Impact of compensation on work outcome of carpal tunnel syndrome

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Background Work-related carpal tunnel syndrome (CTS) is a complex and costly condition. There is some evidence that the employment outcome may be worse in cases of CTS where the condition is being considered for compensation.

Aim To examine whether workers’ compensation status is an important determinant of outcome of CTS.

Methods Cases, with a Workers’ Compensation Board (WCB) claim, and referents, in work but without a WCB claim, were identified from the practice of a single specialist physician. Data on history prior to and at the time of diagnosis, and events since diagnosis, were collected from clinical records and by a telephone-administered questionnaire. Prior events, severity, treatment and outcome associated with a WCB claim were assessed by logistic regression.

Results Interviews were successfully completed for 46 cases and 50 referents. In the model adjusted only for age and gender, claimants had a worse outcome in terms of changing job or stopping work with time loss from work due to CTS [odds ratio (OR) 5.1, 95% confidence interval (CI) 1.9–13.3]. The OR was much influenced by the inclusion of treatment in the model (OR = 9.6, 95% CI 1.6–58.6) with WCB cases more likely to have surgical and physiotherapy treatments. Cases with a WCB claim cost more to treat and reported greater loss in income than those not seeking compensation.

Conclusions Although these data are limited, the results are suggestive of poorer outcome among WCB claimants despite greater use of treatment and comparable severity of disease.

Key words Carpal tunnel syndrome; lost income; outcome; workers’ compensation board; work related.

Introduction

Carpal tunnel syndrome (CTS) is a condition characterized by symptoms of pain, numbness and weakness in the hand resulting from median nerve entrapment at the wrist. Although recognized for many years, a clear understanding of the aetiology of CTS remains elusive. Its occurrence has been associated with a number of non-occupational factors, including female gender, hypothyroidism, diabetes, rheumatoid arthritis, pregnancy and obesity. CTS has also been reported to be associated with certain workplace risk factors including forceful or repetitive movements of the wrist, as well as hand–arm vibration exposure [1–3]. Work-related CTS is a complex and costly condition. A recent paper suggested that the incidence of work-related CTS in Canada was ~30 per 100 000 and that the average cost per patient to the Ontario Workers’ Safety and Insurance Board exceeded $13 700 [4]. A paper from Washington State estimated a cumulative loss of earnings per Workers’ Compensation Board (WCB) claimant with CTS as US$45 000–US$89 000 in the 6-year post-injury [5]. In Alberta in 2006, there were 7294 disabling injury claims (requiring time away from work or job modification) and 2849 compensated lost time claims for injuries to the hand and wrist excluding fingers, although the proportion of these that were due to CTS was not reported [6].

CTS can be difficult to manage, many patients having persistent symptoms several years after treatment, and prognosis may vary by precipitating cause (for example vibration) [7]. A community-based study of workers with CTS in Maine reported that 20% of participants were out of work at the time of the 6-month follow-up, and 14% at the 18-month follow-up, because of self-reported CTS symptoms [8]. Further, this study reported that making a workers’ compensation claim was significantly associated with an increased risk of being out of work at 18
months in univariate analyses, although this factor was not retained in the final multivariate model after adjustment for hiring an attorney. A further recent study suggested that increasing age, lower levels of education, more severe disease, non-availability of job accommodation, high job physical demands and poor psychosocial conditions, low expectations of recovery, poor mental health, tendency to perceive events as ‘catastrophizing’ and fear of work were all associated with chronic work disability [9]. However, this study included only WCB claimants and so the impact of making a WCB claim on outcome could not be assessed. A number of studies reporting outcomes following surgical release for CTS have identified some factors which are associated with a worse outcome. These factors include prior functional limitation, alcohol use, poor mental health, high levels of job strain, work exposure to forceful and repetitive motions and/or hand–arm vibration exposure, involvement of an attorney and workers’ compensation status [10–14]. One important implication of this is that it appears that the clinical outcome, and possibly also the employment outcome, of surgical release for CTS is worse when the condition is thought work related and considered for WCB compensation.

