Open Versus Percutaneous Release for the Treatment of Trigger Thumb

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abstract

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The purpose of this retrospective study was to compare the outcomes and complications of conventional open surgical release and percutaneous needle release in the treatment of trigger thumb. The study comprised 87 patients with trigger thumb who were treated with either open pulley (n=52) or percutaneous (n=32) release between 2008 and 2011. All patients were reevaluated at a mean follow-up of 22.7±9.6 months (range, 9-44 months).

Main outcome measures were the rate of recurrence, pain on movement or tenderness over the pulley, infection rate, digital nerve injury, tendon bowstringing, joint stiffness or loss of thumb range of motion, and patient satisfaction. The groups were statistically similar regarding age, sex, laterality, dominant side involvement, and trigger thumb grade on initial admission. At final follow-up, no patient had recurrence, tendon bowstringing, joint stiffness, or loss of thumb range of motion. No patients in the open pulley release group and 2 (5.7%) patients in the percutaneous release group had a digital nerve injury (P=.159). No statistical difference was found in the infection rate between groups (P=.354). A total of 98.1% of patients in the open pulley release group and 97.1% of patients in the percutaneous release group were satisfied with treatment (P=.646). Both techniques resulted in similar therapeutic efficacy, and the rate of potential complications was also statistically similar in each group.

Although statistically insignificant, the authors believe that the 5.7% rate of iatrogenic digital nerve injury seen in the percutaneous release group is clinically significant and serious. Therefore, they advocate using open surgical release of trigger thumb.

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Trigger finger, also known as stenosing tenosynovitis, is a common disorder characterized by catching, snapping, or locking of the involved finger that leads to limitation of finger range of motion, pain, and difficulty gripping objects. Triggering occurs when the gliding movement of the tendon is blocked due to a mismatch between the size of the flexor tendon and the osteofibrous canal of the A1 pulley, preventing the tendon from naturally extending and returning to its initial position. Although the exact etiology is unknown, chondroid metaplasia of the A1 pulley has been blamed. It also appears to be linked to other diseases, such as rheumatoid arthritis, gout, carpal tunnel syndrome, De Quervain’s tenosynovitis, and diabetes mellitus. Trigger finger is more common in middle-aged women and frequently involves the ring finger and thumb.

Multiple treatment methods are available. In early phases of the disease (mild cases), activity modification, nonsteroidal anti-inflammatory drugs, splinting, and intrasheath corticosteroid injections may provide complete symptom relief. Single or multiple corticosteroid injections have been shown to be effective in approximately 93% of patients. If conservative treatment methods fail, surgical release of the A1 pulley is indicated, which can be performed using conventional open surgery or percutaneous release techniques.

Previously, several clinical and cadaveric studies have demonstrated that percutaneous needle release of trigger finger is effective and safe. However, this procedure is not without complications when performed on the thumb. Due to the close proximity of the neurovascular bundle and the A1 pulley in the thumb, percutaneous release of trigger thumb may cause neurovascular injuries. Consequently, some authors recommend open surgical release for trigger thumb. However, the ideal treatment for trigger thumb is controversial in the current literature.

The purpose of this retrospective study was to compare the outcomes and complications of conventional open surgical release and percutaneous needle release in the treatment of trigger thumb.

**MATERIALS AND METHODS**

This study was performed according to the Declaration of Helsinki, and the study protocol was approved by the local ethics committee. The authors retrospectively reviewed the digital database at their institution to identify all adult patients (older than 18 years) who underwent surgical release of trigger thumb between December 2008 and November 2011. Patients with a follow-up duration shorter than 6 months and patients who underwent open surgical release due to the failure of percutaneous release at the first attempt were excluded from the study. Medical records were used to extract demographic information (age, sex, laterality, dominant side), history, and clinical findings. The severity of the trigger thumb was graded according to the Quinell grading.

Patients were invited to return to the hospital for a final follow-up and clinical evaluation. Recurrence and patient satisfaction were the major outcome measures. Recurrence was defined as the persistence of triggering, and patients’ satisfaction was recorded as yes or no. Furthermore, all patients were evaluated for all potential complications, such as digital nerve injury, scar tenderness or pain on palpation, surgical wound infection, tendon bowstringing, and joint stiffness or loss of thumb range of motion, which was compared with the contralateral thumb.

