



Editorial Board

Dr Jimmy Wong (Chief Editor)
 Senior Medical Officer

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Dr TL Poon
 Consultant

C/o Department of Orthopaedics & Traumatology

5/F Professional Block, Queen Mary Hospital,
 Pokfulam, Hong Kong.
 Tel : (852) 2855 4654
 Fax : (852) 2817 4392
 Email : ortho1@hkucc.hku.hk
 Web site : <http://www.hku.hk/ortho/ortho/>

Nerve Entrapment Syndromes

Dr WY Ip
 Associate Professor

Nerve entrapment syndromes are compression neuropathies at specific sites in the limb. These sites are narrow anatomic passages where nerves are situated. The nerves are particularly prone to extrinsic or intrinsic pressure. Common entrapment neuropathies are shown in Table 1.

Table 1

Median Nerve	Pronator teres syndrome
	Anterior interosseous syndrome
	Carpal tunnel syndrome
Ulnar Nerve	Cubital tunnel syndrome
	Guyon's canal compression
Radial Nerve	Axilla
	Spiral groove
	Radial tunnel syndrome
	Posterior interosseous nerve
Sciatic Nerve	Sciatic notch
	Hip
Peroneal Nerve	Fibular neck
	Anterior compartment
Posterior Tibial Nerve	Tarsal tunnel syndrome (at medial malleolus)

The most common nerve entrapment syndrome in the body is carpal tunnel syndrome.

The Carpal Tunnel

The floor is formed by the carpal bones which are concave in its flexor surface. This bony gutter is converted into a tunnel by the flexor retinacular on the volar aspect.

The median nerve and the long flexor tendons namely flexor pollicis longus, flexor digitorum profundus, and flexor digitorum superficialis together with their synovial sheaths pass through this tunnel to the digits. (Fig. 1 & 2)

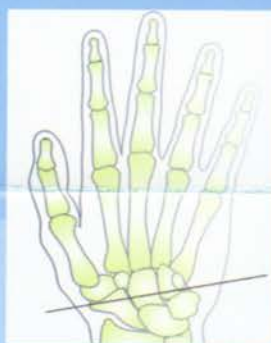


Fig 1

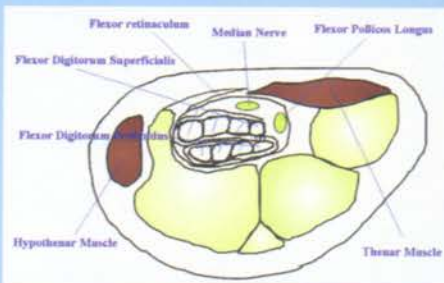


Fig 2

The Median Nerve

The median nerve is a mixed peripheral nerve receiving fibers from C6,7,8 & T1. It supplies to most of the flexor muscles of the forearm, to three thenar muscles and to radial two lumbricals in the hand. It transmits sensation of volar surfaces and nails of radial three and a half fingers and a corresponding area of palm.

Clinical features of carpal tunnel syndrome

1. Usually affects women, commonly bilaterally and the dominant hand is

often affected first and more severely.

2. Numbness over radial three and a half fingers; nocturnal numbness, improves with shaking of hand
3. Progressive clumsiness and weakness of thumb; wasting and weakness of thenar muscles (Fig. 3)
4. Positive Tinel sign
5. Positive Phalen's test (Fig. 4), increase in symptoms with wrist in palmar flexion within 60 second



Fig 3



Fig 4

Causes of Carpal Tunnel Syndrome

Table 2

Local	Systemic
repetitive trauma	endocrine e.g. pregnancy
synovitis	metabolic e.g. myxedema
arthritis	infective e.g. mycobacterial infection
abnormal vessel	collagen disease e.g. rheumatoid arthritis
local tumour	storage disease
	blood disease
	chronic renal failure with amyloidosis

Investigations

1. When there is suspicion of systemic causes, investigate accordingly e.g. renal function test, blood sugar, thyroid function test.
2. XR of carpal tunnel to look for bony abnormality.
3. Electrophysiological studies to determine terminal motor latency, sensory nerve conduction velocity, abnormal wave form or amplitude of thenar muscle electromyogram (EMG.)

