Clinical experience of the percutaneous release for trigger fingers

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Background: Conservative management for the trigger fingers includes splinting, steroid injection and other adjuvant methods. If conservative treatment fails, a surgical release of the A1 pulley is offered. Although the success rate of the surgical intervention is high, the complications, for example, a digital nerve injury, bowstringing, infection and continued triggering, have been reported. Percutaneous release with an 18 gauge needle has been reported as a safe and effective procedure for the trigger fingers. This study evaluates the safety and efficacy of the percutaneous release.

Methods: 33 patients received the percutaneous release of the A1 pulley with an 18 gauge needle and steroid injection (Group A) and 36 patients did the only administration of steroid as a control group (Group B). Patients were examined with a clinical staging for the Watanabe stage (W stage) and 0−10 points verbal numerical rating scale (VNRS) score at 1 week, 3 months, 1 year after the initial treatment.

Results: After 1 year of the follow-up, 93.5% in the group A and 57.6% in the group B had complete release of the trigger fingers in the W stage. VNRS after the initial treatment demonstrated that the decrement of the pain score was more significant in the group A.

Conclusions: We need to consider the percutaneous release with steroid injection at an early stage of the trigger fingers because of the more effective resolution of the symptoms and the better long-term prognosis than a steroid injection alone. (Korean J Anesthesiol 2009; 56: 60−5)

Key Words: Percutaneous release, Steroid injection, Trigger finger, Watanabe stage.

INTRODUCTION

Trigger finger, or stenosing tenosynovitis of the digital flexor tendon, is commonly associated with the symptom of the pain, edema and limitation of the finger motion. An injection of steroid with a local anesthetic into the flexor tendon sheath is well known to be one of the conservative treatments as a primary treatment and an open surgical release of the A1 pulley has been carried out usually in the surgical parts. But, as comparison with the only steroid injection or open surgical release, the percutaneous release with steroid has been reported with a high success rate as well as a low risk rate of the complications such as an infection, digital nerve injury, stiffness and scar.1−7) The objective of this study was to demonstrate the usefulness of the percutaneous release comparing with the only steroid injection for the trigger fingers at pain clinic in the outpatient’s department.

MATERIALS AND METHODS

From January 2006 to April 2008 (a 28 months span), 69 patients had symptoms of the trigger finger. The study group consisted of 2 groups with the group A and B. The group A with 33 patients had the percutaneous release with steroid injection and the group B with 36 patients, as a control group, had the only administration of steroid injection. An institutional review board approved studies and all patients were provided with the informed consent. Patients with the previous history, for example, blood coagulaopathy, diabetes mellitus, carpal tunnel syndrome and less than 18 years old were excluded. Study
results were evaluated with the Watanabe stage (W stage) and the verbal numerical rating scale (VNRS). Patients were examined by telephone at 1 week, 3 months and 1 year after a procedure or injection. The clinical improvement was compared by a reciprocal comparative evaluation among the each follow-up stage. Patients were asked to answer as one of four stages by the W stage (Table 1)\textsuperscript{8}) and VNRS.

One operator performed the percutaneous releases with steroid injection for the group A. The patient was placed in a supine position in abduction with 45 degree of the shoulder and his forearm supinated, so that the volar surface of the trigger finger would face on the ceiling. Hand and wrist were located on the pillow to make trigger finger extended. The skin of metacarpophalangeal joint was under the antiseptic condition during the procedure. A needle was inserted at a 1−2 mm of the distal portion from the metacarpophalangeal joint crease and the patient was administered to a mixture with 0.5 ml of 1% lidocaine (1% Lidocaine vial\textsuperscript{®}, Daihan, Korea) and 20 mg of triamcinolone acetonide (Triamcinolone inj\textsuperscript{®}, Dongkwang, Korea) (Fig. 1). After the local anesthesia, a trigger finger could be hyperextended, which brought the flexor tendon sheath directly under the skin. An 18 gauge needle was inserted to the center of the metacarpophalangeal joint where was applied by a local anesthetic (Fig. 2). The bevel of the needle needed to be parallel to the longitudinal axis of the flexor tendon and the location of needle was confirmed by a needle movement when the patient flexed and extended the distal phalanx. If the needle moved along with the finger’s motion, the needle might be inserted into the flexor tendon,

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Stage & Condition \tabularnewline \hline
0 & Normal \tabularnewline
1 & Locking in flexion or extension/Active movement with a triggering \tabularnewline
2 & Locking in flexion or extension/Passive movement with a triggering \tabularnewline
3 & Locking in flexion or extension \tabularnewline \hline
\end{tabular}
\caption{Classification Stages: Watanabe Stage}
\end{table}

Fig. 1. The surface landmark for a percutaneous A1 pulley release is around metacarpophalangeal joint. ●: A1 pulley, X: needle insertion site, DPC: distal palmar crease, PPC: proximal palmar crease.

