Carpal Tunnel Syndrome: Hand Surgeons, Hand Therapists, and Physical Medicine and Rehabilitation Physicians Agree on a Multidisciplinary Treatment Guideline—Results From the European HANDGUIDE Study

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Abstract

Objective: To achieve consensus on a multidisciplinary treatment guideline for carpal tunnel syndrome (CTS).

Design: Delphi consensus strategy.

Setting: Systematic reviews reporting on the effectiveness of surgical and nonsurgical interventions were conducted and used as an evidence-based starting point for a European Delphi consensus strategy.

Participants: In total, 35 experts (hand surgeons selected from the Federation of European Societies for Surgery of the Hand, hand therapists selected from the European Federation of Societies for Hand Therapy, physical medicine and rehabilitation physicians) participated in the Delphi consensus strategy.

Interventions: Not applicable.

Main Outcome Measures: Each Delphi round consisted of a questionnaire, analysis, and feedback report.

Results: After 3 Delphi rounds, consensus was achieved on the description, symptoms, and diagnosis of CTS. The experts agreed that patients with CTS should always be instructed, and instructions combined with splinting, corticosteroid injection, corticosteroid injections plus splinting, and surgery are suitable treatments for CTS. Relevant details for the use of instructions, splinting, corticosteroid injections, and surgery were described. Main factors for selecting one of the aforementioned treatment options were identified as follows: severity and duration of the disorder and previous treatments received. A relation between the severity/duration and choice of therapy was found by the experts and reported in the guideline.

Conclusions: This multidisciplinary treatment guideline may help physicians and allied health care professionals to provide patients with CTS with the most effective and efficient treatment available.

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The complex movements and tactile sensation of the hand are essential for completing everyday tasks. Consequently, hand disorders affecting these qualities have a significant impact on activities of daily living. Of those with chronic nontraumatic complaints of the arm, neck and/or shoulder, 29% reported complaints in the wrist/hand area. The most prevalent nontraumatic hand disorder is carpal tunnel syndrome (CTS).

Although the exact causative mechanism of CTS is unknown, it is safe to state that CTS is related to an increased pressure within the
carpal tunnel, resulting in mechanical compression and local ischemia—mediated damage to the median nerve.\(^5,6\) The occurrence of CTS can be associated with work-related factors.\(^7,8\) The prevalence of CTS is reported to be 0.6% in men and 5.8% in women in the general population\(^9\) and 1 in 5 in symptomatic subjects.\(^10\)

Interventions used to treat CTS vary from splinting to exercise therapy and from ultrasound to all kinds of surgical interventions.\(^11-13\) Ideally, a treatment guideline for CTS is based on systematic reviews describing the long-term effects of all aspects relevant for the diagnosis and treatment of the disorder. However, systematic reviews on the treatment of CTS mainly describe short-term and midterm effects and focus on the global picture of a treatment (eg, splinting, corticosteroid injections, open surgery), without taking into account relevant details (eg, type of splint; when to wear it; type of corticosteroid; number of injections; types of anesthesia, incision, and stitches). Because such details can have significant consequences, a Delphi consensus strategy was conducted to develop a treatment guideline for CTS. Development of evidence-based protocols and treatment guidelines can aid in optimizing care for hand disorders.\(^14\)

Therefore, in Europe, the HANDGUIDE study was initiated with the goal to create multidisciplinary consensus on treatment guidelines for 5 nontraumatic hand disorders: trigger finger, De Quervain disease, Dupuytren disease, CTS, and Guyon canal syndrome. In a Delphi consensus strategy, a series of sequential questionnaires (or rounds) are presented to a panel of experts, interspersed with controlled feedback, with the aim to achieve consensus of opinion among these experts.\(^15\) This article reports on the results for CTS.

**Methods**

**Steering committee and advisory team**

A steering committee consisting of a hand surgeon (with a PhD), physical medicine and rehabilitation (PM&R) physician (with a PhD), and physiotherapist (with a PhD) was composed to initiate and guide the HANDGUIDE Study. All 3 members of the steering committee have a clinical and scientific and/or epidemiologic background; they designed the questionnaires, analyzed the responses, and formulated the feedback reports. Further, an advisory team (consisting of 2 professors of hand surgery, 1 professor of PM&R, and 1 hand therapist with a PhD) was formed that received regular updates on the progress of the HANDGUIDE Study. This team could be consulted by the steering committee if necessary and could give the steering committee their opinions and advice as they saw fit.

