RESEARCH PAPER

Psychiatric comorbidity and psychosocial impairment among patients with vertigo and dizziness

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▶ Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/jnnp-2014-307601).

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Received 8 January 2014
Revised 29 May 2014
Accepted 6 June 2014
Published Online First 24 June 2014

To cite: Lahmann C, Henningsen P, Brandt T, *et al*. *J Neurol Neurosurg Psychiatry* 2015;**86**: 302–308.

ABSTRACT

Background Vertigo and dizziness are often not fully explained by an organic illness, but instead are related to psychiatric disorders. This study aimed to evaluate psychiatric comorbidity and assess psychosocial impairment in a large sample of patients with a wide range of unselected organic and non-organic (ie, medically unexplained) vertigo/dizziness syndromes.

Methods This cross-sectional study involved a sample of 547 patients recruited from a specialised interdisciplinary treatment centre for vertigo/dizziness. Diagnostic evaluation included standardised neurological examinations, structured clinical interview for major mental disorders (SCID-I) and self-report questionnaires regarding dizziness, depression, anxiety, somatisation and quality of life.

Results Neurological diagnostic workup revealed organic and non-organic vertigo/dizziness in 80.8% and 19.2% of patients, respectively. In 48.8% of patients, SCID-I led to the diagnosis of a current psychiatric disorder, most frequently anxiety/phobic, somatoform and affective disorders. In the organic vertigo/dizziness group, 42.5% of patients, particularly those with vestibular paroxysmia or vestibular migraine, had a current psychiatric comorbidity. Patients with psychiatric comorbidity reported more vertigo-related handicaps, more depressive, anxiety and somatisation symptoms, and lower psychological quality of life compared with patients without psychiatric comorbidity.

Conclusions Almost half of patients with vertigo/dizziness suffer from a psychiatric comorbidity. These patients show more severe psychosocial impairment compared with patients without psychiatric disorders. The worst combination, in terms of vertigo-related handicaps, is having non-organic vertigo/dizziness and psychiatric comorbidity. This phenomenon should be considered when diagnosing and treating vertigo/dizziness in the early stages of the disease.

INTRODUCTION

Vertigo and dizziness, which have a lifetime prevalence of approximately 30%,[1] are common symptoms presented to general practitioners and neurologists.[2 3] In approximately 30–50% of patients with vertigo/dizziness, complaints are not fully explained by a vestibular deficit or a defined organic illness, but instead are related to psychiatric disorders.[4 5] In a sample of 189 patients with complaints of vertigo/dizziness, 52.4% had medically unexplained symptoms. In this group, vertigo/dizziness was often associated with anxiety/phobic (45.5%), somatoform (41.4%) or depressive disorders (13.1%).[4]

Psychiatric comorbidity seems to be more prevalent in certain subgroups of organic vertigo/dizziness.[6] For example, Eckhardt-Henn *et al*[7] found that in a sample of 68 patients with vertigo/dizziness, those who suffered from vestibular migraine or Meniere's disease had significantly higher rates of psychiatric comorbidity (65% and 57%, respectively), particularly anxiety and depressive disorders, compared with patients who suffered from vestibular neuritis (22%) or benign paroxysmal positional vertigo (BPPV) (15%). In a study of 59 patients with vestibular disorders, patients with vestibular migraine had the highest chance of psychiatric comorbidity at a 1-year follow-up (58.5%).[8] Thus, prognosis may be poor in patients who suffer from severe and relapsing vertigo attacks. Additional risk factors may be negative beliefs about the consequences of vertigo/dizziness, anxiety/panic-related cognition or maladaptive coping strategies (eg, catastrophic thoughts, tendency to evaluate body sensations fearfully). By contrast, psychological well-being and resilient coping protect against the development of psychiatric comorbidity.[5 8–10]

Approximately 80% of patients with vertigo/dizziness with a comorbid psychiatric disorder report lower quality of life (QoL) than those without any psychiatric comorbidity. These patients feel more impaired in their daily lives or are unable to work due to their vertigo/dizziness symptoms. Moreover, patients with vertigo/dizziness with a comorbid psychiatric disorder frequently use the healthcare system.[8 11] Given patients' vertigo/dizziness-related handicaps and associated costs for healthcare and social systems, it is important to identify and effectively treat these patients as early as possible.

Although previous studies show associations between selected subgroups of patients with vertigo/dizziness and psychiatric comorbidity,[4 6 9] these studies are based on small sample sizes and focus only on selected organic vertigo/dizziness groups, such as patients with vestibular migraine, Meniere's disease, BPPV or vestibular neuritis. Here we evaluated psychiatric comorbidity in a large, non-preselected sample of patients with either non-organic or organic forms of vertigo/dizziness, including diverse and incompletely explored organic disorders (eg, vestibular paroxysmia). Moreover, we investigated psychosocial impairment

within these patients via self-report questionnaires on vertigo-related handicaps and symptoms, anxiety, depression, somatisation, and health-related QoL (HRQoL). Our hypotheses were that (1) particular psychiatric comorbidities are more prevalent for specific vestibular disorders, and (2) patients with psychiatric comorbidity have greater psychosocial handicaps and impairment compared with those without mental disorders after controlling for age, sex and duration of vertigo/dizziness.

