



# Benign Paroxysmal Positional Vertigo (BPPV) in High School and Collegiate Female Athletes with a Concussion

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## Background

- Known as traumatic brain injury (TBI), a concussion is brought on by complex pathophysiologic processes following a direct or indirect force to the head
- While most individuals report symptom resolution in 1-2 weeks, many have sustained symptoms lasting for months or years
- Post concussion syndrome (PCS) is when symptoms last more than one month post injury
- Common symptoms of PCS include headache, dizziness, trouble remembering or concentrating and balance impairment
- Dizziness is the second most common symptom of concussion and PCS. It has been shown to be the only on-field symptom of sports-related concussion that is independently predictive of a prolonged recovery
- Disorders related to the vestibular system in the inner ear have also been shown to contribute to dizziness in patients with concussion. The most common vestibular disorder is benign paroxysmal positional vertigo (BPPV)

## Significance

- In 2019, the CDC estimated that approximately 283,000 children and adolescents are seen in emergency departments annually, secondary to sports-related concussion
- PCS symptoms have major implications, resulting in absence from school, delayed return to sport, and decreased quality of life
- Following a concussion, problems with the vestibular system are considered the most likely cause of the concussed athlete's inability to maintain balance
- BPPV is the most common peripheral vestibular disorder in adults, but reports in the pediatric population and understanding of its link to concussion are limited

## Aims

- Describe the demographics and clinical characteristics of a group of high school and collegiate female athletes with PCS
- Determine the incidence of BPPV in the sample
- Evaluate differences in clinical characteristics related to concussion among those diagnosed with and without BPPV

## Methodology

- Same size:  $n = 28$
- Inclusion criteria consisted of females between the ages of 13-20 who were diagnosed with PCS between March 2016 and July 2019
- An online questionnaire was completed by all patients and additional diagnostic data was collected from each patient at the time of visit
- REDCap® was used for building / managing surveys, and data collection
- Patients' symptom severity was evaluated using the Post-Concussion Symptom Scale (PCSS), a 22-question self-reporting tool
- Patients rated the severity of various post-concussion symptoms using a 7 point Likert scale (the highest possible score attainable being 132)
- Independent sample t-tests were conducted to compare 1) the number of days between concussion and visit, 2) the average number of days of work missed due to post-concussion symptoms, and 3) PCSS score between BPPV and non-BPPV groups
- Statistical significant was defined as  $p < 0.05$

## Results

Table 1: Demographic Characteristics

	BPPV	No BPPV
<b>Number of Female Athletes that Play Each Sport</b>		
Soccer		
Volleyball	0	7
Skiing	1	5
Basketball	0	3
Field Hockey	1	3
Dance	0	1
Cheerleading	0	1
Gym	1	1
Hockey	1	0
Lacrosse	1	0
Crew	1	0
<b>Total</b>	<b>7</b>	<b>21</b>

