Chapter 1

Introduction
I asked Mrs. T into my consultation room. “Hello doctor”, she greeted me. I had known Mrs. T for 6 years now. She was 62 years old and always in a good mood. While she sat down I looked quickly into her electronic health record and noticed that her diabetes was well regulated. “What can I do for you?” I asked her. “One of the fingers of my right hand is causing some problems”, she replied, “sometimes when I stretch my finger it causes a painful snapping. Do you think you can do something about it?” I examined her hand and palpated a swelling in the lining of the flexor tendon of her index finger and noticed the triggering when she was trying to extend after flexing her finger. No doubt a trigger finger I thought by myself and suggested treatment with a local steroid injection. “Could you please tell me first a little bit more about that injection? Do you think the injection will help me?”...

It was Joseph Lee Hollander, a rheumatologist at the Pennsylvania Hospital in the United States, who started using local corticosteroids in 1951 for the treatment of rheumatoid arthritis and soft tissue rheumatic disorders. In a publication in 1953 in the Journal of Bone and Joint Surgery he reported his experiences with the use of hydrocortisone in over 7000 injections in 2 years and stated that “Traumatic tenosynovitis, a category in which we included peritendonitis crepitans, snapping thumb, trigger finger, and De Quervain’s stenosing tenosynovitis, also responded well” and he concluded that “After two years of extensive clinical trial of local therapy by intrasynovial injection of hydrocortisone, we conclude that this is often a temporary, but usually an effective, palliative treatment in most localized rheumatic conditions”\(^1\). In the following decades steroid injections for soft tissue rheumatic disorders, including those localized in the hand and wrist were adopted by various types of medical practitioners such as rheumatologists, plastic surgeons, orthopaedic surgeons and general practitioners. Unfortunately most of the studies were of poor methodological quality (except for carpal tunnel syndrome) and no study so far addressed explicitly the safety of local corticosteroid injections.

General practitioners are frequently consulted by patients suffering from hand and wrist disorders such as carpal tunnel syndrome (CTS), trigger finger or de Quervain’s tenosynovitis. These disorders are important causes for disability, health-care consumption and absence from work. In the Netherlands virtually every citizen is enrolled with a general practitioner, who has a gate-keeping role in the healthcare-system. Therefore the majority of patients with hand and wrist complaints are treated by general practitioners. Local corticosteroid injection is one of the treatment modalities that can be used for carpal tunnel syndrome, trigger finger and de Quervain’s tenosynovitis. The aim of this thesis is to contribute to the body of evidence concerning effectiveness of corticosteroid injections for hand and wrist disorders such as carpal tunnel syndrome, trigger finger and de Quervain’s tenosynovitis, in particular when applied in general practice.

**Aetiology, pathophysiology and risk factors**

The carpal tunnel is located at the base of the palm, just distal to the distal wrist crease. It is bounded on three sides by the carpal bones, which create an arch, and on the palmar side by the transverse carpal ligament. Nine flexor tendons traverse the carpal tunnel, along with the median nerve. **Carpal tunnel syndrome** is caused by elevated pressure in the carpal tunnel. This increased pressure produces ischemia of the median nerve, resulting in spurious generation of action potentials, local
demyelination and ultimately axonal loss. Impaired nerve conduction causes symptoms such as paresthesia and pain\textsuperscript{2,3}. Risk factors for the development of CTS include genetic predisposition, pregnancy, inflammatory arthritis, Colles' fracture, amyloidosis, hypothyroidism, diabetes mellitus, acromegaly and use of corticosteroids and estrogens. Up to one third of cases of carpal tunnel syndrome occur in association with such medical conditions; about 6 percent of patients have diabetes. Carpal tunnel syndrome has also been suggested to be associated with repetitive activities of the hand and wrist, particularly with a combination of forceful and repetitive activities\textsuperscript{2,3}.

Although trigger finger is also known as tenosynovitis, no inflammatory changes of the tendon or tendon sheath were seen in the histological studies\textsuperscript{4}. For trigger finger the triggering phenomenon is caused by incompatibility between the tendon of the affected finger and its sheath, most probably due to thickening of the first annular pulley. On histological examination the pulley shows fibrous and cartilaginous tissue changes that include the presence of chondrocytes and glycosaminoglycans (a mucopolysaccharide) and degenerative changes. These changes are believed to represent adaptations to shear load. Trigger finger occurs more commonly in patients with diabetes mellitus (probably due to glucose-induced collagen modifications), carpal tunnel syndrome, Dupuytren's disease, rheumatoid arthritis, amyloidosis, hypothyroidism, mucopolysaccharide storage disorders and congestive heart failure\textsuperscript{5,6}.

