# Results of endoscopic carpal tunnel release using supraretinacular approach

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**Background**
Endoscopic carpal tunnel release is evolving with advantages that include shorter hospital stays and earlier recovery. The supraretinacular approach is recent and avoids carpal tunnel dilatation, which may lead to median nerve compression. The study is a cohort prospective study to evaluate short-term results of endoscopic supraretinacular carpal tunnel release.
**Patients and methods**
Prospective study of 12 patients with carpal tunnel syndrome treated using endoscopic supraretinacular approach.
**Results**
All patients in the study reported relief of symptoms and return to their original work. No reported complications. There is an improvement in the Boston score and visual analog scale score.
**Conclusion**
The supraretinacular endoscopic carpal tunnel release is a valuable and reproducible technique with fewer complications.

**Keywords:**
carpal tunnel, endoscopic, release

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## Introduction

Carpal tunnel syndrome is the most common upper limb entrapment neuropathy. It causes nocturnal pain, numbness and paresthesia in the median nerve distribution. If left untreated, it may cause hand disability due to thenar muscle atrophy and decreased prehension [1].

Open carpal tunnel release is considered the standard treatment with adequate short-term and long-term results. However, many complications have been reported, including pillar pain, hypertrophic painful scar, recurrence due to adhesion formation, and even persistence of symptoms if the retinaculum is inadequately released. Furthermore, the long palmar incision may have a poor esthetic result. These complications contribute significantly to patient dissatisfaction [2].

Minimally invasive and endoscopic techniques have been developed to address these complications. The potential advantages include less scarring, less pillar pain, shorter hospital stays, and shorter periods of recovery [3].

However, the safety of endoscopic techniques has been questioned in the literature. Many reports of inadequate release of the flexor retinaculum and drastic iatrogenic injury of the median nerve, recurrent motor branch, or palmar arterial arch. Furthermore, they require a long, steep learning curve [4].

One of the potential complications of endoscopic techniques is that they require dilatation of the tight carpal tunnel to allow insertion of instrumentations in the subretinacular interval, which may cause compression of the median nerve and may result in neuropraxia [5,6].

A new technique developed by Ecker *et al.* [7] involves the release of the tunnel through a supraretinacular approach, which allows the surgeon to release the tunnel in a much more familiar technique like open surgery and avoids tunnel dilatation.

The results of this supraretinacular approach are promising, with good short-term results. However, long-term results are lacking till now [7].

We report the short-term results of a cohort of patients with carpal tunnel syndrome treated using an endoscopic supraretinacular approach.



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## Patients and methods

A prospective cohort study of 25 consecutive patients diagnosed with idiopathic carpal tunnel syndrome who failed conservative treatment for at least 3 months duration. They have been treated by endoscopic supraretinacular carpal tunnel release performed in the period between 2021 and 2023. Informed consent was obtained from all the patients, and the ethical committee approved the study.

Inclusion criteria included patients diagnosed clinically with carpal tunnel syndrome according to CTS 6 score, which is a six items score. It evaluates numbness in median nerve territory, nocturnal pain, positive Phalen's test, positive Tinel's sign, loss of two-point discrimination and thenar muscle atrophy [8].

Nerve conduction studies have been performed on all patients to confirm the diagnosis and grade the severity of carpal tunnel syndrome. They have also excluded double crush syndrome and/or cervical spine disease.

Exclusion criteria included patients with extremely severe CTS, active inflammatory disease like rheumatoid arthritis, patients with active infection at the operative site, and recurrent cases with previous open or endoscopic surgery.

The study included 25 patients, 20 females and five males, with a mean age of 49.5 years (range, 35–62 years). The right side was involved in 14 patients, and the left side was involved in 11 patients. Dominant side in 15 patients. The mean duration of symptoms till intervention is 9.3 months (range, 6–24 months). According to severity, five mild, 15 moderate, and five severe.

Preoperatively, routine laboratory investigations are performed. Preoperative visual analog scale (VAS) score, Boston questionnaire for severity and function are recorded (Tables 1 and 2) [3,4].

