

FIGURE 1. A, Complete ptosis of the right upper eyelid was observed. Motility of both eyes was limited in upgaze, downgaze, and adduction. B, Computed tomography scan revealed an internally hypodense, well-enhanced necrotic mass measuring 5 × 4 cm, with involvement of both the sphenoid and ethmoid sinuses and the upper nasal cavity, pituitary fossa, both cavernous sinuses, and the pituitary stalk with bony wall destruction.

findings were within normal limits, except for increased β_2 -microglobulin, at 3.48 mg/L. An immediate endoscopic sphenoidotomy was performed under general anesthesia. Endoscopic examination revealed a mucopurulent discharge in both sphenothmoidal recesses, and yellowish polypoid tissue showing severe adhesion was observed in both sphenoid sinuses; a biopsy was performed. Frozen section analysis was consistent with malignant neoplasm of lymphoid cells. The final histological diagnosis was non-Hodgkin lymphoma (NHL), of the diffuse large B-cell type, which has uniform, round-to-oval nuclei with vesicular chromatic and high nuclear-to-cytoplasmic ratio (Fig. 2A). Tumor cells were immunopositive for CD20 (Fig. 2B). The patient was referred to medical oncology for a staging workup, including bone marrow biopsy and positron emission tomography, all of which were negative. The patient finally had stage IE and received 6 cycles of chemotherapy consisting of R-CHOP (rituximab, cyclophosphamide, adriamycin, vincristine, and prednisone). Visual acuity, ptosis, and ocular motility were improved after 6 weeks (Fig. 3A), and CT showed no local recurrence of lymphoma in the nasal cavity and paranasal sinuses (Fig. 3B). This clinical report was approved by the institutional review board of the Korea University Ansan Hospital.

DISCUSSION

Between 70% and 80% of NHLs are nodal lymphomas; the most common extranodal localizations are the gastrointestinal tract, skin, and nervous system. One of the rarest extranodal sites (0.44%) is the sinonasal tract. Prevalence of primary nasal cavity involvement is 0.37% of all extranodal NHL sites.^{4,5} Non-Hodgkin lymphomas of the sinonasal tract account for 0.17% of all malignant lymphomas at all ages.⁶ Depending on the phenotype and grade, lymphoma of the nasal cavity may present with a wide variety of symptoms. Low-grade lymphoma generally presents as a mass obstructing the nasal airway, whereas high-grade lymphoma more often causes aggressive signs and symptoms such as nonhealing ulcers, epistaxis, visual disturbances, facial pain, and cranial nerve impairment. Diagnosis of paranasal lymphoma is usually delayed. Initially, tumors in this area cause very few symptoms and are at an advanced stage at the time of diagnosis. The early stage is often asymptomatic, and a complete investigation is postponed until the gross tumor produces obvious symptoms.⁷

Most primary tumors of the paranasal sinuses present with pain and cranial nerve palsies. More than 50% of patients with sinus tumors present with orbital and eye manifestations, and up to 70% show orbital involvement on the initial radiological evaluation.

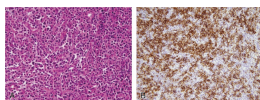


FIGURE 2. Diffuse infiltrate of neoplastic centroblasts shows uniform and round-to-oval nuclei with a high nuclear-to-cytoplasmic ratio (hematoxylin-eosin stain, original magnification ×40). Histology of the tissue showed immunoblasts that were strongly immunoreactive for B-cell markers CD20, with a diagnosis of diffuse large B-cell lymphoma (hematoxylin-eosin stain, original magnification ×40).

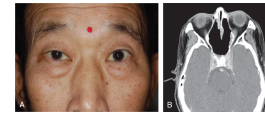


FIGURE 3. Visual acuity, ptosis, and ocular motility were improved after 6 weeks. Computed tomography showed no local recurrence of lymphoma in the nasal cavity and paranasal sinuses.

