THE CARPAL TUNNEL SYNDROME

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In 1947 Russel Brain, Dickson Wright and Wilkinson produced the original paper describing median nerve compression of the wrist and its treatment. Credit for drawing the attention of surgeons to the carpal tunnel syndrome is largely due to Nissen, although he has written little on the subject. Kremer, Gilliatt, Golding and Wilson (1953) emphasized the vascular side-effects—acroparaesthesiae which may accompany median compression.

The subject has been taken up principally by neurologists, many of whom hold conflicting views on the frequency with which this form of peripheral neuritis is encountered in the upper limb. Vicale and Scarff (1951), Beck (1954), Growkaest and Demartin (1954) draw attention to the development of median neuritis at the wrist during systemic disease, and it now seems likely that many patients previously diagnosed as having brachial neuritis or thoracic inlet compression were, in fact, suffering from carpal compression. As pointed out by Heathfield (1957), it is probable that this syndrome will shortly align itself along with prolapse of the lumbar intervertebral disc as one of the major features of isolated peripheral neuritis.

Since 1947, at this centre, when a median nerve was first released for symptoms previously labelled as 'brachial neuritis,' the operation has become a common one. Indeed, the volume of patients requiring 'decompression' justifies the procedure being performed in out-patients under local anaesthetic. For this reason it seems opportune to review the anatomy of the area concerned and to refer to some lesser known pathological and clinical features which may not be yet fully appreciated.

Anatomy

Decompression of the carpal tunnel is performed by slitting the roof of the flexor retinaculum. This is continuous proximally with the deep (investing) fascia of the forearm and distally with the palmar aponeurosis. A palmaris longus tendon, when present, lies superficial to the flexor retinaculum.

The retinaculum extends from hypthenar to

thenar eminence, the muscles of which in each case overhang the structure so that only a very small portion of it is accessible for direct incision. It is 4 cm. in breadth.

The ulnar artery crosses this retinaculum on its ulnar side, while the thenar branch of the median nerve curls around its lower border on the radial side and runs upwards and outwards to its muscle mass.

The whole tunnel is quite rigid, the nerve is packed into the surface of the common palmar bursa and on flexion of the wrist is angled around the lower border of the flexor retinaculum. Figs. 1 and 2 show the surface anatomy and main relations of the flexor retinaculum.

Pathological Features

Compression of the median nerve in the carpal tunnel may follow local swelling outside the nerve or swelling of the nerve itself. In either case the local effects are the same: temporary ischaemic neuritis. At operation, under tourniquet, on a proven case of 'carpal compression' the median nerve is seen to be narrowed distally (opposite the lower border of the flexor retinaculum) and lying in a bed of synovia which shows some congestion. There may or may not be evidence of the prime cause of the neuritis—a haematoma, swelling or tenosynovitis.

The ischaemic nature of the neuritis is well illustrated by a brisk local flush, which follows release of the tourniquet before closing the wound. This is a flush or flare reaction.

Sunderland (1945) has described the blood supply of the various peripheral nerves. Rich perineural and endoneurial anastomosis exists on the median nerve.

The ease with which this network can be temporarily interrupted is shown by the use of the injection method: 250 c.c. of a radio-opaque medium of fine barium (micropaque) was injected slowly into the brachial artery of the cadaver of an elderly female who died of a gastric neoplasm. The wrist joint was acutely flexed during injection. The interruption of neural blood flow is shown

FIG. 1.—Surface anatomy of the flexor retinaculum.

FIG. 2.—Dissection of carpal tunnel. The marker is under the thenar nerve.

taking place at the lower border of the flexor retinaculum (Fig. 3). This vascular effect is probably unobtainable in the normal wrist, as a simple test on oneself will show. Forced firm flexion of the wrist for 10 minutes or more produces slight digital paraesthesiae and a feeling of stiffness and discomfort, but not median neuritis.

Nevertheless, some paraesthesiae do occur and illustrate how small a margin exists between significant and insignificant carpal compression.

The tourniquet test of Gilliatt and Wilson (1953) is merely another method of inciting this potential vascular insufficiency in patients suffering from carpal compression.

These vascular features explain the nature of the paraesthesiae and account for the flushings and sensation of local heat that may follow and signify the end of an attack of neuritis.

