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# UNIVERSITÀ DEGLI STUDI DI TORINO

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# Surgical indication in Menière's disease therapy: clinical and epidemiological aspects

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## Abstract

The aim of this study was to evaluate the frequency of surgical approach in a population of patients affected by definite Menière's disease (MD). In the majority of patients, relief from vertigo attacks can be achieved by means of medical therapy (MT). In cases in which MT fails surgery may offer relief to vertigo. The most applied surgical procedures are intratympanic gentamicin (ITG) and vestibular neurectomy (VN), based on vestibular deafferentation. Until now, the real incidence of the different therapeutic approaches for MD has not been evaluated. The study design was a retrospective study. The study was performed in 177 patients affected by definite MD. Subjects referred directly for surgery by other centers were excluded from the study. All the patients were medically treated with salt restriction and diuretics. In case of MT failure, surgical therapy, ITG or retrosigmoid VN were proposed. In the 75% of cases, the only therapeutic approach was MT, while in 20% of cases we carried out ITG and in 5% VN. In 33% of VN group, this operation was carried out after ITG failure and in 67% as the first surgical approach. The VN group was characterized by younger age and higher disability degree. The primary therapy in definite MD seems to be MT. Ablative therapy represents the second choice: ITG was carried out in 80% of cases, while VN was performed in 20%.

Keywords

Menière's disease Intratympanic gentamicin Vestibular neurectomy

## Introduction

In 1861, Prosper Menière presented a paper before the French Academy of Medicine describing the association of episodic vertigo, ringing in the ears, and fluctuating hearing loss as a single disease resulting from damage to the inner ear rather than from an "apoplectic cerebral congestion", as commonly believed at that time [1, 2]. He and other investigators called the disease "glaucoma of the inner ear" [3].

Menière's disease (MD) is today considered as an idiopathic disorder of the inner ear due to endolymphatic hydrops that causes recurrent acute vertigo and fluctuating neurosensorial hearing loss [4]. MD is one of the most frequent causes of recurrent vertigo, with an estimated prevalence of about 50–500 cases per 100,000 population [5, 6] and it significantly affects the patient's quality of life and work performance.

Sometimes MD may be a consequence of a previous inner ear suffering, not related to endolymphatic hydrops that caused sensorineural hearing loss. This form of MD is named delayed

endolymphatic hydrops and can be classified into ipsilateral (IDEH), if vertigo is due to vestibular crisis arising from the originally diseased ear, and contralateral (CDEH), if MD symptomatology (vertigo and hearing loss) appears at the good ear.

In the majority of patients, symptomatic relief to vertigo attacks can be achieved by medical therapy (MT) principally based on chronic salt restriction and diuretics administration. In cases in which conservative therapy fails a surgical treatment may offer relief to vertigo [6].

Among the different ablative procedures, the most applied are the intratympanic gentamicin (ITG) treatment and the vestibular neurectomy (VN). Both techniques are based on vestibular deafferentation and VN offers a high probability of hearing maintenance at the same preoperative values. Recovery from unsteadiness consequent to peripheral deafferentation takes place later thanks to vestibular compensation.

Intratympanic aminoglycoside administration is a treatment for MD since the Schuknecht's first report in 1956 [7]. Since then, ITG has progressively become the most utilized surgical procedure in MD therapy [8]. ITG at lower dosages determines a selective damage to the dark cells located in the stria vascularis of the cochlea and in the planum semilunatum in the cristae ampullares of the semicircular canals. Since these cells produce endolymph, this treatment can control the endolymphatic hydrops [9]. At higher dose, the drug shows a toxic effect on the vestibular hair cells, causing their necrosis. The efficacy of the drug is documented by the appearance of unsteadiness demonstrating the toxic vestibular suffering. The therapeutic effect can be transient, since recurrence of vertigo is noticed in about 40% of cases [10].

The role of selective VN has become widely accepted in the treatment of MD with vertigo refractory to other therapies [11].

In 1928, Dandy published his first series of nine cases of MD treated by the section of the eighth nerve, since patients observed in those days were completely deaf [12]. Although he subsequently proposed the selective VN for patients still hearing, McKenzie was the first actually to perform the procedure [13]. Anyway Dandy's personal series of eighth nerve section for the treatment of MD included more than 600 procedures between 1927 and 1946 [14].