**SURGICAL TECHNIQUES**

**Percutaneous Release**

The procedures were performed in the outpatient department on the day of admission. The hand was cleansed with a povidone-iodine solution, and 1 to 2 cc of 2% prilocaine hydrochloride was injected subcutaneously at the site of the A1 pulley for local anesthesia. The thumb was held in a hyperextended position, and the snapping movements or the nodule of the flexor tendon was palpated. An 18-gauge needle was inserted through the skin at the proximal extent of the A1 pulley and into the flexor tendon and withdrawn slowly until it no longer moved together with flexor tendon movements. Thereafter, the pulley was divided by moving the sharp tip of the needle from distal to proximal, parallel to flexor tendon. Complete release of the A1 pulley was ensured at the end of the procedure by free thumb movements without triggering.

A sterile adhesive dressing was applied at the puncture site for 2 days postoperatively, and the patient was allowed to return to normal, routine activity as tolerated. An oral analgesic was prescribed for pain control as necessary.

**Open Surgical Release**

Skin preparation, determination of the location of the A1 pulley, and local anesthesia were performed in a manner similar to that for percutaneous release. A single dose of first-generation cephalosporin was administered for infection prophylaxis before the procedure started.

A 1.0- to 1.5-cm transverse incision was made over the metacarpophalangeal crease. The A1 pulley and the flexor tendon sheath were exposed using blunt dissection. Retractors were used to protect the radial and ulnar neurovascular bundles, and the A1 pulley was transected parallel to the flexor tendon sheath. Free finger movements without triggering ensured adequate release. The skin was sutured with a nonabsorbable suture material.

A sterile dressing was applied and changed 2 times until suture removal at postoperative day 10. Patients were encouraged to return to normal, routine activity as soon as possible after the procedure. An oral analgesic was prescribed for 3 days postoperatively to control pain.

**Statistical Analysis**

Patients were divided into 2 groups according to surgical technique: the open pulley release group and the percutaneous
release group. Continuous variables were stated as mean±SD and categorical variables as percentages and frequency distributions. Student’s t test was used to compare the means of independent groups. The chi-square test was used to analyze the distribution of categorical data. A P value less than .05 was considered statistically significant.

**RESULTS**

During the study period, 105 patients who underwent surgical release of trigger thumb were identified. Of these patients, 87 responded to the authors’ invitation to attend a final clinical evaluation for data collection. The final study group comprised 70 women and 17 men with a mean age of 55.4±9.7 years. Of the 87 patients, 52 underwent open surgical release (open pulley release group) and 35 underwent percutaneous release (percutaneous release group). Both groups were comparable regarding age, sex, laterality, dominant side involvement, and trigger finger grade (P=.171, .570, .242, .465, and .082, respectively). However, the duration of symptoms was longer in the open pulley release group (P=.005) (Table 1).

All patients were followed for at least 9 months (mean, 22.7±9.6 months). At the final clinical evaluation, no recurrences were noted in either group. One patient in each group was dissatisfied with the treatment, but the rate of patient satisfaction was similar between groups (98.1% in the open pulley release group vs 97.1% in the percutaneous release group; P=.646).

Although no recurrence was observed, 7 patients in the open pulley release group and 5 in the percutaneous release group had pain and tenderness on A1 pulley localization (P=.576). These persistent minor symptoms did not require further treatment. A superficial wound infection was observed in 2 patients in the open pulley release group and no patients in the percutaneous release group (P=.354). Infections were treated with oral antibiotics without additional intervention. No patients had tendon bowstringing, joint stiffness, or loss of thumb range of motion in either group. Two patients in the percutaneous release group had digital nerve injury (P=.159). One of these patients had transient radial-sided hypoesthesia that lasted for 3 months and subsided eventuantly, whereas the other patient had permanent digital nerve injury that was still present at the final follow-up 20 months postoperatively. She denied further intervention. All results are summarized in Table 2.