Aetiology

Local pressure within the carpal tunnel may follow contusions, fractures and dislocations around the wrist, acute and chronic tendon and joint infections. Even minor tissue fluid exchanges, such

as occur in pregnancy and the menopause, may be sufficient to cause local ischaemic neuritis in the flexed wrist.

More rarely carpal compression may be the result of a swelling of the peripheral nerve, as may occur in the course of an infectious neuritis or follow an acute attack of cervical spondylitis. This latter type of effect is important and resembles the residual sciatica, entirely peripheral in distribution, which may follow an attack of prolapsed lumbar intervertebral disc and may be relieved by Ober's operation of pyriformis tenotomy.

Commonly the carpal tunnel syndrome is seen in the right hand of heavy manual workers or athletes following an attack of non-specific tenosynovitis, in the right hand of post-menopausal women who have more than a fair share of housework to perform, in patients suffering from rheumatoid arthritis and in either hand of middle-aged individuals who have recently had an attack of cervical spondylitis.

FIG. 3.—Shows effect of wrist flexion on neural blood supply. The shaded ridge is the lower border of the flexor retinaculum.

Symptoms and Signs

Carpal compression usually presents with sensory impairment in the median nerve supply to the hand, less often with actual thenar wasting. Frequently the median nerve is tender at the lower border of the retinaculum and symptoms can be brought on by strongly flexing the wrist or by the tourniquet test.

The symptoms may be episodic, acute or moderate and are worse at night, when the wrist is

inadvertently flexed and relaxed. Relief is obtained by hanging the hand over the side of the bed and this corrects the deformity and improves the vascular supply to the nerve. Sometimes the 'burning' is so intense that the patient plunges his hand into cold water to get relief.

The syndrome is to be differentiated from the other causes of pain in the arm. In particular, as noted previously, median neuritis at the wrist may be an end result of an attack of cervical spondylitis with disc degeneration. A guide to diagnosing in this case is restriction of the neck movements. Another, much rarer, condition is the thoracic inlet syndrome, which tends to affect lower roots of the brachial plexus. Finally, it is worth considering pressure due to ganglia about the wrist in the differential diagnoses of isolated median neuritis.

Treatment

The results of operation are so good that surgery should not be withheld. It is to be remembered, however, that carpal compression is transitory in many patients; for example, in pregnancy and after injury to the wrist. Some relief may be obtained by splintage of the wrist in the mid position. This is not always convincing and often may be attributed to a remission rather than to the splintage. Severe symptoms usually warrant early surgery in any case.

The use of hydrocortisone into the carpal tunnel is not recommended. Vitamin B may be administered to cases of toxic and infective peripheral neuritis with developing carpal compression.

Surgery is best performed under tourniquet and therefore general anaesthesia. This enables the surrounding synovia, and particularly the neighbouring reaction, to be studied. Biopsy of the synovial flexor sheaths may be informative in suspected polyarthritis.

A longitudinal incision is recommended in preference to transverse to enable the entire constricting flexor retinaculum to be divided. The incision is made on the hypotenar side of the hollow between the thenar and hypotenar muscles to avoid the thenar branch of the median nerve.

Illustrative Examples

Case 1. A lieutenant-colonel in the Army Medical Services played tennis every evening until prevented by numbness and tingling of his right hand. Division of the flexor retinaculum showed chronic non-specific tenosynovitis of the wrist. His symptoms were relieved.

Case 2. A housewife had oophorectomies and hysterectomy at the age of 40 and thereafter put on two stones in weight. Two years later she

could sleep little from severe nocturnal median-neuritis. Her symptoms were relieved by carpal decompression and the only abnormality noted at operation was slight perineural vascular congestion.

Case 3. A widow was running a farm and had had several attacks of 'stiff neck' with residual cervical pain and pain radiating into the right arm and hand. The pain in the right hand persisted following the last attack. Division of the carpal ligament relieved this pain and appeared to improve her cervical symptoms.

Case 4. A Thames bargemaster awoke in his bunk with a 'crick' in his neck and thereafter developed such severe pain in the median nerve area of his right palm that he could not control the tiller. His symptoms were relieved by carpal decompression and using a Chinese pillow at night.

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