NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of micropressure therapy for refractory Ménière's disease

Air pressure therapy for difficult-to-treat Ménière's disease

Ménière's disease is a progressive disorder of the inner ear that can affect hearing and balance. Symptoms vary in severity and usually start in one ear but can affect the other in time. The cause is not known but it is thought to result from a rise in pressure in the fluid that bathes the nerve endings in the inner ear. Medications aim to address symptoms (usually the imbalance and/or dizziness) but if they fail, surgery may be used to reduce pressure in the inner ear. Micropressure therapy involves inserting a tube through the eardrum into the middle ear and blowing air at low-pressure into the inner ear. This aims to reduce pressure in the ear, relieving symptoms and avoiding the need for more invasive surgery.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in April 2011.

Procedure name

- Micropressure therapy for refractory Ménière's disease.

Specialty societies

- British Association of Otorhinolaryngologists, Head and Neck Surgeons.

Description

Indications and current treatment

Ménière's disease is idiopathic, but is thought to be due to raised endolymph pressure in the inner ear (endolymphatic hydrops). Diagnosis of Ménière's disease is based on the American Academy of Otolaryngology–Head and Neck Surgery (AAO–HNS) Foundation's guidelines: symptoms of tinnitus, vertigo and deafness that do not respond to 6 months of conventional medical treatment (including some or all of betahistine, prochlorperazine, cinnarizine, furosemide, cyclizine) and/or a low-salt diet. Surgical management may also be indicated, including labyrinthectomy, endolymphatic sac decompression and vestibular neurectomy.

What the procedure involves

Micropressure therapy aims to reduce endolymph pressure in the inner ear by administering low-pressure air pulses through the tympanic membrane onto the round window membrane connecting to the cochlea and inner ear. It is thought that these air pulses stimulate the flow of endolymphatic fluid, to normalise pressure within the inner ear and relieve the symptoms of Ménière's disease.

The first step involves insertion of a grommet or ventilation tube into the tympanic membrane of the affected ear, usually with the use of local anaesthesia (but general anaesthetic is sometimes used). A few weeks later, patency of the grommet is confirmed with the Valsalva manoeuvre.

A hand-held air pressure generator is connected to the grommet to form an airtight seal in the outer ear. The device administers computer-controlled micropressurepulses across the tympanic membrane. Each pulse lasts for 60 seconds, with 3 pulses being administered per treatment, with periods of rest (usually less than 1 minute) between each pulse

Micropressure therapy is administered by the patient at home in 3 cycles per day for approximately 4–6 weeks, but can be used for longer periods of time.

Scales used to diagnose Ménière's disease

The (AAO–HNS) guidelines describe the condition in terms of stage and class of disease:

Stage of disease: this is assessed by measuring pure-tone hearing thresholds and is split into 4 stages:

- Stage I: a 4-tone average of less than 26 dB
- Stage II: 26 to 40 dB
- Stage III: 41 to 70 dB
- Stage IV: more than 70 dB.

Class of disease: frequency of vertigo spells over a 6-month period:

- Class A: freedom from vertigo
- Class B: 1 to 40 vertigo spells
- Class C: 41 to 80 vertigo spells
- Class D: 81 to 120 vertigo spells
- Class E: more than 120 vertigo spells
- Class F: secondary treatment initiated due to disability from vertigo

The Gibson 10-point Ménière's score can also be used to diagnose Ménière's disease. One point is awarded to each of 10 clinical signs. The closer the total score is to 10, the more likely the patient is to have the condition:

- Rotational vertigo
- Attacks of vertigo lasting longer than10 minutes
- Rotational vertigo associated with 1 or more of hearing loss, tinnitus or aural pressure
- Sensorineural hearing loss
- Fluctuating hearing loss
- Hearing loss or fluctuation associated with vertigo, tinnitus, or aural pressure
- Peripheral tinnitus lasting longer than 5 minutes
- Tinnitus fluctuating or changing with 1 or more of vertigo, hearing loss or aural pressure
- Aural pressure/fullness lasting longer than 5 minutes
- Aural pressure fluctuating or changing with vertigo, hearing loss or tinnitus.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to micropressure therapy for refractory Ménière's disease. Searches were conducted of the following databases, covering the period from their commencement to 20 April 2011: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with refractory Ménière's disease.
Intervention/test	Micropressure therapy.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on 240 patients from 2 randomised controlled trials (RCTs)[1,2], 1 comparative study[3] and 3 case series[4,5,6].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on micropressure therapy for refractory Ménière's disease

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure-tone audiometry; VAS, visual analogue scale; VT, ventilation tube

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Odkvist LM (2000)[1]

RCT

Sweden

Recruitment period: not reported

Study population: patients who met the clinical and electrophysiological criteria of definite Ménière's disease.

n = 56 (31 active vs 25 placebo)

Age: not reported

Sex: not reported

Patient selection criteria: hearing impairment of 20–65dB PTA, and to have active vestibular symptoms close to the test.

