Background: Trigger finger is associated with limited flexion and extension of the finger due to inflammation in the flexor tendon pulley and leads to a loss of functional capacity in the hands. There is a need for safe, fast management and a low risk of recurrence in managing this disease. This study aims to evaluate the clinical effectiveness of the USG-guided corticosteroid injection with needle release of the A1 pulley in treating the trigger finger, particularly in pain degree, joint function, and adverse effects. The parameters were evaluated, including the NRS, Quinell grading system, and inflammation or infection signs from the physical examination.

Case Presentation: There were seven trigger fingers in five patients with various Quinell grades ranging from 2 to 3. They received a single treatment of USG-guided corticosteroid injection with needle release of the A1 pulley. Follow-up was carried out immediately after the procedure (day 0), 1 day, and 30 days after. Improvement was seen in all fingers immediately and one day after the procedure. After 30 days, all patients no longer experienced pain, snapping, or locking sensations. No adverse events were observed during the follow-up period.

Conclusion: USG-guided corticosteroid injection with needle release of the A1 pulley in treating trigger fingers is safe and has a good effect on reducing pain and improving joint function.

Keywords: Trigger Finger, Percutaneous Release, USG-Guided, Steroid Injection.
METHODS

The following cases were retrieved from physical rehabilitation outpatient care at University Hospital from March to July 2022. Follow-up was conducted immediately after the procedure, 1 day later, and 1 month after treatment. The following parameters were evaluated: pain degree (using the Numeric Rating Score (NRS) system), joint function (assessed using the Quinnell grading system), and adverse effects (edema, inflammation, or infection signs) from the physical examination that was carried out by two examiners certified in medical rehabilitation. The NRS consists of eleven degrees, reflecting the subjective level of pain, in which the patient rates the pain from 0 (no pain) to 10 (worst pain). The Quinnell grading system is used to evaluate the clinical severity of the trigger finger. This classification grades trigger finger in the following ways: Normal digit movement is 0, uneven digit movement is 1, actively correctable digit locking is 2, passively correctable digit locking is 3, and fixed deformity is 4.

A Physical Medicine and Rehabilitation (PMR) specialist performed all the procedures using a GE Logic-e Compact Ultrasound System for MSK imaging unit, with linear probe, 4.2-13.0 MHz. The patient was positioned supine with their forearm and fingers resting on the bed and the palm facing upwards; then, the A1 pulley was evaluated by USG (Figure 1).

The needle entry point was selected in the proximal phalanx, approximately 1 cm from the distal end of the first pulley, directed toward the distal part of the A1 pulley into the synovial sheath of the flexor tendons, and then 1 ml of 1% lidocaine HCl was injected into the subcutaneous volar region over the Metacarpal (MCP) of the affected finger with a 25-gauge needle. Next, a 21-gauge needle was advanced manually at a 120° slope angle, followed by the injection of 2 ml of compound triamcinolone (40 mg) and 1% lidocaine HCl at the intersection of the A1 pulley and tendon. When the needle tip reaches the A1 pulley, the needle is used to repeatedly puncture the A1 pulley from the distal to the proximal ends, parallel to the long axis of flexor tendons, under continuous USG guidance, until there is no resistance as seen in Figure 2. Patients and caregivers knew that any medical procedure conducted in the study center might be used for research purposes. Written consent is given as part of admission.

