ORIGINAL ARTICLE

Management of Chronic Otitis Media by Subtotal Petrosectomy

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Abstract

Introduction and objectives: Subtotal petrosectomy is the complete exenteration of all air cell tracts of the temporal bone. The isthmus of the Eustachian tube is obliterated and the external auditory canal is closed. The aim of this study was to describe the use of this technique in the management of certain cases of chronic otitis media.

Materials and methods: We conducted a retrospective revision of the patients treated in our institution with this technique for chronic otitis media in a 5-year period (2008–2012). All charts were reviewed and data from the otomicroscopy, audiometry, radiology, surgical findings, postoperative complications and follow-up (including diffusion magnetic resonance imaging, MRI) of a minimum of 24 months were collected.

Results: In this period petrosectomy was performed on 28 patients for chronic otitis media. We treated 13 cases as primary cases, while 15 cases were secondary (patients that had already undergone another procedure in that ear). Fifteen cases had no serviceable hearing. Only 1 case had an immediate postoperative complication (infection); during the posterior follow-up, 2 cases had to be reoperated for diffusion restriction in the mastoid area revealed in the MRI 2 years after surgery.

Conclusions: A subtotal petrosectomy is rarely performed for the treatment of chronic otitis media. However, it is a technique that we have to keep in mind for the treatment of certain cases where there is recurrence and deep hearing loss, as well as in cases with good cochlear reserve if the disease coexists with other complications.

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Utilidad de la petrosectomía subtotal en el tratamiento de la otitis media crónica

Resumen

Introducción y Objetivos: La petrosectomía subtotal consiste en la eliminación completa de todas las celdas neumáticas del hueso temporal. La Trompa de Eustaquio se oblitera y el conducto auditivo externo se cierra. El objetivo de este estudio es describir el uso de esta técnica en el manejo de determinados casos de otitis media crónica.

Material y Método: Se realiza un estudio retrospectivo de los pacientes intervenidos en nuestro hospital de petrosectomía subtotal para el tratamiento de otitis medias crónicas en un período de 5 años (2008–2012). Se recogieron datos de su historia clínica, exploración otomicroscópica, audiometría, radiología, hallazgos quirúrgicos, complicaciones postquirúrgicas y seguimiento posterior (incluyendo Resonancia magnética con difusión) con un mínimo de 24 meses de seguimiento.

Resultados: En este periodo se realizaron 28 petrosectomías para el tratamiento de otitis medias crónicas. 15 casos fueron secundarias, es decir, el oído ya había sido intervenido con anterioridad y en 13 casos se trató de una actitud primaria. 15 de estos casos no tenían una audición útil. El postoperatorio inmediato transcurrió sin incidencias en todos los casos salvo en uno en el que ocurrió una infección. A largo plazo, debieron reintervenirse dos casos por mostrar la Resonancia restricción en la difusión a los dos años de la cirugía.

Conclusiones: La necesidad del empleo de la petrosectomía subtotal en el tratamiento de las otitis medias crónicas es rara pero deberemos tenerlo en cuenta en aquellos casos recurrentes en los que exista una hipoacusia severa a profunda así como en casos con buena reserva coclear si coexiste una complicación añadida.

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Introduction

The primary objective in the treatment of chronic otitis media (COM) is to achieve a healthy and dry cavity. For the most part this may be obtained with eradication of the pathology and the creation of a stable cavity.

In some cases the above may not be achieved due either to recurrent or persistent cholesteatoma or in the case of open mastoidectomies without cavity obliteration where we may find granulation tissue, trapped mucosa and insufficient epithelisation which result in cavities with chronic and persistent or recurrent effusion despite several operations to avoid this complication. These patients with open cavities (whether or not they suffer from residual or recurrent cholesteatoma) are patients who are tremendously dissatisfied with the result obtained and with an extremely poor quality of life. They require frequent visits to specialists, frequent treatments to try to dry out the cavity and a higher risk of developing infectious complications. When severe or profound hearing loss coexists in these cases, these are ideal patients for referring for subtotal petrosectomy surgery (STP). Furthermore, thanks to advances which have been made in osseointegrated implants (percutaneous and transcutaneous) and in the middle ear patients with these cavities who have good cochlear reserve may be referred for an STP and the implantation of one of these devices in the same surgical procedure or in second-stage surgery.

However, there are cases of advanced stage COM or with additional complications such as the presence of meningoencephaloceles, intracranial abscesses or venous thrombosis which, regardless of their hearing or the presence or absence of previous surgery on this ear may require STP to achieve a healthy and safe ear.

STP consists of the complete exenteration of temporal bone air-cell tracts. These include the retrosigmoid, retrofacial, retrolabyrinthic, supralabyrinthic, infralabyrinthic, peritubular and pericartid cells. At the end of the procedure only the otic capsule should remain, a fine layer of cortical bone covering the dura mater and a few residual suprameatal and medial apical cells to the OC. The isthmus of the Eustachian tube is obliterated and the external auditory canal (EAC) is closed. Finally, the cavity is obliterated with soft tissue which may often be a fat graft or a peristium muscle flap or a fasciomuscular flap (usually temporal).

