
The authors describe the different techniques for physical therapy of benign paroxysmal positional vertigo of the lateral semicircular canal. All are based on one of three mechanisms: barbeque manoeuvres in which the canals are quickly rotated, so that material heavier than endolymph is induced to move toward the vestibule; repositioning manoeuvres in which debris is induced to move under the force of gravity; brisk deceleration manoeuvres in the plane of the affected canal in which debris is induced to move out of the canal. The authors report good results from different techniques and they suggest a strategy for the treatment of LSC-BPV; they prefer manoeuvres which can bring about immediate recovery. After a few days, it is useful to see patients again, because LSC-BPV may transform into PSC-BPV. Key words: benign paroxysmal vertigo, cupulolithiasis, nystagmus.

INTRODUCTION

Benign paroxysmal vertigo of the lateral semicircular canal (LSC-BPV) was first reported at the beginning of the 1980s. The authors who first studied it (1–3) did not dwell upon therapy, probably because LSC-BPV often recovers spontaneously. Various therapeutic manoeuvres have been proposed for posterior semicircular canal BPV (4–6). In the mid 1980s some authors began to study manoeuvres for LSC-BPV. Vannucchi et al. (7) tried unsuccessfully to cure it by shaking the patient’s head in the supine position. Baloh et al. (8) proposed rapid rotation through 180° toward the healthy side, without success. Lempert (9) tried Baloh’s technique, turning patients through 270° and succeeded in eliminating symptoms immediately in two cases. Baloh (10) obtained the same result with a rotation of 360°. In 1997 Vannucchi et al. (11) proposed forced prolonged position (FPP) and, in a few days, 90% of their patients were symptom-free.

Other techniques have been suggested. All are based on one of the mechanisms:

- Barbeque manoeuvres, in which the canals are quickly rotated, so that material heavier than endolymph is induced to move toward the vestibule.
- Repositioning manoeuvres in which debris is induced to move under the force of gravity.
- Brisk deceleration manoeuvres in the plane of the affected canal in which debris is induced to move out of the canal.

Obviously it is necessary to know the affected side in order to manoeuvre the patient correctly. For geotropic LSC-BPPV, the conditions are: 1) the side on which nystagmus is more intense; 2) the side on which spontaneous inversion occurs or is more evident; 3) the side opposite the direction of nystagmus when the patient goes from sitting to supine position.

For apogeotropic LSC-BPV the conditions are: 1) the side on which nystagmus is less intense; 2) the side opposite that on which spontaneous inversion occurs, but this phenomenon is not frequent; 3) the side to which nystagmus beats when the patient goes from sitting to supine position, but this sign is rarely observed and nystagmus may sometimes be toward the unaffected side.

It is, therefore, more difficult to determine the affected side in the apogeotropic form.

Barbeque manoeuvres

Barbeque rotation manoeuvres, in which a supine patient is rapidly rotated in a single step of 90° toward the healthy side, aim to give material heavier than endolymph an ampullifugal push, exploiting the inertia of otoconia floating free in the endolymph. Once the affected side is identified, the patient is placed in the supine position. Then, with a rapid movement his or her head is rotated 90° toward the healthy side; after a pause of 30 seconds to 1 minute the patient is rotated into the prone position and his/her head rotated in the same direction by another 90°. After a second pause, the head is rotated by another 90°, after which the patient is placed supine for one minute. The final 90° rotation is carried out starting with the head in line with the body, concluding the 360° rotation. The manoeuvre amounts to moving the canal around the debris which is therefore induced to fall into the vestibule.

Sometimes it is difficult to move the patient from a supine to a prone position and vice versa without moving...
the head. We advise placing the patient with his/her head off the edge of the bed, holding it firmly as the body is rotated. Fife (12) proposed laying the patient on the floor and performing a rapid rotation of $360^\circ$ toward the unaffected side.

Vannucchi and Giannoni (13) reported a variant of the barbeque manoeuvre suggested by Vannucchi and Asprella (Figure 1): as in the typical barbeque manoeuvre, the patient in the supine position rotates the head quickly through $90^\circ$ toward the healthy side; keeping the head turned, he/she then goes into a sitting position and brings the head slowly back into line with the body, and then returns supine. This sequence of movements is repeated five times or more, if necessary, as long as it does not provoke nystagmus or vertigo. If nystagmus is monitored by videoculoscopy during the manoeuvre, it is possible to ascertain absence of nystagmus directed toward the unaffected side when the patients goes from sitting to supine position and when he/she rotates the head quickly toward the healthy side while supine. Absence of nystagmus suggests that the canal has been freed of debris.