**Preparation of the study**

**Evidence for effectiveness of interventions of CTS**

To establish an evidence-based starting point for this study, systematic reviews were conducted reporting on the evidence for the effectiveness of nonsurgical, surgical, and postsurgical interventions to treat CTS.\(^14,16,17\)

**Selection of experts**

The Federation of European Societies for Surgery of the Hand (FESSH) and European Federation of Societies for Hand Therapy (EFSHT) endorsed this study. The national member associations of the FESSH and EFSHT selected the experts in their respective field. Each national member association was invited to select a maximum of 3 representative experts per Delphi consensus strategy. In addition, some European PM&R physicians who specialize in hand rehabilitation were invited to participate in this study. The inclusion criteria for the experts to participate in this study/Delphi process are described in appendix 1.

**Procedure**

The questionnaires of the Delphi rounds on CTS included questions on the description, symptoms, diagnosis, and interventions. To ensure the expert-based foundation of the guideline, the experts answered questions only on issues within their field of expertise (ie, only the physicians answered questions on medication and injections, only the hand surgeons answered questions on surgery). All remaining questions were answered by all the experts.

**Cutoff point for consensus:** In the first round of the Delphi consensus strategy on CTS, a cutoff point of 70% was proposed because this is often used in Delphi consensus strategies.\(^1,18\) To reveal any discordant viewpoints between hand surgeons, hand therapists, and PM&R physicians, the amount of consensus was also calculated for each of these 3 professional groups. When \(<50\%\) of the experts within a professional group answered in accordance with the achieved consensus, this was mentioned in the results section.

**Target population**

The target population of this study included physicians and allied health care professionals involved in the treatment of patients with CTS.

**Delphi consensus strategy on CTS**

**Description, symptoms, and diagnosis of CTS**

**First-round questionnaire:** In the first round, literature-based concepts for a short description of CTS, its symptoms, its diagnosis, and its nonsurgical and surgical treatment were presented to the experts. Subsequently, the experts were asked whether they agreed (yes/no/no opinion) with the aforementioned concepts followed by the request to explain their answer (please explain your answer). This allowed the experts at any time to object or suggest alterations to any of the steering committee’s suggestions regarding the aforementioned items.

**Second- and third-round questionnaires:** The questions of the second and third rounds were formulated based on the results of the first and second rounds, respectively.

**Interventions to treat CTS**

**First-round questionnaire:** In the first-round questionnaire, nonsurgical (ie, instructions for the patient, nonsteroidal anti-inflammatory drugs [NSAIDs], splinting, corticosteroid injection) and surgical interventions often reported in (scientific) literature to

**List of abbreviations:**

- CTS carpal tunnel syndrome
- EFSHT European Federation of Societies for Hand Therapy
- FESSH Federation of European Societies for Surgery of the Hand
- IC instructions plus corticosteroid injection
- ICS instructions plus corticosteroid injections plus splinting
- IO instructions plus operative treatment/surgery
- IS instructions plus splinting
- NSAID nonsteroidal anti-inflammatory drug
- PM&R physical medicine and rehabilitation
be used for CTS were listed and discussed. The evidence for the effectiveness of each type of intervention, including the evidence table and full-text article of the review, was incorporated in this questionnaire.

For each intervention, questions were included about its usefulness and the main factors for starting and discontinuing the intervention. To identify useful (combinations of) treatments and preferences regarding treatments especially suitable for certain subgroups of patients with CTS, the experts were asked if the interventions could be used as sole treatment and/or combined with another treatment, whether a specific intervention is the first choice in treatment, and to identify the treatment strategy in case the intervention was insufficient. Additional questions were included on the use of instructions for the patient, NSAIDs, splinting, corticosteroid injection, and surgery. In all situations where options were suggested by the steering committee, the experts were invited to provide additional options to avoid any limitations in the experts’ choices.

Second-round questionnaire: The treatment options (and their combinations) mentioned by the experts were summarized. In the second round, the experts were asked to state (separately for each treatment option/combination of treatment options) whether they agree that this treatment option (or combination thereof) is applicable to treat CTS.

