

# Treatment of Carpal Tunnel Syndrome

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## Abstract

In September 2008, the Board of Directors of the American Academy of Orthopaedic Surgeons approved a clinical practice guideline on the treatment of carpal tunnel syndrome. This guideline was subsequently endorsed by the American Association of Neurological Surgeons and the Congress of Neurological Surgeons. The guideline makes nine specific recommendations:

A course of nonsurgical treatment is an option in patients diagnosed with carpal tunnel syndrome. Early surgery is an option with clinical evidence of median nerve denervation or when the patient so elects.

Another nonsurgical treatment or surgery is suggested when the current treatment fails to resolve symptoms within 2 to 7 weeks.

Sufficient evidence is not available to provide specific treatment recommendations for carpal tunnel syndrome associated with such conditions as diabetes mellitus and coexistent cervical radiculopathy.

Local steroid injection or splinting is suggested before considering surgery. Oral steroids or ultrasound are options. Carpal tunnel release is recommended as treatment. Heat therapy is not among the options to be used.

Surgical treatment of carpal tunnel syndrome by complete division of the flexor retinaculum is recommended.

Routine use of skin nerve preservation and epineurotomy is not suggested when carpal tunnel release is performed.

Prescribing preoperative antibiotics for carpal tunnel surgery is an option.

It is suggested that the wrist not be immobilized postoperatively after routine carpal tunnel surgery.

It is suggested that instruments such as the Boston Carpal Tunnel Questionnaire and the Disabilities of the Arm, Shoulder, and Hand questionnaire be used to assess patient responses to carpal tunnel syndrome treatment for research.

This clinical practice guideline was approved by the American Academy of Orthopaedic Surgeons.

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Carpal tunnel syndrome (CTS) is a common disorder. In the United States, its incidence is approximately 1 to 3 cases per 1,000 persons per year, and its prevalence is approximately 50 cases per 1,000 persons.<sup>1</sup> Untreated or ill-treated CTS may worsen and progress to permanent sensory loss and thenar

paralysis in some cases.

CTS is also an important issue in the workplace and, as the number of workers' compensation cases filed increases, the expense for lost productivity and cost of treatment also increases. According to the National Institutes of Health (NIH), the average lifetime cost of CTS, including medical bills and lost

time from work, is approximately \$30,000 for each injured worker.”<sup>2</sup> Hanrahan et al<sup>3</sup> quote similar estimates by the National Council on Compensation Insurance that estimates the average CTS case costs \$29,000 in workers’ compensation benefits and medical costs. There were more than 3.8 million visits made to physicians in office-based practices in 2003 because of CTS.<sup>4</sup>

Because of the importance of CTS, the American Academy of Orthopaedic Surgeons (AAOS) has developed a clinical practice guideline on it. The recommendations in this guideline assume that the patient has reversible mechanical compression of the median nerve based on the diagnostic criteria set forth in the AAOS *Clinical Guideline on Diagnosis of Carpal Tunnel Syndrome*.<sup>5</sup> This does not include patients who have nerve

damage characterized by irreversible microscopic damage to the nerve ultrastructure. Such cases, understood to exist, without biopsy evidence, have a worse prognosis for recovery with sustained numbness, tingling, paralysis, dyshidrotic changes of the skin, and pain. Diagnostic stratification studies that define preoperative criteria for this division between reversible and irreversible damage were not found. The clinical objective in the more damaged group has lesser expectations and anticipated outcomes by definition. The AAOS guideline on treatment of CTS recommends that a diagnosis of CTS be made on the basis of signs, symptoms, and electrodiagnostic tests, as put forth by the AAOS *Clinical Guideline on Diagnosis of Carpal Tunnel Syndrome*.<sup>5</sup>

The AAOS clinical practice guide-

lines are developed using current standards of evidence-based practice. The recommendations in these guidelines are based on systematic reviews of the available literature. The purpose of systematically performing a review is to combat bias. Substantial documentation accompanies the review and the guideline to ensure readers that the recommendations are, indeed, unbiased. Ideally, those who wish to perform an “intellectual audit” of the guideline can examine this documentation and independently arrived at the same recommendations. The appropriate documentation and details about the methods used to conduct the systematic review for the guideline on the treatment of CTS, as well as the full guideline, can be found at <http://www.aaos.org/Research/guidelines/CTSTreatmentGuideline.pdf>.