Orbital apex syndrome has been previously described as a syndrome involving damage to the oculomotor nerve (III), trochlear nerve (IV), abducens nerve (VI), and ophthalmic branch of the trigeminal nerve (V1) in association with optic nerve dysfunction. Cavernous sinus syndrome may include features of orbital apex syndrome with added involvement of the maxillary branch of the trigeminal nerve (V2) and oculosympathetic fibers.¹ Our patient showed eye manifestation with facial hypesthesia due to involvement of the second and third cranial nerves and V1. Differential diagnosis of CSS includes orbital and sinus infection, idiopathic inflammatory pseudotumor, vasculitis, and cavernous sinus lesions, as well as neoplasms of the orbit, sphenoid wing, sinuses, nasopharynx, or parasellar region.³

A high index of suspicion of sinus malignancy in any patient with a history of chronic sinusitis in combination with cranial neuralgia or orbital symptoms and signs should be considered. Awareness of these symptoms and subsequent early diagnosis are important for effective treatment of this life-threatening malignancy.

REFERENCES

1. Lee JH, Lee HK, Park JK, et al. Cavernous sinus syndrome: clinical features and differential diagnosis with MR imaging. *AJR Am J Roentgenol* 2003;181:583–590
2. Oprea C, Cainap C, Azoulay R, et al. Primary diffuse large B-cell non-Hodgkin lymphoma of the paranasal sinuses: a report of 14 cases. *Br J Haematol* 2005;131:468–471
3. Yeh S, Foroozan R. Orbital apex syndrome. *Curr Opin Ophthalmol* 2004;15:490–498
4. Cleary KR, Batsakis JG. Sinonasal lymphomas. *Ann Otol Rhinol Laryngol* 1994;103:911–914
5. Duncavage JA, Campbell BH, Hanson GA, et al. Diagnosis of malignant lymphomas of the nasal cavity, paranasal sinuses and nasopharynx. *Laryngoscope* 1983;93:1276–1280
6. Park YM, Cho JH, Cho JY, et al. Non-Hodgkin's lymphoma of the sphenoid sinus presenting as isolated oculomotor nerve palsy. *World J Surg Oncol* 2007;5:86
7. Logsdon MD, Ha CS, Kavadi VS, et al. Lymphoma of the nasal cavity and paranasal sinuses: improved outcome and altered prognostic factors with combined modality therapy. *Cancer* 1997;80:477–488

Effects of Systemic Immunotherapy on Olfactory Function in Allergic Rhinitis Patients

Deniz Tansuher, MD,* Berna Uslu Coşkun, MD,†
Yusuf Orhan Uçal, MD,‡ Esra Sözen, MD,†
Cem Erdurak, MD,§ Erdal Sakalli, MD||

Objective: Allergic rhinitis (AR), a chronic inflammatory disorder of the nasal mucosa, affects approximately 20% of the world's

population and often causes olfactory dysfunction. Conventional treatments cannot cure it, but only alleviate and control the symptoms. Systemic immunotherapy (SIT) is the only curative treatment for AR, but its positive effect on olfactory function has not been quantitatively demonstrated. We measured the olfactory function in patients using a “Sniffin’ Sticks” test and analyzed the effects of subcutaneous SIT.

Methods: The study included 12 patients (aged 13–44 years) who were eligible to receive subcutaneous SIT to treat AR between 2010 and 2012 in the Department of Otolaryngology, Sisli Etfal Training and Research Hospital. A 3-step Sniffin’ Sticks test was performed before and 18 months after subcutaneous SIT. The data collected before and after treatment were compared for each patient.

Results: The average scores for smell test parameters increased after treatment. Although improvements in the mean threshold, mean discrimination, and mean total scores were not significant, the mean identification score was significantly improved after treatment ($P < 0.05$). Age, sex, and smoking were not significantly related to the changes in the parameters.

Conclusions: Subcutaneous SIT improved the olfactory performance in AR patients. Additional studies with larger patient populations and longer follow-up periods are needed to establish subcutaneous SIT as an effective treatment for olfactory disorders in these patients.

