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Review Article

Residual Dizziness after Physical Treatment for Benign Paroxysmal Positional Vertigo. A Review of Recent Literature

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Abstract

After successful physical maneuvers for BPPV, some patient refers a non-positional dizziness lasting several days. In our review we considered epidemiology of the disorder, proposed pathophysiological mechanisms and therapy. The duration of Residual Dizziness (RD) has been evaluated by different authors in a range varying from 2 days to 3 weeks. Among pathophysiological mechanisms, it has been considered the possibility of the persistence of a small amount of debris in the canal, the possibility that BPPV could be a more complex disorder implying a primitive utricular dysfunction, the coexistence of emotional factors, possible delaying central compensatory mechanisms. Finally, proposed drug therapy for the disorder has been reported, as well as our experience. Different drugs have been reported to be useful for RD, including betahistine and anxiolytics. We found that the combined therapy with cinnarizine and dimenhydrinate may be useful in reducing both the rate of patients with RD and the duration of RD.

Keywords: *Benign Paroxysmal Positional Vertigo; BPPV; Repositioning Maneuvers; Residual Dizziness; Anxiety; Utricular Dysfunction; Therapy of Vertigo*

Abbreviations

RD: Residual Dizziness; BPPV: Benign Paroxysmal Positional Vertigo; VEMPs: Vestibular Evoked Myogenic Potentials; SVV: Subjective Visual Vertical; DHI: Dizziness Handicap Inventory

Introduction

Benign Paroxysmal Positional Vertigo (BPPV) is the most common type of episodic vestibular vertigo, whose lifetime prevalence is estimated to be around 2.4% in the general population [1]. Diagnosis relies on provocation maneuvers such as the Dix-Hallpike and Pagnini-McClure tests [2] and specific physical maneuvers represent an effective therapy [3-5]. BPPV is suspected to be caused by small otoconial particles detached from the utricle and floating freely in the semicircular canals or attached to the cupola [2]. Even when repositioning maneuvers are successful, some patient reports a non-positional, persistent imbalance or unsteadiness lasting for days, which is known as Residual Dizziness (RD). In our review, epidemiology, pathophysiological mechanisms and proposed therapeutic approach are reported.

Materials and Methods

A research of previously published papers was performed on PUBMED with the search strings BPPV and Residual and Dizziness, BPPV and utricular and dysfunction. We included only papers published after 2000. Eighty-one papers have been found. Only papers including data on RD and/or possible causal factors were considered eligible.

The works were critically evaluated by two different authors and possible duplications of results were excluded. Finally, only 28 papers were included in the study.

Results and Discussion

Epidemiology

RD after successful repositioning maneuvers is far from being a rare complaint and some patient express nonspecific symptoms such as anxiety or discomfort after treatment.

The percentage of patients reporting this condition and the duration of symptoms are often differently reported by authors. With any evidence, the lack of a clear definition of RD and differences in inclusion criteria may play a role in this finding.

Prokopakis., *et al*. (2005), in a retrospective study on a wide sample of 592 treated patients, reported RD in 74% of them, lasting normally 2 - 3 days [6].

Seok., *et al.* (2008) reported that 30 out of 49 BPPV patients presented RD (61%) with a duration of dizziness of 16.4 ± 17.6 days [7].

Teggi., *et al*. (2011), on a sample of 60 subjects aged over 65, found a rate of patients with RD of 36.6% while duration was of 13 ± 7.5 days [8]. In this sample, patients aged over 72 presented a higher rate (56.6%) of RD than patients aged below 72. In a further paper of the same authors (2013),focused on subjects aged below 60, the incidence rate of RD was of 31.1%, with a duration of 11.6 ± 3.9 [9]. Notably in both works patients were affected by idiopathic BPPB, with no previous lifetime episodes of vertigo.

Kim., *et al.* (2014) reported RD in 25 out of 58 (43%) treated subjects, while mean duration was of 3.4 days. No difference was detected for the age between the subgroup of patients with and without RD (57.5 ± 8.6 and 53.6 ± 11.3 respectively) [10].

Faralli., *et al*. (2016) found RD in 41 out of 116 subjects aged below 65, without otological or neurological comorbidities and without previous episodes of BPPV (35.3%) [11].

Martellucci., *et al*. (2016) reported RD in 33 out of 86 patients treated for posterior canal BPPV (38.4%). In 18 of them (54.6%) symptoms resolved in less than 6 days, in 4 cases (12.1%) within 9 days, in 11 (33.3%) dizziness lasted more than 10 days. Authors also reported that the rate of RD was higher in subjects aged over 65 ($p = 0.02$) and in patients performing higher scores at Dizziness Handicap Inventory questionnaire before repositioning maneuvers; above all, the emotional subdomain was highly predictive for developing RD [12]. The DHI questionnaire developed by Jacobson and Newman demonstrated to be useful to evaluate the self-perceived handicapping effects of vestibular disease and its impact on quality of life [13].

