

# Evaluation of Intraoperative Iatrogenic Lesions and Postoperative Complications in 1140 Patients Treated for Carpal Tunnel Syndrome in the Orthopedic Surgery and Traumatology Department of the Moulins-Yzeure Hospital Center in France

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**How to cite this paper:** Sedou, S.L.M., Tshitala, C., Dumez, J.-F., Moumouni, I., Ndangi, K. and Kapay, K. (2023) Evaluation of Intraoperative Iatrogenic Lesions and Postoperative Complications in 1140 Patients Treated for Carpal Tunnel Syndrome in the Orthopedic Surgery and Traumatology Department of the Moulins-Yzeure Hospital Center in France. *Surgical Science*, 14, 705-711.

<https://doi.org/10.4236/ss.2023.1412076>

**Received:** November 4, 2023

**Accepted:** December 18, 2023

**Published:** December 21, 2023

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## Abstract

**Introduction:** Carpal tunnel syndrome is a more common form of upper limb canal syndrome, resulting from compression of the median nerve in the carpal tunnel, but is particularly troublesome. Medical treatment is often unsuccessful, and surgical treatment usually involves transection of the annular ligament. The aim of this study was to assess iatrogenic intraoperative and postoperative complications, as well as patient outcomes following the use of conventional and endoscopic surgery in the surgical management of carpal tunnel syndrome. **Hypothesis:** Are nerve, vascular and tendon injuries of iatrogenic origin always present in the surgical management of carpal tunnel syndrome, even though this surgery is performed on an outpatient basis? **Patients and methods:** This retrospective series is composed of 1140 patients, 230 men and 910 women, mean age  $58.6 \pm 16.4$  years, operated on between 2010 and 2020 for carpal tunnel syndrome by conventional surgery and under endoscopy. Medical records, operative reports and consultation letters were consulted. All patients were reviewed regularly at one month post-op until recovery. **Results:** No nerve, vascular or tendon damage was noted, and at a maximum follow-up of 2 years, 20 patients had recurred, *i.e.* a 2.51% failure rate. Scar disunion was observed in 0.9%, wound infection in 0.9% and scar fibrosis in 0.9%. 92.98% of patients underwent outpatient surgery, irrespec-

tive of the type of anesthesia or surgical technique used. Patients who stayed in hospital for a short time were suffering from carpal tunnel syndrome associated with compression of the ulnar nerve in Guyon's canal, for which both the median and ulnar nerves were freed during the same operation, under general anaesthetic. All patients were able to return to their previous activity within 30 days of surgery. Conclusion: Intraoperative iatrogenic complications, notably nerve, vascular and tendon lesions, were not identified despite the large sample size. On the other hand, postoperative skin complications related to scarring, such as wound disunion, fibrosis and recurrence, were present despite low rates.

## Keywords

Carpal Tunnel, Iatrogenic Complications, Patient Outcome, Surgical Treatment

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## 1. Introduction

Carpal tunnel syndrome is the most common and widespread of the ductal syndromes of the upper limb. It is characterized by compression of the median nerve as it passes through the carpal tunnel; it is the consequence of a mismatch in size between a container and its contents. Its clinical expression is essentially sensory, characterized by paresthesia, which is the reason for consultation [1] [2] [3].

In the majority of cases, carpal tunnel syndrome is idiopathic. It is bilateral in half of cases, but more often asymmetrical. When it is unilateral, it most often affects the dominant hand in 2/3 of cases [4] [5].

Its frequency seems to be increasing, especially as it is recognized as an occupational disease, accounting for 70% of all recognized occupational diseases in France. Musculocutaneous disorders are a major occupational health issue in France [4].

Electromyography is the paraclinical examination of choice for confirming the diagnosis.

The literature describes several types of treatment for carpal tunnel syndrome, including conservative treatment with anti-inflammatory drugs, splints and corticosteroid infiltration. Surgical treatment consists of sectioning the carpal anterior annular ligament using conventional or endoscopic methods.

The aim of this study was to determine the iatrogenic lesions encountered during carpal tunnel syndrome surgery at the Centre Hospitalier de Moulins-Yzeure in France, using an exhaustive sample.

## 2. Patients and Methods

### 2.1. Patients

This study retrospectively analyzed 1140 patients operated on between 2010 and 2020 for carpal tunnel syndrome in the orthopedic department of the Centre

Hospitalier Moulins-Yzeure in France, using both conventional and endoscopic techniques. The 10-year study period selected, from January 2010 to December 2020, is the one during which both surgical methods, conventional and endoscopic surgery, were performed at the same time. We reviewed the records of all patients operated on for carpal tunnel syndrome during our study period.

Data from the records of the patients consulted were collected according to a pre-established questionnaire in which the following parameters were collected:

- Epidemiological data: age, gender, facilitating factors and associated pathologies.
- Clinical data: uni- or bilateral disorders, dominant side, duration of symptoms at the time of consultation, typical or atypical nature of clinical manifestations, etiologies encountered, clinical examination data, notion of corticosteroid infiltration.
- Paraclinical data: EMG, other complementary examinations.
- Surgical aspects: type of anaesthesia used, use of pneumatic tourniquet, surgical technique used (arthroscopy or conventional surgery), iatrogenic intraoperative lesions (vascular, nerve or tendon lesions or sections), appearance of median nerve, presence or absence of inflammation, post-operative care, evolution and post-operative complications: wound infection, scar disunion, skin necrosis, oedema and haematoma, algodystrophy, recurrence, hypertrophic scar, fibrosis, persistence of symptoms or therapeutic failure.

The data collected underwent a quality control procedure to check the accuracy of observations and information, then were recorded in Excel and analyzed using SAS and Chi-square software.

Results were expressed as mean-standard deviation for quantitative variables and as a percentage for qualitative variables.