**Table 1 Boston questionnaire symptom severity score**

| Part 1: symptom severity scale | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. How severe is the hand/wrist pain that you have at night? | Normal | Slight | Medium | Severe | Very serious |
| 2. How often did hand/wrist pain wake you up during a typical night in the past 2 weeks? | Normal | Once | 2–3 times | 4–5 times | >5 times |
| 3. Do you typically have pain in your hand/wrist during the daytime? | No pain | Slight | Medium | Severe | Very serious |
| 4. How often do you have hand/wrist pain during the daytime? | Normal | 1–2 times/day | 3–5 times/day | >5 times | Continued |
| 5. How long, on average, does an episode of pain last during the daytime? | Normal | <10 min | 10–60 min continued | >60 min | Continued |
| 6. Do you have numbness in your hand/wrist? | Normal | Slight | Medium | Severe | Very serious |
| 7. Do you have weakness in your hand/wrist? | Normal | Slight | Medium | Severe | Very serious |
| 8. Do you have tingling sensations in your hand? | Normal | Slight | Medium | Severe | Very serious |
| 9. How severe is numbness (loss of sensation) or tingling at night? | Normal | Slight | Medium | Severe | Very serious |
| 10. How often did hand weakness or tingling wake you up during a typical night during the past 2 weeks? | Normal | Once | 2–3 times | 3–5 times | >5 times |
| 11. Do you have difficulty with the grasping and use of small objects such as keys or pens? | Without difficulty | Little difficulty | Moderate difficulty | Very difficult | Very difficult |

**Table 2 Boston questionnaire functional score**

| Part 2: functional status scale | No difficulty | Little difficulty | Moderate | Intense difficulty | Cannot perform at all |
|---|---|---|---|---|---|
| 1. Writing | 1 | 2 | 3 | 4 | 5 |
| 2. Buttoning of clothes | 1 | 2 | 3 | 4 | 5 |
| 3. Holding a book while reading | 1 | 2 | 3 | 4 | 5 |
| 4. Gripping of a telephone handle | 1 | 2 | 3 | 4 | 5 |
| 5. Opening of jars | 1 | 2 | 3 | 4 | 5 |
| 6. Household chores | 1 | 2 | 3 | 4 | 5 |
| 7. Carrying of the grocery basket | 1 | 2 | 3 | 4 | 5 |
| 8. Bathing and dressing | 1 | 2 | 3 | 4 | 5 |

### Surgical technique

Under general anesthesia, a pneumatic tourniquet is inserted in the upper arm. The arm is put in a supine position with the shoulder abducted to 90°. An incision about 1.5 cm is centered proximal to the distal wrist crease perpendicular to a long line along the third webspace (Fig. 1).

Dissection of subcutaneous tissue and antebrachial fascia to expose the median nerve. The dissection is continued distally to expose the proximal edge of the flexor retinaculum (Fig. 2).

The dissection is turned to the subcutaneous tissue superficial to the retinaculum to develop a plane through which instrumentation is inserted. Instruments include a long handle nasal speculum with lock and 30° 4 mm arthroscope. The nasal speculum is inserted in the supraretinacular plane and opened and held by the assistant in one hand while the other hand supports the operative hand in the supine position (Fig. 3).

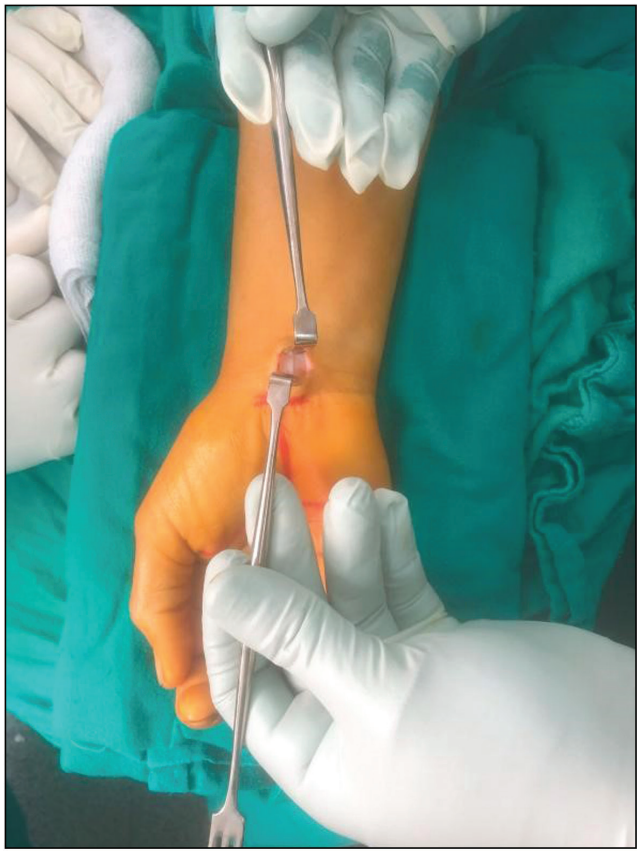
The arthroscope is inserted within the supraretinacular pouch by the left hand, and a metzenbaum scissor is in the right hand, where the retinaculum is cut under direct vision, exposing the median nerve and releasing the tunnel. Release of the tunnel is performed until the fat pad and proximal carpal arch are visualized, which denotes the end of the release of the retinaculum (Figs 4 and 5).

