Original article

Treatment of trigger finger: randomized clinical trial comparing the methods of corticosteroid injection, percutaneous release and open surgery

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Abstract

Objective. The aim of this study is to evaluate the effectiveness of CS injection, percutaneous pulley release and conventional open surgery for treating trigger finger in terms of cure, relapse and complication rates.

Methods. One hundred and thirty-seven patients with a total of 150 fingers were randomly assigned and allocated into one of the treatment groups, with treatments allocated into 150 opaque and sealed envelopes. We included patients >15 years of age with a trigger on any finger of the hand (Types II–IV) and used a minimum follow-up time of 6 months. The primary outcome measures were cures, relapses and failures.

Results. Forty-nine patients were assigned to the conservative group to undergo CS injections, whereas 45 and 56 were assigned to undergo percutaneous release and outpatient open surgery, respectively. The trigger cure rate for patients in the injection method group was 57%, and wherever necessary, two injections were administered, which increased the cure rate to 86%. For the percutaneous and open release methods, remission of the trigger was achieved in all cases.

Conclusions. The percutaneous and open surgery methods displayed similar effectiveness and proved superior to the conservative CS method regarding the trigger cure and relapse rates.


Key words: trigger finger disorder, tendon entrapment, stenosing tenosynovitis, trigger digits, snapping finger, trigger thumb, randomized controlled trial, controlled clinical trial, operative surgical procedure, tendon release

Introduction

Trigger finger is a condition that occurs when the gliding movement of the tendon is blocked by the osteofibrous canal of the A1 pulley, preventing the tendon from naturally extending and returning to its initial position. Although synovial proliferation and fibrosis flexor sheath are identified as triggering factors, there is no consensus in the literature about its true cause and its aetiology remains unknown [1]. Notta [2] described trigger finger as a condition caused by changes to the flexor tendon and its sheath. Hueston and Wilson [3] demonstrated in an anatomical study that the spiral arrangement of the architecture of the intratendon fibres leads to the formation of nodules that form distally to the A1 pulley.

This pathology is more common in women, on the dominant side, and in the sixth decade of life. The most affected finger is the thumb; however, the occurrence of the trigger is also common in the other fingers [4]. The symptoms vary from a slight local discomfort to the formation of a tendon blockage, experienced principally in the morning, which leads to a deficit in actively extending the
finger, which remains fixed in a flexed position [5]. Trigger finger also appears to be linked to other diseases, such as RA, gout, CTS, De Quervain’s disease and diabetes [6, 7]. Quinnell [1] classified the trigger finger using five types during flexion and extension: normal movement (Type 0), uneven movement (Type I), actively correctable (Type II), passively correctable (Type III) and fixed deformity (Type IV).

Although some patients may experience a spontaneous cure or a disappearance of the symptoms by means of the treatment strategies of immobilization or CS injections, many may require surgery for release of the A1 pulley [1, 6, 8–13]. Some authors support a conservative treatment based on steroid injection, whereas others advocate a surgical approach [1, 5, 6, 9–13].

A CS in conjunction with anaesthesia may be administered to the flexor muscle sheath, and this strategy has been demonstrated to produce good results [1, 6, 9–14]. However, that technique can result in a relapse rate of up to 29% [10].

Release through open surgery has a high rate of success with minimal morbidity and recurrence, although they do occur, principally in cases of long-standing illness and in which there was a failure of a conservative remedy; however, accounts of complications do exist, such as painful scarring, infections and nerve damage, in addition to recurrence of the disease [15, 16].

In 1958, Lorthioir [17] described a treatment method for trigger finger consisting of a delicate tenotomy. Other authors have also reported good results by using percutaneous release of the A1 pulley [5, 18–26].

We developed this randomized prospective study with the objective of verifying the most effective treatment method for this pathology by comparing the techniques of CS injection, percutaneous release of the A1 pulley and conventional open surgery in terms of their rates of cure, relapse and complications.

Materials and methods

Study population and inclusion criteria

The study compared the rates of cure, relapse and complications of treatments for trigger finger based on CS injection, percutaneous release and open release of the A1 pulley as realized in the period from November 2002 to March 2007. The research project was analysed and approved by the Ethics Research Committee of the Federal University of São Paulo – São Paulo Hospital (CEP No. 0349/03 on 23 May 2003). Written informed consent was obtained from all the participants.

For both genders, the inclusion criteria were ≥15 years of age and symptomatologies of trigger finger movement blockage on either hand in subjects who had not undergone previous treatment of any type and were classified as Quinnell Types II–IV [1]. We excluded individuals with Type I trigger fingers, which are considered congenital and secondary to the partial lesion to the tendon.

