

## SHORT REPORT

# Benign paroxysmal positional vertigo predominantly affects the right labyrinth

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Benign paroxysmal positional vertigo (BPPV) occurs when there are freely moving particles in a semicircular canal and the head is turned in the plane of the affected canal. The aim of the present study was to clarify whether BPPV manifests equally in both labyrinths or whether there is a preponderance for one side. We conducted a PubMed literature search of BPPV case series which specified the affected side and a retrospective chart review of 80 consecutive patients with BPPV of the posterior canal who had presented at our dizziness clinic.

Eighteen studies with a total of 3426 patients were identified. In our own series the right side was affected in 54 of 80 patients (right/left ratio 2.08). Altogether, in 3506 patients the right labyrinth was involved 1.41 times more often than the left (95% CI 1.37 to 1.45). We think that the reason for the predominant involvement of the right ear in BPPV is the habit—of most patients—of sleeping on the right side.

**B**enign paroxysmal positional vertigo (BPPV) is the commonest vestibular disorder, accounting for about 20% of referrals in specialist dizziness clinics. According to the widely accepted canalolithiasis theory it is caused by mobile particles with density higher than that of the endolymph that have entered a semicircular canal of the vestibular organ.<sup>1</sup> These particles move freely within the endolymph of the affected canal and tend to settle down in the most dependent location. A change in the position of the head in the plane of the affected canal causes the particles in the canal to move resulting in abnormal hydrodynamic forces upon the cupula. There is evidence that the particles consist of dislodged otoconia from the utricle.<sup>2</sup>

Theoretically, one would expect that this pathology affects both ears equally. So far this has not been systematically investigated and the aim of the present study was to clarify whether BPPV involves one ear more often than the other.

## METHODS

The PubMed database was searched from 1966 to December 2002 to identify case series of patients with BPPV. Only those studies were selected which included more than 20 patients with unilateral BPPV and specified the affected side. Another requirement was confirmation of the diagnosis by observation of typical nystagmus during a provocative manoeuvre. Those studies which exclusively included patients with BPPV of the horizontal canal were excluded.

In addition, a retrospective chart review was conducted to identify the affected side in all patients with unilateral BPPV of the posterior canal who had presented to our dizziness clinic between January 2001 and September 2003.

## RESULTS

The PubMed search yielded 18 case series which specified the side affected by BPPV in a total of 3426 patients (table 1).<sup>3–20</sup> The right ear was affected in 1999 patients and the left in 1427, thus the right ear was involved 1.40 times more often than the left. Only two of 18 studies described more patients with BPPV on the left than on the right side.<sup>5, 9</sup> Of 80 patients presenting to our dizziness clinic with unilateral BPPV of the posterior canal, 54 had the right ear affected (right/left ratio 2.08). Altogether, in the 3506 patients included in this study the right labyrinth was affected 1.41 times more often than the left (95% CI 1.37 to 1.45).

## DISCUSSION

According to the canalolithiasis theory typical BPPV of the posterior canal is caused by otoconia that dislodge from the utricle and enter the semicircular canal where they move freely within the endolymph.<sup>1</sup> This theory explains all features of BPPV and has been corroborated by the finding of dense particulate matter, free floating in the endolymph of the posterior canal of patients with BPPV.<sup>2</sup> It is now known that BPPV develops in stages: first the otoconia detach from the utricular matrix, and then they enter into a semicircular canal when the head assumes a critical position. Furthermore, it has been shown by means of physiomathematical models that the prerequisites for BPPV are: (i) there should be approximately 62 otoconia within the semicircular canal and (ii) these particles have to agglomerate in order to exert a hydrodynamic effect when moving in the canal.<sup>21</sup>

Our study shows that the right ear is predominantly affected by BPPV. How can this predilection be explained on the basis of the canalolithiasis model? There are five factors which apparently predispose to BPPV: trauma to the head, other ear disease, advanced age, migraine, and bed rest.<sup>22, 23</sup> The first four factors probably account for the detachment of otoconia from the utricle by mechanical means or degenerative and ischaemic changes, but it seems unlikely that one ear is affected more often by one of these mechanisms than the other. Most studies included patients with both idiopathic and secondary BPPV. One case series also showed a preponderance of right sided BPPV in a group of patients with secondary BPPV due to inner ear disease.<sup>10</sup> Prolonged bed rest probably facilitates agglomeration of otoconia, but again, this should apply equally to both labyrinths.

