

# Vestibular Characteristics of Patients with Chronic Rhinosinusitis

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## Abstract

Chronic rhinosinusitis (CRS) is a common disease entity with symptoms that may extend beyond the sinonasal tract. Limited data exist regarding the relationship between CRS and the vestibular system, and no previous study has investigated the association between objective vestibular findings on videonystagmography (VNG) and the diagnosis of CRS. We analyzed a prospective database of 3078 patients who underwent VNG at our institution over an 8-year period, which included 70 subjects who had a diagnosis of CRS assigned by an otolaryngologist. Overall, the VNG findings for patients with CRS were similar to those of the general population, with 50% exhibiting normal vestibular function. Peripheral lesions were the most common abnormal VNG finding, with a wide range of subjective symptom descriptions. This preliminary report of the prevalence of objective vestibular findings in patients with CRS may form the basis for future study.

## Keywords

chronic rhinosinusitis, vertigo, dizziness, videonystagmography

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Chronic rhinosinusitis (CRS) is a highly prevalent disorder with effects on quality of life and a diverse array of symptoms that may extend beyond the sinonasal tract. Major symptoms of CRS include nasal congestion, facial pressure, and hyposmia. The effects of CRS are also known to affect well-being beyond the sinonasal tract, including associations with sleep dysfunction, impaired cognition, and depression.<sup>1-3</sup> In addition, patients who present with CRS may complain of dizziness and may describe this as related to their sinus condition. However, it is unclear if CRS can produce quantifiable effects on the vestibular

system<sup>4,5</sup> or, alternatively, if dizziness symptoms are derived from a nonvestibular phenomenon. Few studies have been performed investigating this relationship, and those that have been done were limited in objective findings.<sup>5-7</sup> The criterion standard for evaluation of vestibular disease is videonystagmography (VNG). To our knowledge, no previous study has investigated the association between objective vestibular findings on VNG and the diagnosis of CRS. Our aim was to use VNG data to evaluate the relationship between dizziness associated with CRS and objective vestibular dysfunction.

## Methods

Study data were derived from a prospectively collected database of patients aged 16 years or older who underwent VNG at a tertiary medical center between 2008 and 2016 inclusive. Subjects were identified with a diagnosis of CRS assigned during a visit in the otolaryngology clinic relative to the date of the VNG. Quantitative VNG data were available for all patients, including the site of any vestibular lesion. Peripheral vestibular disease was defined as a unilateral weakness >25% or positional vertigo on examination. A subjective 1-word description of the symptom that prompted the VNG was elicited from the patient at the time of the test, and the duration of dizziness symptoms was noted. Subsequent occurrence of sinus surgery was also recorded as a proxy for disease severity.

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**Table 1.** Summary of VNG Results for Patients with and without CRS.<sup>a</sup>

	CRS (n = 70)	No CRS (n = 3008)	P Value
Age, mean (SD)	58.7 (12.7)	59.1 (15.8)	.352
Female sex, n (%)	40 (57.1)	1890 (62.8)	.331
VNG findings, n (%)			
Normal VNG	35 (50.0)	1530 (50.9)	.886
Peripheral weakness	20 (28.6)	1090 (36.2)	.187
Central weakness	5 (7.1)	161 (5.4)	.512
Mixed weakness	4 (5.7)	63 (2.1)	<b>.040</b>
Oculomotor	1 (1.4)	29 (1.0)	.696
Nonlocalizing	3 (4.3)	134 (4.5)	.946

Abbreviations: CRS, chronic rhinosinusitis; VNG, videonystagmogram.

<sup>a</sup>Bold values indicate statistical significance.

**Table 2.** Characteristics of Abnormal versus Normal VNG Findings among Patients with CRS.

	Total (N = 70)	Abnormal VNG (n = 35)	Normal VNG (n = 35)	P Value
Age, mean (SD)	62.0 (48.0-68.0)	62.0 (48.0-70.0)	62.0 (47.0-67.0)	.644
Male sex, n (%)	30 (42.9)	16 (53.3)	14 (46.7)	.629
White race, n (%)	50 (72.5)	24 (48.0)	26 (52.0)	.463
Sinus surgery, n (%)	39 (55.7)	18 (46.2)	21 (53.9)	.470
Duration of symptoms, median (IQR)	4.0 (1.50-19.0)	5.0 (1.75-24.0)	2.8 (1.0-8.0)	.173

Abbreviations: CRS, chronic rhinosinusitis; IQR, interquartile range; VNG, videonystagmogram.

Descriptive statistics were performed for the entire sample. Bivariate analysis was performed by VNG results, CRS status, and sinus surgery. Continuous and categorical variables were compared using Wilcoxon rank test and Mantel-Haenszel chi-square test, respectively. This study was approved by the institutional review board of the Ochsner Clinic Foundation.