Fig. 2. The needle is inserted 1−2 mm distal to the metacarpophalangeal crease in the midline of the finger. The finger is in full extension to prevent digital nerve injury.

Fig. 3. The bevel of the needle should be moved longitudinally to cut the A1 pulley. A grating sensation is felt as the needle tip cuts the A1 pulley.
which was an incorrect location. The target structure to be inserted by a needle was not a flexor tendon but an A1 pulley. So, to make sure that the needle tip was placed in the A1 pulley, the needle must be slowly withdrawn until its movement ceased. Then, moving the needle from the proximal portion to the distal portion of the longitudinal axis on the flexor tendon and getting a grating sensation, we could confirm the A1 pulley was located correctly below a needle (Fig. 3). After confirming the location of the needle tip, the operator kept the needle moving for cutting the A1 pulley until there was no further grating sensation. The disappearing of the grating sensation indicated that the A1 pulley was being cut. Once the operator believed the pulley has been released adequately, then the patient was asked to flex and extend the digit to confirm relief from the symptom of triggering. We kept to a rule that the operation was tried to perform only one time. After the operation, a dressing was applied and the procedure site was compressed for 3 minutes to be protected hematoma. The patients were prescribed for 3 days of the nonsteroidal anti-inflammatory drugs (NSAID).

For the group B, the same operator performed the steroid injection. The injection was performed under all the same condition as the group A, in other words, with the same injection material, the same patients’ position, the same injection site, a 1−2 mm of the distal portion from the metacarpophalangeal joint crease, as the group A. After the injection, a dressing was applied and the injection site was compressed for 3 minutes to be protected the soft tissue necrosis and hematoma. The patients were prescribed for 3 days of the nonsteroidal anti-inflammatory drugs (NSAID).

All patients of both groups were reviewed at 1 week, 3 month and 1 year, to evaluate the current movement compared with the movement before the procedure. All cases were done by one operator. The finger function and pain degree were evaluated using the W stage and 0−11 point of the VNRS.

The data were analyzed by SPSS 14.0 and expressed as mean ± SD. The comparison of the preoperative and postoperative W stage was done with the Chi-square test and the VNRS score with the Wilcoxon signed rank test. A value of P less than 0.05 was considered statistically significant.

### RESULTS

There was no significant difference between two groups in demographic data (Table 2).

After accessing the Chi-square test, the two groups did not differ in the W stage of baseline. Of the total 33 digits in the group A, 27 digits (81.8%) were completely free from the triggering symptoms immediately after the first procedure, but the remaining 6 digits were incompletely relieved of the symptoms immediately after the first procedure. Immediately after the first treatment, the group A had a higher ratio than the group B for the distribution of the W stage 0 (P < 0.05, Table 3). At 1 week after the first treatment, there was a general trend of increasing in number of the W stage 0 for both groups, but the group A had a higher ratio than the group B (P < 0.05, Table 3). At both 3 months and 1 year after the first treatment, the group A had still a higher ratio than the

Table 2. Demographic Data

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M/F)</td>
<td>3/30</td>
<td>2/34</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>55.6 ± 6.1</td>
<td>54.11 ± 7.0</td>
</tr>
<tr>
<td>Duration of symptom (month)</td>
<td>2.0 ± 1.5</td>
<td>2.1 ± 1.5</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.4 ± 6.9</td>
<td>158.6 ± 6.4</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.6 ± 7.0</td>
<td>62.1 ± 5.1</td>
</tr>
</tbody>
</table>

Values are mean ± SD.

Table 3. Results of Watanabe Stage Change of Trigger Finger for 1 Year of The Follow-up

<table>
<thead>
<tr>
<th>W stage</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
<td>Group A</td>
<td>Group B</td>
</tr>
<tr>
<td>Baseline</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>24 (72.7)</td>
<td>29 (80.6)</td>
</tr>
<tr>
<td>Immediate*</td>
<td>27 (81.8)</td>
<td>18 (50.0)</td>
<td>5 (15.2)</td>
<td>18 (50.0)</td>
</tr>
<tr>
<td>1 week*</td>
<td>29 (87.9)</td>
<td>23 (63.9)</td>
<td>3 (9.1)</td>
<td>13 (36.1)</td>
</tr>
<tr>
<td>3 months*</td>
<td>30 (93.8)</td>
<td>18 (51.4)</td>
<td>2 (6.3)</td>
<td>17 (48.6)</td>
</tr>
<tr>
<td>1 year*</td>
<td>29 (93.5)</td>
<td>19 (57.6)</td>
<td>2 (6.5)</td>
<td>14 (42.4)</td>
</tr>
</tbody>
</table>

