European Archives of Oto-Rhino-Laryngology (2019) 276:985–991
https://doi.org/10.1007/s00405-019-05313-y

OTOLOGY

Diagnosis and treatment choices of suspected benign paroxysmal positional vertigo: current approach of general practitioners, neurologists, and ENT physicians

Agnė Ulytė[1,2] · Domantas Valančius[3] · Rytis Masiliūnas[2] · Aistė Paškonienė[4] · Eugenijus Lesinskas[4] · Diego Kaski[5] · Dalius Jatužis[2] · Kristina Ryliškienė[2]

Received: 17 December 2018 / Accepted: 21 January 2019 / Published online: 29 January 2019

Abstract

Purpose Benign paroxysmal positional vertigo (BPPV) is a frequently underdiagnosed cause of vertigo, potentially due to the underuse of diagnostic and therapeutic canalith repositioning procedures (CRPs). We aimed to investigate self-reported use of the diagnostic and therapeutic approach to BPPV patients by Lithuanian neurologists, ear, nose, and throat (ENT) physicians, and general practitioners (GPs), and to explore potential reasons for the underuse of the maneuvers.

Methods Neurologists, ENT physicians, and GPs were invited to complete a written questionnaire focused on diagnostic and therapeutic practices related to BPPV. Between-group differences and associations between responses were analyzed statistically.

Results In total, 97 neurologists, 85 ENT physicians and 142 GPs (21.1%, 26.8%, and 5.7%, respectively, of all corresponding licensed Lithuanian physicians) completed the questionnaire. 24% of neurologists, 33% ENT physicians and 50% GPs do not perform diagnostic maneuvers for patients with suspected BPPV, and 28%, 61%, and 84%, respectively, do not perform CRPs. Years of clinical experience was a negative predictor of CRP performance [OR 0.97 (95% CI 0.95–0.99), $p = 0.001$]. Frequent reasons for not performing CRPs were time taken for the procedure, fear of provoking symptoms, and lack of knowledge. All physicians frequently ordered additional imaging or consultations for suspected BPPV and reported prescribing a range of medications.

Conclusions A significant proportion of Lithuanian neurologists, ENT physicians, and GPs do not employ diagnostic maneuvers and CRPs for BPPV patients, contrary to established guidelines. Lack of expertise and time available is a common culprit that leads to unnecessary drug prescribing and investigation.

Keywords BPPV · Canalith repositioning procedure · Epley maneuver · Lithuania

Introduction

Benign paroxysmal positional vertigo (BPPV) is the most frequent cause of acute vertigo in primary and emergency healthcare settings with an overall lifetime prevalence of 2.4% and a yearly incidence of 0.6% [1]. The median

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00405-019-05313-y) contains supplementary material, which is available to authorized users.

✉ Agnė Ulytė
agne.ulyte@uzh.ch

[1] Epidemiology, Biostatistics and Prevention Institute (EBPI), University of Zurich, Hirschengraben 84, 8001 Zurich, Switzerland

[2] Clinic of Neurology and Neurosurgery, Institute of Clinical Medicine, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

[3] Faculty of Medicine, Vilnius University, Vilnius, Lithuania

[4] Clinic of Ear, Nose, Throat, and Eye Diseases, Institute of Clinical Medicine, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

[5] Department of Clinical and Motor Neuroscience, 33 Queen Square, WC1N 3BG London, UK

duration of a BPPV episode with vertigo attacks is 2 weeks, with a third of patients experiencing the symptoms for more than a month [1], leading to decreased quality of life, reduced workload capacity, and restricted daily activities [1–3].

The diagnosis and treatment of BPPV require little more than general physical examination. The gold standard for the diagnosis of the most frequent variant—posterior semicircular canal BPPV—is specific nystagmus induced by Dix–Hallpike positional maneuver [4–7]. 90% of BPPV cases are treatable with canalith repositioning procedures (CRPs), such as Epley maneuver for the posterior semicircular canal BPPV [5, 8, 9], which has a treatment success rate of 80–90% [5, 10–15].

