SHORT REPORT

Splinting for carpal tunnel syndrome: prognostic indicators of success

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Objectives: To identify (combinations of) prognostic indicators for the long term success of splinting in patients with electrophysiologically confirmed idiopathic carpal tunnel syndrome (CTS).
Methods: This study was conducted within the framework of a randomised controlled trial on the efficacy of splinting and surgery for CTS. Patients randomised to splinting received a wrist splint, which they had to wear during the night for at least six weeks. To assess the long term success, patients were asked to indicate whether there was any improvement 12 months after randomisation. Potential prognostic indicators included variables from the history taking and physical examination, self administered questionnaires on severity of symptoms, and electrodiagnostic studies. Multiple logistic regression was used to identify (combinations of) prognostic indicators.
Results: Of the 89 patients randomised to splinting, 83 attended the follow up measurement at 12 months, of whom 60 reported improvement. However, 34 patients had received one or more additional types of treatment during the follow up period and were therefore considered as treatment failures for splinting, resulting in a final success rate of 31% for splinting (26 of 83 patients). Only two prognostic indicators could be identified, namely a short duration of CTS complaints (one year or less) and a score of 6 or less for severity of paraesthesia at night at baseline.
Conclusions: For patients to whom both factors applied, the predicted probability of treatment success, according to the model, was 62%. The overall percentage of patients who were correctly classified by the model was 78% (95% CI 69% to 87%).

Carpal tunnel syndrome (CTS) is a common disorder,[1 2] for which several conservative[3] and surgical[4] treatment options are available. A randomised controlled trial (RCT) comparing splinting and surgery for the treatment of CTS reported success rates of 92% for the surgery group and 72% for the splint group after 12 months.[5] Although much of the improvement seen in the splint group was attributable to patients who had received additional treatment (mainly surgery), some patients improved after splint treatment alone. For clinical practice it would be useful to identify this group of patients with long term successful results from splinting at an early stage, because in their case referral for surgery is not necessary.

The objective of this study is to identify (combinations of) prognostic indicators for the long term success of splint treatment in patients with electrophysiologically confirmed idiopathic CTS.

METHODS

This study was conducted within the framework of the RCT comparing the efficacy of splinting and surgery for CTS. An extensive description of the design[6] and results[5] of this RCT can be found elsewhere. Eighty nine patients with clinically and electrophysiologically confirmed[7 8] CTS were randomised to splinting. The characteristics of these patients at baseline can be found elsewhere.[5] The patients received a splint that immobilised the wrist in neutral position[9 10] and were instructed to wear the splint every night for at least six weeks. Altogether 39 of the 89 patients received one or more additional types of treatment in the follow up period of 12 months (mainly surgery: 33 patients). Eighty three patients attended the follow up measurement at 12 months after randomisation. To assess the success of splinting, success rates were calculated, dichotomising the primary outcome "general improvement" into "improved" (completely recovered or much improved) and "not improved".[11] Patients that received additional treatment, were considered as treatment failures for splinting.

As there is little information available about prognostic indicators for the success of conservative treatment options for CTS, a large number of variables were evaluated, most of which can easily be measured in clinical practice. This made the approach, in essence, exploratory. Use was made of variables from the standardised history taking (for example, age, duration of complaints, bilateral complaints, dominant side most severely affected) and physical examination (for example, thenar atrophy, provocative tests, strength),[12–14] which was performed by trained research physiotherapists at baseline. The baseline values of the outcomes of the trial were also used (for example, number of nights waking up, severity of the main complaint,[15] pain and paraesthesia at night and during the day (scale ranging from 0 "no symptoms" to 10 "very severe symptoms"), Symptom Severity Score and Functional Status Score[16]). Finally, the results of the electrodiagnostic studies, performed to confirm the clinical diagnosis of CTS, were used.

