Trigger digit is a common finding in clinical practice and frequently involves the thumb. Surgical treatments for trigger digit include open and percutaneous release, and good results have been reported with both techniques. Because the thumb plays an important role in hand function, treatment outcomes are especially important. Good long-term results after release of trigger thumb also have been reported with both open and percutaneous methods. After open release, sequelae may include delayed healing and wound infection, and concerns after percutaneous release include incomplete release, tendon injury, and neurovascular injury. Because neurovascular bundles are located close to the A1 pulley in the thumb, damage to neurovascular structures is an important concern in the treatment of trigger thumb, especially with percutaneous release.

This study compared and evaluated the short-term and long-term outcomes of both open and percutaneous release in treating trigger thumb.

**Materials and Methods**

The study was approved by the institutional review board at the study institution. Written informed consent was waived because of the retrospective nature of the study.

The Quinell grading system was used to assess the preoperative severity of trigger thumb. Good outcomes have been reported after both open and percutaneous surgery to release trigger thumb. This study evaluated short-term and long-term outcomes after treatment of trigger thumb with open or percutaneous release. A total of 126 trigger thumbs in 107 patients were reviewed from 2009 to 2012. Short-term (3 months) and long-term results (2 years) and complications of open release (58 digits) and percutaneous release (68 digits) were recorded and compared. Short-term complications included pain occurring in 9 digits (15.5%) in the open release group and in 2 digits (2.9%) in the percutaneous release group and scarring in 4 digits (6.9%) only in the open release group. Long-term complications included pain in 13 digits (19.1%) in the percutaneous release group and in 4 digits (6.9%) in the open release group; in addition, recurrent triggering occurred in 6 digits (8.8%) in the percutaneous release group and in 2 digits (3.4%) in the open release group. Pain and patient satisfaction were significantly better in the percutaneous release group in the short term, but they were better in the open release group in the long term. Although percutaneous release for trigger thumb is a safe and quick procedure, with good short-term outcomes, open release may provide better long-term outcomes. [Orthopedics. 2017; 40(1):e131-e135.]

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Received: August 27, 2015; Accepted: August 31, 2016.

doi: 10.3928/01477447-20161017-06
ger thumb (Table 1). The study included patients who had painful grade II or III trigger thumb for at least 4 months and who had undergone unsuccessful nonoperative treatment, including at least 1 intrasheath steroid injection. Patients were excluded if they had any of the following: a history of cancer, tumor noted during open release, rheumatoid disease, recent trauma, or severe neurologic deficit of the involved upper extremity. In addition, patients were excluded if they were lost to follow-up or if they had diabetes mellitus according to the American Diabetes Association criteria.

Between January 2009 and October 2012, a total of 150 patients (176 thumbs) underwent surgery. Of these, 112 patients (131 thumbs) met the inclusion criteria and 107 patients (126 thumbs) had sufficient follow-up to be included in the study. Patients with bilateral trigger thumbs underwent surgery at different times, with an interval of at least 3 months between the 2 procedures. For each patient, demographic and preoperative characteristics, including sex, involved side, and duration of symptoms, were recorded.

### Surgical Technique

All patients had local anesthesia before the office-based surgical procedure. All open release procedures were performed by 2 senior hand surgeons (J.-P.W., Y.-C.H.), and all percutaneous release procedures were performed by 1 of these surgeons (J.-P.W.). Both surgeons were classified as level III (experienced specialist) according to Tang’s grading.15

**Percutaneous Release.** Before anesthesia, surgical landmarks were marked according to the system of Wilhelmi et al.16 According to the established techniques for percutaneous release,2,17,18 an 18-gauge needle tip was inserted perpendicularly through the skin and through the A1 pulley at the metacarpophalangeal flexion crease of the thumb. The bevel of the needle was parallel to the longitudinal axis of the flexor tendon. The surgeon checked the needle tip position by passively flexing and extending the patient’s thumb. The needle was slightly withdrawn until no paradoxical swing occurred when the thumb was moved passively. The pulley was incised longitudinally with a sweeping motion with the needle tip, proximally to distally. A characteristic grating sensation was felt by the surgeon when the surgeon incised the pulley. Complete release was confirmed by cessation of the grating sensation and full active thumb motion without residual triggering.

**Open Release.** For open release, a transverse incision of approximately 1 cm was made over the metacarpophalangeal flexion crease of the thumb, followed by blunt dissection of the A1 pulley, with the bilateral neurovascular bundles protected with retractors. The surgeon incised the A1 pulley along the direction of the flexor tendon and took care to avoid injuring the flexor tendon. To confirm successful surgery, the surgeon moved the thumb to check the free excursion of the flexor tendon. The wound was sutured with a 5-0 nylon suture.