The main advantage of VN versus ITG is that, in the majority of patients, vertigo is definitively controlled [15]. Regarding the surgical technique, several approaches for VN have been proposed. Most reviews have reported good (85–100%) vertigo control rates either with retrosigmoid, retrolabyrinthine or with middle fossa vestibular nerve section [16–18]. Restrosigmoid VN seems to provide a faster and better exposure of the VIIth and VIIIth cranial nerves in the cerebellopontine angle and shows the lower incidence of hearing loss, facial suffering, and cerebrospinal fluid leakage.

The real incidence of the different therapeutic approaches for MD (medical vs. surgical and ITG vs. VN) has not been evaluated on large series of patients in literature. In this retrospective study, we evaluated the frequency of the surgical approach in a population of patients affected by MD, with an analysis of the clinical features of the patients who underwent different therapeutic treatments.

## Materials and methods

### Patients

This retrospective study was performed in 177 consecutive patients affected by definite MD according to the 1995 American Academy of Otolaryngology and Head and Neck Surgery (AAO-HNS) Committee on hearing and equilibrium guidelines [4]. Subjects referred directly for surgery by other centers were excluded from the study.

The mean age of patients was 55 years (SD 14), the mean duration of the disease was 74 months (SD 77), and the mean age at the beginning of the pathology was 49 years (SD 16). The affected ear was the right in 79 cases (44%) and the left in 82 (46%); in 16 cases, the pathology was bilateral (10%). There were 83 males (47%) and 94 females (53%).

The functional level of disability of the patients before medical or surgical therapy was classified by a scale ranging from one (mild) to six (severe), according to the 1995 AAO-HNS criteria [4]. The series included 53 patients with grade 1 disability (30%), 55 patients with grade 2 (31%), 51 patients with grade 3 (29%), and 18 patients with grade 4 (10%).

Clinical evaluation included pure tone audiometry (PTA) threshold detection at the first control and at each following examination. Threshold refers to the mean PTA value at 0.5–1–2–3 kHz, according to the 1995 AAO-HNS criteria [4]. Bithermal caloric test was carried out only in patients surgically treated in order to evaluate the results of vestibular deafferentation. MRI of the brain was always carried out prior to ITG or VN in order to rule out any posterior fossa pathology. In none of the cases considered in the study, a posterior fossa lesion was observed.

## Medical treatment

All the patients were medically treated with salt restriction and diuretics. In fact, it is our habit to present patients, at the moment of diagnosis, all the possible therapies, describing outcome and risks, but suggesting to start with MT, if not already carried out.

Subsequently, controls were carried up after 3 months and then for every 6 months or in case of recrudescence of vertigo. Follow-up ranged from 12 to 60 months.

In case of failure of MT, judged by patients on the basis of frequency, intensity and acceptance of vertigo, surgical therapy, ITG or retrosigmoid VN were proposed. Between the indication to surgery and the procedure, it lasts at least 1 week for ITG and 1 month for VN.

## ITG administration

Gentamicin, 40 mg/ml tamponate with sodium bicarbonate, was infiltrated in the middle ear in local anesthesia by means of micro-needle inserted in the postero-superior part of the tympanic membrane, near the oval and round windows region. ITG was carried out weekly in order to minimize the risk of hearing worsening [18]. The administration was prolonged until the appearance of unsteadiness (usually slight); the appearance of this symptom demonstrates the vestibular suffering and suggests the positive effect of ITG in vertigo attack control. The number of ITG consecutive applications ranged from one to six. After six applications, the therapy was stopped anyway and the treatment was considered ineffective.

## Vestibular neurectomy

VN was always carried out by a retrosigmoid approach. All the procedures were performed by both a neurosurgeon and an otologist. A small craniectomy was made in the retromastoid region close to the sigmoid sinus. The dura was incised allowing for easy exposure of the eighth nerve at the cerebellopontine angle with minimal or no cerebellar retraction. The vestibular nerve, which is cranial in respect to the cochlear nerve and posterior to the facial nerve, was gently dissected and then sectioned for a 1 cm tract (neurectomy).

To evaluate the incidence of the different therapeutic approaches and to analyze the clinical characteristics of the patients, three groups were identified:

- Group A: patients submitted to MT only;
- Group B: patients treated by ITG after the failure of the MT therapy;
- Group C: patients submitted to retrosigmoid VN after the failure of MT and in case after the failure of ITG.

Statistical analysis was carried out with the SPSS package. Distribution of data was normal. The test applied was Chi-square and ANOVA. The significativity level was set at 0.05.