Based on the answers given by the experts in the first round, preferences regarding treatments were formulated (ie, from the lightest form of treatment to the most severe form of treatment), and the experts were asked if they agreed with the preferences.

The experts were also asked what they considered to be the main factors for choosing a certain treatment option and in which way these factors influenced their choice. For questions relevant for each specific intervention for which no consensus was achieved in the second round were added in the third round.

Third-round questionnaire: In the third round, the summaries of the consensus on the main factors for choosing a treatment option for CTS were combined and presented in the table included in the final guideline as presented in appendix 2.

Any remaining questions on this table and all other items for which no consensus was achieved in the second round were added to the third-round questionnaire.
Table 2  Experts and participating countries

<table>
<thead>
<tr>
<th>Profession (European Federation)</th>
<th>Participating Countries</th>
<th>Total No. of Experts in the HANDGUIDE Study</th>
<th>No. of Experts for CTS/Years of Experience*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand surgeons (FESSH)</td>
<td>Belgium, Denmark, Estonia, Finland, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, Turkey, United Kingdom</td>
<td>52</td>
<td>17/19.2 (7−37)</td>
</tr>
<tr>
<td>Hand therapists (EFSHT)</td>
<td>Belgium, Denmark, Finland, France, Italy, The Netherlands, Norway, Slovenia, Sweden, Switzerland, Turkey, United Kingdom</td>
<td>47</td>
<td>13/16.7 (2−30)</td>
</tr>
<tr>
<td>PM&amp;R physicians (not applicable)</td>
<td>Austria, The Netherlands Portugal, Slovenia, Switzerland, Turkey</td>
<td>13</td>
<td>5/14.0 (8−20)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>112</td>
<td>35/17.4 (3−37)</td>
</tr>
</tbody>
</table>

* Years of experience are presented as mean (range).

**Analysis**

After every Delphi round for each question we reported the number and percentages of experts who gave a certain answer and the rationale for the answers given by each expert.

**Results**

**Expert panel**

A total of 112 experts (52 hand surgeons, 47 hand therapists, 13 PM&R physicians) from 17 European countries were selected to participate in 1 of the 3 Delphi consensus strategies of the HANDGUIDE Study, which was performed between June 2009 and December 2012.

For the Delphi consensus strategy on CTS, 36 experts were selected (18 hand surgeons, 13 hand therapists, 5 PM&R physicians). Of these, 1 expert did not finish any of the questionnaires. Response rates of the remaining 35 experts for rounds 1 to 3 were 89%, 94%, and 89%, respectively.

Table 2 lists the participating countries, total number of experts of the HANDGUIDE Study, number of experts participating in the Delphi consensus strategy on CTS, and expert’s years of experience with this topic.

**Results of the Delphi consensus strategy on CTS**

**Consensus**

_Cutoff point for consensus:_ In the first round, consensus was achieved on a cutoff point of 70% for consensus. In this Delphi consensus strategy, there was only 1 discordant viewpoint between a professional group and the general consensus namely the cell in the severity/duration table as presented in the guideline representing patients with CTS with severity subgroup 1 and duration subgroup 1. This concerned 1 cell in the severity/duration table in the guideline, namely the one representing patients with CTS categorized as severity subgroup 1 and duration subgroup 1. Less than 50% (2 out of 5) of the PM&R physicians agreed to add instructions plus splinting (IS) to this cell.

_Guideline for CTS:_ Three rounds were needed before consensus on the treatment guideline for CTS was achieved. The guideline is reported in appendix 2.

**Description, symptoms, and diagnostics of CTS**

In the first round, consensus was achieved on the short description of CTS, its _International Statistical Classification of Diseases and Related Health Problems, 10th revision_ code, and symptoms. In the second round, the experts agreed on the diagnosis of CTS. The diagnosis of CTS, as stated in the guideline, is (primarily) made on the basis of the clinical symptoms presented by the patient. Several experts suggested adding the Phalen and Tinel sign tests to the physical examination. However, although the specificity of these tests is high, their sensitivity is low, which limits their diagnostic value.19-22 Because it is important to take this into account when using the aforementioned tests in the diagnosis of CTS, the experts agreed to add this information on specificity and sensitivity to the description of the diagnosis.