Despite more than 25 years since the first publication and evidence of their clinical efficacy [16], diagnostic maneuvers and CRPs for BPPV are still underused [17, 18], and consequently, BPPV is underdiagnosed [19]. Instead of the straightforward physical examination, physicians often rely on extensive investigations, consultations, imaging, and prescription of medications for acute vertigo patients [20, 21], that are universally discouraged [5, 22]. The deviation from clinical practice guidelines leads to an average duration of symptoms-to-diagnosis of 19–70 months [20, 23] as well as unreasonably high direct and indirect costs.

According to the official Lithuanian statistics [24], only 15.9% out of 27,618 outpatients and inpatients with a vestibular disorder (vertigo) (ICD-10 [25] diagnosis codes H81.0–H81.9) were diagnosed with BPPV (H81.1) in 2016, while 67.7% were diagnosed with other and non-specific disorders (H81.8 and H81.9). High prevalence of non-specific vertigo diagnoses and relatively low prevalence of BPPV in Lithuania suggests potential underdiagnosis. Furthermore, many of the BPPV patients were hospitalized: 13.4% of the hospitalized vertigo patients (1796 in total) were diagnosed with BPPV, although the condition can be effectively treated on an outpatient basis [5, 26]. In 2016, the mean length of stay of inpatient treatment for BPPV was 5.5 days—comparable to vestibular neuronitis (6.7 days) or Ménière disease (5.6 days) [24].

Physicians' attitude and experience with the maneuvers could play a role in their diagnostic and therapeutic choices, but the reasons for the propensity to rely on imaging and medications instead of the positional maneuvers have not been examined adequately. The aim of this study was to describe and analyze the current approaches to BPPV diagnosis and treatment in Lithuania by general practitioners (GPs), neurologists, and ear, nose and throat (ENT) physicians, and to investigate the reasons for the deviation from the international and local clinical practice guidelines [5, 7, 27] that likely apply to practices on a more global scale.

Methods

We performed and analyzed a cross-sectional survey of Lithuanian GPs, neurologists, and ENT physicians (Fig. 1), who were approached during five major specialty-specific medical conferences, workshops and schools in 2016 in Lithuania. During the plenary sessions of the events, all participating physicians were asked to fill in a written questionnaire. Questionnaires filled in by physicians of other specialties or doctors in training (resident trainees) were excluded.

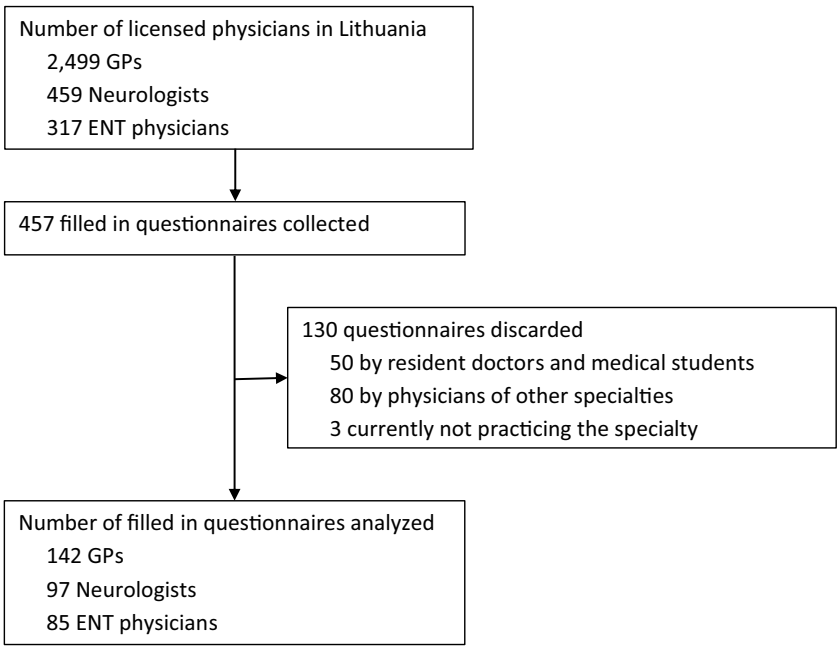

Fig. 1 Flowchart of study participants: general practitioners, neurologists and ENT physicians in Lithuania

