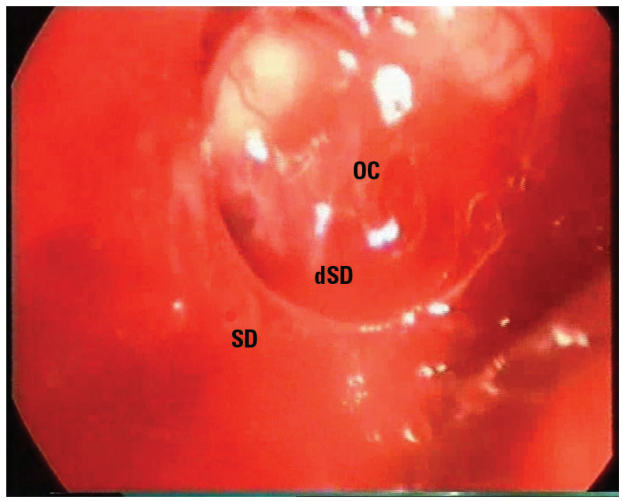

Fig 2. Defect in sellar diaphragm; SD: sellar diaphragm; dSD: defect in sellar diaphragm; OC: optic chiasm.

Results are in Table 1 and 2. Once the analysis was performed through the exact test of Fisher, with a significance level of 5%, no association was found between the collected variables and the postoperative CSF fistula.

DISCUSSION

Pituitary adenomas originate under the sellar diaphragm and thus out of the arachnoid membrane and subarachnoid space[6]. This allows the resection of many tumors without the risk of disrupting the arachnoid[4].

Table 1. Comparison between patients operated via transsphenoidal endoscopy without postoperative and intraoperative CSF fistula(n=57) and with postoperative CSF fistula (n=6).

	Without CSF fistula (n=57)	With CSF fistula (n=6)
Age	7-80 years (mean: 50 years)	45-67 years (mean: 55 years)
Sex	61% female / 39% male	50% female / 50% male
Hospitalization stay	mean:7 days	mean:12 days
Suprasellar extension	35	2
Type of tumor	40 adenomas	5 adenomas
Previous surgery	8	3
Previous radiotherapy	4	zero

Table 2. Comparison between patients with intra and postoperative CSF fistula.

	Postoperative CSF fistula	
Intraoperative CSF fistula	Yes	No
Yes	3	4
No	3	57

Postoperative CSF fistula rates after microscopic or endoscopic transsphenoidal methods range between 0.5 to 15%[4,6]. Therefore, the rate of 8.2% of CSF fistula from the present study is documented in these reports.

The endoscopic endonasal pituitary surgery differs from the transsphenoidal microsurgery in the following aspects: plane vision, close vision, no nasal speculum, endonasal and ample vision field[7]; microscopy, however, featuring a three-dimensional vision, in the distance, with transnasal speculum. The use of the endoscope during the transsphenoidal surgery is important in that it presents maximum tumoral excision and allows for a better visibility of slight CSF fistula[5]. The decision to use the microscope or the endoscope or both, is primarily based on the surgeon's experience and preference[7].

In 1997 Ciric et al.[6] presented data in which 958 North American neurosurgeons reported the complications of transsphenoidal surgery, through a questionnaire. When he subdivided the number of surgeries performed: <200, 200-500, >500, the following postoperative CSF fistula index was found, 4.2%, 2.8% and 1.5%[6] respectively. Cappabianca et al. describe an incidence of postendoscopic transsphenoidal CSF fistula around 2% in 170 surgeries[8,9].

Potential morbidities associated with CSF fistula after transsphenoidal surgery include: prolonged hospitalization, reintervention, bacterial meningitis, abscess[7], subdural hematoma and pneumoencephalus of tension[4].

According to Hegazy et al. conditions that increase intracranial pressure like hydrocephalus are an important cause of CSF fistula and its recurrence even after the initial treatment[7]. Among six patients of our study who showed postoperative CSF fistula, only one had hydrocephalus.

According to Nishioka[2] et al. there is an association between old age and CSF fistula; however, no association between any age and CSF fistula was found in the present study.

Regarding the type of tumor, Tamasãuskas et al. report an increase of postoperative CSF fistula in adenoma producer of growth hormone[5]. Shiley et al., on the other hand, describe an increase in CSF fistula rate in patients with nonadenomatous disease, for example, craniopharingioma[4]. Nevertheless, in these situations, no association was found between the factors mentioned in our analysis.