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Because a systematic review combats bias, the studies included in it are not chosen on the basis of whether they were published by an expert. Similarly, the physician Work Group members who prepared this guideline did not begin work on it by exchanging articles from their personal files. Rather, articles were identified using comprehensive searches of several electronic databases and were included in the guideline only when they met specific criteria that were developed before work on the guideline began.

To further combat bias, the information extracted from published articles did not include the conclusions of the articles' authors (who, themselves, might be biased). Rather, the focus of the guideline and the systematic review upon which it is based is on the data and how they were collected. Thus, information for the guideline was principally derived from information contained in an article's Methods and Results sections. A total of 332 articles were reviewed for this guideline, 94 of which were ultimately included.

We did not search for, or include, all available evidence. Wherever appropriate, we searched for and included the best available evidence. Hence, if level II evidence was available, we did not search for or include level III evidence or lower unless there was very little level II evidence and a great deal of level III evidence.

Our analyses focused on patient-oriented outcome measures. These measures are defined in clinical research as "outcomes that matter to patients including reduced morbidity, reduced mortality, symptom improvement, or improving patients' quality of life."<sup>6</sup> By critically focusing on patient-oriented outcomes, the recommendations in this guideline are expected to improve overall patient care in the treatment of CTS.

The final draft of the guideline was

peer reviewed by reviewers from professional societies other than the AAOS, as well as by the Evidence-Based Practice Committee and Guidelines Oversight Committee of the AAOS. After addressing peer review, the draft guideline was sent for commentary to volunteers from the Board of Councilors and the Board of Specialty Societies, as well as to all members of the Council on Research, Quality Assessment and Technology and the AAOS Board of Directors. The final guideline was approved by the Evidence-Based Practice Committee; Guidelines and Technology Oversight Committee; the Council on Research, Quality Assessment, and Technology; and the AAOS Board of Directors. Additionally, the American Association of Neurological Surgeons and the Congress of Neurological Surgeons subsequently endorsed this guideline.

The final guideline on treatment of CTS should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. Further, the patient must be an active participant in treatment decisions. All treatment of CTS is based on the assumption that final decisions are predicated on patient and physician mutual communication about available treatment alternatives and procedures applicable to the individual patient. These decisions include an evaluation of the patient's current quality of life with CTS. Patients will present with considerable variability in acceptable choices, needs, and access to nonsurgical alternatives. It is understood that after the patient has been informed of available alternative non-

surgical therapies and has discussed these options with the physician, the informed patient choice may be to go directly to surgery.

The AAOS Research Department, with the collaboration of Physician Work Group members, has been involved with the development of Clinical Practice Guidelines based upon the existing medical literature. These guidelines, approximately four per year, will be regularly presented in the *Journal of the American Academy of Orthopaedic Surgeons*. They each represent more than a year's work by AAOS staff and volunteer committee members of the Evidence-Based Practice Committee and the Guidelines and Technology Oversight Committee. By the introduction of new statistical methodology, which is discussed in the data summaries, we have moved ahead from previous efforts and have created state-of-the-art recommendations. While we recognize that the literature is imperfect and thus any guideline must be supplemented by experience, principles of good care, and other sources of information for decision support, these guidelines represent the best source of defense, based on the broadest literature search possible. They also represent the definition of a quality orthopaedic practice from an evidence-based view. There will be measurable improvements in patient care quality standards as evidence emerges and is summarized in future guidelines.

## Recommendations

Each recommendation in this guideline is accompanied by a grade. These grades communicate the degree of confidence that one can have that future research will not cause the recommendation to be modified. The grades were assigned using the following system:

A: Good evidence (level I studies with consistent findings) for or against recommending intervention.

B: Fair evidence (level II or III studies with consistent findings) for or against recommending intervention.

C: Poor-quality evidence (level IV or V) for or against recommending intervention.

I: There is insufficient or conflicting evidence not allowing a recommendation for or against intervention.

The language of each recommendation is linked to its grade.<sup>7,8</sup> Accordingly, we use the phrase “we recommend” for grade A recommendations, “we suggest” for grade B recommendations, or “is an option” for grade C recommendations.

### Recommendation 1

A course of nonsurgical treatment is an option in patients diagnosed with CTS. Early surgery is an option when there is clinical evidence of median nerve denervation or the patient elects to proceed directly to surgical treatment.