Single variable analyses were performed to examine the relation between the outcome at 12 months (success compared with no success) and each of the potential prognostic indicators, using χ^2 tests for categorical variables and logistic regression for continuous variables. All variables for which an association was found ($p<0.10$) were subsequently included in a multiple logistic regression model. This was followed by stepwise backward selection of prognostic indicators (LR-test $p_{removal}>0.10$), retaining only those that were most strongly associated with success. Firstly, continuous variables were entered as such in the model. Then these variables were dichotomised, using the median value, and the same analysis was repeated. Furthermore, the interaction between prognostic indicators retained in the final model was examined.

The percentage of correctly classified patients gives an indication of the predictive value of the model. A patient was considered to be correctly classified if the predicted probability

Abbreviations: CTS, carpal tunnel syndrome; RCT, randomised controlled trial

(by the prognostic model) of improvement at 12 months was more than 0.5 in patients who had indicated that they were "improved", or if the predicted probability was less than 0.5 in patients who indicated that they were "not improved".

RESULTS

Twelve months after randomisation 60 of the 83 patients (72%) indicated that they were "improved". However, 34 of these 60 patients indicated that they were "improved" after having received one or more additional types of treatment. These patients were therefore considered as treatment failures for splinting, resulting in a final success rate of 31% for splinting (26 of 83 patients) at 12 months.

In the single variable analyses, five potential prognostic indicators were significantly associated ($p<0.10$) with success at 12 months: duration of the current episode of CTS complaints, number of nights waking up, severity of pain and severity of paraesthesia at night in the past week, and the Symptom Severity Score. These prognostic indicators were first entered as continues variables in the multiple logistic regression model. There were no missing values. After running a backward elimination procedure (LR-test $p_{removal}>0.10$) only duration of complaints and severity of paraesthesia at night were retained in the final model. After dichotomising the prognostic indicators, using the median value, the same analysis was repeated. Again, duration of complaints ("complaints for one year or less" compared with "complaints for more than one year") and severity of paraesthesia at night ("a score of 6 or less" compared with "a score of more than 6") were retained in the final model. No interaction between these two indicators was found. It was decided to present the model with the two prognostic indicators included as dichotomous variables, because the overall percentage of patients who were correctly classified by this model was somewhat higher than that of the model with the continuous variables, and because this model is easier to apply in clinical practice.

Sixteen of the 26 patients who were "improved" (true positive rate: 62%, 95% CI 43% to 80%) and 49 of the 57 who were "not improved" (true negative rate: 86%, 95% CI 77% to 95%) were correctly classified. The overall percentage of patients who were correctly classified by the model was 78% (95% CI 69% to 87%). This percentage gives an indication of the predictive value of the model. Table 1 presents the predicted probabilities of success after splinting for the possible combinations of the two indicators. For patients with complaints for one year or less and with a score of 6 or less for severity of paraesthesia at night, the success rate for splinting was 62% after 12 months.

The actual treatment success at 12 months was 67% in this group of patients.

DISCUSSION

Because of the small number of patients this study may have lacked the power to detect associations between the outcome and certain potential prognostic indicators. Furthermore, as a large number of variables were evaluated, the associations that were found could in theory, despite statistical significance, be attributable to chance only. This study is therefore regarded as exploratory.

In the final model two factors were identified, namely duration of complaints and severity of paraesthesia at night, that were related to the outcome after splinting. In other studies on prognostic indicators for conservatively treated or untreated CTS,[17–19] an association between a short duration of symptoms and improvement was also found, and in one study[17] constant paraesthesia was associated with poor results.

In clinical practice these results would only be useful if a physician could make a distinction between patients with and without long term successful results from splinting on the basis of these two prognostic indicators. This proved to be difficult, because the predictive power of the model was only modest. Moreover, if this model would be applied to a new group of patients its predictive power would probably be less favourable. As a consequence, even patients with complaints for one year or less and a score of 6 or less for severity of paraesthesia at night have an estimated chance of only 62% of long term successful results from splinting.

Table 1 Predicted probabilities of success of splinting at 12 months follow up

Duration of complaints	Severity of paraesthesia at night	Predicted probability of success at 12 months	Actual success at 12 months
>1 year	>6	5%	13% (2/16)
>1 year	⩽6	19%	12% (2/17)
⩽1 year	>6	28%	23% (6/26)
⩽1 year	⩽6	62%	67% (16/24)

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