ORIGINAL ARTICLE

Mastoid Oscillation in the Treatment of the Apogeotropic Variant of Benign Paroxysmal Positional Vertigo of the Lateral Semicircular Canal

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OBJECTIVE: The study attempts to verify the effectiveness of mastoid oscillation as a physical measure in addition to repositioning manoeuvres for the treatment of the apogeotropic variant of paroxysmal positional vertigo of the lateral semicircular canal.

MATERIALS AND METHODS: We evaluated 18 patients divided into two groups based on the physical procedures that were used: Group A (9 patients), in which the repositioning manoeuvre alone was used; Group B (9 patients), in which the manoeuvre was preceded by mastoid oscillation (frequency: 100 Hz; amplitude: 0.8 mm) for 60 seconds. The transformation of nystagmus into the geotropic form, expressing migration of the otoliths into the non-ampullary arm, was the main assessment parameter.

RESULTS: Geotropic nystagmus was observed in 22% and 77% of cases, respectively in Group A and Group B, during the first repositioning session, and in 44% and 100%, respectively, after two sessions. The remaining patients from Group A required two more sessions in order to convert nystagmus in all cases. Overall, when compared to Group B (2.22 ±1.86), the patients from Group A presented a statistically significant increase (P=0.014) in the average number of manoeuvres (6.00 ±3.64) in order to convert nystagmus.

CONCLUSIONS: Our experience demonstrates that the use of mastoid oscillation in addition to repositioning manoeuvres provides a substantial therapeutic advantage as it shortens the time required to resolve BPPV, thereby reducing the physical and mental stress that vertigo causes in these patients.

Benign paroxysmal positional vertigo (BPPV) of the lateral semicircular canal (LSC) was first reported in 1985, when Cipparone et al.[1] observed a clinical picture resembling BPPV of the posterior semicircular canal (PSC) in terms of symptoms, paroxysmal nystagmus and good prognosis, but with certain differences as far as triggering manoeuvre and oculomotor pattern are concerned. At the same year, McClure[2] also reported seven cases, detailing the principal clinical aspects of benign paroxysmal positional vertigo of the lateral semicircular canal (LSC-BPPV). In 1989 Pagnini et al.[3] not only discussed its pathophysiology but also described the apogeotropic form for the first time. In the 1990s various therapeutic techniques were proposed, such as Lempert's barbecue manoeuvre[4] and then Baloh's manoeuvre,[5] Vannucchi's position,[6] the Vannucchi-Asprella manoeuvre[7] and Gufoni's position.[8]

Depending on the location of the otoconial debris in the LSC, nystagmus can present in two different forms. Most commonly, the free otoconia tend to collect - by gravity - in the posterior part of the canal when the subject shifts from a seated to a recumbent position. If this is followed by lateral rotatory movement of the head, more intense two-phase horizontal geotropic nystagmus is evoked when the affected labyrinth is placed in a lower position. If the otoliths are not in the non-ampullary arm but rather in the ampullary arm (canalolithiasis) or adhere to the cupula (cupulolithiasis), in the same conditions more intense apogeotropic nystagmus occurs when the affected labyrinth is elevated. Treatment of the geotropic forms does not pose particular clinical problems and the techniques that are used are equally and highly effective. For apogeotropic forms, the objective is conversion of nystagmus expressing migration of the otolithic debris, not only as definitive proof that otoconia are responsible for the disorder, but also vis-à-vis its prognosis. In fact, we have frequently encountered cases resistant to geotropic conversion, which leads to doubts in terms of interpretation and delays resolution, in turn generating a significant impact on the patent's mental and emotional state. This study attempts to verify the effectiveness of a physical measure - i.e. mastoid oscillation - in addition to repositioning manoeuvres in order to facilitate conversion of apogeotropic to geotropic nystagmus and thus shorten the time it takes to resolve canalolithiasis-cupulolithiasis of the ampullary arm of the LSC.