Grade of Recommendation: C

Data were extracted from 3 systematic reviews and 23 randomized controlled or controlled trials for evidence to support this recommendation. This literature supports the effectiveness of nonsurgical treatment over placebo. No data were found that clearly identified when nonsurgical treatment should be considered the only option, nor were studies found in which nonsurgical treatment was clearly shown to be completely ineffective and therefore contraindicated.

Studies of CTS often included denervation as an indication for surgery and as a relative contraindication for nonsurgical treatment, so such cases were not studied systematically. Consequently, it was not possible to make a grade A or B recommendation.<sup>9</sup> Therefore, this

guideline recommendation is, of necessity, based upon expert opinion.

### Recommendation 2

We suggest another nonsurgical treatment or surgery when the current treatment fails to resolve the symptoms within 2 to 7 weeks.

Grade of Recommendation: B

Considerable evidence exists suggesting that patients benefit from a variety of nonsurgical treatment and surgical options for CTS. Although the data did not report the minimum time for effectiveness, an analysis of the level I and II data reviewed for Recommendations 4a to 4c suggested that all effective or potentially effective nonsurgical treatments (ie, local steroid injections, splinting, oral steroids, ultrasound) for CTS have a measurable effect on symptoms within 2 to 7 weeks of the initiation of treatment. If a treatment is not effective in reducing symptoms within that time frame, then consideration should be given to trying a different one, assuming, of course, that the diagnosis of CTS is not in doubt.<sup>5</sup>

Because this recommendation considers a variety of nonsurgical treatments, the levels of evidence varied. More level II evidence exists than level I evidence; hence, the grade of recommendation is based on consistent level II evidence.

### Recommendation 3

We do not have sufficient evidence to provide specific treatment recommendations for CTS found in association with the following conditions: diabetes mellitus, coexistent cervical radiculopathy, hypothyroidism, polyneuropathy, pregnancy, and rheumatoid arthritis, or for CTS in the workplace.

Grade of Recommendation: I

Despite an exhaustive review of the literature, there was insufficient evi-

dence to make conclusions about these conditions and about CTS in the workplace. These potentially treatable medical conditions are common exclusion criteria from controlled trials; for this reason, it is difficult to make specific recommendations about how to treat such patients.

### Recommendation 4a

Local steroid injection or splinting is suggested when treating patients with CTS, before considering surgery.

Grade of Recommendation: B

Local steroid injection and splinting are effective in treating CTS. Splinting was effective at 2, 4, and 12 weeks in reducing symptoms and improving functional status.<sup>10,11</sup> No conclusion could be drawn at the 6-month time point because the studies were underpowered.

Steroid injections are also effective for treating CTS. Several factors were shown to improve after cortisone injections: patient satisfaction (2 weeks<sup>12</sup>), clinical improvement (4 weeks,<sup>13,14</sup> 8 weeks,<sup>15</sup> 12 weeks<sup>15</sup>), symptoms (2 weeks,<sup>16</sup> 4 months,<sup>17</sup> 6 months<sup>18</sup>), function (3 months<sup>18</sup>), and pain (8 weeks<sup>16</sup>).

Patients with more severe or prolonged CTS, however defined, may not benefit from prolonged nonsurgical treatment. Trials of nonsurgical treatment are suggested for the treating physician and should show remission, as described in the recommendations above at the intervals indicated.

### Recommendation 4b

Oral steroids or ultrasound are options when treating patients with CTS.

Grade of Recommendation: C

Oral steroid treatment is effective in the treatment of CTS.<sup>10,19</sup> However, the evidence suggests that local steroid injection is more effective

than oral steroids.<sup>14</sup> Because the evidence supports other, more effective treatments, the Work Group downgraded the recommendation about oral steroids to grade C, “optional.”

Ultrasound was also shown to be effective in the treatment of CTS in two studies.<sup>10,20</sup> One of the studies,<sup>20</sup> however, compared ultrasound with laser treatment, an unproven modality, rather than with a control. Hence, there was only one level II study supporting ultrasound. Based on this methodological flaw, the Work Group chose to downgrade this recommendation on ultrasound to grade C, “optional.”

### Recommendation 4c

We recommend carpal tunnel release as treatment of CTS.

Grade of Recommendation: A

Level I evidence demonstrates that surgical release of the flexor retinaculum is an extremely effective treatment of patients with CTS.<sup>18,21-23</sup> The evaluation of surgical versus nonsurgical treatment of CTS demonstrated the effectiveness of the surgical treatment.

