

Significance of imaging in the diagnosis of olfactory disorder

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Abstract

Objectives/Hypothesis: To report the utilization and cost effectiveness of magnetic resonance imaging (MRI) in the evaluation of patients with idiopathic olfactory loss.

Methods: A retrospective review of patients presenting with olfactory disorders at Nalanda Medical College and Hospital, Patna from July 2014 through October 2015 was performed to determine the diagnostic utility of MRI in the evaluation of patients with idiopathic olfactory loss.

Results: In a cohort of 839 patients with olfactory loss, idiopathic olfactory loss was most common, accounting for 247 patients—or 29% of this cohort. MRI was used in the evaluation of idiopathic olfactory loss 54.9% of the time, and abnormalities were identified in 4.6% of these patients. However, only 0.8% of these patients had olfactory loss attributable to imaging abnormalities.

Conclusion: In this cohort of patients with olfactory loss, the etiology most commonly remained idiopathic. Brain MRI, though frequently performed, demonstrated a very low diagnostic yield, with a rate of abnormal findings similar to that seen in the normal population. Based on these data, the routine use of MRI in patients presenting with isolated idiopathic olfactory loss may be unwarranted. Selection bias may contribute to the low yield of MRI among this cohort; further studies are needed to characterize those patients most likely to benefit from MRI evaluation.

Keywords: olfaction, anosmia, magnetic resonance imaging, cost effectiveness

1. Introduction

Olfactory dysfunction may include hyposmia (partial loss of smell), anosmia (complete loss of smell), phantosmia (a perceived scent or odor not produced by an external stimulus), and parosmia (a change in the usual perception of a scent or odor). These olfactory disorders have myriad etiologies, including postupper respiratory illness (post-URI), trauma, toxic exposures, obstruction (due to nasal or sinus disease), and congenital etiologies. Olfactory disturbance has also been seen in several neurologic diseases, most notably Parkinson's disease, multiple sclerosis, and Alzheimer's disease [1-5].

Reduced olfactory acuity is also considered to be part of the normal aging process [6]. Commonly, the etiology remains unknown despite an extensive evaluation, and in these cases it is considered idiopathic. Currently, there is no standardized workup for the patient with olfactory loss, although various authors have advocated diagnostic interventions ranging from endoscopic examination to magnetic resonance imaging (MRI) as part of a routine evaluation and examination [7-9].

Previous work has demonstrated the utility of nasal endoscopy in diagnosing an obstructive olfactory loss, despite a history that suggests otherwise [7]. It is important that a validated test be used to measure olfactory function as self-assessment of olfaction has been shown to be unreliable [11].

In this era of increased awareness of the cost of health care, it is important that we critically analyze expensive diagnostic techniques such as MRI in order to utilize them most effectively. As such, this retrospective review of patients with idiopathic olfactory loss attempts to identify both the frequency of MRI utilization as well as the diagnostic yield of this imaging technique in patients with idiopathic olfactory loss.

2. Materials and Methods

Radiologists' interpretations of brain MRIs were used when extracting data from charts. Nonspecific findings identified by the radiologist, such as diffuse vascular disease and age-related changes, were not considered abnormal for the purpose of data analysis. Abnormal MRI findings were then classified as either incidental or potentially responsible for olfactory disorders.

3. Results

The charts of 839 patients presenting with olfactory loss were reviewed; their characteristics are presented in Table I. The presumptive etiology of patients' olfactory disorders, as assessed by the treating physician, were assigned one of the following categories: post-URI, obstructive, traumatic, congenital, toxic exposure, or idiopathic.

As some patients' olfactory loss was thought to be multifactorial or could not be ascertained from chart review, these patients were grouped with other miscellaneous causes for the purpose of data analysis. Two hundred forty-seven patients were identified who presented with presumed idiopathic olfactory loss, representing 29% of all patients with olfactory loss in this cohort. Although all patients presenting with idiopathic olfactory loss were recommended to undergo MRI evaluation, this was not completed in all patients.

Reasons included a lack of insurance coverage, patient refusal or failure to follow through, or a medical contraindication to MRI. Brain MRI data were available on 130 patients (54.9%) presenting with idiopathic olfactory loss (Table II). A total of 4.6% of MRIs were considered abnormal.

The following abnormalities were seen in one patient each: hypertensive encephalopathy, left frontal lobe vascular

malformation, right third ventricle mass, left olfactory bulb atrophy, possible left posterior fossa schwannoma, and multiple white matter abnormalities suggestive of multiple sclerosis (MS). Only one finding (the MRI suggestive of MS) was considered to be potentially causative of an olfactory loss,

accounting for 0.8% of all MRIs. The MRI consistent with olfactory bulb atrophy was not considered causative as this finding has been demonstrated in olfactory loss of many etiologies, and is therefore considered a result of olfactory loss rather than a cause.

TABLE I.
Characteristics of Patients with Olfactory Loss.