**DISCUSSION**

This study investigated the outcomes of open pulley vs percutaneous release for the treatment of trigger thumb. The results show that both techniques resulted in similar therapeutic efficacy when the rate of recurrence and patient satisfaction were considered as primary outcome measures. Besides having a similar therapeutic efficacy, the rate of potential complications was also statistically similar in each group. Although no statistically significant difference was found between the groups regarding digital nerve injury, the 5.7% rate of iatrogenic digital nerve injury seen in the percutaneous release group is clinically significant and serious. Therefore, the authors advocate using open surgical release of trigger thumb.

The close anatomical relationship between the radial digital nerve of the thumb and the A1 pulley has been demonstrated in several cadaveric studies. Pope and Wolfe12 performed percutaneous release in 25 cadaveric palms and found that the radial digital nerve was within 2 to 3 mm of the needle site in 3 of 5 thumbs and 5 of 5 index fingers. They recommended that percutaneous release should not be used in the index finger and the thumb.12 Buldu et al14 dissected 20 thumbs of 10 fresh cadavers and reported that the radial digital nerve is 3.4 mm lateral to the A1 pulley at the proximal margin level of the A1 pulley. However, any sharp dissection proximal to the margin of the A1 pulley may cause digital nerve injury where radial digital neurovascular bundle crosses the flexor tendon sheath.14 Schramm et al15 performed percutaneous release of the A1 pulley in 6 fresh-frozen cadaveric hands. After freezing all specimens (−80°C), they performed cross-sections at the level of the A1 pulley and found that the closest distance between needle tracts to the neurovascular bundle was 2.7 mm.15 Bain et al16 performed percutaneous A1 pulley release on 17 fresh-frozen cadaveric hands with a 14-gauge needle and then explored the degree of injury to the adjacent structures. They found that the release was within 2 mm of the radial digital nerve in 7 of 17 hands. Although they could not de-

<table>
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<tr>
<th>Table 1: Demographic and Clinical Patient Characteristics</th>
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<tr>
<td>Variables</td>
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<td>---------------------------------------------------------</td>
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<tr>
<td>Mean age, y</td>
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<tr>
<td>Sex, No. of F/M</td>
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<tr>
<td>No. of right/left</td>
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<td>Dominant side involvement, No. (%)</td>
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<tr>
<td>Grade, No. of II/III/IV</td>
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<td>Mean duration of symptoms, mo</td>
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*Statistically significant.
tect any nerve injury, they concluded that percutaneous release of trigger thumb is potentially hazardous.\textsuperscript{16}

Due to the close anatomical relationship of the A1 pulley and the radial digital neurovascular bundle, various complications related to surgical release of trigger finger have been reported. Carrozella et al\textsuperscript{10} reported 4 cases of radial digital nerve injury after surgical release of trigger thumb. They proposed that the nerve is vulnerable to transaction when it is trapped between the sesamoid and the knife blade.\textsuperscript{10} Gilberts et al\textsuperscript{11} retrospectively evaluated the long-term results of 266 percutaneously released trigger digits and 70 open released trigger digits. They reported 3 (1\%) iatrogenic injuries to the radial digital nerve of the thumb in the percutaneous surgical group.\textsuperscript{11} Finally, Taylor et al\textsuperscript{9} reported 1 case of digital artery pseudoaneurysm following a percutaneous release of trigger thumb. Similar to these previous reports, the current authors observed 2 iatrogenic radial digital nerve injuries in patients treated with percutaneous release. Other than the thumb, Sreedharan et al\textsuperscript{17} reported 1 case of radial digital neuroma following trigger release in middle finger.

Conversely, several other clinical studies favor percutaneous release of trigger fingers. Gilberts et al\textsuperscript{5} compared open vs percutaneous release of 100 trigger digits in a prospective randomized trial. Both techniques were equally effective and no serious complications were observed, including digital nerve injury in each group. They concluded that percutaneous technique is simple, quick, and less painful and that rehabilitation is easier when compared with the open surgical release technique.\textsuperscript{5}