## Results

Among the 177 MD patients included in the study, 132 (75%) were submitted to MT only since they had a satisfactory relief from vertigo or they refused a vestibular ablation. Forty-five patients (25%) were submitted to surgery due to failure of MT, 3–60 months after the first control. Thirty-six patients (20%) underwent ITG and nine (5%) underwent VN. Three of the nine patients treated by VN (33%) had been previously submitted to ITG with no results, while the remaining six (67%) chosen to be treated by VN as the first surgical step.

Table 1 shows the clinical features of the three groups of patients.

Table 1

Clinical features of the MD patients in relation to the type of treatment

Age, disease length, mean functional level of disability (according to AAO-HNS scale) and PTA differences among groups were evaluated by means of ANOVA test of variance; side and sex by means of Chi-square test

Therapy	N° of patients	Age (years)	Side	Sex	Disease length (months)	Mean functional level of disability	PTA
MT (group A)	132 (75%)	54.7 (±15)	R = 62 (47%) L = 57 (43%) Bil = 13 (10%)	M = 63 (52%) F = 69 (48%)	72 (±73)	1.93 (±1)	45.7 (±23.4)
ITG (group B)	36 (20%)	60.4 (±13.1)	R = 15 (42%) L = 19 (53%) Bil = 2 (5%)	M = 14 (39%) F = 22 (61%)	98 (±93)	2.81 (±0.82)	49.7 (±24.4)
VN (group C)	9 (5%)	47 (±7.2)	R = 3 (33%) L = 5 (55%) Bil = 1 (12%)	M = 6 (67%) F = 3 (33%)	112 (±100)	3.56 (±0.53)	54.7 (±29.8)
<b>p</b>		<b>p&lt;0.05</b>	<b>p&gt;0.05</b>	<b>p&gt;0.05</b>	<b>p&gt;0.05</b>	<b>p&lt;0.001</b>	<b>p&gt;0.05</b>

MT medical therapy, ITG intratympanic gentamicin, VN retrosigmoid vestibular neurectomy, PTA pure-tone audiometry threshold

Subjects treated by VN were younger than subjects submitted to MT only, while subjects treated by ITG were the oldest; differences are significant at the ANOVA test ( $p < 0.05$ ).

The affected side and the sex of patients were homogeneously distributed in the three groups ( $p > 0.05$  at the Chi-square test).

MD was bilateral in 16 cases (9%): 13 patients were treated only by MT, 1 patient developed a bilateral MD after ITG and 1 patient after VN. The remaining one patient was treated by ITG, even in the presence of a bilateral MD, because clinical data strongly indicated the side affected at the moment of treatment (unilateral aural fullness and fluctuating hearing loss) and the vertigo intensity was judged unbearable by the patient.

The duration of the disease was longer in subjects surgically treated, especially in patients submitted to VN, but the difference is not significant at the ANOVA test ( $p > 0.05$ ).

The mean disability grade before therapy was higher in subjects treated by surgery, and particularly in those submitted to VN; differences are strongly significant at the ANOVA test ( $p < 0.001$ ). Most patients treated with MT showed a disability grade 1 or 2, while the majority of subjects submitted to ITG reported a disability grade 3 and those submitted to VN a disability grade 3 or 4 (Fig. 1).

Fig. 1

Functional level of disability according to AAO-HNS scale in MT, ITG, and VN patients. Black grade 1, vertical lines grade 2, horizontal lines grade 3, oblique lines grade 4

In our series, 11 patients (6%) were affected by IDEH and 7 by CDEH (4%). MT was the only therapy carried out in CDEH, while in IDEH the surgical therapy was carried out in four cases: 3 ITG and 1 VN (Table 2).

Table 2

Therapeutic approaches in patients affected by ipsilateral delayed endolymphatic hydrops (IDEH) and by contralateral delayed endolymphatic hydrops (CDEH)

	MT	ITG	VN
IDEH	7 ( 64%)	3 (27%)	1 (9%)
CDEH	7 (100%)	0	0

MT medical therapy, ITG intratympanic gentamicin, VN retrosigmoid vestibular neurectomy  
Surgical patients were pre-operatively affected by a higher degree of hearing loss than medical ones; among subjects submitted to surgery, hearing loss was more pronounced in the VN group (Table 1). However, threshold differences among the three groups are slight and not significant at the ANOVA test ( $p > 0.05$ ).

