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Comparison of functional outcome between local steroid injection and percutaneous release of trigger finger

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Abstract
The best modality for management of correctable triggering of fingers has remained controversial. This study focuses on the outcome of 2 minimally invasive techniques, the percutaneous release of A1 pulley and the local Corticosteroid injection. Aim of this Prospective study is to compare the functional outcome in terms of pain, remnant and recurrent triggering over a period of 6 months, in patients of trigger finger, treated with percutaneous release and steroid injection.
For this study, 100 patients of grade 2 and 3 triggering of fingers underwent percutaneous release or steroid injection (50 each) randomly, and they were assessed repeatedly over a follow up period of 6 months. The analysis was done using a Green's grading, Roles-Maudsley score and VAS Score. Results were analysed with graphical representation.
Percutaneous release gave an excellent relief from triggering with no recurrence, and 98% success rate. Steroid injection had only 56% success rate with 22% recurrence at the end of 6 months (higher with grade 3). The roles Maudsley score was almost equal at the end of 6 months, with 98% patients having *good* and *excellent* results in both groups. Pain relief was immediate after the steroid injection but there was a relapse in a few patients by the end of 6 months (14% developed VAS Score 4 and higher). It took 1 month for pain to get relieved in the percutaneous group, but the relief was well sustained (96% had absolute relief in percutaneous group vs 66% in steroid group). The percutaneous release should be the preferred modality in all grade 2 and 3 trigger fingers with adequate analgesia for the 1st week post-procedure.

Keywords: Trigger finger, percutaneous release, Notta's node, flexor tenosynovitis

Introduction
Trigger finger is a pathology in which a focal nodular thickening of flexor digitorum tendon catches on the proximal edge of the 1st annular pulley (A1). Due to this catch, the Flexion-extension motion at PIP is met with an uneven resistance, and patient describes a painful click or a popping sound every time finger extension is attempted.
The incidence has a bimodal peak, first being at 8 years of life (a few common causes being hurler syndrome [1], collagen diseases), and the other peak age of involvement being 4th-5th decade of life (more common) [2]. It's more commonly seen in females (6:1 female predisposition), and on the dominant side (3:2). Thumb and ring finger have been seen to be overall most commonly involved [1]. When it occurs in children, it most commonly involves the Thumb [3].
The incidence has been reported to be 28/100000 population per year, with a life time risk of 2.6% for average population, and 10% in diabetics [4]. While the incidence has been noted to be higher in cases of diabetes mellitus, gout, amyloidosis, hypothyroidism and rheumatoid arthritis, the condition has also been seen in association with carpal tunnel syndrome and dequervain tenosynovitis [4]. The condition is slightly more prevalent in *blue collar workers* [5].
The flexor sheath of a finger is a membranous tunnel which acts as a passage for the flexor tendons. It spans from the volar aspect of each metacarpal neck to the volar plate of the distal interphalangeal joint. The sheath is thicker over the bones, forming the annular pulley system. It's thin just proximal to the joint capsules, and those portions form the cruciate pulleys. This aids in flexion of fingers, as during the maximal flexion, when the edges of the pulleys of annular system approximate (and may even collapse telescopically), the cruciform pulleys just

concertina [4]. Retinacular portion of flexor tendon sheath has 5 annular pulleys and 3 cruciform pulleys. These pulleys are present at the retinacular sheath of each digit, and they increase the efficiency of sliding of flexor tendon, hence increase the maximum force production [2].

A1 is situated at MCP Joint, and marks the proximal border of the flexor sheath. A2 is over the proximal phalanx, A3 at proximal interphalangeal joint, A4 over the middle phalanx and A5 at the distal interphalangeal joint.

The first cruciform pulley (C1) is located near the head of proximal phalanx, C2 is at base of middle phalanx, and C3 is at the distal end of middle phalanx, near the head.

A vast array of treatment options is available for the patients with trigger finger. Conservative modalities include stretching of fingers, night splinting, local heat/ice application, ultrasound therapy and NSAIDs.

The Non operative treatments, although non invasive, have their disadvantages like low success rate, recurrence, and transient increase in serum glucose in diabetics who get local corticosteroid injection.

Open release of the 1st annular pulley has been a gold standard, but the procedure has the potential risk of Infection, digital nerve injury (found to be most frequent in Thumb and little finger [4], scar formation (and tenderness), and MCP joint contracture, leading to deformity and stiffness.