PATIENTS AND METHODS

Study design and sample

This cross-sectional study, conducted between May 2010 and June 2012, involved 687 patients who gave informed consent (from a total of 860 eligible patients). Reasons for refusal were insufficient language skills, a lack of interest, blindness, cognitive difficulties in filling out a questionnaire, feelings of excessive demands or privacy concerns. Patients were recruited through routine care appointments at the German Centre for Vertigo and Balance Disorders at the University Hospital Munich, Campus Großhadern. For organisational reasons (eg, living outside of Munich or vomiting after caloric testing), not all patients underwent a Structured Clinical Interview (SCID-I) to assess mental disorders.[12] Therefore, we only included and analysed data from the 547 patients (44.1% male, 54.8±16.0 years of age) who were interviewed. There were no significant differences between patients who did and did not participate in the SCID-I concerning age, sex, vertigo severity, vertigo-related handicap, depression, anxiety, somatisation, or physical or psychological HrQoL.

Nearly all (91.5%) patients suffered from vertigo/dizziness for at least 3 months; 46.2% had vertigo/dizziness symptoms for more than 3 months up to 2 years, and 45.3% had symptoms for more than 2 years. Furthermore, 26.1% of patients had taken medication (43.2% of patients with Meniere's disease received Betahistin), 7.5% practised liberatory manoeuvres, 4.8% received physiotherapeutic treatment, 4.2% had psychotherapy and 0.7% underwent surgery.

Patients were included if they were at least 18 years of age and possessed sufficient German language skills. Exclusion criteria were any of the following diagnoses: neurodegenerative disorder (eg, dementia), schizoaffective or psychotic disorder, substance abuse or severe suicidal tendencies. All patients were informed about the aims of the study and gave written informed consent. This study was approved by the Ethics Committee of the University of Munich (ref. 108–10).[13]

Assessment and psychological instruments

Neurological diagnostic workup

All patients underwent structured history-taking and a systematic and standardised physical examination by an expert medical scientist at the German Centre for Vertigo and Balance Disorders, including complete neurological, neuro-otological and neuro-ophthalmological examinations. Vestibular testing included the head impulse test, measurement of subjective visual vertical and ocular torsion, and caloric irrigation by video-oculography. The expert medical scientist made a clinical diagnosis based on the results of examinations according to diagnostic criteria.[14] The diagnosis of vestibular migraine was based on criteria from Neuhauser and Lempert,[15 16] the diagnosis of Meniere's disease was based on criteria from the American Academy of Otolaryngology, Head, and Neck Surgery,[17] and the diagnosis of vestibular paroxysmia, which is attributed to neurovascular cross-compression and leads to vertiginous spells often accompanied by unsteadiness in stance or gait, was based on criteria from Brandt and Dieterich[18] and Hüfner *et al*.[19] The co-occurrence of multiple organic vertigo/dizziness diagnoses was possible. Based on the neurological diagnostic workup, the following two groups emerged:

1. Patients with an organic or vestibular cause of vertigo/dizziness (ie, the presence of one or more of the above mentioned diagnoses, including those patients with a combination of organic and non-organic causes of dizziness).
2. Patients with a non-organic or non-vestibular cause of vertigo/dizziness (ie, medically unexplained vertigo/dizziness).

Psychometric examination: Structured Clinical Interview (SCID-I)

Clinical staff conducted SCID-I interviews to assess patients' psychiatric disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) classification system.[12] The co-occurrence of multiple psychiatric diagnoses was possible. All interviewers were initially blind to the organic vs non-organic vertigo/dizziness diagnoses of patients, that is, the SCID-I interviewers were not informed about any potential diagnoses of these patients. If the interviewer suspected a somatoform disorder due to vertigo/dizziness, this diagnosis was assigned only if the patient had been classified as having non-organic vertigo/dizziness. All interviewers underwent intensive training, including practice interviews with patients who were not recruited for the study. Inter-rater reliability was evaluated via interviews with a simulated patient; the κ value was 0.94. Interviewers were required to undergo SCID-I supervision led by a senior physician on a regular basis (ie, every 3–4 weeks).

Patient self-report questionnaires

The Vertigo Handicap Questionnaire,[20] the Vertigo Symptom Scale,[21] the revised Beck Depression Inventory,[22] the Beck Anxiety Inventory,[23] the Patient Health Questionnaire[24] and the Short-Form Health Survey (SF-12) on HRQoL[25] were completed by patients (table 1).

Statistical analysis

Statistical analysis was conducted using SPSS (V.21.0). To test for differences among SCID-I participants and non-participants, independent samples t tests were conducted; because of inflation of α due to multiple comparisons, statistical significance level was set at $p<0.006$ (0.05/8). To test for differences in self-report questionnaire scores among vertigo/dizziness subgroups, we computed descriptive statistics and performed χ^2 tests and analyses of variance controlled for sex, age and duration of vertigo/dizziness. Due to inflation of α, statistical significance level was set at $p<0.002$ (0.05/28) for χ^2 tests and $p<0.01$ (0.05/8) for analyses of variance. When statistically significant main effects were detected, we conducted Bonferroni post hoc tests controlled for age and sex. Effect sizes (partial η^2) were computed and considered small if partial η^2 was ≥ 0.01 and <0.06, medium if partial η^2 was ≥ 0.06 and <0.14, and large if partial η^2 was ≥ 0.14.[26] To examine the relationship between self-report questionnaire scores and the occurrence of psychiatric comorbidity, we conducted binary logistic regression analysis controlled for sex, age and duration of vertigo/dizziness. The fit of the model was evaluated using the omnibus test of coefficients (χ^2, statistically significant if $p<0.05$) and the Hosmer-Lemeshow statistic (χ^2, good fit if $p>0.05$).[27]