Outpatient follow-up was conducted over a minimum period of 6 months. The patients were prospectively assessed after 1, 2 weeks, 1, 2, 4 and 6 months, after which they were discharged from the study. For the injection group, those that received a second injection were followed for 6 months starting from the second intervention.

Study analysis and design

The patients were initially treated by outpatient hand surgery in the Discipline of Hand and Upper Limb Surgery, Department of Orthopedics and Traumatology, Paulista Medical School – Federal University of São Paulo (UNIFESP) – Brazil. Treatment was started for a group of 137 patients presenting 150 cases of trigger finger. The patients were treated by resident physicians, assistant physicians and the author of this article according to the study intervention methodologies.

The study participants and each finger submitted to treatment were grouped and numbered chronologically. In cases in which the patient presented with two trigger fingers, each finger received its own order number regardless of whether the fingers were on the same or different hands.

In the study, 12 patients had a trigger on more than one finger of a hand. Each trigger finger received an order number. Eleven patients participated in the study on two occasions, and one participated on three occasions.

Calculation of the size of the study sample was based on the primary outcome of the differences in cure rates among the different proposed treatment techniques, with the sample being considered dichotomically and categorically variable. The difference in cure rates was originally determined to be ~25%. Each group finally consisted of 50 fingers, after 43 were calculated per group with a β-value of 80% and an α statistical significance of 5%.

For the purposes of randomization, we used a six-sided die, with the treatment method selection depending on the result obtained. When sides one and six were scored, the selected method was injection, surgical release was selected when sides three and four were scored and percutaneous release was selected when sides five and six were scored, resulting in three study groups. The draw was conducted before the study by a person independent of the research. There were 150 draws conducted. As the methods were drawn, each result was placed in an opaque envelope, which was then sealed; envelopes were numbered from 1 to 150. None of the project participants had prior access to the envelope contents. Before treatment, the envelope was opened and the paper, with either one, two or three methods to be used, was read by the assistant physician. The patient was informed of the type of treatment he or she would receive and was led to the operating theatre. In this manner, each patient received treatment according to his or her number (e.g. the first patient received the treatment indicated within envelope number one).

Intervention methods

CS injection consisted of an injection of 2 ml of methylprednisolone acetate 40 mg/ml at the site corresponding to the A1 pulley, attempting to inject the solution within the osteofibrous canal [11]. Percutaneous release consisted
of release of the A1 pulley with a 40 \times 12 needle, using longitudinal movements, in the direction of the axis of the flexor tendon, and this release was introduced at the site corresponding to the A1 pulley [5, 27] (Fig. 1). Conventional open surgery consisted of an incision of 2 cm in the skin transverse to the axis of the finger at the palmar skin fold, followed by subcutaneous dissection and longitudinal opening of the A1 pulley [15].

Methods for comparing outcomes

Primary outcomes

Cure of the trigger was considered as the remission of the trigger, cessation of blockage (bending) of the finger, and the free flow of its movement. Patients were deemed cured if they maintained remission of the ‘trigger’ for 6 months of follow-up. Relapse of the trigger was classified as the relapse or return of blockage of the finger within the 6 months of post-study follow-up. With respect to percutaneous release and open release, we classified as failures those fingers that relapsed or in which blockage of the finger was maintained after treatment. For the purposes of the injection, we considered as failures those fingers that relapsed or in which blockage of the finger was maintained after the second injection.

Secondary outcomes

Topical pain was defined as pain at the site of the procedure 1 and 2 weeks and 1, 2, 4 and 6 months after the procedure. Articular pain was defined as pain at the IP joint of the thumb and at the PIP joint of the fingers 1 and 2 weeks and 1, 2, 4 and 6 months after the procedure. For the purposes of assessing the active movement of the fingers, we used the total active motion (TAM) method as advocated by the Committee for Tendon Lesions of the International Federation of Societies of Hand Surgery [28]. To calculate the TAM value, we added the degree of flexure of the joints of the fingers with active flexure and subtracted the loss of extension as measured with the finger in active extension. The measurements were collected using a goniometer in the dorsal region of the fingers. The measurements were taken before and 1, 2, 4 and 6 months after the treatment. Complications, including those linked to the treatment methods used, infection, total lesion of the flexor tendon and lesion of the digital nerve, were measured.

Statistical method

Analysis of variance (ANOVA) was used to compare the averages of the numerical variables. For the categorical variables, we used the Pearson’s chi-square test. For all tests, an \( \alpha \)-value of 5% was used, with \( P < 0.05 \) indicating statistical significance. All analyses were performed using SPSS 8.0 for Windows.