Steroid Injection was first attempted by Howard, 1953. Percutaneous Release was first performed by Lorthioir [2], 1958 (claimed success rate 100%). Both of them are OPD procedures. While the patients of grade 4 trigger fingers are good candidates for a release- open or percutaneous, it's the patient cohort with grade 2 and 3 trigger finger (actively and passively correctable triggering) which falls in the gray area between these 2 treatment modalities.

We did this prospective study to compare these two minimally invasive procedures- local corticosteroid injection and percutaneous release of A1 pulley, and to determine if the corticosteroid injection is as effective and can replace the percutaneous release in future.

Aims and Objective

The purpose of this study is to compare the functional outcome in terms of pain and recurrent/remnant triggering after Corticosteroid Injection and percutaneous release in the patients with trigger finger.

Materials and Methods

This is a Prospective Study which spanned from April 18-Oct 2019 for this study, all patients of trigger finger presenting to SRM Hospital OPD during this time period were included in the study, till the planned number of 100 patients was reached.

Those 100 patients were allotted a serial number, and were divided randomly into 2 sets of 50 each.

Set 1- corticosteroid injection; Set 2- percutaneous release

Randomization was done by *randomizer.org* (based on patients' serial number).

Written and Informed consent was taken for all the patients who fit all the criteria.

Inclusion Criteria being grade 2 or grade 3 trigger fingers and Age 18 and older Exclusion Criteria Being Grade 1 or 4 trigger finger, Age <18yr or congenital trigger finger, Previous history of open surgery/percutaneous release, Skin lesions/ulcers/infection, Pre-existing Neuropathy in hand**,** Pre-existing arthropathy in small joints of hand**,** Previous procedure on the same finger for the triggering**,** Known case of bleeding disorders.

Methodology

Set 1 (Corticosteroid Injection)

Procedure, prognosis and risk were explained to the patient. Consent was taken. Hand was made to rest on a folded towel to create hyperextension at MCP. Under strict aseptic conditions, 1ml (20mg) Triamcinolone Acetonamide in 1% lignocaine was injected in the flexor sheath using *26G needle*. Before injecting the solution, it was ensured that the needle was outside the substance of the tendon by looking out for the paradoxical movement of the needle with movement of the finger.

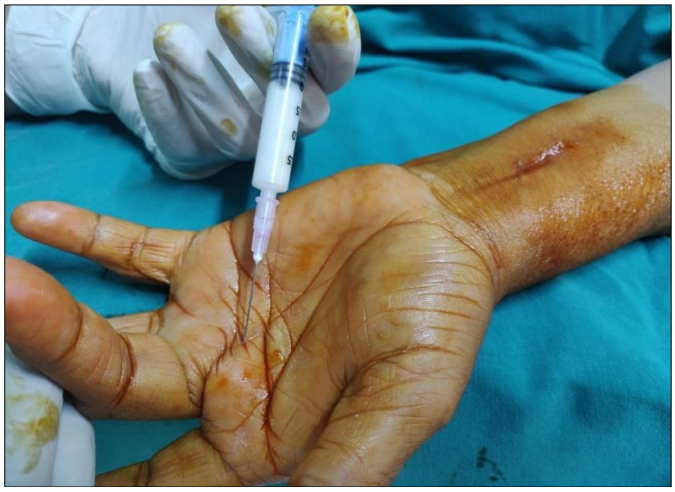


Fig 1: Corticosteroid injection within the A1 sheath, but outside the tendon substance

Set 2 (Percutaneous Release)

Procedure, prognosis and risk were explained to the patient. Consent was taken. Local Anaesthetic 2% Lignocaine, deeper and proximal to the intended release site, longitudinally, along the midline. Hand was made to rest on a folded towel to create hyperextension at MCP. A1 pulley was incised by 18G needle by moving the needle longitudinally along the tendon, till there was no more grating sound.