The closure is done in layers using 4/0 subcuticular sutures, and a compressive dressing is applied.

**Figure 1**

Incision landmark.

**Figure 2**

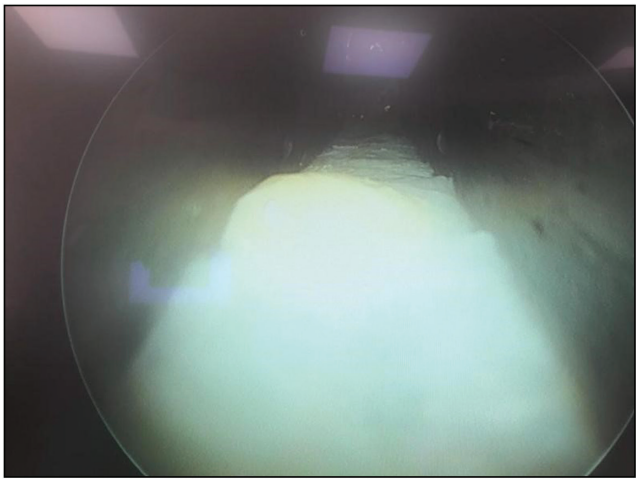


Dissection of subcutaneous tissue.

**Figure 3**

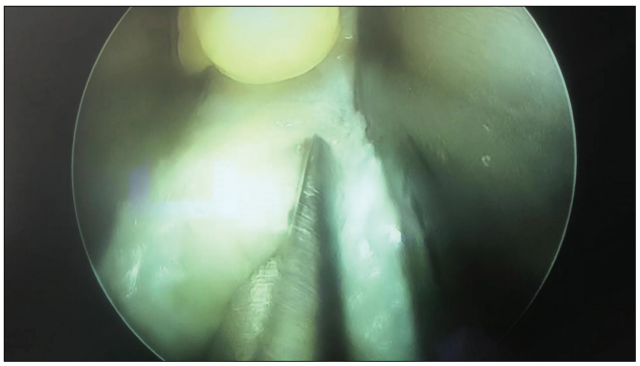
Nasal speculum inserted.

**Figure 4**



View of retinaculum.

**Figure 5**



Scissor cutting of retinaculum under direct vision.

### Follow up

Patients are reviewed at 2 weeks postoperatively when stitches are removed.

Then, a review will be conducted 1 month where the assessment of scar condition and resolution of symptoms are evaluated.

The final follow-up at 6 months included an assessment of VAS score and Boston CTS questionnaire (severity and functional scores) and compared to preoperative scores. Grip strength is recorded and compared to the contralateral side preoperatively and postoperatively.

All data were analyzed using SPSS, version 26.0 (IBM, Armonk, New York, United States). The demographic data were analyzed using descriptive statistics. Nonparametric tests were chosen for the analysis of outcome measures because the samples were not normally distributed. The Wilcoxon signed-rank test was used to compare the distribution of each outcome across the two time points (preoperative and postoperative). A two-tailed $P$ value of less than 0.5 was considered significant.

## Results

No incision-related complication is reported in the study, and all scars healed eventually. Only one patient reported induration and hardness at the base of the palm, which improved with massage within 2 months period.