**De Quervain's tenosynovitis** is a disorder characterized by pain on the radial (thumb) side of the wrist, impairment of thumb function and thickening of the ligamentous structure covering the tendons in the first dorsal compartment in the wrist. The first dorsal compartment is located on the thumb side of the wrist (at the radial styloid) proximal to the wrist joint. Although the term stenosing tenosynovitis is frequently used, pathophysiology of De Quervain's disease does not involve inflammation. Predominant histopathological features are degenerative changes (myxoid degeneration, fibrocartilagenous metaplasia and deposition of mucopolysaccharide) resulting in impaired gliding of the abductor pollicis longus (APL) or extensor pollicis brevis (EPB) tendons because of thickening of the extensor retinaculum and narrowing of the fibro-osseous canal. Most pain is probably elicited by mechanical impingement between the tendon and its narrowed fibro-osseous canal resulting in stimulation of nociceptors\textsuperscript{7}. In a literature review of epidemiological studies, strong evidence was found for links between some biomechanical risk factors (e.g. repetition, force and posture) and musculoskeletal disorders of the upper limb but for de Quervain's tenosynovitis a causative role of work been questioned\textsuperscript{8,9}.

**Taxonomy, epidemiology and predictors of severity and prognosis of hand and wrist disorders in general**

Traditionally, the nomenclature of upper extremity musculoskeletal disorders (UEMSD), including the hand and wrist, is related to symptoms (e.g. trigger finger), the anatomical site (e.g. carpal tunnel syndrome), the tissue affected (e.g. tenosynovitis) or to the underlying pathophysiology (e.g. stenosing tenosynovitis). Unfortunately, diagnostic criteria for these disorders are often not uniform and lack validity since they are not repeatable, sensitive or specific\textsuperscript{10}. In recent years attempts
have been made to develop consensus-based classification systems such as the Southampton examination model and the CANS model\textsuperscript{11-13}. However their applicability in daily clinical practice for general practitioners appears to be limited since for classification of problems and diagnosis in general practice the second version of the International Classification of Primary Care (ICPC-2) is widely used\textsuperscript{14}. Another diagnostic challenge is posed by the fact that in 20\% of patients who consult their general practitioner for complaints of the upper extremity no specific diagnosis can be established\textsuperscript{15}. Management of these patients with non-specific forearm pain is known to be unsatisfactory. Both psychosocial and ergonomic factors have been found to be of influence in the etiology\textsuperscript{16}.

In the international literature population-based surveys show that symptoms of the wrist and hand are common in the general population. Lifetime prevalence for pain lasting more than one month was found to be 3\% for wrist pain and 7\% in fingers in a sample of 6913 participants from the US. The period prevalence of hand and wrist pain in southwestern Finland was 12\% for men and 10\% for women (pain in the last year). Another study performed in Manchester (UK) revealed a period prevalence of 12 \% (pain in the hand lasting more than one week in the past month). Point prevalence of hand and wrist pain was assessed in a Swedish study by asking for current pain in the hand and wrist that had lasted for more than 3 months and was found to be 13\% (10\% for men and 17 \% for women)\textsuperscript{17}. In the Netherlands period prevalence (12-months) was 17.5\%, point-prevalence was 12.5\% and for participants reporting chronic pain of the hand and wrist point-prevalence was 9.3\%\textsuperscript{18}.

Contrary to hand and wrist symptoms in general, epidemiologic data on specific hand and wrist disorders in the general population are scarce except for carpal tunnel syndrome. The point prevalence for carpal tunnel syndrome reported in different countries, depending on which diagnostic criteria are used, ranges from 3\% (clinically and electrophysiologically diagnosed) to 35\% (reported pain, numbness, tingling in fingers). Period prevalence for self reported CTS was 2\% in a population survey including 44223 participants from the US. In the Netherlands in 1985 point prevalence ranged from 5\% (electrophysiologically diagnosis of CTS with symptoms of nocturnal numbness and/or tingling) to 35\% (reported pain, numbness, tingling in fingers)\textsuperscript{19}. Stenosing tenosynovitis (trigger finger) was estimated to have a lifetime prevalence of 2.2\% among nondiabetic adults aged 30 years or older\textsuperscript{20}. The prevalence of de Quervain’s tenosynovitis in the general population in the UK was estimated to be 0.5\% for men and 1.3\% for women\textsuperscript{17}.

Regarding wrist, hand and finger symptoms the incidence in general practice in 2001 in the Netherlands was 4.6 per 1000 person-years for wrist symptoms (3.6 for males and 5.6 for females) and 7.6 per 1000 person-years for hand or finger symptoms (6.8 for males and 8.7 for females). The number of consultations per year per 1000 registered patients was 8.7 for wrist symptoms (6.3 for males and 11.1 for females) and 14.0 for hand or finger symptoms (11.9 for males and 16 for females)\textsuperscript{21}. The incidence rate of specific disorders in general practice is only available for carpal tunnel syndrome: in 2001 the annual incidence rate was 1.8 per 1000 registered patients (males 0.9/1000, females 2.8/1000) in the Netherlands\textsuperscript{19}. Patients appeared to have significantly higher scores on experienced severity of hand or wrist problems when they did not have paid work, had longer duration of symptoms, a diagnosis of entrapment, higher pain intensity, higher body mass index and higher scores on worrying\textsuperscript{22}. Non-recovery for UEMS D in general practice was
predicted by characteristics of UEMSD such as long duration of the complaint before consultation, recurrent complaint, musculoskeletal co morbidity and complaint mainly located at wrist or hand. Also psychosocial characteristics, such as more somatisation and experiencing less social support predicted non-recovery.\(^{23}\)

**Treatment options, effectiveness of interventions and possible complications**

Treatment options for hand and wrist disorders presenting in general practice consist of a wait and see strategy (some disorders are self-limiting), activity modification, topical Non Steroidal Anti-Inflammatory Drugs (NSAID’s), oral analgesics (mostly paracetamol or NSAID’s), splinting, referral to physiotherapist or hand therapist for treatment or referral to secondary care for surgical therapy. The most appropriate management strategy depends on which specific disorder is considered and treatment preferences of patients and physicians. We could not find any reports of studies of effectiveness and safety of treatments for specific hand and wrist disorders in the setting of general practice.