To our knowledge, no psychometrically tested validated questionnaire exists to probe the self-reported diagnostic and therapeutic choices of BPPV treatment by physicians. Therefore, a custom-made questionnaire was designed by the authors. Neurologists and ENT physicians from a specialized vertigo disorders center were consulted about the range of questions to be included. They also suggested the options of multiple-choice questions (e.g., the potential reasons for not performing the diagnostic maneuvers or the choice of medications prescribed) based on clinical experience. The resultant draft questionnaire was further distributed to four neurologists and two ENT physicians at a university hospital and adapted according to their feedback for clarity. The questionnaire included questions on physician demographic characteristics, clinical experience and employment, and details on encounters with BPPV patients. Choices of diagnostic techniques, tests, and prescribed treatment were recorded. Some of the multiple-choice questions allowed more than one option to be selected if the options were not mutually exclusive. The English translation of the questionnaire is provided in Supplementary material 1.

Chi square and analysis of variance (ANOVA) tests were used to examine the between-group differences in the categorical and continuous responses of the three physician specialties, respectively. Relationships between physician age, clinical experience, employer and work setting, and the diagnostic and therapeutic practices were investigated with multivariate logistic regression, adjusting for physician specialty, with effect size reported as odds ratio (OR). Categorical and ordinal variables were transformed into binary for regression analysis. Results are given with the associated p values. Statistical analysis was performed with R version 3.4.4 [28].

Results

The summary of the results of the questionnaire are presented in Table 1.

A total of 457 physicians completed the survey, 97 of whom were practicing neurologists, 85 ENT physicians, and 142 GPs, which corresponds to 21.1%, 25.8%, and 5.7%, of overall licensed neurologists, ENT physicians and GPs in Lithuania, respectively [29]. The 133 responses answered by trainees, physicians of other specialties and non-practicing physicians were excluded. The proportion of women among respondent neurologists, ENT physicians and GPs was 75.3%, 72.9%, and 95.1%, respectively (respective proportions in the total Lithuanian physicians' population are 67.5%, 69.7%, and 87.1% [29]). GPs were the youngest respondents and consequently had the least clinical experience (Table 1). 23% of physicians were working for multiple different employers (e.g., both in private and public hospitals) and 30% in multiple settings (e.g., both in inpatient and outpatient clinics).

From the three physician specialty groups analyzed, a large proportion of neurologists (72%) claimed to have seen 50 or more patients with BPPV ($p < 0.001$). As expected, odds of having encountered more than 50 BPPV patients increased with years of clinical experience [OR 1.03 (95% CI 1.02–1.06), $p < 0.001$]. Neurologists also performed CRPs for the treatment of BPPV most frequently ($p < 0.001$).

The results of the logistic regression of performing diagnostic maneuvers and CRPs are shown in Table 2. Compared to neurologists, GPs were less likely to perform diagnostic maneuvers [OR 0.31 (95% CI 0.17–0.54)] and any CRPs [OR 0.07 (95% CI 0.04–0.14)], and ENT physicians were less likely to perform CRPs [OR 0.24 (95% CI 0.13–0.45)]. The duration of clinical experience was not a statistically significant predictor of diagnostic maneuvers, but significant for CRPs performance rate [OR 0.97 (95% CI 0.95–0.99), $p = 0.001$], when adjusted for physician specialty. Similarly, clinical employer type (public university, regional, primary care hospital or private practice) did not have a significant effect (except working in a private practice where more diagnostic maneuvers were performed, Table 2). Work setting did not have a significant effect either (results not shown).