### Postoperative Assessment

Full, unrestricted range of motion was allowed postoperatively for patients in both groups, and all patients were allowed to return to daily activity as tolerated. Patients did not undergo formal occupational therapy. In the open release group, the suture was removed 10 to 14 days postoperatively. After surgery, all patients had follow-up at 2 weeks, 3 months, and 2 years. The evaluation at 3 months was recorded as short-term follow-up, and the evaluation at 2 years was recorded as long-term follow-up. Functional outcome was evaluated with the questionnaire of Gilberts and Wereldsma1 (Table 2).

### Statistical Analysis

Patients were assessed for all response variables. The chi-square test was used to compare differences between the 2 groups for each discrete variable, and Student’s t test was used for each continuous variable. P<.05 was considered statistically significant. Post hoc analysis of the significant P values showed a probability of detecting a significant difference of 51.6% to 88.9%.

### RESULTS

Demographic and preoperative characteristics for both patient groups are shown in Table 3. No significant differences were found between the groups.

This study included 49 patients (16 men, 33 women) with 58 treated thumbs in the open release group, with a mean age of 57.8 years (range, 43-81 years), and 58 patients (21 men, 37 women) with 68 treated thumbs in the percutaneous group, with a mean age of 59.7 years (range, 45-85 years). Average time from onset of symptoms to treatment was 13.1 months.
months (range, 4-40 months) in the open release group and 12.9 months (range, 4-35 months) in the percutaneous release group. No wound infection or tendon injury was noted in either group.

At the 3-month follow-up (short term), residual pain persisted in 9 (15.5%) digits in the open release group and in 2 (2.9%) digits in the percutaneous release group, which was a significant difference ($P=.013$). In both groups, all patients with residual pain reported pain relief at additional follow-up within 1 year, and pain did not recur at the 2-year follow-up. Wound scarring occurred in 4 (6.9%) digits in the open release group, but not in any patients in the percutaneous release group. The difference was significant ($P=.028$). Short-term patient satisfaction was significantly better in the percutaneous release group ($P=.005$) (Table 4).

At 2-year follow-up (long term), recurrent triggering occurred in 2 (3.4%) digits in the open release group and in 6 (8.8%) digits in the percutaneous release group, but the difference was not statistically significant ($P=.217$). Revised open release was performed in 7 of the 8 thumbs with recurrence (7 patients). In all patients who underwent the revised procedures, a hypertrophic and scarred A1 pulley was found. One patient in the percutaneous release group who had recurrence refused further surgery. Pain in the operated area occurred in 4 (6.9%) digits in the open release group and in 13 (19.1%) digits in the percutaneous release group. The difference was statistically significant ($P=.045$). Long-term satisfaction was significantly greater in the open release group ($P=.047$) (Table 5).

**DISCUSSION**

No complications of neurovascular injury occurred in either group after trigger thumb release. The study findings suggest that, with meticulous release, neurovascular injury of the thumb can be avoided, even with percutaneous release. Short-term results showed significantly greater wound pain and dissatisfaction in the open release group, and significantly more patients in the percutaneous release group reported that they were very satisfied. Over the long term, however, patients in the open release group reported significantly less pain, and more patients in this group were satisfied or very satisfied. These findings suggest that percutaneous release for trigger thumb can achieve good short-term outcomes, but open release provides better long-term results.

Previous studies showed that diabetes mellitus can lead to poor results and higher complication rates after surgery for trigger finger release.12,19 In the current study, patients with diabetes were excluded to decrease bias in comparisons.

The short-term incidence of wound pain and scar formation was significantly higher in the open release group. Patient satisfaction was significantly greater in the percutaneous group. One reason for this difference may be that percutaneous release is a minimally invasive procedure. In open release, the wound could cause more pain and scar formation because of the inflammatory response. However, over the long term, scar formation and pain after open release did not seem to be a problem and appeared to resolve. In the current series, in both groups, short-term

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Open Release (58 Digits)</th>
<th>Percutaneous Release (68 Digits)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, No.</td>
<td>49</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Sex, male/female, No.</td>
<td>16/33</td>
<td>21/37</td>
<td>.703</td>
</tr>
<tr>
<td>Age, mean (range), y</td>
<td>57.8 (43-81)</td>
<td>59.7 (45-85)</td>
<td>.282</td>
</tr>
<tr>
<td>Duration of symptoms, mean (range), mo</td>
<td>13.1 (4-40)</td>
<td>12.9 (4-35)</td>
<td>.967</td>
</tr>
<tr>
<td>Hand side, right/left, No.</td>
<td>35/23</td>
<td>40/28</td>
<td>.864</td>
</tr>
<tr>
<td>Grade, II/III, No.</td>
<td>35/23</td>
<td>44/24</td>
<td>.617</td>
</tr>
</tbody>
</table>