The term middle ear total obliteration with EAC closure is also given to complete or total eardrum-mastoid obliteration or tympanum-mastoid exclusion. This technique has several different indications (see Table 1) but in this article we wish to study its use in the treatment of certain cases of COM.

In 1957 Rambo was the first to report its description for this use with a procedure described as “a technique to eliminate postoperative care of the cavity”. Since then several publications have described is usefulness to this end.

Materials and Methods

We carried out a retrospective study of consecutive cases with surgical interventions using this technique in our
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Table 1  Most Common Indications of Subtotal Petrosectomy.

<table>
<thead>
<tr>
<th>Tumours</th>
<th>CSF leak</th>
<th>Cholesteatoma</th>
<th>Fracture of the temporal bone</th>
<th>Chronic otitis media</th>
<th>Hearing implants</th>
<th>Prior to lateral cranium base surgery</th>
<th>Osteoradionecrosis</th>
</tr>
</thead>
</table>

hospital during a period of 5 years (2008–2012) for the treatment of COM. Data was collected relating to medical record, ear microscopic examination, pre and postoperative audiometry, vestibular examination, radiology, surgical findings, post surgical complications and posterior follow-up, including diffusion weighted magnetic resonance imaging (MRI) and with a minimum of 24 months follow up.

The performance of STP due to other causes or whose primary indication was not for the treatment of a COM were excluded from the study.

All operations were performed by two surgeons.

Results

During the period 50 STP were performed, or which 28 were for the treatment of COM. Over 1400 cases of chronic suppurative otitis media were operated on during the same 5-year period and STP for the treatment of this pathology did therefore not exceed 2% of the treatments for this condition.

The mean cohort age was 53.5 years with a range between 7 and 81 years of age. 20 patients were male and 8 female.

Computerised axial tomography (CAT) scans and diffusion weighted MRI imaging was performed on all patients preoperatively.

Tone audiometry was carried out on all patients pre and postoperatively (Fig. 1).

Fifteen cases were second-stage surgery, the ear had already been operated on, on one or more occasions, and in 13 cases surgery was first-stage.

Secondary Surgery Cases

Thirteen of these 15 cases of second-stage surgery had bone conduction below 90 decibels (dB) and a persistent or recurrent wet ear cavity. Their hearing was therefore not useful. Of these 13 cases with a wet ear cavity, 8 did not present with cholesteatoma and 5 did (either recurrent or persistent).

Hearing was useful in 2 patients in this group and there was mixed hearing loss with a mean transmission component of 32 dB. Petrosectomy was performed to treat one residual cholesteatoma and both the existing bone conduction and the differential hearing threshold (DHT) were maintained postoperatively.

Primary Surgery Cases

In 13 cases the ear had not previously been treated and the STP was the first surgical intervention used to treat the patient’s otitis media. In this group this type of surgery was chosen due to the presentation of the following conditions: apical temporal bone cholesteatoma (3 cases), cholesteatoma with extensive infralabyrinthic and apical involvement (2 cases), supralabyrinthic involvement (1 case), presence of extensive meningoecephalocele (1 case), cholesteatoma with extensive involvement of the EAC (2 cases), suppurrative COM with deep vein thrombosis (1 case), suppurrative COM with a history of regional radiotherapy and osteoradionecrosis (2 cases) and cholesteatoma with cerebellum abscess and extensive bone defect (1 case).

Two of these 13 first-stage surgery cases presented with preoperative cofoysis and in 11 cases the hearing loss presented was mixed or purely transmission in nature. In these 11 cases, the preoperative mean bone conduction for the 5 frequencies measured (0.25–4kHz) was 39 dB and the mean preoperative UDA was 26 dB. All the patients
with the exception of 2 preserved the same unaltered bone conduction and UDA postoperatively.

The mean duration of surgery was 188 min with a minimum of 118 and maximum of 360 min (SD: 64.5 min). This variability was due to the fact that despite the STP technique always being the same, in many cases the extent of the pathology was diverse and on other occasions, the form of reinstating hearing with a middle ear implant lengthened the time in surgery.

The mean hospital stay was 4 days (SD: 2.3) with a minimum of 48 h and a maximum of 9 days hospital stay for one patient.

There were no intraoperative complications relating to the surgical technique used. We observed two cases of infection of the surgical wound and mastoid cavity, one early case (on day 4) which required surgical drainage and a temporal flap and another delayed (at 5 weeks) upon whom the same intervention was repeated. Both cases were the initial ones in this series and although the STP was an active cavity it was obliterated with abdominal fat. In successive cases when we found a wet cavity or one which was susceptible to infection we performed first-stage surgery obliteration we used a temporal flap and not a free abdominal fat flap.