Key Words: Allergic rhinitis, subcutaneous systemic immunotherapy, Sniffin’ Sticks smell test

Allergic rhinitis (AR), a chronic inflammatory disorder of the nasal mucosa, affects approximately 20% of the world’s population and often causes olfactory dysfunction, with 54% of AR patients complaining of a decreased sense of smell.¹ Objective testing has revealed a decreased sense of smell in a lower, but still substantially important, percentage of AR patients,^{1,2} and the incidence of severe olfactory dysfunction in AR patients is accepted as 21% to 23%.^{1,3}

The cause of the decreased sense of smell in AR patients is thought to be obstruction of the air flow reaching the olfactory fissure secondary to edema of the nasal mucosa due to inflammation.⁴ However, hyposmia is not observed during normal daily changes in nasal resistance during the nasal cycle.^{5,6} In addition, surgical and/or medical treatments that reduce nasal obstruction by decreasing nasal mucosa edema may not adequately treat hyposmia.⁴ These findings, demonstrated in several studies, indicate that nasal obstruction is not the only mechanism of olfactory dysfunction related to AR.⁴ An alternative mechanism is that the allergic inflammation damages the olfactory epithelium, directly causing

olfactory dysfunction.⁴ In a study performed by Kern,⁷ which examined inflammatory factors in chronic sinusitis, inflammatory infiltrates were observed in human olfactory epithelial biopsy specimens. These cells also play significant roles in AR.⁴

Treatments for AR include lifestyle changes to decrease allergen exposure, oral and topical H1-antihistamines, intranasal glucocorticoids, leukotriene antagonists, cromolyns, decongestants, anticholinergics, systemic glucocorticoids, and systemic immunotherapy (SIT).^{8,9} All of these treatment methods except SIT aim to decrease or prevent the symptoms of AR disease. Systemic immunotherapy, which was first performed in 1911 but not widely practiced until the 1960s and 1970s, is the only treatment option capable of changing the natural course of AR because SIT controls the underlying immune response.^{10,11} In allergen-specific immunotherapy, tolerance to a certain allergen is induced by administering gradually increasing doses to the patient.¹² Among other treatment methods, intranasal steroids have been shown to decrease olfactory dysfunction in AR patients.¹³ Intranasal steroids are thought to be beneficial by directly decreasing inflammation and edema in the nasal mucosa, thereby improving the delivery of air and odor molecules to the olfactory fissure.⁴

The benefits of SIT for olfactory dysfunction have been evaluated clinically and nonquantitatively via patient questionnaires, but no quantitative analysis has been reported. The “Sniffin’ Sticks” test, which is becoming more widely used especially in European clinics, is a diagnostic tool to quantitatively evaluate the sense of smell by determining the detection threshold, discrimination, and identification of odors.¹⁴ The aim of the current study was to use the Sniffin’ Sticks test to quantitatively demonstrate the effects of subcutaneous SIT on olfactory dysfunction in AR patients.

PATIENTS AND METHODS

The study group was selected from among patients with AR who were eligible for SIT in the Department of Otolaryngology of the Sisli Etfal Training and Research Hospital (Istanbul, Turkey) between 2010 and 2012. Inclusion criteria were as follows: AR symptoms including olfactory loss from mild to severe, a diagnosis of AR based on history, physical examination, and allergy tests; inability to achieve the desired alleviation of symptoms despite previous topical or systemic drug treatment; sensitivity to at least 1 and at most 3 of the tested allergens; positive (high) specific immunoglobulin E levels against the allergen(s) to which the patient was sensitive; and patient acceptance of SIT. To maintain patient homogeneity, only subcutaneous SIT patients were included in the study. Exclusion criteria were as follows: any contraindication for subcutaneous SIT; additional anatomic or systemic disease that decreased olfactory function such as chronic sinusitis, nasal polyposis, clinically significant nasal septal deviation, and so on; inability to complete SIT because of patient’s preference or allergic reaction; any mental or motor conditions that would inhibit olfactory testing; and necessity for β -blocker antiarrhythmic or antihypertensive drugs. The patients did not use any AR medication including intranasal steroid and antihistaminic during the study.

