CHAPTER 25

Categorization of Chemosensory Disorders

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The senses of smell and taste determine the flavor and palatability of food and beverage. Along with the trigeminal, glossopharyngeal, and vagal sensory systems they monitor inhaled and ingested chemicals. Although qualitative sensations of the sense of smell are subserved by the olfactory neuroepithelium and its central connections and the perceptions of sweet, sour, bitter, and salty substances are subserved by the taste buds and their central connections, many substances are capable of producing somatic sensations of coolness, warmth, and irritation through the trigeminal, glossopharyngeal, and vagal afferents from the nose, mouth, pharynx, and larynx. The vehicle of most ingested chemical substances provides another sensory dimension, a textural perception. Therefore, the senses of smell and taste must be considered as one of several chemosensory and haptic systems since most chemical substances initiate olfactory, gustatory, trigeminal, glossopharyngeal, and vagal perceptions.

Chemosensation provides an early warning system for toxic substances in the environment and spoiled and toxic food and beverage. Smoke, fumes, industrial pollutants, and additives to natural gas are detected principally by the olfactory and trigeminal systems and expedite the avoidance of these dangerous substances. Spoiled food and beverage characteristically have a noxious bitter or sour taste. Some naturally occurring vegetal poisons such as the alkaloids and anticholinergic agents characteristically have a bitter taste that may at times prevent their accidental ingestion. Unfortunately, other vegetal toxins such as those occurring in poisonous mushrooms provide no such warning.

The hedonic role of chemosensation is known through the daily experiences of everyone. We need only mention an example of one’s own culinary experience with aromatic substances, occurring in a common food such as chicken or added to chicken such as ginger, to evoke a multitude of similar experiences. In beverage the unique effects of combinations of tastes and odors is exemplified in wine. Some hedonistic chemosensory experiences such as the smell of oncoming rain are more difficult to describe or understand. The pleasures of the scents of flowers and all of the things made to wear or ingest from flowers defy enumeration but are common in our daily experience. The appreciation of the natural odors of our environment provides a lesson in the enormous variety in nature.

Alterations in the pleasures of these sensations have serious effects on the quality of life. Of special interest, the hedonic properties of taste and olfaction are not equivalent. The hedonic reactions to sweet and bitter are present at birth, but the hedonic properties of olfactory stimuli are more closely related to experience. This is of great clinical importance since food
and beverage odors can be rendered extremely unpleasant in clinical disorders like cancer where the odors are paired with nausea (see the chapter by Bernstein, this volume). Since the pleasantness and unpleasantness of foods have important consequences for behavior, hedonic issues are discussed in the chapters in Part III of this book.

The individuality of odors leads to great diversity, but the combination of odorants, either naturally or by man, compounds the complexity and variety of olfactory experiences. The rapid adaptation to an odorant results in another dimension of the complexity of the hedonic role of odorants. The evocation of long dormant memories also lends marvelous pleasure to chemoreception.

**TYPES AND SEVERITY OF CHEMOSENSORY DISORDERS**

Disorders of smell and taste can be classified on the basis of the patient’s complaint or on the basis of the psychophysical evaluation, that is, the measurement of the detection threshold or the suprathreshold identification.

**Olfactory Disorders**

Anosmia may be subdivided as follows:

1. General (or total) anosmia is the inability to detect any qualitative olfactory sensation.
2. Partial anosmia is the ability to detect some, but not all, qualitative olfactory sensations.
3. Specific anosmia is a type of partial anosmia in which only one or a very limited number of odorants cannot be sensed.

Hyposmia may be subdivided as follows:

1. General (or total) hyposmia is the decreased sensitivity to all odorants.
2. Partial hyposmia is a decreased sensitivity to some, but not all, odorants.
3. Specific hyposmia is a type of partial hyposmia in which there is decreased sensitivity to only one or a very limited number of odorants.

Dysosmia (paraosmia or cacosmia) is a distortion or perversion in the perception of an odorant (e.g., the presence of an unpleasant olfactory experience when a normally pleasant odor is being presented) or the perception of an odor that occurs in the absence of an odorant in the environment, that is, an olfactory hallucination. Dysosmia may or may not be associated with a loss of olfactory sensitivity. Under both circumstances, dysosmia may occur spontaneously or only be evoked by odorants.

Hyperosmia may be subdivided as follows:

1. General (or total) hyperosmia is increased sensitivity to all odorants.
2. Partial hyperosmia is increased sensitivity to some, but not all, odorants.
3. Specific hyperosmia is a type of partial hyperosmia in which there is increased sensitivity to only one or a very limited number of odorants.

Olfactory agnosia is inability to classify, contrast, or identify an odorant verbally even though the ability to distinguish between odorants or to recognize them may be normal. It may be general, partial, or specific.