We analysed the homogeneity of participants of the study according to their gender, the onset of diabetes, age and duration of disease at the date they committed to the protocol. The Pearson’s chi-square test was used to verify the existence of the link among the categorical variables, gender and onset of diabetes. ANOVA was used to make comparisons among the averages of the numeric variables, gender and duration of disease at the date of committing to the protocol. We used Pearson’s chi-square test for the statistical analysis of the frequency of complaints regarding pain subsequent to the treatments, both at the site of the procedure as well as at the IP joints of the digits. We used ANOVA for the statistical analysis of the variation of movement of the fingers before and after the treatments. Pearson’s chi-square test was used for statistical comparisons among the cure rates for the injection, percutaneous and open methods.

Results

Sample

The three groups were homogeneous in terms of age, comorbidity, gender, time of onset of trigger finger and classification [1] (Tables 1 and 2). The data pertaining to the analysis of the rates of cure, relapse and failure observed among the injection, percutaneous and open groups are presented in Table 3.

![Fig. 1 Percutaneous release.](image-url)
Outcomes

**Cure for trigger finger**

The open and percutaneous methods resulted in significantly higher rates of cure of trigger finger than the injection method ($P = 0.004$).

**Relapse of trigger finger**

The injection group presented a rate of trigger finger relapse of 12.5%. All relapses received a second injection. The group that received two injections presented a relapse rate of 18%. No relapse was observed in the groups treated by percutaneous release and open surgery.

**Failures**

There were seven failures in the injection method group after the second injection: four occurred as a result of the persistence of the trigger and three occurred as a result of relapse. There were no failures in the percutaneous and open surgery groups. The results of the interventions are summarized in Fig. 2.

**Topical pain**

The percentage of patients experiencing topical pain in the injection group was statistically lower than those in the percutaneous and open surgery groups after 1 week ($P = 0.000$), 2 weeks ($P = 0.000$) and 1 month ($P = 0.008$) of follow-up. After 2, 4, and 6 months of follow-up, the percentage of patients experiencing topical pain was similar among the three groups (Table 4).

**Articular pain**

The percentage of patients complaining of articular pain in the injection group was statistically lower than those in the percutaneous and open surgery groups after 1 week ($P = 0.014$), 2 weeks ($P = 0.023$) and 1 month ($P = 0.029$) of follow-up. After 2, 4 and 6 months of follow-up, the percentage of patients complaining about pain was similar among the three groups (Table 4).

**TAM analysis**

There was no difference in the TAM values among the injection, percutaneous release and open surgery groups in the pre-treatment period and 6 months after treatment.

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**TABLE 2** Distribution of patients by classification [1]

<table>
<thead>
<tr>
<th>Type</th>
<th>Method</th>
<th>Open</th>
<th>Injection</th>
<th>Percutaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>31</td>
<td>23</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>II</td>
<td>36</td>
<td>13</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>III</td>
<td>15</td>
<td>15</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>IV</td>
<td>15</td>
<td>15</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>n = 66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P-value*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test. $n$: number of patients per group.

**TABLE 3** Distribution of results with grouping by method: injection, percutaneous and open surgery

<table>
<thead>
<tr>
<th>Method</th>
<th>Result</th>
<th>Open (n = 66)</th>
<th>Injection (n = 49)</th>
<th>Percutaneous (n = 45)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Cure</td>
<td>56</td>
<td>28</td>
<td>42</td>
<td>0.004**</td>
</tr>
<tr>
<td>Injection</td>
<td>Relapse</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Percutaneous</td>
<td>Failure</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test. **Statistically significant ($P < 0.05$). $n$: number of patients per group.

**Fig. 2** Flowchart of the intervention results.
No differences were observed after 1, 2 and 4 months of follow-up between the injection and percutaneous release groups. Lower values were observed in the open surgery group than in the injection and percutaneous release groups after 1 (P = 0.012), 2 (P = 0.048) and 4 months (P = 0.068) of follow-up (Table 5).

**Complications**

We did not record any complications such as infection and total lesion of the flexor tendon or digital nerve among the three groups receiving CS injections, percutaneous release or conventional open surgery.

**Discussion**

The treatment approach to trigger finger can be conservative, such as the method of CS injection, or can be surgical, such as open surgical and percutaneous release methods. Conclusive evidence regarding the best treatment option is lacking. We consequently developed this randomized-format study based on a homogeneous population to test the effectiveness of the three methods.

We included patients >15 years of age with a trigger on any finger, although authors such as Bain et al. [29] have indicated that a greater risk of lesion to the neurovascular sheath exists with the percutaneous release of the thumb and small finger. With respect to the stage of disease, we included Types II–IV triggers because in a previous study we observed that the percutaneous method is not indicated for Type I due to the need for active demonstration of the flexion-extension activity of the finger for that procedure. With Type I, the trigger occurs sporadically at the time of surgery and a blockage may not occur, which would give an erroneous impression of remission.