Physicians of all specialties frequently ordered additional imaging tests or consultations for patients with suspected BPPV, and reported prescribing a range of medications, most frequently betahistine, homeopathic medications, *Ginkgo biloba* and vinpocetine for the patients diagnosed with BPPV. Compared to neurologists, prescription of any medication was more frequent by GPs [OR 1.82 (95% CI 0.86–3.95), $p = 0.008$], but not ENT physicians ($p = 0.119$). Odds of ordering any additional diagnostic examination were not significantly different between specialties. Age and clinical experience of a physician were positive predictors of any drug prescription, the number of different drug categories prescribed and additional test ordering, adjusted for medical specialty ($p < 0.001$ for all). Physicians working at a university or regional hospital, or at an inpatient department were less likely to prescribe any drugs ($p < 0.05$ for all). Physicians working at a university hospital or emergency department were less likely to order additional examination or referrals ($p < 0.05$ for both).

Discussion

We found that GPs, neurologists and ENT physicians in Lithuania rarely perform diagnostic maneuvers for suspected BPPV patients. The majority of ENT physicians and GPs, as well as almost a third of neurologists, do not perform any CRPs. Instead—against the best practice—they often

Table 1 Benign paroxysmal positional vertigo (BPPV) questionnaire data from neurologists, ear, nose and throat (ENT) physicians and general practitioners (GPs)

	Neurologists, *N* (%)	ENT physicians, *N* (%)	General practitioners, *N* (%)	*p*
Total	97	85	142	
Gender (women)	73 (75.3)	62 (72.9)	135 (95.1)	< 0.01
Age (years ± SD)	50.3 ± 11.0	51.2 ± 14.2	47.1 ± 11.8	0.039
N reporting age	92	85	142	
Clinical experience (years ± SD)	25.1 ± 12.4	24.7 ± 14.6	19.7 ± 12.7	0.001
N reporting clinical experience	91	85	142	
Clinical employer[a]				
University hospital	21 (21.6)	25 (29.4)	1 (0.7)	
Regional hospital	48 (49.5)	28 (32.9)	12 (8.5)	
Primary health care center	40 (41.2)	51 (60.0)	93 (64.5)	
Private practice	14 (14.4)	20 (23.5)	52 (36.6)	
Work setting[a]				
Emergency department	42 (43.3)	13 (15.3)	12 (8.5)	
Inpatient department	60 (61.9)	42 (49.4)	4 (2.8)	
Outpatient clinic	66 (68.0)	65 (76.5)	135 (95.1)	
Other	5 (5.2)	2 (2.4)	5 (3.5)	
Total number of encounters with BPPV patients through career				0.000
Less than 10	3 (3.1)	25 (29.4)	48 (33.8)	
From 10 to 50	23 (23.7)	27 (31.8)	60 (42.3)	
More than 50	70 (72.2)	33 (38.8)	34 (23.9)	
Performance of diagnostic maneuvers for suspected BPPV				0.000
Always	42 (43.3)	15 (17.6)	18 (12.7)	
Rarely	31 (32.0)	42 (49.4)	53 (37.3)	
Never	23 (23.7)	28 (32.9)	71 (50.0)	
Reasons for not performing diagnostic maneuvers[a]				
They take too long to perform	31 (32.0)	26 (30.6)	51 (35.9)	
I do not know how to perform them	6 (6.2)	12 (14.1)	39 (27.5)	
I find no use for them in clinical practice	1 (1.0)	7 (8.2)	2 (1.4)	
I fear to provoke vertigo and other symptoms	25 (25.8)	21 (24.7)	37 (26.1)	
Patients do not cooperate	12 (12.4)	7 (8.2)	8 (5.6)	
Additional examination for suspected BPPV[a]				
No additional examination	44 (45.4)	38 (44.7)	48 (33.8)	
Head CT/MRI	38 (39.2)	37 (43.5)	12 (8.5)	
Cervical spine X-ray	25 (25.8)	22 (25.9)	78 (54.9)	
Extracranial cerebrovascular ultrasonography	44 (45.4)	29 (34.1)	70 (49.3)	
Vascular surgeon consultation	3 (3.1)	11 (12.9)	34 (23.9)	
Choice of canalith-repositioning maneuvers for BPPV[a]				
Epley	54 (55.7)	31 (36.5)	21 (14.8)	
Semont	18 (18.6)	7 (8.2)	4 (2.8)	
Barbecue	5 (5.2)	6 (7.1)	3 (2.1)	
Brandt-Daroff	4 (4.1)	4 (4.7)	2 (1.4)	
None	27 (27.8)	52 (61.2)	119 (83.8)	
Choice of medication for BPPV[a]				
Betahistine	84 (86.6)	60 (70.6)	125 (88.0)	
Cinnarizine	13 (13.4)	6 (7.1)	16 (11.3)	
Vinpocetine	17 (17.5)	21 (24.7)	47 (33.1)	
Aminophylline	4 (4.1)	1 (1.2)	11 (7.7)	
Ginkgo biloba or similar	26 (26.8)	34 (40.0)	57 (41.0)	

