Functional Outcome and Safety of Percutaneous Trigger Thumb Release

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ABSTRACT

BACKGROUND

Trigger finger is also known as stenosing tenosynovitis and is characterized by pain catching snapping or triggering of the affected finger leading to difficulty in grasping objects. The surgical options include open and percutaneous release. The percutaneous release was first reported in 1958 and has gained popularity in the recent years with adequate success rate as open release without many complications. But apprehension prevails in the percutaneous release of trigger thumb due to the proximity of radial digital nerve of thumb to A 1 pulley which was confirmed by various anatomical studies. We evaluated the results of percutaneous release of trigger thumb with special attention to the safety of a standard surgical technique based on anatomical landmarks. We wanted to study the functional outcome and complications of percutaneous trigger thumb release.

METHODS

In the present retrospective study, 42 patients with isolated trigger thumb treated at Government T.D. Medical college, Alappuzha from August 2017 to August 2018 who underwent percutaneous release and were available for follow up for 6 months were selected. The cases were managed by a single surgeon experienced in percutaneous release by standard safe surgical technique. Percutaneous release was done as a day care procedure. Release was done by a safe surgical technique based on anatomical landmarks. Functional outcome was assessed in terms of recurrence of triggering, presence of complications and a 5-point functional assessment and ability for early return to work. Digital nerve injury was considered as a major complication.

RESULTS

Out of 42 patients treated by percutaneous trigger thumb release using our protocol, 41 patients had complete recovery and only 1 patient had recurrence of symptoms requiring open release. At 6 months follow up no single patient had any serious complication.

CONCLUSIONS

Percutaneous release of trigger finger is effective, convenient, cost effective day care surgery without any significant complications in skilled hands. Localization of A1 pulley using anatomical landmarks during percutaneous release can prevent neurological injury to thumb.

KEYWORDS

Trigger Thumb, Percutaneous Release

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BACKGROUND

Trigger finger is also known as stenosing tenosynovitis is characterised by pain, catching, snapping or triggering of the affected finger leading to difficulty in grasping objects. Inflammation of this tunnel occurs due to repetitive use thereby preventing smooth gliding of the tendon under the A1 pulley. Triggering commonly involves the dominant hand. Percutaneous release of trigger fingers has recently gained popularity. Thumb differs from other fingers in such a way that neurovascular bundles are more central making them more prone to injury during percutaneous release. Of the several methods of treating trigger thumb, percutaneous release has recently gained popularity due to its ease, low complications and high patient satisfaction. But there is apprehension regarding the percutaneous release in the thumb due to the high chance of injury to the digital nerve.

Majority of patients with mild to moderate trigger fingers are treated by conservative treatment including splinting, stretching, Non-steroidal anti-inflammatory drugs (NSAIDs) and steroid injections with a success rate of 50 to 84 %. When conservative treatment fails, surgical release of A1 pulley is done which has a reported success rate of up to 100 percentage.[1] But complications like scar tenderness, infection, digital nerve injury and bowstringing of tendons have been reported.[2] The percutaneous release was first reported in 1958 and has gained popularity in the recent years with adequate success rate as open release without many complications. But apprehension prevails in the percutaneous release of trigger thumb due to the proximity of radial digital nerve of thumb to A 1 pulley which was confirmed by various anatomical studies.[3]

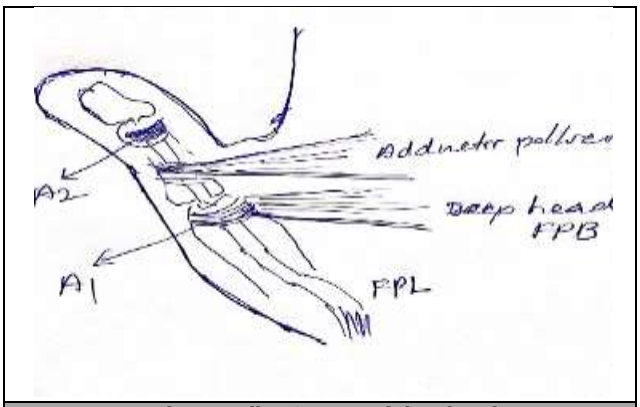
Ultrasonography-guided percutaneous A1 pulley release has been introduced in this procedure, providing direct visualization of the vascular and nerve structures during the procedure (Hopkins and Sampson, 2014; Hoang et al., 2016; Lapègue et al., 2016; Rajeswaran et al., 2016; Guo et al., 2017). With the application of high-frequency ultra-sonographic instrument, the flexor digitorum tendons, pulley systems, volar plate, metacarpophalangeal and interphalangeal joints can be seen. But this requires additional infrastructure and may not be accessible in the OPD minor procedure rooms.

