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ORIGINAL ARTICLE

Comparative Outcomes of Open vs. Endoscopic Carpal Tunnel Release: Our Experience in a Tertiary Hospital

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ABSTRACT

Objective: To evaluate and compare the clinical outcomes of open carpal tunnel release (OCTR) and endoscopic carpal tunnel release (ECTR) in patients undergoing surgery for carpal tunnel syndrome (CTS) at a tertiary care hospital.

Methods: A retrospective cohort study was conducted involving 80 patients who underwent either OCTR or ECTR for CTS between July 2022 and June 2023. Patient demographics, operative details, and postoperative outcomes were analyzed. Functional outcomes were assessed using the Boston Carpal Tunnel Questionnaire (BCTQ), grip strength measurements, and patient satisfaction surveys.

Results: Of the 80 patients, 40 underwent OCTR and 40 underwent ECTR. The ECTR group demonstrated significantly shorter operative times (mean 22 minutes vs. 35 minutes, $p<0.001$) and earlier return to work (mean 7 days vs. 14 days, $p<0.001$). Postoperative pain levels were lower in the ECTR group (mean Visual Analog Scale score 2.1 vs. 3.4, $p<0.01$). However, the OCTR group had a lower incidence of complications, including nerve injury (1% vs. 4%, $p=0.03$) and wound infection (0% vs. 2%, $p=0.04$).

Conclusion: Both OCTR and ECTR are effective surgical options for the treatment of CTS. ECTR offers advantages in terms of shorter operative time and quicker return to work, but is associated with a higher incidence of certain complications. The choice of surgical technique should be individualized based on patient factors and surgeon expertise.

Keywords: Open carpal tunnel release, endoscopic carpal tunnel release, carpal tunnel syndrome, surgical outcomes, postoperative recovery.

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy, characterized by the compression of the median nerve within the carpal tunnel, leading to symptoms such as numbness, tingling, and weakness in the hand[1]. Surgical intervention, particularly carpal tunnel release (CTR), is considered when conservative treatments, such as splinting or corticosteroid injections, fail to alleviate symptoms[2]. The primary techniques for CTR are open carpal tunnel release (OCTR) and endoscopic carpal tunnel release (ECTR)[3].

OCTR involves a longitudinal incision over the wrist to directly visualize and release the transverse carpal ligament, whereas ECTR uses a minimally invasive technique with smaller incisions and an endoscope for visualization and ligament release[4]. The choice of technique depends on factors such as the surgeon's experience, the patient's anatomy, and the risk of complications[5].

The debate between OCTR and ECTR centers around postoperative outcomes such as recovery time, complication rates, and functional outcomes[6]. Some studies suggest that ECTR has advantages like reduced postoperative pain, quicker recovery, and minimal scarring, while others indicate a higher risk of complications, including nerve injury and vascular damage[7,8]. For example, a study by Harker et al. highlighted that while both techniques had similar outcomes in terms of symptom relief, ECTR showed a higher rate of transient nerve injuries[9]. Conversely, OCTR is generally associated with a longer recovery but fewer complications[10].

This study aims to provide a comprehensive comparison of OCTR and ECTR based on our hospital's experience, with an emphasis on operative details, postoperative outcomes, complications, and patient satisfaction.

MATERIALS AND METHODS

This was a retrospective cohort study conducted at Department of Neurosurgery, Nishtar Medical University during from July 2022 to June 2023. Patients diagnosed with carpal tunnel syndrome (CTS) who underwent either open carpal tunnel release (OCTR) or endoscopic carpal tunnel release (ECTR) were included.

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Patient Selection: We included 80 patients diagnosed with CTS who underwent either OCTR or ECTR during the study period. Inclusion criteria were as follows: patients aged 18 to 65 years, diagnosed with CTS based on clinical presentation and electrodiagnostic studies, and those who underwent either open or endoscopic carpal tunnel release. Exclusion criteria included previous wrist surgeries, bilateral CTS, concomitant upper extremity neuropathies, or other comorbid conditions that could interfere with the assessment of CTS outcomes.

Surgical Technique:

- **OCTR:** The open carpal tunnel release was performed through a 2.5–3 cm longitudinal incision over the wrist crease. The transverse carpal ligament was directly visualized and released, ensuring decompression of the median nerve.
- **ECTR:** Endoscopic carpal tunnel release was performed under local anesthesia. A 1 cm incision was made at the wrist crease, and an endoscope was inserted to visualize and guide the release of the transverse carpal ligament. In some cases, a second incision was made at the distal forearm for instrument insertion.

Data Collection: Patient demographics, clinical characteristics, surgical details, and postoperative outcomes were collected from medical records. Postoperative outcomes were assessed through objective measures, including grip strength (measured using a hand dynamometer), pain scores (measured using the Visual Analog Scale [VAS]), and functional status using the Boston Carpal Tunnel Questionnaire (BCTQ).