Conservative Treatment

If the compression is mild, the motor function is preserved and the numbness is not severe, adjustment of hand and wrist movements in work and activity of daily living will help improve the symptoms. Resting splint during sleep in neutral or in slightly dorsiflexion will improve the numbness. Some patients may reponse to careful steroid injection, ultrasound treatment or diuretics.

Surgical Treatment

If the symptoms are severe and do not respond to conservative treatment or there is motor involvement indicating significant compression, surgical treatment should be advised. The flexor retinaculum can be released surgically to relieve the median nerve compression. Open release is traditionally done (Fig. 5). The nerve can be explored directly and local procedures such as neurolysis or synovectomy can be done at the same time. The operation can be done under Bier's block and postoperatively a resting plaster is usually given for a week or two.

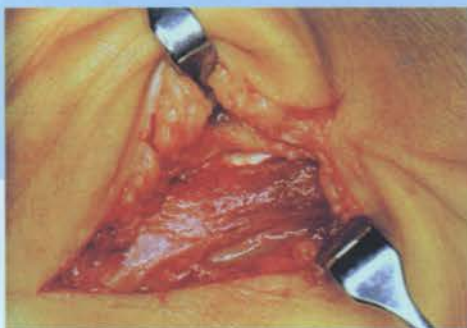


Fig 5

Recent Advances

Recently, release of retinaculum can be performed endoscopically (Fig. 6). One or two incisions are made to pass the endoscope. A camera can be used to take real time images of the views of the endoscope. The undersurface of the

flexor retinaculum is visualized. Release is done without opening up the tissues on top of it. The procedure is less invasive and post-operative rehabilitation can be hastened. However, there is higher risk of normal tissue injury due to limited exposure. This procedure requires more training and should be performed by a hand specialist.



Fig 6

Key points of carpal tunnel syndromes

1. The most common entrapment neuropathy.
2. It is predisposed by repetitive hand and wrist movements.
3. Numbness of radial three and a half fingers, nocturnal numbness are common presenting symptoms. Motor symptoms vary.
4. Conservative treatment is suitable for milder cases without motor involvement and release operation is required for severe cases.

Cubital tunnel syndrome

Cubital tunnel syndrome is the most common pathological entrapment of the ulnar nerve. It may be caused by constricting fascial bands, hypertrophied synovium, a tumour, a ganglion etc. Bony abnormalities like cubitus valgus as a result of previous fracture around the elbow or bony spur may also cause ulnar neuropathy. Subluxation of the ulnar nerve over the medial epicondyle with elbow flexion will also result in frictional injury to the nerve.

The patient may present with numbness along the little and ulnar half of the ring finger and corresponding area of the palm and dorsum of the hand. It is frequently accompanied by weakness of the grip, particularly in activities like using a tool. Patients with more severe neuropathy would present with wasting of the intrinsic muscles of the hand (Fig

7). They may have the classic Froment's sign (Fig 8). Sensory involvement on the ulnar dorsal aspect of the hand suggests cubital tunnel syndrome, as the dorsal cutaneous branch of the ulnar nerve originates proximal to the wrist. Weakness of the deep flexors to ring and little fingers as well as weakness of the flexor carpi ulnaris also point to proximal ulnar nerve entrapment.



Fig 7



Fig 8

About half of the patients improve spontaneously. A neurophysiological study can confirm the diagnosis and assess the severity of the neuropathy. A decrease in nerve conduction velocity at the elbow joint level is expected.

For those patients with persistent symptoms, surgery is the mainstay of treatment. Options for treatment include simple compression, anterior transposition of the ulnar nerve (Fig 9) or medial epicondylectomy. Any of these techniques is expected to provide 80 to 90% good result. Most of the functional recovery occurs within six months.



Fig 9



The Dexter Hand Centre is a tremendously versatile tool. It combines three major features into one system for maximum efficiency: evaluation, therapy and documentation.

With the Hand Centre we can conduct physical examination, strength tests and impairment ratings and automatically document the results. Patients can be treated using a variety of modes – isometric, isotonic, isokinetic and continuous passive motion.

The Dexter Hand Centre can test movements that until now have been difficult to test accurately and effectively, such as finger abduction/adduction and flexion/extension.