All potential participants were provided with detailed information regarding the study. Eleven patients between the ages of 18 and 44 years met all the criteria and provided informed consent to be included in the study. In addition, the family of a patient younger than 18 years also provided informed consent. Thus, 12 patients were enrolled in the study. The study protocol was approved by the ethics committee at Sisli Etfal Training and Research Hospital.

The Sniffin’ Sticks test was used to determine the threshold, discrimination, and identification of odors before and 18 months after subcutaneous SIT. The instructional guide for the 3-part

From the *Department of Otolaryngology, Devrek State Hospital, Devrek, Zonguldak; †Department of Otolaryngology, Sisli Etfal Training and Research Hospital, Istanbul; ‡Department of Otolaryngology, Ercis State Hospital, Ercis, Van; and §Department of Otolaryngology, Hisar Intercontinental Hospital, and ||Department of Otolaryngology, Safa Hospital, Istanbul, Turkey.

Received June 30, 2013.

Accepted for publication November 14, 2013.

Address correspondence and reprint requests to Yusuf Orhan Uçal, MD, Department of Otolaryngology–Head and Neck Surgery, Ercis State Hospital, 65400, Ercis, Van, Turkey; E-mail: orhanucal@gmail.com

The authors report no conflicts of interest.

Copyright © 2014 by Mutaz B. Habal, MD

ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000000599

TABLE 1. Results of Olfactory Testing Before and After Treatment of the 12 Patients Who Received Subcutaneous Systemic Immunotherapy

Patient	Age	Sex	Smoking	Threshold		Discrimination		Identification		Total Score	
				Before	After	Before	After	Before	After	Before	After
1	31	Male	—	6	8	11	13	11	13	28	34
2	35	Female	+	3	0	7	2	7	5	17	7
3	42	Female	—	0	2	0	3	0	5	0	10
4	26	Male	—	4	6	5	7	5	8	14	21
5	28	Female	+	7	8	3	7	11	12	21	27
6	13	Female	—	7	6	10	10	10	15	27	31
7	35	Male	—	5	5	6	6	10	10	21	21
8	36	Female	—	6	6	7	12	13	14	26	31
9	29	Female	—	6	7	11	12	13	14	30	33
10	23	Male	—	6	8	8	10	8	10	22	28
11	44	Female	+	1	3	8	9	9	11	18	23
12	26	Male	+	5	6	10	9	11	11	26	26

Sniffin' Sticks test was precisely followed. First, each patient smelled Sniffin' Sticks containing n-butanol at various concentrations, which were scored on an intensity scale of 1 to 16 (1, most intense; 16, most diluted), and the lowest detectable score was recorded as the threshold value. For smell discrimination, each patient smelled 3 Sniffin' Sticks, 2 containing the same odor and 1 containing a different odor, to determine whether the patient could distinguish between the odors; the number of correct answers in 16 attempts was recorded. Finally, for smell identification, each patient was asked to identify each odor on the Sniffin' Sticks by choosing among 4 possibilities, and the number of correct answers on a total of 16 questions was recorded.

The Wilcoxon signed rank test was used to compare the threshold, discrimination, and identification values; the sum of these 3 values (total score) between before and 18 months after subcutaneous SIT was recorded. The relationships between these parameters and age, sex, and smoking status were analyzed by repeated-measures analysis of variance (ANOVA). $P < 0.05$ was considered to indicate significance.

RESULTS

Twelve patients ranging in age from 13 to 44 years (mean, 30.67 [SD, 8.51] years) were included in this study (Table 1). Men comprised 41.67% ($n = 5$) of the patients and had a mean age of 28.2 (SD, 4.76) years. Women, with a mean age of 32.4 (SD, 10.4) years, represented 58.33% ($n = 7$) of the patients.

Although the mean values for all of the Sniffin' Sticks test parameters were higher after SIT compared with the respective values before SIT, only 1 parameter (mean identification value) changed significantly (Table 2).

