

Syndroma canalis carpi

Canalis carpi syndrome (carpal tunnel syndrome, SKT) is a compression neuropathy in the wrist area. It is the most common entrapment syndrome, the most common mononeuropathy and, at the same time, the most common occupational disease. The main risk factors include long-term, excessive and unilateral overloading of the hand and wrist, vibration with transfer to the hand, but also diabetes mellitus or thyropathy. Subjective symptoms include paresthesia and dysesthesia of the 1st to 4th finger, and objective symptoms include atrophy of the outer part of the thenar. Impairment is quantified using electromyography.

Incidence

The incidence is reported to be between 180 and 346 diagnosed cases/100,000 inhabitants per year, with women being affected approximately 3 times more often than men. The average age of the patients is between 45 and 55 years, with a prevalence of disabilities in the working population. SKT often occurs bilaterally and the dominant hand is more commonly affected.

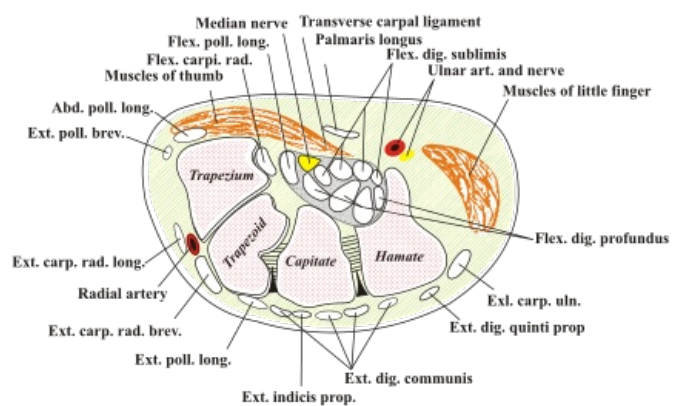
It is more common in older, petite women.

Anatomy of the carpal tunnel

Anatomy of the carpal tunnel The walls of the carpal tunnel are made up of:

- *eminentia carpi ulnaris*: pisiform bone, hamate bone
- *eminentia carpi radialis*: tuberculum of scaphoid and tuberculum of trapezium bone
- palmar side: ligamentum carpi transversum or retinaculum musculorum flexorum,
- dorsal side: carpal bones.

The median nerve and 9 finger flexor tendons pass through the tunnel. The median nerve sends the ramus palmaris nervi mediani above the carpal tunnel — a sensitive branch for the lateral area of the carpus and the lateral part of the palm; this area is therefore not sensitively affected in SKT. After passing through the carpal tunnel, it sends rami musculares to the thenar muscles except for the adductor pollicis muscle and the deep head of the flexor pollicis brevis muscle, which are supplied by the ulnaris nerve. It also sends out nervi digitales palmares, which supply motor musculi lumbricales I et II (for the 2nd and 3rd fingers) and sensitively the 1st finger to half of the 4th finger from the palmar side, and their innervation extends over the fingertips to the dorsum of the hand, where sensitively they supply the distal parts of the finger joints.



Anatomy of the carpal tunnel

Etiology and pathogenesis

The carpal tunnel is a strait, which is why it anatomically predisposes to nerve damage. Any abnormality of the nerve or its surroundings, which results in a reduction of the surrounding space, leads to nerve compression. First, the vasa nervorum is oppressed and thus the nerve is ischemia and its edema occurs, which further increases the pressure on the nerve at the point of passage through the carpal tunnel. Persistent chronic compression of the nerve can then induce structural changes in the nerve (initially there is a lesion of the myelin sheath, later individual axons are affected) with a gradual loss of function of sensitive and motor fibers. Sometimes intraneural fibrosis can occur. Weakly myelinated fibers leading to pain perception are more resistant.