**Interventions to treat CTS**

_Treatment options:_ Experts did not add any interventions that should be included as “most commonly used interventions” to the suggested list of nonsurgical and surgical interventions (as previously described in the Methods section). Consensus was achieved that treatment with NSAIDs is not useful for treating CTS.

The experts agreed that patients with CTS should always receive instructions, and these instructions should always be combined with another form of treatment. Consensus was achieved that IS, instructions plus corticosteroid injection (IC), instructions plus corticosteroid injections plus splinting (ICS), and instructions plus operative treatment/surgery (IO) are suitable treatment options.

Therapeutic preferences for patients with CTS symptoms of different severity and duration from the lightest to the most severe form of treatment for CTS were proposed by the steering committee: 1st IS, 2nd IC, 3rd ICS, and 4th IO. Because no consensus on the therapeutic hierarchy was achieved, this was not presented in the guideline.

_Additional questions for instructions, splinting, corticosteroid injections, and surgery:_ For instructions, splinting, corticosteroid injections, and surgery, consensus was achieved on the aim of the treatment. For the latter 3 treatments, consensus was also achieved concerning when the treatment should be adjusted or discontinued. Other items for each specific treatment are subsequently discussed.
Instructions to the patient: Instructions to the patient should include information on the nature of CTS and advice to limit full extension/flexion of the wrist, reduce heavy work activities, and avoid repetitive movements.

Splinting: In the first-round questionnaire, 4 types of splints regularly used in clinical practice to treat CTS were presented to the experts (appendix 3). The experts considered no other splints sufficiently applicable. Consensus was achieved that a splint in which the wrist is in a neutral position (whereby the pressure in the carpal tunnel is lowest) and the fingers free is preferable. Further, the splint should be worn between 4 and 12 weeks and should be used only at night or both at night and during the day in case of aggravating activities.

Corticosteroid injection: Consensus was achieved that intermediate-acting corticosteroid injections (eg, methylprednisolone, triamcinolone) should be used in the treatment of CTS. Treatment with a corticosteroid injection can be performed with or without a local anesthetic; on the latter item no consensus was achieved. The number of corticosteroid injections should be restricted to a maximum of 3; in case more injections are given, an interval of 2 to 3 months between these injections should be considered. The experts also achieved consensus on the advice that should be given to the patient after treatment with corticosteroid injections.

Surgery: The preferred surgery is open surgery (in preference to mini-open surgery, percutaneous with ultrasound guidance, percutaneous without ultrasound guidance, 1-portal endoscopic, 2-portal endoscopic, or another surgical technique) using a longitudinal, not extended incision under local anesthetic. The wound should be closed with nonresorbable sutures. Advice for the primary postoperative period (ie, until the sutures are removed) is also included in the guideline.

Further, consensus was achieved that postsurgical instructions and exercise therapy can be considered after surgery. Instructions to the patient should focus on scar care, edema control, and exercise therapy (eg, tendon and nerve-gliding exercises). Similarly, exercises are indicated for those who are afraid to use the hand, for scar care, in case of stiffness and/or edema of the hand, and to promote tendon and nerve gliding. Postsurgical splinting can be indicated after surgery. However, this should not be used routinely but can, for example, be applied in cases of severe postoperative symptoms.

Other therapeutic interventions: As suggested by several experts, the steering committee proposed to include the following note into the guideline: Depending on the patient’s situation personal preferences, additional therapeutic modalities (eg, ultrasound or nerve- and gliding-enhancing exercises) can be added to the treatment. However, no consensus was achieved to add this note to the guideline.

Main factors for choosing a specific treatment option: In the first Delphi round, the experts’ answers suggested that the main factors for choosing a treatment option are as follows: severity of the disorder, duration of the disorder, and previous treatments given. The relation between severity/duration and choice of therapy was further explored in the consecutive Delphi rounds. On the basis of the terminology used by the experts for severity and duration, 5 levels were created for both variables. In the first Delphi round the experts described the severity of CTS in terms of the severity of symptoms (mild, severe, etc) of pins and needles, pain, thenar atrophy, and/or sensitivity loss. The duration of CTS was expressed in terms of acute, subacute, and chronic or by mentioning the exact durations in terms of number of weeks or months. Combining these expressions for severity and duration resulted in the identification of 5 subgroups for both severity and duration (fig 1).

