Study protocol: Benign peripheral paroxysmal positional vertigo (BPPV): Comparison of the Epley maneuver with the so-called SémontPLUS liberation maneuver.

Basis and rationale of the study and theoretical background

BPPV is the second most common form of vertigo. Reported prevalence ranges from 10 to 140 per 100,000 and lifetime prevalence is at least 2.4% (1, 2); prevalence of 9-11% have been found in a population older than 75 years (3, 4).

The leading symptom is recurrent attacks of spinning vertigo, each triggered by changes in position relative to gravity and lasting from seconds to one minute. The cause is usually freely moving otoconia in the posterior arcuate canal (so-called canalolithiasis); the horizontal arcuate canal is affected much less frequently. In 70% of patients there is a spontaneous remission within days. In case of persistence, about 95% of patients can be successfully treated with so-called freeing maneuvers, e.g., the Sémont maneuver. However, this often requires 20 to 30 maneuvers over several days (overview in (6)).

Based on

a) our own biophysical studies, which we performed together with colleagues from Switzerland on a mechanical model of positional vertigo (7) and which show that theoretically the effectiveness of the Sémont maneuvers can be increased by changing the positional angle by 30° in the so-called step two of the positional maneuvers, as well as

b) an analysis of the comparison of the conventional Sémont maneuver with the so-called SémontPLUS maneuver (477/17), which shows that the mean time to freedom from symptoms for the Sémont maneuver is 3.9 days and only 2.3 days for the SémontPLUS maneuver ($p<0.05$), the efficacy of the Epley maneuver will be compared with the SemontPLUS maneuver in a parallel group design.

The primary endpoint is the duration, i.e., days ("mornings") until freedom from symptoms with continuation of the two maneuvers in the following days, three times in the morning, at noon and in the evening. This is assessed by the patient's statements that he/she can still induce rotational vertigo or not during the positioning maneuvers to the affected side performed by him/herself.

Reference List

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Study design

1. Diagnostic examinations

Patients who present to our outpatient clinic or to one of our wards for vertigo anyway will undergo routine history taking and clinical neurological, neuro-otological and neuro-ophthalmological examination. No diagnostic measures beyond these are required for this study.

2. Inclusion criteria

Subject (≥ 18 years of age) meets diagnostic criteria for the current presence of BPPV of a posterior arcuate duct (8):

History: rotary vertigo attacks triggered by head or body position change. Duration: < 1 minute, associated with nausea, vomiting, oscillopsia

Findings: When positioned to the affected ear: torsional and vertically to the forehead beating, exhaustive nystagmus with crescendo-decrescendo-like course.

3. Exclusion Criteria:

a) Subjects not capable of giving consent

b) Respondent does not want therapy for BPPV

4. Recruitment procedure

The recruitment of subjects takes place

- in Munich
    a) in the outpatient clinic of Prof. M. Strupp in the Neurological Clinic and Polyclinic
    b) in the outpatient clinic of the German Dizziness Center and
    c) on the neurological wards
- in Italy in Siena
- in Belgium in Bruges.

Eligible subjects with positive inclusion criteria as well as missing exclusion criteria will be selected.

5. Course of studies

a) Patients present to our clinic for vertigo as part of routine care.

b) Routine history taking, physical examination and standardized apparative diagnostics by means of so-called neuro-orthoptic diagnostics (oculomotor and nystagmus, Halmagyi head impulse test, eye rolling, subjective visual vertical) and caloric testing are performed.

c) Diagnostic positioning maneuvers are used to make the diagnosis of BPPV of a posterior arch.

d) Patient is informed about the study.

e) Patient consents

f) Randomization (1:1). Randomization alternates between Epley and SémontPLUS and is documented in a list kept at the participating center with consecutive number, maneuver, name and date of birth of the patient. Only number and maneuver are to be passed on for evaluation.

g) One-time performance of the Epley (figure) release maneuver or the SémontPLUS maneuver. The angle of the head inclination is measured by means of an app ("compass"), which can also be used as a so-called inclinometer, so that standardized examination conditions are ensured. SémontPLUS means 50 degrees beyond the earth's horizontal.

h) Diagnostic maneuver to check the effect of therapy, i.e., is positional vertigo and/or positional nystagmus still present (*secondary* endpoint).

i) Depending on randomization, the subject will then perform the Epley (Figure) or SémontPLUS maneuver three times in the morning, three times at noon, and three times in the evening (this frequency is also recommended elsewhere) independently according to prior instructions. He will document on a form after the first maneuver of each day whether positional vertigo was induced (*primary* endpoint). If the subject is unable or unwilling to perform these independently, they may be performed under the guidance of a physician or physical therapist.

j) A routine follow-up, which is also recommended in the current guidelines anyway (6), is planned after two to four weeks to check the therapy effect.