Risk factors for the development of SKT:

- excessive, long-term and unilateral local muscle load of the small muscles of the hand and forearm — use of greater muscle power with a lower frequency of movements or smaller muscle power with a high frequency of movements (working with a screwdriver, holding heavier hand tools, playing stringed instruments, working with a computer keyboard and mouse in an inappropriate position) — leads to hypertrophy, traumatization and edema of soft tissues;
- vibration with transfer to the hands (work with a chainsaw, jackhammer, pneumatic hammer or drill) — leads to microtraumas directly in the nerve, or damage to the vasa nervorum with subsequent ischemia of nerve fibers;
- diseases that affect the nervous, vascular or musculoskeletal system: diabetes mellitus, hormonal changes (thyreopathy, 3rd trimester of pregnancy — problems disappear within a few weeks after birth, use of hormonal contraception, menopause, acromegaly), rheumatological diseases (rheumatoid arthritis, systemic lupus erythematosus), traumatic changes (fractures of wrist bones with subsequent formation of bone muscle, Colles fracture), obesity, gout, alcoholism, nutritional deficiency and many others;
- congenitally narrow carpal tunnel, anomalous tendon spacing, vascular anomaly, ganglion, tumor.

Diagnostics

- medical history, physical examination and EMG.

Clinical picture

- sensitive symptoms appear first:
 - paresthesia (tingling sensation) or dysesthesia of the 1st to 3rd and adjacent parts of the 4th finger on the palmar side of the hand and dorsally around the nails of the same fingers (i.e. in the range of sensitive innervation of the median nerve), sometimes the symptoms can affect all fingers (based on the anastomoses between the median nerve and the ulnaris nerve: Martin-Gruber anastomosis on the forearm or Cannie-Riche anastomosis in the palm);
 - feeling of "swollen hand" without obvious swelling;
 - at first, typically at night — it wakes the patient up in the morning, and after shaking the hand and moving the fingers, there is relief, later even during the day;
 - or during manual work, when bending the wrist in a static position of the hand (holding the handlebars of a bicycle) or when elevating the upper limb (holding in a means of transport).
- mild to severe hypoesthesia in the area of the 1st to the radial half of the 4th finger from the ventral part and on the dorsal tips of the fingers
- deterioration of fine motor skills (difficulty turning on a button or picking up a small coin)
- motor symptoms: paresis of abduction and opposition of the thumb
- in the severe stage, sensitive symptoms may disappear, there is atrophy of small thenar muscles due to severe denervation
- atypical symptoms include pain radiating from the hand to the forearm, arm or shoulder, or pain in the carpal area
- fasciculations or spasm of thenar muscles rarely occur
- autonomic symptoms may also appear — a change in temperature, color and trophism of the skin and nails



Video in English, definition, pathogenesis, symptoms, complications, treatment.

Development of subjective symptoms

- 1st phase – morning numbness in the fingers;
- 2nd phase – nocturnal paresthesia;
- 3rd phase – daytime paresthesia – mainly when working with hands above the head (for example, holding on to a handrail in public transport);
- 4th phase – clumsiness of small movements.

Objective finding

Sensitivity disorders – we assess them on the 2nd finger (we compare sensation on the belly of the 2nd and 5th fingers).

The motor defect arises later – mainly the abductor pollicis brevis muscle atrophies;

- we demonstrate the sign of a candle – hand palm up, thumb sticking up, we press it into the palm, watch its resistance;
- the resulting atrophy of this muscle makes such a dimple laterally on the thenar.

Sensation above the thenar is normal (the subcutaneous branch originates from the median nerve before entering the carpal tunnel!!!).

A pseudoneuroma of the median nerve is formed - a spindle-shaped thickening of the nerve resulting from compression of the nerve and accumulation of axonoplasm.

Examination

Provocation tests — maneuvers that narrow the space for the nerve in the carpal tunnel:

- tapping with a hammer or finger above the carpal tunnel (Tinel's test)
- compression with our fingers over the carpal tunnel for 30 seconds (Durkan's test)
- flexion of the hand at the wrist for 60 seconds (Phalen's test),
- hand wrist extension for 60 seconds (reverse Phalen test)
- hand elevation test for 60 seconds

Classification according to the severity of clinical findings

1. light degree: intermittent symptoms, physically only positive provocation tests can be provided, event.
moderate degree: positive provocation tests, muscle weakness, possible hypotrophy of the thenar muscle, reduced vibration perception in the distribution of the median nerve; response to vibration stimulus, irritation of the median nerve without the presence of extinction symptoms;
2. moderate degree: positive provocation tests, muscle weakness, possible hypotrophy of the thenar muscle, reduced vibration perception in the distribution of the median nerve;

3. severe degree: muscle atrophy, sensitive symptoms are permanent, abnormal two-point discrimination sensation, extinction symptoms are prominent.