Zyluk and Jagielski\textsuperscript{7} compared percutaneous A1 release (46 digits) vs steroid injection (59 digits) for trigger finger in a randomized clinical trial. They concluded that percutaneous A1 pulley release is a more effective medium-term therapy for trigger digit than steroid injection because of a lower risk of recurrence.\textsuperscript{7} In a randomized clinical trial, Sato et al\textsuperscript{14} evaluated the effectiveness of corticosteroid injection, percutaneous pulley release, and conventional open surgery for treating trigger finger in terms of cure, relapse, and complication rates. The percutaneous and open surgery techniques displayed similar effectiveness (100\% cure rate) with no complications and proved superior to corticosteroid injections (86\% cure rate).\textsuperscript{1}

Some studies have attempted to improve the safety of the percutaneous release technique, thus reducing the rate of complications. Ultrasound-guided percutaneous release of trigger finger has been advocated to avoid digital nerve injury during the procedure.\textsuperscript{16-20} Rajeswaran et al\textsuperscript{19} reported that direct visualization of the A1 pulley and its anatomic relation with the neurovascular bundle is possible with ultrasound guidance and that the risk of iatrogenic injury to the neurovascular bundle can be reduced almost to zero. Furthermore, Hazani et al\textsuperscript{21} described safe surface landmarks to prevent neurovascular bundle injuries. According to this study, the A1 pulley of the thumb is located at the intersection of the line between the tip of hook of the hamate and midpoint of the distal interphalangeal crease and proximal interphalangeal crease. Transection of the A1 pulley along the course of this line did not injure the neurovascular bundle. Finally, specially designed knives and surgical instruments have been made for percutaneous release of trigger thumb to increase the success rate and decrease the complication rate. In studies with these special instruments, no complication including digital nerve injury has been determined.\textsuperscript{22,23}

This study has some strengths and limitations. The major limitation is that it is a retrospective study and conclusions should be evaluated within this context and level of evidence. Patients were not followed prospectively or randomly allocated in 1 of the treatment groups. The choice of surgical technique and patient selection solely depended on the surgeons’ preference. The duration of symptoms in the open release group is longer than that seen in the percutaneous release group. Thus, a tendency exists toward open surgical release when the symptoms last longer. In addition, a relatively small number of patients is included in this study. However, the authors exclusively included the patients with trigger thumb and identified no clinical study specifi-

<table>
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<tr>
<th>Outcome Variables</th>
<th>Open Release (n = 52)</th>
<th>Percutaneous Release (n = 35)</th>
<th>P</th>
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<tr>
<td>Mean follow-up, mo</td>
<td>24 ± 10.5</td>
<td>20.8 ± 8</td>
<td>.131</td>
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<tr>
<td>No. of recurrences</td>
<td>0</td>
<td>0</td>
<td>NC</td>
</tr>
<tr>
<td>Patient satisfaction, No. (%)</td>
<td>51 (98.1)</td>
<td>34 (97.1)</td>
<td>.646</td>
</tr>
<tr>
<td>Digital nerve injury, No. (%)</td>
<td>0 (0)</td>
<td>2 (5.7)</td>
<td>.159</td>
</tr>
<tr>
<td>Pain/tenderness, No. (%)</td>
<td>7 (13.5)</td>
<td>5 (14.3)</td>
<td>.576</td>
</tr>
<tr>
<td>Infection, No. (%)</td>
<td>2 (3.8)</td>
<td>0 (0)</td>
<td>.354</td>
</tr>
<tr>
<td>Tendon bowstringing, No. (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>NC</td>
</tr>
<tr>
<td>Joint stiffness and/or loss of thumb ROM, No. (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>NC</td>
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Abbreviations: NC, not computable; ROM, range of motion.
cally evaluating the outcomes of surgical release of trigger thumb in the relevant literature. Furthermore, more than 80% of the patients could be clinically evaluated at final follow-up, and both groups were comparable regarding the majority of clinical characteristics.

**Conclusion**

Digital nerve injury after percutaneous release of trigger thumb is a serious complication. Blinded percutaneous release of trigger thumb using 18-gauge needle puts the neurovascular bundle at risk for injury. Surgeons should identify the proximal margin of the A1 pulley either by surface landmarks or ultrasound guidance. It is better to perform open surgical release than percutaneous techniques in the treatment of trigger thumb.

**References**