Systems similar to the Canadian WCB system are used in many parts of the world to ensure that workers with work-related injury and illness receive prompt treatment and compensation as an alternative to resorting to civil law claims against current or former employers. The costs are generally borne by businesses, rather than being met by government. In return for access to compensation in this way, workers lose the right to start a legal action against their employer. The WCB will usually pay wage replacement for any time lost from work, compensation for any permanent disability as well as possibly an amount to cover retraining costs, if a claim is accepted. The WCB also pays all treatment costs for the injury or illness. Consequently, there are considerable financial benefits available if an injury or illness is accepted as work related, and the need to provide adequate evidence that an injury or illness is work-related and of a particular severity may impact on the course of an illness in a way analogous to being involved in a legal case.

The present study was set up, using a case-referent design, to examine whether workers’ compensation status was an important determinant of outcome of CTS. We examined whether employment-related outcomes, treatments used and costs in workers newly diagnosed with CTS who had made a WCB claim for this disease were different to those similarly diagnosed but without a WCB claim.

Methods

Subjects were identified from the records of a single specialist in physical medicine and rehabilitation, who assessed a large proportion of cases of CTS in Alberta in which a WCB claim was made. All patients assessed by this physician for CTS in the period 1994–2000 and who were working at the onset of symptoms were identified. Each patient whose assessment was requested by the WCB was matched with a referent, also newly assessed for CTS but without a WCB claim, for sex, age (± 5 years) and year of diagnosis. The study was approved by the Health Research Ethics Board of the University of Alberta.

Cases (those with a WCB claim) and referents (those without) were contacted by mail and asked to participate in the study. A telephone interview was conducted by a single interviewer (P.S.) with each consenting participant. The information collected included

(i) History prior to and at the time of diagnosis: duration of work prior to symptoms, duration of symptoms prior to diagnosis, occupation at time of onset of symptoms, occupation at time of diagnosis, job change due to symptoms prior to diagnosis, handedness, previous trauma to wrist, co-morbidity and concurrent symptoms in neck or shoulder.

(ii) Events since diagnosis: treatments received, job change subsequent to diagnosis, lost income due to time away from work, lost income due to changing job to one with lower pay and estimated amount of income lost.

In addition, age, sex, date and result of electrophysiological studies, and severity of CTS, were extracted from the clinical record. CTS severity had been classified on electrophysiological evidence: mild CTS consisted of sensory fibre slowing only, moderate CTS required sensory and motor fibre conduction slowing but no axonal loss and severe CTS consisted of both sensory and motor fibre conduction slowing and evidence of axonal loss [15]. Electrophysiological estimates of severity were used as opposed to symptom-based assessments because they show a relatively close association with clinical diagnosis and because of the possibility of bias in symptom reporting, although electrophysiological findings and symptoms show a reasonable association in most populations [16,17]. Nine potential subjects had severe CTS on electrophysiological testing (five cases and four referents) but only two of these (both cases) completed the interview and so for the analyses these were included in a moderate/severe group. Severity was recorded by the clinician at the time of the electrophysiological assessment, independently of the current study.

The principle outcome variable, ‘changed job/stopped work with time loss from work’, was derived for each subject by combining information on employment outcomes. A bad outcome was defined as changing job or stopping work with time loss from work reported by the subject to be due to CTS symptoms. A good outcome was defined
as continuing in the same job throughout or a job change but with no time loss from work.

Finally, the WCB provided information on the average costs of a range of different treatments for CTS. These were used as a basis for estimation of treatment costs for both cases and referents and did not necessarily reflect the actual costs incurred by any particular patient in the study.

A single investigator (P.S.) coded and entered all questionnaires and verified data by checking outliers and logical inconsistencies. Occupation was coded using National Occupational Classification 2001 [18]. To allow for a possible confounding effect of occupation task requirements on outcome, each job at diagnosis was then identified in an electronic database of occupations, O*NET online, a resource developed for the US Department of Labor to provide comprehensive information on key attributes and characteristics of workers and occupations [19]. Scores for exposure to three types of work hazard were extracted for each job. The three exposures were ‘how much does this job require using your hands to handle, control, or feel objects, tools or controls’; ‘how much does this job require making repetitive motions’ and ‘how often does this job require exposure to whole-body vibration (e.g. operate a jackhammer)’. No work hazard exposure category was available for upper limb vibration.