MATERIALS AND METHODS

We studied 18 patients with LSC-BPPV who were referred to us between 1 January 2004 and 31 December 2006. The following inclusion criteria were applied:

1) apogeotropic bidirectional nystagmus evoked by Pagnini-McClure manoeuvres, indicating canalolithiasis-cupulolithiasis of the ampullary arm of the LSC

2) cerebral MR negative for neurological lesions

3) normal physical and functional condition of the patients to be able to perfor the barbecue repositioning manoeuvres

In order to exclude a functional deficit, vestibulo-ocular reflex (VOR) was examined at the different frequency ranges via caloric test, rotary chair, head-shaking test and vibration test. The latter two tests were conducted after resolution of the clinical picture in order to avoid any shifts of the otoconial masses that would have been induced by these head manoeuvres if the tests had been conducted previously, as this would have modified nystagmus. The patients were divided into two groups of nine patients based on the procedure used to convert apogeotropic nystagmus into geotropic nystagmus:

- Group A: patients who underwent the barbecue manoeuvre only according to Baloh.

- Group B: patients who underwent ipsilateral oscillation at the site of canalolithiasis-cupulolithiasis for 60 seconds prior to executing the barbecue manoeuvre.

The oscillator had the following features: contact surface 250 mm^2, stimulation frequency 100 Hz and movement amplitude 1 mm. It was applied with the patient in a supine position and with the head tilted by 25° so as to position the LSC vertically and elevate the ampullary arm.

The first session took place within 48 hours following diagnosis of BPPV. At this time, the positionings were rechecked to confirm the clinical data and they were followed by the procedures described above. For the patients from Group A, the outcome of Baloh's manoeuvre was checked with a new Pagnini-McClure positioning. For the patients from Group B, the check was conducted after mastoid oscillation and also after Baloh's manoeuvre. A maximum of three attempts were made to achieve conversion of nystagmus, followed by diagnostic positionings (Table 1). The subsequent sessions took place three days after the previous one, using the same methods.

Furthermore it has been pondered an average number of necessary maneuvers in order to obtain a conversion of the nystagmus, in each of the inspected groups. The confrontation of all the averages, obtained by the Student test, has allowed us to detect some statistically relevant differences among the detected results.

RESULTS

First session

Conversion to geotropic nystagmus was observed in two of the patients from Group A. In one this occurred following a single manoeuvre, and in the other two Baloh's manoeuvres sufficed. In the remaining seven, nystagmus had not changed after the three attempts envisaged by the protocol (Table 2).

Conversion to geotropic nystagmus occurred in five of the patients from Group B. In two of the cases conversion occurred at the first attempt, without any need to perform Baloh's manoeuvre; in two patients it occurred at the second attempt, one of which after Baloh's manoeuvre; in one patient it occurred at the third attempt, likewise after the manoeuvre was performed (Table 3).

Therefore, at the end of the session, conversion from the apogeotropic variant of LSC-BPPV to the geotropic form was observed in 22.2% of the patients from Group A and in 77.7% of the patients from Group B (Fig. 1). Among the latter, conversion was achieved directly as a result of mastoid oscillation in 60% of the cases.

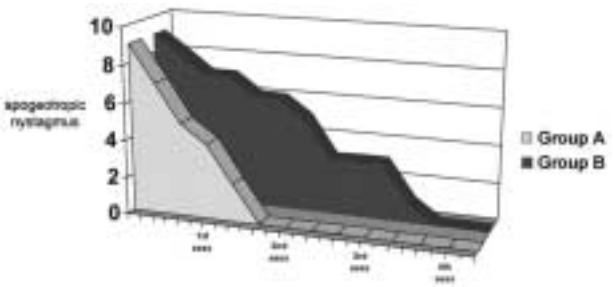

Figure-1: Timeline of the treatment results by group

Second session

Among the seven patients from Group A who required a second session, conversion of nystagmus occurred in two cases, respectively after one and three manoeuvres. Five patients continued to present the same clinical picture (Table 2).