CASE REPORT

Case 1
A 69-year-old female with a trigger finger on her right hand's middle finger for approximately one year, worsening in the last two months before being admitted. The patient was treated six times with physical therapy, but there was no satisfying improvement. When she came to the hospital, she reported pain with NRS of 6/10 and triggering on the affected finger, which was actively correctable. There was no history of diabetes mellitus (DM) or trauma on the affected hand. On day 0 and day 1 after the procedure, there were no complaints of pain or triggering, and those complaints did not occur within 1 month of follow-up. There was no edema, inflammation, or infection due to the procedure.
Table 1. Baseline characteristics.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (y.o)</th>
<th>DM (Yes/No)</th>
<th>Duration of Previous Physical Therapy (Week)</th>
<th>Hand Affected (Right/Left)</th>
<th>Finger Affected (I-V)</th>
<th>Symptom Pre-procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woman (A)</td>
<td>69</td>
<td>No</td>
<td>2</td>
<td>Right</td>
<td>III</td>
<td>12</td>
</tr>
<tr>
<td>Man (B)</td>
<td>61</td>
<td>No</td>
<td>8</td>
<td>Right</td>
<td>V</td>
<td>6</td>
</tr>
<tr>
<td>Man (B)</td>
<td>61</td>
<td>No</td>
<td>2</td>
<td>Left</td>
<td>II</td>
<td>5</td>
</tr>
<tr>
<td>Woman (C)</td>
<td>65</td>
<td>Yes</td>
<td>2</td>
<td>Left</td>
<td>II</td>
<td>6</td>
</tr>
<tr>
<td>Woman (D)</td>
<td>60</td>
<td>Yes</td>
<td>8</td>
<td>Right</td>
<td>IV</td>
<td>3</td>
</tr>
<tr>
<td>Woman (E)</td>
<td>54</td>
<td>Yes</td>
<td>8</td>
<td>Right</td>
<td>III</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: II: Index Finger; III: Long Finger; IV: Ring Finger; V: Small Finger. DM: Diabetes Mellitus; NRS: Numeric Rating Scale; yo: years old.

Table 2. Comparison of NRS and Quinnell Grading system before and after the procedure and evaluation of the adverse effect.

<table>
<thead>
<tr>
<th>Finger Affected</th>
<th>NRS</th>
<th>Quinnell Grading System</th>
<th>Adverse Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-procedure</td>
<td>Day-0&amp;1</td>
<td>Day-30</td>
</tr>
<tr>
<td>II (L)</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>II (L)</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II (L)</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>III (R)</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>III (R)</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IV (R)</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V (R)</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: II: Index Finger; III: Long Finger; IV: Ring Finger; V: Small Finger. NRS: Numeric Rating Scale.

Figure 3. Chart of follow-up progression of NRS and Quinnell Grading System.

Case 2
A 61-year-old male developed a trigger finger on both hands. In the little finger of the right hand, the symptoms appeared six months before coming to the hospital, with NRS 5/10 and intermittent triggering on the affected finger, which was actively correctable. On the other hand, on the index finger, the symptoms appeared one month after the right-hand case, with NRS 6/10 and continuous triggering, which was usually correctable by manipulation with the other hand. There was no history of DM or trauma, but he engaged in frequent typing activity. The patient went to physical therapy for two months and saw no improvement. Immediately after the procedure, there was no pain in either hand, although a sense of tightness and tenderness around the MCP joint of the index finger did exist. Nevertheless, in one month’s follow-up, the overall complaints were resolved. There were also no adverse effects during or after the procedure.

Case 3
A 65-year-old male with a history of DM presented with pain (NRS: 4/10) at the base of the index finger of the left hand and a snapping sensation when extending his affected finger, which was correctable by manipulation. The complaints occurred for more than six months before being admitted to the hospital. After the procedure, there was an improvement with diminishing pain and snapping sensations during the 0-day, 1-day, and 1-month follow-ups. In addition, during the follow-up period, the affected finger had no worsening symptoms.

Case 4
A 60-year-old female with a history of DM had a trigger finger on the ring finger of her right hand for 3 months. Pain (NRS: 7/10), particularly on snapping, was actively correctable. The patient received physical therapy for 2 months but did not see significant improvement. However, there was no pain or snapping sensation from day 0 until the 1-month follow-up after the procedure. There were no signs of edema, inflammation, or infection during the follow-up period.
Case 5
A 54-year-old female was admitted with a trigger finger on the long finger of the right hand and an index finger on the left hand. The patient felt pain (NRS: 5/10 on both hands) and triggering on the affected finger, which was actively correctable. There was a history of DM, and she underwent physical therapy for more than 8 weeks but did not significantly improve. However, the complaints about both ring fingers were resolved, and no side effects were reported.