Based on Nishioka et al.[2], risks factors for the occurrence of CSF fistula are: previous transsphenoidal surgery or radiotherapy. Previous radiotherapy causes secondary alterations, such as poor vascularization and tissue necrosis, including the thinning of the bone at the base of the skull and thus, predisposes to CSF fistula, according to Nishioka[2]; a relationship that was not found in this study.

In the article of Shiley et al.[4], there is an association between intra and postoperative CSF fistula. The intraoperative CSF fistula index is described in the literature to be between 18.1 and 53.2%[4]. According to Shiley, postoperative CSF fistula is 6 times greater when intraoperative CSF fistula occurs. It is important to identify the dural defect[10] through meticulous hemostasia, Valsalva maneuver and Trendelenburg's position[2,10]. Intraoperative fluorescein may also be a helpful method in the intraoperative visibility of CSF fistula. However, in the present study, patients with intraoperative CSF fistula developed with or without postoperative CSF fistula practically in the same proportion.

Another factor to be taken into account is the surgeon's experience[11]. The surgeon must curette the tumor meticulously and to avoid moving the sellar diaphragm by traction[11].

It is general consensus that CSF fistula after transsphenoidal surgery should be avoided; there is a variety of opinions on how to treat it after its occurrence[5]. The most important step in the surgical treatment of CSF rhinorrhea is the identification of the fistula location. Several strate-

gies have been described in the treatment of postoperative CSF fistula, including nonoperative manipulation, CSF derivation and reintervention[4]. Conservative measures like bolstering, use of laxatives and/or diminishing the CSF pressure through drainage and punctures do not appear to significantly influence the rate of closure success[7].

Material used:

[1] Dural substitute: dura mater substitute composed of collagen, derived from bovine skin (Durepair®, Medtronic). As it is malleable, its emplacement is easy.

[2] Fat: in comparison with the muscle and fascia, it is less painful. It fills the dead intrasellar space and the sphenoid sinus, acting as a barrier to CSF. Tamašauskas et al.[5] finds in his casuistic of 356 transsphenoidal operations an increased risk of developing postoperative sphenoiditis in postoperative, after packing the sphenoidal sinus with fat ($p<0.001$). Nishioka et al.[2] cover the fat with oxidized cellulose to prevent rapid absorption.

[3] Fibrin glue: bioadhesive, a by-product of plasma. Biodegradable and biocompatible, it contains human lyophilized fibrinogen, human factor XIII, bovine aprotinin, human lyophilized thrombin and CaCl2 (Tissucol®, Baxter). It imitates the last phase of the coagulation cascade through polymerization of fibrinogen by thrombin, leading to the formation of a semi-rigid fibrin clot, seen by the naked eye and stable enough to help wound healing, preventing the migration of the remaining material. It enhances adhesion of the graft, when used, avoiding the need for nasal packing[10]. Esposito et al.[3] describe a grading system of transsphenoidal CSF fistula from zero to four (based on the size of the CSF fistula) and respective treatment according to the classification. This author indicates a reduction in the postoperative CSF fistula as a result of three modifications, including the use of biological glue.

[4] Nasoseptal flap (Hadad-Bassagasteguy): it has shown to be effective in the treatment of CSF fistula in skull base surgery[12]. It was used in one patient with a very severe defect in the sellar diaphragm, with the CSF fistula resolution.

Like Shiley et al.[4], we recommend precocious reoperation of CSF fistula to prevent prolonged hospitalization.

Closure method. Inlay technique: intact dura mater is separated from the border of skull base defect. Onlay technique: closure below the skull base defect is recommended if there is a risk that nerves and vessels may be damaged when the dissection of the dura mater from the adjacent bone occurs, or if the inlay technique is technically unfeasible[7].

In a study of 1240 patients, CSF fistula was closed successfully in all patients with patch dural in the sella and packing the sphenoid sinus with autologous abdominal fat, in addition to lumbar spinal drainage for 5 days[1].

Cappabianca et al., pack the sella with fat when there is intraoperative CSF fistula[9], different from our approach, once patients with intraoperative CSF fistula evolved with and without postoperative CSF fistula practically in the same proportion.

We concur with Hegazy et al.[7], who confirm the selective use of lumbar spinal drainage for persistant or recurrent CSF fistula.

In conclusion, the rate of CSF fistula after endoscopic transsphenoidal surgery from the present study is contained within the literature. Unlike other reports, this research found no association between the variables and postoperative CSF fistula. We will need to increase the number of patients to be able to draw definite conclusions.

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