At every patient visit the Hand Centre automatically stores and updates all the test and treatment data. What's more, as patients progress through therapy we can obtain an instant trend analysis and output full colour graphic reports.

Current Approach in Occupational Therapy Program for CTS patients

By Rebecca K.Y. Chan,
Senior Occupational therapist,
Duchess of Trench Rehabilitation Centre

Introduction

Carpal Tunnel Syndrome (CTS) is a common upper extremity musculo-skeletal disorder. Patients often report gradual onset of numbness of the radial 3 fingers. It is a frequent cause of hand pain and paraesthesia. CTS is particularly common among women. People with jobs involving prolonged static gripping or forceful and repetitive hand movements are prone to develop CTS.

Wrist Splintage

Wrist splint is widely used as a form of conservative treatment for CTS. The static splint is usually made of thermoplastic material. It is custom molded with the involved wrist neutral in position. The rationale for using wrist splint is based on minimizing carpal tunnel pressure.

Carpal tunnel pressure increases with the wrist deviated away from neutral position.



Night wrist splint to keep wrist in neutral position to reduce carpal tunnel pressure



Day working splint made with soft material to prevent excessive flexion or extension of wrist during typing

Besides wrist position, forearm position and finger joints position and fingertip loading can also elevate carpal tunnel pressure.

A recent study conducted by Walker¹ suggests that continual wearing of splint for 6 weeks has been found useful in improving symptoms and function deficits. The results also indicate that either night only or full time splintage is effective, but full time splintage is slightly superior in improving the condition.

Multiple Components Occupational Therapy Program

With the increased knowledge of etiology of CTS, education on ergonomic and habit training of wrist and hand use appears helpful for this group of patients. Recent literature review supports multiple components rehabilitation program^{2,3} for treating CTS patients.

i). Identification of risk factors in daily activities & ergonomic advice
Activities with forceful exertion and sustained grip, like carrying groceries from market to home may aggravate CTS symptoms. Interventions include ergonomics advice, audio-visual biofeedback, workstation redesign, job tasks rescheduling.



Giving ergonomic advice to patient working at the visual display unit

ii). Mobilization and Training Program
Building up the proximal muscles strength can reduce the chance of overloading the hand and wrist in daily activities. Home stretching and mobilization program for whole upper limb especially shoulder, wrist and fingers are found useful.



Stretching programme for the whole upper limb especially the wrist and the fingers

Pilot Study Conducted in DTRC

A pilot study was conducted in 1997 to 1998 to study the treatment outcomes of a multiple components rehabilitation program for CTS. 18 patients with 28 wrists were recruited. The patients went through a two months programme. Repeated assessments at 4 weeks, 8 weeks and 1 month after discharge from the programme were conducted. The results showed a decrease in symptom severity ($F=9.018$, $df=3, 54$, $p<0.001$). Dysfunction score also

On the lateral projection, there is mild anterior subluxation (about 25%) of C4 vertebral body upon C5 vertebral body. The articular pillar below C4 is in oblique profile whereas the rest of the upper cervical articular pillar is in true lateral projection. The obliquely projected facets at C5 to C7 levels assume the characteristic 'bow-tie' or butterfly appearance. On the frontal projection, the spinous process of C4 and above are abruptly deviated to the left in relation to those at C5-C7 which are located in the midline. There is no bony fracture obvious. Findings are typical of unilateral facet dislocation (unilateral locked facet) at left C4/C5 facet joint. A combination of flexion, distraction and rotation results in unilateral locking of the facet joint. The involved vertebra moves anteriorly and rotates on its vertical axis, causing distortion of the interfacetal joint on the side opposite the direction of the rotation. The distal facet is 'locked' anteriorly against the adjacent facet. Spinal cord is not frequently injured due to usually mild degree of spinal canal compromise. Computed tomography is particularly useful in demonstrating any facet fractures frequently associated with the injury. As the fracture is rather stable, patient can often present long after the initial injury.

