A Meta-analysis of Corticosteroid Injection for Trigger Digits Among Patients With Diabetes

CHAO-JUI CHANG, MD; SHEN-PENG CHANG, MS; LO-TING KAO, MD; TA-WEI TAI, MD, PHD; I-MING JOU, MD, PHD

abstract

A majority of patients with diabetes have trigger digits. Initial management of symptomatic trigger digits commonly involves corticosteroid injection. However, varying outcomes have been reported for patients with diabetes who receive corticosteroid injections. The authors conducted a meta-analysis to evaluate the effect of diabetes on outcome after corticosteroid injection for trigger digit. PubMed and other Internet databases were searched for the period 1977 to 2015. Five articles, involving 381 diabetic digits and 449 non-diabetic digits, were included in the meta-analysis. The authors found treatment failure rates of 78% for patients with insulin-dependent diabetes, 47% for patients with non–insulin-dependent diabetes, and 49% for patients without diabetes when a single injection of corticosteroid was administered for trigger digit. After 3 injections, the failure rates were 57%, 39%, and 30%, respectively. The pooled data showed that patients with insulin-dependent diabetes and patients with non–insulin-dependent diabetes had worse prognoses after corticosteroid injection for trigger digit than patients without diabetes. Furthermore, the patients with insulin-dependent diabetes had a trend toward multiple digit involvement and much worse treatment outcomes than the patients with non–insulin-dependent diabetes. The authors conclude that more aggressive treatment, such as surgical intervention, should be considered for those patients expected to have high failure rates after injection.

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tenosing flexor tenosynovitis (trigger digit) is caused by inflammation or swelling of the flexor tendons and surrounding retinacular pulley system at the first annular (A1) pulley. It usually leads to a painful condition that causes the fingers or thumb to catch or lock when bending and requires passive manipulation of the finger into extension.

Approximately 20% of patients who are treated for trigger digits have diabetes.1,2 The prevalence of trigger digits among patients with diabetes varies from 5%3 to 20%.4 Women are affected significantly more frequently than men and at a younger age.5

Treatments for trigger digits include daily activity modification, an anti-inflammatory regimen, splinting, corticosteroid injection, and an open or percutaneous A1 pulley release. Of these, corticosteroid injection, involving a medication that reduces the inflammatory process, is the mainstream initial management for a symptomatic trigger digit.6,7 Benson and Ptaszek5 reported a 60% success rate for a single corticosteroid injection. Schubert et al5 showed that the efficacy of the total injection therapy regimen (without receiving surgery) was approximately 80%. Moreover, Freiberg et al9 reported that...
up to 3 corticosteroid injections provide long-term relief of symptoms in 60% to 92% of affected digits.

Some studies have supported the idea that underlying diabetes affects the outcome of corticosteroid injection for trigger digit, but others have not. However, these studies had small samples. To the current authors’ knowledge, no wide-ranging study or meta-analysis has been published addressing this issue. Thus, the objective of this study was to evaluate whether diabetes influences the result of corticosteroid injection for trigger digit. Furthermore, the authors compared the efficacy of treatment among patients with insulin-dependent diabetes and patients with non–insulin-dependent diabetes.

### Materials and Methods

This meta-analysis was conducted according to Meta-analysis of Observational Studies in Epidemiology guidelines. This meta-analysis was conducted according to Meta-analysis of Observational Studies in Epidemiology guidelines. The authors used the Google search engine and the following terms: “diabetes mellitus,” “insulin dependent diabetes mellitus,” “noninsulin dependent diabetes mellitus,” “trigger digits,” “trigger fingers,” “corticosteroid injection,” and “prognostic outcome.” PubMed, Medline, Embase, and the Cochrane Library were also searched using the keywords “diabetes mellitus,” “corticosteroid injection,” “trigger digits,” and “trigger fingers” for the period 1977 to 2015. References from articles and related citations of articles were also searched for further research.

Articles with unclear patient characteristics, insufficient available data, and patients’ preference of surgery treatment (ie, patients choosing surgery on their own and not according to indications) were excluded. Articles with low-intensity evidence were also excluded. The authors used the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement to assess the quality of each article.

### Study Selection

The searching of relevant studies and processing of paper exclusions were executed by 2 authors (C.-J.C., I.-M.J.) independently. Data extraction and article appraisal were conducted by 2 authors (C.-J.C., T.-W.T.). When discrepancies occurred, consensus was reached via discussion with the review team.

