

## Case Report

# Circadian Anosmia: A Rare Clinical Presentation

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We report the case of a 27-year-old female who presented with a peculiar story of anosmia fluctuating in a circadian manner. Olfactory function appeared an hour after breakfast, was normal during daytime, and disappeared in the early evening. Imaging confirmed chronic rhinosinusitis (CRS). Initial systemic, followed by topical steroid treatment, rapidly and sustainably reversed this condition. The olfactory fluctuation paralleled the endogenous steroid production. This suggests that slight congestion changes in a chronically inflamed nasal mucosa may have been sufficient to induce this circadian anosmia. The importance of identifying fluctuation of olfactory function as a sign of CRS is emphasized and discussed.

**Key Words:** Chronic rhinosinusitis, fluctuation, anosmia, olfaction, circadian.

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## INTRODUCTION

Olfactory dysfunction is a widespread but generally underestimated condition.<sup>1</sup> Although some patients resign themselves to the deficit, smell loss can dramatically affect health, personal safety, and quality of life.<sup>2</sup> Common causes of olfactory impairment are head trauma and post-upper respiratory tract infections.<sup>3</sup> In these cases, no curative treatment is available. However, spontaneous recovery<sup>4</sup> or smell training may improve the condition over time.<sup>5–7</sup> In contrast, smell loss due to chronic rhinosinusitis (CRS), which is the most common cause of smell loss, can be successfully treated with high rates of olfactory recovery.<sup>8,9</sup> Therefore, otolaryngologists must be familiar with clinical elements leading to the diagnostic suspicion of CRS-related olfactory impairments. These elements are the cardinal symptoms and signs of CRS,<sup>10</sup> preserved retronasal olfactory function,<sup>11</sup> and smell improvement after systemic corticosteroid.<sup>12</sup> Another important symptom suggesting CRS is fluctuating olfactory function, a self-reported complaint that is not well investigated.<sup>13</sup> It may be caused by alteration in nasal airflow related to inflammation within the olfactory epithelium.<sup>14</sup>

We present a case of a patient suffering from CRS with olfactory fluctuation. This fluctuation reflected

daily cortisol changes related to circadian rhythm. We could sustainably cure the issue with treatment of the underlying chronic sinusitis.

## CASE REPORT

A 27-year-old female in good general health was referred to us for fluctuating olfactory function. The striking piece of information in the patient's history was the pattern of fluctuation. For the year preceding the consultation, the patient reported to wake up early in the morning around 7 AM without having any sense of smell. Olfactory function appeared approximately an hour after breakfast around 9 AM, which was normal and stable during daytime and disappeared in the early evening/late afternoon around 6:30 PM. The patient did not report phantosmia or parosmia. No head trauma or upper respiratory tract infection preceded the onset of this olfactory fluctuation. The patient's personal explanation was that it occurred after a quinsy tonsillectomy she had undergone a year earlier. The patient had seen her general practitioner and several ear, nose, and throat (ENT) specialists without feeling that she had been taken seriously and without receiving any treatment option. Unfortunately, we could not measure olfactory function very early in the morning or late in the afternoon, partly due to the patient's unavailability and our hospital logistics. We managed to measure olfactory function at noon by means of the Sniffin' Sticks, showing a threshold-discrimination-identification composite score of 36.5 points on the right side and 36.25 points on the left side,<sup>15</sup> indicating bilateral normosmia. Nasal endoscopy was normal as the rest of the ENT exam. Retronasal olfactory function was normal, with 10 odors recognized from the 10 presented.<sup>11</sup> Taste strip assessment showed 16 correctly identified tastants per side, confirming normal gustatory function.<sup>16</sup> The head-neck computed tomography (CT) scan performed at the time

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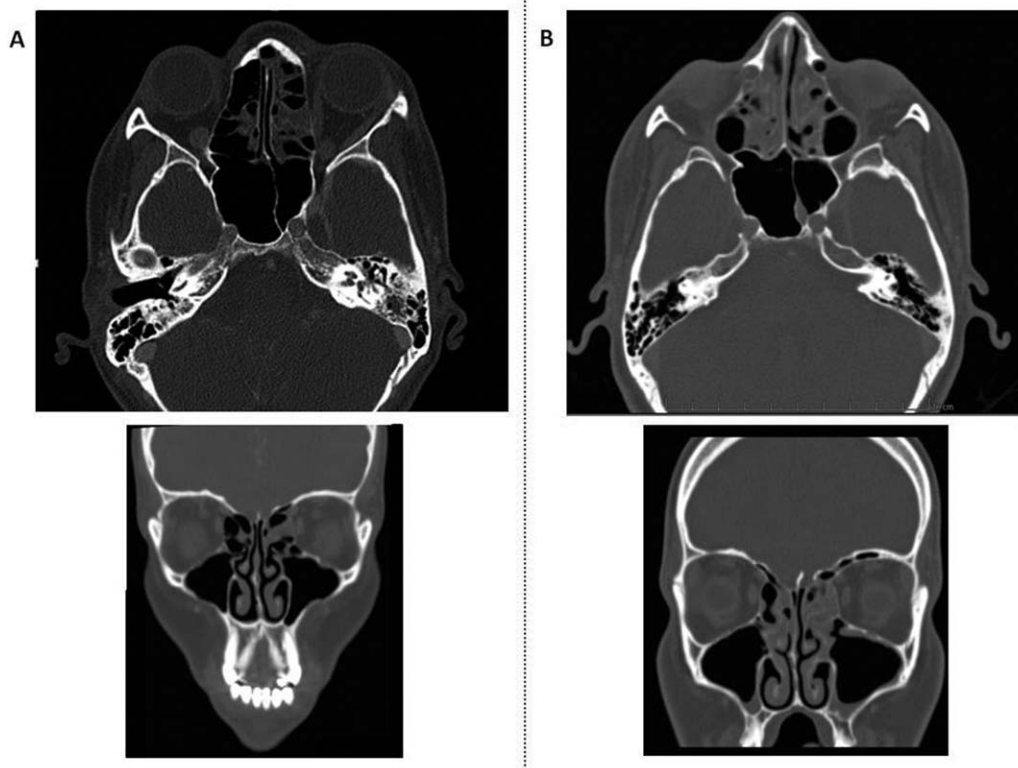