Technique: insertion of ventilation tube in all patients. Repeated pressure pulse applications (amplitude: 120 mmH_20, sinusoidal modulation: 6 Hz for 0.6 seconds) using Meniett device vs placebo device that looked the same but gave no stimulation to the ear. Identical instructions for use were given to both groups.

Follow-up: 2 weeks

Conflict of interest/source of funding: not reported</td>
<td>Number of patients analysed: 56 (31 active vs 25 placebo)

Patient estimates of vertigo, tinnitus and functional profile after 2 weeks:

<table>
<tr><th></th><th>Active treatment (n = 31)</th><th>Placebo (n = 25)</th></tr>
<tr><td>Vertigo</td><td>4.55</td><td>–0.64</td></tr>
<tr><td>Tinnitus</td><td>2.52</td><td>–1.6</td></tr>
<tr><td>Functional profile</td><td>3.48</td><td>0.2</td></tr>
</table>
Paper reported that the improvement from baseline in the active group is significant but no p values or baseline figures are reported.

No significant changes in the placebo group.

Hearing
Mean differences in hearing threshold levels before and after active treatment were significantly different from zero at frequencies 500 Hz ($p < 0.03$) and 1 KHz ($p < 0.01$) but not at higher frequencies. There was no significant difference in the placebo group (no data provided).</td>
<td>Not reported</td>
<td>Follow-up issues:
All patients completed follow-up at 2 weeks.
Study design issues:
Four centres took part.
Method of randomisation was not reported.
No explanation provided about the scale used to assess symptoms or whether the tool is validated.
Very little outcome data provided.
Study population issues:
No demographic information provided.</td>
</tr>
</table>

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure tone audiometry; VAS, visual analogue scale; VT, ventilation tube

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Thomsen J (2005)[2]

RCT

Sweden & Denmark
Recruitment period: not reported
Study population: patients with active Ménière's disease as defined by AAO–HNS criteria.

n = 40 (20 active vs 20 placebo)

Age: active group: 44 years (median), placebo group: 48 years (median)
Sex: not reported
Patient selection criteria: age 20–65 years, with a history of at least 8 attacks of vertigo lasting at least 20 minutes each in the last year, MRI to rule out cerebellopontine angle tumours or other intracranial disease, hearing loss in range 20– 65 dB PTA in frequencies 500 Hz, I KHz, 2 KHz and 3 KHz.

Exclusion criteria: previous surgery of the inner ear and any systemic disease requiring steroid therapy. Pregnancy, use of diuretics or vasodilators in the previous 2 weeks, active bilateral disease or previous destructive procedure, patients with pure vestibular symptoms or cases of possible perilymphatic fistulae.

Technique: insertion of ventilation tube and repeated pressure pulse applications (amplitude: 120 mmH_20, sinusoidal modulation: 6 Hz for 0.6 seconds), for a 2 month treatment period, using Meniett device vs placebo device.

Follow-up: 2 months

Conflict of interest/source of funding: not reported</td>
<td>Number of patients analysed: 40 (20 active vs 20 placebo)

Frequency of vertigo attacks:
<table>
<tr><th></th><th>Active group (n = 20)</th><th>Placebo group (n = 20)</th><th>p value</th></tr>
<tr><td>8 weeks before treatment</td><td>9.6±6.7</td><td>10.5±8.2</td><td>NR</td></tr>
<tr><td>During last 4 weeks of treatment</td><td>1.9±4.1</td><td>4.0±5.9</td><td>0.09</td></tr>
</table>
Vertigo VAS scale:
<table>
<tr><th></th><th>Active group (n = 20)</th><th>Placebo group (n = 20)</th><th>p value</th></tr>
<tr><td>8 weeks before treatment</td><td>67.3±21.7</td><td>64.9±22.4</td><td>NR</td></tr>
<tr><td>During last 4 weeks of treatment</td><td>25.5±20.5</td><td>46.6±25.6</td><td>0.005</td></tr>
</table>
Functional level (AAO–HNS criteria)
<table>
<tr><th></th><th>Active group (n = 20)</th><th>Placebo group (n = 20)</th><th>p value</th></tr>
<tr><td>8 weeks before treatment</td><td>4.2±1.1</td><td>4.1±0.9</td><td>NR</td></tr>
<tr><td>During last 4 weeks of treatment</td><td>2.4±1.1</td><td>3.5±1.2</td><td>0.0014</td></tr>
</table>
Paper reports no statistical difference between groups for perception of tinnitus, perception of aural pressure and perception of hearing.</td>
<td>Not reported</td>
<td>Follow-up issues:
• 63 patients passed the entry criteria but were later excluded because of non-compliance with treatment or study protocol.
• Completeness of follow-up was not reported.