## Discussion

The ablation of the vestibular end organ is nowadays a common practice in case of disabling vertigo in MD resistant to MT [19]. Nowadays, the commonest techniques performed for vestibular ablation are ITG and VN [19]. Moreover, these techniques allow preserving the residual hearing, even if severely compromised; this may be of particular importance in case of MD bilateralization or appearance of severe hearing loss due to other causes at the better ear.

Several studies have demonstrated the efficacy of ITG and VN in vertigo control [15–18], with a higher rate of definitive results for VN [15, 20, 21]. On the other hand, ITG is preferred by patients since it is less traumatic and can be carried out in outpatients. In both cases, a slight unsteadiness may result in about 50% of cases that is, however, well accepted by patients disabled by acute recurrent vertigo attacks [17].

Until now, the real frequency of surgical indication in MD patients has not been precisely evaluated since papers on surgery in MD referred principally to technical aspects and results. In order to define the real frequency of surgical indication in MD, we studied a large series of patients affected by definite MD, condition in which diagnosis and affected side are known with certainty. To avoid the risk of overestimating the percentage of patients treated by surgery, we excluded from the study the patients referred to us by other centers directly for surgery. In fact, the largest series of MD surgical therapy are published by centers that gather patients specifically sent for surgery, but obviously their sample are not useful to evaluate the true rate of different therapeutic options in a MD population. In this paper, it was not our intention to discuss about results, in terms of resolution of vertigo and residual symptomatology; these results have been presented elsewhere [15]. The presentation of results referred to MT and ITG was necessary in order to explain how patients arrived to ask VN.

According to previous report [22] in our sample, the ablative therapy was carried out in 25% of cases of definite MD and always after MT failure.

Surgery was not applied in all cases of MT failure but only on the basis of patient request; therefore, our data do not indicate that the rate of MT failure in MD is 25% (probably it is higher), but simply that 75% of patients ruled out the surgical option or thought that MT results were enough to gain a good quality of life.

In the overall sample, 20% of cases were submitted to ITG and 5% to VN; therefore, in the surgical group 80% of patients were treated with ITG and 20% with VN. After the indication to surgery, we

have anyway still waited 1 week as regard ITG and 1 month as regards VN since it has been demonstrated that the simple indication to surgery could reduce the number of crisis [23].

Regarding ITG administration, we have chosen the so-called titration method, i.e., administration weekly until the appearance of unsteadiness that is the technique that has shown the higher rate of success with the lower risk of complications [24]. Following this protocol, vertigo attacks are usually relieved in 95% of patients [25].

VN was chosen as first ablative therapy by six patients (67% of the VN group) while three patients had been previously treated by ITG. This means that often MD patients after MT failure prefer to be submitted to a therapy with lower rate of failure. Therefore, we cannot conclude that in our sample the rate of failure of ITG was 20% but that 20% of surgical patients prefer, before or after ITG, to be submitted to a more radical vestibular ablation.

The clinical features of patients submitted to surgery indicate that subjects submitted to ITG were older while those who were submitted to VN were younger than MT group. This demonstrates the importance of the age for the indication. In our opinion, invalidating MD vertigo in the elderly should be treated with the low-risk ITG approach even if the risk of persistent unsteadiness is higher. In fact, this unsteadiness is better tolerated than recurrent acute vertigo.

The longer disease length in surgical patients, and above all in VN group, shows how the psychological disability due to the repetition of the vertigo attacks is important in the acceptance of a surgical procedure, that anyway cause a temporary disability, more or less pronounced and prolonged.

This aspect is well documented even by the higher disability score reported in the surgical group and particularly in subjects submitted to VN, who never presented a score less than 3.

Hearing threshold did not differ significantly among the three groups; therefore, audiometric data at the diseased ear cannot be considered, in our hand, a relevant parameter in the therapeutic decision.

As regards the type of the disease we have not treated surgically CDEH since in these subjects the pathology affects the better ear and it is necessary to avoid the risk of a hearing worsening due to surgery; moreover, CDEH is well responsive to steroid [26]. In the surgical cases of IDEH, in which we operated on the same ear affected by the sensorineural hearing loss, we preferred VN to labyrinthectomy in order to preserve the residual hearing at the diseased ear.

## Conclusion

The primary therapy in definite MD seems to be MT, while ablative therapy represents the second choice (25% of cases). Among the two vestibular ablative techniques considered in this study, ITG was carried out in 80% of cases, while VN was performed in 20% (7% after ITG and 13% as first therapeutic choice).



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