These recommendations assume that the patient has reversible mechanical compression of the median nerve based on the diagnostic criteria set forth in the AAOS *Clinical Guideline on Diagnosis of Carpal Tunnel Syndrome*.<sup>5</sup> This does not include patients who have nerve damage characterized by irreversible microscopic damage to the nerve ultrastructure. Such cases, understood to exist, without biopsy evidence, have a worse prognosis for recovery, with sustained numbness, tingling, paralysis, dyshidrotic changes of the skin, and pain. Diagnostic stratification studies, which define preoperative criteria for this division between reversible and irreversible damage, were not found. The clinical objective in the more damaged group has lesser expecta-

tions and anticipated outcomes by definition.

### Recommendation 4d

Heat therapy is not among the options that should be used to treat patients with carpal tunnel syndrome.

Grade of Recommendation: C

Heat therapy was less effective than placebo control in treating CTS.<sup>24</sup> The grade of recommendation is based on a single level II study; therefore, it was assigned grade C, “optional.”

### Recommendation 4e

The following treatments carry no recommendation for or against their use: activity modifications, acupuncture, cognitive behavioral therapy, cold laser, diuretics, exercise, electric stimulation, fitness, Graston instrument, iontophoresis, laser, stretching, massage therapy, magnet therapy, manipulation, medications (including anticonvulsants, antidepressants, and nonsteroidal anti-inflammatory drugs), nutritional supplements, phonophoresis, smoking cessation, systemic steroid injection, therapeutic touch, vitamin B<sub>6</sub> (pyridoxine), weight reduction, yoga.

Grade of Recommendation: I

Despite an extensive review of the literature, there was insufficient evidence to make conclusions about these modalities. For some treatments, there were simply no studies that met the inclusion criteria. For others, the studies had too little statistical power to allow for meaningful conclusions. Still other studies were downgraded from a higher grade of recommendation because their applicability was questioned. Consequently, we are unable to make recommendations for or against the use of these treatments.

One study compared the Graston instrument with manual therapy.<sup>25</sup> The applicability of this study was

questioned because the Graston instrument was compared with an unproven alternative treatment. This was the only study looking at the Graston instrument that met the inclusion criteria. The grade of recommendation was downgraded because the evidence was inconclusive.

One systematic review<sup>10</sup> examined the comparison of vitamin B (pyridoxine) with placebo. The applicability of the outcome measure was questioned because it was not considered to be critical to determining whether vitamin B was beneficial in the treatment of CTS. The grade of recommendation was downgraded because the evidence was inconclusive.

All of these modalities require further investigation in appropriately designed studies to determine their efficacy in the treatment of CTS.

### Recommendation 5

We recommend surgical treatment of CTS by complete division of the flexor retinaculum, regardless of the specific surgical technique.

Grade of Recommendation: A

Complete division of the flexor retinaculum is an effective method for treating CTS. Two systematic reviews<sup>26,27</sup> and six randomized controlled trials<sup>28-33</sup> examined comparisons between open carpal tunnel release, endoscopic carpal tunnel release, or minimal incision carpal tunnel release. Using meta-analysis, we compared several patient-oriented outcome measures, (including symptom severity and functional status at 52 weeks postoperatively, residual pain at 12 weeks postoperatively, reversible nerve damage, return to work, and wound-related complications) after open or endoscopic carpal tunnel release. Endoscopic release was favored in residual pain at 12 weeks postoperatively, return-to-work time, and wound-related com-

plications. Open release was favored when reversible nerve damage was the outcome compared. No difference in the techniques was found in symptom severity or functional status at 52 weeks, in complications, and in infections.

In addition, minimal incision release was compared with open or endoscopic release in level I studies. Compared with open release, minimal incision was favored in symptom severity, functional status, and scar tenderness. Compared with endoscopic release, minimal incision was favored when pain at 2 or 4 weeks was the outcome measure.

The Work Group discussed the studies and agreed that not all relevant outcomes were available, addressed, and/or analyzed by the evidence comparing the various surgical techniques. Nevertheless, level I and level II evidence clearly indicates the effectiveness of complete division of the flexor retinaculum, regardless of surgical technique, as a treatment of CTS.

### Recommendation 6

We suggest that surgeons do not routinely use the following procedures when performing carpal tunnel release: skin nerve preservation (grade: B), epineurotomy (grade: C).

The following procedures carry no recommendation for or against use: flexor retinaculum lengthening, internal neurolysis, tenosynovectomy, ulnar bursa preservation.

