Obesity as a Risk Factor for Primary Spontaneous Rhinoliquorrhea

David Holzmann, MD; Corina Wild, MD

Objective: To determine whether obesity is a potential risk factor of primary spontaneous cerebrospinal fluid rhinorrhea (CSFR).

Design: Retrospective study.

Setting: University hospital.

Patients and Methods: The clinical data of 79 patients diagnosed with CSFR who had been treated at our hospital between 1991 and 2001 were assessed. The data of 61 (77%) of 79 cases were complete and could be used for this study. Patients were segregated according to the cause of their CSFR: 21 (34%) due to head trauma, 14 (23%) due to previous surgery, 7 (11%) due to congenital malformation, and 2 (3%) due to tumor adjacent to the anterior cranial fossa. Of the 61 subjects, 17 (28%) had CSFR without any detectable reason. This group was therefore designated as primary spontaneous CSFR. The body mass indexes (BMIs) of all patients were compared and statistically evaluated.

Results: The mean BMI (calculated as weight in kilograms divided by the square of height in meters) of the 17 patients with primary spontaneous CSFR was 34.87, which was significantly higher ($P < .001$) than the mean BMI of the other 44 patients (28.53). The mean BMI of the group of patients with CSFR due to previous surgery or trauma was significantly lower than the BMI of the group with primary spontaneous CSFR ($P < .003$), whereas in relation to the group afflicted with tumors and malformations, only a tendency ($P < .28$) was found.

Conclusion: Our data suggest that obese patients are at an increased risk to develop primary spontaneous CSFR.


Cerebrospinal fluid (CSF) rhinorrhea (CSFR) can be classified as traumatic or spontaneous. Among the traumatic causes, most are shown to be head traumas (80% of all CSFR cases), whereas 16% of CSFR cases occur after surgery to the skull base. Spontaneous CSFR accounts for 3% to 4% of cases and can be subdivided into a group with detectable underlying causes (eg, empty sella syndrome, hydrocephalus, or meningoencephaloceles) and a group in which investigations do not reveal any pathologic findings. The latter is defined as primary spontaneous CSFR and has been documented several times in the literature. Several hypothetical causes are stated among this group in which the origin of CSFR (such as a Valsalva effect of sneezing or nose blowing) is unclear. In a recent survey, the data of 9 patients seen within 10 years with primary spontaneous CSFR are presented, among which 6 are clinically obese by definition with a body mass index (BMI) greater than 30 (calculated as weight in kilograms divided by the square of height in meters). Owing to their obvious findings, the authors of the survey postulated a possible relationship between obesity and primary spontaneous CSFR. However, they did not compare these patients’ data with the data of patients with CSFR from other causes. We therefore carried out a retrospective analysis of our own patients with CSFR to determine whether patients with primary spontaneous CSFR are significantly more obese than patients with CSFR from other causes.

Methods

During a 10-year period (1991-2001), 79 patients with CSFR were treated in the Department of Otorhinolaryngology–Head and Neck Surgery of the University Hospital of Zurich, Zurich, Switzerland. They all were referred by their family physician, by other clinics within the University Hospital, or by smaller primary care hospitals lacking facilities to treat such patients. The examination of CSFR in these patients was similar to an already pre-
sented algorithm. After clinical examination, all patients underwent $\beta$-transferrin testing and/or nasal endoscopy after intrathecal administration of fluorescein to confirm CSFR. To evaluate the cause of CSFR and location of the CSF fistula, all patients underwent a high-resolution computed tomographic scan. If these findings suggested a pathologic condition such as malformation or tumor at or adjacent to the skull base, magnetic resonance imaging was performed. In addition, intraoperative findings of those undergoing surgery, such as the location of the CSF fistula, were recorded. Children as well as patients whose data were missing on preoperative investigation or who did not undergo surgery in our institution were excluded from this study.

The remaining patients with CSFR enrolled in the study were subdivided according to the cause of CSFR: head trauma (group T), after surgery (group AS), malformation of the anterior skull base (group MF), or tumor involving the skull base (group TU). The last group (group SP) comprised those patients in whom no cause of CSFR was found despite investigation. The BMI of all included patients was recorded. To determine statistical significance in difference of the BMI, the Mann-Whitney rank sum test was used.

Of the 79 patients initially enrolled, 18 dropped out of this study because of the aforementioned exclusion criteria. Thus, the data of 61 (77%) of the 79 patients were used in this study.

Cerebrospinal fluid rhinorrhea occurred due to trauma in 21 patients (34%) and after previous surgery in 14 patients (23%) (10 neurosurgical and 4 endoscopic sinus surgery), and rhinoliquorrhea was caused by a malformation in 7 patients (11%) (meningoencephalocele [1 patient] or arachnoidal cyst [2 patients] and osseous dehiscences along the lamina cribrosa, sphenoid, and sella [4 patients]). In 2 patients (3%), a tumor (olfactory meningioma after radiation of a clear cell carcinoma) adjacent to the anterior skull base caused a CSF fistula. In 17 patients (28%), no cause of CSFR could be detected despite thorough investigation (Table 1). A hydrocephalus was not found in any of these patients.