RESULTS

Neurological diagnosis

Neurological diagnostic workup revealed organic vertigo/dizziness in 442 (80.8%) patients and non-organic (ie, medically

Table 1 Overview and description of patients' self-report questionnaire scores

Questionnaire	Description	Scores, scales	Reliability (α)	Validity
Vertigo Handicap Questionnaire (VHQ)	▶ Assessment of physical and psychosocial handicap due to vertigo/dizziness ▶ 25 items ▶ Five-point scale: 0 (never) to 4 (always)	Sum score ranging from 0 to 100	High (α=0.92)	Good construct validity
Vertigo Symptom Scale (VSS)	▶ Assessment of frequency of dizziness-related symptoms ▶ 34 items ▶ Five-point scale: 0 (never) to 4 (more than once per week)	Two subscales: (I) vertigo and associated symptoms (VSS-VER) and (II) somatic anxiety and autonomic arousal (VSS-AA)	Good (VSS-VER α=0.79; VSS-AA α=0.89)	Good construct validity
Beck Depression Inventory, revised (BDI-2)	▶ Assessment of depression severity during the last 2 weeks ▶ 21 items ▶ Four-point scale: 0–3	Sum score ranging from 0 to 63: ≤8, not clinically relevant; 9–13, subclinical depression; 14–19, mild depression; 20–28, moderate depression; ≥29, severe depression	Good (α≥0.80)	Good construct validity
Beck Anxiety Inventory (BAI)	▶ Assessment of anxiety severity during the last 7 days ▶ 21 items ▶ Four-point scale: 0 (not at all) to 3 (strongly)	Sum score ranging from 0 to 63: ≤7, not clinically relevant; 8–15, mild anxiety; 16–25, moderate anxiety; ≥26, clinically relevant anxiety	Good (α≥0.085)	Good construct validity
Patient Health Questionnaire (PHQ-15)	▶ Assessment of most important Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for somatisation disorders, and two items from the depression module ▶ 15 items ▶ Three-point scale: 0 (not bothered at all) to 2 (bothered a lot/more than half of the time or nearly every day)	Sum score ranging from 0 to 30:≤4, minimal; 5–9, low; 10–14, medium; ≥15, high	Good (α=0.080)	Good construct validity
Health-related quality of life measure (HRQoL) Short-Form Health Survey (SF-12)	▶ Assessment of HRQoL during the last 4 weeks ▶ 12 items	Physical and psychological HRQoL, ranging from 0 (very poor) to 100 (optimal)	Moderate to good (α≥0.070)	Good convergent validity

unexplained) vertigo/dizziness in 105 (19.2%) patients. Among patients with organic vertigo/dizziness, vestibular migraine was the most frequent diagnosis (n=95), followed by BPPV (n=87), Meniere's disease (n=81), bilateral vestibulopathy (n=45), vestibular paroxysmia (n=43), multisensory deficit (n=42), central vertigo (n=38), vestibular neuritis (n=29), polyneuropathy (n=26) and unilateral vestibular loss (n=20). Although most (75.1%) patients had a single organic vertigo/dizziness diagnosis, 20.6% had two diagnoses, 3.6% had three diagnoses and 0.7% had four diagnoses.

Prevalence of psychiatric comorbidity

Next, we analysed the prevalence of current psychiatric comorbidity. SCID-1 using DSM-IV criteria led to a diagnosis of current mental disorder in 48.8% of patients. Specifically, 158 (28.9%) patients had an anxiety/phobic disorder, 136 (24.9%) had a somatoform disorder, 104 (19.0%) had an affective disorder, 16 (2.9%) had a substance abuse disorder and 4 (0.7%) had an eating disorder. Some patients had more than one psychiatric comorbidity; 42 patients (7.7%) had anxiety/phobic and somatoform disorders, 32 (5.9%) had anxiety/phobic and affective disorders, 21 (3.8%) had affective and somatoform disorders and 20 (3.7%) had anxiety/phobic, affective and somatoform disorders.

Among patients with current anxiety/phobia, the most frequent diagnosis was specific phobia (n=61), primarily of heights, flying, or small and tight rooms, followed by agoraphobia without panic disorder (n=53), panic disorder with agoraphobia (n=33), panic disorder without agoraphobia (n=24), generalised anxiety disorder (n=16) and social phobia (n=10).

Combination of neurological and psychiatric diagnoses

When considering neurological diagnoses and psychiatric comorbidities, four subgroups emerged: patients with organic vertigo/dizziness and no psychiatric comorbidity (group o^+/p^-), patients with non-organic vertigo/dizziness and no psychiatric comorbidity (group o^-/p^-; ie, patients with disturbed well-being on a subclinical level), patients with organic vertigo/dizziness and psychiatric comorbidity (group o^+/p^+), and patients with non-organic vertigo/dizziness and psychiatric comorbidity (group o^-/p^+). The prevalence of psychiatric disorders was significantly higher ($\chi^2=45.9$; df=1; $p<0.001$) among patients with non-organic vertigo/dizziness (75.2%) than among patients with organic vertigo/dizziness (42.5%) (table 2).