In the second round, the experts were asked which treatment options (ie, IS, IC, ICS, IO) were suitable for the different subgroups of severity of symptoms. Subsequently, the steering committee calculated for each level of severity which treatment or combination of treatments the cutoff point of 70% for consensus was reached or exceeded. The same process took place for the duration of the complaints.

The results for severity and duration were combined and reported in the table included in the guideline. In this table, each cell represents a subgroup of patients with a certain severity and duration of CTS and the corresponding suitable treatment options. For additional information, see the table in the guideline (appendix 2). In case of an empty cell (ie, no consensus was achieved on the treatment option in this cell), it was reported in the legend of the table which treatment option(s) was suggested by most of the experts.

Discussion

After publishing systematic reviews on evidence for the effectiveness of interventions for CTS, a European Delphi consensus strategy was performed resulting in a treatment guideline for CTS. To our knowledge, this is the first time that a multidisciplinary treatment guideline for CTS was developed on a European level in which the relation between the main factors for selecting a treatment option and the choice of therapy are also reported.

Diagnosis of CTS

In this guideline the diagnosis of CTS is primarily based on the clinical picture. The sensitivity and specificity of special tests (eg, Phalen test, Tinel sign test) are reported to be 34% to 59% and 51% to 93% and 25% to 41% and 66% to 91%, respectively.20–22 These tests have limited diagnostic value,20–22 which was corroborated by the experts in the Delphi consensus strategy.

When in doubt, electrodiagnostic testing on the clinical pictures can be performed. This policy is comparable with the 2009 guideline23 of the American Academy of Orthopaedic Surgeons that is endorsed by the American Society of Plastic Surgeons, American Academy of Physical Medicine and Rehabilitation, and American Association of Neuromuscular and Electrodagnostic Medicine. However, it deviates from the 2002 guideline24 of the American Association of Electrodiagnostic Medicine, American Academy of Neurology, and American Academy of Physical Medicine and Rehabilitation regarding which electrodiagnostic testing is recommended for all patients with suspected CTS. This suggests that the observed discrepancy in the diagnostic approach is more specialization related than continent (America-Europe) related. A possible reason for this difference in insight is the methodologic heterogeneity of the relevant literature, resulting in the absence of a criterion standard
test for CTS, thereby hampering the assessment of the sensitivity and specificity of other tests. Consequently, it is not possible to determine the best combination of clinical and electrodiagnostic data for the diagnosis of CTS, and the prediction of the postsurgical outcome cannot be determined. This lack of clarity obliges caregivers to use expert opinion to create a viable workflow. In this ambiguous situation, it is not surprising that according to Kaplan’s law of the instrument, more neurologically oriented specialists tend to electrodiagnostic testing, whereas more intervention-oriented specialists tend less to electrodiagnostic testing. This approach allows the surgeon to operate in the absence of electrodiagnostic abnormalities, which is not entirely without merit because these patients generally respond favorably to therapy.

Treatment of CTS

The experts achieved consensus that IS, IC, ICS, and IO are suitable treatment options for CTS. Instructions should always be given and should include information on the nature of CTS and advice to limit full extension/flexion of the wrist, reduce heavy work activities, and avoid repetitive movements. These findings are in agreement with the literature in which it is concluded that the occurrence of CTS is associated with high levels of hand-arm vibration, prolonged work with a flexed or extended wrist, high requirements for hand force, high repetitiveness, and a combination of these.

For corticosteroid injections, the experts agreed that the aim of this treatment is to decrease the symptoms of CTS, even though the mechanism behind this decrease remains unclear. Originally, corticosteroids were used to decrease the amount of inflammation. However, although inflammatory changes of the synovial sheath of flexor tendons are present in CTS, this is probably not the main cause as the effects of corticosteroids in CTS are (generally) temporary. Therefore, the exact mode of action of corticosteroids in CTS remains unclear, and its current use is described as decreasing the symptoms of CTS. Strong evidence for effectiveness was found in favor of corticosteroid injection compared with placebo in the short term. Although higher doses of corticosteroid show more effect than lower doses, the effect does not last in the long term. These findings are in agreement with similar results on other upper-extremity disorders, including lateral epicondylitis and frozen shoulder.

