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Postural restrictions in labyrintholithiasis

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Abstract Benign paroxysmal positional vertigo (BPPV) is the most frequent labyrinthopathy in humans. Treatment consists mainly of liberatory maneuvers aiming to remove otolithic debris and subsequent postural restrictions in order to prevent debris from returning into the canal. The reappearance of symptoms after an effective liberatory maneuver was studied in a group subjected to restrictions and in a second group free from restrictions. The effects of these restrictions were evaluated. No statistically significant difference was found between the groups. Accordingly, restrictions seem to have no effect upon symptom recurrence. The slight supremacy of the Semont maneuver and the prevalence of subsequent relapse compared with the Epley maneuver suggests that these maneuvers could operate on different disorders (cupulolithiasis versus canalolithiasis). Finally, late recognition of relapse in patients who undergo restrictions might even make the liberatory maneuver less effective.

Keywords Benign paroxysmal positional vertigo · Cupololithiasis · Canalolithiasis · Liberatory maneuver · Postural restrictions

Introduction

For many years now, benign paroxysmal positional vertigo (BPPV) has been known to be a canalopathy with a variable etiology (Marcelli and Vannucchi 1999). It is caused by a massive detachment of otoliths from the utricular macula, which, because of gravity, mostly enter the posterior semicircular canal (PSC).

The pathogenesis can be traced either to a direct (cupulolithiasis, see Schuknecht 1969; Schuknecht et al. 1973) or to an indirect action on the cupula (canalolithiasis, see Parnes and McClure 1992; Epley 1992) generated by the gravitational shift of the otolith mass that occurs when the patient carries out a movement in the vertical plane.

The clinical features are dominated by canalar symptoms (brief but intense vertigo, which takes place after the following movements: lying down or getting out of bed, hyperextension and hyperflexion of the head and forward flexing at the waist) and macular symptoms (prolonged instability, which persists even after the patient has recovered from the canalar symptoms of the acute condition and which can probably be ascribed to the different weight of the utricular macula from which the detachment has occurred, with consequent informational mismatch of gravitational type). The classic diagnostic maneuver is the Dix-Hallpike test (Dix and Hallpike 1952). When this is carried out in an upright position with the head rotated towards the pathological side, it produces an utriculofugal deflection of the cupula and then an excitatory nystagmus. A return to a seated position causes an utriculopetal deflection of the cupula with a nystagmus in an inverted direction, which is less intense, because, as Ewald's law states, it is "inhibitory."

The principal therapy is the removal of the mass through the non-ampullar hemicanal with a Semont maneuver (SM) (Semont et al. 1988) or a series of so-called repositioning maneuvers (Epley 1992; Herdman et al. 1993; Parnes and Price-Jones 1993; Harvey et al. 1994; Welling et al. 1997), which differ in the speed of movements applied to the patient. Very low speeds are used in the movements of repositioning. Repositioning maneuvers could better be called removal or liberatory maneuvers, because the final position of the mass is the same as that obtained by SM. In both cases, the mass is not re-positioned in the area where the detachment occurred, because they are basically based on mass decantation.

Maneuver efficacy is made evident by the appearance of a liberatory apogeotropic nystagmus, which is always present with the SM and is present in 75% of the cases treated with repositioning procedures.

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Indeed, the efficacy seems to be quite similar (80% of the patients are cured in one or more attempts during the same session), but the success rate of the SM is apparently greater, probably due to its dynamic features.

Both the repositioning procedure and the SM are successful in cases of canalolithiasis, but the SM, with its sudden acceleration, could also produce detachment of the otholithic debris adherent to the cupula, thus overcoming the most infrequent cases of cupulolithiasis, which are normally unresponsive to the repositioning approach. Some patients do not respond to the treatment with the above-mentioned maneuvers. Under these circumstances, Brandt-Daroff exercises (Brandt and Daroff 1980) are carried out for 7–10 days. Then, if the patients remain symptomatic, the liberatory maneuvers are performed again.

After a successful liberatory maneuver, patients are requested to adhere to postural restrictions for some days, e.g., to avoid sudden head movements in the vertical plane or to enter a critical position, and they are asked to sleep in a semi-seated position (as suggested by Semont) or to wear a cervical collar (as reported by Herdman).

The present study evaluates the usefulness of postural restrictions and their bearing on symptom relapse.

Material and methods

From January 1998 to June 1999, 1,963 patients affected by balance disorders were referred to the audiology section of the Neurosciences Department at the University of Naples, Federico II. All patients underwent evaluation of visual-oculomotor, vestibular-oculomotor and vestibular-spinal reflexes. Visual-oculomotor and vestibular-oculomotor reflexes were assessed by videonystamyography (VNG) using the following standard procedure: calibration saccades; sacccades, smooth pursuit and optokinetic evaluation; gaze nystagmus 30° right and 30° left; spontaneous, positional and positioning nystagmus; horizontal and vertical head-shaking test; caloric stimulation with visual suppression test. Vestibular-spinal reflexes were examined by static posturography. Diagnosis of BPPV was established in 810 patients (41%). The Dix-Hallpike maneuver was positive for BPPV of the posterior semicircular canal (PSC) in 674 patients. In this case, a rapid change from sitting up to the supine, head-hanging position with the head rotated towards the pathological side induced an utriculofugal deflection of the ipsilateral cupola with typical paroxysmal excitatory nystagmus. Nystagmus was characterized by a combined torsional, geotropic component in the lower eye and a linear, up-beating component in the upper eye; nystagmus inverted its direction once the patient moved back to the sitting-up position.

