Endoscopic Carpal Tunnel Release

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CTS – Definition: MN compression neuropathy

“Carpal” = wrist

The commonest entrapment neuropathy

“Median nerve is compressed at the wrist, resulting in numbness or pain”

CTS – Epidemiology

“who gets CTS?”

• Majority of sufferers are idiopathic

• Minority have an identifiable cause:
  — Space occupying lesion
    — RA, synovitis.
  — Fluid retention disorders
    — Hypothyroidism
  — Diabetes
  — Peripheral neuropathies
    — Alcohol, cis-platin, vincristine, vitamin disorders, etc.
  — Vibrational tools (so-called “V.A.S.”)
    — Electric hammer, moulder, power tools etc.
CTS pathology

- Either:
  - Tunnel gets smaller
    - (collateral or capsule space. May flatten)
  - Contents get bigger

- Mismatch in size; nerve suffers first

- Compressed nerve
  - Macro:
    - hyper, hypo – aemia
    - Thickened gritty FR/TCL
  - Micro:
    - Demyelination – slower conduction of AP’s
    - Axonal degeneration
    - Axonal fibrosis

Idiopathic CTS – aetiology

- Fuchs et al –
  - biopsied tenosynovium from 177 wrists
  - = non inflammatory D

- SK personal view
  - “multiplanar carpal chondral degeneration” MCCD
  - decrease in size of carpal tunnel.

Multiplanar Carpal Chondral Degeneration (MCCD)

Hypothesis:
- Tunnel is reduced in 3D volume
- Contents become compressed
- Excitable tissue (median N) suffers first.
- Sensory symptoms precede motor, + asso electrical changes.
- Path changes eg demyelination are reversible at first
- Later becomes irreversible, eg axonal fibrosis
- Symptoms may even subside in the later stages.

Clinical Findings

Dx is largely clinical & takes some experience:
- Recognised variation in Dx accuracy between hand surgeons, orthopods, hand therapists, students, physios, nurses & GP’s & other allied.

- History
  - Nocturnal, sleep, shakes, car, kitchen, clumsy
  - Responds to splinting
  - Duration worth noting.

- Physical
  - Derkan’s, Phalen’s, Tinel’s
  - Locates mechanical irritation of MN @ wrist
  - Quite likely correlates with Px.

- NCS
  - I tx on (a) malingering/WC, (b) diagnostic dilemmas, (c) re-dos.
    - Sensory : N=55m/s; 45 bad; 35 severe.
    - Motor : late changes. severe CTS disease.
Physical findings

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>Derkan's compression test</td>
<td>0.87</td>
<td>0.90</td>
</tr>
<tr>
<td>Phalen's test</td>
<td>0.75</td>
<td>0.47</td>
</tr>
<tr>
<td>Tinel's sign</td>
<td>0.60</td>
<td>0.67</td>
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- Diagnosis is clinical.
- Semmes-Weinstein 2-point sensory mapping has limited value in diagnosis or monitoring of CTS.
- The likelihood of a correct diagnosis correlates with the experience of the examiner.

Non operative Rx

- Splints
  - Good data, provides relief but cumbersome.
- Steroids
  - Short term relief with high recurrence rates
- Not supported by Fuchs et al
  - Single portal ECTR Avoids incision at Glabrous skin
  - OCTR vs ECTR
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- NSAID's
- Rest/activity modification

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Surgical Rx

- More cost effective than a trial of Non-op-Rx in NCS + proven cases of CTS.
- OCTR
- ECTR
  - Single portal –eg Agee/Microaire CTRS
  - Double Portal

OCTR vs ECTR

- Single portal ECTR Avoids incision at Glabrous skin
- ECTR associated with
  - Less post op pain
  - Less use of analgesics
  - Faster recovery times
  - In WC & non WC patients
Open vs Endoscopic

- Glabrous skin
  - Greater post op induration
- Non-glabrous skin
  - Less pain
  - Faster recovery (WC & non WC pts)

Glabrous skin
- No hair follicles
- No sebaceous glands
- Lots of eccrine ducts & glands
- Thicker stratum corneum (SC)
- More post op induration

Non Glabrous Skin
- "OCTR before & after tourniquet release"
Dr John Agee; Sacramento CA
Microaire Pty Ltd

Single portal ECTR:
• Mark 1 instruments c 1995 ??
• Mark 2 instruments c 1998 ??

Prior to TCL/FR division.

Post TCL/FR division

“The safe zone”

Surgical technique
The safe zone
The safe triangle.

- The surface anatomy is only a rough guide.
- The blunt instruments are passed blind using surface anatomy & palpation.
- The endoscope is advanced under vision - only as far as the distal edge of the TCL.
- The scalpel is deployed under endoscopic vision which allows you to avoid the nerves and vessels.
- Do not cut what you cannot see!
- If you lose vision, convert to DCTR. E.g., severe tenosynovitis.

