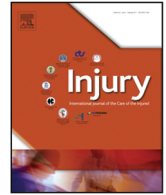




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## Does routine carpal tunnel release during fixation of distal radius fractures improve outcomes?

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### KEY WORDS

Carpal tunnel syndrome  
Carpal tunnel release  
Not carpal tunnel release  
Distal radius fractures  
ORIF

### ABSTRACT

**Objective:** This case–control study was designed to test the hypothesis whether carpal tunnel release (CTR) during fixation of distal radius 23–C2 AO fractures improves outcomes.

**Methods:** Thirty-five consecutive patients who sustained distal radius fractures of the dominant hand participated in this study. Patients were allocated into two groups: (a) The ORIF + CTR (16 patients (11 males and 5 females)); (b) the ORIF and NOT CTR 19 patients (12 males and 7 females). Patient assessment included visual analogic scale of pain (VAS), the subjective Mayo Wrist Score (MWS), electromyograms (EMG) at 3 month and 6 months from the day of injury and complications. All patients had the same physiotherapy treatment algorithm following surgery. Patient follow up took place at 1 month, 3, 6, and 12 months.

**Results:** At the T12 month follow up point the VAS average was 0.8 (range 0–3) in ORIF + CTR group compared to 1.2 (range 0–3) in the ORIF and NOT CTR. The MWS average was 98.7 (range 95–100) in ORIF + CTR group versus 97.6 (range 95–100) in ORIF no CTR group. There was no statistical significance ( $p > 0.5$ ) between the two groups during the follow up period. Patients in the sixth month of ORIF + CTR had no suffering of the median nerve, while 31.58% of patients in ORIF and no CTR found to have carpal tunnel syndrome.

**Conclusions:** Routine release of the transverse carpal ligament at the time of fracture fixation may reduce the incidence of postoperative median nerve dysfunction.

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### Introduction

Metaphyseal and intra articular distal radius fractures may cause symptomatic median nerve dysfunction through compression of the median nerve by volar displaced fragments, an increase in intracompartmental pressure secondary to post-traumatic edema, direct injury from fragment displacement causing contusion of the median nerve, hemorrhage, or a combination of any of these conditions [1]. The percentage of fracture fragment translation can be considered one of the most important risk factors for developing acute median nerve symptoms in patients with distal radius fractures and subsequent open reduction internal fixation (ORIF) [2]. The reported incidence of

median nerve neuropathy associated with distal radius fractures varies greatly in the literature ranging from 0.5% to 21% [1]. This case–control study was designed to test the hypothesis that patients who suffered 23–C2 AO fractures would have a better outcome with carpal tunnel release (CTR) during fracture fixation compare to patients that do not undergo CTR release.

### Materials and methods

This study was conducted from January 2010 to December 2014 at the Department of Orthopedics and Traumatology, Gaetano Rummo in Benevento, Italy. 35 consecutive patients who sustained distal radius fractures 23–C2 AO classification of the dominant wrist were invited to participate. Patients were divided in two groups: a group with ORIF and CTR at the time of surgery whereas the other Group of patients underwent ORIF without CTR (Table 1). The decision to decompress or not the carpal tunnel was taken by the surgeon. Fixation of the fractures in all patients was carried out with plates and wires utilizing

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**Table 1**  
Description of population.

Description of population	ORIF + CTR	ORIF NOT CTR
<b>Numbers of Patients</b>	<b>16</b>	<b>19</b>
<b>Average Age of Patients</b>	<b>30.4</b>	<b>28.3</b>
<b>Range of Age of Patient</b>	<b>18–55</b>	<b>18–55</b>
<b>Gender Ratio (M:F)</b>	<b>2.2 (11:5)</b>	<b>1.71(12:7)</b>
<b>Miscellaneous comorbidities: Numbers (%)</b>	Kidney: <b>1 (6.25%)</b> Diabetes: <b>2 (12.50%)</b> Thyroid: <b>1 (6.25%)</b>	Kidney: <b>0 (0%)</b> Diabetes: <b>2 (10.53%)</b> Thyroid: <b>2 (10.53%)</b>
<b>Upper Limb Tunnel Syndrome</b>	Guyon's canal syndrome: <b>1 (6.25%)</b> Cubital Tunnel syndrome: <b>2 (12.50%)</b> Radial Tunnel Syndrome: <b>0 (0%)</b>	Guyon's canal syndrome: <b>1 (5.26%)</b> Cubital Tunnel syndrome: <b>1 (5.26%)</b> Radial Tunnel Syndrome: <b>1 (5.26%)</b>
<b>Work of Population: Number (%)</b>	Agricultural Activity: <b>5 (31.25%)</b> Industrial Sector: <b>9 (56.25%)</b> Tertiary Industry: <b>2 (12.50%)</b>	Agricultural Activity: <b>6 (31.58%)</b> Industrial Sector: <b>10 (52.63%)</b> Tertiary Industry: <b>3 (15.79%)</b>
<b>Type of Accident: Number (%)</b>	Fall From Height: <b>4 (25%)</b> Car Accident: <b>3 (18.75%)</b> Motorbike Accident: <b>4 (25%)</b> Sport Accident: <b>2 (12.5%)</b> Agriculture Accident: <b>3 (18.75%)</b>	Fall From Height: <b>2 (10.53%)</b> Car Accident: <b>6 (31.58%)</b> Motorbike Accident: <b>5 (26.31%)</b> Sport Accident: <b>5 (26.31%)</b> Agriculture Accident: <b>1 (5.27%)</b>
<b>Type of Fractures According AO Classification: Number (%)</b>	<b>23-C2</b>	<b>23-C2</b>

the anterior Henry approach to the wrist. Following informed consent, patients were allocated to either one of the two groups and were treated according to the Helsinki Declaration of ethical standards.