The present guideline advocates the treatment of CTS with corticosteroid injections. This policy is comparable with the 2010 guideline of the American Academy of Orthopaedic Surgeons that is endorsed by the American Association of Neurological Surgeons, Congress of Neurological Surgeons, American Society of Plastic Surgeons, American Academy of Physical Medicine and Rehabilitation, and American Association of Neuromuscular and Electrodiagnostic Medicine. However, the use of corticosteroid injections for CTS remains controversial. First, the exact effect of corticosteroids in CTS is unknown. Second, the positive short-term and midterm effects of corticosteroids do not extend into the long term and can adversely affect the outcome of carpal tunnel surgery. Finally, they may have a negative effect (eg, osteonecrosis, tendon rupture).

The experts mentioned several additional therapeutic modalities (besides instructions, splinting, corticosteroid injections, surgery, or a combination of these interventions). Examples are ultrasound and exercise therapy, including nerve-gliding exercises. To indicate that the guideline concentrates on the most commonly used interventions but that additional therapeutic modalities can be added, the steering committee of the Delphi consensus strategy
proposed to include the following note in the guideline: Depending on the patients’ situation and personal preferences, additional therapeutic modalities can be added. However, the experts did not achieve consensus on this topic. Including this note in the guideline would emphasize the idea that the guideline should not to be seen as a rigid set of rules. There are various reasons (eg, related to patient circumstances, medical advances) for choosing another/newer treatment option for a particular patient. Guidelines are intended to guide and certainly not to dictate to the user.

Therapeutic hierarchy

Although no consensus could be achieved on therapeutic preferences for subgroups of patients with CTS, the severity/duration table in the guideline strongly suggests its presence. Nonsurgical treatment seems to be the first step in treatment of CTS, the lightest form being instructions, followed by splinting and corticosteroids. More advanced compressions were treated with surgery. By ranking different therapies according to their properties, such as complication rates, success rates, and costs (both financial and in terms of patient inconvenience), a therapeutic hierarchy can be created that can be used in the absence of scientific evidence to aid in deciding which treatment is most suitable for which subgroup of patients. If such a system exists (as Table 1 suggests), it is probably mainly used subconsciously. A comparable system can be assumed with respect to the disorders, considering symptom duration and severity and personal, familial/societal, financial, psychological, and social cost. Although a certain balance between the hierarchies of disease and therapy seems logical, different caregivers can select different therapies for comparable patients. Knowledge on these processes can be used to improve medical decision making and clinical guidelines and direct scientific research. More research on this subject is necessary because these therapeutic hierarchies are complex, not easily unraveled, and often require structured questioning before being revealed.

Study limitations

Some weaknesses of this Delphi consensus strategy should be mentioned. The results of a Delphi consensus strategy depend on the composition of the participating experts. In a decision-making group, heterogeneity can help promote consideration of all relevant aspects of a topic.33 In the present study, heterogeneity of the composition of the participating experts (hand surgeons, hand therapists, PM&R physicians) achieved multidisciplinary consensus on a treatment guideline for CTS. This guideline may help and guide physicians and allied health care professionals to provide patients suffering from CTS with the most effective and efficient treatment available.

Keywords

Carpal tunnel syndrome; Consensus; Rehabilitation; Surgical procedures, operative; Splints

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Appendix 1. Expert’s Criteria for Participation in the Delphi Consensus Strategy

1. The expert* should be a medical or allied health care professional with considerable experience in treating patients with nontraumatic hand disorders (tendinopathies, Dupuytren disease, neuropathies)
2. The expert should be considered by their own professional specialty to be a key person in the field of nontraumatic hand disorders
3. The expert should have basic knowledge of evidence-based practice

* Participating hand surgeons and hand therapists participated as delegates for their respective professional association.

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Appendix 2. Guideline for Carpal Tunnel Syndrome

The aim of the European HANDGUIDE study was to achieve consensus on multidisciplinary treatment guidelines for the following five non-traumatic hand disorders: trigger finger, De Quervain’s disease, Dupuytren’s disease, carpal tunnel syndrome, and Guyon’s canal syndrome.

To establish an evidence-based starting point for the HANDGUIDE study, systematic reviews were written reporting on the evidence for effectiveness of non-surgical, surgical or as post surgical interventions for these five hand disorders.