RESULTS
There were seven fingers (three indexes, two middle, one ring, and one little finger) in five patients with stiffness and snapping or locking sensation for at least 3 months. All patients were diagnosed with trigger fingers with a variety of Quinnell grades ranging from 2 (in five fingers) to 3 (in two fingers), and all patients reported NRS ≥ 5. Most of the patients were women with DM, affecting the right hand. All patients had undergone physical therapy for at least 2 weeks, but there was no significant improvement and no previous history of pulley release in the affected finger, as seen in Table 1.

Immediately after the procedure and 1-day follow-up, no complications occurred, and all patients demonstrated improvement in their triggering. At the 1-month follow-up, all patients had a complete resolution (NRS: 0/10, Quinnell Grade : 0). No recurrence was observed in the treated digits in a 1-month follow-up, as seen in Table 2 and Figure 3.

DISCUSSION
The trigger finger presents discomfort in the palm during movement of the involved fingers. Although it can occur in anyone, it is seen more frequently in the diabetic population and women, typically in the fifth to sixth decade of life. As in this report, most trigger finger patients were women with diabetes over 50 years old. All fingers were treated by USG-guided corticosteroid injection with A1 pulley release; all had improved symptoms immediately after the procedure, and no recurrence was observed. In addition, all patients were entirely resolved with no significant complications.

The main point of concern in this report is the expected improvement in all patients after USG-guided corticosteroid injection with percutaneous needle release. This finding is consistent with a prior study that reported a significantly better improvement in the Quinnell grading system in patients treated with a combined USG-guided steroid injection and A1 pulley release than a single USG-guided steroid injection, as well as percutaneous release. In addition, the outcome of percutaneous release procedures with and without ultrasound guidance is different, and ultrasound-guided needle release has a higher success rate, with one meta-analysis study reporting patients in the USG guidance group having a pooled success rate of 99%. A1 release.

As a result, we suggest that the USG-guided method be preferred over the non-USG-guided method.

The corticosteroid injection for the trigger finger is assumed to have a superior effect compared to the non-surgical method. Another thing that may be a contributing factor to this good outcome is the type of corticosteroid used, namely triamcinolone. According to a previous study, triamcinolone demonstrated excellent efficacy at 79.7% in terms of preferred steroids. In addition, previous studies have shown that USG-guided corticosteroid injection is better than blind administration in terms of accuracy of needle placement and has higher effectiveness. Thus, combining steroid injections with percutaneous release using ultrasound may increase the probability of improvement in pain and function.

Interestingly, all the DM patients in this report expected improvement in their NRS and Quinnell grades after treatment. Even though a previous study found that patients with diabetes are more challenging to treat and more likely to need surgery and protracted periods of physical therapy than people without diabetes. Therefore, we consider recommending this therapeutic option, especially in the DM population, as an alternative to surgery. This study demonstrated a higher success rate without complications. Aside from using ultrasound as a guide for the procedure, using a smaller caliber needle may affect the low rate of complications due to trauma in this study. According to a previous study, the complication rate using a 21-gauge needle has a relatively low complication rate of 7.5%, compared to using a 20-gauge needle, with a higher complication rate of 10%-20%. Therefore, using a smaller caliber in this procedure can reduce risks while successfully releasing the A1 pulley.

CONCLUSION
In conclusion, USG-guided needle release of the A1 pulley with corticosteroid injection is safe. It has a good outcome in reducing pain and finger joint function immediately after the procedure and a one-month follow-up, regardless of the presence of diabetes or the hand involved. This new technique uses a widely available and safe needle device and can be used to provide definitive management for the trigger finger.

CONFLICTS OF INTEREST
The authors declared no potential conflicts of interest concerning this article’s research, authorship, and/or publication.

ETHICAL APPROVAL
Informed consent was obtained from the patients as a part of standard routine care. Participants agree that their clinical data can be used for research and presented without identifying information. Furthermore, participants were aware that they might experience an adverse event, and should they require immediate care, they could contact the health provider. Since all procedures are within the scope of routine care, this study is exempted from IRB review.
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AUTHOR CONTRIBUTION

All authors contributed to the study from the conceptual framework, data gathering, and analysis until the study’s results were interpreted upon publication.

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