Among the remaining four patients from Group B, conversion to geotropic nystagmus was achieved in all cases, two at the first attempt after mastoid oscillation alone, and two at the second attempt following Baloh's manoeuvre (Table 3).

At the end of the two sessions, conversion of BPPV was achieved in 44.4% of the patients from Group A and in 100% of the patients from Group B (Fig. 3). Among the latter, geotropic nystagmus was evoked at diagnostic positioning following mastoid oscillation and after Baloh's manoeuvre, respectively in 55.5% and 45.% of the cases.

Third and fourth sessions

This involved only five patients from Group A in whom nystagmus remained unchanged following the measures described above. During the third session,

Table-1: Treatment protocol used during for the study

	1st session		
	1st attempt	**2nd attempt**	**3rd attempt**
Group A	manoeuvre → diag. pos.	manoeuvre → diag. pos.	manoeuvre → diag. pos.
Group B	vibration → diag. pos.	vibration → diag. pos.	vibration → diag. pos.
	manoeuvre → diag. pos.	manoeuvre → diag. pos.	manoeuvre → diag. pos.

(diag. pos.: diagnostic positioning)

Table-2: Behaviour of Group A patients (manoeuvres used before the conversion of nystagmus are in grey)

	1st session			2nd session			3rd session			4th session		
patient	1st M	2nd M	3rd M	1st M	2nd M	3rd M	1st M	2nd M	3rd M	1st M	2nd M	3rd M
1												
2												
3												
4												
5												
6												
7												
8												
9												

Table-3: Behaviour of Group B patients (oscillations are marked with "O" and the manoeuvres used before the conversion of nystagmus are marked with "M")

	1st session						2nd session						3rd session						4th session					
patient	1st M		2nd M		3rd M		1st M		2nd M		3rd M		1st M		2nd M		3rd M		1st M		2nd M		3rd M	
1	O	M	O																					
2	O	M	O	M	O	M	O																	
3	O																							
4	O	M	O	M	O	M	O	M	O	M														
5	O	M	O	M	O	M	O																	
6	O	M	O	M																				
7	O	M	O	M	O	M	O	M	O	M														
8	O																							
9	O	M	O	M	O	M																		

conversion of nystagmus was achieved in two patients, both of whom during the first manoeuvre; it was achieved during the fourth session for the remaining three, respectively during the first attempt (two patients) and during the second attempt (one patient) (Table 2).

Overall, the patients from Group A presented a statistically significant increase (P=0.014) in the average number of manoeuvres (6.00 ±3.64) required to convert nystagmus with respect to Group B (2.22 ±1.86).

DISCUSSION

The use of mastoid stimulation with a bone oscillator (first at 700 and then at 80 Hz) for the purpose of facilitating mobilization of endolymphatic debris was suggested by Epley[9] for the treatment of PSC-BPPV. This procedure was considered fundamental by some authors[10] but it was not used by others.[11,12,13] In addition to repositioning manoeuvres, bone vibration was also used during the Semont liberatory manoeuvre, likewise to treat PSC-BPPV that was refractory to common treatment. In this case, the bone vibrator is applied to the ipsilateral mastoid (as already suggested by Epley) immediately after the second position has been reached,[14] in an attempt to overcome any obstacles to the migration of the otoliths to the endocanal and evoke violent liberatory nystagmus. Other authors have maintained that this measure can also be used for LSC-PPV. Our experience shows that additional use of mastoid oscillation provides a substantial therapeutic advantage in treating the apogeotropic variant of LSC-BPPV. Its application at different times rather than at the same time as the liberatory manoeuvre allowed us to verify - through diagnostic positioning - the effective contribution of mastoid oscillation in inducing the conversion of nystagmus, independently of the manoeuvre itself. In fact, mastoid oscillation alone appeared to be effective in more than half of the patients who were treated. Furthermore, in other cases it reduced the average number of manoeuvres needed to convert nystagmus to the geotropic variant. Naturally, this has favourable clinical consequences as it shortens the time required to resolve BPPV and thus minimizes the physical and mental stress that vertigo induces in these patients.

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