Table 1 (continued)

	Neurologists, *N* (%)	ENT physicians, *N* (%)	General practitioners, *N* (%)	*p*
Homeopathic medication	35 (36.1)	18 (21.2)	61 (43.0)	
Infusion therapy	21 (21.6)	17 (20.0)	35 (24.6)	
Other (Mg, group B vitamins, diazepam, etc.)	14 (14.4)	4 (4.7)	2 (1.4)	
No additional medication	14 (14.4)	20 (23.5)	6 (4.2)	

N number of respondents, *SD* standard deviation, *BPPV* benign paroxysmal positional vertigo, *ENT* ear nose throat, *CT* computed tomography, *MRI* magnetic resonance imaging, *Mg* magnesium

[a]More than one option was allowed for this multiple choice question

Table 2 Logistic regression results of diagnostic maneuvers and CRPs' performance

	Diagnostic maneuvers performed		CRPs performed	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Specialty				
Neurologist	1.00 (reference)		1.00 (reference)	
ENT physician	0.63 (0.33–1.21)	0.168	0.24 (0.13–0.45)	< 0.001
GP	0.31 (0.17–0.54)	< 0.001	0.07 (0.04–0.14)	< 0.001
	(Adjusted for physician specialty)			
Clinical experience (years)	1.00 (0.98–1.02)	0.955	0.97 (0.95–0.99)	0.001
Having seen > 50 BPPV patients	1.68 (1.00–2.83)	0.051	0.93 (0.52–1.63)	0.811
Clinical employer				
University hospital	1.43 (0.56–3.79)	0.459	2.27 (0.91–5.86)	0.084
Regional hospital	1.49 (0.73–3.10)	0.281	1.76 (0.87–3.54)	0.115
Primary health care center	1.58 (0.85–3.05)	0.154	1.26 (0.68–2.37)	0.472
Private practice	2.40 (1.23–4.90)	0.013	1.17 (0.60–2.28)	0.641

CRPs canalith repositioning procedures, *OR* odds ratio, *CI* confidence interval, *ENT* ear, nose and throat physician, *GP* general practitioner

prescribe a wide range of imaging tests and medications for patients with BPPV.

Physicians of different specialties differed in their approach to BPPV patients. Neurologists claimed to have encountered BPPV patients and performed the therapeutic maneuvers the most frequently, while the majority of GPs reported not to have encountered a single BPPV patient, never to have used the diagnostic maneuvers, or not to know how to perform them. 27% of neurologists, 61% ENT physicians and 76% GPs reported having seen less than 50 BPPV patients in their careers. As expected, physicians with longer clinical experience reported more encounters, suggesting that the questionnaire was able to capture reliable data. However, given the high prevalence of BPPV [1] and the mean reported length of clinical experience (Table 1), more encounters would perhaps have been expected.