TABLE 2. Comparison of the Mean Olfactory Test Parameters Before and After Subcutaneous Systemic Immunotherapy

	Before	After	<i>z</i>	<i>P</i>
	Mean (SD)	Mean (SD)		
Threshold	4.67 (2.27)	5.42 (2.54)	−1560	0.119
Discrimination	7.17 (3.33)	8.33 (3.47)	−1640	0.101
Identification	9.00 (3.67)	10.67 (3.31)	−2265	0.024
Total score	20.83 (8.16)	24.33 (8.58)	−1842	0.065

Wilcoxon signed rank test.

The effects of patient age, sex, and smoking status on the parameter that showed significant improvement (identification value) were examined by ANOVA. The results showed that none of the 3 factors had a significant association with the identification value (Table 3).

DISCUSSION

The current study used the Sniffin' Sticks test to quantitatively evaluate the effects of subcutaneous SIT on decreased olfactory performance in AR patients. The mean values of all 3 olfactory parameters and the total score measured with the Sniffin' Sticks were higher 18 months after SIT than before, although only the increase in the mean identification value was significant ($P < 0.05$). Age, sex, and smoking status did not affect the olfactory parameters. Our study demonstrates that allergen-specific immunotherapy can improve olfactory performance in AR patients. No study investigating the effects of subcutaneous SIT or sublingual SIT (a newer method) on olfactory dysfunction in AR patients has been previously reported.

A decreased sense of smell is a common symptom of AR.^{1,2,15,16} Studies have shown that 50% of patients with AR have partial or complete loss of sense of smell.^{1,15} In addition, the severity and duration of olfactory dysfunction may be greater in AR patients with existing sinonasal diseases.^{15,17} Patients with AR also have an increased risk for the development of upper respiratory tract infections, further decreasing olfaction.^{18,19}

Although hyposmia has been observed in 23% to 88% of AR patients,^{1,20,21} the pathogenesis of olfactory dysfunction in AR has not been fully elucidated.¹⁵ The most widely accepted potential causes include obstruction and inflammation. Guilemany et al¹⁵ showed that decongestion in the nasal mucosa induced by epinephrine did not increase olfactory functions and suggested that the mutual effects of

TABLE 3. Effects of Patient Age, Sex, and Smoking Status on the Identification Score

Demographic Properties				
	Age	Sex	Smoking	
Olfactory test parameter	Identification	$P = 0.583$	$P = 0.357$	$P = 0.100$
Repeated-measures ANOVA.				

obstruction and inflammation explain olfactory dysfunction in AR patients. Other studies have shown that the degree of nasal obstruction in AR patients is not correlated with the degree of decreased sense of smell,^{15,22,23} indicating that inhibited delivery of smell particles to the olfactory epithelium owing to nasal congestion can only partially explain olfactory dysfunction in AR. All of these studies implicate the inflammatory process in the development of olfactory dysfunction in AR.²⁴

By reducing inflammation, intranasal steroid treatment may improve olfaction in AR patients.²⁵ Intranasal steroids decreased the number of eosinophils in the nasal region, demonstrating an effect on allergic inflammation in the olfactory epithelium.⁴ Sivam et al⁴ reported that the quality of life increased in terms of sense of smell in 85% of the AR patients who received intranasal steroid treatment for a decreased sense of smell, although olfactory tests performed before and after treatment did not show a significant improvement.

Allergic rhinitis is one of the most common causes of conduction-type olfactory dysfunction.^{1,26} Damm et al²⁷ showed that the volume of the nasal valve region was correlated with the olfactory threshold value. However, the etiology of olfactory dysfunction in AR patients involves more than physical inhibition of the delivery of odor molecules to the olfactory mucosa in the skull base.²⁸ In AR patients, hyposmia also arises from inflammatory dysfunction of the neuroepithelium, inflammatory hypersecretion, and mucosal destruction.^{1,17} Allergic rhinitis patients who are predisposed to nasal infections display functional and morphological changes in the olfactory cilia, dendrites, and neurons, and the quantity and function of the olfactory mucus are altered in these patients.^{29,30} In contrast to olfactory threshold values, olfactory discrimination and identification measurements reflect the central nervous system component of olfaction.³¹