Most patients in subgroups o^+/p^- (48.7%), o^-/p^- (60.9%), and o^+/p^+ (44.7%) suffered from vertigo/dizziness for between 3 months and 2 years, whereas most patients in subgroup o^-/p^+ had vertigo/dizziness for 2–10 years (46.3%). Furthermore, age and sex differed significantly among the four subgroups (see online supplementary table A1).

Psychiatric comorbidity in organic vertigo/dizziness subgroups

In the organic vertigo/dizziness subgroup, 22 (51.2%) patients with vestibular paroxysmia and 47 (49.5%) patients with vestibular migraine had a current psychiatric comorbidity, whereas only 11 (24.4%) of patients with bilateral vestibulopathy fulfilled criteria for a current comorbid mental disorder. Anxiety/phobic disorders were most frequent in patients with vestibular paroxysmia (32.6%) or vestibular migraine (32.6%) and least frequent in patients with bilateral vestibulopathy

Table 2 Combination of neurological diagnosis with psychiatric comorbidity (n=547)

	SCID-I		
	No psychiatric comorbidity	Psychiatric comorbidity	
Neurological diagnosis			
Organic vertigo/dizziness	254 (57.5%) (group o^+/p^-)	188 (42.5%) (group o^+/p^+)	442 (80.8%)
Non-organic (ie, medically unexplained) vertigo/dizziness	26 (24.8%) (group o^-/p^-)	79 (75.2%) (group o^-/p^+)	105 (19.2%)

Group o^+/p^-, organic vertigo/dizziness without psychiatric comorbidity.
Group o^-/p^-, non-organic vertigo/dizziness without psychiatric comorbidity.
Group o^+/p^+, organic vertigo/dizziness with psychiatric comorbidity.
Group o^-/p^+, non-organic vertigo/dizziness with psychiatric comorbidity.

(17.8%) or vestibular neuritis (17.2%). Affective disorders occurred most frequently in patients with central vertigo (23.7%) or BPPV (23.0%) and occurred least frequently in patients with bilateral vestibulopathy (11.1%). Somatoform disorders were most frequent in patients with vestibular migraine (21.1%) and least frequent in patients with bilateral vestibulopathy (8.9%) (table 3).

Differences in psychosocial impairment assessed by self-report questionnaires

Overall, there were significant differences in subjective psychosocial impairment and handicaps between patients with and without psychiatric comorbidity (table 4). That is, compared with patients with psychiatric comorbidity, patients with no psychiatric comorbidity reported less vertigo-related handicaps, fewer vertigo-related symptoms, less autonomic arousal, fewer depressive, anxiety and somatisation symptoms, and higher psychological HRQoL after controlling for age, sex and duration of vertigo/dizziness. Effect sizes were clinically relevant (table 4, see online supplementary tables A2 and A3). The worst combination, in terms of vertigo-related handicaps, was having non-organic vertigo/dizziness and psychiatric comorbidity.

Finally, we found that vertigo-associated symptoms (Vertigo Symptom Scale-VER: OR 1.8, 95% CI (1.1 to 2.9)), depression (Beck Depression Inventory: OR 1.1, 95% CI (1.04 to 1.2)) and anxiety (Beck Anxiety Inventory: OR 1.1, 95% CI (1.01 to 1.1)) increased the odds of having psychiatric comorbidity after controlling for age, sex and duration of vertigo/dizziness. The fit of the model was good (omnibus test of coefficients: $\chi^2=79.9$; df=14; $p<0.001$; Hosmer-Lemeshow statistic: $\chi^2=12.3$; df=8; p=0.14).

DISCUSSION

The aim of this study was to investigate psychiatric comorbidity in a large, unselected sample of patients, who were referred to a specialised, interdisciplinary treatment centre for vertigo/dizziness, which allowed the inclusion and analysis of several previously unexplored subgroups. We hypothesised that specific vestibular disorders are associated with particular psychiatric comorbidities and that patients with mental disorders have more psychosocial handicaps and impairment compared with those without mental disorders after controlling for age, sex and duration of vertigo/dizziness.

Our results support our first hypothesis. We found that specific psychiatric comorbidity was more prevalent in patients with certain vestibular disorders. In particular, patients who suffered from episodic vertigo/dizziness, namely vestibular paroxysmia or vestibular migraine, had the highest prevalence of psychiatric disorders. The most frequent mental disorders in patients with episodic vertigo/dizziness, such as vestibular migraine, vestibular paroxysmia and Menière's disease, were phobias or anxiety, which is partly in line with previous studies.[6 7] Moreover, our results point towards patients with vestibular paroxysmia as a particularly vulnerable subgroup. To our knowledge, there have been no studies to date investigating psychiatric comorbidity in patients with vestibular paroxysmia. In episodic vertigo/dizziness conditions, such as vestibular migraine and vestibular paroxysmia, patients may unexpectedly experience intense and recurrent vertigo attacks, which might be a particular burden for these patients. One hypothesis may be that patients perceive the onset and intensity of vertigo/dizziness attacks as uncontrollable, which could trigger anxiety and panic-related cognition and sometimes lead to the development of avoidance behaviour.[9 28] Previous studies also suggest a link

Table 3 Current psychiatric comorbidity in patients diagnosed with organic vertigo/dizziness (n=442) and differences among subgroups