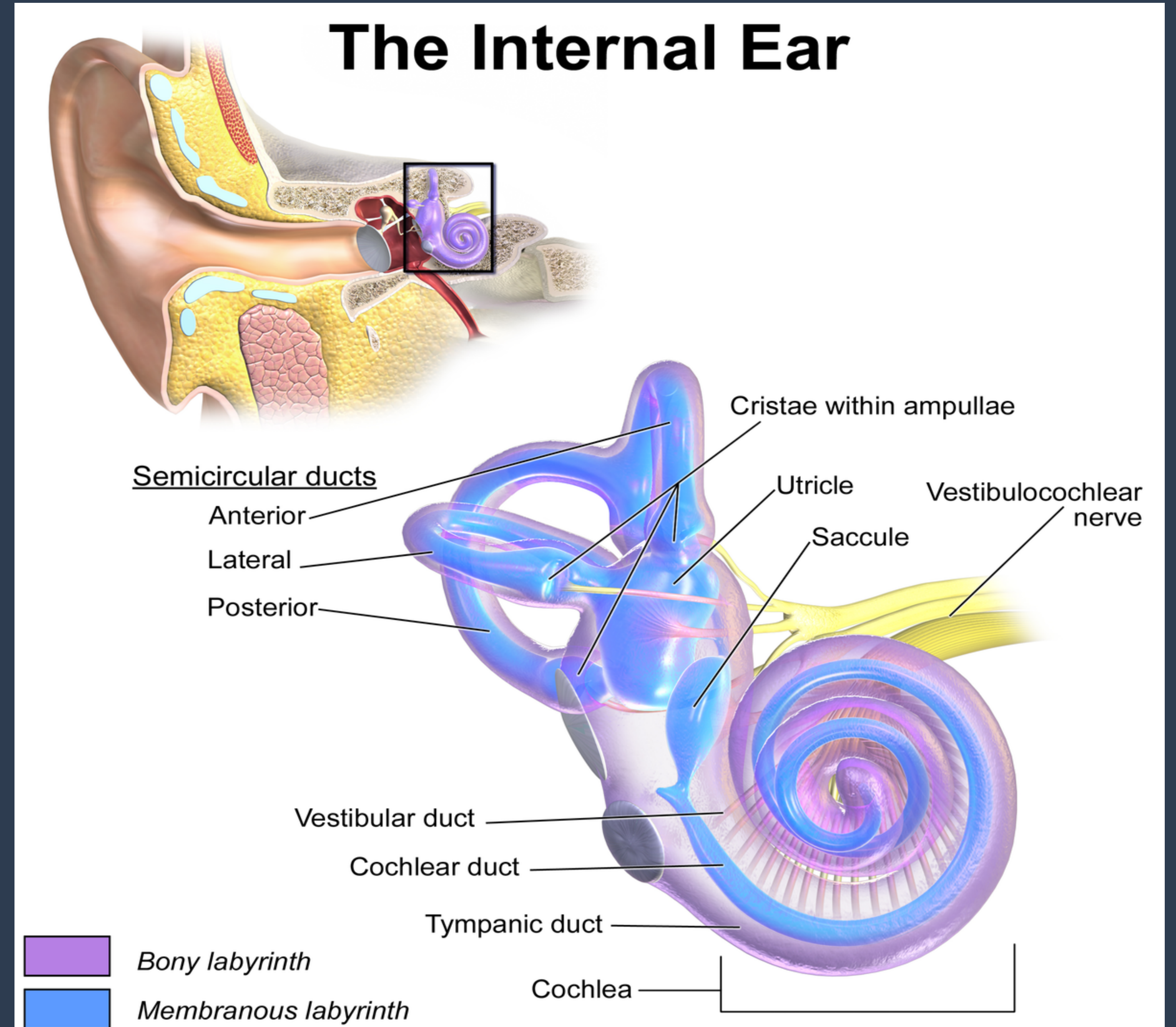
## Results

Table 2: Comparison of Clinical Characteristics Among Groups

	BPPV	No BPPV	P-value
<b>Days Between Most Recent Concussion and Visit</b>			
Average	178	245	0.49
Median	138	170	
Minimum	85	40	
Maximum	440	1,002	
Standard Deviation	121	241	
<b>Days Missed from School/Work Due to Concussion</b>			
Average	26	21	0.59
Median	10	20	
Minimum	5	1	
Maximum	93	60	
Standard Deviation	33	17	
<b>Number of Athletes With Previous Concussion Diagnosed by Clinical Provider</b>			
	4	11	
<b>Number of Concussions if Previously Diagnosed by Clinical Provider</b>			
Average	2	2	0.97
Minimum	2	1	
Maximum	3	6	
Standard Deviation	1	1	
<b>Number of Female Athletes with Diagnostic Study</b>			
CT	1	3	
MRI	4	18	
X-Ray	1	4	
<b>PCSS for Balance Problems or Dizziness</b>			
Average	3.4	1.8	0.02
Standard Deviation	1.7	1.4	
<b>Total PCSS Score</b>			
Average	55	38	0.13
Minimum	14	1	
Maximum	78	94	
Standard Deviation	24	25	

## Results

- The average PCSS score for female athletes diagnosed with BPPV was 55, compared to an average score of 38 for those not diagnosed with BPPV
- Although the average PCSS score for patients diagnosed with BPPV was ~1.5x higher than those without BPPV, an independent t-test found this result to not be statistically significant ( $p = 0.13$ )
- Athletes diagnosed with BPPV reported an average dizziness/balance problems subscale score of 3.4, compared to 1.8 for those not diagnosed with BPPV.
- This result was statistically significant ( $p = 0.02$ )



## Conclusion

- Results of this study demonstrate the importance of considering BPPV, a commonly missed condition on initial evaluation
- BPPV is often not suspected until many weeks after a concussion
- Delayed treatment results in missed time from academic & athletic activities
- Concussion providers will benefit from increased awareness of potential impacts of concussion on the inner ear

## Future Implications

- Nursing leaders are responsible for engaging in evidence-based research that can lead to practice changes that improve the outcome of high school and collegiate female athletes who might otherwise suffer significant long-term impairment related to neurologic injury

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