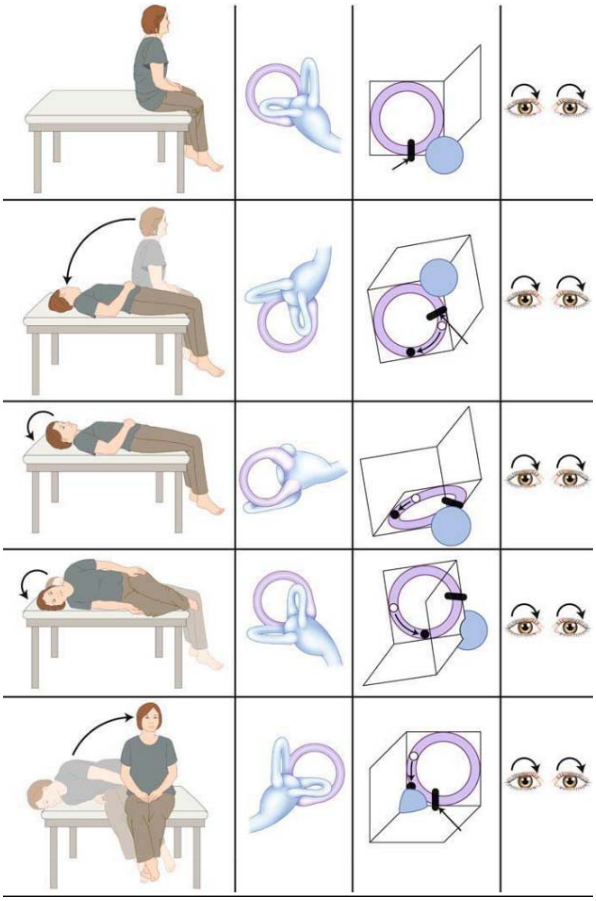

Figure. Schematic representation of the modified Epley repositioning maneuver (9) in a patient with left BPPV. **1** In the seated starting position, the head is rotated 45° toward the affected (left) ear. **2 The** head and upper body are tilted backward to a slight head hanging position. This triggers movement of the heavy particles in the canal, with ampullofugal cupular deflection of the BPPV attack. The patient remains in this position for approximately 1 minute. **3a** The head is now rotated 90° toward the unaffected ("healthy") ear. **3b The** head and upper body are rotated another 90° to the right in the same direction, causing the particles to move toward the exit of the posterior arcuate duct. This position is maintained for approximately 1 minute. A positional nystagmus to the affected overlying ear during positioning steps 3a and 3b indicates that therapy was successful. **4** The patient is raised back to a sitting position (modified according to (10)).

6. Criteria for individual dropout

Criteria for individual dropout are

a) Withdrawal of consent

b) Refusal of diagnostic or therapeutic measures (see above).

7. Criteria for discontinuation of the study

Because these are routine diagnostic and therapeutic procedures, criteria for study discontinuation are not apparent.

8. Endpoints

Primary endpoint. Number of days up to which no positional vertigo was triggered during the 1 maneuver of the day ("morning maneuver"). To be considered a success, no positional vertigo must be triggered on three consecutive days during the "morning maneuver".

Secondary endpoint. Success of the freeing maneuver in diagnostic maneuver performed immediately afterwards. If no torsional vertigo AND no nystagmus can be triggered in the latter, the extrication maneuver is rated as primarily successful. If torsional vertigo OR nystagmus OR both can be triggered, it is rated as primarily unsuccessful.

Statistical analysis

Kaplan-Meier curves stratified by maneuver are generated for the primary endpoint.
Depending on the curve shape, the strata are compared with an appropriate statistical test. The secondary endpoint will be analysed in a four-field table (maneuver vs. primary outcome) using Chi^2 test.

Case Count Estimate

In other studies of BPPV therapy, between 100 and 200 patients were studied (11, 12). To demonstrate an improvement from 50% to 70% success rate (simplified primary endpoint for case number estimation) with 80% power at a two-sided test level of alpha = 0.05, one needs 93 in each group, for a total of 186 analysable patients. In our planned study, a total of 200 should be included to compensate for failures at follow-up (loss-to-follow-up, noncompleted forms). Due to the high prevalence and the short observation period, within 24 months these patients can be included and the results analysed.

Duration of study

The recruitment period begins with a positive evaluation by the ethics committee and lasts 24 months.