Study design issues:
• Multicentre study.
• Method of randomisation was not reported.
• All patients were monitored for 2 weeks after meeting the inclusion criteria, after which they had a ventilation tube inserted through the tympanic membrane. Patients were then monitored for 2 months. Only patients who maintained at least 2 vertigo attacks in these 2 months entered the trial and started to use the active/placebo devices.
• Placebo and active devices were identical. The placebo device did not give any pressure pulses except a slight pressure increase to 2 cm H20 for 5 seconds to maintain the leakage test. Patients were unable to detect any difference.</td>
</tr>
</table>

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure tone audiometry; VAS, visual analogue scale; VT, ventilation tube

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Barbara M (2001)[3]

Case series
Italy

Recruitment period: not reported

Study population: patients with definite Ménière's disease as defined by AAO–HNS criteria.

n = 22 (18 VT + Meniett, 2 VT only)

Age: 30–64 years

Sex: 54.2% (13/24) female

Patient selection criteria: patients with recurrence of vertigo spells for which they had already undergone standard medical treatment based on a low-salt diet and diuretics.

Technique: Patients had a ventilation tube inserted under local anaesthesia. After 20 days active treatment started; comprising repeated pressure pulse applications (amplitude: 120 mmH_20, sinusoidal modulation: 6 Hz for 0.6 seconds) using Meniett device for 20 days.

Follow-up: 20 days

Conflict of interest/source of funding: not reported</td>
<td>Number of patients analysed: 18

Frequency of vertigo

<table>
<tr><th></th><th>Mean number of vertigo attacks</th><th>p value</th></tr>
<tr><td>Baseline (2 weeks before procedure)</td><td>9.22±7.97</td><td>-</td></tr>
<tr><td>VT only</td><td>1.28±1.36</td><td>0.001</td></tr>
<tr><td>Active treatment</td><td>1.67±2.25</td><td>0.000</td></tr>
<tr><td>Difference between VT only and active</td><td>0.39±2.09</td><td>NS</td></tr>
</table>
No change found in hearing threshold or tinnitus. However, 1 patient reported permanent improvement in pure-tone hearing threshold and disappearance of tinnitus.</td>
<td>Not reported</td>
<td>Follow-up issues:
• 2 patients were lost to follow-up after insertion of ventilation tube.
• 2 patients refused to use the Meniett device, 1 patient because they were so satisfied with the results from tube insertion.
• An additional 2 patients without vertigo underwent the therapeutic protocol but were not included in the analysis in the paper.

Study design issues:
• Single-centre study.

Study population issues:
• Duration of Ménière's disease: 1 to 20 years.
• Episode of vertigo in previous 2 months before procedure: 1–2 per month: 1 patient; > 3 per month: 4 patients; sub-continuous: 17 patients.
• 8 of the patients were on a waiting list for vestibular neurectomy.</td>
</tr>
</table>

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure-tone audiometry; VAS, visual analogue scale; VT, ventilation tube

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Densert B (2001)[4]

Case series
Sweden
Recruitment period: not reported

Study population: patients with definite Ménière's disease

n = 37

Age: 32–75 years
Sex: not reported

Patient selection criteria: at least 1-year history of Ménière's disease including attacks of rotatory vertigo lasting > 20 min, fluctuating hearing loss, tinnitus and aural fullness; a functional disability score of at least 3 (AAO–HNS criteria); active clinical symptoms such as hearing loss within 20–80 dB PTA; a score of ≥7 on Gibson’s 10-point Ménière's score; and recurrent attacks of vertigo and imbalance interfering with daily activities during the 2–4 weeks before the insertion of the ventilation tube.

Technique: insertion of ventilation tube and repeated pressure pulse applications (amplitude: 120 mmH_20, sinusoidal modulation: 6 Hz for 0.6 seconds) using Meniett device 3 times a day for 3 minutes. If remission of symptoms was established, exposure was reduced to once a day and stopped when remission was complete.

Follow-up: 2 years

Conflict of interest/source of funding: not reported</td>
<td>Number of patients analysed: 37
Spells per month of vertigo by stage of the disease
<table>
<tr><th></th><th>Stage1 & 2 (n = 9)</th><th>Stage 3 (n = 18)</th><th>Stage 4 (n = 10)</th></tr>
<tr><td>Baseline</td><td>2.3±2.3</td><td>2.6±2.6</td><td>3.9±3.0</td></tr>
<tr><td>2 years</td><td>0.3±0.7</td><td>0.2±0.4</td><td>0.3±0.3</td></tr>
<tr><td>p value</td><td>0.012</td><td><0.0005</td><td>0.008</td></tr>
</table>
No significant difference between groups.
51.4% (19/37) reported freedom from vertigo, 40.5% (15/37) reported a significant decrease in vertigo and 8.1% (3/37) patients did not respond to treatment.