Grade of Recommendation: I

A single level I study<sup>34</sup> evaluated the effect of preserving cutaneous nerves in the path of a skin incision made in the customary location for a carpal tunnel release. Preservation was compared with a standard approach to making a skin incision, which did not seek to preserve any nerve branches encountered as the wound was deepened down to the

palmar fascia. The Patient Evaluation Measure (PEM) indicated a slight advantage in favor of the standard approach at the 3-month assessment. The PEM is a broader evaluation of outcome than the Visual Analog Scale (VAS), suggesting that the advantages for a standard carpal-tunnel-release incision refer to a domain other than pain.

Epineurotomy was studied in a systematic review and in a single level II study. In the systematic review the outcome was described as “overall improvement” at 12 months;<sup>26</sup> in the single level II study, the outcomes were “nocturnal pain” and “paresthesia” at 3 months following surgery.<sup>35</sup> Both studies indicated a mild effect favoring no epineurotomy.

Tenosynovectomy and internal neurolysis were compared in a systematic review,<sup>26</sup> and the data were inconclusive. Lengthening of the flexor retinaculum was studied in a level I study<sup>36</sup> that used the Boston Carpal Tunnel Questionnaire (BCTQ) as the outcome measure. The results were inconclusive because the study had too little power to allow for statistically meaningful comparison. A single level I study<sup>37</sup> examining ulnar bursa preservation, with VAS and PEM as the outcome measures at 8 weeks, also had too little power to allow for meaningful statistical comparisons. The study was therefore inconclusive.

### Recommendation 7

The physician has the option of prescribing preoperative antibiotics for carpal tunnel surgery.

Grade of Recommendation: C

Our searches indicated that the current literature rarely reports whether preoperative antibiotic treatment was used in carpal tunnel release. Of 45 studies analyzed for this recommendation, 44 did not report whether preoperative antibiotics were used. The study

that did report antibiotic use reported that 6.03% of patients developed a postoperative infection, even though all patients received antibiotics.<sup>38</sup>

An examination of the various trials addressing CTS treatment did not provide insight on whether there are conditions or comorbidities that predispose patients to postsurgical infection. Patients with diabetes mellitus, for example, were excluded from the trials.<sup>9</sup> A single level IV study<sup>39</sup> looked at rates of postoperative infections in persons with and without diabetes and found that the rate was similar in the two groups.

Infection rates from controlled trials of surgical treatments, included in Recommendations 5 and 6, and controlled trials of postsurgical treatments, included in Recommendation 8, were extracted from studies. Additionally, other study designs (eg, prospective cohorts, case series) describing surgical or postsurgical treatments (and passing exclusion and inclusion criteria) were examined for infection rates.

### Recommendation 8

We suggest that the wrist not be immobilized postoperatively after routine carpal tunnel surgery.

Grade of Recommendation: B

We make no recommendation for or against the use of postoperative rehabilitation.

Grade of Recommendation: I

The wrist should not be immobilized postoperatively after routine carpal tunnel release. Several level II studies suggest that postoperative splinting for longer than 2 weeks did not offer any specific benefit in terms of grip or lateral pinch strength, bowstringing, complication rates, subjective outcome, and patient satisfaction.<sup>40-43</sup>

Clinicians may wish to provide protection for the wrist in a working environment or for temporary protection. However, the evidence does

Table 1

Psychometric Properties of Instruments				
Instrument	Internal Consistency (Reliability)	Reproducibility (Reliability)	Construct Validity (Validity)	Responsiveness (SRM)*
BCTQ-Total				>0.8
BCTQ-SSS	X	X	X	>0.8
BCTQ-FSS	X	X	X	>0.8
AIMS2 subscales*				0.06-1.72
DASH	X	X	X	0.76
MHQ subscales*				0.5-1.1
PEM		X	X	>0.8
VAS			X	0.51
SF-36 subscales*				0-0.86
SF-12 subscales*				0.08-0.58

\*SRM refers to standardized response mean

AIMS2 = Arthritis Impact Measurement Scales 2; BCTQ = Boston Carpal Tunnel Questionnaire; DASH = Disabilities of the Arm, Shoulder and Hand; FSS = Functional Status Scale; MHQ = Michigan Hand Outcomes Questionnaire; PEM = Patient Evaluation Measure; SF-12 = Medical Outcomes Study 12-Item Short Form; SF-36 = Medical Outcomes Study 36-Item Short Form; SSS = Symptom Severity Scale; VAS = Visual Analog Scale

not provide objective criteria for these situations. Clinicians should be aware of the detrimental effects, including adhesion formation, stiffness, and prevention of nerve and tendon movement, which may compromise the carpal tunnel release results in achieving another objective, such as early release to work.

