

Incidence of CSF fistula after paranasal sinus surgery: the Northern Norwegian experience*

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SUMMARY

Statement of problem: Cerebrospinal fluid (CSF) fistula is a well-known complication of paranasal sinus surgery. Not only manifest, but also occult CSF fistulas occur. The incidence of occult CSF fistula has been described only once and has not been tested since.

Material and Methods: In a prospective diagnostic study, the incidence of manifest and occult CSF fistulas was measured. Fortyfour patients operated for paranasal sinus diseases were included between 2002 and 2006. Seventyfour fluid samples were collected by pressing nasal tamponades the day after surgery, and were measured for beta-trace protein using laser-nephelometry. In patients with a beta-trace value in secretion between 0.68 and 1.11 mg/l, a serum sample was taken and measured for beta-trace protein.

Results: Thirty-one patients had a secretion beta-trace protein value below 0.68 mg/l. Thirteen patients had a secretion beta-trace protein value between 0.68 and 1.11 mg/l. The secretion/serum ratio in this group was below 1.57, not indicating the presence of CSF traces. The incidence of CSF fistula in this study population was zero.

Principal conclusion: A previously described incidence of occult CSF fistula after paranasal sinus surgery was not confirmed in the present study.

Key words: cerebrospinal fluid, fistula, paranasal sinus surgery, complication, endoscopic surgery

INTRODUCTION

Occult CSF fistula is still an unsolved problem. It might occur after paranasal sinus surgery, after trauma or due to arachnoid granulation formation or intracranial hypertension. Beta-trace protein is an immunological marker for CSF traces and the characteristics of the protein have been described before ⁽¹⁾.

The existence of otherwise unobserved CSF fistulas was demonstrated by a previously published study in 2002. The incidence of occult CSF fistula after paranasal sinus surgery was 2.9% in 69 subjects ⁽²⁾. The incidence of manifest CSF fistula after paranasal sinus surgery was 0.9% in 800 subjects, published in a study in 1991 ⁽³⁾. Taking these results into account, further data were collected in order to test the incidence of occult CSF after paranasal sinus surgery in another study population. The present study population was operated by one surgeon and the surgical approach was slightly different compared to the approach from the previously published studies.

MATERIAL AND METHODS

In a prospective diagnostic study, adult patients undergoing paranasal sinus surgery were included. Patients with a manifest CSF fistula were not excluded in this study.

Patients who had been previously operated on the paranasal sinuses were included. Three patients were operated because

of chronic frontal sinusitis, two because of a mucocele in the frontal sinus or the sphenoid sinus, respectively, and 39 because of chronic rhinosinusitis with polyposis nasi.

Surgical procedures

The surgery was performed by the author at the University Hospital of Northern Norway during the years 2002 - 2006. The surgical procedures were performed using Storz rigid endoscopes coupled with a suction-irrigation handle according to the principles described by Messerklinger, Wigand and Stammberger ⁽⁴⁻⁶⁾. In three subjects, nasal polyps were removed and the ethmoid bulla was opened under local anesthesia. In three subjects, nasal polyps were removed, the ethmoid bulla was opened and an anterior ethmoidectomy was performed under local anaesthesia. In 16 subjects, an antrostomy and complete ethmoidectomy was performed under general anaesthesia. In 18 subjects, a complete sphenoidectomy was performed under general anaesthesia. In four subjects with chronic frontal rhinosinusitis, an ethmoidectomy combined with an endoscopic frontal drainage procedure were performed under general anaesthesia. Two of them were operated with a Draf type 2 and the two other were operated with a Draf type 3 procedure ⁽⁷⁾. After surgery, the patients were followed-up three times per year on an out-patient basis.

Sampling

Fluid samples were collected from 74 nasal tamponades, originating from 44 patients. The tamponades (Merocel[®]) were primarily placed in order to control bleeding at the end of the procedure. When removing the tamponades the day after surgery, secretion samples were obtained by pressing out approximately 100 µl fluid.

Beta-trace protein analysis

The samples were investigated by laser-nephelometry on a BN[™]II nephelometer system (Dade Behring, Liederbach, Germany). As the processing is automated including the first dilution step of 1:100, a minimum volume of 60 µl was necessary. The research kit N-Latex-β-TP was purchased from Dade Behring. The cut-off for samples indicative for CSF was set at 1.11 mg/l. In cases with a secretion value between 0.68 and 1.11 mg/l, a serum sample was requested too and the secretion-serum ratio was calculated. The secretion-serum ratio cut-off was set at 4.9 according to Risch et al. ⁽⁸⁾.

RESULTS

The female/male ratio of the study population was 22/55. The average age was 50 ± 15.3 years. A manifest CSF fistula was not observed during surgery or during follow-up. The follow-up range was between 1 and 5 years. The secretion samples were collected unilaterally in 13 patients and bilaterally in 31 patients. The results are given in Table 1. The secretion samples from nasal tamponades contained blood in all cases. The average β-TP value in secretion samples was 0.58 ± 0.14 mg/l. All secretion samples contained less than 1.11 mg/l beta-trace protein. In 13 subjects, the secretion value was in the range between 0.68 and 1.11 mg/l. Ten of these 13 patients were available for a serum sample. The average β-TP value in serum samples was 0.64 ± 0.09 mg/l. The secretion-serum ratios in these 10 cases were below 1.57, not indicating the presence of CSF traces.