Since damage to the utricle and agglomeration of otoconia are unlikely reasons for the predominance of the right side, we suspect that the critical mechanism occurs in the last stage in the pathophysiology of BPPV: the entry of particles into a semicircular canal depending on the position of the head.

Interestingly, sleep seems to be involved in the pathophysiology of BPPV and many patients experience their first

**Abbreviations:** BPPV, benign paroxysmal positional vertigo

**Table 1** Laterality of ear affected by benign paroxysmal positional vertigo (BPPV) in 18 studies reported in the literature and patients presenting to the dizziness clinic

Reference	Patients (n)	BPPV		Right/left ratio
		Right	Left	
Asawavichianginda <i>et al</i> , 2000 <sup>3*</sup>	83	48	35	1.37
Blakley, 1994 <sup>4*</sup>	37	20	17	1.18
Brandt and Daroff, 1980 <sup>5*</sup>	61	24	37	0.65
Dal <i>et al</i> , 2000 <sup>6*</sup>	63	35	28	1.25
Epley, 1992 <sup>7*</sup>	30	16	14	1.14
Froehling <i>et al</i> , 2000 <sup>8*</sup>	50	26	24	1.08
Harvey <i>et al</i> , 1994 <sup>9*</sup>	25	11	14	0.79
Karlberg <i>et al</i> , 2000 <sup>10,†‡</sup>	81	49	32	1.53
Katsarkas, 1999 <sup>11,†</sup>	1528	887	641	1.38
Korres <i>et al</i> , 2002 <sup>12*</sup>	97	58	39	1.49
Lopez-Escámez <i>et al</i> , 2002 <sup>13*</sup>	45	27	18	1.50
Marciano and Marcelli 2002 <sup>14*</sup>	674	425	249	1.71
Nuti <i>et al</i> , 2002 <sup>15*</sup>	53	36	17	2.12
O'Reilly <i>et al</i> , 2000 <sup>16*</sup>	72	39	33	1.18
Sargent <i>et al</i> , 2001 <sup>17*</sup>	175	99	76	1.30
Serafini <i>et al</i> , 1996 <sup>18*</sup>	143	82	61	1.34
Soto Varela <i>et al</i> , 2001 <sup>19*</sup>	105	61	44	1.39
Wolf <i>et al</i> , 1999 <sup>20*</sup>	104	56	48	1.17
Current series*	80	54	26	2.08
Total	3506	2053	1453	1.41

\*Study includes only patients with BPPV of the posterior canal (PC-BPPV).

†Patients with PC-BPPV and BPPV of the horizontal canal.

‡Patients exclusively with BPPV secondary to inner ear disease.

attack when moving in bed after awakening.<sup>12</sup> Recently, it has been shown that the side affected by BPPV correlates with the preferred position in bed: in 33 of 45 patients with BPPV of the posterior canal the side of the involved semicircular canal was the side patients used to lie on. Most patients slept in the right supine position and had BPPV on the right.<sup>13</sup> Freely moving otoconia in the labyrinth have a higher density than endolymph and follow gravity. In the right lateral supine position the openings of both the right posterior and the horizontal canals are in the lowermost position, which facilitates entry of heavy particles from the utricle. Thus one might speculate that BPPV predominantly involves the right ear because many persons prefer to sleep on the right side, possibly due to an uncomfortable awareness of the heart beat when lying on the left side. Positions during sleep have received little scientific attention, but it is known that patients with congestive heart failure spend significantly more time on the right than on the left side during sleep, whereas subjects without heart disease lie for an equally long time in both lateral positions.<sup>24</sup> As most patients with BPPV are of advanced age<sup>22</sup> when heart failure is a frequent comorbid condition, we suggest that a potential factor favoring the occurrence of BPPV on the right side is the preference of the right lateral supine position in bed.

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