Supplementary to the available evidence-based information, a Delphi consensus strategy was used to achieve consensus on each treatment guideline. In a Delphi consensus strategy a series of sequential questionnaires or rounds is presented to a panel of experts, interspersed by controlled feedback, with the aim to achieve consensus of opinions within this group of experts.

A total of 112 experts – hand surgeons, hand therapists, and PM&R physicians – from 27 countries were selected by their national member associations of the Federation of European Societies for Surgery of the Hand (FESSH) and the European Federation of Societies for Hand Therapy (EFSSH) to participate in the HANDGUIDE study. Also, a number of Physical Medicine and Rehabilitation (PM&R) physicians specialized in hand rehabilitation were added to the expert group. The HANDGUIDE study was performed between June 2009 and December 2012.

Treatment guideline for carpal tunnel syndrome (CTS)

This guideline concerns the treatment of CTS. A total of 35 experts (17 hand surgeons, 13 hand therapists and 5 PM&R physicians) cooperated in the Delphi consensus strategy to achieve consensus on this treatment guideline.

For whom?

All physicians and allied healthcare professionals who are involved in the treatment of patients with CTS can use this guideline.

INITIATIVE AND ORGANISATION

This guideline is part of the HANDGUIDE study, which was initiated and organised by the Erasmus MC – University Medical Center Rotterdam, department of Rehabilitation Medicine & Physical Therapy. This study is supported by the FESSH and the EFSSH.

Project group:

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J. Hoeve, PhD (PM&R physician)

GUIDELINE FOR CARPAL TUNNEL SYNDROME

Description of CTS

Although the exact mechanism is not entirely clear it seems safe to state that CTS is caused by an increased pressure within the carpal tunnel resulting in mechanical compression and local ischemia mediated damage to the median nerve.

ICD-10 (2010)

Diseases of the nervous system (G00-G99)

- Nerve, nerve root and plexus disorders (G50-G59)

- G56 Mononeuropathies of upper limb

- G56.0 Carpal tunnel syndrome

Symptoms of patients

Patients suffering from CTS generally experience numbness and tingling of the hand in the thumb, index, middle, and radial part of the fourth finger, but sometimes in the whole hand. Symptoms are often more pronounced at night and can awaken people from sleep. Long-standing CTS can result in thenar atrophy.

Diagnosis

History:

The diagnosis of CTS is primarily made based on the clinical symptoms described above.

Physical examination:

- In case of doubt, determination of motor or sensory nerve conduction in the median nerve across the wrist can be determined. When delayed this can add to the diagnosis of CTS.

- The Phalen and Tinel test are often used when diagnosing CTS. However, although the specificity of these tests is high, the sensitivity is low. A low sensitivity implies that persons with the disorder will be missed. These limitations should be taken into account when using these tests to diagnose the CTS.

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I NON-SURGICAL TREATMENT

1 Instructions for the patient

Aim of instructions: To restrict certain activities, or perform them in an alternative way, and to limit extreme flexion and extension positions of the wrist to decrease mechanical loading of the affected nerve and thereby decrease the symptoms of CTS.

Patients with CTS should always be instructed. Instructions should be combined with another form of treatment.

Advice to the patient should include: Information on the nature of CTS as well as advice to limit full extension and flexion of the wrist, to reduce heavy work activities, and to avoid repetitive movements.

2 Splinting

Aim of splinting: To decrease the amount of mechanical load on the affected nerve by immobilizing the tendons and the median nerve in the carpal tunnel, to decrease the symptoms of CTS.

Type of splint: A long-based splint (i.e., incorporating the wrist) with the wrist in neutral position (thereby minimally lowering the pressure in the carpal tunnel), and the fingers free.

Duration of wearing the splint: For 4 to 12 weeks. The splint should be used at night only, or both at night and during the day in case of aggravating activities.

When should a splint be adjusted or stopped? When the patient is free of symptoms, or splinting has insufficient or no effect.

3 Corticosteroid injection

Aim of a corticosteroid injection: To decrease the symptoms of CTS, however, the mechanism behind this reduction has not yet been fully elucidated.

Kind of corticosteroid injection: Intermediate-acting corticosteroid injections such as methylprednisolone or triamcinolone, with or without a local anesthetic.