We wanted to evaluate the results of percutaneous release of trigger thumb with special attention to the safety of a standard surgical technique based on anatomical landmarks.

Review of Literature Applied Anatomy

The long flexor tendon of the thumb arises from the flexor pollicis longus (FPL). It passes into the hand through the carpal tunnel. The FPL tendon then enters the fibrous flexor sheath of the thumb and attaches to the base of the distal phalanx. The fibrous flexor sheath of the thumb is reinforced by three pulleys:

- A1 – overlies the metacarpophalangeal joint
- Oblique – overlies the proximal half of proximal phalanx
- A2 – overlies the distal half of proximal phalanx



Flexor Pulley System of the Thumb

Epidemiology

Stenosing tenosynovitis (trigger finger) is most common in women, TF is one of the most common diseases seen in hand surgery clinics and is the fourth leading cause of referral to these clinics. It is characterised by pain, swelling, and clicking of a digit during flexion or extension.[4] Usually, the extension is more problematic. The incidence of Trigger finger (TF) is 28:100 000 per year or a lifetime risk of 2.6 % in the general population, but it increases to 10% in the diabetic population.[5,6] The mean age of onset for TF is 58 years., and it is diagnosed in women two to six times more frequently than in men.[7] commonly associated with diabetes and inflammatory arthropathy. May otherwise result from repetitive grasp activities (idiopathic form). The literature describes the symptoms of TF, but there is a lack of reference to the broader consequences of this pathology. Furthermore, treatment efficacy studies measure change in symptoms as the primary outcome measure and does not include measures of functional status and QOL (Quality of life).

Pathophysiology

Micro-trauma, whether through repetitive use or compression forces, results in inflammation and injury of the flexor tendon-sheath complex. The greatest degree of force occurs on the A1 pulley, and hence, this is the one that is most commonly affected. Inflammation, over time, results in the tendon sticking within its sheath and is perceived by the patient as locking. Because the flexor tendon apparatus has superior strength, compared to the extensor tendon apparatus, patients classically do not have difficulty in flexing their fingers. However, the inflammation causes the flexor tendon to catch in the flexor sheath during extension, and patients will notice locking when they attempt to extend their fingers.[8] This immobility may lead to a secondary contracture at the proximal interphalangeal (PIP) joint. 1,5 As the palmar fascia overlying the tendon sheath gradually thickens, it can pull on the finger so that it remains in a flexed position.

Histological Finding

Fibro cartilaginous metaplasia (pulley and / or FDS tendon) initially characterised by pain, tenderness in the distal palm,

progresses to mechanical catching / locking, and may become "fixed". Patients often complain of referred pain at the dorsal metacarpophalangeal (MCP) / PIP area. The inflammation may cause the tendon to become nodular.

The Quinnell Grading of Trigger Finger

Grade Clinical findings (during flexion and extension)
I Normal movement.
II Uneven movement.
III Actively correctable.
IV Passively correctable.
V Fixed deformity.

Ultrasound can be obtained in assessing this condition. Ultrasound may demonstrate thickening of the pulley as well as inflammation and irregularity of the underlying flexor tendon. However, it may not reliably predict the site. Ultrasound can be used dynamically to demonstrate the catching and clicking during tendon sliding. We don't use ultrasound in our centre routinely.

The following Differential Diagnosis must be ruled out on clinical examination

- Abnormal sesamoids
- Acromegaly
- Ganglion cyst of the wrist
- Ganglion involving the tendon sheath
- Infection within the tendon sheaths
- Presence of loose body in MCP joint
- Subluxation of extensor digitorum communis

Middle and ring finger involvement most common in adults. Concomitant trigger finger / carpal tunnel syndrome in 60% of patients at initial presentation. Recent evidence shows the pulley system of the thumb to be composed of four components rather than the traditional view of three.[9] Variable annular pulley (Av) is found in approximately 75%; four types of arrangements possible which may contribute to stenosis. Generally, mild cases are first treated conservatively, with oral anti-inflammatory drugs, physical therapy, or corticosteroid injections; while severe cases are often treated with an open surgical release, which is successful in 83~98% of cases (Paulius and Maguina, 2009). Many respond to corticosteroid injection into flexor tendon sheath, but diabetic patients generally less responsive to injection.