Functionality levels by stage of disease
<table>
<tr><th></th><th>Stage1 & 2 (n = 9)</th><th>Stage 3 (n = 18)</th><th>Stage 4 (n = 10)</th></tr>
<tr><td>Baseline</td><td>5.0±1.3</td><td>4.8±0.9</td><td>4.8±0.8</td></tr>
<tr><td>2 years</td><td>2.1±1.5</td><td>1.7±1.1</td><td>2.3±1.4</td></tr>
<tr><td>p value</td><td>0.011</td><td><0.0005</td><td>0.007</td></tr>
</table>
No significant difference between groups.

Hearing levels by stage of disease
<table>
<tr><th></th><th>Stage1 & 2 (n = 9)</th><th>Stage 3 (n = 18)</th><th>Stage 4 (n = 10)</th></tr>
<tr><td>Baseline</td><td>26±8.0</td><td>52±7.6</td><td>74±4.4</td></tr>
<tr><td>2 years</td><td>21±11</td><td>46±11</td><td>74±10</td></tr>
<tr><td>p value</td><td>NS</td><td>0.002</td><td>NS</td></tr>
</table>
No notable decrease in the feeling of aural pressure. Substantial decrease in tinnitus in some patients (numbers not reported).

Patient satisfaction: 79.4% (27/34) reported that the pressure treatment had been helpful and that it had substantially improved their ability to perform daily tasks and work.</td>
<td>Middle ear infections: 5 patients. Pressure treatment was resumed after treatment with local antibiotics and an exchange of ventilation tubes.

No permanent perforations of the tympanic membrane or prolonged discharge from the middle ear.</td>
<td>Follow-up issues:
• Completeness of follow-up is not reported

Study design issues:
• Single-centre study.
• The use of diuretics was terminated 2 weeks before the procedure.
• A ventilation tube was inserted in all patients and active treatment started 2–4 weeks later if the patient still presented with active vestibular symptoms.
• Ventilation tubes were replaced twice per patient on average during follow-up.

Study population issues:
• Disease was bilateral in 4 patients.
• All patients had previously received standard medical treatment (including low-salt diet). 83.8% (31/37) had also failed to respond to treatment with diuretics.</td>
</tr>
</table>

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure-tone audiometry; VAS, visual analogue scale; VT, ventilation tube			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Barbara M (2007)[5] **Retrospective case series** Italy Recruitment period: not reported Study population: patients meeting AAO–HNS criteria for diagnosis of Ménière's disease. Patient selection criteria: patients in whom vestibular neurectomy was indicated. Minimum 2 years since first local pressure treatment. All patients had previously experienced unsuccessful medical trials. All had been on a low-salt diet and diuretics for 3 months. All patients classed as class D according to AAO–HNS criteria. n = **36** Age: 52.2 years (mean) Sex: 47.2% (17/36) female Technique: insertion of ventilation tube and repeated pressure pulse applications (amplitude: 120 mmH_20, sinusoidal modulation: 6Hz for 0.6 seconds) using Meniett device. Two groups: (1) 18 patients who started pressure on the same day as the tube insertion and (2) 18 patients who waited 2 weeks. All patients self-administered the treatment 5 times a day for 1 month. Follow-up: **2 years** Conflict of interest/source of funding: not reported	Number of patients analysed: **36** **% patients with a positive response** (defined as a shift from class D to class A at follow-up): 69.4% (25/36) **% patients with a positive response who started pressure therapy on the same day as tube insertion:** 55.6% (10/18) **% patient with a positive response who waited 2 weeks to start pressure therapy:** 83.3% (15/18) **Number of cycles/tube insertions in those who had a positive response:** 1 cycle / 1 tube insertion: 52% (13/25) 2 cycles / 2 tube insertions: 28% (7/25) 3 cycles / 3 tube insertions: 8% (2/25) 4 cycles / 4 tube insertions: 12% (3/25) Tinnitus severity reduced in 10 patients. Aural fullness disappeared in 4 patients. The 11 patients who did not have a positive response to pressure therapy requested vestibular neurectomy. All of these patients were disease free at 2-year follow-up.	Immediate postoperative ear discharge was observed in 2 patients. Sudden aural fullness without vertigo was observed in 10 patients requiring tube recanalisation or reinsertion. No residual perforation was detected in those undergoing multiple tube insertions.	**Follow-up issues**: • All patients had 2-year follow-up. **Study design issues**: • Single centre study. • Patients returned the device after each cycle. If vertigo returned they could go back and request a further cycle. • Ventilation tubes allowed to stay in place until their spontaneous extrusion usually within 3–5 months. • No details provided for how the outcomes were assessed. **Study population issues**: • Disease was unilateral in all patients. • Mean duration of disease before procedure: 6.2 years • Hearing level: all patients classed as stage 2 (26–40 dB) or class 3 (41–70dB).

