

Asymmetry in the autonomic nervous system with reference to the nasal cycle, migraine, anisocoria and Menière's syndrome

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SUMMARY

Studies on the nasal cycle have demonstrated that the autonomic tone to the nose is asymmetrical and oscillates in a regular cycle. Autonomic tone may be regulated from a centre in the hypothalamus and normally there is a balance between the autonomic tone of the right and left halves of the body. However, under stress or with hypothalamic instability this balance may be disrupted and result in the marked autonomic asymmetry seen in migraine or Menière's syndrome. Research on the nasal cycle in conditions where autonomic asymmetry is apparent could change the entire concept of autonomic control.

INTRODUCTION

The autonomic innervation of paired organs such as the salivary glands, kidneys, eyes etc. may be divided anatomically into right and left outflows from the brain or spinal cord and even the sympathetic innervation of the skin may be separated into right and left halves. However, functionally the autonomic nervous system normally operates as a unified reflex system and gives a bilateral response to a unilateral stimulus. For example illumination of one retina results in bilateral miosis, and chemical stimulation of one half of the tongue results in bilateral salivation. However, it is proposed that the autonomic nervous system may exhibit a marked asymmetry in nervous activity in certain normal or abnormal conditions and the following examples are used to illustrate this hypothesis of autonomic asymmetry.

NASAL CYCLE

The resistance to airflow through the nasal passages alternates from side to side in a regular cycle due to the alternate dilation or constriction of the venous erectile tissue in the mucosa of the nasal turbinates. The nasal cycle in man has been well documented by Stoksted (1952) and Eccles (1978a), and is normally present in 80% of subjects (Heetderks, 1927). The spontaneous changes in resistance to airflow of each nasal passage are regulated by the sympathetic innervation and the cyclic changes in vasomotor activity are believed to be controlled from a nasal

centre in the hypothalamus or medulla (Eccles, 1978a; Eccles, 1978b). The concept of oscillations in autonomic tone and autonomic asymmetry provided by the nasal cycle may explain other conditions as diverse as migraine and Menière's syndrome.

ANISCORIA

Anisocoria, an inequality in the size of the pupils, may be caused by various pathological processes but is also commonly found in normal subjects, where it may be due to central asymmetry in autonomic tone to the iris (Jones, 1949). The pupil may exhibit cyclic oscillations similar in time course and in phase with the nasal cycle yet under normal conditions this cyclic activity is not readily apparent as there is only a slight inequality in pupil size. The evidence for cyclic changes in pupil diameter was first put forward by Beickert in 1951 who studied the nasal cycle after unilateral stellate ganglion blockade. Immediately after nerve block a typical Horner's syndrome developed with ipsilateral, ptosis, miosis, conjunctival injection and swelling of the erectile tissue of the nasal mucosa. However, the reverse changes were nearly always observed on the side contralateral to the nerve block with mydriasis and a constriction of the nasal erectile tissue. On recovery from the nerve block oscillations in autonomic activity were observed with nasal vasodilation or vasoconstriction, and mydriasis or miosis alternating from side to side with a time period of around one hour. Beickert described this oscillatory autonomic activity as being caused by a disruption of normal autonomic balance due to nerve block. The initial autonomic equilibrium was only regained after several oscillations as though the system were compensating and hunting for equilibrium. The oscillations in nasal vasomotor activity on recovery from nerve block are to be expected as part of the normal nasal cycle; however, the oscillations in pupil diameter are quite unusual and indicate that when the normal equilibrium is disrupted autonomic asymmetry may occur in other areas apart from the nasal mucosa. As though there were a spread of nervous activity from the area of the brain controlling the nasal cycle into other areas concerned with the autonomic innervation of the eye. Such a disruption in autonomic balance may explain the asymmetrical autonomic response observed in migraine with unilateral flushing, nasal congestion and visual disturbances.