The Sniffin' Sticks test of olfactory performance has been recommended by the German Olfactology and Gustology Committee and accepted as a standard test.³² The Sniffin' Sticks test quantitatively evaluates the sense of smell in terms of threshold, discrimination, and identification parameters. It is becoming more widely used as a diagnostic tool for olfactory dysfunction, especially in European clinics. Nevertheless, this test can be affected by factors including age, sex, the nostril tested (right, left, or both), the environment/climate, and smoking status.¹⁴ Based on the Sniffin' Sticks test, Katotomichelakis et al¹⁴ reported that olfactory performance was lower in children younger than 15 years and in adults older than 55 years and that olfactory sensitivity was better in women than in men. Katotomichelakis et al¹⁴ also reported that the right nostril had better olfactory function than the left, that smelling with both nostrils gave better olfactory performance compared with each nostril separately, and that chronic smoking decreased olfactory performance. In our study, we eliminated all variables that might have affected the performance scores except the treatment and compared the olfactory parameters determined before and after the treatment. In addition, both nostrils were used for smelling the Sniffin' Sticks in our study.

The Sniffin' Sticks test is a convenient and reliable method for determining the olfactory dysfunction, which can be related to different systemic and nasal diseases, and for long-term clinical follow-up of these diseases, it is also useful for establishing olfactory performance according to age and sex in medicolegal situations such as traffic accidents or cranial trauma and for measuring olfactory function following sinonasal surgery.¹⁴ We chose the Sniffin' Sticks test for our study because it allowed the quantitative assessment of olfactory function for determining the efficacy of subcutaneous SIT in the treatment of olfactory dysfunction in AR patients.

A limitation of the current study was the small sample size. Only 12 patients could be included in the study because of the specific subcutaneous SIT indication criteria, inconvenience of the treatment for the patient, low patient compliance, high cost, potential

risks, and voluntary nature of the study. The relatively small sample size may explain the statistical insignificance of the improvements in some parameters.

CONCLUSIONS

The current study indicates that subcutaneous systemic immune treatment can improve olfactory function in AR patients, but studies with larger populations and longer follow-up times are necessary to confirm this.

