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CERVICAL SYMPATHETIC PARALYSIS

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The effects of unilateral paralysis of the cervical sympathetic chain, almost invariably referred to in standard textbooks as Horner's syndrome, are generally given as ptosis, enophthalmos, pupillary constriction, and anidrosis of the face on the affected side. This description of the syndrome not only is inaccurate and incomplete but differs from that published in 1869 by Horner himself. Further, accounts of sympathetic paralysis were published by many earlier workers, and it therefore seems justifiable to review the whole status of the eponym.

Historical

Pourfour du Petit (1727) recognized that injury to the sympathetic chain in the neck could cause pupillary changes. In many domestic animals he noted myosis and partial closure of the third eyelid at the inner canthus. His results were confirmed by Mollinelli in 1755 and by many others. Similar effects after section of the trigeminal nerve near the Gasserian ganglion were observed by Fodera (1823), Magendie (1824), and Sir Charles Bell.

Budge and Waller in 1841 demonstrated that the sympathetic supply to the iris has its origin in the anterior and middle columns of the spinal cord from the sixth cervical to the fourth thoracic segment, passing via the spinal nerves to the cervical sympathetic chain and thence to the first division of the trigeminal nerve. Brown-Séquard and Bernard in 1854 noted that section of the sympathetic chain caused pupillary contraction, closure of the eyelids, and increased vascularity and temperature on the affected side, all these changes being reversed by galvanic stimulation of the upper divided end of the nerve.

Despite all these observations, clinical descriptions of such conditions occurring in the course of natural diseases

do not appear in the earlier literature. In 1809 Sir Astley Cooper, in a case of aneurysm of the internal carotid artery, noted ptosis on the affected side together with "a feeling of hot and cold in the ear." He did not record whether or not these signs disappeared after he had cured the aneurysm by ligation of the common carotid artery, nor did he remark on the state of the pupils, an omission which is understandable when it is realized that the pupillary constriction of opium-poisoning was not recognized until Kinnis described it in 1818. Coates, in 1822, recorded a case in which successful ligation of the common carotid artery for an aneurysm was followed by restoration to normal of a pupil which had been markedly constricted. Sir Benjamin Brodie (1828) noted bilateral pupillary constriction in a man with fracture-dislocation of the cervico-dorsal spine. Willebrandt (1854) recorded similar pupillary constriction in a case of cervical tumour, and Gairdner (1855) described an instance of aortic aneurysm accompanied by eye changes which he rightly regarded as similar to those produced experimentally by section of the cervical sympathetic chain.

Notwithstanding the value of these earlier contributions it is probable that much of the credit for the clinical evaluation of the syndrome produced by cervical sympathetic paralysis should be accorded to J. W. Ogle, physician to St. George's Hospital, London. In his carefully reasoned publication (Ogle, 1858) he pointed out some of the fallacies in the application to man of the results of animal experiments, summarized the previous literature, and collected and reviewed a series of 27 cases. In these, unilateral myosis and ptosis were sometimes associated with vascular and temperature changes, and the interference with the cervical sympathetic chain was the result of intrathoracic aneurysms, cervical lymphadenopathy, or spinal injury. He recorded one case in which an acute abscess of the neck was accompanied by dilatation of the pupil, which returned to normal after incision of the abscess. The role of the cervical sympathetic seems to have been well recognized by this time. Weir Mitchell *et al.* (1864) described a patient in whom a gunshot wound of the neck was followed by unilateral pupillary constriction, narrowing of the palpebral fissure, and very pronounced vasodilatation of the corresponding side of the face and neck, ending abruptly at the midline. These changes were confidently ascribed to injury of the cervical sympathetic chain.