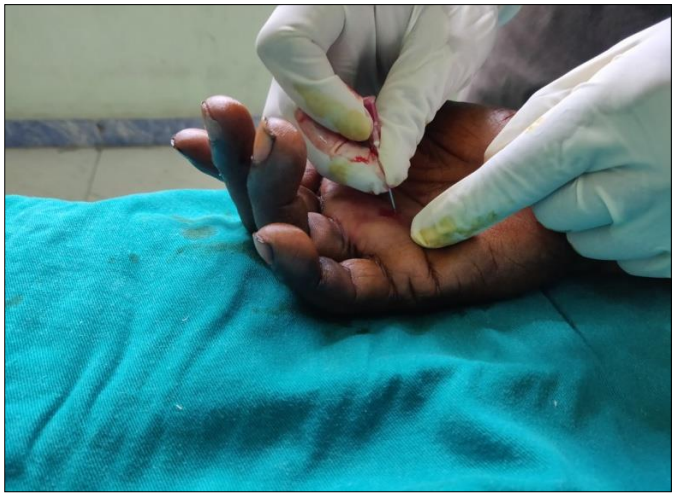


Fig 2: A1 pulley being transected percutaneously by longitudinal motion of the needle

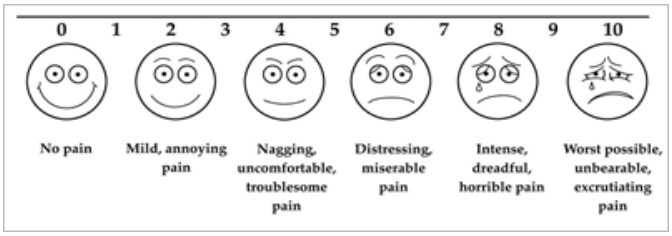
Post procedure, in both sets, a light non-restrictive dressing was applied, active finger use with stretching exercises were encouraged. NSAIDS to given for 5 days and patients to be explained regarding the subsequent follow ups

Evaluation

For the sake of uniformity, all the percutaneous releases were done by a single doctor, and so were all the steroid injections. The assessment was done by a doctor, who is not aware of the treatment modality given to the patient who is being assessed. Tools of assessment were Green's Grade, Roles Maudsley Score and VAS Score.

Functional outcome was evaluated in terms of presence of remnant/recurrent pain, function, and recurrent triggering, during a follow up period of 6 months. Any patient who failed to appear for the follow up was excluded from the study and that serial number was allotted to the immediate next patient who satisfied the inclusion and exclusion criteria

vas score chart [29]



Roles-Maudsley Score [30]

Assessment	Score	Remarks
Excellent	1	No pain, Full movement and activity
Good	2	Occasional discomfort, Full movement and activity
Fair	3	Some discomfort after prolonged activity
Poor	4	Pain, limiting Activity

Results

Number of male patients was significantly higher in both groups. Left sided pathology was seen to be more common in both the groups. And the difference is statistically significant (P>0.05). Majority of the patients (around 64%) had symptoms duration less than six months. Diabetes accounted for about 12-14% in both the groups. Around 85% of the study population had no co morbidities. Around 63% of the study population had Grade II classification while the rest had Grade III. None had grade 0,I & IV classification.

In the steroid group, by the end of the 1st week, only 8% of the patients had grade II, while all others have improved to either grade 0 or Grade I. All the patients in percutaneous release group have been cured fully of their triggering except 3 patients, who had some remnant triggering (grade 1).

In the steroid group, at the end of 1st month, only 7% of the patients show grade II, while all others have improved to either grade 0 or Grade I. There is not much improvement between 7th post-operative day and 30th post-operative day.

However in the percutaneous release group, all but one patient were completely cured of the triggering. Only one patient had remnant triggering (ie- grade 1; indicating partial cure).

At the end of 3rd month, only 8% of those in steroid injection group had grade II, while all others had improved to either grade 0 or Grade I, there was not much improvement between 7th post-operative day, 30th post-operative day & 90th post-operative day. In the steroid injection group, one patient, who had grade 1 triggering at the end of 1st month, progressed to grade 2 (relapse), and one patient who had been cured to grade 0 at the end of 1st month, developed grade 1 triggering (recurrence). No change was observed in the Post procedure status of release group, from when compared to the 1st month.

At 6th month, around 11% of those in steroid injection group have grade II (from 7% at 1st month and 8% at 3rd month), while all others have improved to either grade 0 or Grade I. 4 more patients developed recurrence in the period between 3rd to 6 months, while 3 of the patients who had grade 1 triggering at the end of 3rd month, worsened to grade 2. No change was seen in the status of percutaneous release group.

Around 75% of the study population had either fair or poor pain Score in both the groups before the respective procedures.

After 1 week of procedure, all study participants, except one patient (2%) in percutaneous release group, had improved to excellent or good category from fair and poor. The improvement was significantly better in steroid group compared to percutaneous release group (94% Vs 32% in excellent category).