	Diagnoses of organic vertigo/dizziness									
SCID-I diagnosis*	VP (n=43) Frequency (%)	VM (n=95)	MultD (n=42)	BPPV (n=87)	CV (n=38)	MD (n=81)	VN (n=29)	BV (n=45)	Subgroup differences	χ^2; df (p)
Current psychiatric comorbidity	51.2	49.5	45.2	44.8	42.1	37.9	37.0	24.4	VP>BV VM>BV BPPV>BV	16.7; 1 (<0.001) 32.4; 1 (<0.001) 19.7; 1 (<0.001)
Anxiety/phobic	32.6	32.6	23.8	24.1	18.4	25.9	17.2	17.8	VM>CV VM>VN VM>BV	12.8; 1 (<0.001) 15.9; 1 (<0.001) 14.3; 1 (<0.001)
Affective	16.3	14.7	21.4	23.0	23.7	16.0	17.2	11.1	BPPV>BV	12.5; 1 (<0.001)
Somatoform	16.3	21.1	9.5	16.1	15.8	12.3	17.2	8.9	VM>MultD VM>BV	14.8; 1 (<0.001) 17.3; 1 (<0.001)

*Multiple psychiatric diagnoses were possible.
BPPV, benign paroxysmal positional vertigo; BV, bilateral vestibulopathy; CV, central vertigo; MD, Meniere's disease; MultD, multisensory deficit; VM, vestibular migraine; VN, vestibular neuritis; VP, vestibular paroxysmia.

Table 4 Differences among vertigo/dizziness subgroups in self-report questionnaire results after controlling for sex, age and duration of vertigo/dizziness

Outcome	Subgroups*	Mean (±SD)	F; df (p)†	Post hoc comparison of subgroups (p); partial η^2‡
VHQ—sum score	o^+/p^-	39.8±17.0	**12.0; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); *0.04*
	o^-/p^-	31.9±15.8		$o^+/p^- < o^-/p^+$ (<0.001); 0.07
	o^+/p^+	47.9±17.3		$o^-/p^- < o^+/p^+$ (<0.001); 0.09
	o^-/p^+	50.9±15.1		$o^-/p^- < o^-/p^+$ (<0.001); **0.28**
VSS—vertigo and associated symptoms	o^+/p^-	1.0±0.7	**7.1; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); 0.07
	o^-/p^-	0.8±0.4		$o^+/p^- < o^-/p^+$ (0.008); *0.05*
	o^+/p^+	1.5±0.9		$o^-/p^- < o^+/p^+$ (0.003); 0.10
	o^-/p^+	1.5±1.0		$o^-/p^- < o^-/p^+$ (0.004); **0.17**
VSS—autonomic arousal	o^+/p^-	0.9±0.6	**12.6; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); 0.08
	o^-/p^-	1.1±0.7		$o^+/p^- < o^-/p^+$ (<0.001); 0.08
	o^+/p^+	1.4±0.8		
	o^-/p^+	1.4±0.6		
BDI-2	o^+/p^-	8.0±5.5	**25.7; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); **0.17**
	o^-/p^-	9.7±8.5		$o^+/p^- < o^-/p^+$ (<0.001); **0.20**
	o^+/p^+	15.3±10.0		$o^-/p^- < o^-/p^+$ (0.004); 0.12
	o^-/p^+	15.2±7.3		
BAI	o^+/p^-	9.6±7.2	**23.9; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); 0.13
	o^-/p^-	9.3±5.4		$o^+/p^- < o^-/p^+$ (<0.001); **0.19**
	o^+/p^+	17.0±10.9		$o^-/p^- < o^+/p^+$ (0.004); 0.06
	o^-/p^+	18.6±8.9		$o^-/p^- < o^-/p^+$ (<0.001); **0.20**
PHQ-15	o^+/p^-	8.3±4.5	**14.0; 3 (<0.001)**	$o^+/p^- < o^+/p^+$ (<0.001); 0.09
	o^-/p^-	8.1±3.6		$o^+/p^- < o^-/p^+$ (<0.001); 0.10
	o^+/p^+	11.4±5.1		
	o^-/p^+	11.9±4.7		
SF-12—Physical HRQoL	o^+/p^-	45.3±10.7	0.6; 3 (0.62)	–
	o^-/p^-	45.8±10.2		
	o^+/p^+	44.8±11.2		
	o^-/p^+	44.1±11.3		
SF-12—Psychological HRQoL	o^+/p^-	53.0±9.0	**8.6; 3 (<0.001)**	$o^+/p^- > o^+/p^+$ (<0.001); *0.03*
	o^-/p^-	52.8±11.1		$o^+/p^- > o^-/p^+$ (<0.001); 0.07
	o^+/p^+	48.6±13.0		$o^-/p^- > o^-/p^+$ (0.005); 0.08
	o^-/p^+	45.8±13.0		

*Group o^+/p^-: n=(123; 254), group o^-/p^-: n=(14; 26); group o^+/p^+: n=(79; 188); group o^-/p^+: n=(38; 79).
†Adjusted statistical significance level, p<0.01; statistically significant results are in bold.
‡All comparisons are Bonferroni-adjusted; classification of effect sizes: italics: small if 0.01 ≤ partial η^2<0.06; underlined: medium if 0.06 ≤ partial η^2<0.14; bold: large if partial $\eta^2 \geq 0.14$.
BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; HRQoL, health-related quality of life; PHQ-15, Patient Health Questionnaire; SF-12, Short-Form Health Survey; VHQ, Vertigo Handicap Questionnaire; VSS, Vertigo Symptom Scale.

