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The surgical treatment of vertigo

N. Deggouj, S. Castelein and M. Gersdorff

Academic Hospital Saint-Luc, ENT Department, Université catholique de Louvain, Brussels, Belgium

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Abstract. *The surgical treatment of vertigo.* We present surgical treatments for vertigo targeting symptoms and aetiology.
The choice of treatment should be guided by the symptoms, the supposed aetiological factors and the age of the subject. Surgery is rarely indicated in the majority of the patients with vertigo.
Surgical solutions should be proposed for cases of chronic incapacitating vertigo that are refractory to medical or physical treatment.
The surgical procedures possible today target aetiological factors or attempt to cancel information coming from the vestibular organ. We will refer to the latter as "symptomatic treatment".

A. Symptomatic surgical treatment

These treatments destroy all or part of the labyrinth, or deconnect it from the vestibular centres.

1. *Labyrinthectomy*

a) Total labyrinthectomy

This procedure may be either chemical or surgical. The intratympanic application of Gentamycin is the gold standard for the treatment of intractable chronic vertigo of the kind found in Ménière's disease.[1-4] Ideally, the aminoglycosides are administered in the round window niche through a paracentesis, a transtympanic tube or sometimes through a pump (not available now). The easiest solution today is to administer it using the Spongostan of a Silverstein tube (Micromedics Inc. Minnesota 5510 USA). This treatment results in good control of the vertigo (>80%) but it may adversely affect hearing. Surgical labyrinthectomy should be avoided. Otologists should aim to preserve cochlear morphology so that cochlear implantation remains possible at a later stage. The destruction of the diseased end organ will eliminate vertigo symptoms but also destroys hearing. This procedure should be reserved for ears with significant hearing loss in old patients.

b) Localised labyrinthectomy

The plugging of a semi-circular canal is an effective treatment with >90% success in vertigo control in cases of intractable benign paroxysmal positional vertigo (BPPV).[5-7] It usually involves the posterior canal and sometimes the horizontal. Incomplete occlusion of the canal may result in recurrence of BPPV and in a catiogenic fistula.[8]

2. *Vestibular neurotomies and neurectomies*

a) Singular neurectomy

This approach is proposed for chronic disabling refractory BPPV. The neurectomy is carried out in the ampullary recess of the posterior semi-circular canal. This technique provides complete relief from BPPV in 96% of subjects.[9] Sensorineural hearing loss is a complication in 3-4%. A positive fistula response may be present for a few months in some patients.

b) Vestibular neurotomy

A vestibular neurotomy in the pontocerebellar angle allows for the deconnection of the vestibular end organ from the vestibular nuclei and the cerebellum. It usually results in a central vestibular compensatory reorganisation, allowing for the recovery of functional equilibrium. This compensation can happen despite the persistent evolutive disease in the ear or the nerve. It is less efficient in the elderly and so this will not be the first-choice surgical option for them.

A vestibular neurotomy results in improvements or the resolution of vertigo in >90%.[10-12] The retrosigmoid approach is simpler, safer and more reliable than the middle or retrolabyrinthine

approaches.[11] The retrosigmoid approach has been used to associate neurotomy and vascular decompression.[13] A recurrence of vertigo after surgery can be observed. This may be due to an incomplete neurotomy or, more frequently, to the passage of vestibular neural fibres into the preserved cochlear nerve.[14]

B. Aetiological surgical treatments

The aim of these treatments is to correct the supposed aetiological factors of vertigo.

1. *Treatments acting on the pressure in the ear*

Those treatments were developed historically to cure or to improve an endolymphatic hydrops (EH), which was presumed to explain the symptoms. The first decompressive surgical treatments consisted of sacculotomy or cochleosacculotomy. They were intended to reduce EH by drainage and therefore improve the symptoms.

They were found to be effective for vertigo in 80%.[15,16] However, the risk of associated deterioration in hearing was higher: 20%.[16]

Decompressive surgery procedures involving the endolymphatic sac continue to be used by many teams.[17-26]

In fact, all these decompressing sac surgeries have been found to be unspecific.[16,19,21] They have the same positive effect on vertigo improvement as a simple mastoidectomy[19] on transtympanic ventilation tube in humans.[15,16] In animal models of EH, the cochleo-sacculotomy was not found to have any effect on the induced EH.[15]

A severe permanent hearing loss may occur in 20% of patients after sacculotomy and cochleosacculotomy.[16]

A transtympanic tube seems preferable to sac surgery in Ménière's disease.

This tube makes it possible to apply low-intensity alternating pressure. The Meniett device seems to be a promising and efficacious treatment for Ménière's subjects with vertigo uncontrolled by other treatments.[27]

2. *Treatment of fistula*

Labyrinthic fistulae may be primitive or secondary to an inflammatory process in the middle ear (cholesteatoma, granulomatosis); to surgery (cholesteatoma, cochlear implantation otosclerosis); to traumatisms; to malformations (Mondini). In the case of symptomatic fistulae, there should be a surgical exploration of the middle ear and the fistula should be packed with periosteum muscle or other tissues.[28-30]

The superior semicircular canal dehiscence is a special type of fistula.[31-33] It must be treated using a combined otological and neurosurgical procedure through the middle cranial fossa.

3. *Other*

Some cases of Tullio's phenomenon are due to abnormal mobility of the stapes or other ossicles. The hypermobility may be stabilised by placing cartilage chips beside the crurae of the stapes.[34] Abnormal scar tissue around the ossicles may be resected during a surgical exploration of the middle ear.

Conclusion

Rapid surgical treatment is indicated when a aetiological factor may be safely corrected. In other cases, the surgical option should be reserved for incapacitating vertigo that does not respond to medical or physical treatment. The choice of treatment must be guided by the symptoms, experience and the age of the subjects.

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Naïma Deggouj, M.D.
Academic Hospital Saint-Luc
ENT Department
Université catholique de Louvain
avenue Hippocrate 10
B-1200 Brussels, Belgium
Tel.: 32.2.764.19.49.
Fax: 32.2.764.89.35.
E-mail: Naima.Deggouj@uclouvain.be