The Work of Horner

Horner (1869) based his observations on one case, that of a woman aged 40, who, six weeks after parturition, developed right-sided myosis, ptosis, and diminished ocular tension without evidence of eye disease or of trigeminal paralysis. Although remarking that some slight enophthalmos was present, Horner regarded this as of little importance, concentrating more on the study of the vascular effects. He noted that the affected side of the face was redder and distinctly warmer than the other and that it did not perspire. He measured the temperature on both sides of the face, finding a difference of 5 ° C. under normal conditions. Bandaging the face resulted in an increase in temperature on the normal side so that the difference was reduced to about 1 ° C. The vasodilatation of the face when warmer was, he noted, accompanied by a corresponding dilatation of the retinal veins. Atropine enlarged the pupil but slowly, irregularly, and to a lesser extent than on the normal side. Although recognizing that cervical sympathetic paralysis was the cause of the signs he expressed no views as to the fundamental pathology of the condition.

Horner's work appears to have stimulated his associate Nicati (1873), whose observations are remarkable for their anticipation of much of the modern view of the control of the blood vessels of the skin. He distinguished three stages in the development of the paralysis. In the first he considered that the encroachment of the lesion might produce stimulation of sympathetic activity as shown by hyperidrosis of the affected side of the face. Such changes might be found, for example, in cases of cervical abscess, the face returning to normal after this was incised. The second stage, that of early paralysis, he found to be characterized by unilateral myosis, ptosis, enophthalmos, anidrosis, and lowered ocular tension, with flushing and increased warmth of the affected side of the face and neck. Measuring the temperature of the skin of the two sides of the face Nicati found the affected side constantly warmer. In particular, the temperature on the paralysed side did not fall appreciably on exposure to excessive cold and on return to warmer conditions it rose more quickly than on the normal side. In the third and final stage some atrophy and wasting followed. The affected side, formerly highly coloured, was now paler. It was also cooler except when the vessels of the normal side were strongly contracted in response to excessive cold, when once again the diseased side became the warmer.

Of Nicati's 25 cases, 20 occurred in women. Although he enumerated the causes of the syndrome fairly completely he was unable to determine any underlying pathological condition in the majority of his own patients, some of whom continued in good health for many years. He fell into the trap of attempting to correlate the syndrome with the ocular changes occurring in exophthalmic goitre, suggesting that excessive sympathetic stimulation might be the *fons et origo* of both the exophthalmos and the thyrotoxicosis, but his arguments are speculative and unconvincing.

From that time onwards the term "Horner's syndrome" appears to have come into common usage to describe the effects of cervical sympathetic paralysis, although the origin of the term is not widely known and the original description little consulted.

Anatomy

The sympathetic nerves of the head and neck are derived from the spinal segments D1 and D2. The fibres supplying the pupil have their connector cells in lateral horn cells of these segments, pass into the anterior primary rami of the first two thoracic spinal nerves, and thence into the sympathetic chain to relay in the superior cervical ganglion. The excitator fibres pass thence along the coat of the internal carotid artery to the cavernous plexus, whence they may pass to the pupil by one of two routes: either entering the Gasserian ganglion and passing into the first division of the trigeminal nerve, thence into the long ciliary nerves and thus to the pupil; or entering the ciliary ganglion by its sympathetic route, passing through it without synapsing and reaching its pupil by the short ciliary nerves.

The centre for the sympathetic control of the pupil is in the superior corpus quadrigeminum, and the path from here to the spinal cord is believed to be in the tectospinal tract. This centre receives fibres from the optic nerve.

The vasomotor fibres of the skin of the face are distributed from the superior cervical ganglion along the branches of the external carotid artery. The vasomotor centre is in the calamus scriptorius in the floor of the fourth ventricle, from which fibres pass to the connector cells of the sympathetic in the lateral horn of grey matter.

The levator palpebrae superioris muscle is supplied by the third cranial nerve through its upper branch. This,

however, supplies only striped muscle, and the ptosis which occurs in cervical sympathetic paralysis is due to interruption of the sympathetic nerve supply to the smooth muscle of the upper and lower eyelids called, respectively, the upper and lower tarsal muscles (of Müller).