MIGRAINE

Migraine attacks are often accompanied by a variety of unilateral effects of autonomic activity such as nasal stuffiness, conjunctival injection, flushing and lachrymation (Brain, 1977; Migraine Trust, 1975). These autonomic responses may be accompanied by various focal cerebral cortical phenomena such as visual, sensory, or speech disturbances. The central problem with migraine is whether the condition is caused by pathology of the cerebral blood vessels or by a disturbance

in the central control of the autonomic nervous system. Studies on the nasal cycle have demonstrated that autonomic asymmetry is a normal occurrence in the nasal mucosa and it is interesting to note that the autonomic nerves which supply the nose, the greater the superficial petrosal nerve and the cervical sympathetic nerve, also innervate cerebral blood vessels (Owman et al., 1974). Section or block of these autonomic nerves has occasionally been claimed to be successful in the treatment of certain types of migraine (Gardner et al., 1947; Dandy, 1931). An autonomic imbalance in migraine could explain the peripheral autonomic responses in the skin, nose and eye; and may also explain the sensory disturbances which may be secondary to a unilateral vasomotor disturbance in the cerebral blood vessels innervated by autonomic nerves. The autonomic centre regulating the nasal cycle has been proposed to be in the hypothalamus, and this area of the brain because of its great involvement in autonomic and emotional responses has been implicated in the aetiology of migraine (Eccles, 1978a; Herberg, 1975). It would be interesting to study the nasal cycle in persons suffering from migraine to determine if the cyclic fluctuations in nasal resistance were altered in any way as this might indicate an instability in the central control of the autonomic nervous system.

MENIÈRE'S SYNDROME

It is generally believed that autonomic dysfunction is the cause of Menière's syndrome and recent research by Uemura et al., (1980) using pupil diameter as a measure of autonomic activity has provided some evidence that the disease is caused by an asymmetrical autonomic outflow. In this recent study instillation of mecholyl into the conjunctiva of both eyes demonstrated an asymmetrical miosis associated with Menière's syndrome. The asymmetrical response of the pupils was interpreted as an indication of either peripheral or central autonomic dysfunction on the side affected by Menière's disease as the authors eliminated the possibility of autonomic disorder being secondary to the occurrence of a labyrinthine disorder.

DISCUSSION

The present paper puts forward the hypothesis that functionally the autonomic nervous system may be divided into right and left halves. An asymmetrical autonomic outflow is normally present in the nasal mucosa associated with the nasal cycle and this is not associated with any pathology or disorder. However a marked autonomic asymmetry is apparent in both migraine and Menière's syndrome and may be a causative factor in each condition and not just symptomatic.

Autonomic asymmetry has been noted in the literature associated with the nasal cycle, migraine, anisocoria and Menière's syndrome yet the literature on these

topics has not been previously brought together to support the concept of autonomic asymmetry. The central control of the autonomic nervous system is poorly understood but it is apparent that there must normally be autonomic balance between the right and left halves of the body. Although nasal airflow may alternate in a cyclic way from one nasal passage to the other the total resistance to airflow remains relatively constant indicating that there is a reciprocal relationship between the right and left autonomic outflows in this case. In migraine and Menière's syndrome the autonomic balance is disrupted perhaps due to stress, and autonomic asymmetry results. In these cases studies on nasal resistance to airflow could provide valuable data on the cause or mechanism of the disorders as the fluctuations in left and right nasal resistance associated with the nasal cycle provide a measure of autonomic activity. One might speculate that the nasal cycle would be exaggerated before an attack of migraine or Menière's syndrome and that during an attack the nasal cycle would cease with left and right autonomic outflows markedly out of phase. The observations describing marked nasal engorgement on the affected side in migraine support this speculation. Further studies on autonomic activity during attacks of Migraine or Menière's syndrome perhaps by measuring nasal resistance to airflow or pupil diameter could throw new light on the aetiology of these disorders.

ZUSAMMENFASSUNG

Durch Untersuchungen über den Nasenzyklus konnte festgestellt werden daß der autonome Tonus der Nase asymmetrisch ist und in einem regulären Zyklus hin- und herschwankt. Der autonome Tonus dürfte von einem Zentrum im Hypothalamus gesteuert werden. Normalerweise besteht ein Gleichgewicht zwischen dem autonomen Tonus der rechten und linken Körperhälfte. Bei Streßbelastung oder hypothalamischer Unausgeglichenheit kann dieses Gleichgewicht unterbrochen werden und zu der ausgeprägten autonomen Asymmetrie führen, die bei Migräne oder Menières Symptomenkomplex zur Beobachtung kommt. Untersuchungen über den Nasenzyklus unter Bedingungen, bei denen eine autonome Asymmetrie in Erscheinung tritt, könnte das Gesamtkonzept der autonomen Steuerung verändern.

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