Abbreviations used: AAO–HNS; American Academy of Otolaryngology – Head and Neck Surgery Foundation; dB, decibels; MRI, magnetic resonance imaging; NR, not reported; NS, not significant; PTA, pure-tone audiometry; VAS, visual analogue scale; VT, ventilation tube			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Buchanan MA (2010) [6] **Case series** UK Recruitment period: 2004 - 2008 Study population: patients with definite Ménière's disease. Patient selection criteria: presence of disease according to AAO–HNS guidelines (patients had 2 or more attacks of vertigo of at least 20 minutes duration each, documented loss of hearing on at least 1 occasion, tinnitus and aural fullness). Patients underwent low-pressure therapy for 4 to 6 weeks. MRI used to exclude cerebellopontine angle lesion. All patients had tried previous treatments and were offered this procedure if they still had symptoms of troublesome vertigo 6 months later. n = **33** Age: 55 years (mean) Sex: 72.7% (24/33) female Technique: insertion of Shah grommet and repeated pressure pulse applications (amplitude range 0–20cmH_20, sinusoidal modulation: 6 Hz for 0.6 seconds) using Meniett device was started a few weeks later. Patients administered 3 cycles of treatment each day. Each cycle comprised 3 60-second cycles of pressure and 3 40-second cycles of rest. Follow-up: **not reported** Conflict of interest/source of funding: manufacturer sponsored lead author to attend and present paper at a meeting in Brazil.	Number of patients analysed: **30** **Vertigo and hearing** Improvement in symptoms of vertigo and hearing: 63.3% (19/30). The improvement usually occurred immediately or within a few days of starting treatment. Two patients only reported improvement from 1 month onwards. No change in vertigo or hearing symptoms: 36.7% (11/30) **Vertigo only** Mean vertigo symptom scale score (measured on a scale from 0 to 4, with 4 being several times per day in an average month) at follow-up: 0.7 (range 0 to 2.1) **Functionality** Mean Glasgow Benefit Inventory general subscale score (measured on scale from -100 to 100 with positive scores being an improvement) at follow-up: 24.1	Not reported	**Follow-up issues**: • 90.9% (30/33) completed the follow-up questionnaires. • Patient who received treatment in the recruitment period were eligible for follow-up. **Study design issues**: • Retrospective study. • Single-centre study. • No other treatments used during the study. • All patients instructed to check the patency of their grommet using a Valsalva manoeuvre. • Postal questionnaire were sent to all patients who used the device for 4-6 weeks. • Patients were asked to indicate vertigo symptom scale scores for an average month following treatment. **Study population issues**: • Previous treatments tried: betahistine: 80% (24/30), prochlorperazine: 50% (15/30), intra-tympanic gentamicin: 26.7% (8/30), cinnarizine: 13.3% (4/30), low-salt diet: 13.3% (4/30), furosemide: 6.7% (2/30), cyclizine: (1/30) and saccus decompression: 3.3% (1/30). • Disease was unilateral in all patients.

Efficacy

Disease symptoms

An RCT of 56 patients (31 active treatment vs 25 placebo) reported significant improvement in vertigo, tinnitus and functional profile at 2 weeks (no baseline or p values reported)[1].

A case series of 36 patients reported a positive response (defined as a shift from Class D to Class A using the American Academy of Otolaryngology – Head and Neck Surgery Foundation criteria) following treatment in 69% (25/36) of patients. The 11 patients who did not achieve a positive response went on to have vestibular neurectomy and were disease-free at 2-year follow-up[5].

A case series of 33 patients reported improvement in symptoms of vertigo and hearing in 63% (19/30) patients who responded to a follow-up questionnaire (timing unclear)[6].

Vertigo

An RCT of 40 patients (20 active treatment vs 20 placebo) reported a lower mean number of vertigo attacks during the last 4 weeks of treatment in the active group compared with the placebo group, but this difference was not significant (1.9 vs 4, $p = 0.09$). The same study also reported a significantly lower (and better) vertigo score in the active group compared with the placebo group (25.5 vs 46.6, measured on a visual analogue scale, $p = 0.005$)[2].

A comparative study of 22 patients (20 had the ventilation tube only and 18 of these patients then used the pressure therapy device) reported a significant reduction in the mean number of vertigo attacks for both groups, from 9.22 to 1.28 ($p = 0.001$) for the ventilation tube only and from 9.22 to 1.67 ($p < 0.001$) after using the pressure therapy device. There was no significant difference between the two readings at 40 days[3].

A case series of 37 patients reported freedom from vertigo in 51% (19/37) of patients, a significant decrease in vertigo in 41% (15/37) and no change in 8% (3/37) at 2-year follow-up[4].

The case series of 33 patients reported a mean vertigo symptom scale score (measured on a scale from 0 to 4, with 4 being several times per day per month) of 0.7 at follow-up (timing unclear)[6].

Functional level

The RCT of 40 patients (20 active treatment vs 20 placebo) reported a significantly lower (and better) functional level (measured using AAO–HNS criteria) in the active group compared with the placebo group (2.4 vs 3.5, $p = 0.0014$) during the last 4 weeks of treatment[2].