Differences between WCB cases and non-WCB referents in events prior to and subsequent to diagnosis were examined using simple descriptive statistics (chi-squared test, Mann–Whitney U-test and Student’s t-test). Multiple logistic regression was used to develop models of treatment and outcome differences between cases and referents, allowing for potential confounders. Because of the relatively small proportion of pairs in which both case and referent responded, an unmatched analysis was performed.

**Results**

We obtained a total of 110 completed consent forms from the 214 identified potential participants. Of these, 14 subjects either could not be contacted or later indicated that they were not willing to participate in the telephone interview. We successfully completed 96 interviews, 46 with cases and 50 with referents. Those who took part were slightly older, particularly among referents, and were somewhat less likely to be male than those who did not (Table 1). The rate of participation was very similar in WCB cases (46/110, 42%) and referents (50/104, 48%), and the CTS was of comparable severity with no significant difference between participants and non-participants (cases and referents).

No difference was found between WCB cases and non-WCB referents for any of the events or conditions prior to diagnosis. Cases and referents were of similar mean age (44 versus 45 years) and gender (54% male in both groups). Differences in job duration before symptoms, duration of symptoms prior to diagnosis and presence of co-morbid conditions between WCB cases and referents were no greater than might be expected by chance ($P > 0.1$).

At diagnosis, cases were somewhat less likely to have bilateral CTS (52 versus 66%, $P > 0.1$) and to have moderate or severe disease than referents (54 versus 66%, $P > 0.1$), but these differences were not statistically significant (Table 2). None of the median scores for exposure to the three identified workplace hazards was significantly different for WCB cases and non-WCB referents.

Despite this, during the period since diagnosis, WCB cases had fared worse occupationally with nearly half (48%) having changed job or stopped work with time loss from work compared with a relatively small proportion (16%) among the non-WCB referents (Table 3). The odds ratio (OR) adjusted only for age and gender was 5.1, 95% confidence interval (CI) 1.9–13.3. The cases also reported their financial loss as greater than that of referents with a mean loss for the 46 WCB cases of $22 872 (median $4000) compared with a mean loss for non-WCB referents of $5313 (median $0). This outcome occurred despite greater use of treatment modalities and higher estimated treatment costs (Table 4). In both the bivariate and multivariate analyses of treatments, it was apparent that the WCB cases’ greater use of treatments was largely confined to surgery (OR 12.8, 95% CI 2.8–59.3) and physiotherapy (OR 38.2, 95% CI 6.6–221.4).

In a final logistic regression model including factors prior to, and since diagnosis, and including severity (‘mild’ versus ‘moderate or severe’), the OR for cases

**Table 1.** Comparison of participants and non-participants

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Referents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants ($n = 46$)</td>
<td>Non-participants ($n = 64$)</td>
</tr>
<tr>
<td>Mean (SD) age</td>
<td>43.6 (10.8)</td>
<td>42.5 (11.5)</td>
</tr>
<tr>
<td>Proportion (%) male</td>
<td>25/46 (54)</td>
<td>36/64 (56)</td>
</tr>
<tr>
<td>Proportion (%) with mild disease</td>
<td>21/46 (46)</td>
<td>31/64 (48)</td>
</tr>
</tbody>
</table>
reporting changed job/stopped work with time loss from work was 9.6 (95% CI 1.6–58.6) (Table 5).

**Discussion**

These data suggest that WCB cases were more likely to change job or stop work with time loss from work due to CTS symptoms than referents with CTS who were not assessed for WCB compensation. The results are compatible with the relatively few studies that have reported the impact of making a WCB claim on employment outcomes for CTS, although these have mostly focused on outcomes post-surgery [8,11,13,20]. Interestingly, a WCB claim has also been reported to adversely impact outcome among individuals with low back pain [21,22].