Asprella Libonati (14) treated four patients with geotropic LSC-BPV, successfully in three cases. Galletti et al. (15) obtained 100% success with 10 patients (8 with geotropic and 2 with apogeotropic LSC-BPV) by this technique. Asprella Libonati (16) subsequently used the Vannucchi-Asprella technique in 55 patients: 40 with geotropic and 15 with apogeotropic LSC-BPV. Thirty patients with the geotropic form recovered immediately, six with the apogeotropic form became symptom free, and two developed the geotropic form.

The Vannucchi-Asprella manoeuvre can be used to transform apogeotropic LSC-BPV into geotropic or directly eliminate both, because it causes debris to move from the cupula toward the vestibule. Its rationale is the same as that of the barbeque rotation: rapid angular acceleration moves the debris in a direction opposite to that of rotation of the head and canal; for example, if the head rotates clockwise the debris moves anticlockwise. The only difference between geotropic and apogeotropic forms is the initial position of the debris; in the apogeotropic form, the debris is near the cupula and has to travel further in the canal to reach the vestibule, making it necessary to repeat the manoeuvre a number of times. The great advantage of this technique with respect to the barbeque rotation is that it avoids movement from supine to prone and vice versa.

Fig. 1. Vannucchi Asprella manoeuvre.
Therapeutic strategy. In 2003, Asprella Libonati (16) proposed a new strategy in the therapy of LSC-BPV, known as ‘step-by-step rehabilitation under videonystagmoscopic control’. The rationale is to monitor ampullifugal progression of the debris in the canal, observing the nystagmus evoked during each step of the liberatory barbeque technique (14). By Ewald’s second law (in the LSC the ampullipetal flow provokes an excitatory stimulus and the ampullifugal flow an inhibitory stimulus), nystagmus with the fast phase directed toward the healthy side suggests ampullifugal deflection of the cupula provoked by movement of material heavier than endolymph toward the utricle. In this way it is possible to adopt a less rigid approach, adapting therapy during the manoeuvre so as to obtain complete success in one session.

Repositioning manoeuvre (forced prolonged position – FPP)
This technique was proposed by Vannucchi et al. (17). In the geotropic form of LSC-BPV, the affected side is determined and the patient is instructed to lie for about 12 hours on the healthy side. In this position the affected ear is uppermost with debris in the downward-facing non-ampullary arm. Under gravity, the debris gradually moves into the vestibule (Figure 2).

The technique was tried in 13 patients and after two days, eight patients (62%) were symptom free and four (31%) had BPV-PSC instead of LSC-BPV. The latter did not show horizontal nystagmus on the right or left side, but in the Dix-Hallpike position there was typical rotational nystagmus. Only one patient retained LSC-BPV.

In 1997 the same authors compared the results obtained by FPP with two other physical therapies. Horizontal canal BPPV patients were divided into three therapy groups: 1) 35 patients treated with FPP; 2) 24 patients treated with head-shaking in a supine position; 3) 15 untreated patients.

More than 90% of the patients treated with FPP recovered within three days, although six patients out of 35 subsequently developed BPV of the posterior semicircular canal, which then responded well to Semont’s manoeuvre. The results of FPP were significantly better than those obtained by head-shaking or no treatment. FPP is suitable for patients of all ages and general condition. It is not strenuous and is easy for patients to understand and perform. Therapy failed in three cases and required much longer treatment (15, 40 and 43 days) and other physical therapy such as Brandt-Daroff (5) exercises, to recover.

If the patient lies on the wrong side (the affected side instead of the healthy side) geotropic LSC-BPV probably transforms into apogeotropic. FPP can be used in the apogeotropic form, but the patient must lie on the affected side; in this way the debris moves from the anterior to the posterior side of the canal, changing the apogeotropic into the geotropic form. The patient must then lie on the healthy side to become symptom-free.

We advise checking the outcome of therapy and examining patients a few days later, because the syndrome may transform into PSC-BPV.

Brisk deceleration manoeuvres (Gufoni’s manoeuvre)
The barbeque manoeuvres may be difficult in patients with obesity and cervical spondylosis. In 1998 Gufoni (18) introduced a new liberatory manoeuvre possible even in patients with such problems. Because the manoeuvre is so easy to perform, it may be used as first choice whenever vertigo does not cause nausea and vomiting; moreover, the patient rolls onto the side associated with less intense vertigo.