REFERENCES

- Cowart BJ, Flynn-Rodden K, McGeady SJ, et al. Hyposmia in allergic rhinitis. *J Allergy Clin Immunol* 1993;91:747-751
- Meltzer EO, Jalowayski AA, Orgel HA, et al. Subjective and objective assessments in patients with seasonal allergic rhinitis: effects of therapy with mometasone furoate nasal spray. *J Allergy Clin Immunol* 1998;102:39-49
- Rydzewski B, Pruszecki A, Sulkowski WJ. Assessment of smell and taste in patients with allergic rhinitis. *Acta Otolaryngol* 2000;120:323-326
- Sivam A, Jeswani S, Reder L, et al. Olfactory cleft inflammation is present in seasonal allergic rhinitis and is reduced with intranasal steroids. *Am J Rhinol Allergy* 2010;24:286-290
- Eccles R, Jawad MS, Morris S. Olfactory and trigeminal thresholds and nasal resistance to airflow. *Acta Otolaryngol* 1989;108:268-273
- Doty RL, Frye R. Influence of nasal obstruction on smell function. *Otolaryngol Clin North Am* 1989;22:397-411
- Kern RC. Chronic sinusitis and anosmia: pathologic changes in the olfactory mucosa. *Laryngoscope* 2000;110:1071-1077
- Topuz B, ed. Türkiye Klinikleri. *J Allergy Spec Top* 2010;3:37-42
- Önerci M, ed. Medical treatment in allergic rhinitis. *Curr Man Otorhinolaryngol Head Neck Surg* 2007;3:44-48
- Jacobsen L, Dreborg S, Moller C, et al. Immunotherapy as a preventive treatment. *J Allergy Clin Immunol* 1996;97:232
- Durham S, Walker SM, Varga EM, et al. Longterm clinical efficacy of grass-pollen immunotherapy. *N Engl J Med* 1999;341:468-475
- Topuz B, ed. Türkiye Klinikleri. *J Allergy Spec Top* 2010;3:43-47
- Goodspeed RB, Gent JF, Catalanotto FA, et al. Corticosteroids in olfactory dysfunction. In: Meiselman HL, ed. *Clinical Measurement of Taste and Smell*. New York: McMillan, 1986:514-518
- Katotomichelakis M, Balarsouras D, Tripsianis G, et al. Normative values of olfactory function testing using the "Sniffin Sticks". *Laryngoscope* 2007;117:114-120
- Guilemany JM, Pinero AG, Alobid I, et al. Persistent allergic rhinitis has a moderate impact on the sense of smell, depending on both nasal congestion and inflammation. *Laryngoscope* 2009;119:233-238
- Apter AJ, Mott AE, Frank ME, et al. Allergic rhinitis and olfactory loss. *Ann Allergy Asthma Immunol* 1995;75:311-316
- Apter AJ, Gent JF, Frank ME. Fluctuating olfactory sensitivity and distorted odor perception in allergic rhinitis. *Arch Otolaryngol Head Neck Surg* 1999;125:1005-1010
- Duncan HJ, Seiden AM, Paik SI, et al. Differences among patients with smell impairment resulting from head trauma, nasal disease, or prior upper respiratory infection. *Chem Senses* 1991;16:517
- Papi A, Johnston SL. Rhinovirus infection induces expression of its own receptor intercellular adhesion molecule 1 (ICAM-1) via increased NF-kappaB-mediated transcription. *J Biol Chem* 1999;274:9707-9720
- Church JA, Bauer H, Bellanti JA, et al. Hyposmia associated with atopy. *Ann Allergy* 1978;40:105-109
- Fein BT, Kamin PB, Fein NN. The loss of sense of smell in nasal allergy. *Ann Allergy* 1996;24:278-283
- Lane AP, Zweiman B, Lanza DC, et al. Acoustic rhinometry in the study of the acute nasal allergic response. *Ann Otol Rhinol Laryngol* 1996;105:811-818

23. Hinriksdottir I, Murphy C, Bende M. Olfactory threshold after nasal allergen challenge. *ORL J Otorhinolaryngol Relat Spec* 1997;59:36–38
24. Higo R, Ichimura K, Ota Y, et al. Investigation of anosmic zones associated with nasal allergy. *Nippon Jibiinkoka Gakkai Kaiho* 1996;99:1648–1652
25. Hilberg O. Effect of terfenadine and budesonide on nasal symptoms, olfaction, and nasal airway patency following allergen challenge. *Allergy* 1995;50:683–688
26. Seiden AM, Duncan HJ. The diagnosis of a conductive olfactory loss. *Laryngoscope* 2001;111:9–14
27. Damm M, Vent J, Schmidt M, et al. Intranasal volume and olfactory function. *Chem Senses* 2002;27:831–839
28. Katotomichelakis M, Riga M, Davris S, et al. Allergic rhinitis and aspirin-exacerbated respiratory disease as predictors of the olfactory outcome after endoscopic sinus surgery. *Am J Rhinol Allergy* 2009;23:348–353
29. Vento SI, Simola M, Ertama LO, et al. Sense of smell in long-standing nasal polyposis. *Am J Rhinol* 2001;15:159–163
30. Klimek L, Eggers G. Clinical aspects of allergic disease. Olfactory dysfunction in allergic rhinitis is related to nasal eosinophilic inflammation. *J Allergy Clin Immunol* 1997;100:158–164
31. Kobal G, Barz S, Hummel T. A combined psychophysiological and electrophysiological olfaction test. *Chem Senses* 1992;17:850–851
32. Hummel T, Sekinger B, Wolf SR, et al. 'Sniffin' Sticks': olfactory performance assessed by the combined testing of odor identification, odor discrimination, and olfactory thresholds. *Chem Senses* 1997;22:39–52