DISCUSSION

The incidence of occult or manifest CSF fistula in this study population was zero. The previously described incidence of occult CSF fistula from Germany ⁽²⁾ thereby could not be confirmed by the results of the present study from Northern Norway. This might be related to different attitudes. During the period 1998 - 2000, the policy for surgical treatment of chronic rhinosinusitis was a) to remove almost all nasal polyps from the paranasal sinuses, b) to subtotaly resect the middle nasal turbinate and c) to perform the procedure under general anaesthesia. In the presented study population from the period 2002 - 2006, a few aspects were different in respect to the surgical approach for the treatment of paranasal sinus diseases: a) in geriatric patients, when possible, surgery was performed under local anaesthesia aiming to restore a free nasal passage and not to radically remove nasal polyps from every affected paranasal sinus. b) The middle nasal turbinate was partially resected only

Table 1. Nasal tamponade.

Nr.	Serum	NT-I	NT-II	S/s ratio
1		0,561	nv	
2	0,731	0,842	nv	1,15
3		0,12	nv	
4		0,42	0,46	
5		0,617	0,648	
6		0,716	0,711	
7	0,473	0,744	0,368	1,57
8		0,528	0,489	
9		0,567	0,517	
10		0,483	nv	
11		0,503	0,466	
12		0,793	nv	
13		0,498	0,615	
14		0,79	0,607	
15		0,451	0,369	
16		0,454	0,526	
17		0,491	0,49	
18		0,4	0,5	
19		0,645	nv	
20	0,649	0,588	0,769	0,91
21		0,536	0,567	
22		0,426	nv	
23	0,568	0,7	0,692	1,23
24		0,566	0,566	
25		0,511	0,485	
26		0,544	0,627	
27		0,597	0,65	
28		0,666	nv	
29		0,561	nv	
30		0,595	nv	
31		0,621	0,555	
32		0,538	0,608	
33	0,72	0,804	nv	1,12
34		0,445	0,506	
35		0,442	0,502	
36	0,632	0,486	0,878	0,77
37	0,614	0,692	0,681	1,13
38	0,526	0,664	0,995	1,26
39	0,747	0,619	0,735	0,83
40	0,733	0,852	nv	1,16
41		0,501	nv	
42		0,664	nv	
43		0,523	0,533	
44		0,615	0,615	

NT; Secretion/serum ratio, S/s ratio; No value, nv; Values in the range between 0.68 and 1.11 mg/l are given in bold.

when necessary for the treatment of nasal obstruction or improving the surgical access to the posterior ethmoid sinuses. c) The removal of polyps from the nasal cavity under local anaesthesia was an option for patients who asked for a less radical surgical treatment.

When operating under local anaesthesia, a CSF fistula is less likely to occur as the skull base and especially the dura mater are sensitive structures. It is difficult to achieve a satisfactory

local anesthesia of the dura mater. In addition, an occult CSF fistula is less likely to occur when only partially removing the middle nasal turbinate. Some of the fila olfactoria, which are surrounded by dura mater, reach the mucosa of the upper middle nasal turbinate. From a theoretical point of view, it is possible for an occult CSF fistula to occur by just performing a subtotal resection of the middle nasal turbinate.

However, a direct comparison of the German study with the present one is not advisable due to a different size of the study populations.

REFERENCES

1. Petereit HF, Bachmann G, Nekic M, Althaus H, Pukrop R. A new nephelometric assay for beta-trace protein (prostaglandin D synthase) as an indicator of liquorrhoea. *J Neurol Neurosurg Psych.* 2001; 71: 347-351.
2. Bachmann G, Djenabi U, Jungehülsing M, Petereit H, Michel O. Incidence of occult cerebrospinal fluid fistula during paranasal sinus surgery. *Arch Otolaryngol Head Neck Surg.* 2002; 128: 1299-1302.
3. Stankiewicz JA. Cerebrospinal fluid fistula and endoscopic sinus surgery. *Laryngoscope.* 1991; 101: 250-256.
4. Messerklinger W. Background and evolution of endoscopic sinus surgery. *Ear Nose Throat J.* 1994; 73: 449-450.
5. Wigand ME, Steiner W, Jaumann MP. Endonasal sinus surgery with endoscopic control: from radical operation to rehabilitation of the mucosa. *Endoscopy.* 1978; 10: 255-260.
6. Stammberger H, Hosemann W, Draf W. Anatomic terminology and nomenclature for paranasal sinus surgery. *Laryngorhinootologie.* 1997; 76: 435-449.
7. Weber R, Draf W, Kratzsch B, Hosemann W, Schaefer SD. Modern concepts of frontal sinus surgery. *Laryngoscope.* 2001; 111: 137-146.
8. Risch L, Lisec I, Jutzi M, Podvinec M, Landolt H, Huber AR. Rapid, accurate and non-invasive detection of cerebrospinal fluid leakage using combined determination of beta-trace protein in secretion and serum. *Clin Chim Acta.* 2005; 351: 169-176.

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