The first line of treatment for trigger finger is conservative management, which involves activity modification, NSAIDs (topical and oral) and splinting. People with mild trigger finger or who have declined injections and surgery are prescribed the first-line treatment. Topical NSAIDs such as ketoprofen and oral NSAIDs such as ibuprofen are commonly given to relieve the pain from trigger finger. Steroid injections have an established role as the second line treatment for trigger digit, at many centres as they are easy to administer and cost-effective. The relapse rate for a single corticosteroid injection is approximately 29 %.[10] However, even with steroid injection, full recovery can take months. For patients who have no response to steroid injections or who have recurred following steroid injections, invasive intervention (third line of treatment) needs to be considered. Failure of non-operative management is treated by surgical release of Al pulley (open or percutaneous). Refractory cases need surgery, through an incision over the distal palmar crease or in the MCP crease of the thumb - the Al section of the fibrous sheath is incised until the tendon moves freely. Care should be taken to avoid injury to the digital neurovascular bundles during surgery. The risk is greatest in the thumb (where the nerves are close to the midline) and the index finger (where the radial digital nerve crosses the tendon.[11] Relatively higher minor complication rate includes wound dehiscence, scar tenderness, decreased range of movements. Interestingly, male gender, sedation, and the use of general anaesthesia during an open release may be associated with higher incidence of complications.[12] We want to study the functional outcome and complications of percutaneous trigger thumb release.

METHODS

42 patients with isolated trigger thumb treated at government TDMCH, Alappuzha from August 2017 to August 2018 who underwent percutaneous release and were available for follow up for 6 months were selected for the study. The cases were done by a single surgeon experienced in percutaneous release by standard safe surgical technique.

Figure 1. Identification of Land Marks

The Surgical Technique

Percutaneous release is done as a day-care procedure. Release is done by a safe surgical technique based on anatomical landmarks.[12] In the minor OT, procedure is done under strict aseptic precautions. Affected hand is prepared and draped. Triggering of thumb confirmed. Thumb is extended. With marking pen, the digito-palmar crease and the interphalangeal crease of the thumb are marked transversely. Midpoints of these creases are marked and they are connected.

1 ml of plain 1% lignocaine is injected into the location of the A1 pulley at the midpoint of the digito palmar crease using a thin needle. An 18 G needle is inserted with the thumb in the extended position with the bevel in the longitudinal axis of the thumb. Needle passed into the tendon and confirmed by interphalangeal joint flexion and then slowly withdrawn and positioned in the pulley. Now the needle is scored proximally and distally to cut the pulley. The scoring of the needle is done exactly in the direction of

connecting line. This avoids accidental diversion of the needle tip and injury to digital nerves. Complete severing of the pulley is confirmed by checking the disappearance of triggering. Needle is withdrawn and finger pressure applied at the prick site to achieve haemostasis. An antiseptic ointment is applied at the site and a small dressing is given. Single dose of oral cefuroxime 500 mg is given and two doses of analgesics prescribed. Patient is advised active movement of the finger and to remove the dressing very next day. The outcome measures were studied in terms of recurrence of triggering, pain on movement or tenderness over the pulley, evidence or history of post procedure infection, history or findings suggestive of digital nerve injury and overall patient satisfaction based on a five point functional assessment.[14] Outpatient medical records and minor OT data and follow up register data were used for identification of patients with inclusion criteria and for the collection of demographic data, history and clinical findings. Severity of trigger thumb had been graded based on Quinell's grading.[15] The outcome measures were assessed with the help of these records.

This is a Descriptive Retrospective study done for a duration of 1 year from August 2017 to August 2018 in the Department of Orthopaedics, Govt. TD Medical college, Alappuzzha.

Inclusion Criteria

Adult patients (18 - 60 yrs.) treated by percutaneous release available for 6 months follow up.

Exclusion Criteria

1. Patients with Multiple trigger fingers treated by open method / percutaneous method.
2. Rheumatoid hand with multiple deformities.
3. Uncontrolled diabetes mellitus.

Data Collection Procedure

Outpatient medical records and minor operation theatre registers were used to identify patients with the inclusion criteria. Records were used to get demographic information (age, sex, laterality and dominant side), clinical features and treatment details. Telephonic follow up was also used to supplement information. Some data were transferred through whats app chat with the patients. Data anonymity were ensured. Functional outcome was assessed in terms of recurrence of triggering, presence of complications and a 5-point functional assessment and ability for early return to work

Digital nerve injury is considered as a major complication. Other Complications are:[10]

1. Pain on IP joint movements.
2. Tenderness over the pulley.
3. History or evidence of puncture site infection.
4. Evidence of tendon bowstringing.