Our results provide insight into the possible reasons for the underuse of the positioning maneuvers. Physicians reported the excessive time taken to perform maneuvers, fear of side effects, and a lack of knowledge of how to perform them as the primary reasons for not performing the diagnostics maneuvers. These responses point to a lack of skill and experience with the maneuvers. In fact, diagnostic and repositioning maneuvers take approximately 5 min. to perform, with only minimal side effects, such as temporary nausea or fainting, occurring in only 12% of patients [26]. A study by Sridhar and Panda found that 90% of BPPV patients were relieved of the provoked symptoms by the end of the week, 7 days post-procedure and no major complications were noted [30]. GPs performing the diagnostic maneuvers and CRPs the least frequently further suggests that short consultation length and the lack of specialized training could have an influence. Physicians working in university hospitals—an academic environment which potentially encourages the application of up-to-date knowledge—reported more guideline-compliant treatment choices (less medication and additional examinations). The fact that the length of clinical experience in years was a negative predictor of performing CRPs, and a positive predictor of unnecessary prescribing, suggests a need for improved post-graduate education. Few studies have investigated the reasons for diagnostic maneuver and CRPs' underuse before. Bashir

et al. [18] conducted a similar, less-detailed survey of 81 emergency department physicians. Only 11% of physicians reported using positional maneuvers for BPPV diagnosis or CRPs for treatment. The most common reason for not using the maneuvers was the lack of training (76%), lack of time (14%) and the ease of availability of medications (10%). The physicians in our survey stated the duration of the maneuvers to be the biggest obstacle, followed by the fear to provoke further vertigo. The lack of skills was less relevant and mostly reported by GPs (Table 1).

All specialties were likely to order imaging and prescribe medication, but the choice was slightly different. More neurologists and ENT physicians used head CT or MRI imaging, while GPs ordered cervical spine X-ray and extracranial cerebrovascular ultrasound imaging more often. This is not explained by the availability of imaging services, as physicians working in university and emergency departments were less likely to order additional investigations. Unnecessary investigations and medication prescription for BPPV patients have been observed previously. In line with our findings, the majority of BPPV patients undergo at least one unnecessary diagnostic test, most frequently head MRI [21, 31, 32]. Up to 50% of patients are prescribed medications that are not indicated [31, 32].

A major advantage of our study is the big and representative sample of Lithuanian physicians. Although we relied on convenience sampling, we have surveyed from 6 to 27% of all target-specialty physicians in Lithuania, recruited in national conferences and schools that are part of the obligatory life-long medical education program, minimizing sampling bias. The survey was anonymous and there is no reason to suspect untruthful responses. However, the study also has a few limitations. Although we could estimate that the gender distribution of the sample population corresponds to the general population of Lithuanian physicians, a more detailed analysis of external validity was limited by the officially available information [29]. We relied on self-evaluation for the number of suspected BPPV cases through the career, and we could not test whether physicians in fact perform the maneuvers (correctly) as they report. These questions, as well as the more detailed reasons, barriers, and possible solutions to the underuse, are outside the scope of this study. Finally, more detailed reasons for the underuse of the positional maneuvers as well as possible solutions could be identified in other qualitative study types, such as interview or focus group studies. One such study has recently been conducted with primary care physicians diagnosing vertigo [33].

Our study results hint at potential solutions. Major subjective barriers to the maneuver use were lack of time, skills, and self-confidence in side-effect management. Novel focused education and effective tools for self-administration of CRPs could help bridge this skill gap. Studies have shown the effectiveness of such interventions; practicing with a tangible head and semicircular canal models, medical students learned to perform Epley maneuver more effectively [34]. A mobile device application and a head-mounted mechanic device could be used to facilitate self-administration of CRPs [35, 36]. Computer-controlled repositioning is also now available [37].