The open and percutaneous surgery methods proved similar and superior to injection in terms of cure and relapse rates. In the injection group, a 57% cure rate of the trigger was achieved with CS injection. The cases of failure of relapse were submitted to a second injection; in this manner, the cure rate increased to 86% over a 6-month follow-up period. A third injection was not offered, and the relapses were considered failures, which were then treated by means of open or percutaneous release. The results for those patients were computed in the initially randomized group, in line with the principle of intent of treatment. Of the cases in which there were failures in the remission of the trigger, six were initially classified as Type II, and one was classified as Type III. We did not find any studies related to the percentage of cure by injection in conjunction with the type of trigger in the literature. The patients in the percutaneous and open release groups had remission rates of 100%, similar to the results presented by Gilberts et al. [30] in a randomized prospective study comparing the percutaneous method with the open method, in which they reported remission rates of 98% with the open surgery method and 100% with the percutaneous method.

The patients in the injection group experienced a lower incidence of pain in the first month of follow-up compared with those of the open and percutaneous groups, which had similar incidences. Authors such as Chao et al. [31] compared the percutaneous and injection methods and reported that the group given injections also presented a lower incidence of pain in the first month after the procedure than patients submitted to percutaneous release.

For all three groups, TAM values in the sixth month of follow-up were greater than the values observed before treatment, similar to the findings of Marcus et al. [32]. The open group had lower TAM values than the injection and

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**Table 4** Distribution of topical and joint pain frequency by method 1 and 2 weeks and 1, 2, 4 and 6 months after treatment

<table>
<thead>
<tr>
<th>Method</th>
<th>Topical pain</th>
<th>Joint pain</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open (n = 56)</td>
<td>38</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Injection (n = 49)</td>
<td>9</td>
<td>3</td>
<td>0.000**</td>
</tr>
<tr>
<td>Percutaneous (n = 45)</td>
<td>30</td>
<td>13</td>
<td>0.014**</td>
</tr>
<tr>
<td>1 week</td>
<td>Topical pain</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>Joint pain</td>
<td>22</td>
<td>15</td>
<td>0.008**</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Topical pain</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Joint pain</td>
<td>8</td>
<td>4</td>
<td>0.170</td>
</tr>
<tr>
<td>4 months</td>
<td>Topical pain</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Joint pain</td>
<td>1</td>
<td>4</td>
<td>0.122</td>
</tr>
<tr>
<td>6 months</td>
<td>Topical pain</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Joint pain</td>
<td>0</td>
<td>2</td>
<td>0.148</td>
</tr>
</tbody>
</table>

*Chi-square test. **Statistically significant (P < 0.05). n: number of patients per group.

**Table 5** Distribution of the average measurements of movement of the fingers by active movement (TAM values) by method before and 1, 2, 4 and 6 months after treatment

<table>
<thead>
<tr>
<th>Method</th>
<th>Before</th>
<th>Injection</th>
<th>Percutaneous</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>184.46</td>
<td>200.31</td>
<td>197.42</td>
<td>0.333</td>
</tr>
<tr>
<td>Injection</td>
<td>176.41</td>
<td>207.18</td>
<td>201.76</td>
<td>0.012**</td>
</tr>
<tr>
<td>Percutaneous</td>
<td>184.89</td>
<td>208.53</td>
<td>207.78</td>
<td>0.048**</td>
</tr>
<tr>
<td>4 months</td>
<td>187.75</td>
<td>210.96</td>
<td>207.87</td>
<td>0.068</td>
</tr>
<tr>
<td>6 months</td>
<td>190.07</td>
<td>210.04</td>
<td>207.98</td>
<td>0.138</td>
</tr>
</tbody>
</table>

*ANOVA. **Statistically significant (P < 0.05). Before: TAM before treatment.
percutaneous groups after 1, 2 and 4 months of follow-up, which may be explained by the greater morbidity of the open surgery.

We did not observe any lesion of the digital nerve among the three treatment groups, which would be a distressing factor, principally for the percutaneous method group. We believe that the demarcation of the longitudinal axis of the tendon in the percutaneous technique and precise anatomical knowledge of the pulleys are important factors for preventing complications, which is similar to the conclusion reached in anatomical studies [33, 34].

Conclusions

The levels of effectiveness of open surgical and percutaneous methods were superior to the conservative method of using CSs based on the cure and reappearance rates of the trigger.

Rheumatology key messages

- Trigger finger should be treated first by steroid injection due to its low morbidity.
- Trigger finger treatment by percutaneous pulley release and open surgery showed similar levels of pain.
- Steroid injection is a less painful method than surgery for treating trigger finger.

Disclosure statement: The authors have declared no conflicts of interest.

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