5-Point Functional Assessment of Patient Satisfaction (Based on Modified DASH Score)

1. Opening a lock by turning a key.
2. Holding a glass of water for 1 min.
3. Squeezing a sponge ball.
4. Holding a pen and drawing a circle.
5. Opening the lid of a closed jar.

Each Function was Assessed on a 3-Point Pain Related Score as

1. Easy - 3 points,
2. Some difficulty - 2 points
3. Very difficult - 1 point.
    - 15 points: excellent;
    - 10 - 14 points: good
    - < 10 points: poor

Irrespective of the functional score recurrence was considered as the worst outcome, digital nerve injury was considered as a poor outcome.[17] Presence of 2 or more of the other described complications was[18] considered as a poor outcome. Early return to work (in less than 10 days) was considered as a good functional outcome.

Statistical Analysis

Data was entered into Excel sheet. Analysis was being done using appropriate statistical software. All qualitative variables were expressed as proportions or percentages with 95% confidence interval and quantitative variables were expressed as mean with standard deviation. The association between the dependent variables and the risk factors was checked using chi-square test. Quantitative variables were analysed using Students t-test. The sample size was calculated using the formula, N = Zα2PQ / L2, as according to a study conducted by Alper Aksoy and et al., prevalence of complication following trigger finger release were 44 %. Taking the lowest prevalence as 44 %, the sample size was calculated using the formula $N = Z\alpha 2PQ \ / \ L2$ and estimated to be 42, where Zα is 1.96, P is 44 and Q is 56. L is taken as 15, which is the absolute precision.

RESULTS

Out of 42 patients with trigger thumb 26 were males and 16 were females, 28 right sided and 14 left sided. 4 patients were in the age group of 18 - 30. 26 patients were in the age group of 30 - 50. And 12 patients were in the age group of 50 - 60. All patients were right handed. The average duration of symptoms was 2 months. Out of 42 patients 24 were manual labourers and 8 house jobs and 10 with office jobs. Quinnell grade 3 was observed for 22 patients and grade 4 was observed for 10 patients and grade 5 for ten patients. Most of the patients underwent oral medications and physiotherapy before intervention. 4 patients were

having controlled diabetes mellitus and 2 patients had rheumatoid arthritis without hand deformities and 4 patients had hypothyroidism. 32 patients didn't have any comorbidities. All patients returned to work at one month and one patient returned to work at first week. There was one case of digital nerve injury (paraesthesia) and 4 cases of pain on moving inter phalangeal joints and 5 case of mild tenderness and 1 case of puncture site infection at first week. 5-point functional score shows 30 patients were excellent with 15 points and 11 were good with more than 10 points and 1 was poor with 9 points.