Etiology	Patients	% Total	Average UPSIT	% Female	Average Age
Idiopathic	247	29%	21.2	59%	58
Postviral	230	27%	24.7	73%	54
Obstructive	112	13%	20.1	62%	49
Traumatic	87	10%	14.5	45%	45
Congenital	31	4%	12.4	61%	23
Toxic	58	7%	17.4	57%	56
Other	74	9%	23.0	64%	59
Total	839		21.0	62%	53

TABLE II.
MRI Analysis for Patients with Idiopathic Olfactory Loss.

Etiology	Complete Data Available	Number of MRIs	% MRI	Number of Abnormal MRIs*	Number of MRIs/Abnormality	Number of Attributable MRIs*	Number of MRIs/Attributable Finding	Cost/Attributable Finding†
Idiopathic	237	130	54.9%	6	21.7	1	130	\$325,000

4. Discussion

This study describes the characteristics of a large cohort of patients presenting with olfactory disorders at a large tertiary center. The leading identified etiologies were similar to those seen in previous studies [7, 12] although post-URI and idiopathic loss were more frequently noted and posttraumatic and conductive olfactory disorders were less commonly identified. No standard protocol for the evaluation of patients with idiopathic olfactory loss exists in the literature, and the utility of MRI in these patients has not been well demonstrated. Various authors have discounted the use of any diagnostic imaging altogether.

Others have stressed the value of CT scanning or have advocated routine MRI on all patients with idiopathic olfactory disorders [7, 8].

Recently, a cost-effectiveness argument from a medicolegal perspective was made to encourage MRI as an initial study in patients with idiopathic olfactory loss.8 In this study of 122 patients, 25.4% of MRI scans were interpreted as identifying a causative finding; however, the majority of these (18.8%) had occult frontoethmoid sinusitis, a diagnosis that could be made by less expensive means.

Almost 5% of patients were noted to have intracranial neoplasms, although only two of these were thought to be responsible for olfactory loss and no malignancies were identified. In the present study, less than 1% of all patients with idiopathic olfactory dysfunction who underwent brain MRI had imaging findings considered to be possibly causative of their symptoms. A large volume of work has identified decreased olfactory bulb volume as a common finding in

olfactory loss of numerous etiologies in studies using dedicated olfactory bulb imaging [6].

Therefore, this finding was considered a result of olfactory loss rather than causative. Intracranial neoplasm was identified in two patients (1.5% of patients who underwent brain MRI), yet olfactory loss was not attributable to either of these lesions. No malignancies were identified on MRI in the present study. The number of scans per identified abnormality that prompted referral for further workup or management in idiopathic olfactory dysfunction in the present study was 21.7.

This is comparable to the rate of incidental findings in large cohorts of healthy volunteers, which range from 34.5 brain MRIs per abnormality requiring referral in an asymptomatic population to 9.8 MRIs per clinically significant finding requiring further evaluation in a young, healthy German population. A meta-analysis of incidental findings on brain MRI of asymptomatic patients calculated a number needed to scan of 37 that would prompt referral; this decreased to 23 scans per referral if high-resolution MRIs were performed.

In this study, one patient (0.8%) who underwent brain MRI for idiopathic olfactory loss had findings consistent with a possible demyelinating process. Radiologically isolated syndrome (RIS), or radiographic evidence of multiple sclerosis without typical neurologic symptoms, has been described and prevalence has been estimated at 0.06% to 0.7%. The treatment of patients with RIS is controversial.

It is unclear if the patient identified in this study represents an individual with RIS or if the patient’s olfactory disturbance was a symptom of MS. While we are unaware of any adverse effects from MRI in any of the patients included in this study,

MRI with gadolinium is not without risk. Although adverse reactions associated with iodine-based contrast are both more common and more familiar to physicians, adverse reactions to gadolinium that include nephrogenic systemic fibrosis have also been identified, prompting a warning from the FDA concerning contrast-enhanced MRI in patients with impaired kidney function.

Acute reactions to gadolinium have also been reported, from the mild and relatively common nausea and rash to the decidedly more severe and rare anaphylaxis. Thus, contrasted MRI should be obtained only when it is likely to impact patient management. There are several limitations to the current study. First, as this study is a retrospective review of patient data, the diagnostic evaluation of these patients could not be completely standardized. MRI was uniformly recommended for patients without a clear etiology of their olfactory loss, but many patients ultimately did not undergo MRI testing.

5. Conclusion

In this study, the diagnostic yield of brain MRI in patients with idiopathic olfactory dysfunction was low. The rate of detectable abnormalities among patients with idiopathic olfactory loss was similar to large cohort radiologic data of asymptomatic adults. While the observed rate of abnormalities on MRI may be artificially decreased due to selection bias, given the significant cost, inherent risk in terms of both rare adverse reactions and possibly unnecessary further testing or intervention, and low diagnostic yield, routine brain MRI in the evaluation of isolated idiopathic olfactory loss may need to be reconsidered. Further studies are needed to characterize those patients who would be most likely to benefit from MRI evaluation.

6. Reference

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