### Data Extraction

The following data were extracted from the included articles: (1) quantity of treated trigger digits, (2) characteristics of patients, (3) type of diabetes, (4) indications for corticosteroid injection, (5) dosage of corticosteroid injection, (6) duration of treatment and follow-up, (7) complications of corticosteroid injection, and (8) treatment failure rate. Patients with comorbidity treated with long-term corticosteroids or pain control medication (eg, nonsteroidal anti-inflammatory drugs) were excluded from this study because they could have introduced bias. Patients who were previously treated with corticosteroid injection or surgical intervention for trigger digits were also excluded. The authors of these articles were contacted if more or missing data were needed.

### Statistical Analysis

Outcomes were collected using the Mantel–Haenszel method. The authors used the quantity \( P \), ranging from 0% to 100%, to test the variation across studies that was due to heterogeneity rather than to chance and to quantify the effect of heterogeneity. An \( P \) value of more than 50% was considered notable heterogeneity. A random-effects analysis was used to compare trials showing heterogeneity, whereas a fixed-effects analysis was used to compare trials not showing heterogeneity. Heterogeneity and relative risk (RR) were calculated for all outcomes in this study. The authors assessed the possibility of publication bias using Egger funnel plots. The meta-analysis was conducted using Review Manager version 5.3 software (The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark).

### Results

There were 665 potentially relevant articles initially found in the literature search. After the titles and abstracts of these articles were quickly reviewed for further relevance, 43 articles remained for additional evaluation in full-text form. Ultimately, 5 articles fulfilled the inclusion criteria of this study (Figure 1). A total of 381 diabetic digits and 449 non-diabetic digits were included in this meta-analysis. Characteristics of the patients of these 5 studies are summarized in Table 1. Of these 5 studies, 4 compared corticosteroid injection for trigger digits between patients with and patients without diabetes and 4 did so between patients with insulin-dependent diabetes and patients with non–insulin-dependent diabetes. Funnel plots were used to assess the possibility of publication bias in the current study. The results indicated that publication bias was unlikely (Figure 2).

Three studies reported the outcomes after both 1 and 3 corticosteroid injections. Of the remaining 2 studies, 1 reported the results of a single injection and 1 reported the results of 3 injections. Patients who received 3 injections were seen for further evaluation from 3 weeks to 3 months after the initial injection. The second or third injection was recommended if patients experienced partial relief of symptoms or recurrent or persistent symptoms. In both the single-injection and the 3-injection groups, treatment failure was defined as the persistence of local pain or tenderness or the requirement for further surgical intervention after the first or third injection.

The treatment failure rates reported in the 5 studies are summarized in Table 2 and Table 3. With a single corticosteroid injection, the patients with insulin-dependent diabetes had a higher failure rate...
(78%) than the patients with non–insulin-dependent diabetes (47%) and the patients without diabetes (49%). Furthermore, a similar failure rate pattern was seen for 3 injections: 57% for patients with insulin-dependent diabetes, 39% for patients with non–insulin-dependent diabetes, and 30% for patients without diabetes.

For a single injection, the pooled data showed that the insulin-dependent diabetic group had a higher risk of treatment failure than the non–insulin-dependent diabetic group (RR of treatment failure, 1.60; 95% confidence interval [CI], 1.28-1.99). However, there was no significant difference between the diabetic group and the non-diabetic group (RR, 1.49; 95% CI, 0.80-2.79; P=21). Subgroup analysis also revealed that, compared with the non-diabetic group, both the insulin-dependent diabetic group (RR, 1.64; 95% CI, 0.80-3.37) and the non–insulin-dependent diabetic group (RR, 1.06; 95% CI, 0.61-1.84) did not have higher treatment failure rates (Figure 3).

For 3 injections, the pooled data revealed that the diabetic group had double the risk of failure compared with the non-diabetic group (RR, 2.03; 95% CI, 1.51-2.74). The insulin-dependent diabetic group had a much worse prognosis after corticosteroid injection than the non-diabetic group (RR, 2.37; 95% CI, 1.61-3.47). The non–insulin-dependent diabetic group also had a poorer treatment outcome than the non-diabetic group (RR, 1.47; 95% CI, 1.02-2.13). Moreover, the insulin-dependent diabetic group showed

**Table 1**

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Insulin-Dependent Diabetes</th>
<th>Non–Insulin-Dependent Diabetes</th>
<th>No. of Injections</th>
<th>STROBE Score</th>
<th>Study Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nimigan et al (2006)</td>
<td>23</td>
<td>19</td>
<td>1 &amp; 3</td>
<td>70</td>
<td>Retrospective cohort study</td>
</tr>
<tr>
<td>Baumgarten et al (2007)</td>
<td>93</td>
<td>49</td>
<td>1 &amp; 3</td>
<td>21</td>
<td>Randomized controlled study</td>
</tr>
<tr>
<td>Stahl et al (1997)</td>
<td>32</td>
<td>29</td>
<td>1 &amp; 3</td>
<td>19</td>
<td>Prospective cohort study</td>
</tr>
<tr>
<td>Wojahn et al (2014)</td>
<td>70</td>
<td>61</td>
<td>1 &amp; 3</td>
<td>70</td>
<td>Retrospective cohort study</td>
</tr>
<tr>
<td>Suh et al (1997)</td>
<td>19</td>
<td>NA</td>
<td>1 &amp; 3</td>
<td>19</td>
<td>Retrospective cohort study</td>
</tr>
</tbody>
</table>