between anxiety and balance disorders.[29] Patients with phobic/anxiety and vestibular disorders frequently exhibit avoidance behaviour and report dizziness, spatial disorientation and anxiety in particular environments.[30] Increased visual dependence (ie, the preferential use of vision for spatial orientation and postural control) and subsequent increased body sway can be observed in patients with primary vestibular disorders and those with phobic/anxiety disorders.[31 32] However, upon a closer look, increased body sway differed in patients with vestibular disorders from those with phobic/anxiety disorders. In patients with vestibular disorders, the body sway increased in more difficult balance tasks, whereas in patients with phobic disorders, it turned out that the more difficult the balance task was, the better the balance performance occurred.[33] Thus, 'instability' measured in patients with phobia may just be a matter of postural strategy rather than postural capability. Although the term 'phobic postural vertigo' is not a recognised DSM-IV/V or International Classification of Diseases-10 diagnosis, it is a clinically used concept describing a subgroup of patients with certain characteristics, such as dizziness and postural imbalance in particular situations (eg, in shopping centres) and with avoidance behaviour.[34] More generally, it has been suggested that the association between vertigo/dizziness and anxiety may be explained by neuroanatomical connections between the vestibular system and neuronal pathways that are involved in anxiety/phobic conditioning and modulated by monoaminergic and noradrenergic influences.[29]

We also found that affective disorders were most frequent in patients with BPPV, central vertigo or multisensory deficits. These vertigo/dizziness disorders are typically observed in older patients and are often associated with feelings of depression.[35] Furthermore, somatoform disorders were mainly diagnosed in patients with vestibular migraine, which agrees with previous studies.[6 36]

A second major finding in the present study was that nearly half of the patients who were referred to a specialised, interdisciplinary vertigo/dizziness treatment centre had a current psychiatric comorbidity according to the SCID-I, which is the gold standard for diagnosing mental disorders and was conducted blind to patient vestibular diagnosis.[37] In agreement with previous studies,[4 11] we found that anxiety and phobic disorders were most frequent, followed by somatoform and affective disorders. The prevalence of psychiatric disorders was significantly higher in the non-organic vertigo/dizziness subgroup than in the organic subgroup. Our results also support our second hypothesis, as patients with psychiatric comorbidity reported more psychosocial impairment, including more vertigo-related symptoms, greater autonomic arousal, more depressive, anxiety and somatisation symptoms, and lower psychological HRQoL, as compared with patients without psychiatric comorbidity. With

respect to vertigo-related handicaps, the worst combination was having non-organic vertigo/dizziness and psychiatric comorbidity. These differences in self-reported complaints and symptoms underscore the impairment and handicaps experienced by people with vertigo/dizziness and psychiatric comorbidity.[4 8] In longitudinal studies, patients with mixed physical and psychological symptoms were found to be at risk of remaining symptomatic and handicapped.[38] However, we found no difference between subgroups in physical HRQoL as measured by the SF-12. Vertigo/dizziness-related QoL measures, however, may be more sensitive and reliable than general physical HRQoL measures, such as the SF-12, as the former measures reflect the specific impact of vertigo/dizziness and associated symptoms.

Given the associations among vertigo/dizziness, comorbid psychiatric disorders and self-reported impairment that may lead to high costs for the healthcare and social systems, it is important to identify and effectively treat these patients early.[8 11] Our findings illustrate the relevance of an interdisciplinary approach when diagnosing patients with vertigo/dizziness. Psychological counselling and psychotherapy should be included in the treatment plan of these patients to address the predominant psychiatric problem, as there is preliminary evidence that psychotherapy may be effective in patients with medically unexplained vertigo/dizziness.[39]

Our results are limited because the SCID-I does not consider the aetiology of psychiatric disorders (ie, whether they are caused by vertigo/dizziness). Although all interviewers underwent intensive training and regularly attended supervision meetings, and SCID inter-rater reliability is typically high, there may have been systematic overdiagnosis or underdiagnosis as compared with standard norms. Further, the study design was cross-sectional, which does not allow for causal conclusions. The vestibular paroxysmia group may also be slightly contaminated by patients with non-organic dizziness, as this diagnosis was based on patient history, positive MRI for neurovascular cross-compression and response to treatment with carbamazepine (ie, diagnostic criteria as defined by Brandt and Dieterich and Hüfner *et al*).[18 19] The MRI criterion (ie, cross-compression) is very sensitive (<5% false negative) but not very specific (>25% false positive),[40] and in addition, response to carbamazepine could be a placebo response. Thus, there may be in some cases a slight overlap between the 'organic' and 'non-organic' groups. Furthermore, according to the definition of somatoform disorders in the DSM-IV (SCID-I) we used the term 'medically unexplained vertigo/dizziness' though it may be problematic, particularly in regard to the concept of the Somatic Symptom Disorder of the DSM-V. However, as the study began in 2010, we used the SCID-I, which is based on the DSM-IV—the valid diagnostic manual of that time. Our sample was unselected and representative of a specialised tertiary care department, rather than composed of all patients with vertigo/dizziness. As most patients who present in tertiary care were previously treated by neurologists in secondary care settings, and as only patients who do not adequately respond to previous treatment approaches are referred to tertiary care, a selection bias must be assumed (ie, some dizziness syndromes are missing). Nevertheless, recruitment within a specialised tertiary care department allowed us to include and investigate a wide range of organic vertigo/dizziness subgroups, such as vestibular paroxysmia, which had never been investigated until now. Additional strengths of this study are that we examined a large sample of patients and used extremely high international diagnostic standards. Different diagnostic approaches were also used, including clinical-neurological examinations by experts at a tertiary referral centre, structured interviews for assessing psychiatric disorders by trained clinical staff, and patient self-report questionnaires concerning psychosocial variables that were evaluated in light of diagnostic subgroups.