In conclusion, GPs, neurologists, ENT physicians tend to underuse the diagnostic maneuvers and CRPs for BPPV patients. Lack of expertise and limited time resources are the likely reasons. Unnecessary testing and medications are also often prescribed, with detrimental costs to the patient and society at large. Whilst our results are specific to Lithuanian practice, we suspect that the data are generalizable across a number of countries. Education of both physicians and patients, as well as devices and technologies to assist the diagnosis and therapeutic maneuvers, could help bring the clinical practice closer to the standard suggested by guidelines.

Acknowledgements We would like to thank the Lithuanian Institute of Hygiene, Health Information Centre for sharing summary data on vertigo patients' hospitalizations and diagnoses in Lithuania.

Funding The study received no funding.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interests.

Ethical approval The study protocol was approved by the local bioethics committee. The study did not involve patient participants and was performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. von Brevern M, Radtke A, Lezius F et al (2006) Epidemiology of benign paroxysmal positional vertigo: a population based study. J Neurol Neurosurg Psychiatry 78:710–715
2. Benecke H, Agus S, Kuessner D et al (2013) the burden and impact of vertigo: findings from the REVERT patient registry. Front Neurol 4:136
3. Li JC, Li CJ, Epley J, Weinberg L (2000) Cost-effective management of benign positional vertigo using canalith repositioning. Otolaryngol Neck Surg 122:334–339
4. Dix MR, Hallpike CS (1952) The pathology symptomatology and diagnosis of certain common disorders of the vestibular system. Proc R Soc Med 45:341–354
5. Bhattacharyya N, Gubbels SP, Schwartz SR et al (2017) Clinical practice guideline: benign paroxysmal positional vertigo (Update). Otolaryngol Neck Surg 156:S1–S47