A certain amount of misunderstanding has centred upon the subject of Müller's muscle. This term has been applied to the tarsal (or palpebral) muscle described above, and to the orbital muscle of Müller. The latter is a collection of plain muscle arising from the periorbita, bridging the inferior orbital fissure and radiating in a thin layer over the orbital floor. It is variable in size, and is the vestigial remnant of the muscular membrane completing the lateral wall of the orbit in those lower animals in which this does not consist of bone. In certain of these animals it acts as a protruder of the eye (Müller, 1858). In man, stimulation of the sympathetic does not produce protrusion of the eye (Turner, 1862), although this muscle is supplied by the sympathetic. It is difficult to see how this structure can have any notable effect on the position of the eyeball in man.

Pathology

Consideration of these anatomical facts makes it clear that the syndrome may be produced in several ways—namely, (1) by brain-stem lesions, notably thrombosis of the posterior-inferior cerebellar artery; (2) by intramedullary cord lesions at or above the level of D1—if at D1 there will also be wasting of the small muscles of the hand; (3) by extramedullary spinal lesions such as trauma and neoplasm; (4) by lesions involving the peripheral course of sympathetic fibres, such as trauma, aneurysm of the aorta or carotid vessels, or neoplasm in the neck or superior mediastinum; and (5) it also occurs in the rare condition of partial facial hemiatrophy (Parry-Romberg syndrome), the causation of which is as yet imperfectly understood.

The Clinical Syndrome

Whatever the site of the lesion the obvious clinical syndrome is fairly constant. The stage of stimulation described by Nicati is rarely, if ever, seen in present clinical practice, but should be borne in mind as a possible source of confusion in diagnosis.

1. *Myosis*.—This constantly occurs. Although the pupil is small the light reflexes are still present. The pupil does not dilate under cocaine, and the reaction to atropine is slow, irregular, and incomplete. This myosis is greater in lesions involving the superior cervical ganglion than in those arising more centrally.

2. *Narrowing of the Palpebral Fissure due to Descent of the Upper Lid and Raising of the Lower Lid*.—Horner, in his original description, remarked that the degree of enophthalmos was trivial, but in almost every current description enophthalmos is described as a cardinal feature. This is unjustifiable. The apparent enophthalmos is an optical illusion arising from the narrowing of the palpebral fissure. Actual measurements by Pochin (1939) have shown that sympathetic paralysis produces no immediate enophthalmos, such as might be produced by muscular paralysis. Only in long-standing cases is there a very slight degree of recession, of the order of 1 mm. Pochin has also shown the essential difference of the lid retraction produced by sympathetic stimulation and that occurring in Graves's disease. The lower eyelid is lowered in sympathetic stimulation but raised relative to the cornea when the upper lid is retracted by levator palpebrae spasm or Graves's disease. The true exophthalmos occurring in Graves's disease tends to give a false impression of the position of the lower lid. Pochin accordingly rejects the theories of earlier workers that the lid retraction in Graves's disease results from sympathetic overactivity.

3. *Other Eye Changes.*—Hypotonia, depigmentation of the iris, and cataract may occur.

4. *Anidrosis.*—Although the sweat glands are cholinergic they are innervated by the sympathetic, and therefore interference with function will be more or less complete according to the extent of the lesion. This affection is confined to one side of the face, stopping at the midline.

5. *Vascular Changes.*—These are variable, depending to some extent upon the degree of completeness of the paralysis, the rapidity of onset, and the presence of other vascular lesions, especially aneurysm or arteriosclerosis, the latter of which may prevent full dilatation. It is seldom that circulatory changes are as prominent a feature of the syndrome as are the eye changes. Where the lesion is of rapid onset, as in Weir Mitchell's case, loss of sympathetic tone may be followed by vasodilatation persisting even on exposure to cold. The vasodilator fibres, too, are involved, and on exposure to excessive warmth the normal side will show fuller dilatation than the other. But with the passage of time compensatory mechanisms are brought into play, the arteries and arterioles regaining some of their lost tone, so that actual pallor may develop, or the vessels may remain in a permanent state of incomplete relaxation. It is not true to say that the paralysed side is always warmer than the normal, although this is so under the usual environmental conditions of temperate climates. The temperature tends to remain relatively constant, failing to show the normal wide variations that follow those alterations in vasomotor tone which ordinarily result from fluctuations in surrounding temperature.