Single portal ECTR technique

- Surgical goals:
  1. Completely Divide TCL (FR), distal to proximal.
  2. Avoid:
     - SPA
     - MN- Branch to 3rd web space
     - Superficial palmar veins

Surface anatomy; planning skin incision.

Kaplan’s line safe zone surg technique

Palmar veins are variable. Can bleed post op causing potential adhesions.
Kaplan’s Cardinal Line

Find:
- Thenar motor br
- Hook of hamate
- Distal edge of the TCL (FR).

Surface anatomy; planning skin incision.

PCBWN is most likely pranged during skin incision and not by the endoscope. Incision is ulnar to PL. The diagram exaggerates true position of PCBWN.
Bruising is common.
6 months

Post op regime

- Naropin: & +/- Celestone
- Soft bandage, no slab or splint.
- No hand therapy
- Active ROM
- Drive car on day 1
- RTW
  - Office: 3 days
  - Self employed pts: RTW 1-2 days.
- ROS 2 wks
- Only see again if having problems.

3 phases of “getting better” after ECTR

1. Nerve decompression
   - Immediate
   - “I slept better that night & ever since”
2. Wound healing
   - Measured in weeks
   - Skin, TCL wound, bruise,
   - Gripping & leaning sore for ~ 3-4 weeks.
3. Nerve regeneration
   - Slow; measured in 1-2 years.
   - Cell bodies at DRG manufacture proteins; axonal transport.
   - Limited by:
     - (a) pre-op severity of CTS
     - (b) duration of CTS
     - (c) comorbidities.

Variations of thenar motor branch.

All of these should be avoided by the suggested ECTR single portal technique.

I personally have had nil iatrogenic nerve lacerations.

The nerve most likely to lac is the CDN to the 3rd web space, not the thenar motor br.
Ulnar nerve Variations

A: Riche-Cannieu anastomosis – motor fibres of UN & MN communicate at wrist. FPB supplied by UN in 77% cases.

B: communicating sensory br between UN & MN at the palm.

C: variant lumbrical motor supply

Variations in Arterial anatomy

Problematic in up to 10% of pts.

Variations in tendons – FCR

Type D is the only type likely to be relevant to CTS.

Variations in tendons – PL

PL is a highly variable m. Absent in 10% population

Palmaris profundus (F) may pass through the C tunnel & attach to the deep surface of palmar aponeurosis.
Outcomes

• 95-99% G/E results:
  – Mild will often fully recover median n sensation
  – Mod some full, some partial
  – Severe usually partial; will usually report less nocturnal sx

• Outcomes are probably determined by:
  – Pre op severity of CTS
  – Pre op duration of Sx
  – Comorbidities, ability for n regeneration
  – Surgical avoidance of iatrogenic injury
  – Post op bleeding & adhesions *

• Prospective RCT
  • 2002
  • 192 hands
  • Multicenter
  • 1 year f/u
  • ECTR:
    • Better functional
    • Less pain
    • Less symptoms
    • Shorter Return to work
Complications of ECTR (& OCTR)

**Short-lived :**
- Bruising, bleeding. (palmar vv)
- Pain on gripping, opposing – rel N.
- Pillar Pain
- RSD

**More problematic/ongoing :**
- Scarring, tethering, fibrosis – progressive nerve strangulation !
- Iatrogenic injury to anatomy: nn,aa,tt,vv.
- Infxn – uncommon.

“Pillar pain”
- Can occur after ECTR or OCTR.
- FR/TCL has been divided.
- Thenar & hypothenars take partial origin from FR.
- Muscles are de-stabilised.
- Altered resting tension, resting sarcomere lengths.
- Typical symptom is pain/ache with active use eg gripping.
- Improves typically at 6-8 weeks, due to ? Re-scarring, re-forming a new elongated TCL/FR. ????

Re-do’s after ECTR
- 6 / 1200 cases
  - 3 had aberrant muscles
    - 1 revised, improved.
    - 2 observed, improved.
    - slower than ave pts; recommend observe 12/12
  - All others (n= 5) for scarring, bleeding
  - Of the 6 revised to OCTR:
    - 5 improved of 1st op – happy.
    - 1 not improved; remains unhappy after 2 ops.
    - (after that he had a successful contra-lateral ECTR) !!!

How I Mx a failed ECTR or OCTR
- Important: acknowledge pts ongoing sx.
- Re-assess for
  - neck, pronator,
  - other medical causes.
- MRI—
  - to see if you’ve missed a Dx
  - Space occ lesion, Ganglion, Etc
- Comments about nerve unreliable?
- NCS – baseline for future
- Re-explore via OCTR, not ECTR.
Interestingly

- We believe that the TCL/FR regenerates or heals in some newly elongated fashion, maintaining the newly dilated, more-voluminous carpal tunnel.
- In majority of cases this causes no problem.