**Makhlouf T, Emil N S, et al. Outcomes and cost-effectiveness of carpal tunnel injections using sonographic needle guidance. Clin Rheumatol. 2014;33(6);849-58.**

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Design: randomized clinical trial

Population/sample size/setting:

* 64 patients with 77 wrists (67 female wrists, 10 male wrists, mean age 49) treated for CTS in a rheumatology clinic at the University of New Mexico
* Inclusion criteria were (1) hand numbness and tingling in the distribution of the median nerve, (2) decreased grip strength, (3) persistent hand pain, (4) nocturnal hand pain, (5) pain VAS≥5 cm, (6) positive Tinel’s and/or Phalen’s sign, (7) failure of splinting and/or hand rest, and (8) the desire of the participant to have a corticosteroid injection
* Exclusion criteria included (1) thenar atrophy, (2) prior carpal tunnel decompressive surgery, (3) thoracic outlet syndrome, (4) non-CTS polyneuropathy as documented on electromyogram/nerve conduction studies, (5) hemorrhagic diathesis, (6) use of warfarin or antiplatelet drugs, (7) the presence of infection, or (8) previous corticosteroid injection into the carpal tunnel in the preceding 6 months

Interventions:

* All patients received an injection of 3 ml 80 mg triamcinolone acetonide suspension, and all steroid injections were preceded by creating a neutral fluid space in the vicinity of the flexor sheath of the flexor digitorum profundus tendons with 3 ml of 1% lidocaine solution
* Randomization was to different methods of directing the injections with either US guidance (n=37) or landmark guidance using palpation (n=40)
  + The ulnar side of the palmaris longus tendon was the site of injection for both groups
  + In the US group, correct positioning was confirmed with sonographic identification of the median nerve, palmaris longus tendon, radial artery, and ulnar artery with Doppler imaging
* After the steroid injection , pressure was applied to the injection site and followup was scheduled for each patient

Outcomes:

* During the injection office visit, pain was assessed prior to the procedure (baseline pain), during the insertion of the needle (procedural pain), and during injection of the treatment drug (injection pain)
* Followup evaluations were schedules at 2 weeks and again at 6 months
* There were no complications with either group, but there were differences in procedural pain and injection pain which favored the US group
  + Mean procedural pain was 4.7 in the palpation group and was 3.1 in the US group
  + Mean injection pain was 3.5 in the palpation group and 0.8 in the US group
    - Injection pain ≥5 was experienced by 15/40 palpation guided patients and by only 1/37 US patients
* Pain at 2 weeks also favored the US group (mean 1.1) over the palpation group (mean 3.0)
  + Responders, defined as having pain VAS less than 2, were counted in 19/40 (47.5%) of the palpation group and in 34/37 US patients (91.9%)
* At 6 months, pain VAS still favored the US group (mean 3.1) over the palpation group (mean 6.1), indicating that pain had recurred to near-baseline levels in a large number of palpation-guided patients
* Mean duration of therapeutic effect was longer for the US group (5.3 months) than for the palpation group (3.1 months)
* The time to the next procedure (reinjection or referral to surgery) was longer for the US group (9.1 months) than for the palpation group (7.0 months)
* Some cost analyses were done for US Medicare rates showing that the costs per patient for an office procedure was greater by 80% ($263 versus $146) with US versus palpation guidance
  + However, the cost per patient per year for a hospital outpatient injection setting was lower for US guidance (%95 versus $120) than for palpation guidance

Authors’ conclusions:

* Carpal tunnel injection with corticosteroid is effective in producing pain relief, and sonographic guidance makes the procedure more comfortable and also increases the duration of pain relief
* There is a difference between cost-effectiveness in a physician office, where US adds costs, versus hospital outpatient settings, where US lowers costs; this is due to the different methods that Medicare uses for cost bundling in the two settings
* US-guided carpal tunnel steroid injection may serve as a helpful bridge to carpal tunnel release, or it may permit time for spontaneous resolution of symptoms and thereby reduce the rate of surgery

Comments:

* The group comparisons for procedural pain were large and not likely to be artifacts of how the data were gathered and analyzed
* However, there are several problems with the presentation of the pain data
  + There were 64 patients and 77 wrists, meaning that there must have been 13 patients with involvement of both wrists
  + Therefore, for these 13 patients, the responses in the two wrists are correlated and not independent
  + The numbers of bilateral cases allocated to US versus palpation guidance are not reported, and may or may not have been balanced between groups
  + The precision of the mean differences in pain at 2 weeks and at 6 months should be viewed with caution due to the likely side-to-side correlation for the bilateral cases
  + The followup reports times to additional treatment in the form of reinjection or referral to surgery, but the numbers of referrals to surgery are lacking
* Pain is the only clinical outcome reported; no functional outcomes were reported
* It is not possible to determine whether the study protocol planned for functional outcome analysis, due to the fact that the authors report a clinical trial identifier for clinicaltrials.gov (NCT00651625) which was a study of a new pain device being tested at the University of New Mexico by one of the authors of this study, where the patients had osteoarthritis, rheumatoid arthritis, thyroid nodules, trauma, and cancer
* Except for the reporting of less procedural pain with US guidance, the other outcomes are inadequately reported and analyzed

Assessment: adequate for some evidence that in patients with CTS who are undergoing a corticosteroid injection, ultrasound guidance significantly reduces the pain associated with the injection, compared to injections done with landmark and palpation guidance alone