By Henry Ho, Mphil student

decreased ($F=3.448$, $df=3$, 54 , $p=0.023$). Motor power showed improvement, i.e. power grip ($F=10.44$, $df=2.6$, 46.7 , $p<0.001$), and tripod strength ($F=5.459$, $df=1.2$, 21.3 , $p=0.025$). The results showed significant changes in symptoms improvement and grip strength. However, due to the relatively small sample size and short follow-up duration, larger scale study might be needed to understand the treatment efficacy of the multiple component programme for CTS.

Reference:

1. Walker WC et al. Neutral wrist splinting in carpal tunnel syndrome: a comparison of night-only versus full-time wear instructions. *Archives of Physical Medicine & Rehabilitation*. 81(4):424-9, April, 2000
2. Andrew E. et al. Interventions for the Primary Prevention of Work-related CTS. *American Journal of Preventive Medicine* 18(4) 37-50, May, 2000
3. Feuerstein, M. et al. Clinical management of carpal tunnel syndrome: a 12 year review of outcomes. *American Journal of Industrial Medicine* 35(3), 232-245, 1999



Design of a unique Plate for Distal Radius Fracture

The objective of the study is to provide a unique and special plate for use in distal radius fractures. The plate should have characteristics and shape that can be reliably and securely used in the fixation of distal radius fracture, and contoured to allow early wrist movement.

One of the most common fractures in humans is fracture of the distal radius. Inherent bony instability, soft tissue damage, and frequent associated injuries make the distal radius fractures very difficult to treat.

Closed treatment methods including casting, pins and plaster, and external fixation have frequently yielded unsatisfactory results. Treatment using formal open reduction and internal fixation with the conventional plate system, when achieving anatomic reduction and early mobilization, has produced some promising results. The value of immediate mobilization of the injured joints is clear. But the currently available plate systems for use in the internal fixation of distal radius fractures frequently fail to achieve sufficient stability to allow early mobilization and thus fail to provide the accompanying benefits.

With the integration of the concepts of an anatomical low profile plate design, and accurate reduction accessories, it is believed that the new generation of the implant plate will be born. Currently, the New-Y plate system (shown in figure) has been developed and being tested mechanically and bio-mechanically in our laboratory to compare its strength with other implant systems. Of course, this will need further development in design and testing, after which it may be ready for human trial.

65 year-old female presented with persistent neck pain. She had neck injury several years ago. There was slight limitation of movement of the neck but neurological deficit could be elicited.

What are the radiographical findings on the frontal and lateral projections of the cervical spine? What is the diagnosis?

News in Flash

The paper titled "Ten year follow-up of hemivertebrae treated by anterior convex epiphysiodesis and posterior concave distraction" by Dr Kenneth Cheung and co-authors, Dr YK Chan, Dr JG Zhang, Dr DS Lu, Dr YW Wong, Professor Keith Luk and Professor John Leong, won the Hodgson Award for the best paper presented in the Hong Kong Orthopaedic Association Annual Meeting in 2000. The Award was given to the best paper presented in the meeting out of a total of over 100 papers.



Dr Kenneth Cheung

Congratulation to Professor John Leong who was awarded the University Fellowship of the Hong Kong Polytechnic University by the Council of that University in recognition of the enormous contributions which he made towards its development. This was the first time that the Polytechnic University conferred Fellowships upon respected personalities. The conferment took place in November 2000 at the Polytechnic University's Sixth Congregation.

HK\$895,200 and HK\$650,000 funded by the Research Grants Council were awarded to the projects titled "Development of novel artificial finger joints" by Professor SP Chow and "Gradual scoliosis correction by use of a superelastic alloy" by Dr Kenneth Cheung respectively. Congratulations to Professor Chow and Dr Cheung!

The annual specialist exit examination for the Hong Kong College of Orthopaedic Surgeons was held in December 2000. Three candidates, Drs WP Yau, WY Ho

and James KF Kong from Queen Mary Hospital entered and all of them passed. Dr WP Yau in particular passed with fine colours and won the Gold Medal, which was awarded to the most outstanding candidate who had scored the highest marks in the examination. Our Department has been the only one so far to have produced the "Gold Medallists". The other two previous Gold Medal winners from our Department are Drs W Chow and HY Kwok. Congratulations to all of them!



From left to right: Drs WP Yau, HY Kwok, W Chow

Radiographic Quiz

Dr. L.L.S. Wong
Department of Radiology
Queen Mary Hospital