Values are the number of digits (%). W stage: watanabe stage. *: P < 0.05, group A vs group B. Significant differences are shown between the W stage of the group A and B at all each follow-up stages by chi-square test.
group B for the distribution of the W stage 0 (P < 0.05, Table 3). As a result of the follow-up ranged up to 1 year, 93.5% in the group A and 57.6% in the group B had the complete release of the trigger fingers.

The VNRS of both groups showed a significant decreases at each follow-up stage compared with a baseline (P < 0.05), and there was significant differences between the two groups at 1 week and 1 year after the first procedure (P < 0.05, Table 4). The differences of the mean VNRS for the two groups were 0.8 at 1 week, 0.29 at 3 months and 0.64 at 1 year, which meant that the group A kept significantly lower mean values of the VNRS than the group B. As a result, there was a general decline for the VNRS of both groups, but much higher rate of a decline for the VNRS of the group A, especially at 1 week and 1 year after the first procedure.

There were no complications such as digital nerve injuries, bowstringing of the flexor tendon and infections for both groups.

**DISCUSSION**

Trigger finger, or stenosing tenosynovitis, is more frequent in women than in men at the 50 and 60 of the life. Also people whose work requires repetitive grasping actions or prolonged use of tools, be susceptible to develop the trigger finger. Some trigger fingers are associated with diabetes mellitus, rheumatoid arthritis, amyloid degeneration and mucopolysaccharidosis.

The A1 pulley is the most common being of triggering. The thickened A1 pulley locks the flexor tendon at the level of metacarpophalangeal joint, which results in the triggering of fingers (Fig. 4). The patients may present the symptom of the locked fingers in flexion and extension. This occurs frequently in the proximal interphalangeal joint or metacarpophalangeal joint, which has been mainly found in the thumb or the ring fingers of the dominant hand and also found in other fingers. The injection of steroid with local anesthetics into the flexor tendon sheath is commonly offered to the trigger fingers as the first line treatment. Overall rate of the improvement of the symptom is between 32−84% of patients after one or more times steroid injections.

Anderson and Kaye reported a recurrence rate of 33% within 1 year with steroid injections alone for trigger fingers. When the repeated steroid injections are not effective to release of symptoms, the patient may consider a surgery which is the open release of the A1 pulley. The percutaneous release of the A1 pulley was first described by Lorthioir who used a fine tenotome. Since then, Eastwood et al. reported the method using a needle. Additionally, other studies have reported a specially designed curved blade, HAKI knife and a fine sharp scalpel, which have shown high success rates, easy operations and low complications. The percutaneous release of the A1 pulley using a needle was cheaper, more simple and effective procedure than other open surgery in the outpatient’s department. Gilbert et al. performed to compare the percutaneous release with the open surgery. The percutaneous release showed a 100% resolution of symptoms and the open surgery showed a 98% relief of symptoms. Also the percutaneous release was a quick, less painful procedure, and helped to obtain a more successful outcome than the open surgery. On the basis of these findings, in this study of the percutaneous release with 18-gauge hypodermic needle, we successfully relieved symptoms in 93.5% of patients after 1 year.
However, the main concern with the percutaneous release is the digital nerve injury, which is the most severe complication. Bain et al. reported that the digital nerves of thumb lay a 2.9 mm away from the A1 pulley, and Pope and Wolfe examined in cadaveric hands that the radial nerve branch was within a 2 mm from the A1 pulley. Despite these studies, digital nerve injury after the percutaneous release has not been reported as complications. To prevent the digital nerve injury, it is the most important that an operator needs to carry out carefully the procedure. In this study, none of the patients had digital nerves injury during the 1 year follow-up range. In order to prevent the digital nerve injury, it needs a good position for the procedure. Firstly, a needle should be held above the flexor tendon in the midline of the finger. Secondly, a needle should be inserted to the distal portion of the metacarpophalangeal crease. Thirdly, the flexor tendon should be held in full extension during the procedure, which will move the flexor tendon in front of the neurovascular bundle. Finally, the forearm should be placed in supination to make the palmar surface of the finger face on the ceiling. Additionally, if it's a difficult case which needs repeating the procedure, for example, the case that the patient with a rare grating sensation or the operator deemed to have the suspicious of the release accuracy, the ultrasound-guided procedure may help. It can visualize target structures and perform an effective and safe percutaneous release, preventing the digital nerve injury as well as improving the accuracy of the procedure.