The ORIF + CTR group was composed of 16 patients (11 males) while the ORIF NOT CTR group was composed of 19 patients (12 male), (Table 1).

The average patient age in ORIF + CTR group was 30.4 years (range 18–55) compared to 28.3 in ORIF NOT CTR group (range 18–55), (Table 1). Comorbidities in ORIF + CTR group included: renal failure  $n = 1$  (6.25%).

Diabetes  $n = 2$  (12.50%), Thyroid metabolism diseases  $n = 1$  (6.25%). Comorbidities in ORIF NOT CTR group included: renal failure  $n = 0$  (0%); Diabetes  $n = 2$  (10.53%); Thyroid metabolism diseases  $n = 2$  (10.53%).

In ORIF + CTR group clinical signs of peripheral nerve syndromes prior to trauma were: Guyon's canal syndrome  $n = 1$  (6.25%), Cubital Tunnel syndrome  $n = 2$  (12.50%), Radial Tunnel Syndrome  $n = 0$  (0%). In the ORIF NOT CTR group the following were noted: Guyon's canal syndrome  $n = 1$  (5.26%), Cubital Tunnel syndrome  $n = 1$  (5.26%), Radial Tunnel Syndrome  $n = 1$  (5.26%).

Before trauma, in ORIF + CTR group patients' occupations consisted of agricultural activity  $n = 5$  (31.25%), industrial sector  $n = 9$  (56.25%), and tertiary industry  $n = 2$  (12.50%), (Table 1). In the ORIF NOT CTR group patients' occupations consisted of agricultural activity  $n = 6$  (31.58%), industrial sector  $n = 10$  (52.63%), and tertiary industry  $n = 3$  (15.79%), (Table 1).

In the ORIF + CTR group mechanism of injury included fall from a height  $n = 4$  (25%); car accident  $n = 3$  (18.75%); motorbike accident  $n = 4$  (25%); sport accident  $n = 2$  (12.5%); agriculture accident  $n = 3$  (18.75%), (Table 1). In the ORIF NOT CTR group the following mechanism of accidents were documented: fall from height  $n = 2$  (10.53%); car accident  $n = 6$  (31.58%); motorbike accident  $n = 5$  (26.31%); sport accident  $n = 5$  (26.31%); agriculture accident  $n = 1$  (5.27%), (Table 1).

All patients had initially standard AP and lateral radiographs and CT scans with 3D reconstructions. None of the patients had sustained other associated injuries. All patients underwent closed manipulation initially to improve fracture position and application of a back slab. Surgery was carried out with regional block anesthesia.

After surgery all wrists were immobilized with a volar splint for about 3 weeks, and active and passive finger motion exercises were started on the second postoperative day. An early active motion of the wrist was undertaken from about the 3rd postoperative week. The criteria chosen for the evaluation between the two groups were: visual analogic scale of pain (VAS), the subjective Mayo Wrist Score (MWS),

Electromyograms (EMG) and perioperative and postoperative complications.

The follow-up visits in the outpatient clinic were carried out at 1 month, 3 months, 6 months, 12 months. EMG studies were performed at 3 and 6 months.

Patients were excluded if they had pre-existing symptoms of carpal tunnel syndrome (CTS) or Median nerve symptoms after the trauma and previous treatment with CTR. The exclusion Criteria included alcohol or drug abuse, Rheumatoid Arthritis, relevant hematological pathologies, corticosteroid use, previous upper limb surgery, osteoporosis, and an age below 18 years or over 55 years. Patients that did not adhere to the assigned protocol and the 6-month follow up were also excluded. Data were imported in an electronic spreadsheet for further processing.

### Statistical analysis

Descriptive statistics were used to summarize the characteristics of the study group and subgroups, including means and standard deviations of all continuous variables. The t test was used to compare continuous outcomes. The Chi-square test or Fisher (in subgroups smaller than 10 patients) exact test were used to compare Categorical variables. The statistical significance was defined as  $p < 0.05$ .

### Results

Operation details between the two groups in terms of average days from trauma to surgery, duration of surgery, length of cast immobilization, length of surgical scar, and time to union is shown in Table 2.

Table 3 demonstrates the trend of wrist pain assessed with VAS pain score during the 12 months of follow up between the two groups of patients. There was not statistical significance ( $p > 0.5$ ) between the two groups.

Before the trauma both group had excellent wrist's function measured with Mayo Wrist Score (MWS). At hospital admission the average MWS was 0 in both groups (Table 4). After surgery the average MWS was 15 in both groups (Table 4). At the First Month of follow up the average MWS was 3.4 (range 3–6) in ORIF + CTR group, while 3.4 (range 3–6) in ORIF NOT CTR (Table 4). The MWS score during the other follow up time points is shown in Table 4. There was not statistical significance ( $p > 0.5$ ) between the two groups during the follow up.

With regards to assessment of the median nerve function with electromyography, at the 3 months time point in the ORIF + CTR group

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