All patients had paresthesia, which was the main reason for consultation.

The aim of the study was to evaluate iatrogenic lesions per operatively, and the fate of patients after carpal tunnel syndrome surgery.

## **2.2. Methods**

### **Operating Technique**

The patient was positioned supine, with the affected upper limb resting on a table, and the pneumatic tourniquet on the arm inflated according to each patient's blood pressure. Disinfection and sterile draping were performed according to the operating protocol. The approach consisted of a 0.5 cm horizontal incision opposite the lower wrist crease for the endoscopic method, and a 2 cm vertical incision at the knob of the hand on the fourth radius for conventional surgery. Dissection of the subcutaneous tissue until the nerve was visualized, then section of the anterior carpal ring ligament, skin closure with 4/0 skin suture and drainage with Manovac.

### **2.3. Operative Follow-Up**

Most patients were treated on an outpatient basis, with 30 days off work.

## 2.4. Evaluation Methods

All patients were reviewed clinically by the operators with a minimum follow-up of 1 month. During the consultation, the condition of the wound, scar and the- nar amyotrophy was assessed, as well as the analysis of paresthesias.

## 3. Results

Among the 1140 patients, there were 230 men and 910 women, with a mean age of  $58.6 \pm 16.4$  years. Conventional surgery was used in 96% of cases. All patients had an electromyogram prior to surgery. Outpatient surgery was performed in 93% of cases. Patients who were hospitalized for one day had carpal tunnel syndrome associated with compression of the ulnar nerve in Guyon's canal, and both nerves were freed during the same operation under general anesthesia. 130 patients out of 1140 had compression of two median and ulnar nerves in the hand. Despite the large number of patients operated on, no iatrogenic lesions, notably nerve, vascular or tendon injuries, were recorded during the operation. Inflammatory fluid was found intraoperatively in 150 out of 1140 patients.

90 of the 1140 patients had initially undergone corticosteroid infiltration, which had failed, representing a rate of 7.89% (Table 1).

## 4. Discussion

In our series, the 46 - 55 age group had constituted the modal class representing approximately 22.8%. This is either included or similar to the predilection for the 40 - 70 age range found by DUDLEY *et al.* [4] and between 40 and 60 years found by PETIO *et al.* [3].

**Table 1.** Frequency of surgical lesions and other variables.

Parameters	Open surgery	Endoscopy	Total	
Patient frequency	1100 (96.49)	40 (3.5)	1140	
Tourniquet	1100 (100)	40 (100)	1140	
Electromyography	1100	40	1140	
Corticosteroid infiltration	80	10	90	
Appearance of median nerve	Well visible	Undifferentiated		
Inflammatory fluid	150	0	150	
Release of ulnar nerve	130	0	130	
Iatrogenic lesions	Vascular	0	0	
	Nervous	0	0	
	Tendinous	0	0	
Post-op stays	Outpatient	1020 (92.72)	40 (100)	1060 (93)
	Hospital 1j	80 (7.27)	0	80 (7.01)

**Table 2.** Results of postoperative evaluation of carpal tunnel syndrome.

Variable (n = 1140)	Frequency	%
Satisfactory	1079	94.64%
Scar fibrosis	10	0.87%
Hypertrophic scar	10	0.87%
Scar disunion	10	0.87%
Therapeutic failure	10	0.87%
Recurrence	11	0.96%

The mean age was  $58.6 \pm 16.4$  years, close to the mean age of 45 years, with extremes from 20 to 84 years found by PETER K [6]. This confirms the idea of certain authors who had described carpal tunnel syndrome as a common condition in the fifth decade. SEROR [7] carried out a study in subjects over 70 years of age and found a higher clinical severity and a novel atypical clinical presentation which is exclusive diurnal paresthesia.

The satisfaction rate in our series was 94% at 1-month follow-up and 97% at 2-year follow-up, well above the 86% reported as good results with an average follow-up of 5.5 years by HAUPT [8] (Table 2).

In our series, despite the large number of patients operated on by several surgeons using two different surgical techniques or methods, we did not observe any iatrogenic nerve, vascular or tendon damage intraoperatively, but rather inflammation, with inflammatory fluid in 13% of cases. Postoperatively, we observed a few cases of scar disunion, hypertrophic and fibrosed scars, but at low rates: For Agee [9], 1 lesion of the deep branch of the ulnar nerve, 2 flexor tendon subluxations and 2 healing problems were observed. For Jacobsen [10], one patient had a prolonged discharge from the scar, which healed at the two-week assessment. Erdmann [11] observed transection of the cutaneous palmar nerve and wound infection leading to hypertrophic scarring. Dumontier [12] observed, as in the endoscopy group, 2 possible algodystrophies that regressed without sequelae. Two patients experienced paresthesia of the 3rd space at 2 weeks, which subsequently disappeared (versus 6 in the endoscopic surgery group). For Sennwald [13], painful hypertrophic scarring and serious algodystrophy were observed.

The incidence of recurrence of carpal tunnel syndrome observed in our series corroborates the findings of some authors described in the literature, who had concluded that recurrence of carpal tunnel syndrome was present although very low [14].

## 5. Conclusion

The iatrogenic intraoperative complications associated with the surgical management of carpal tunnel syndrome, in particular the nerve, vascular and tendon injuries described in the literature, are rare and can be avoided by careful sur-

gery. The fluid and inflammatory nature of the median nerve may be noted during its surgical decompression in the carpal tunnel, but no therapeutic attitude is envisaged. Infiltration is not an absolute preoperative treatment. Regardless of the surgical technique used, recurrence may occur, but at a low rate.

### Study Limits

We did not select all the patients operated on for carpal tunnel syndrome in this health establishment, as the period of our study was 10 years.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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