**Carpal tunnel syndrome** can be treated with oral analgesics, splinting, injections with corticosteroids or surgery. One third of neurophysiological mild and moderate cases may improve untreated.\(^{24}\) In a Cochrane review local corticosteroid injection for carpal tunnel syndrome proved to provide greater improvement in symptoms one month after injection compared to placebo in a secondary care setting, but significant symptom relief beyond one month could not be demonstrated.\(^{25}\) With eight documented cases of median nerve injury the risk of adverse events for steroid injection therapy for CTS has been estimated to be less than 0,1%.\(^{26}\) In another Cochrane review addressing efficacy of other non-surgical treatments oral steroids, splinting, ultrasound, yoga and carpal bone mobilisation showed to be of short-term benefit.\(^{27}\) A third Cochrane review comparing surgical to non-surgical treatment concluded that surgical treatment of carpal tunnel syndrome relieves symptoms significantly better than splinting.\(^{28}\) In general practice in the Netherlands 25% of consultations with patients with a clinical diagnosis of CTS is followed by a referral to secondary care for further evaluation and treatment.\(^{29}\) It is not known what percentage of patients with CTS is treated conservatively and which operatively.

For **trigger finger** spontaneous resolvement has been reported in 20-29%. Splinting maybe successful in 50-70% of patients based on data from observational studies.\(^{30}\) For local corticosteroid injections (for which intrasheath injection was not thought to be necessary) success rates range from 38-93% in observational and controlled studies.\(^{30}\) Possible side effects are those that are associated with local steroid injections: steroid flare, menstrual irregularities, subcutaneous fat atrophy, skin hypopigmentation, local infection and hyperglycaemia. Only one case-reports exists of a serious adverse event of rupture of a flexor pollicis longus tendon rupture in a trigger thumb which was treated with 2 injections of steroids prior to the rupture.\(^{31}\) Surgical therapy consists of percutaneous or open release. Success rates are high, ranging from 60-97%, but complications such as digital nerve injury, bow-stringing, infection, haematoma and long term scar tenderness may occur.\(^{30}\)

In a systematic review of observational studies with a mean follow-up of 9.6 months including 459 wrists effectiveness of conservative treatments for **de Quervain’s tenosynovitis** were assessed. Cure rates were 0%, 0%, 14%, 61%, 83% for respectively resting, oral NSAID’s, splinting combined with local steroid injections
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and steroid injections alone. No serious adverse events were reported and the side effects that occurred most were skin colour changes, subcutaneous fat atrophy and steroid flare\(^2\). Surgical therapy (slitting or removing a strip of the tendon sheet) has a success rate of 91%, but is associated with the risk of surgical complications such as radial sensory nerve injury\(^3\).

Objectives of this thesis

The aim of this thesis is to contribute to the body of evidence concerning the effectiveness of corticosteroid injections for carpal tunnel syndrome, trigger finger and de Quervain’s tenosynovitis in general practice. As a consequence we tried to provide an answer to the following research questions:

1. What is known about effectiveness and safety of local corticosteroid injections for trigger finger in adults and de Quervain’s tenosynovitis?
2. Are local corticosteroid injections effective for carpal tunnel syndrome, trigger finger in adults and de Quervain’s tenosynovitis in the setting of general practice?
3. What is the reliability, responsiveness and interpretability of the Dutch version of the Boston Carpal Tunnel Questionnaire?

Outline of this thesis

Chapter 2 presents the results of a systematic review assessing effectiveness of local corticosteroid injections for the treatment of trigger finger in adults and chapter 3 presents the results of a systematic review assessing effectiveness of local corticosteroid injections for the treatment of de Quervain’s tenosynovitis. Both systematic reviews were written according to the conventions of the Cochrane collaboration and with guidance of the editors of the Cochrane Musculoskeletal Group.

Chapters 4, 5, 6 describe the results of a randomized controlled trial in general practice, investigating the effectiveness of injections with triamcinoloneacetonide versus placebo injection (NaCl) for respectively carpal tunnel syndrome, trigger finger and de Quervain’s tenosynovitis.

Chapter 7 focuses on the measurement properties reliability, responsiveness and interpretability of the Dutch version of the Boston Carpal Tunnel Questionnaire. We translated the BCTQ into Dutch for use as an outcome assessment tool in the randomised controlled study described in chapter 4.

In Chapter 8 the findings of the previous chapters are interpreted and implications for daily practice and future research are discussed.

Finally a summary in English and Dutch are given.
References


