Hazardous Events Associated With Impaired Olfactory Function

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Objective: To evaluate the risk of olfactory-related hazardous events in patients with impaired olfactory function.

Design: Retrospective cohort study.

Setting: A university-based clinic for smell and taste disorders.


Interventions: Patient interview, olfactory testing.

Main Outcome Measures: (1) Frequency of olfactory-related hazardous events including cooking incidents (ie, burning pots or pans), undetected fires, undetected gas leaks, and ingestion of spoiled foods or toxic substances; (2) level of olfactory function (anosmia; severe, moderate, or mild hyposmia; or normosmia) as determined by olfactory testing.

Results: Olfactory testing revealed that 76% of patients had some degree of impairment; 30% had complete anosmia. Thirty-seven percent of patients with olfactory impairment but only 19% of patients without impairment experienced at least 1 olfactory-related hazardous event. Of the hazardous events reported by impaired patients, cooking-related incidents were most common, representing 45%, with ingestion of spoiled food (23%), inability to detect a gas leak (23%), and inability to smell a fire (7%) reported less frequently. There was a significant correlation between frequency of hazardous events and degree of olfactory impairment (Cochran-Armitage trend test, \( P < .001 \)): at least 1 hazardous event was reported by 45.2% of patients with anosmia, 34.1% with severe hyposmia, 32.8% with moderate hyposmia, 24.2% with mild hyposmia, and 19.0% of patients with with normal olfaction by testing.

Conclusion: Patients with impaired olfactory function are more likely to experience olfactory-related hazardous events than those with normal olfactory function.

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THERE ARE APPROXIMATELY 2.7 million adults in the United States with chronic olfactory dysfunction.1 Disturbances include complete (anosmia) or partial (hyposmia) loss of smell, distortion of smell (dysosmia), and perceived smell in the absence of stimuli (phantosmia).2,3 Causes of olfactory dysfunction include head trauma, chronic rhinosinusitis, viral infection, nasal obstruction (ie, septal deviation, neoplasm), neurologic disorders, medications, endocrine disturbances, and normal aging.4-6

Olfaction has been shown to affect quality of life, modulate dietary behavior, and act as a pleasurable stimulus.7 It also plays an important role in safety and prevention.3 As with blindness and deafness, there are risks associated with impaired olfactory function. Olfaction provides environmental cues to warn us of dangerous or potentially life-threatening situations.8 Olfactory dysfunction thus exposes patients to risks associated with cooking accidents, undetected fires or gas leaks, ingestion of spoiled foods or toxic substances, and occupational hazards encountered by chemists, cooks, firefighters, and contractors.3,10

Currently there is limited information regarding safety issues in patients with olfactory impairment. The present investigation was conducted to determine the impact of olfactory impairment on the occurrence of olfactory-related hazardous events.

METHODS

The patient database at the Smell and Taste Clinic of Virginia Commonwealth University Medical Center was accessed to retrospectively identify patients who had undergone olfactory function testing and responded to 4 standard hazard questions. Between 1983 and 2001, 767 patients were evaluated at the Smell and Taste Clinic, of whom 445 had undergone olfactory function testing and a standard hazard interview.

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The Table summarizes the demographic data for the study population. The average age of the cohort was 50 years (range, 18-92 years); 51.5% were men and 48.5% women. Most patients were white (76.6%) or African American (20.4%). Eighteen percent reported regular tobacco use. Formal olfactory function testing performed at the time of the clinic visit demonstrated that 76.4% of the patients had degrees of olfactory impairment ranging from mild hyposmia to complete anosmia. Normal olfactory function was measured in the remaining 23.6% of patients.

Of the 340 patients with olfactory impairment, 124 (37%) had experienced at least 1 of the 4 hazardous events, which they attributed to their olfactory dysfunction. Only 19% of those found on testing to have normal olfaction had experienced 1 of these events. The Figure shows the percentage of patients at each level of impairment who had experienced a hazardous event. Of the 135 anosmic patients, 61 (45.2%) experienced 1 of the 4 olfactory-related hazards. This percentage declined with decreasing level of impairment as follows: severe hyposmia, 34.1%; moderate hyposmia, 32.8%; and mild hyposmia, 24.2%.

One hundred twenty-four patients with olfactory impairment reported a total of 165 hazardous events in the following distribution:

<table>
<thead>
<tr>
<th>Reported Event</th>
<th>% of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking-related hazard</td>
<td>45</td>
</tr>
<tr>
<td>Spoiled food/toxic substance ingestion</td>
<td>25</td>
</tr>
<tr>
<td>Unable to detect gas leak</td>
<td>23</td>
</tr>
<tr>
<td>Unable to smell fire</td>
<td>7</td>
</tr>
</tbody>
</table>

Table

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%) of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>M 229 (51.5)</td>
</tr>
<tr>
<td></td>
<td>F 216 (48.5)</td>
</tr>
<tr>
<td>Race</td>
<td>White 341 (76.6)</td>
</tr>
<tr>
<td></td>
<td>Black 91 (20.4)</td>
</tr>
<tr>
<td></td>
<td>Other 13 (3.0)</td>
</tr>
<tr>
<td>Smoker</td>
<td>No 357 (80.2)</td>
</tr>
<tr>
<td></td>
<td>Yes 83 (18.7)</td>
</tr>
<tr>
<td></td>
<td>Not reported 5 (1.1)</td>
</tr>
<tr>
<td>Olfactory test results</td>
<td>Anosmia 135 (30.3)</td>
</tr>
<tr>
<td></td>
<td>Severe hyposmia</td>
</tr>
<tr>
<td></td>
<td>Moderate hyposmia</td>
</tr>
<tr>
<td></td>
<td>Mild hyposmia</td>
</tr>
<tr>
<td></td>
<td>Normosmia 105 (23.6)</td>
</tr>
</tbody>
</table>

Percentages of subjects who reported at least 1 olfactory-related hazardous event.