In the present study, the reasons for this poorer outcome are not clear. It is possible that cases with work-related CTS had a poorer outcome because they were more likely to have been precipitated by a type of exposure, such as vibration, that is thought to carry a worse prognosis. It may also be that cases approached the WCB because the nature of their work exacerbated their symptoms, and made it particularly difficult to return to work once the CTS had developed. However, hazard exposure scores for cases and referents from the O*NET website were very similar for cases and referents suggesting that exposure to these hazards was not a major determinant of outcome, whatever the mechanism. It must be borne in mind, however, that with this approach to exposure assessment, there are significant opportunities for misclassification, and as such differences in job demands cannot be altogether excluded. However, it provides at least some data to suggest that this is not the complete explanation.

The cases and referents were also similar in ratings of severity with cases, if anything, being rated as somewhat milder. This assessment was based on the results of electrophysiological testing, the techniques used being the same for cases and referents. While it is possible that some bias arose in these measurements, as the clinician was not blind to the source of referral when interpreting the tests, this is unlikely as all scores were allocated according to a standardized scoring scheme, independent of the present study. Similarly, the interviews were all carried out by a single investigator (P.S.) who had also extracted the clinical records, and thus was not blinded to WCB status. Any possible impact of this was minimized by using
a standardized, pre-coded questionnaire. Finally, none of the outcome data were verified from an outside source and some, such as that on financial loss, might have been less accurate in one group. Estimates of treatment costs obtained from the WCB are less subject to bias and are in line with estimates published from a previous Canadian study [4].

The response rate was relatively low, although similar in cases and referents. On those factors we were able to quantify, there was little difference between those who took part and those who did not. However, given the paucity of data available for non-responders, we are unable to explore whether there was response bias with, for example, cases (but not referents) with a bad outcome being particularly likely to respond.

In considering these limitations, we need to decide whether, individually or in total, they could account for the large negative associations seen with a WCB claim. While the contribution of bias and exposure misclassification cannot be fully quantified or discounted, the results are highly suggestive of a poorer outcome and greater use of treatment among WCB cases in the absence of more severe disease or greater job demands. There are two important implications of this. First, some of the treatment received by the WCB cases may be unnecessary or inappropriate. Among the WCB cases with mild disease, 14/21 (67%) had surgery, whereas only 7/17 (41%) non-WCB cases did so. The benefit to any of these is debatable [23]. Second, if the poorer outcome is a direct effect of a system which seeks to discriminate in terms of the award of compensation between work-related and non-work-related injury and illness this has potential implications for the management of such problems in many jurisdictions. A system which does not seek to make such a determination (as in New Zealand) may ultimately lead to better outcomes.

Conflicts of interest
None declared.

References

Table 4. Treatment used by cases and referents

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cases</th>
<th>Referents</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Surgery</td>
<td>35</td>
<td>76</td>
<td>22</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>37</td>
<td>80</td>
<td>13</td>
</tr>
<tr>
<td>Splints</td>
<td>32</td>
<td>70</td>
<td>24</td>
</tr>
<tr>
<td>Prescription analgesics</td>
<td>39</td>
<td>85</td>
<td>31</td>
</tr>
<tr>
<td>Steroid injection</td>
<td>8</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Chiropractic</td>
<td>5</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Acupuncture</td>
<td>7</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>35</td>
<td>12</td>
</tr>
<tr>
<td>Median total cost of all treatments</td>
<td>$1184</td>
<td>0–2034</td>
<td>$431</td>
</tr>
</tbody>
</table>

<sup>a</sup>P values estimated using chi-squared test.
<sup>b</sup>P value estimated using Mann–Whitney U-test.

Table 5. Final logistic regression model showing ORs associated with being a case

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed job/stopped work with time loss</td>
<td>9.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Treatments</td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Surgery</td>
<td>12.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>38.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Use of splints</td>
<td>4.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Use of prescription analgesics</td>
<td>0.2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Adjusted for age, sex, severity, symptom period prior to diagnosis, job duration prior to diagnosis, year of interview and nature of pre-diagnosis work.

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