In conclusion, our study supports previous findings that many patients suffering from vertigo/dizziness also exhibit comorbid psychiatric disorders, particularly anxiety and phobic disorders.[6] In particular, we identified vestibular paroxysmia as an especially vulnerable subgroup for the occurrence of comorbid psychiatric disorders. Patients with vestibular migraine, vestibular paroxysmia or Meniere's disease were frequently affected by anxiety/phobic disorders, which may be explained by the uncontrollability of vertigo/dizziness attacks in these conditions.[28] Patients with psychiatric comorbidity reported more psychosocial impairment and greater handicaps as compared with patients without psychiatric comorbidity, indicating the urgent need for the early and effective detection and treatment of these patients.[39 41] Further research should focus on risk factors for the development of psychiatric comorbidity subsequent to organic vertigo/dizziness. Also, considering the high prevalence rate of psychiatric comorbidity and the substantial impairment and handicaps in patients with vertigo/dizziness, an internationally accepted diagnostic classification that describes all aspects of patients with psychiatric comorbidity should be developed and implemented.

Contributors All authors made substantial contributions to this study. CL designed the study and contributed to the final draft of the manuscript. PH and MD designed the study and contributed to the final version of the manuscript. TB provided conceptual advice and contributed to the final version of the manuscript. MS and KJ recruited patients, performed data assessment and contributed to the final version of the manuscript. AE-H contributed to the final version of the manuscript. RF recruited patients and contributed to the final version of the manuscript. AD contributed to the final draft of the manuscript. GS designed the study, conducted statistical analysis and wrote the manuscript.

Funding Parts of this project were supported by funding from the German Federal Ministry of Education and Research (01 EO 0901). The authors bear full responsibility for the content of this publication.

Competing interests KJ has received speaker's honoraria from Abbott, Alkem, Boehringer Ingelheim and Medtronic and research support from Biogen Idec. MS is Joint Chief Editor of the *Journal of Neurology*, Editor-in-Chief of *Frontiers in Neuro-otology*, and Section Editor of *F1000*. He has received speaker's honoraria from Abbott, UCB, GSK, Teva, Biogen Idec, Pierre-Fabre, Eisai and Hennig Pharma. CL has received speaker's honoraria from Heel and royalties from Abbott and Heel.

Patient consent Obtained.

Ethics approval This study was approved by the Ethics Committee of the University of Munich (ref. 108–10).

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Neuhauser HK. Epidemiology of vertigo. *Curr Opin Neurol* 2007;20:40–6.
2 Tusa RJ. Dizziness. *Med Clin North Am* 2009;93:263–71, vii.
3 de Waal MW, Arnold IA, Eekhof JA, *et al*. Somatoform disorders in general practice: prevalence, functional impairment and comorbidity with anxiety and depressive disorders. *Br J Psychiatry* 2004;184:470–6.
4 Eckhardt-Henn A, Breuer P, Thomalske C, *et al*. Anxiety disorders and other psychiatric subgroups in patients complaining of dizziness. *J Anxiety Disord* 2003;17:369–88.
5 Best C, Eckhardt-Henn A, Diener G, *et al*. Interaction of somatoform and vestibular disorders. *J Neurol Neurosurg Psychiatry* 2006;77:658–64.
6 Best C, Eckhardt-Henn A, Tschan R, *et al*. Psychiatric morbidity and comorbidity in different vestibular vertigo syndromes. Results of a prospective longitudinal study over one year. *J Neurol* 2009;256:58–65.
7 Eckhardt-Henn A, Best C, Bense S, *et al*. Psychiatric comorbidity in different organic vertigo syndromes. *J Neurol* 2008;255:420–8.
8 Tschan R, Best C, Beutel ME, *et al*. Patients' psychological well-being and resilient coping protect from secondary somatoform vertigo and dizziness (SVD) 1 year after vestibular disease. *J Neurol* 2011;258:104–12.
9 Godemann F, Schabowska A, Naetebusch B, *et al*. The impact of cognitions on the development of panic and somatoform disorders: a prospective study in patients with vestibular neuritis. *Psychol Med* 2006;36:99–108.