6. Bhattacharyya N, Baugh RF, Orvidas L et al (2008) Clinical practice guideline: benign paroxysmal positional vertigo. Otolaryngol Neck Surg 139:47–81
7. von Brevern M, Bertholon P, Brandt T et al (2015) Benign paroxysmal positional vertigo: diagnostic criteria. J Vestib Res 25:105–117
8. Nunez RA, Cass SP, Furman JM, Holt GR (2000) Short- and Long-Term Outcomes of Canalith Repositioning for Benign Paroxysmal Positional Vertigo. Otolaryngol Neck Surg 122:647–653
9. Lopez-Escamez JA, Gamiz MJ, Fernandez-Perez A, Gomez-Fiñana M (2005) Long-term outcome and health-related quality of life in benign paroxysmal positional vertigo. Eur Arch Oto-Rhino-Laryngol 262:507–511
10. Helminski JO, Zee DS, Janssen I, Hain TC (2010) Effectiveness of particle repositioning maneuvers in the treatment of benign paroxysmal positional vertigo: a systematic review. Phys Ther 90:663–678
11. Gordon CR, Gadoth N (2004) Repeated vs single physical maneuver in benign paroxysmal positional vertigo. Acta Neurol Scand 110:166–169
12. Liu Y, Wang W, Zhang A et al (2016) Epley and Semont maneuvers for posterior canal benign paroxysmal positional vertigo: a network meta-analysis. Laryngoscope 126:951–955
13. Lee JD, Shim DB, Park HJ et al (2014) A multicenter randomized double-blind study: comparison of the epley, semont, and sham maneuvers for the treatment of posterior canal benign paroxysmal positional vertigo. Audiol Neurotol 19:336–341
14. Saberi A, Nemati S, Sabnan S et al (2017) A safe-repositioning maneuver for the management of benign paroxysmal positional vertigo: Gans vs. Epley maneuver; a randomized comparative clinical trial. Eur Arch Oto-Rhino-Laryngol 274:2973–2979
15. Fife D, FitzGerald JE (2005) Do patients with benign paroxysmal positional vertigo receive prompt treatment? Analysis of waiting times and human and financial costs associated with current practice. Int J Audiol 44:50–57
16. Epley JM (1992) The canalith repositioning procedure: for treatment of benign paroxysmal positional vertigo. Otolaryngol Neck Surg 107:399–404
17. Polensek SH, Sterk CE, Tusa RJ (2008) Screening for vestibular disorders: a study of clinicians' compliance with recommended practices. Med Sci Monit 14:CR238–C242
18. Bashir K, Qotb MA, Alkahky S et al (2015) Are emergency physicians and paramedics providing canalith repositioning manoeuvre for benign paroxysmal positional vertigo? Emerg Med Australas 27:179–180
19. Geser R, Straumann D (2012) Referral and final diagnoses of patients assessed in an Academic Vertigo Center. Front Neurol 3:169
20. Wang H, Yu D, Song N et al (2014) Delayed diagnosis and treatment of benign paroxysmal positional vertigo associated with current practice. Eur Arch Oto-Rhino-Laryngol 271:261–264
21. Polensek SH, Tusa R (2009) Unnecessary diagnostic tests often obtained for benign paroxysmal positional vertigo. Med Sci Monit 15:MT89–M94
22. Hain TC, Yacovino D (2005) Pharmacologic treatment of persons with dizziness. Neurol Clin 23:831–853
23. Arshad M, Abbas S (2013) Qureshi IA Delay in diagnosis and treatment of benign paroxysmal positional vertigo in current practice. J Ayub Med Coll Abbottabad 25:93–95
24. Lithuanian Institute of Hygiene. Health statistics. https://stat.hi.lt/default.aspx. Accessed 4 May 2018
25. World Health Organization (1992) 10th revision of the International Statistical Classification of Diseases and Related Health Problems. http://apps.who.int/classifications/icd10/browse/2016/en. Accessed 11 Nov 2017
26. Fife TD, Iverson DJ, Lempert T et al (2008) Practice parameter: therapies for benign paroxysmal positional vertigo (an evidence-based review): report of the quality standards subcommittee of the American Academy of Neurology. Neurology 70:2067–2074
27. Jatuzis D, Lesinskas E, Paskoniene A et al (2015) Galvos svaigimo diagnostika ir gydymas: mokomoji knyga. Medicinos spaudos namai, Kaunas
28. R Core Team (2018) R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna. https://www.r-project.org/. Accessed 8 June 2018
29. State Health Care Accreditation Agency under the Ministry of Health. http://www.vaspvt.gov.lt/en. Accessed 11 Nov 2017
30. Sridhar S, Panda N (2005) Particle repositioning manoeuvre in benign paroxysmal positional vertigo: is it really safe? J Otolaryngol 34:41–45
31. Grill E, Strupp M, Müller M, Jahn K (2014) Health services utilization of patients with vertigo in primary care: a retrospective cohort study. J Neurol 261:1492–1498
32. Kattah JC, Talkad AV, Wang DZ et al (2009) HINTS to diagnose stroke in the acute vestibular syndrome. Stroke 40:3504–3510
33. Stephan A-J, Kovacs E, Phillips A et al (2018) Barriers and facilitators for the management of vertigo: a qualitative study with primary care providers. Implement Sci 13:25
34. Fujisaka M, Akaogi K-I, Shojaku H (2015) A tangible head model showing semicircular canals for demonstrating the physical treatment for BPPV. Acta Otolaryngol 135:1212–1218
35. Organ B, Liu H, Bromwich M (2015) An iPhone-assisted particle repositioning maneuver for benign paroxysmal positional vertigo (BPPV): a prospective randomized study. J Am Board Fam Med 28:118–120
36. Bromwich M, Hughes B, Raymond M et al (2010) Efficacy of a new home treatment device for benign paroxysmal positional vertigo. Arch Otolaryngol Neck Surg 136:682
37. Shan X, Peng X, Wang E (2015) Efficacy of computer-controlled repositioning procedure for benign paroxysmal positional vertigo. Laryngoscope 125:715–719