For postoperative rehabilitation, one level II study examined supervised hand therapy.<sup>44</sup> The applicability of the outcome measure (return to work) was questioned because it was not considered to be critical in determining whether supervised hand therapy was beneficial to postoperative rehabilitation. The grade of recommendation was downgraded because the evidence was inconclusive.

There were no included studies that looked at work hardening and the role of various modalities for postoperative carpal tunnel management. The role of supervised therapy after carpal tunnel release in the work-related population will need further evaluation to determine whether there is any advantage to

work hardening, work simulation, or routine strengthening.

### Recommendation 9

We suggest that physicians use one or more of the following instruments when assessing patients' responses to CTS treatment of research:

- Boston Carpal Tunnel Questionnaire (disease-specific)
- Disabilities of the Arm, Shoulder, and Hand (DASH) (region-specific: upper limb)
- Michigan Hand Outcomes Questionnaire (MHQ) (region-specific: hand/wrist)
- Patient Evaluation Measure (region-specific: hand)
- Medical Outcomes Study 12-Item Short Form (SF-12) or Medical Outcomes Study 36-Item Short Form (SF-36) Health Survey (generic: physical health component for global health impact)

Grade of Recommendation: B

These instruments, whether they are aimed at diagnosis, evaluation of disease activity, or outcome, must be judged on their key psychometric

characteristics: reliability, validity, interpretability, and responsiveness. Reliability was generally measured in these studies by assessing internal consistency and reproducibility. A summary of these key psychometric properties for these instruments appears in Table 1.

Responsive instruments detect small changes in a given condition. This may be important where subtle differences could be clinically important. Responsive instruments are helpful in the planning of trials where the objective may be to demonstrate a small difference between, for example, treatments.

Generally speaking, generic measures, like the SF-36, look at a broadly based assessment of health and, as a result may not be very responsive to changes in status related to a relatively minor condition such as CTS.<sup>9</sup>

Disease-specific instruments such as the BCTQ are most responsive.<sup>9</sup> The BCTQ shows excellent responsiveness for the measurement of disease activity in CTS. Wherever possible, the full instrument should be used because this gives the most

comprehensive evaluation of both function and symptoms in CTS without any loss of responsiveness. The subscales of this instrument also have satisfactory responsiveness<sup>9</sup> but give a narrower view of disease activity. The BCTQ is fully validated in the treatment of CTS.

The region-specific DASH instrument was moderate to highly responsive<sup>9</sup> and the MHQ was highly responsive in three of five subscales.<sup>9</sup>

The PEM, MHQ, and DASH are more broadly based region-specific instruments that can be considered to be responsive for the evaluation of CTS. The responsiveness of the DASH is slightly below the acceptable threshold but should be considered if the goal of the evaluation is a focus on disability because it has been evaluated in three key domains: internal consistency, reproducibility, and responsiveness.

## Conclusion

Although we made every effort to find studies of the highest quality, such evidence is not readily available at this time for CTS treatment. Development of this guideline has been hindered by a relative lack of statistical power in relevant studies even though these studies are level I and II evidence. The recommendations of this guideline therefore depend to some degree on lesser evidence, including expert opinion.

To achieve a high-quality literature base, academic authors and scientists should invest their time and effort in studies designed to avoid bias (ie, blinded and properly randomized controlled trials of sufficient power to address the outcome of interest). Future studies should, from the onset, be based on improved study design that includes a priori power calculations. Risk stratification studies are also needed to detect when anti-

biotics might be justified on the basis of comorbidities and cointerventions.

We recognize that the issue of CTS in the workplace is important. Studies identified by the literature search commonly analyze risk, prevalence, and predictability of CTS in specific job categories, but good evidence to address the effectiveness of workplace modifications was not available. Working patients, payors, and physicians clearly lack the evidence base to determine “best options.” Physicians and patients must first decide the desired outcome. Should the goal be permanent modification of activities for the worker, or to proceed to surgery and return to normal activities? Future research must rigorously address this subpopulation to determine whether activity modification will result in positive outcomes such as ultimately avoiding surgery.

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