All study participants had improved to excellent or good category from fair and poor. Around 48% of percutaneous release group have improved from good category to excellent category. This signifies a tremendous symptomatic improvement in the patients with release between 1st to 4th weeks after procedure.

The improvement in percutaneous release group remains constant but 14% of steroid group deteriorated from excellent to good category, which coincides with the recurrence and worsening of triggering in some patients of the steroid group.

There was a further slight downgrade of Roles Maudsley Score in all the patients, more in percutaneous release group compare to steroid injection group (6% slide from *excellent*, down to *good/fair*). Both groups more or less had a similar distribution ranging between VAS Score of 2-8, with majority (around 47%) at Score 4.

There was a rapid improvement in VAS Score for steroid group compare to percutaneous group. All the patients with VAS Score 4 and above at the beginning of study in steroid injection group reported massive improvements in their VAS Score to 0 or 2. However in the release group, out of the 47 patients who reported a VAS Score of 4 and above, 18 were still in pain (had VAS Score 4 or more). There was a good improvement in steroid injection group after 30 days. 37 patients reported full relief from pain, remaining 13 had some discomfort. But there was an even better improvement in percutaneous group after 30 days, compared to first week. 44 patients in group 2 had absolute pain relief, while the remaining 6 had mere discomfort (VAS Score 2).

Of the 13 patients of partial relief (ie VAS Score 2) in steroid group at the end of 3rd month, 2 patients further improved to absolute relief (VAS Score 0), while 2 worsened to VAS Score 4. But there was a overall improvement in percutaneous release group after 90 days (4 patients with VAS Score 2 improved to VAS Score 0), compared to first week and 30 days.

At the end of 6 months, only 33 of the 50 patients in steroid group remained pain free. One patient relapsed back to VAS Score 6, while 6 others reported VAS Score 4.

While there was an evident deterioration of pain Score in Steroid injection group, in percutaneous release, the same good results were sustained from 30 days post procedure onwards up until 6 months.

There is no difference in mean triggering grade between two groups before the procedure (Sample selection is unbiased). The difference becomes significant between the 2 groups in all the subsequent time frames. While the mean Score of steroid injection improves as time passes, (the steroid treatment gives good acute relief from pain), it's not sustainable.

Table 1: Comparison of mean Green's score between two procedures at different stages

Variables	group	Mean	Std. Dev.	Mean diff	t-value	p-value
Before Procedure	Steroid Injection	2.36	0.485	0.02	-.205	0.838
	Percutaneous Release	2.38	0.490			
After 7 days of procedure	Steroid Injection	0.56	0.76	0.50	4.435	0.000
	Percutaneous Release	0.06	0.24			
After 30 days of procedure	Steroid Injection	0.48	0.735	0.46	4.345	0.000
	Percutaneous Release	0.02	0.141			
After 90 days of procedure	Steroid Injection	0.52	0.762	0.50	4.560	0.000
	Percutaneous Release	0.02	0.141			
After 180 days of procedure	Steroid Injection	0.66	.823	0.64	5.417	0.000
	Percutaneous Release	.02	0.141			

Table 2: Comparison of mean Roles Maudsley Score between two procedures at different stages

Variables	group	Mean	Std. Dev.	Mean diff	t-value	p-value
Before Procedure	Steroid Injection	2.82	.629	0.06	-0.466	0.642
	Percutaneous Release	2.88	0.659			
After 7 days of procedure	Steroid Injection	1.06	.240	0.64	-8.093	0.000
	Percutaneous Release	1.70	.404			
After 30 days of procedure	Steroid Injection	1.06	0.404	0.14	-2.107	0.038
	Percutaneous Release	1.20	0.414			
After 90 days of procedure	Steroid Injection	1.2	.404	0.02	-0.243	0.808
	Percutaneous Release	1.22	.418			
After 180 days of procedure	Steroid Injection	1.22	0.465	0.08	-0.824	0.412
	Percutaneous Release	1.30	0.505			

There is no difference in mean RM Score between two groups before the procedure (Sample selection is unbiased). There is a significant difference between both groups at 7th POD and 30th POD. The mean RM Score of steroid was reduced (lower is better) and stayed constant from 7th day to 30th day, but increases (worsens) after that. The mean Score of percutaneous group decreases at 7th day (some improvement, less than that of steroid group), and then reduces further by 1st month (more improvement), and is sustained from then onwards (increases slightly, corresponding to minimal worsening in 3 patients). The mean of both groups are similar at 90th and 180th day. Steroid group had an acute decrease in pain, which was short lived. Percutaneous group had a gradual decrease in pain Score and it sustained. The resultant score at the end of 6 months had insignificant difference (similar result).