The case series of 37 patients reported a significant improvement in functionality in all patients at different stages of the disease from baseline to 2-year follow-up (stages 1– 2: 5.0 to 2.1, p = 0.011; stage 3: 4.8 to 1.7, p = <0.0005 and stage 4: 4.8 to 2.3, p = 0.007)[4].

The case series of 33 patients reported a mean Glasgow Benefit Inventory general subscale score (measured on a scale from -100 to 100 with positive scores being an improvement) of 24.1 at follow-up (timing unclear)[6].

Hearing

The RCT of 56 patients (31 active treatment vs 25 placebo) reported improvement in hearing thresholds in the active group only. The mean difference before and after treatment was significantly different to zero in the active group at frequencies of 500Hz (p < 0.03) and 1KHz (p < 0.01) at 2-week follow-up[1].

The case series of 37 patients reported a significant improvement in hearing level for patients at stage 3 of the disease (n = 18) from baseline to 2-year follow-up (52 to 46, p = 0.027)[4].

Patient satisfaction

In the case series of 37 patients 79% (27/34) of patients reported that the treatment had been helpful and had substantially improved their ability to perform daily tasks and work at 2-year follow-up[4].

Safety

The case series of 37 patients reported middle ear infection in 5 patients. Pressure treatment was resumed after local antibiotics and an exchange of ventilation tubes[4].

The case series of 36 patients reported immediate postoperative ear discharge in 2 patients[5].

Validity and generalisability of the studies

- RCT evidence is available although the quality of these 2 studies is questionable.
- Small numbers of patients are included in each study.
- No long-term follow-up (longer than 2 years).
- Lack of safety data. No mention of complications in 4 of the 6 studies reported.

Existing assessments of this procedure

In 2003, the UK National Horizon Scanning Centre published a briefing on Meniett low-pressure pulse generator for Ménière's disease. The paper reported that Meniett may provide an alternative to ablative or surgical intervention for severe vertigo without causing permanent hearing loss. Early intervention may also lead to the prevention of future hearing loss[7].

The Australia and New Zealand Horizon Scanning Network (ANZHSN) published a report in 2005 on 'The Meniett device for the treatment of Ménière's disease'. The report stated "in summary, Meniett appears to benefit most, but not all patients in terms of reducing the number of vertigo episodes. It is difficult to ascertain if treatment with Meniett has a positive effect on the hearing levels of patients. It appears that treatment with Meniett would have to be continued in the long term for a sustained reduction in symptoms and as yet the longest follow-up study is 18 to 24 months. Long-term use of Meniett may be associated with adverse events associated with long-term implantation of tympanic tubes such as infection and the need for regular replacement of the tube"[8].

Related NICE guidance

There is currently no NICE guidance related to this procedure.

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Mr Ian Bottrill, Dr Neil Donnelly and Mr S. Musheer Hussain (British Association of Otorhinolaryngologists, Head and Neck Surgeons [ENT UK]).

- Two of the Specialist Advisers have performed this procedure at least once and one has never performed the procedure.
- One of the Specialist Advisers considered this to be an established procedure and no longer new. The other two Specialist Advisers considered the procedure to be definitely novel and of uncertain safety and efficacy.

- Comparators: intratympanic gentamicin infiltration for vestibular ablation or placement of a grommet alone without concomitant use of overpressure therapy.
- Efficacy outcomes: frequency and severity of vertigo, hearing threshold, tinnitus control and progression to further therapy.
- Adverse events reported in the literature and/or own experience: post tympanostomy otorrhoea, repeated need for short stay ventilation tube insertion and permanent ear drum perforation if a long stay ventilation tube is used.
- Theoretical adverse events: infection of the grommet, loss of ventilation tube in the inner ear, scarring of the wear drum and hearing loss.
- Training and facilities: surgical training in ventilation tube (grommet) insertion.
- One Specialist Adviser reported that they have used the procedure in approximately 20 patients and very few have found it useful.
- One Specialist Adviser stated that the relapsing remitting nature of Ménière's disease and the tendency for any intervention, including placebo, to improve the short-term outcome make it difficult to be certain of the efficacy of the procedure.
- One Specialist Adviser stated that published studies have small patient numbers, inadequate follow-up times and fail to differentiate between treatment and natural remission.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme sent questionnaires to 1 trusts for distribution to patients who had the procedure (or their carers). NICE received no completed questionnaires.

Issues for consideration by IPAC

- Future paper: A German RCT was completed in April 2009 comparing pulsed pressure application with a placebo device in patients with Ménière's disease entitled 'Efficacy of Local Overpressure Treatment for Ménière's Disease'. Estimated recruitment: 80 patients. Awaiting publication.