The location of the CSF fistulas in these 17 patients could be identified in the sphenoid sinus (7 patients) and in the cribriform plate (8 patients). In 1 patient there were 2 defects on the same side of the cribriform plate, whereas in another a 6-mm slitlike osseous dehiscence was found along the cribriform plate.

**Table 1. Patients (N = 61) With Cerebrospinal Fluid Rhinorrhea (CSFR)**

<table>
<thead>
<tr>
<th>Cause of CSFR</th>
<th>Patients, No. (%)</th>
<th>Mean Age (Range), y</th>
</tr>
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<tbody>
<tr>
<td>Trauma</td>
<td></td>
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<tr>
<td>Head trauma</td>
<td>21 (34)</td>
<td>40 (17-88)</td>
</tr>
<tr>
<td>Previous surgery</td>
<td>14 (23)</td>
<td>49 (29-78)</td>
</tr>
<tr>
<td>Spontaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malformation of the anterior skull base</td>
<td>7 (11)</td>
<td>54 (40-63)</td>
</tr>
<tr>
<td>Tumor adjacent to the anterior skull base</td>
<td>2 (3)</td>
<td>42 (20-57)</td>
</tr>
<tr>
<td>“Primary” (ie, unknown cause)</td>
<td>17 (28)</td>
<td>52 (35-70)</td>
</tr>
</tbody>
</table>

Most frequently, CSFR occurs after head trauma and after surgery. Malformations such as meningocele, meningoencephalocele, arachnoidal cysts, empty sella syndrome, hydrocephalus, and bony dehiscences along the skull base can be responsible for 3% to 4% of the cases in which CSFR occurs spontaneously. Tumors also can provoke CSF fistula, particularly when the skull base is involved. Most of these pathologic conditions can be found by clinical investigation and/or high-resolution computed tomographic scans (or in magnetic resonance imaging); therefore, they would most probably be detected in the course of the clinical examination of patients with CSFR. However, in a few patients, no underlying disease was found. This is why they were diagnosed with primary spontaneous CSFR. Reasons for high prevalence of spontaneous leaks in our study population (27% in contrast to 3% to 4% in the literature) can be explained by the fact that many traumatic CSFR cases are managed in primary care hospitals that are able to

**Table 2. Distribution of Body Mass Index* of Each Patient Group**

<table>
<thead>
<tr>
<th></th>
<th>Trauma (n = 21)</th>
<th>After Surgery (n = 14)</th>
<th>Malformation (n = 7)</th>
<th>Tumor (n = 2)</th>
<th>Primary Spontaneous (n = 17)</th>
<th>Total (N = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>14.84</td>
<td>17.44</td>
<td>18.00</td>
<td>26.83</td>
<td>21.29</td>
<td>14.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>32.86</td>
<td>31.91</td>
<td>34.20</td>
<td>29.74</td>
<td>34.87</td>
<td>55.78</td>
</tr>
<tr>
<td>Mean</td>
<td>23.70</td>
<td>24.53</td>
<td>27.24</td>
<td>28.29</td>
<td>33.20</td>
<td>25.40</td>
</tr>
<tr>
<td>Median</td>
<td>23.21</td>
<td>25.36</td>
<td>28.73</td>
<td>28.29</td>
<td>33.20</td>
<td>25.40</td>
</tr>
<tr>
<td>Male-female ratio</td>
<td>13.8 7.7</td>
<td>2.5</td>
<td>2.0</td>
<td>9.8</td>
<td>33.28</td>
<td></td>
</tr>
</tbody>
</table>

*Calculated as weight in kilograms divided by the square of height in meters.
manage CSF fistulas by, for example, a neurosurgical approach. Regarding older studies, it has been known that spontaneous CSFR can occur even in patients with clinically normal intracranial pressure.\textsuperscript{13} According to the findings from clinical examination, the intracranial pressure of our SP group was also normal, although no invasive intracranial pressure measurement had been performed. Our data show that 12 (71\%) of 17 patients in this group were obese, presenting a BMI of greater than 30. In patients whose CSFR was caused by trauma or by previous surgery, the BMI was statistically lower than in those with primary spontaneous CSFR as opposed to the TU and MF groups in which there was only a tendency for lower BMI.

It must be mentioned that the TU group only comprised 2 patients, which would make a statistical analysis senseless, whereas the tendency for lower BMI in the MF group in contrast to the SP group remains unclear. Nonetheless, the SP group showed significantly higher BMIs ($P<.001$) compared with the rest of the study patients. On clinical investigation, the only difference of the SP patients from the other 44 study patients was their obesity. In addition, no clinical sign of elevated intracranial pressure could be identified in all study patients, and after a follow-up time of more than 18 months, no recurrence of CSFR was observed in this group. To our knowledge, there is no pathogenetic pathway explaining the relation of obesity to primary spontaneous CSFR.

According to our results, it can be suggested that obese patients with a BMI greater than 30 are at risk to develop CSFR. A potential pathogenetic connection of obesity with primary spontaneous CSFR is not known.

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**REFERENCES**