All patients reported relief of nocturnal pain within 2 weeks after surgery. Numbness has improved within 1 –2 months duration, and no residual numbness or sensory loss has been reported at final follow-up after 6 months.

**Hand grip has improved significantly from 16 to 25 kg at final follow-up.**

No reported complications related to motor weakness, sensory loss, or onset of new symptoms at final follow-up.

VAS score has improved significantly from 5.4 to 2 at the final follow-up ($P$<0.000).

The mean Boston score has improved from 3.9 preoperatively to 1.1 at 6 months of evaluation for severity score and from 3.7 to 1.1 for functional score, which are considered statistically significant. ($P$<0.000).

## Discussion

Open release of the flexor retinaculum is considered the gold standard treatment of CTS, whether idiopathic or resulting from space-occupying lesion. It stands the test of time with well-known adequate short-term and long-term results regarding the resolution of symptoms and recovery of function [1,9].

However, many complications have been reported in the literature, including early complications such as bleeding, seroma formation, painful hypertrophic scar, and late complications, including pillar pain (thenar and hypothenar pain and tenderness) and adhesions, which result in the recurrence of symptoms. Rarely, drastic complications in the form of cutting the motor branch of the median nerve and persistence of symptoms due to inadequate release of the flexor retinaculum been reported. These complications contribute to longer hospital stays, loss from return to work, and patient dissatisfaction [10–12].

To address these complications, many minimally invasive techniques and endoscopic techniques have been introduced. Potentially, shorter hospital stays, less postoperative pain and earlier recovery have been considered advantages of these techniques [10].

Since their introduction by Chow and Agee and colleagues, endoscopic techniques are evolving, and there is an increasing trend among surgeons to perform endoscopic techniques. Many kits and instruments are being developed to improve endoscopic techniques and make them more reproducible [6,13].

Most endoscopic techniques use special instrumentation kits that approach the subretinacular interval to divide the flexor retinaculum. This subretinacular approach requires gradual dilatation of the potentially tight carpal tunnel to allow insertion of the scope. This dilatation itself may compress the median nerve and may lead to temporary neuropraxia. Furthermore, many studies have reported inadvertent cutting of the median nerve and palmar arch, and incomplete resection of the retinaculum, which may lead to the persistence of symptoms. This has led to questionable safety of endoscopic techniques [6,11,12].

Another issue is the cost of endoscopic techniques, which may introduce a burden to the health care system [12].

Recently, a supraretinacular approach has been introduced. It allows the introduction of the scope through the subcutaneous space above the retinaculum and, hence, avoids the dilatation of the tunnel and avoids compression of the median nerve. Another advantage is that it allows the release of the retinaculum in a similar way to open techniques. It allows exposure of the retinaculum under direct vision [7].

However, most of the results reported are short term. No long-term results or comparative studies with the open techniques are available [14].

One of the main concerns about using the supraretinacular approach is that it may put the palmar cutaneous branch of the median nerve at risk during dissection of the subcutaneous tissue above the retinaculum, which may result in painful neuroma. However, we did not encounter this complication in our patients.

One of our patients had induration and hardness at the base of the palm, which, in our opinion, resulted from excessive dissection of the subcutaneous tissue, leading to more scarring. However, the condition was resolved with massage. We avoided excessive dissection in other patients to avoid this complication. Ip *et al.* [15] reported four cases of pillar pain and two patients with hypertrophic scars out of 10 patients in their series.

The and colleagues have reported 48 cases with a supraretinacular approach. They noticed improvement in Boston score and VAS score in a 3-month duration postsurgery. They did not have cases of pillar pain. They designed small instruments with less dissection in the subcutaneous plane, which may explain the absence of pillar pain in their series [16].

We think that the supraretinacular approach is safe and reproducible. However, long-term results and comparative studies with the open and endoscopic subretinacular approach are needed to better elucidate the value of this technique.

## Conclusion

Supraretinacular endoscopic technique of carpal tunnel syndrome is evolving new techniques with valuable early results as regards symptom resolution and early recovery of function. However, long-term studies are needed to better evaluate the final outcome of this procedure compared to open techniques.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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