Finally, Tirelli., *et al*. (2016) in a retrospective work on a sample of 292 subjects treated for a first episode of BPPV found a rate of RD of 67.9% [14].

Epidemiologic data are summarized in table 1.

Author	Sample numerosity	Age of the sample	Rate of patients with RD	Duration of RD in days
Prokopakis (2005)	592	-	74%	2 - 3 days
Seok (2008)	49	-	61%	16.4 ± 17.6
Teggi (2011)	60	72 ± 4	36.6%	13 ± 7.5
Teggi (2013)	90	42.9 ± 10.2	31.1%	11.6 ± 3.9
Kim (2014)	58	-	43%	3.4
Faralli (2016)	116	Below 65	35.3%	-
Martellucci (2016)	86	-	38.4%	54.6% less than 6 12.1% less than 9 33.3% more than 10
Tirelli (2016)	292	-	67.9%	-

Table 1: *Demographic data, sample numerosity, rate of subjects reporting RD and duration in days in previously published papers.*

Pathophysiological mechanisms

Different pathophysiological mechanisms leading to RD have been proposed.

The persistence of debris in the canal, insufficient to provoke cupula deflection and positional nystagmus, may lead to RD. In a sample of patients with RD after repositioning maneuvers and without positional nystagmus at the follow up, Tirelli., *et al*. demonstrated a higher rate of recovery when therapeutic maneuvers were anyway repeated [14].

Otherwise, RD may be linked to incomplete adaptation after particle repositioning maneuvers. Di Girolamo., *et al.* demonstrated that the overall postural control in BPPV subjects, studied with a dynamic posturography, was impaired before repositioning maneuvers, showing a specific pattern of vestibular involvement. After successful maneuvers, an improvement was demonstrated, but significant differences from controls were still detected 3 days and 1 month after clinical recovery from BPPV [15].

Conflicting data have been reported regarding a possible correlation between the duration of vertigo (i.e. the time in days between the onset of positional vertigo and repositioning maneuvers) and the occurrence of RD [7,8]. This hypothesis was not confirmed by other authors [16].

Moreover, another undiagnosed coexisting vestibular disorder may be the causal factor for RD; it should be noted that previous studies demonstrated a longer RD in subjects with BPPV and a coexisting different vestibular dysfunction [17].

Other papers support the hypothesis that BPPV is a more complex disorder, implying a primary utricular dysfunction which may be among causal factors for RD. Kim., *et al*. found a significantly higher rate of ortostathic hypotension in patients with residual dizziness at the next follow-up after physical treatment than those without residual dizziness (40% and 3% respectively); since vestibular-sympathetic reflex (VSR) is mediated by the stimulation of the otolith receptors, authors concluded that an utricular dysfunction may be the causal factor of RD [10].

Further studies [18] support the hypothesis of a primary utricular dysfunction leading to BPPV; von Brevern., *et al.* assessed the otolith function with estimation of the subjective visual vertical and analysis of the torsional otolith-ocular reflex while unilateral stimulation of the utricle was performed on a rotator that allowed eccentric lateral displacement of the patient during earth-vertical rotation with constant velocity. Authors found that after several weeks, only the affected labyrinth showed a reduced otolith-ocular reflex gain; they concluded that this finding may explain the imbalance referred by some patient after repositioning maneuvers. Similarly, Faralli., *et al.* tested patients with BPPV before repositioning maneuvers with a subjective visual vertical test (SVV); they demonstrated pathological values of SVV in all patients with a recent onset of BPPV [11]. The findings of this work agree with those of a previous work by Iwasaki., *et al*. in which a reduction of abnormal SVV has been reported after successful repositioning maneuvers [19]. Bremova., *et al.* found transient increase of bone-conducted ocular vestibular evoked myogenic potential amplitudes, which assess utricular function, in the affected ear after successful liberatory maneuvers but no changes in air-conducted cervical VEMP amplitudes, which are related to saccular function [20].

Similarly, a recent paper [21] assessed the utricular function using ocular VEMPs, performed before successful physical maneuvers and one week later; authors reported that the presence of RD was significantly associated with the results of the second ocular vestibular evoked myogenic potential test. On the opposite, RD was not related to the gender, affected side, age, duration of symptoms, recurrence, or the results of the initial ocular vestibular evoked myogenic potential test. According to these findings it could be speculated that RD may be linked to a persistent utricular dysfunction.

The possibility that RD may arise from a vestibular dysfunction is also supported by stabilometric findings. Teggi., *et al.* reported increased parameters in patients with RD compared with a matched for sex and age group of subjects without RD after liberatory maneuvers, above all in eyes closed conditions [9].