Patient database entries included patient age, sex, race, tobacco usage, and history of olfactory dysfunction. Four questions related to olfactory impairment were asked: (1) Have you had any incidents while cooking that were caused by your smell disturbance (ie, burned pots or pans)? (2) Were you ever unable to smell a fire? (3) Have you had any incidents in which natural gas was leaking and you were unable to smell it? and (4) Have you ingested any spoiled foods or swallowed any toxic substances?

Olfactory function testing was performed using a standardized method developed at the University of Connecticut Chemosensory Clinical Research Center. Threshold scores (0-50) were obtained by administering serial dilutions of butanol to each nostril in a 2-bottle forced-choice paradigm. Odor discrimination scores (0-50) were obtained by asking patients to correctly identify 7 common household odorants. Threshold and odor identification scores for each nostril were averaged to obtain a measurement of overall olfactory function.

Olfactory test results for each nostril were added. Scores for the 2 sides were averaged to obtain a measurement of overall olfactory function: anosmia, 0-14; severe hyposmia, 15-44; moderate hyposmia, 45-64; mild hyposmia, 65-89; and normosmia, 90-100.

Data from patient interviews and olfactory testing were collected and stored in spreadsheet format (Excel 97; Microsoft Corporation, Redmond, Wash). Statistical analyses were performed with SPSS (version 11.0; SPSS Inc, Chicago, Ill). This study was approved by the Virginia Commonwealth University Office of Research Subjects Protection.

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olfactory disturbances. This is evidenced by the fact that, despite the number of patients with olfactory disturbances, there are still fewer than 10 smell and taste research centers in the United States.

Nonetheless, a significant impact of olfactory dysfunction on physical and emotional well-being has been shown. Deems et al demonstrated that the prevalence of depression in patients with chemosensory dysfunction was higher than in controls. Furthermore, a survey of patients with olfactory dysfunction from our institution suggested that patients’ overall satisfaction with life correlated positively with smell scores. These patients’ perception of increased susceptibility to life-threatening situations likely reduced their perceived quality of life. Additionally, those with olfactory dysfunction reported increased concerns over gas leaks, fires, and exposure to harmful substances compared with controls. Finally, these patients reported significant disabilities in common activities of daily living compared with patients without olfactory dysfunction. Other studies have also demonstrated similar deleterious effects of olfactory dysfunction on patients’ well-being.

The literature to date has limited data quantifying the impact of olfactory impairment on safety issues. However, a review of fire casualties by Hall indicates that the elderly are involved in a disproportionate number of house fires and gas poisonings. Given the well-documented increase in olfactory dysfunction with increasing age, this may be a factor in the increased risk of fire-related deaths in this population. Obviously, many other factors may also apply, and further research is needed to conclusively identify a contributory role of olfactory dysfunction.

The present investigation sought to determine the extent to which olfactory impairment increases the risk of 4 specific olfactory-related hazardous events: cooking accidents, undetected gas leaks, undetected fires, and ingestion of harmful substances. Interview questions were worded such that patients attributed a particular hazard specifically to their smell dysfunction thereby minimizing the introduction of inappropriate data. This should have limited reports of events that might have occurred regardless of olfactory impairment and thus avoided overestimation of the effects of olfactory impairment.

In addition, patients in our group who presented with olfactory complaints but tested as “normosmic” serve as a worst-case control population. Since some of these patients may have had transient olfactory impairment that improved prior to the time of testing, we may assume that their rate of hazardous event occurrence should be the same as, or possibly even higher than, we would expect for a true population of normosmic subjects without olfactory complaints. Thus, this group’s frequency of hazardous events (19%) may be considered a baseline risk of occurrence of these events. The Figure shows that there is a correlation between degree of olfactory impairment and the frequency of experiencing a hazardous event.

Unfortunately, our armamentarium for the definitive treatment of olfactory disorders is currently limited. While physicians have several therapeutic modalities to assist patients with conductive olfactory disorders, patients with olfactory neurosensory deficits are frequently told by their treating physician that “nothing can be done.” However, the results of the present study underscore the importance of counseling for patients presenting with olfactory disturbances. Patients with olfactory dysfunction must be forewarned about the specific risks associated with their deficit. They should also be advised to institute protective measures to avoid potentially life-threatening events. Installation and regular maintenance of smoke and natural gas detectors are of paramount importance. Similarly, regular inspection and maintenance of natural gas appliances is beneficial. Written dating of perishable food items and intermittent inspection of the refrigerator and pantry by a friend or family member without impaired olfaction should minimize the potential for food poisonings. These seemingly simple measures, without curing the underlying disorder, may help reassure patients, lessen their risk of life-altering consequences, and thus potentially improve their perceived quality of life.

In summary, olfactory impairment exposes patients to an increased risk of cooking accidents, ingestion of toxic or spoiled substances, and inability to detect fires and gas leaks. These hazards are potentially life-threatening and collectively pose a significant public health risk. As patients with olfactory dysfunction will often seek evaluation by an otolaryngologist, otolaryngologists must be capable not only of diagnosing and treating patients with olfactory disturbances, but also of counseling them regarding the potential risks of their disorders.

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REFERENCES