**Abbreviations:** BM, betamethasone; MP, methylprednisolone; NA, not available; STROBE, Strengthening the Reporting of OBServational studies in Epidemiology.
almost double the risk of treatment failure compared with the non–insulin-dependent diabetic group (RR, 1.80; 95% CI, 1.26-2.56) (Figure 4).

Two articles also provided information on multiple digit involvement.\textsuperscript{11,21} The pooled data revealed that the insulin-dependent diabetic group had a trend toward greater risk of multiple digit involvement compared with the non–insulin-dependent diabetic group, although the difference was not statistically significant (RR, 1.71; 95% CI, 0.81-3.63) (Figure 5).

Three studies used betamethasone as the steroid formula,\textsuperscript{2,10,21} whereas 2 studies applied methylprednisolone.\textsuperscript{11,12} One study mentioned a transient rise in fingerstick blood glucose level after injection in the insulin-dependent diabetic group.\textsuperscript{21} Another study reported an inflammatory reaction and fat atrophy after injection.\textsuperscript{2}

### DISCUSSION

The most important finding of this study was that the patients with insulin-dependent diabetes and the patients with non–insulin-dependent diabetes had a significantly higher failure rate than the patients with non–insulin-dependent diabetes. The authors also found a trend for the patients with insulin-dependent diabetes to have a greater risk of multiple digit involvement than the patients with non–insulin-dependent diabetes.

### Table 2

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>All Diabetes</th>
<th>Insulin-Dependent Diabetes</th>
<th>Non–Insulin-Dependent Diabetes</th>
<th>No Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nimigan et al\textsuperscript{2} (2006)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Baumgarten et al\textsuperscript{10} (2007)</td>
<td>42% (8/19)</td>
<td>NA</td>
<td>NA</td>
<td>24% (7/29)</td>
</tr>
<tr>
<td>Stahl et al\textsuperscript{11} (1997)</td>
<td>74% (96/130)</td>
<td>82% (80/98)</td>
<td>50% (16/32)</td>
<td>35% (25/72)</td>
</tr>
<tr>
<td>Wojahn et al\textsuperscript{12} (2014)</td>
<td>53% (47/88)</td>
<td>64% (25/39)</td>
<td>45% (22/49)</td>
<td>55% (153/278)</td>
</tr>
<tr>
<td>Griggs et al\textsuperscript{11} (1995)</td>
<td>NA</td>
<td>80% (74/93)</td>
<td>46% (13/28)</td>
<td>NA</td>
</tr>
<tr>
<td>Overall</td>
<td>64% (151/237)</td>
<td>78% (179/230)</td>
<td>47% (51/109)</td>
<td>49% (185/379)</td>
</tr>
</tbody>
</table>

**Abbreviation:** NA, not available.

### Table 3

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>All Diabetes</th>
<th>Insulin-Dependent Diabetes</th>
<th>Non–Insulin-Dependent Diabetes</th>
<th>No Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nimigan et al\textsuperscript{2} (2006)</td>
<td>74% (17/23)</td>
<td>100% (4/4)</td>
<td>68% (13/19)</td>
<td>43% (30/70)</td>
</tr>
<tr>
<td>Baumgarten et al\textsuperscript{10} (2007)</td>
<td>37% (7/19)</td>
<td>NA</td>
<td>NA</td>
<td>14% (4/29)</td>
</tr>
<tr>
<td>Stahl et al\textsuperscript{11} (1997)</td>
<td>51% (66/130)</td>
<td>57% (56/98)</td>
<td>31% (10/32)</td>
<td>24% (17/72)</td>
</tr>
<tr>
<td>Wojahn et al\textsuperscript{12} (2014)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Griggs et al\textsuperscript{11} (1995)</td>
<td>NA</td>
<td>56% (52/93)</td>
<td>29% (8/28)</td>
<td>NA</td>
</tr>
<tr>
<td>Overall</td>
<td>52% (90/172)</td>
<td>57% (112/195)</td>
<td>39% (31/79)</td>
<td>30% (51/171)</td>
</tr>
</tbody>
</table>

**Abbreviation:** NA, not available.
Women who were 52 to 62 years old had the greatest risk of having trigger digits. This review also showed that corticosteroid injections were effective for 57% of patients with trigger digits. In addition, it was previously found that a single injection of corticosteroids relieved symptoms in 47% to 87% of patients with trigger digits.