About the persistent or recurrent triggering symptom after percutaneous release, Fu et al. reported that 4% of patients were still remaining to have the symptoms after the first procedure and 10% of patients kept the symptoms after the second procedure. Comparing the frequency of the procedure, there was no statistical difference between the first and second procedure. That says a successful outcome of the percutaneous release depends on the accuracy of the procedure rather than the frequency, so it's thought to be the most important that an operator try to do it accurately.

A painful tenosynovitis after the percutaneous release was found as an inflammation in the flexor tendon by the repeated scratching with a needle. There were longitudinal lacerations of the flexor tendon in the cadaveric model after the percutaneous release. Performing the percutaneous release, the use of steroid along with local anesthetic agent is thought to prevent the postoperative inflammation and pain reaction. In this study, none of the patients, who had steroid injection during the percutaneous release, did not show any pain and inflammation during the follow-up period.

Many other studies have reported the high success rates in the percutaneous release with the local anesthetics alone. So, Uras and Yanvuz suggested that the effect of steroid was questionable. But, Patel and Moradia found that the steroid injection group had a higher successful rate (96%) than the non-steroid injection group (89%) in the percutaneous release. This result indicated that a successful outcome might be affected by the anti-inflammatory effect of steroid. Moreover, Maneerit reported that the percutaneous release with steroid injection group had a higher successful rate (91%) than the only steroid injection group (47%) for the trigger fingers. Similarly in our study, the percutaneous release with steroid injection group had significantly successful outcomes (93.5%) whereas the only steroid injection group had 57.6% of successful rate during 1 year follow-up range. On the basis of these findings, the steroid injection alone might be limited to eliminate the triggering symptom. After considering all that factors, the steroid injection with percutaneous release is thought to be very useful to a successful release from the triggering symptom.

Patients with common medical conditions such as diabetes mellitus, hypothyroidism, rheumatoid arthritis and renal failure and so on, may not be recommended to the percutaneous release for the trigger fingers. Ryxewicz and Wolf noted that the diabetic patients are known to have the hyperglycemia. Subsequently, the hyperglycemia progress the fibrosis of the tissue and increase the collagen cross-linking, then accumulate the collagen, which may cause higher incidence of the tenosynovitis, the resistance to a cure and a higher frequency of the recurrence rate. Amyloid degeneration and mucopolysaccharidosis result in the accumulation of the metabolites which make the tenosynovitis of the digits, so the patient needs the open surgery. In case of the rheumatoid arthritis, the patient is also recommended the open surgery at an early stage but not recommended the percutaneous release.

We can summarize and conclude the usefulness of percutaneous release from these points of view.

Firstly, the percutaneous release with steroid injection is the more effective resolution of the symptoms and better for the long-term prognosis than the steroid injection alone for the trigger finger, which is supported by the results of the W stage and VNRS. In other words, the patient who received a
steroid injection alone without the percutaneous release, can show a relief of the symptom immediately and reduce the pain in a short time. But, like that, the patient whose the anatomical structure has not been fully released, still have a possibility of the recurrence of the symptom while he returns to work anytime.

Additionally, the success rate of the percutaneous release without complications is well known to depend on an operator’s skill. Therefore, in order to overcome a difference of the individual techniques, it’s the most important to pay close attention for a procedure, and as occasion demands, the ultrasound-guided percutaneous release may be helpful.

Secondly, to evaluate the prognosis for the percutaneous release, it is thought that we have need of at least 3 months of the follow-up term in the outpatient’s department.

The related reports give an account of various follow-up terms, several months to years. In this study, we set the follow-up term of 1 year. As a result, there is no marked change from 3 months to 1 year, in the W stage and VNRS of the both groups. So, if the patient’s condition shows no further improvement in 3 months, we need to revaluate and consider reoperating for the trigger finger. There are many causes for the trigger fingers, so it’s thought to be unreasonable to standardize the follow-up term regardless of various environments, for example, occupations, habits, sex and so on. Although we must consider the patient’s environment carefully to decide the proper follow-up term, it is thought that we have need of at least 3 months of the follow-up term for the trigger finger in our study.

In conclusion, the treatment for the trigger fingers must be considered the percutaneous release with steroid injection at an early stage of the disease. We need to consider actively the percutaneous release rather than the repeated steroid injection, because the percutaneous release for the trigger finger might be related with the effective resolution of the symptoms and the better long-term prognosis.

REFERENCES