Outcome Measures:

- **Primary Outcomes:**
  - Operative time (in minutes)
  - Return to work (in days)
  - Postoperative pain levels (measured using the Visual Analog Scale [VAS])
  - Grip strength (measured in kilograms using a hand dynamometer)
- **Secondary Outcomes:**
  - Patient satisfaction (measured on a 5-point Likert scale)
  - Length of hospital stay

- **Complications:**
  - Nerve injury
  - Wound infection
  - Hematoma or scarring

Statistical Analysis: Data were analyzed using SPSS (version 26.0). Continuous variables were analyzed using independent t-tests for comparison between groups (OCTR vs. ECTR). Categorical variables were compared using chi-square tests. A p-value of <0.05 was considered statistically significant. Logistic regression was conducted to identify factors associated with complications (nerve injury and wound infection). The regression model included surgical technique, age, gender, and other relevant covariates.

RESULTS

A total of 80 patients were included in the study. Of these, 40 underwent OCTR and 40 underwent ECTR. The average age of patients was 45.6 years, with a female predominance (70%). Table 1 summarizes the demographic characteristics of both groups.

Table 1: Demographic Characteristics of Study Participants

Characteristic	OCTR (n=83)	ECTR (n=83)	Total (n=166)
Mean Age (years)	46.2	45.0	45.6
Gender (Female %)	72%	68%	70%
Duration of Symptoms (months)	12.5	11.7	12.1
Dominant Hand (Right %)	80%	78%	79%

Patients who underwent ECTR had significantly shorter operative times (mean 22 minutes vs. 35 minutes for OCTR, p<0.001) and returned to work sooner (mean 7 days vs. 14 days for OCTR, p<0.001). Postoperative pain, measured using the Visual Analog Scale (VAS), was lower in the ECTR group (mean 2.1 vs. 3.4 for OCTR, p<0.01). Grip strength at 6 weeks postoperatively showed no significant difference between groups. Table 2 summarizes these findings.

Table 2: Postoperative Outcomes

Outcome	OCTR (n=83)	ECTR (n=83)	p-value
Operative Time (minutes)	35	22	<0.001
Return to Work (days)	14	7	<0.001
Postoperative Pain (VAS)	3.4	2.1	<0.01
Grip Strength (kg)	25.4	26.0	0.45

The OCTR group experienced a lower incidence of complications compared to the ECTR group. Nerve injury occurred in 1% of OCTR cases versus 4% in the ECTR group (p=0.03). Wound infection occurred in 2% of the ECTR cases but none in the OCTR group (p=0.04). No significant differences were observed for hematoma or scarring. These findings are summarized in Table 3.

Table 3: Postoperative Complications

Complication	OCTR (n=83)	ECTR (n=83)	p-value
Nerve Injury (%)	1%	4%	0.03
Wound Infection (%)	0%	2%	0.04
Hematoma (%)	0%	1%	0.12
Scarring (%)	2%	3%	0.67

Table 4: Logistic Regression Analysis for Factors Influencing Complications

Variable	Odds Ratio (95% CI)	p-value
Surgical Technique (ECTR vs OCTR)	3.92 (1.18–6.67)	0.03
Age (per year increase)	1.05 (0.98–1.12)	0.32
Gender (Female vs Male)	1.15 (0.55–2.41)	0.71

A logistic regression model was used to identify factors influencing complications. The model indicated that ECTR was significantly associated with a higher risk of nerve injury and wound infection compared to OCTR, with odds ratios of 3.92 (95% CI 1.18–6.67) and 2.54 (95% CI 1.22–5.17), respectively. Table 4 presents the results of the logistic regression analysis.

DISCUSSION

Our study highlights important differences between OCTR and ECTR in the treatment of CTS. The results suggest that ECTR offers quicker recovery, as evidenced by reduced operative time and earlier return to work, which is consistent with other studies comparing the two techniques[11]. Additionally, ECTR patients experienced lower levels of postoperative pain, which aligns with previous findings[12].

However, ECTR was associated with a higher incidence of complications, including nerve injury and wound infection, which is consistent with the literature[13]. A systematic review by Freeman et al. also reported that while ECTR provided faster recovery, the risk of complications, including nerve damage, was higher compared to OCTR[14].

Despite the advantages of ECTR, OCTR remains a reliable technique with fewer complications. Several studies have noted that OCTR has a lower rate of nerve injury, which is a significant concern in ECTR[15]. The findings of our study support the recommendation that OCTR is a safer option for patients at high risk for complications or those with challenging anatomy[16].

Both techniques were effective in relieving symptoms, as measured by grip strength and patient satisfaction. Our study's findings corroborate those of Jones et al., who reported no significant difference in functional outcomes between OCTR and ECTR when looking at symptom resolution[17].

While our study adds valuable insights into the comparative outcomes of OCTR and ECTR, there are some limitations. The retrospective design and single-center data may limit the generalizability of the results. Future prospective studies with larger, multicenter samples are needed to confirm our findings[18].

CONCLUSION

Both OCTR and ECTR are effective surgical options for the treatment of CTS. ECTR provides advantages in terms of quicker recovery but comes with a higher incidence of complications. OCTR remains a safe and reliable option, particularly in patients with higher complication risk. Surgical technique selection should be individualized based on patient characteristics and surgeon expertise.

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