Radiologic Misunderstanding of Cutaneous Angiomyolipoma in the Alar Base

Hyun Ho Han, MD, Jong Yun Choi, MD, Bommie F. Seo, MD, Suk Ho Mun, MD, Jong Won Rhie, MD, Sang Tae Ahn, MD, Deuk Young Oh, MD

Abstract: In this article, we will examine a case of cutaneous angiomyolipoma in the right nasal alar base area of a 36-year-old man. Generally, angiomyolipoma occurs in the kidney and, histologically, has features that are similar to cutaneous angiomyolipoma: smooth muscle cells, mature adipose cells, and a convoluted thick-walled blood vessel. Clinically, renal angiomyolipoma is related to tuberous sclerosis, but cutaneous angiomyolipomas occur very rarely, with a total of only 23 cases documented in the literature, with 39% (9/23) of those cases occurring in the ear or surrounding areas.

In particular, the abundance of blood vessels inside a cutaneous angiomyolipoma produces good enhancement on computed tomographic image, making it easy for the tumor to be mistaken for a

vascular tumor. In this particular case, we will report about a previously unheard case of cutaneous angiomyolipoma occurring in the nasal alar base that was mistaken for a vascular tumor.

Key Words: Angiomyolipoma, cutaneous, kidney

A 36-year-old man visited the clinic with a mass that was slowly expanding in his right nasal alar base area. The painless mass, approximately 1 × 1 cm in size, was palpable just below the dermis, showing a slightly bluish color underneath normal skin (Fig. 1). The absence of symptoms led us to believe that this was not tuberous sclerosis because characteristics such as hypopigmented macules, facial angiofibromas, or shagreen patches were not found, nor did the patient have any family history or personal history of such disorders. Before radiologic examination to detect a predicted epidermoid inclusion cyst or lymph node, an enhanced computed tomographic (CT) scan was performed. The CT scan showed the muscle density to be similar to that of surrounding tissue, but once it was contrast enhanced, a highly homogenous and dense 1.2-cm nodular mass was found, which, in the opinion of the radiologist, was a vascular tumor (Fig. 2).

During surgery on this patient, a well-encapsulated mass with clear boundaries was found, and total excision was performed (Fig. 3).

From the histologic examination, the mass was surrounded by a capsule of fibrouslike tissue, and it contained mature adipose cells, smooth muscle cells, and a convoluted thick-walled blood vessel, which are all standard characteristics of a typical angiomyolipoma (Fig. 3). Immunohistochemistry examination included staining with smooth muscle myosin heavy chain antibody and HMB-45 stains, and only the smooth muscle myosin heavy chain stain tested positive, whereas HMB-45 proved negative, leading us to diagnose the lesion as cutaneous angiomyolipoma (Fig. 4).

DISCUSSION

Angiomyolipoma is a benign hamartomatous lesion, generally found in the kidneys of patients with tuberous sclerosis.¹ It is occasionally found in areas other than the kidney, such as the liver,² but the cutaneous form of the tumor is very rare. Cutaneous angiomyolipoma



FIGURE 1. Preoperative photograph. A bluish mass appearing under the skin.

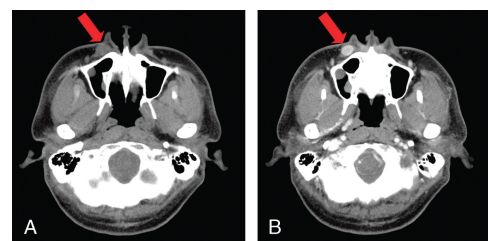


FIGURE 2. CT findings. When contrast was enhanced, a homogeneous high-density encapsulated tumor was spotted. A, before enhancement; B, after enhancement.

From the Department of Plastic Surgery, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea.

Received September 9, 2013.

Accepted for publication November 14, 2013.

Address correspondence and reprint requests to Deuk Young Oh, MD,

Department of Plastic Surgery, Seoul St. Mary's Hospital, 505

Banpo-dong, Seocho-gu, Seoul, Republic of Korea, 137-701;

E-mail: ohdeuk1234@hanmail.net

The authors report no conflicts of interest.

Copyright © 2014 by Mutaz B. Habal, MD

ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000000600