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3. Barbara M, Consagra C, Monini S et al. (2001) Local pressure protocol, including Meniett, in the treatment of Meniere's disease: short-term results during the active stage. Acta Oto-Laryngologica 121:939-944.

4. Densert B and Sass K. (2001) Control of symptoms in patients with Meniere's disease using middle ear pressure applications: two years follow-up. Acta Oto-Laryngologica 121:616-621.

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6. Buchanan MA, Rai A, Prinsley PR. (2010) Initial UK experience of patient satisfaction with the Meniett device for Meniere's disease treatment. Journal of Laryngology and Otology 124:1067-1072.

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8. Mundy L, Merlin T, Braunack-Mayer A et al. (2005) The Meniett device for the treatment of Meniere's disease. Australia and New Zealand Horison Scanning Unit:1-32.

Appendix A: Additional papers on micropressure therapy for refractory Ménière's disease

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Barbara M Lazzarino Al, Biagini M et al. (2010) Influence of Meniett treatment on hearing. Acta Oto-Laryngologica 130 (11): 1256-1259.	Case series n = 27 Follow-up: 2 years	Pure tone average values increased by an average of 7.1dB (95% confidence interval [CI]: 2.7 to 11.5; p = 0.003). Q scores decreased on average by 20.6 (95% CI: 8.8 to 32.4; p < 0.001).	Larger studies in Table 2
Boudewyns AN, Wuyts FL, Hoppenbrouwers M et al. (2005) Meniett therapy: rescue treatment in severe drug-resistant Meniere's disease? Acta Oto-Laryngologica 125 (12): 1283-1289.	Case series n =12 Follow-up: 37 months (mean)	2 patients stopped treatment after 1 month due to persistent severe vertigo. Remaining 10 patients reported significant decrease in median number of vertigo spells from 10 per month at baseline to 3 month at follow-up (p = 0.02). No improvement in hearing, tinnitus, functional level or self perceived dizziness. 50% (6/12) had ablative surgery within 1 year.	Larger studies in Table 2
Densert B, Densert O, Arlinger S et al. (1997) Immediate effects of middle ear pressure changes on the electrocochleographic recordings in patients with Meniere's disease: a clinical placebo-controlled study. American Journal of Otology 18 (6): 726-733.	RCT n = 39 (21 active vs 18 placebo) Follow-up: not reported	Visual scales evaluating changes in the subjective symptoms of vertigo, tinnitus and aural fullness showed no significant changes in either the active or the placebo group.	No data or p values provided in the paper for relevant clinical outcomes. Method randomisation is not stated.
Densert B, Densert O. (1982) Overpressure in treatment of Meniere's disease. Laryngoscope 92 (11): 1285-1292.	Case reports n = 5 Follow-up: 2 years	Vertigo symptoms completely relieved in all patients.	Larger studies in Table 2
Dornhoffer JL, King D (2008) The effect of the Meniett device in	Case series	Follow-up questionnaire 25% (3/12) showed no	Larger studies in Table 2

patients with Meniere's disease: long-term results. Otology & Neurotology 29 (6): 868-874.	n =12 Follow-up: 4 years (mean)	benefit 75% (9/12) reported a reduction in frequency and severity of vertigo attacks. 58% (7/12) continued to use the device on a daily basis and 2 patients went into remission 2 to 3 years after initiating treatment.	
Gates GA, Green JD, Jr. (2002) Intermittent pressure therapy of intractable Meniere's disease using the Meniett device: a preliminary report. Laryngoscope 112 (8:Pt 1): t-93.	Case series n = 10 Follow-up: 8 months (mean)	90% (9/10) achieved complete control of vertigo. The remaining patient reported a 50% reduction in severity and frequency. Mean hearing gain of 9dB (p = 0.046). 2 patients required tube reinsertion. 2 patients developed otorrhoea that responded to topical therapy and 1 patients had a blood clot that obstructed the tube and delayed use of the device. 2 subjects reported recurrence of vertigo when the tube was blocked and 2 patients reported recurrence of vertigo when they used the device less often than recommended.	Larger studies in Table 2
Huang W, Liu F, Gao B et al. (2009) Clinical long-term effects of Meniett pulse generator for Meniere's disease. Acta Oto-Laryngologica 129 (8): 819-825.	Case series n = 22 Follow-up: 28 months (mean)	Mean vertigo severity on VAS scale: Baseline: 43.8 12 months: 2.3 (p = 0.002) 24 months: 1.1 (p = 0.043) % sick days taken: Baseline: 33.5% 12 months: 1.1% (p = 0.021) 24 months: 0.4% (p = NS) No middle ear infections, perforation of tympanic membrane or prolonged middle ear discharge reported.	Larger studies in Table 2
Mattox DE, Reichert M (2008) Meniett device for	Case series	52% (11/21) had good control of vertigo at 2	Larger studies in Table 2