**Table 4**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>Open Release (58 Digits)</th>
<th>Percutaneous Release (68 Digits)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triggering</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>NC</td>
</tr>
<tr>
<td>Pain</td>
<td>9 (15.5%)</td>
<td>2 (2.9%)</td>
<td></td>
<td>.013</td>
</tr>
<tr>
<td>Stiffness</td>
<td>0</td>
<td>0</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>Digital nerve injury</td>
<td>0</td>
<td>0</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>Scar</td>
<td>4 (6.9%)</td>
<td>0</td>
<td></td>
<td>.028</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Dissatisfied</td>
<td>4 (6.9%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Satisfied</td>
<td>8 (13.8%)</td>
<td>2 (2.9%)</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td>Very satisfied</td>
<td>46 (79.3%)</td>
<td>66 (97.1%)</td>
<td></td>
</tr>
</tbody>
</table>

* Abbreviation: NC, not computable.
pain did not seem to be related to recurrent pain or long-term triggering.

In the study by Gilberts and Wereldsma,9 the percutaneous group had more pain (17%) than the open release group (8%) after more than 2 years of follow-up, although the difference was not significant. Stiffness and patient satisfaction also were not significantly different in the 2 groups. The authors concluded that percutaneous and open procedures for the treatment of trigger digits have similar excellent long-term results. In the current study, however, pain was significantly greater and patient satisfaction was significantly lower in the percutaneous group at 2-year follow-up. It is difficult to compare the results of these 2 studies because of differences in study design. In addition, both studies were limited by the number of patients treated. However, patients treated with percutaneous release may have relatively poorer long-term outcomes, especially in the thumbs.

In another study, Guler et al7 compared the results of open and percutaneous release for trigger thumb. All patients were followed for a mean of 22.7 months. The study found no recurrence in any patients. Only 1 of 52 patients in the open release group and 1 of 35 patients in the percutaneous release group reported dissatisfaction with the treatment. Two patients in the percutaneous release group had digital nerve injury. Although this finding was not statistically significant, the authors believed that the iatrogenic digital nerve injury in the percutaneous release group was clinically noteworthy and serious. Therefore, they advocated open release for trigger thumb. The current study showed poorer outcomes in the percutaneous group at 2-year follow-up, but no digital nerve injuries occurred. Although it is difficult to compare the results of these 2 studies, the current authors recommend open release for treating trigger thumb.

The long-term results of the current study were poorer than those of Guler et al.7 One possible reason is that, during percutaneous release, the disappearance of triggering and the grating sensation indicates complete release. Surgeons who are concerned about injuring the neurovascular bundles of the thumb may stop the release before triggering and the grating sensation disappear completely. Incomplete release may be more likely when surgeons take an overly conservative approach at this point in surgery.

Two possible mechanisms for failure of trigger thumb release are incomplete release and scar formation. As reported in the literature, percutaneous release may be incomplete, even if triggering disappears after surgery.2,20,21 In open surgery for recurrent trigger finger after percutaneous or open release, a hypertrophic and scarred A1 pulley can be found. The symptoms of triggering can be relieved by incision of the scarred pulley. Fu et al21 showed that percutaneous release was effective in treating residual triggering after primary percutaneous release. Their patients had secondary percutaneous release 1 to 36 weeks after primary release. Although 28 of their patients were completely free of residual triggering, treatment failed in 3 patients. Of these 3 patients, 1 underwent an additional open release procedure, and diffuse hypertrophic change at the distal A1 pulley was noted during surgery.

Tendon injury may occur after percutaneous release.22,23 A hypertrophic nodule or attrition of the flexor tendon may be noted with revised open surgery. However, a hypertrophic nodule on the flexor pollicis longus could also be the origin of a pathogenic change in the trigger thumb.24 The relationship between tendon injury and recurrence is uncertain and requires further study.

Limitations

The limitations of the current study include its retrospective nature, which could cause bias. The sample size may not be large enough to reach a powerful conclusion, and the 2-year follow-up may not reliably indicate longer-term results. Exacerbating factors, such as the patient’s occupation and consequent stress on the thumb, were not the same for each patient. To evaluate the results influenced by the risk factors (eg, diabetes mellitus), multivariable analysis with a larger sample and longer follow-up is needed.

CONCLUSION

In the current study of patients with trigger thumb, short-term pain and patient
satisfaction were significantly better in the percutaneous release group; however, long-term results were better in the open release group. Although percutaneous release for trigger thumb is a safe and quick procedure, with good short-term outcomes, open release may provide better long-term outcomes.

REFERENCES