Electromyography (EMG)

- to verify the diagnosis and to determine the severity of the disability and to objectively monitor the disease;
- verifies the involvement of the sensory and motor fibers of the median nerve (neurography) and shows whether the process is chronic, acute or subacute;
- evidence of demyelinating signs of nerve involvement — reduced speed of sensitive conduction and prolonged distal motor latency (DML), picture of dispersion of potentials;
- in the later stages, evidence of axonopathy — a decrease in the amplitudes of the sensory nerve summation action potential (SNAP) and the summation muscle action potential (CMAP);
- needle EMG — reinnervation potentials (chronic involvement) and abnormal spontaneous activity (acute involvement).

Imaging methods

- sonography, CT, magnetic resonance — in the event of failure of the operation or to rule out a tumor as the cause of SCT;
- x-ray image — if a rheumatological disease or bone abnormality is suspected (e.g. after trauma).

Differential diagnosis

- C6 and C7 radiculopathy — pain radiates to the fingers in a band-like distribution, worsening with movements of the cervical spine;
- pronator tunnel syndrome — pain/tingling radiating to the fingers and hypoesthesia in the distribution of the median nerve, palpable tenderness in the area of the pronator teres muscle and, in more severe cases, paresis of the flexors of the fingers;
- cervical myelopathy — difficulties with fine motor skills of the hands, but then the development of atrophy in the distribution of several nerves;
- polyneuropathy — tingling of the fingers of the upper and lower extremities;
- Raynaud's syndrome — attacks of vasoconstriction and vasodilation accompanied by pain and paresthesias of the fingers;
- diseases of tendons, sheaths, their attachments and joints;
- stenosing tendovaginitis — the so-called jumping or loupe finger;
- thoracic outlet syndrome;
- sometimes it is also possible to have one of the above-mentioned diagnoses with SKT.

Therapy

Conservative therapy

- causal treatment of the underlying disease;
- reducing the load on the upper limb;
- middle position of the hand, limitation of flexion and extension of the wrist (at night, a soft orthosis or bandage on the wrist to maintain the middle position);
- fyzioterapie — ultrazvuk, laser, magnetoterapie, iontoforéza, mobilizace zápěstních kostí atp.;
- non-steroidal antiphlogistics overall in combination with local therapy;
- spraying with the application of local anesthetics, steroids or non-steroidal anti-rheumatic drugs;
- B vitamins.

Surgical therapy

- moderate to severe disability according to clinical and EMG findings is indicated;
- decompression of the nerve by dissection of the ligamentum carpi transversum;
- classic open approach (gold standard) or endoscopy;
- in LA, this procedure is performed on an outpatient basis;
- there are quite a few complications - insufficient cutting of the ligament (insufficient incision, us of the so-called retinaculoma blindly).



Carpal tunnel surgery



Carpal tunnel surgery scars

Links

Související články

- Syndrom kubitálního tunelu
- Meralgia paraesthetica
- Nádory periferních nervů

Reference

1. ↑ Skočit nahoru k: a b c d e f g h i j k l MINKS, E, A MINKSOVÁ a P BRHEL, et al. Profesionální syndrom karpálního tunelu. *Neurol. praxi* [online]. 2014, roč. 15, vol. 5, s. 234–239, dostupné také z <<http://solen.cz/pdfs/neu/2014/05/03.pdf>>. ISSN 1803-5280.
2. ↑ Mondelli et al., 2002; Roquelaure et al., 2008; Bongers et al., 2007; Nordstrom et al., 1998
3. ↑ Skočit nahoru k: a b c d Vypracované otázky J. Beneše, zdroj: ZEMAN, Miroslav, et al. *Speciální chirurgie*. 2. vydání. Praha : Galén, 2004. 575 s. ISBN 80-7262-260-9.
4. ↑ Skočit nahoru k: a b c d e f g SMRČKA, M, V VYBÍHAL a M NĚMEC. Syndrom karpálního tunelu. *Neurol. pro praxi* [online]. 2007, roč. 8, vol. 4, s. 243-246, dostupné také z <<http://solen.cz/pdfs/neu/2007/04/14.pdf>>. ISSN 1803-5280.
5. ↑ MacKinnon SE, Dellon AL. Surgery of the peripheral nerve. 1st Ed. New York: Thieme Medical Publishers, Inc., 1988. 638 s