Intracavitary Treatment of Intracavitary Irradiation of Intrasellar Cystic Craniopharyngeomas with 90-Yttrium by Trans-sphenoidal Approach – a Technical Note

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Summary

Intracavitary irradiation of intrasellar cystic craniopharyngeomas by stereotactic cyst puncture and injection of radioactive solutions is not yet possible. Therefore we designed a new method which allows such intracavitary irradiation. Its principle is a trans-sphenoidal approach with only a small bony opening of the sella floor, followed by cyst puncture, exclusion of cyst leakage by Metrizamid injection under x-ray control, injection of Y-90-colloid solution at a dosage which delivers a radiation of 200 Gy to the cyst wall, and finally tight closure of the puncture site using fibrin glue and gelfoam.

This method has been used in three patients with good results (follow-up 12–15 months) and without complications.

Even though long-term follow-up is not yet available, our preliminary results suggest that this method will be useful for future patients with intrasellar cystic craniopharyngeomas.

Keywords: Intrasellar cystic craniopharyngeoma; trans-sphenoidal approach; intracavitary irradiation; 90-Yttrium.

Introduction

Stereotaxic puncture of cystic craniopharyngeomas with consecutive intracavitary 90-Yttrium irradiation is a well-known and established therapeutic strategy [1, 2, 5, 7, 10]. However, because of the anatomical situation, the stereotaxic approach cannot be used for the treatment of intrasellar cystic lesions. Usually, these tumour cysts can be decompressed by the trans-sphenoidal route [3, 4, 6, 9, 11]. Intracavitary irradiation, however, has not been performed for intrasellar craniopharyngeoma cysts by the use of an open trans-sphenoidal approach – only the puncture technique has been described so far [4, 6]. In this paper, a new combined treatment regime is presented, which allows decompression of the intrasellar cyst by trans-sphenoidal surgery together with intracavitary irradiation.

Material and Methods

Three patients were operated on in 1991 for recurrent cystic intrasellar craniopharyngeomas. The clinical data of these patients are presented in Table 1.

In all cases, the following procedure was adopted: The cyst volume was calculated by CT (Siemens DRH, volume calculation program for irregular shaped cysts) to determine the therapeutic radioactivity dosage.

Dosimetry

The radioactive substance for therapy is a colloidal preparation of 90-Yttrium-Silicat. 90-Y is a pure β-emitter with a maximum β-energy of 2.27 MeV (mean 0.93 MeV) and an emission halftime of 64 hours. The maximum range of the β-particles in soft tissue is 11 mm, the “halve value layer” 1.1 mm. Assuming a homogeneous distribution of the colloid within the (spherical) cyst, a radiation dose of 200 Gy (20000 rads) is intended to be delivered to the cyst wall. After measurement of the volume of the cyst by CT (or by a radionuclide method using the dilution technique with l ll-In-DTPA), the individual dosage was calculated applying the formula given by Loewinget al. [8] for β-dose calculations. This formula was modified by Backlund et al. [1] for the application of 90-Y.

\[ A = \frac{0.109 V}{f} \] (mCi),

where A is the radioactivity to be injected, V the volume of the cyst and f a volume dependent factor in a range from 0 to 0.5 f with increasing diameter of the cyst.

Operative Technique

The patients were operated on under general anaesthesia, in the supine position. Following a trans-sphenoidal approach, only a very small bony opening in the sellar floor was made. Then the cyst was punctured using a specially thin biopsy canula. After removal of 2–3 ml of the cyst material, leakage of the cyst was obviated by injection of Metrizamid under x-ray control monitoring (Fig. 1) and the Y-90-colloid solution was injected. The sella was closed then with human fibrin glue and gelfoam. Within 24 hours the patients were checked again under a Gamma counter-camera (Fig. 2) to leakage of the 90-Yttrium.

Some days later, the patients were discharged. Endocrinological
Fig. 1. This figure demonstrates the intra-operative x-ray control monitoring. After preparation of the sellar floor and performing a small bony opening by a trans-sphenoidal approach (speculum and tip of the suction device), the cyst was punctured and, after removing some cyst fluid, Metrizamid was injected under x-ray control. The contrast material remained in the cyst, no leakage into the subarachnoid space was observed and ophthalmological checks were performed pre- and postoperatively. Another CT or MRI was done three months later.

**Results**

In all cases the cysts were drained and irradiated without any complications. The ophthalmological control indicated some weeks later an improvement of vision (Table 1). The imaging controls after three months showed a decreased or collapsed cyst (Fig. 3 a, b). In one case another check-CT after one year was obtained, which showed only a calcified remnant

Table 1. Clinical Dates of the Treated Patients

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex/Age</th>
<th>Time between first surgery and cystic recurrence</th>
<th>Actual symptomatology</th>
<th>Cyst volume</th>
<th>Applied activity (90-Yttrium)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.M.</td>
<td>femal / 73</td>
<td>4 years</td>
<td>visual disturbances sweep of the hand / 0,5</td>
<td>1,8 ml</td>
<td>11,4 MBq</td>
<td>visual improvement, sweep of the hand / 0,8</td>
</tr>
<tr>
<td>M.F.</td>
<td>male / 9</td>
<td>1 year</td>
<td>visual disturbances 0,7/lux</td>
<td>4,4 ml</td>
<td>41,7 MBq</td>
<td>visual improvement 1,0/lux</td>
</tr>
<tr>
<td>H.S.</td>
<td>male / 18</td>
<td>14 years</td>
<td>visual disturbances 0,8/1/20</td>
<td>6,3 ml</td>
<td>60 MBq</td>
<td>visual improvement 1,0/1/20</td>
</tr>
</tbody>
</table>

**Discussion**

The treatment strategy of craniopharyngeomas depends on the localisation and consistency of the tumour. Whereas solid tumours were usually operated on by the transcranial or trans-sphenoidal approach, cystic lesions can be approached by stereotaxic means [1, 2, 5, 7]. To prevent cyst regrowth, intracavitary irradiation was usually performed by instillation of colloid 90-Yttrium using an Ommaya-reservoir [2, 4].