Table 3: Comparison of mean VAS Score between two procedures at different stages

Variables	group	Mean	Std. Dev.	Mean diff	t-value	p-value
Before Procedure	Steroid Injection	5.02	1.436	0.06	0.206	0.837
	Percutaneous Release	4.96	1.470			
After 7 days of procedure	Steroid Injection	0.76	0.981	1.56	-5.433	0.00
	Percutaneous Release	2.32	1.778			
After 30 days of procedure	Steroid Injection	0.52	0.886	0.28	1.795	0.076
	Percutaneous Release	0.24	0.657			
After 90 days of procedure	Steroid Injection	0.52	0.886	0.44	2.762	0.007
	Percutaneous Release	0.08	0.396			
After 180 days of procedure	Steroid Injection	1	1.578	0.92	3.999	0.000
	Percutaneous Release	0.08	0.396			

There was no difference in mean VAS Score between two groups before the procedure (Sample selection was unbiased). There was a significant difference in the VAS Score between both groups at 7th POD, suggesting massive improvement in steroid group. There onwards, mean VAS Score of steroid group was constant at 30th day to 90th day, but increases after that (indicating worsening/relapse).

The mean Score of percutaneous group decreases and then becomes constant. Steroid group had an acute decrease in pain, which was short term. Percutaneous group had a more gradual decrease in pain Score and it was better sustained)

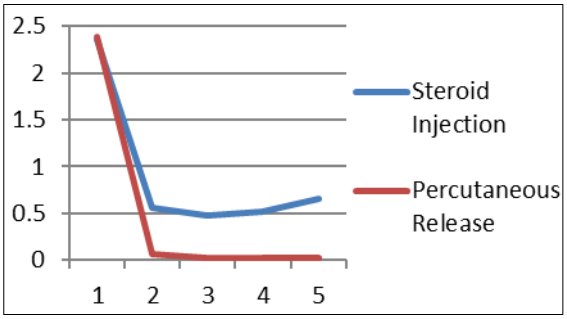


Chart 1: Comparison of mean Roles Maudsley Score between two procedures at subsequent visits

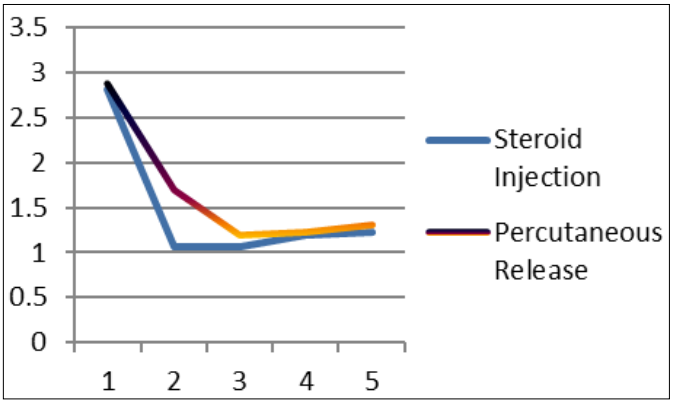


Chart 2: Comparison of mean VAS Score between two procedures at different visits

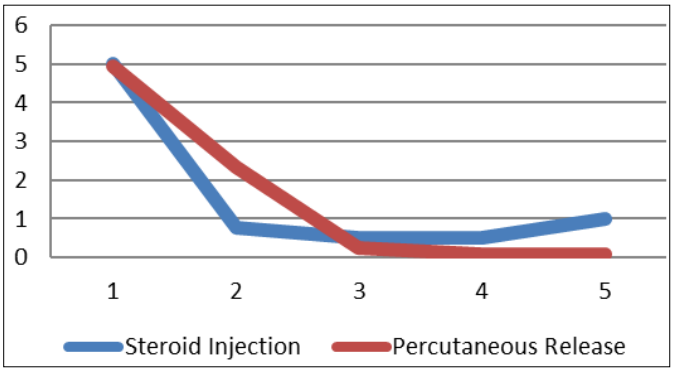


Chart 3: Comparison of mean VAS SCORE score between two procedures at different visits

Discussion

The literature suggests higher frequency of Trigger Finger on the dominant side, but we observed Left hand involvement more frequent (61%) than the right (39%). The number of male patients in our study was also higher than females, while the incidence of trigger finger has been observed to be higher in females. This discrepancy was due to the higher number of drop out we observed in female patients (31 female patients did not appear for regular follow up, so they had to be removed from the study, while the same number in males was 7). 36% of the patients had middle finger involvement while 28% had involvement of the ring finger. 64% of the patients in our OPD had symptom duration of less than 6 months, and 13% of the cases had DM.