10 Yardley L, Beech S, Weinman J. Influence of beliefs about the consequences of dizziness on handicap in people with dizziness, and the effect of therapy on beliefs. *J Psychosom Res* 2001;50:1–6.
11 Wiltink J, Tschan R, Michal M, *et al*. Dizziness: anxiety, health care utilization and health behavior—results from a representative German community survey. *J Psychosom Res* 2009;66:417–24.
12 Wittchen H-U, Wunderlich U, Gruschwitz S, *et al*. SCID-I: structured clinical interview for DSM-IV. Axis I: mental disorders. *Interview book*. Göttingen: Hogrefe, 1997.
13 Lahmann C, Henningsen P, Dieterich M, *et al*. The Munich Diagnostic and Predictor Study of Dizziness: objectives, design, and methods. *J Neurol* 2012;259:702–11.
14 Brandt T, Dieterich M, Strupp M. *Vertigo and dizziness: common complaints*. 2nd edn. London: Springer, 2013.
15 Radtke A, Neuhauser H, von Brevern M, *et al*. Vestibular migraine—validity of clinical diagnostic criteria. *Cephalalgia* 2011;31:906–13.
16 Neuhauser H, Leopold M, von Brevern M, *et al*. The interrelations of migraine, vertigo, and migrainous vertigo. *Neurology* 2001;56:436–41.
17 American Academy of Otolaryngology Head and Neck Surgery. Committee on Hearing and Equilibrium guidelines for the diagnosis and evaluation of therapy in Meniere's disease. American Academy of Otolaryngology-Head and Neck Foundation, Inc. *Otolaryngol Head Neck Surg* 1995;113:181–5.
18 Brandt T, Dieterich M. Vestibular paroxysmia: vascular compression of the eighth nerve? *Lancet* 1994;343:798–9.
19 Hüfner K, Barresi D, Glaser M, *et al*. Vestibular paroxysmia: diagnostic features and medical treatment. *Neurology* 2008;71:1006–14.
20 Tschan R, Wiltink J, Best C, *et al*. Validation of the German version of the Vertigo Handicap Questionnaire (VHQ) in patients with vestibular vertigo syndromes or somatoform vertigo and dizziness. *Psychother Psychosom Med Psychol* 2009;59:1–12.
21 Tschan R, Wiltink J, Best C, *et al*. Validation of the German version of the Vertigo Symptom Scale (VSS) in patients with organic or somatoform dizziness and healthy controls. *J Neurol* 2008;255:1168–75.
22 Kuhner C, Burger C, Keller F, *et al*. Reliability and validity of the Revised Beck Depression Inventory (BDI-II). Results from German samples. *Nervenarzt* 2007;78:651–6.
23 Margraf J, Ehlers A. *Beck anxiety inventory, original version by A.T. Beck and R.A. Stern*. Pearson Assessment, 2007.
24 Gräfe K, Zipfel S, Herzog W, *et al*. Screening for psychiatric disorders with the Patient Health Questionnaire (PHQ). Results from the German validation study. *Diagnostica* 2004;50:171–81.
25 Bullinger M, Morfeld M, Kohlmann T, *et al*. SF-36 health survey in rehabilitation research. Findings from the North German Network for Rehabilitation Research, NVRF, within the rehabilitation research funding program. *Rehabilitation (Stuttg)* 2003;42:218–25.
26 Cohen J. *Statistical power analysis for the behavioural sciences*. Hillsdale: Lawrence Erlbaum Associates, 1988.
27 Tabachnick BG, Fidell LS. *Using multivariate statistics*. Boston: Pearson Education, 2007.
28 Kirby SE, Yardley L. Physical and psychological triggers for attacks in Meniere's disease: the patient perspective. *Psychother Psychosom* 2012;81:396–8.
29 Furman JM, Balaban CD, Jacob RG, *et al*. Migraine-anxiety related dizziness (MARD): a new disorder? *J Neurol Neurosurg Psychiatry* 2005;76:1–8.
30 Beidel DC, Horak FB. Behavior therapy for vestibular rehabilitation. *J Anxiety Disord* 2001;15:121–30.
31 Jacob RG, Redfern MS, Furman JM. Space and motion discomfort and abnormal balance control in patients with anxiety disorders. *J Neurol Neurosurg Psychiatry* 2009;80:74–8.
32 Bronstein AM. Under-rated neuro-otological symptoms: Hoffman and Brookler 1978 revisited. *Br Med Bull* 2002;63:213–21.
33 Querner V, Krafczyk S, Dieterich M, *et al*. Patients with somatoform phobic postural vertigo: the more difficult the balance task, the better the balance performance. *Neurosci Lett* 2000;285:21–4.
34 Brandt T. Phobic postural vertigo. *Neurology* 1996;46:1515–9.
35 Wetmore SJ, Eibling DE, Goebel JA, *et al*. Challenges and opportunities in managing the dizzy older adult. *Otolaryngol Head Neck Surg* 2011;144:651–6.
36 Jahn K, Dieterich M. Recent advances in the diagnosis and treatment of balance disorders. *J Neurol* 2011;258:2305–8.
37 Ventura J, Liberman RP, Green MF, *et al*. Training and quality assurance with the Structured Clinical Interview for DSM-IV (SCID-I/P). *Psychiatry Res* 1998;79:163–73.
38 Yardley L. Overview of psychologic effects of chronic dizziness and balance disorders. *Otolaryngol Clin North Am* 2000;33:603–16.
39 Schmid G, Henningsen P, Dieterich M, *et al*. Psychotherapy in dizziness: a systematic review. *J Neurol Neurosurg Psychiatry* 2011;82:601–6.
40 Best C, Gawehn J, Krämer HH, *et al*. MRI and neurophysiology in vestibular paroxysmia: contradiction and correlation. *J Neurol Neurosurg Psychiatry* 2013;84:1349–56.
41 Sattel H, Lahmann C, Gundel H, *et al*. Brief psychodynamic interpersonal psychotherapy for patients with multisomatoform disorder: randomised controlled trial. *Br J Psychiatry* 2012;200:60–7.

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J Neurol Neurosurg Psychiatry 2015 86: 302-308 originally published online June 24, 2014
doi: 10.1136/jnnp-2014-307601