Finally, emotional factors and anxiety may play a role in occurrence of RD. On a sample of elderly subjects successfully treated, RD was associated with duration of vertigo before repositioning maneuvers and anxiety, evaluated with a VAS scale; interestingly, a correlation was found between the two parameters, while no correlation was found between RD and migraine [8]. In another paper Faralli., *et al.* studied RD patients through SVV test and a VAS scale for anxiety in the 14 days following recovery from BPPV attacks. They concluded that otolithic dysfunction explains only dizziness of short duration, while persistent dizziness is mainly correlated with mental stress which in turn is affected by the duration and recurrence of BPPV [22]. Martellucci., *et al*. studied 86 patients with a without RD with a Dizziness Handicap Inventory (DHI) questionnaire performed before repositioning maneuvers; a logistic regression analysis showed that the probability of RD occurrence increased with the increase of the emotional subdomain score of the DHI questionnaire [12]. The same author found a correlation between RD and the age of subjects, the elderly presenting 2.29 times increased possibility to develop RD. These results are in line with those published by Teggi., *et al* [8,9].

Treatment

Since RD has been described by few years, at present six papers concerning its possible pharmacological treatment have been published.

Guneri., *et al*. [23] evaluated the efficacy of betahistine in reducing symptoms after Epley maneuver for posterior canal BPPV; they compared data of 4 different vertigo symptom scales in 3 groups of patients, the first performing only Epley maneuver, the second performing also a placebo, the third betahistine 24 mg/day. Above all, they found that the symptoms were significantly reduced in group 3 patients overall, supporting the efficacy of drug treatment after physical maneuvers.

Kim., *et al.* investigated the efficacy of dimenhydrinate, 50 mg per day, in preventing RD after successful repositioning maneuvers, on a sample of 50 subjects with idiopathic BPPV. They compared the results with two different groups matched for sex and age, a placebo group and a group of subjects performing no therapy. They found that RD was significantly prevalent in the placebo and non-treated groups compared with the treated group. However, in the analysis of DHI, total and subscale scores did not differ across the three groups before or after successful maneuvers; authors concluded that the residual symptoms could not be evaluated by DHI score alone [24].

On the opposite, Acar., *et al*. studied the efficacy of trimetazidine, betahistine, and ginkgo biloba extract in the treatment of RD after successful repositioning maneuvers with a randomized controlled clinical trial, comparing the results with a no medication group; each group was composed by 25 subjects. They found no significant differences in the pre-repositioning DHI scores of patients (with residual dizziness) among the four groups. After 3 and 5 days of treatment, the mean DHI scores of the groups receiving medication did not differ significantly from the mean DHI score of the control group. The authors concluded that their results do not support the necessity of a pharmacological treatment for RD [25].

Since anxiety has been considered among causal factors for RD, other studies [26] tried to assess with a DHI questionnaire with a randomized double blind study a possible role of benzodiazepines in the treatment of the disorder; the authors found that the medication group showed significantly greater decrease in the functional and emotional subscale scores, as well as in the total DHI.

Finally, Deng., *et al*. proposed Danhong injection, a traditional Chinese medical treatment which aims to improve microcirculation in the inner ear, as a possible therapy for RD. The Danhong injection, composed by 2 herbal compounds (Salvia miltiorrhiza and Floscarthami),was administered intravenously for 5 continuous days after successful repositioning treatment. The authors found a shorter duration of RD in treated subjects compared with the non-treated group. There was no significant difference in the DHI score in the first week between these two groups, while a significant difference was detected in the second, the fourth, the sixth and eighth weeks [27].

We studied the efficacy of association of cinnarizine and dimenhydrinate for the treatment of RD on a sample of 64 BPPV patients after repositioning maneuvers for idiopathic BPPV [28].

Patients were proposed to perform therapy to prevent RD. On the total sample, 43 accepted, while 21 decided to avoid drug therapy. Between the group of patients performing therapy and the non-performers, no statistical difference was detected for age and sex. Only 10 out of 43 subjects (23.3%) performing therapy referred RD, while 10 out of 21 of subjects non performing therapy (47.6%; p = 0.048).

Moreover, the main duration of RD in the group of subjects performing drug therapy was of 9 ± 3.9 days while subjects non performing therapy was of 13.9 ± 3.8 (t = 2.59; p = 0.03). Among patients performing therapy, 12 referred somnolence in the first days, but none of the patients had to stop the therapy for the appearance of side effects.

Conclusion

As a personal consideration, RD has been linked to various conditions, considering poor adaptation after repetitive vestibular overloadings and a variable personal predisposition to develop dizziness after a vestibular disorder.

In previous papers the rates of subjects and the duration of the RD are reported in a wide range. Different situations may play a role on it.

Firstly, the lack of a clear definition of RD. Moreover, possibly patients with coexisting psychological disorders or migraine might be more prone to develop RD, and at present few or nothing is known on these subgroups of patients.

Contrasting results have been found regarding the causes of RD, some of them reporting a pre-existing utricular dysfunction or poor adaptation to this disorder, while other data support the hypothesis that anxiety may play a role in the disorder.

Similarly, only one paper dealing with drug therapy was a prospective randomized double blind study; none of them included a large sample and different outcomes have been proposed to evaluate efficacy.

Conflict of Interest

The authors declare no conflict of interests.

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