**Gustatory Disorders**

Ageusia may be subdivided as follows:

1. General (or total) ageusia is inability to detect any qualitative gustatory sensations.
2. Partial ageusia is the ability to detect some, but not all, qualitative gustatory sensations.
3. Specific ageusia is a type of partial ageusia in which only one or a very limited number of tastants cannot be sensed.

Hypogeusia may be subdivided as follows:

1. General (or total) hypogeusia is a decreased sensitivity to all tastants.
2. Partial hypogeusia is a decreased sensitivity to some, but not all, tastants.
3. Specific hypogeusia is a type of partial hypogeusia in which there is decreased sensitivity to only one or a very limited number of tastants.

Dysgeusia (parageusia) is a distortion or perversion in the perception of a tastant (e.g., the presence of an unpleasant taste when a normally pleasant tastant is being presented) or the perception of a taste that occurs in the absence of a tastant, that is, a gustatory hallucination. Dysgeusia may or may not be associated with a loss of gustatory sensitivity. Under both circumstances, dysgeusia may occur spontaneously or only be evoked by tastants.

Hypergeusia may be subdivided as follows:

1. General (or total) hypergeusia is an increased sensitivity to all tastants.
2. Partial hypergeusia is an increased sensitivity to some, but not all, tastants.
3. Specific hypergeusia is a type of partial hypergeusia in which there is increased sensitivity to only one or a very limited number of tastants.

Gustatory agnosia is the inability to classify, contrast, or identify a tastant verbally even though the ability to distinguish between tastants or to recognize
them may be normal. It may be general, partial, or specific.

Ageusia, hypogeusia, dysgeusia, and hypergeusia are not infrequently associated with another disorder of oral sensation, burning mouth syndrome. In addition to this associated sensory disorder, disorders of the sense of taste may have an associated secretory disorder, xerostomia. Likewise, disorders of the sense of smell may have an associated secretory disorder, atrophic rhinitis.

**SITE OF LESION**

Once a chemosensory disorder has been recognized, it is useful in the diagnostic process to determine the site of the lesion that is causing the disorder, that is, to make an anatomic diagnosis. It is helpful to make an anatomic diagnosis prior to attempting to make an etiologic diagnosis because knowing the site of the lesion limits the possible causes of the disorder. The following scheme categorizes olfactory and gustatory disorders by the site of the lesion.

**Olfactory Losses**

Losses of olfactory sensitivity are caused by conditions that interfere with the access of an odorant to the olfactory neuroepithelium (transport loss), injure the receptors cells and their supporting cells (sensory loss), or damage the olfactory nerves and the central olfactory pathways (neural loss).

*Transport olfactory loss* results from swollen nasal mucous membrane in allergic rhinitis and bacterial and viral rhinitis as well as structural abnormalities in the nasal cavities such as neoplasms, polyps, and deviations of the nasal septum. Although little is known clinically about alterations in the mucous environment of the olfactory neuroepithelium, it is probable that abnormalities of the mucous secretion could result in a loss of olfactory sensitivity.

*Sensory olfactory loss* is caused by destruction of the olfactory neuroepithelium as may occur with viral infections, the inhalation of toxic chemicals, neoplasms, drugs that affect cell turnover, and radiation therapy to the head.

*Neural olfactory loss* occurs with neoplasms of the anterior cranial fossa, head trauma with or without fracture of the cribriform plate area, neurosurgical procedures, administration of neurotoxic agents, and in congenital disorders such as Kallman’s syndrome. Neural olfactory losses may be peripheral, as in fracture of the cribriform plate, or central, in neoplasms of the central nervous system. Since it is often not possible clinically to differentiate between sensory and neural olfactory losses, it is appropriate to refer to these olfactory losses as sensorineural until the differentiation into sensory or neural can be made.

**Gustatory Losses**

Similarly, losses of gustatory sensitivity are caused by conditions that interfere with access of a tastant to the taste bud (transport loss), injure the receptor cells (sensory loss), and damage the gustatory afferent nerves and the central gustatory pathways (neural loss).

*Transport gustatory loss* results from bacterial colonization of the taste pore, inflammatory processes in the oral cavity, poor oral hygiene, and xerostomia.

*Sensory gustatory loss* is caused by a vast number of drugs, particularly those that interfere with cell turnover such as antithyroid and antineoplastic agents, radiation therapy to the pharynx and oral cavity, inflammatory and degenerative diseases in the oral cavity including viral infections, endocrine disorders, and neoplasms.

Neural gustatory loss results from neoplasms, trauma, and operations in which the afferent nerves are damaged. Neural gustatory losses may be peripheral, as in injury resulting from dental and otologic operations, or central, as in neoplasms of the brainstem.

The categorization in this chapter provides a framework for the assimilation of the known causes of chemosensory disorders presented in the next chapter.