## Results

A total of 3078 patients were included from the database, of which 70 (2.3%) had a diagnosis of CRS. Overall, the mean (SD) age was 59.0 (15.7) years, and 1930 (62.7%) patients were female. VNG results in the CRS group included 20 (28.5%) patients with peripheral vestibular weakness, 5 (7.1%) with a central origin of vertigo, and 4 (5.7%) with mixed dysfunction. Thirty-five (50.0%) patients had normal VNG. The frequency of each VNG finding was comparable between the CRS and non-CRS groups for every finding except for mixed weakness (**Table 1**). The median (interquartile range) duration of symptoms prior to VNG was 4.0 (1.5-19.0) months. Within the CRS group, there was no significant difference between patients with abnormal and normal VNG based on age, gender, race, sinus surgery, or duration of symptoms (**Table 2**). A variety of potential vestibular symptoms was presented by the patients, with no significant difference in symptom frequency between the CRS and non-CRS groups (**Table 3**).

Sinus surgery was performed in 39 (55.7%) subjects, including 21 (53.8%) with abnormal VNG. Differences in

VNG findings were not found between those who had sinus surgery and those who did not. However, patients requiring surgery had a shorter median duration of dizziness symptoms compared with those who did not have surgery (2 months vs 10 months,  $P = .038$ ).

## Discussion

To our knowledge, there are few studies, retrospective or prospective, that have examined the relationship between complaints of dizziness and sinusitis. Cohen et al<sup>5</sup> suggested that patients with benign paroxysmal positional vertigo have a higher prevalence of sinonasal disease. Gavriel et al<sup>7</sup> found that 20% of patients with abnormal computerized dynamic posturography had evidence of rhinosinusitis; however, this was most commonly acute rhinosinusitis, and the vertigo would resolve with the resolution of the infection.

Overall, the VNG findings for patients with CRS mirror the larger population who underwent VNG at our institution, including the finding that half had no objective abnormality. This suggests that the dizziness symptoms reported by patients with CRS may be either transiently absent at the time of testing, undetectable by VNG, or nonvestibular in nature. However, any potential pathophysiologic relationship between these entities at present remains speculative.

This preliminary investigation is limited by its retrospective design, which relied on chart review and cannot definitely account for the indication or circumstances under which VNG was performed, and therefore it serves only to correlate 2 conditions with an unclear relationship. To that

**Table 3.** Subjective Symptom Description at Time of Videonystagmography.

Symptom, n (%)	CRS (n = 70)	No CRS (n = 3008)	P Value
Vertigo	44 (62.9)	1825 (60.7)	.711
Imbalanced	5 (7.1)	380 (12.6)	.170
Dizzy	5 (7.1)	275 (9.1)	.565
Lightheaded	5 (7.1)	151 (5.0)	.423
Dysequilibrium	0 (0)	40 (1.3)	.332
Unsteady	0 (0)	31 (1.0)	.393
Woozy	1 (1.4)	27 (0.9)	.644
Falling	0 (0)	21 (0.7)	.483
Other <sup>a</sup>	5 (7.1)	90 (3.0)	.047
No response	7 (10.0)	168 (5.6)	.115

Abbreviation: CRS, chronic rhinosinusitis.

<sup>a</sup>Responses categorized as "other" included ataxia, bobbing, bouncing, disorientation, dropping, drowsy, floating, foggy, heavy headed, leaning, nausea, pressure in head, presyncope, rocking, sinking, spatial disorientation, swaying, sinking, syncope, tilting, and wobbly.

end, prospective study using VNG testing of CRS patients with a complaint of dizziness would be informative. Another limitation is the inability to account for central nervous system adaptation, which could result in false-negative findings. VNG tests only the horizontal and posterior semi-circular canals and therefore offers an incomplete assessment of peripheral lesions; moreover, VNG findings may not correlate with actual vestibular symptoms. The status of receiving sinus surgery as a proxy for disease severity did not reveal differentiating results on VNG, although detailed description of CRS phenotype and medical treatments is lacking. Importantly, if VNG were performed during a nadir of symptoms following successful treatment of CRS, little if any difference would be expected between groups. Comorbid disease factors that could modify a perception of dizziness are likewise unaccounted for in the present report and should be carefully controlled in a future study.

## Conclusion

Among patients undergoing vestibular testing, there was no meaningful difference in the prevalence of vestibular dysfunction between patients with and without CRS. The clinical and pathophysiologic relationships between these conditions is unclear and warrants prospective study, including patient-reported outcome measures specific for vestibular dysfunction and a potential role of vestibular therapy in symptom management.

## Author Contributions

**Sabrina Brody-Camp**, acquisition of data, drafting, final approval, accountable for all aspects; **John A. Risey Jr**, design, acquisition of data, drafting, final approval, accountable for all aspects; **Edward D. McCoul**, conception and design, interpretation of data, drafting, final approval, accountable for all aspects.

## Disclosures

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