In this study, we found that percutaneous release, although gives immediate relief from triggering, is painful/uncomfortable till 7 days of the procedure. However, almost all these patients were pain free at the end of 1st month. The procedure also resulted in a sustained pain and triggering relief, with only 1 patient having partial failure of treatment (remnance of grade 1 even at the end of 6m). That patient initially had grade 3 (with no co morbidities) before the procedure. In both the groups, the functionality (Roles Maudsley) of the hand was *excellent* and *good* in total 49 of the patients, with only one patient reporting *Fair* function. This improvement came faster in the steroid injection group than the percutaneous release group. All but 2 patients were absolutely pain free by the end of 6 months, and those 2 patients too, had only *mild discomfort* (VAS Score 2).

Compared to the percutaneous release group, the steroid group had immediate pain relief (VAS Score improvements) within the 1st week of the injection. This result was surpassed by the percutaneous release only at the 1st month visit. The steroid group sustained the results well till upto 3 months of procedure, after which pain relapses were reported.

Steroid group also saw an immediate improvement in the functionality, with sustained results till 6 months. On the other hand, the mean RM Score of the percutaneous group improved slowly and continuously over 1 month; and by the end of 6 months the mean RM was almost equal to the steroid group (the difference was insignificant).

The relief in triggering in the steroid injection group was less than that of the percutaneous release group, and there were higher number of relapses, with only 56% had complete cure of trigger finger at the end of 6 months. The failure and recurrence rate was higher in grade 3 patients (7 out of 18 grade 3 patients had treatment failure, while only 4 out of 32 grade 2 patients reported the same.

None of the 100 patients in the study had a digital nerve injury, procedure site infection, or acute/delayed tendon rupture over the 6 month follow up.

The previous studies on percutaneous release for trigger finger showed excellent improvement in ROM, just like our study. But some of them were done on a small sample size- Eastwood Dm, and Gupta *et al*. released 35 fingers, Singh *et al*. released 26 fingers, Aref H, Amiri *et al*. did the same in 25 cases. Bain GI *et al*. and Lyu *et al*. and Ha *et al*. used a large sample size, and all these studies showed massive improvement in finger mobility, but post procedure pain wasn't taken into consideration (Bain's study was done on cadavers).

Singh *et al*. used local triamcinolone injection, but they too followed up the patients till only 1 month. We saw in our study that the majority of relapses and recurrences happened from 3rd month onwards. They reported distal phalanx numbness in 1 patient of the steroid group; and in two patients of their percutaneous group, MCP stiffness and bowstringing of the flexor tendon happened. Few Patients in Aref H *et al*. study's percutaneous group too had A2 pulley and digital nerve. None of our patients had any such complications.

Vivek Ajit Singh chose grade 2 and grade 3 trigger finger patients as their study population. They compared the outcome of percutaneous release with that of corticosteroid injection with an extremely small sample size (13 in each group). Their assessment over 1 month follow up showed more pain relief and fewer complications in steroid injection group, with recurrence rate being equal in both group. With our study on a larger sample size and a longer follow up, we found all the recurrences to happen in corticosteroid group, that too from 3rd month onwards. We found percutaneous group to have 0 recurrences, most likely because complete resection of the A1 pulley was confirmed during the procedure itself via feeling for cessation of the grating sensation, and asking the patient to feel for any remnant resistance to finger motion. This led to the percutaneous release procedure having 98% complete success rate in our study.

Edson and Sato *et al*. compared the 3 modalities of treatment- surgery, release and steroid, but again, their sample included grade 4 patients too, which skewed the data in favour of surgery and release groups.

Conclusion

Percutaneous release for trigger finger provides significantly better relief from triggering with lower rates of recurrences as compared to the steroid injection (particularly in grade 3 trigger finger), with both procedures being safe.

So we conclude that for both trigger fingers of grade 2 and grade 3, percutaneous release would be a better treatment

option, along with an adequate analgesic prescription for 1 week to reduce post procedure pain.

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