Hearing rehabilitation was performed in 9 of the 28 cases. For this, on 4 occasions a percutaneous osseointegrated implant was used (1 for unilateral coexistence and 3 for transmission hearing loss), one cochlear implant in 3 occasions due to the presentation of severe concomitant contralateral neurosensory hearing loss, and in 2 cases a middle ear implant was used for rehabilitation.

Follow up was carried out in all cases, with the exception of 5, by diffusion weighted MRI one year and 2 years after surgery. 2 cases underwent further surgery during this period due to diffusion weighted restrictions in the mid MRI and as a result the outcome of surgery was the extirpation of a pearl of cholesteatoma close to the EAC closure. Both cases had a history of meatoplasty in previous operations which resulted in complicated correct closure of the EAC during this operation, to which special attention must be paid.

Discussion

The broadest series on STP for the treatment of chronic otitis mediais report very similar indications and results to those described in this publication.\textsuperscript{1,4,10,11} Indications are similar for both the secondary (the most common) and the primary cases.

Compared with published series in our series we observed two facts worth highlighting.

Firstly, we observed 2 infections of the fat which was used to fill the cavity. The decision regarding what type of material to use to fill or close the cavity is important and the most widely used tissue in this technique is abdominal fat.\textsuperscript{1,4,8,10} In other cases surgeons opt for the use of pedicle muscle and specifically temporal muscle flaps.\textsuperscript{1} We primarily use abdominal fat to fill the STP cavity but as a result of these 2 cases of fat graft infection, we subsequently used temporal muscle flap for the closure or obliteration of an active cavity.

Secondly, we observed two cases of delayed intervention, at 25 months and 27 months since the performance of STP as a result of observing a diffusion weighted restriction in the MRI at 24 months and the suspected cholesteatoma. Diffusion weighted MRI is a very useful technique for the follow-up of these cases and of other cases of partial surgical obliteration of mastoidectomy cavities due to cholesteatoma.\textsuperscript{12-15} We always repeat MRI 12 months and 24 months after STP. In both cases there was a restriction of diffusion weighted observed in the second review (at 24 months) and reinervention revealed pearls of cholesteatoma which justified said restriction. Both cases, as described above, had a history of meatoplasty and the pearl was found in this site, which brought us to the conclusion that the cause was an iatrogenic epidermal inclusion cyst. EAC closure is essential in STP, not just to prevent this complication when there is a history of surgery on the meatus, but also to prevent the formation of fisulas or repermeabilisation\textsuperscript{16} (not found in our series).

Another fact to bear in mind is that the presence of restriction in diffusion weighted MRI appeared in both cases 24 months after surgery and was not present at 12 months. We should therefore consider rescheduling this test at 18 months instead of performing it earlier and then do another after 3 or 4 years.

In general, the patients’ degree of satisfaction is very high and their quality of life improves considerably (although this is merely conjecture or perception and was not measured with quality of life surveys in this series). We should consider that the patients stop suffering from suppurative, stop needing to make repetitive visits to the specialist, can get their ear wet and have a safe, dry ear. Moreover, the hearing of 26 out of 28 patients did not get any worse, either because a preoperative coexistence persisted or because the postoperative bone conduction and UDA were not altered.

Hearing rehabilitation should play an increasingly major role in these patients.\textsuperscript{5,16-18} Rehabilitation with osteointegrated implants is simple and produces very favourable outcomes. Rehabilitation with cochlear implants or middle ear active implants is also possible in these cases and the degree of patient satisfaction is even greater due to the obtainment of not only a dry and safe ear but also a significant gain in hearing. The only problem in these cases is the impossibility of diffusion weighted MRI follow-up in these patients, although rehabilitative surgery may in cases of cholesteatoma and the possibility of persistence, be delayed for between 24 and 36 months.

STP prior to the insertion of a cochlear implant was performed in the Hospital in a larger number of patients than those appearing in this series. However, as explained previously, in the patient selection for this series, we excluded those cases where the main indication was not for the treatment of a COM regardless of the method of hearing rehabilitation used a posteriori.

In the case of primary surgery for a complex or extensive disease, we understand that STP provides excellent possibilities of disease control without additional impairment in the patient’s hearing.\textsuperscript{1} Although it is true that there are cases of meningoencephalocele or extensive cholesteatomas which may be cured and reconstructed first-stage, in other cases this is not possible and it is for these cases that we reserve
the STP as a first choice option, as seen in this series of patients.6,7

Conclusions
The decision to perform a STP for the treatment of a COM is not common. However, there are cases with non-useful hearing and an active cavity where the decision making is easier and the level of postsurgical satisfaction is higher. There are others were the extension and possible complications of the pathology demand the performing of this technique regardless of the cochlear reserve.

The degree of disease management is high, early and delayed complications are low and hearing remains unaltered in the majority of cases.

References