The same maneuver was positive for BPPV of the anterior semicircular canal (ASC) in four patients. A rapid change from the sitting-up to the supine, head-hanging position with the head rotated towards the normal side usually induced an utriculopetal deflection of the contralateral cupola with a typical paroxysmal inhibitory nystagmus. In this case, it was characterized by the combined torsional, geotropic component in the lower eye and linear, up-beating component in the upper eye; nystagmus inverted its direction once the patient moved back to the sitting-up position.

Therefore, nystagmus in BPPV of the ASC has the same features of nystagmus as observed in BPPV of the contralateral PSC, but the former is more intense when the patient moves back to the sitting position, because the deflection of the cupula is utriculofugal, thus enabling an easy diagnosis.

For BPPV of the lateral semicircular canal (LSC) (Cipparrone et al. 1985; McClure 1985), we performed the Pagnini-McClure maneuver. For this maneuver, the patient is in a supine position and rotates his or her head first towards one side and then towards the other. A paroxysmal, horizontal, bi-directional, bi-positional, geotropic nystagmus, otolith mass in the posterior aspect of the LSC (McClure 1985; Pagnini et al. 1989), is triggered, which is more intense when the patient lies on the pathological side. On the other hand, a paroxysmal, horizontal, bi-directional, bi-positional, apogeotropic nystagmus, otolith mass in the anterior aspect of the LSC (Pagnini et al. 1989; Pagnini et al. 1994; Casani et al. 1997) is triggered, which is more intense when the patient lies on the unaffected side. In pluricanals monolateral BPPV, the Dix-Hallpike maneuver provokes a typical torsional-linear nystagmus; changing the position of the head with the Pagnini-McClure maneuver, a horizontal, bi-directional, bi-positional nystagmus is evoked. This indicates an otolith mass in both the vertical and lateral semicircular canals. In bilateral BPPV, the above-mentioned maneuvers provoke a typical nystagmus when performed on both sides. Features of the sample are reported in Table 1.

Table 1 Features of a sample consisting of 810 patients affected by BPPV; *R* right

Sample features (810 patients with BPPV)	
Average age at first attack	52 ± 13 (13–87 years)
Gender	F/M = 2,6/1
Posterior semicircular canal	674 (83%) (R: 63%)
Lateral semicircular canal	86 (11%)
Anterior semicircular canal	4 (0.5%)
Pluricanals monolateral	41 (5%)
Bilateral	5 (0.5%)

A further sample of 200 patients was selected according to the following criteria: they all suffered from a typical BPPV of the PSC, the etiology was idiopathic without any apparent risk factor and all tests performed were normal. Patients were classified into two groups, which were homogeneous in terms of number, gender and age.

According to our protocol, the first group (group A) did not follow any postural restriction, whereas the second group (group B) was instructed to sleep in a semi-sitting position and not to perform forward or backward head movements. To evaluate a possible slight superiority of the SM, patients of both groups were initially treated with a modified Epley repositioning maneuver (EM), without premedication or bone oscillator.

Positive prognostic factors in the assessment of EM efficacy were considered: the appearance of liberatory nystagmus or the absence of nystagmus. Inversion of nystagmus during repeated Epley maneuvers represented a negative prognostic factor, which induced the operator to carry out a SM in the same session. As suggested in the current study, the SM may achieve a good outcome also in patients with otolithic debris adherent at the cupula, a circumstance in which decantation does not work. Such a situation would be an indirect proof of two different physiopathological mechanisms.

Results

In group A, a modified EM was effective in 71% of the cases; liberatory nystagmus appeared in 75%, often not in the liberatory position, but on return to the seated position. Patients who did not respond to treatment (inversion of nystagmus in liberatory position) underwent the therapeutic maneuver developed by Semont, which increased the overall success rate to 79% (i.e., a further 8% of cases, unmanageable with EM, were resolved). In the remaining cases (21%), both procedures were ineffective and patients were instructed in Brandt-Daroff exercises.

Table 2 Maneuver effectiveness in the two groups

Effective maneuver in the two groups		
	Group A	Group B
Modified Epley	71%	73%
Semont M. after ineffective Epley	8%	7%
No maneuver	21%	20%

In group B, a modified EP was effective in 73% of the cases, and the liberatory nystagmus had features similar to those of group A. In the event of nystagmus inversion, SM was performed, resolving a further 7% of the cases. The overall success rate in all patients was about 80%. Brandt-Daroff exercises were recommended in the remaining 20% of the cases in which treatment was ineffective. (Table 2 summarizes the results of the studies using EM or SM to treat BPPV).

