ABSTRACT

Objective: Carpal tunnel syndrome (CTS) is common amongst women. We investigated gender differences in neurography values preoperatively and in QuickDASH scores before and at one year after open carpal tunnel release.

Methods: Patients that underwent open carpal tunnel release (n=493) during 18 months due to primary CTS were enrolled. Data were collected from medical records, QuickDASH questionnaires and preoperative neurographies. The patients filled out the QuickDASH questionnaire pre- and at 12 months postoperatively and were instructed to rate his/her ability [range from 0 (no difficulty) to 5 (impossible to perform)] to do the listed activities during the last week.

Results: Preoperatively, women (n=343) had higher sensory amplitudes in the median nerve in the thumb (median 7 µV IQR 3-12 vs. 3 IQR 0-7; p<0.0001) and in the middle finger (median 5 µV IQR 1-10 vs. 2 IQR 0-5; p<0.0001) than men, but sensory conduction velocity at wrist level did not differ. Total QuickDASH scores were higher both preoperatively (55 [36-68] vs. 39 [26-58]; p<0.0001) and postoperatively (22 [7-50] vs. 14 [2-39]; p<0.05) in women, but there was no difference in the change in total score. Eighty-four (25%) women and 40 (27%) men had a change in total score <8, i.e. less than the minimal clinically important difference.

Conclusion: Women rate their symptoms higher in the QuickDASH than men before and after surgery, while men have more severe nerve damage on preoperative neurography.

Key words: Carpal tunnel syndrome, median nerve, open carpal tunnel release, neurography, QuickDASH

Introduction

Hypothesis

Carpal tunnel syndrome (CTS) is common amongst women. When evaluating CTS, there are several patient reported outcome measures (PROM) to select from in order to evaluate pre- and postoperative disability. The most widely used are the Boston Carpal Tunnel Questionnaire [1], the Disabilities of the Arm, Shoulder and Hand (DASH) [2], the short-ened version of the DASH (QuickDASH) [3] and the Michigan Hand Outcomes Questionnaire [4]. At our department, QuickDASH is routinely used to evaluate
hand surgery procedures, and patients are asked to fill out the questionnaire both preoperatively and at 12 months postoperatively. Women rate their preoperative symptoms higher than men in the Boston Carpal Tunnel Questionnaire [5]. In patients with shoulder pain, there is a difference in responses between men and women when using the QuickDASH [6]. However, it is not known whether there is a gender difference in the QuickDASH when evaluating carpal tunnel release. We investigated gender differences in preoperative neurography and in QuickDASH scores before and at one year after open carpal tunnel release (OCTR).

**Patients and Methods**

The study design is described elsewhere [7], but, in short, 493 patients that underwent OCTR during 18 months (September 2009 – February 2011) due to primary CTS were enrolled. Data were collected from medical records, QuickDASH questionnaires and preoperative neurography. The patients filled out the QuickDASH questionnaire pre- and at 12 months postoperatively and were instructed to rate his/her ability [range from 0 (no difficulty) to 5 (impossible to perform)] to do the listed activities during the last week. A total score ranging from 0-100 is then calculated; i.e. the higher the score, the more disability. The Swedish version of the QuickDASH was used [8]. We used eight as the minimal clinically important difference in the QuickDASH [9]. Data is presented as median [interquartile range; IQR] if not otherwise stated. We used Mann-Whitney U-test for comparisons between groups and Chi-square test for comparison of proportions between groups. A p-value of <0.05 was considered statistically significant. All calculations were performed in SPSS (IBM, version 24).

The study protocol was presented to the regional Ethics Committee (#2011/607). They found the study sound, without ethical problems, and judged that the study was not applicable in the Swedish Ethical Review Act. Neither advertising nor formal informed consent by each patient was needed. Chief of service at our department approved the quality control. Therefore, no formal permission number has been attached to the study. The study was performed according to the Helsinki declaration.

**Results**

Population characteristics can be found in Table 1. Men were slightly older and comorbidities were more frequently observed in the male group.

Preoperatively, women (n=343) had higher sensory amplitudes in the median nerve in the thumb (median 7 µV [IQR 3-12] vs. 3 [IQR 0-7]; p<0.0001) and in the middle finger (median 5 µV [1-10] vs. 2 [0-5]; p<0.0001) than men, but sensory conduction velocity at wrist level did not differ (Table 2).

Total QuickDASH score was higher both preoperatively (55 [36-68] vs. 39 [26-58]; p<0.0001) and postoperatively (22 [7-50] vs. 14 [2-39]; p<0.05) in women, but there was no difference in the change in

**Table 1. Characteristics of 493 patients treated with open carpal tunnel release due to primary carpal tunnel syndrome.**

<table>
<thead>
<tr>
<th></th>
<th>Women (n=343)</th>
<th>Men (n=150)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years median [IQR]</td>
<td>54 [44-64]</td>
<td>60 [48-68]</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td>94 (27)</td>
<td>49 (33)</td>
<td>ns</td>
</tr>
<tr>
<td>Obesity, n (%)</td>
<td>82 (24)</td>
<td>54 (36)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Smoking, n (%)</td>
<td>72 (21)</td>
<td>22 (15)</td>
<td>ns</td>
</tr>
<tr>
<td>Statin treatment, n (%)</td>
<td>51 (15)</td>
<td>35 (23)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Diabetes, n (%)</td>
<td>46 (13)</td>
<td>30 (20)</td>
<td>ns</td>
</tr>
</tbody>
</table>