Close relationships exist between hand disorders and diabetes. Rosenbloom et al suggested that a correlation existed between limited joint mobility and microvascular complications among patients with type 1 diabetes. The cause of hand disorders among patients with diabetes is thought to be multifactorial. Decreased collagen degradation, diabetic microangiopathy, and increased glycosylation of collagen may play a role and may contribute to the outcome of treatment for trigger digits. Further studies are needed to investigate the major factors influencing the efficacy of corticosteroid injection for trigger digits among patients with diabetes.

This meta-analysis revealed that all of the patients with diabetes, the patients with insulin-dependent diabetes, and the patients with non–insulin-dependent diabetes had worse prognoses after corticosteroid injection than the patients without diabetes. The patients with insulin-dependent diabetes also had a worse prognosis after injection than the patients with non–insulin-dependent diabetes. However, for the single-injection studies, the pooled data showed that only the insulin-dependent diabetic group had a higher risk for treatment failure than the non–insulin-dependent diabetic group. Patients with diabetes did not have a higher risk for treatment failure than controls. It is possible that the number of injections or the concentration of corticosteroid influenced the efficacy of treatment.

The patients with insulin-dependent diabetes had a failure rate of 78% after a single injection and 57% after 3 injections. These results would be disappointing to most physicians and patients. Physicians should inform patients about this before the intervention. Recently, minimally invasive surgical release has proved to be safe and effective. The current authors believe that more aggressive treatment, such as early surgical intervention, should be considered for patients expected to have higher failure rates after injection. Theoretically, the side effects of steroid injection include pain or infection at the injection site, ecchymosis, subcutaneous fat atrophy, stiffness, and tendon rupture. However, to date, only minor adverse events have been reported after steroid injection for trigger digit, indicating that it is a potentially safer treatment option for patients who do not want to undergo surgical intervention.

Demographics such as age and sex, study quality, severity of disease, and co-existing conditions could lead to clinical heterogeneity. The current authors found that there was heterogeneity between the

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**Figure 3:** The pooled treatment failure rate data for a single injection of corticosteroid for trigger digit. The diabetes group vs the non-diabetes group (relative risk of treatment failure [RR], 1.49; 95% confidence interval [CI], 0.80-2.79; P<.21) (A). The insulin-dependent diabetes (ID-Diabetes) group vs the non-diabetes group (RR, 1.64; 95% CI, 0.80-3.37; P=.18) (B). The ID-Diabetes group vs the non–insulin-dependent diabetes (NID-Diabetes) group (RR, 1.60; 95% CI, 1.28-1.99; P=.001) (C). The NID-Diabetes group vs the non-diabetes group (RR, 1.06; 95% CI, 0.61-1.84; P=.85) (D). Abbreviation: M–H, Mantel–Haenszel.
It may have resulted from different mean ages of the patients (59.2 vs 55.1 years) and different proportions for sex (126 male/240 female vs 32 male/88 female). Also, the rates of multiple digit involvement differed in these 2 studies (44% vs 38%). Moreover, these 2 studies evaluated the failure rate at different times.11,12

This study had several limitations. First, the formula of steroid and the number of injections administered differed in each of the 5 included studies. Betamethasone and methylprednisolone were both used. However, the current authors could not identify a particular corticosteroid formula as being more effective. A previous review study also indicated that different corticosteroid regimens led to nearly similar outcomes.22 Second, the evaluation of trigger symptoms and the duration of follow-up varied among the studies. This could have influenced symptom relief or exacerbated symptoms and may have contributed to bias in the study. In these 5 studies, treatment failure was defined as the persistence of local pain, tenderness, or recurrent triggering. Subjective perception of pain and endurance played the most important role, which is a common flaw of this type of study. Third, multiple digits or bilateral involvement may bias results.34,35 However, the involvement of multiple digits is high, especially in patients with diabetes. Because no study enrolled patients with only a single trigger digit, the current authors could not assess the bias from multiple digit involvement. Fourth, because few studies have investigated the prognosis for patients with diabetes treated with corticosteroid injection for trigger digits, the sample size was limited. However, to date, the authors’ meta-analysis is the largest assessing this issue.

**Conclusion**

This study found that patients with diabetes had worse prognoses after corticosteroid injection for trigger digit than patients without diabetes. Additionally, patients with insulin-dependent diabetes had a trend toward multiple digit involvement and had a higher treatment failure rate than patients with non-insulin-de-
dependent diabetes. Physicians should inform patients with diabetes, especially insulin-dependent diabetes, about the high failure rate of injection. More aggressive treatment, such as surgical intervention, should be considered for this group of patients.

References