Rationale of manoeuvre. The aim of the manoeuvre is to move otoconial debris from the lateral semicircular canal to the utricle, exploiting its inertia in the gravitational field and correct disposition in the canal outlet, obtained by correct positioning of the patient’s head. The debris may be in the ampullary arm or the posterior part of the canal, determining apogeotropic or geotropic forms of LSC-BPV. In both situations, the debris remains in the canal because the curve prevents its exit. In the apogeotropic form the debris may even be in the ampulla and cannot move in the canal.
Any approach must evaluate these limits and try to obviate them. It is often not sufficient to rotate the head from one side to the other to make the debris leave the canal. The course of the debris needs to be accompanied by correct head rotation.

The manoeuvre consists of the following steps (Figure 3): 1) the patient sits on the edge of the bed; 2) the patient lies down suddenly on one side: for geotropic LSC-BPV the patient lies on the healthy side, in the apogeotropic form on the affected side. In the first case the vector of gravitational force pushes the debris from the non-ampullary arm to the exit, in the second case from the ampulla toward the posterior part of the canal, transforming nystagmus from apogeotropic to geotropic; 3) the head is rotated 45° downward and held for 2–3 minutes. In this position the outlet of the canal (in the geotropic form) and the ampulla (in the apogeotropic) are in a vertical plane to favour movement of debris; 4) the patient returns to sitting position; 5) the outcome of the manoeuvre is checked.

Apogeotropic forms are sometimes converted to geotropic by this manoeuvre. In such cases, it is necessary to repeat therapy on the other side.

Results with Gufoni’s manoeuvre. From May 1997 to October 2003, we treated 174 cases of LSC-BPV (91 females and 83 males, age 12–81 years, mean 56 years) at the Audiological Service of the ENT Department of Livorno Hospital. Diagnosis was based on geotropic paroxysmal or transient apogeotropic nystagmus evoked by rapid rotation of the head in a supine position. Atypical cases were excluded.

Patients underwent standard otoneurological examination of the vestibulo-ocular reflex, during which we looked for spontaneous, gaze-evoked, rebound, positional and positioning nystagmus, both during fixation and under Frenzel glasses. Caloric testing was carried out according to the Fitzgerald-Hallpike method. Outcome was checked immediately after therapy, as well as the day later and one week later, by testing spontaneous and positional nystagmus in the right and left side and Dix-Hallpike position.

Forty-three patients had apogeotropic LSC-BPV. Five (11.6%) were symptom-free after only one manoeuvre and it was therefore not necessary to repeat the manoeuvre on the other side. In 28 cases (65.1%), the apogeotropic form was transformed into the geotropic form by treatment, but when the manoeuvre was repeated on the other side, the patients became symptom-free. In 10 cases (23.3%), therapy failed and there was no modification of the nystagmus.

We also treated 131 patients with geotropic LSC-BPV. The 28 patients mentioned above, originally with apogeotropic form, were also treated. Therefore the patients with geotropic LSC-BPV were 159. Therapy was successful in 147 (92.4%) patients, with complete disappearance of nystagmus and vertigo; in seven cases, canalolithiasis transformed into that of the PSC, successively cured with
the Semont or Epley manoeuvre. Treatment only failed in 5 cases (3.1%) and these patients were treated with FPP.

DISCUSSION
In the apogeotropic form, Gufoni’s manoeuvre was successful in almost 77% of cases (five directly and 28 after transformation from apogeotropic to geotropic). In the geotropic form, therapy was successful in more than 96% of cases (directly or after transformation). No side-effects were recorded, and since the manoeuvre is always carried out on the side preferred by the patient, no problems of compliance or drop-out were encountered. When nystagmus no longer occurs, vertigo is not experienced and normal activity can be resumed.

Two cases of the apogeotropic form of LSC-BPV were associated with spontaneous stationary nystagmus which disappeared in response to the manoeuvre. Debris in the canal probably caused higher pressure below the otoconia with permanent deflection of the cupula, associated with spontaneous, non-paroxysmal nystagmus, eliminated by the brisk deceleration manoeuvre (19, 20).

STRATEGY
As a first technique, we prefer manoeuvres which can bring about immediate recovery, such as those of Vannucchi-Asprella and Gufoni. Classical barbeque manoeuvres are difficult because it is not easy to rotate patients from supine to prone and vice versa. Our advice is to check outcome immediately if possible and advise patients to perform FPP at home. After a few days, it is useful to see patients again, because LSC-BPV may transform into PSC-BPV.

REFERENCES

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