Fig. 1. (A) Head and neck CT scan done shortly before onset of the circadian anosmia. Partly congested ethmoid cells suggest a beginning chronic rhinosinusitis. (B) CT scan done shortly after the consultation for the circadian anosmia showing increased signs of chronic rhinosinusitis, with almost completely congested bilateral ethmoid cells. CT = computed tomography.

of quinsy tonsillectomy confirmed our suspicion of chronic rhinosinusitis, with parts of the ethmoid sinus being congested (Fig. 1A). We repeated the CT scan, which again showed signs of CRS that had meanwhile increased (Fig. 1B). In line with previous studies,<sup>8</sup> we initiated the treatment with 5 days of 50mg prednisolone once a day orally, followed by topical steroid treatment (fluticasone propionate 400 mcg twice/day) administered as drops (Flutinas Polynex, GlaxoSmithKline, Münchenbuchsee, Switzerland), in a head-overhanging midline position without side movements (modified Mygind position), for a month. This position was chosen in order to favor the drops to reach the upper part of the nasal cavity and potentially parts of the olfactory cleft.<sup>17</sup> Although classical modes of topical steroid administration seem to be ineffective for reaching the olfactory cleft,<sup>18</sup> several recent attempts with different head positions,<sup>19</sup> special devices,<sup>20</sup> or longer time in the head-downward position<sup>17</sup> seem to increase the likelihood for drops to reach the olfactory cleft. After 2 days of systemic prednisolone, the patient reported disappearance of the anosmia. One year after discontinuation of both systemic and topical steroid treatment, the patient is fine, without symptoms of olfactory dysfunction.

## DISCUSSION

The present case represents a hitherto not described form of fluctuating anosmia with a circadian

pattern. As with all previously reported forms of fluctuating olfactory symptoms, this case is also associated with chronic sinonasal disease.<sup>8,13,21</sup> This underlines that CRS should be actively searched in similar cases, even when the remaining CRS-related symptoms are lacking. Fluctuation of olfactory function is a pattern of olfactory dysfunction in CRS, similar to what could be recently observed by Whitcroft et al. in a retrospective analysis of the causes and related pattern of olfactory impairment in test results.<sup>22</sup> Taken together, the current literature provides evidence that CRS-related olfactory dysfunctions may appear also without other CRS-related symptoms in noticeably distinct forms. The particularity of the present case is the circadian appearance, with its potential of being overlooked; not taken seriously; or even worse, assigned to a psychological state of the patient. We have the feeling that peculiar forms of olfactory dysfunction remain unfamiliar to wide ranges of even specialized ENT physicians (e.g., the case we recently reported of a patient who had rapidly fluctuating anosmia<sup>21</sup>). Our hypotheses in the present case are an underlying mucosal congestion within the nasal and ethmoid cavities (Fig. 1A and 1B) that more or less were congested according to the endogenous release of cortisol. These slight congestional changes were probably sufficient to totally hamper or considerably alter the airflow to the olfactory cleft or the olfactory epithelium during the mentioned periods.

The normal human cortisol levels are determined by pulse-like secretions that peak at the early morning, have a plateau-phase during the day, and start to drop by late afternoon and then remain very low during the night.<sup>23,24</sup> This cortisol level is almost parallel to the patient's symptoms. The successful and sustainable treatment with corticosteroids strengthens our belief that subtle—cortisol-induced—changes in nasal mucosal congestion were sufficient to generate the symptoms. Further support comes from work by Nordin et al., who investigated the circadian changes of normal olfactory function as well as many parameters such as sleepiness, nasal volume, and oral temperature.<sup>25</sup> Although they did not per se find circadian changes of olfactory function,<sup>26</sup> they found significant changes in variability of olfactory thresholds throughout the daytime, with the lowest variability in the night (4 AM). They also nicely showed that nasal volume is the lowest in the night hours and increases during the day, with a peak at 4 PM. This parallels the previously mentioned endogenous cortisone levels and supports the idea of a slight decongestant effect on the normal human mucosa. We have the feeling that their findings may support our hypothesis of circadian nasal congestion/decongestion in relation to endogenous cortisone, thus exerting an air-flow relevant decongestion.

The presentation of this case has several shortcomings that make the story less appealing. First, we (especially the patient) were unable to measure olfactory function at night. This would have provided a formal confirmation of the anosmia. Second, we did not measure continuous blood samples with endogenous cortisol levels. However, even without these two elements, we believe that the present case has its value as clinical presentation that might have been observed by other clinicians but has not yet been reported. We hope this case helps other colleagues who might be puzzled by such an unusual strange presentation of olfactory disorder.

## CONCLUSION

We present a hitherto not described form of fluctuating anosmia with a circadian pattern. It is suggested that it is related to nasal mucosa congestion changes dependent on the endogenous cortisol secretion in a patient with preexisting chronic rhinosinusitis. Clinical symptoms such as olfactory fluctuation, whatever the on-off pattern, should always guide to active inquiry and searching for chronic rhinosinusitis.

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