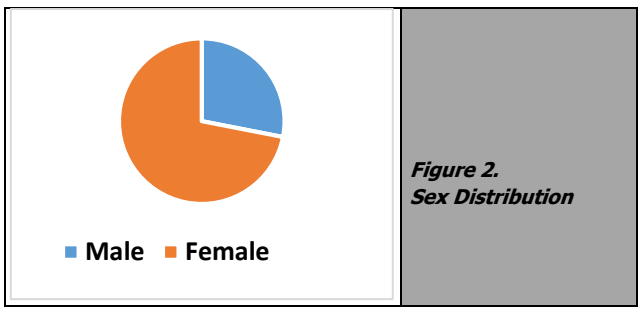


Figure 2. Sex Distribution

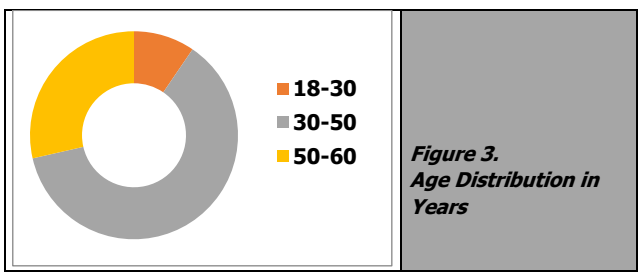


Figure 3. Age Distribution in Years

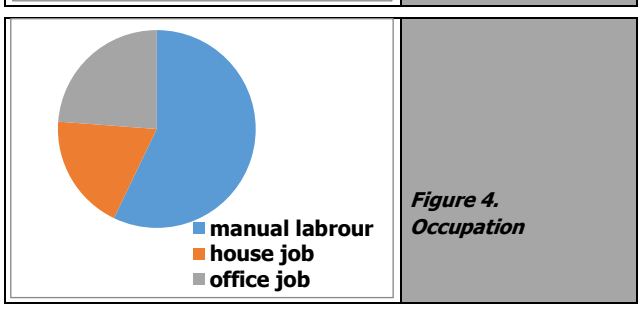


Figure 4. Occupation

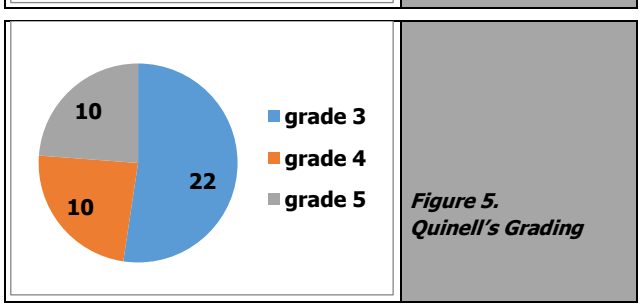


Figure 5. Quinell's Grading

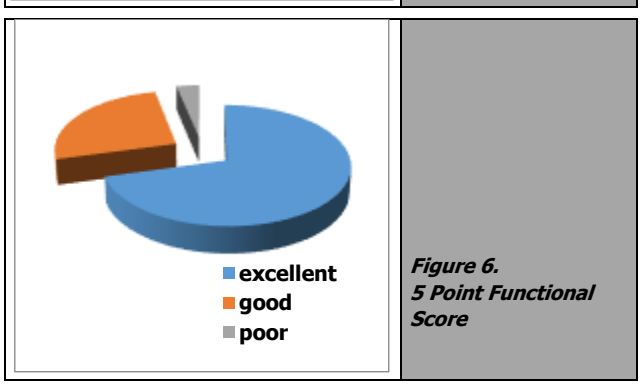


Figure 6. 5 Point Functional Score

On 6-month follow-up, one patient was worse with recurrence and one patient bad and 10 patients good and 30 patients were excellent. The single case of recurrence of triggering underwent open release later. At 6 month follow up the single case that was having digital nerve injury symptoms at 1 month had recovered fully and there was no case of interphalangeal joint pain / pulley tenderness / infection / tendon bowstring.

DISCUSSION

The flexor tendons are long cord-like structures that attach the muscles of the forearm to the bones of the fingers. When the muscles contract, the flexor tendons allow the fingers to bend. Each of the flexor tendons passes through a tunnel in the palm and fingers that allows it to glide smoothly as the finger bends and straightens. This tunnel is called the "tendon sheath." Along the tendon sheath, bands of tissue called "pulleys" hold the flexor tendons closely to the finger bones. The tendons pass through the pulleys as the finger moves. The pulley at the base of the finger is called the "A1 pulley." This is the pulley that is most often involved in trigger finger[19]

In a patient with trigger finger, the A1 pulley becomes inflamed or thickened, making it harder for the flexor tendon to glide through it as the finger bends. Over time, the flexor tendon may also become inflamed and develop a small nodule on its surface.[20] When the finger flexes and the nodule passes through the pulley, there is a sensation of catching or popping. This is often painful.

Management of trigger thumb varies from non-operative to operative treatment. Steroid injections into tendon sheaths have reported varying success. Quinnell and Rhoades et al., with their study have demonstrated success rate of steroid injection as 38 % and 55 % respectively. Open release of A1 pulley is associated with complications like scar tenderness, digital nerve injury and bow stringing of flexor tendons.[21]

Percutaneous release of the A1 pulley using tenotome was described by Lorthoir in 1958 and many studies have described about using needle for percutaneous release. Various authors have reported neurological injury during percutaneous release for trigger thumb.[22] This is because of the anatomic variation of the digital nerve which courses obliquely proximal to the A1 pulley.

Percutaneous release of trigger finger is a popular method with good success rate and functional outcome. But there is apprehension regarding percutaneous trigger thumb release due to its high risk of digital nerve injury.

Our study consists of 42 cases of trigger thumb with Quinnell 3,4,5 grades. We performed percutaneous release based on specific anatomical landmark as described. Majority of cases showed excellent and good functional outcome at 6 months follow up. One case which showed signs of digital nerve injury at one month recovered completely. Only one case of recurrence of triggering probably due to incomplete release of A1 pulley.

CONCLUSIONS

Percutaneous trigger thumb release is a safe and effective procedure if done with caution based on specific anatomical landmarks as described. Localization of A1 pulley using anatomical landmarks during percutaneous release can prevent neurological injury to thumb. Complications like scar tenderness, digital nerve injury and bow stringing of flexor tendons which was found in open technique was not observed in this percutaneous technique.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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