Meniere's disease: use and compliance at 3 to 5 years. Otology & Neurotology 29 (1): 29-32.	n = 23 Follow-up: 3-5 years	years. 19% (4/21) were asymptomatic at 1 year and discontinued use of device and 29% (6/21) had no impact on their symptoms and stopped using the device within 3 months. 2 patients lost to follow-up. No complications attributable to the device reported.	
Park JJ, Chen Y.S., and Westhofen M. (2009) Meniere's disease and middle ear pressure: vestibular function after transtympanic tube placement. Acta Oto-Laryngologica 129 (12): 1408-1413.	Case series n = 22 Follow-up: 20 months (median)	68.2% reported an improvement in vertigo.	Larger studies in Table 2
Rajan GP, Din S, and Atlas MD (2005) Long-term effects of the Meniett device in Meniere's disease: the Western Australian experience. Journal of Laryngology & Otology 119 (5): 391-395.	Case series n =18 Follow-up: 18 months (mean)	Mean vertigo severity on VAS scale: Baseline: 67.3 6 months: 25.5 (p = 0.005) 18 months: 25.9 (p = NS) Mean functional score (6 point scale): Baseline: 4.1 6 months: 2.3 (p = 0.0014) 18 months: 2.4 (p = NS) 29% (5/17) had audiometric improvement. 3 patients required ventilation tube reinsertion due to extrusion and one tube was removed because the patient experienced aural foreign body sensation.	Larger studies in Table 2
Stokroos R, Olvink MK, Hendrice N et al. (2006) Functional outcome of treatment of Meniere's disease with the Meniett pressure generator. Acta Oto-Laryngologica 126 (3): 254-258.	Case series n = 32 Follow-up: 10 weeks	Hearing threshold averages did not change significantly following treatment.	Larger studies in Table 2
Shojaku H, Watanabe Y, Mineta H et al. (2011) Long-term effects of the	Case series	57% with Ménière's disease reported significant decrease in	Larger studies in Table 2

Meniett device in Japanese patients with Meniere's disease and delayed endolymphatic hydrops reported by the Middle Ear Pressure Treatment Research Group of Japan. Acta Oto-Laryngologica 131 (3): 277-283.	n = 28 Follow-up: 24 months	the frequency of vertigo spells. 12% of ears showed a significant hearing improvement. In 4 ears, persistent perforation after tube insertion remained at the end of the pressure treatment. These patients refused tympanoplasty.	

Appendix B: Related NICE guidance for micropressure therapy for refractory Ménière's disease

There is currently no NICE guidance related to this procedure.

Appendix C: Literature search for micropressure therapy for refractory Ménière's disease

Database	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	20.04.2011	Issue 2 of 4, Apr 2011
Database of Abstracts of Reviews of Effects – DARE (CRD website)	20.04.2011	n/a
HTA database (CRD website)	20.04.2011	n/a
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	20.04.2011	Issue 2 of 4, Apr 2011
MEDLINE (Ovid)	20.04.2011	1948 to April Week 1 2011
MEDLINE In-Process (Ovid)	20.04.2011	April 15, 2011
EMBASE (Ovid)	20.04.2011	1980 to 2011 Week 15
CINAHL (NLH Search 2.0/EBSCOhost)	20.04.2011	n/a
BLIC (Dialog DataStar)	20.04.2011	n/a

Trial sources searched on 20.04.2011

- Current Controlled Trials *meta*Register of Controlled Trials – *m*RCT
- Clinicaltrials.gov
- National Institute for Health Research Clinical Research Network Coordinating Centre (NIHR CRN CC) Portfolio Database

Websites searched on 20.04.2011

- National Institute for Health and Clinical Excellence (NICE)
- Food and Drug Administration (FDA) - MAUDE database
- French Health Authority (FHA)
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- Conference search
- General internet search

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	exp Labyrinth Diseases/
2	meniere*.tw.

3	((vestibular or cochlear or labyrinth*) adj3 disease*).tw.
4	(aural adj3 (vertigo or pressure or fullness*)).tw.
5	(endolymph* adj3 (hydrops or pressur* or fluid*)).tw.
6	or/1-5
7	otologic surgical procedures/
8	(otologic adj3 surgical adj3 procedur*).tw.
9	((pressur* or over pressur* or overpressur* or over-pressur*) adj3 (treatment* or therap*)).tw.
10	(pressur* adj3 (puls* or intermittent*)).tw.
11	((transtympanic or micro pressur* or micropressur* or micro-pressur*) adj3 (treatment* or therap*)).tw.
12	(ear adj3 pressur* adj3 change*).tw.
13	((tympanostomy or vent*) adj3 tube*).tw.
14	Middle Ear Ventilation/
15	(middle adj3 ear adj3 ventilat*).tw.
16	meniett.tw.
17	p100-meniere.tw.
18	medtronic.tw.
19	enttex.tw.
20	or/7-19
21	6 and 20
22	Animals/ not Humans/
23	21 not 22