IQR = interquartile range, ns = non-significant
total score. Eighty-four (25%) women and 40 (27%) men had a change in total score <8, i.e. less than the minimal clinically important difference. Three items in the QuickDASH differed both pre- and postoperatively (Figure 1); women scored higher on opening a tight or new jar (question 1) pre- (median 4 [IQR 3-4] vs. 2 [2-4]; p<0.0001) and postoperatively (median 3 [IQR 2-4] vs. 2 [1-3]; p<0.0001), difficulty doing heavy household chores (question 2) pre- (median 3 [IQR 2-4] vs. 2 [1-3]; p<0.0001) and postoperatively (median 2 [IQR 1-3] vs. 1 [1-3]; p=0.0001) and carrying a shopping bag or briefcase (question 3) both pre- (median 3 [IQR 2-4] vs. 3 [2-3]; p <0.0001) and postoperatively (median 2 [IQR 1-3] vs. 1 [1-3]; p=0.0003).

Women preoperatively scored higher on difficulty washing their backs (question 4), difficulty using a knife to cut food (question 5), difficulty during recreational activities in which you take some force or impact through your arm/shoulder/hand (question 6), limitation in work or other daily activities (question 8) and severity of tingling (question 10) (Figure 1). Scoring on to what extent hand/arm/shoulder problem interfered with normal social activities (question 7), severity of pain (question 9) and difficulty sleeping (question 11) did not differ.

**Discussion**

Our results show, in accordance with previous studies using other evaluation system [5], that women with CTS rate their problems higher than men in the QuickDASH both before and after surgery even up to 12 months after OCTR. QuickDASH is a reliable and validated questionnaire, also to judge function in patients with CTS [7]. In contrast to the QuickDASH, the Boston Carpal Tunnel Questionnaire is disease-specific for CTS. The full DASH has been compared to the Boston Carpal Tunnel Questionnaire [10], and proven to be both responsive and reliable when assessing CTS.

### Table 2. Results of preoperative neurography in patients with carpal tunnel syndrome.

<table>
<thead>
<tr>
<th></th>
<th>Women (n=195)</th>
<th>Men (n=88)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCV wrist level (m/s)</td>
<td>32 [24-38]</td>
<td>29 [19-40]</td>
<td>ns</td>
</tr>
<tr>
<td>SNAP thumb μV</td>
<td>7 [3-12]</td>
<td>3 [0-7]</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SNAP middle finger μV</td>
<td>5 [1-10]</td>
<td>2 [0-5]</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

SCV = sensory conduction velocity, SNAP = sensory nerve action potential, ns = not significant

Figure 1. Replies to questions Q1-Q11 in spider diagrams (median values) in QuickDASH in men (n=150) and women (n=343) with carpal tunnel syndrome pre- (a) and at one year postoperatively (b).
One advantage of the QuickDASH is that it is short and not very time-consuming to fill out; i.e. suitable in daily practice as a routine to follow up outcome of surgery in the health care system.

The present study confirms in a large material that there are gender differences to consider when evaluating results after OCTR using the QuickDASH. Regarding the separate items in QuickDASH, women scored higher on actions that require high grip strength. It is possible that these tasks are normally more difficult for women due to lower grip strength, which possibly explains the differences seen in total scores. In a study on normative values in the QuickDASH in a Norwegian population, QuickDASH scores were higher in women than in men [11], especially in older persons. In a smaller study on surgical treatment for ulnar nerve entrapment, QuickDASH scores were higher in women than in men, although not statistically significant [12]. It is possible that other hand conditions, such as osteoarthritis of the first carpometacarpal joint, that are more common in women [13], affect the total QuickDASH score. Hence, gender differences should be kept in mind when evaluating patients with CTS.

Men had lower sensory nerve action potential amplitudes in the median nerve preoperatively, but there was no difference in conduction velocity. This new finding indicates more frequent conduction blocks and higher degree of axonal degeneration, which we cannot explain. In the present study, we could not observe any differences in presence of treated hypertension or smoking habits between men and women; factors that may influence the intraneural microcirculation and also the pressure level at which the viability of the median nerve is jeopardized [14,15]. Furthermore, there were no gender differences with respect to diabetes among the patients, which may also impair nerve function. Men may also develop signs of diabetic neuropathy earlier than women [16]. In spite of this, in the present patients with CTS, men scored their symptoms lower than women.

**Conclusions**
- Women rate their symptoms worse in the QuickDASH than men before and after surgery.
- Women score worse on items requiring more grip strength.
- Men have more severe nerve damage on preoperative neurography.

**Conflict of interest statement**
The authors have no conflicts of interest to declare.

**References**
7. Zimmerman M, Dahlin E, Thomsen NO, Anderson GS, Bjorkman A, Dahlin LB. Outcome after