6. Some degree of facial hemiatrophy may occur in established cases, although this is never so pronounced as in the Parry-Romberg syndrome.

Summary

The inadequacy of many current accounts of the effects of cervical sympathetic paralysis is noted.

The history of the condition is reviewed, with particular reference to Horner's original account.

The anatomy, pathology, and clinical features of the syndrome are discussed.

As a result of this survey it is concluded that retention of the eponym "Horner's syndrome" is fully justified.

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Mr. Clement Shaw, chairman and managing director of T. C. Cornwell, Ltd., succeeds Mrs. Jean K. Irvine, M.B.E., as president of the Pharmaceutical Society of Great Britain. Mr. J. F. McNeal, of Amersham, has been elected vice-president and Mr. W. Spencer Howells, Richmond, re-elected treasurer.

DAY NURSERIES AND THE MAN-POWER PROBLEM

BY

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The writer of a leading article on day nurseries and industry (*British Medical Journal*, 1947, **1**, 644), after considering the results of recent research into the well-being of the children concerned, stated that the cost to the latter was such as cannot be justified except on grounds of overriding national economic need. He went on to say that if, as seemed to him probable, day nurseries consume as much or more labour than they free all basis for urging women to take up full-time work and leave their young children in a nursery disappears. This conclusion was partly based upon the Luton investigation made by F. Grundy in 1943.

There are really two questions to be considered: Do the day nurseries economize the use of woman-power? ; and Does the economy, or the redistribution of labour involved, result in an increased supply of labour to work of national importance? The results of an investigation made in Birmingham in 1945 are interesting in this connexion.

During the whole of the war the labour shortage in Birmingham was such that a continual stream of men and women were moved from their homes in other parts of the country to work in Birmingham. At least 80,000 are actually recorded as having been brought in, placed, and billeted directly through the transfer and accommodation machinery set up by the Ministries of Labour and Health. Innumerable others drifted in on their own. This was the scale of the man-power problem which led to the setting up of 72 day nurseries and five 24-hour nurseries—the largest number of wartime nurseries set up by any local authority outside the L.C.C. The scheme was definitely intended as one of the alternative solutions to the problem of labour supply in the area.

The nurseries were almost continuously short of staff, and from 1942 the number opened lagged well behind the direct evidence of need shown by the long waiting-lists, but gradually the Child Care Reserve and other schemes for the training or retraining of staff, together with the working of the National Service Orders, did much to clarify and stabilize the position.

The Ministry of Health in a circular letter to local authorities in August, 1940, had suggested that one staff to every five children attending would be necessary, but this was found insufficient in Birmingham, where the nurseries were open from 7 a.m. to 8 p.m., to cover the long hours worked by many mothers, and the wide variety of starting and stopping times. A number of attempts were made to shorten nursery hours, but owing to the large number of small factories concerned—a feature of this area—this proved impossible, and as a result overlapping shifts were worked with a total ratio of one staff to every four children (rather more in the 24-hour nurseries).

In June, 1945, the Public Health Department drew up the following picture of the provision made:

Nurseries and the Children

Capacity	3,695	Under 2	1,215
Vacancies	223	Over 2	2,257
Children on register	3,472	Mothers on register	3,143

Employment of Mothers

Employment	Full-time	Part-time
Factory	1,448	169
Transport	100	6
Canteen and waitresses	277	30
Shop assistants	293	34
Domestic	234	64
Other work	432	56