Maximum number of injections: 3; an interval of 2-3 months should be considered when more than one corticosteroid injection is used.

Advice after treatment with a corticosteroid injection should concentrate on 2 levels:

1. Post-treatment
   - Resting the hand, i.e., no stressful use for 24-48 hours.
   - Pain: the patients may have increased pain for 2-3 days.
   - In case of diabetes: there might be an increase in blood sugar level.

2. When should treatment with corticosteroid injections be stopped? When the patient is free of symptoms, when there is insufficient or no effect, and in case of complications. Complications can be local (e.g., infections and tendon ruptures) or systemic (e.g., hyperglycemia in patients with diabetes mellitus, an allergic reaction, or hypertension).

Surgical decompression

Aim of surgery: To reduce the pressure on the median nerve in the carpal tunnel by surgically opening the roof of the carpal tunnel, thereby reducing the symptoms of CTS.

Preferable technique:
- Anaesthesia technique: Local anaesthesia,
- Incision: longitudinal, not extended,
- Open surgery,
- Sutures: Non-removable.

What to do if the effect of carpal tunnel release is insufficient?
1. The diagnosis should be reconsidered,
2. Consider whether the release of the flexor retinaculum was incomplete.

Primary post-operative advice: During this primary post-operative period - i.e., up to 10-15 days after surgery, when the sutures are removed - advice for the patient consists of:
- Elevation of the hand,
- Rest the hand, but with gradual movement of the fingers/wrist as tolerated,
- Avoid heavy loading of the fingers and hand.

Post-surgical interventions

Interventions after surgery can include instructions to the patient, splinting, and exercise therapy.

Post-operative instructions should concentrate on:
1. Scar care,
2. Edema control,
3. Exercise therapy such as tendon and nerve gliding exercises.

Post-surgical splinting can be indicated after surgery to treat CTS, but should not be used routinely. It can, for example, be applied in case of severe post-operative symptoms.

Post-surgical exercise therapy is indicated for those who are afraid to use the hand, for scar care, in case of stiffness and/or edema of the hand, and to promote tendon and nerve gliding.

Treatment combinations for CTS

The following combinations of treatments are applicable in the treatment of CTS:
- Instructions plus splinting (OS),
- Instructions plus corticosteroid injection (IC),
- Instructions plus operative treatment (O).

1. Treatment with NSAIDs was considered not useful for treating CTS.
2. Originally, the aim of corticosteroid use was to decrease the amount of inflammation. Although inflammatory changes of the general sheath of flexor tendons are present in CTS, this is not the most important cause, and the effects of corticosteroids in CTS are generally temporary. Therefore, the exact mode of action of corticosteroids in CTS remains unclear.
### Table: Severity and duration of CTS and suitable treatment options

Severity and duration of CTS are the main factors when deciding on the type of treatment. Both severity and duration were divided into five subgroups. For each subgroup of patients, the suitable treatment options are indicated below.

<table>
<thead>
<tr>
<th>Duration</th>
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<th>3</th>
<th>4</th>
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<td>IS</td>
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<td>IS</td>
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<tr>
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<td>Subacute stage</td>
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<td>≤ 1 month</td>
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<td>ICS</td>
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</tbody>
</table>

#### Notes:
- IS: Instructions plus splinting.
- ICS: Instructionplus corticosteroid injection plus splinting.
- * Very mild symptoms (mostly only during nighttime) of pins and needles, pain, no thenar atrophy and/or sensitivity loss in the fingers and/or the hand.
- ** Severe symptoms:** Continuous very severe symptoms.

### References:
- 1. No consensus was achieved by the experts on the treatment option(s) for this cell.
- 2. 15.9% of the experts (i.e., 3/19) indicated that “ICS” should be included in the cell.
- 3. 15.9% of the experts (i.e., 3/19) indicated that “IS” should be included in the cell.
- 4. 15.9% of the experts indicated (i.e., 3/19) that “IS” should be included in this cell.
Appendix 3. Kinds of Splints Used in Clinical Practice for CTS

1. Wrist in neutral position and fingers free
2. Wrist in neutral position with fingers included in the splint
3. Cock-up splint, that is wrist in slight extension (0°–15°) and fingers free
4. Cock-up splint with fingers included in the splint

References