All the cases resolved by means of maneuvers were promptly checked with the Dix-Hallpike maneuver. This was found to be negative in 92% of the patients. In the remaining 8%, a nystagmus inversion was present during the diagnostic procedure. This can be ascribed to an ampullopetal shift of the mass, which does not leave the canal and is located in the non-ampullar semicanal or in the common crus. These patients were successfully treated in the same session with a modified EM.

Discussion

Group A (restrictions-free) patients with a positive outcome were invited to perform all daily activities without any restrictions, while group B patients were requested to observe the above-described restrictions. A follow-up program was deliberately avoided; nevertheless, patients were told to seek help immediately in case of clinical symptoms.

In order to evaluate whether or not the inobservance of postural restrictions in group A could affect the recurrence of particles in the canal, we investigated the difference in relapse percentage between the groups within 96 hours. Any recurrence would not invalidate the data, because it would have the same statistical impact upon both groups. Moreover, the short time interval required to assess the relapse decreases the chance of a new otolith detachment, which is frequent, for example, in patients suffering from head trauma (secondary BPPV); these were not included in our study. Symptom recurrence was 10.12% in group A (called "A-ns," new symptomatic) and 12.5% in group B ("B-ns," new symptomatic): the findings overlapped completly.

Although our preliminary data need further confirmation, they seem to be quite intriguing. First, non-fulfillment of postural restrictions has no effect on symptom recurrence. Second, re-appearance of symptoms after modified EM is about 8.45% in group A-ns versus 10.9% in group B-ns. Such values are definitely lower than those obtained with SM carried out after an ineffective modified EM (25% and 28.5% in groups A-ns and B-ns, respectively), and this fact could lead to a diagnosis of cupulolithiasis. In such cases, a partial detachment of cupular otolithis could be hypothesized: particles promote a new mass formation and clinical relapse, little by little; as the debris is physiologically detached from the macule, it enters the canal and is imprisoned in the cupular mass without any opportunity of being dissolved by the lytic effect of the endolymph. (Table 3 shows the relapse-rate in absolute terms and the relapse rate resulting from an effective liberatory maneuver; Table 4 shows the effectiveness of maneuvers in case of BPPV recurrence).

The following results were obtained with regards to the results of liberatory maneuvers carried out in patients after relapse: modified EM was effective in seven out of the eight patients in group A-ns. The only patient who did not respond underwent SM, which was also ineffective. It is noteworthy that this patient was one of the two cases that previously had been treated successfully with the same maneuver. In group A-ns, the liberatory maneuver was ef-

Table 3 Relapses in the two groups: absolute and related to an effective liberatory maneuver

Group A-ns: 8/79 (10.12%)			
	Effective	Relapse	Total %
Epley	71	6	8.45%
Semont	8	2	25%
Group B-ns: 10/80 (12.5%)			
	Effective	Relapse	Total %
Epley	73	8	10.9%
Semont	7	2	28.5%

Table 4 Maneuver effectiveness in case of relapse in the two groups. Patients initially cured with SM show a lower percentage of resolution. Patients invited to observe postural restriction show a clearly lower percentage of resolution

Group A-ns				
Symptom recurrence with:		Success rate with:		
		EM	SM	Total
EM	6/71	6		6
SM	2/8	1	0	1
Total	8/79	7	0	7 (87%)
Group B-ns				
Symptom recurrence with:		Success rate with:		
		EM	SM	Total
EM	8/73	5	1	6
SM	2/7	0	0	0
Total	10/80	5	1	6 (60%)

fective in 87% of the cases. Moreover, the ten patients in group B-ns underwent modified EM: this was effective in five out of ten cases. The five patients who did not respond were subjected to SM, which was effective in only one case. It is noteworthy that of the eight patients previously treated with EM, five were cured with the same maneuver and one with SM, but two did not respond to treatment. The two patients previously treated with SM did not benefit from any maneuver. In the B-ns, the percentage of resolution reached 60. Less satisfactory results were obtained in patients subjected to restrictions and initially treated with SM. The temporal delay because of restrictions (group A-ns patients were referred within 48 hours of the liberatory maneuver, whereas group B-ns patients were referred within 72–96 hours) and the possible cupular residue capable of catching the free-floating particles that are normally present inside the canal could be the main reasons for a new symptomatic event, which is more difficult to overcome.

Conclusions

Comprehension of the physiopathological mechanism of BPPV of the PSC has permitted the development of maneuvers capable of immediate symptomatic relief. After a liberatory maneuver, many authors advise patients to adhere to postural restrictions with the aim of avoiding a resettlement of the otolithic mass inside the affected canal.

In our sample, we did not observe any difference in symptom recurrence between the group subjected to restrictions and the group without restrictions. Restrictions have no effect on the possibility of relapse, and the non-fulfillment of such prescriptions does not increase the risk of an otolith mass reappearing inside an already treated canal.

Liberatory maneuvers seem to be less effective in patients who have a relapse after having accomplished postural restrictions. Restrictions per se together with the time delay involved in such cases could even facilitate the reconstitution of a cupular mass, especially in patients who have undergone SM. An eventual cupular residual could act as a catalyst, promoting the adhesion of free-floating otoliths that are normally present inside the canal in a subcritical amount. Our hypothesis, of course, needs to be supported by further confirmation.

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