

## PHYSIOTHERAPY MANAGEMENT FOR CARPAL TUNNEL SYNDROME BILATERAL : A CASE STUDY

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### Abstract

**Introduction:** Carpal Tunnel Syndrome (CTS) is a disorder of the forearm due to compression of the median nerve in the carpal tunnel, either due to fascial edema in the carpal tunnel or due to abnormalities in the small bones in the palm. Carpal tunnel syndrome (CTS) is the most common upper extremity pressure neuropathy, with a prevalence of 3%-5% in the general population, and is 6% more common in women over 40 years of age. The objectives to be achieved in this study are to reduce the pain complained of by the patient, increase the strength of the muscles around the wrist and optimize the increase in daily functional activities in household work activities.

**Case Presentation:** Mrs. K is female, 47 years old, works as a housewife. Mrs. K complains of pain, numbness, tingling and discomfort in both right and left wrists until they radiate to the upper arm. Complaints become worse when buttoning clothes, opening bottles, washing clothes which activities involve movement of the fingers.

**Management and Outcome:** Patients do therapy twice a week for two weeks with physiotherapy programs of ultrasound therapy, stretching exercises, strengthening exercises, and manual therapy. Patients were evaluated using the Numerical Rating Scale (NRS) to measure pain, Manual Muscle Testing (MMT) to measure muscle strength, and the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) to measure functional ability.

**Discussion:** Ultrasound produces a warm effect that increases blood circulation and reduces pressure on the median nerve which can reduce pain. Strengthening Exercise by using Hand Exercise with Ball which is able to increase muscle strength, balance, and blood flow to the hand, wrist, and elbow. The manual therapy carried out is Median Nerve Mobilization and Nerve and Tendon Gliding which aims to reduce pressure on the median nerve at the wrist by returning the anatomical structure to its original position.

**Conclusion:** Physiotherapy programs for Bilateral Carpal Tunnel Syndrome patients using Ultrasound Therapy, Stretching Exercises, Strengthening Exercises and Manual Therapy interventions can reduce pain, increase muscle strength and improve functional abilities.

**Keyword:** Carpal Tunnel Syndrome, Physiotherapy Program, Exercise, Manual Therapy

## **Introduction**

*Carpal Tunnel Syndrome* (CTS) is a disorder of the forearm due to compression of the median nerve in the carpal tunnel, either due to fascial edema in the carpal tunnel or due to abnormalities in the small bones in the palm. Carpal tunnel syndrome (CTS) is the most common upper extremity pressure neuropathy, with a prevalence of 3%-5% in the general population, and 6% more often in women over 40 years of age (Dec & Zyluk, 2018). Pain is not a causative characteristic of CTS, although some patients describe paresthesia as pain rather than numbness or tingling (Duckworth et al., 2014). Symptoms can range from pain (especially at night) and paresthesia to the thenar eminence muscle atrophy. This syndrome is the most common nerve injury in the general population and poses a risk to workers requiring repetitive wrist movements (Ballester-Pérez et al., 2017).

Most cases of carpal tunnel syndrome are idiopathic. Symptoms of CTS have been estimated to be bilateral in up to 73% of cases, although they may not manifest simultaneously. Several factors are risk factors for CTS, such as pregnancy, overuse of hands or wrists, wrist trauma, obesity, hypothyroidism, kidney failure, diabetic, and inflammatory arthropathy (Middleton & Anakwe, 2014). Clinically, patients may present with complaints of hyperesthesia or paresthesia in the sensory distribution of the median nerve in the hand, and in severe cases there is usually weakness in the muscles innervated by the median nerve (Shem et al., 2020). Generally, conservative treatment is recommended for CTS in mild to moderate conditions, such as splinting and undergoing a physiotherapy program, namely by administering ultrasound (US) modalities and manual therapy (Talebi et al., 2018). Then based on a study (Horng et al., 2011) there is also an explanation that the modality that can be given for CTS cases is tendon and nerve gliding.

## **Case Presentation**

### **Subjective Examination**

Mrs. K is female, 47 years old, works as a housewife and is Muslim. Mrs. K complains of pain, numbness, tingling and discomfort in both right and left wrists until they radiate to the upper arm. Complaints become worse when buttoning clothes, opening bottles, washing clothes which activities involve movement of the fingers. This complaint has been felt since

2020, patients often traveling long distances with her husband in a long sitting position. Then after that the patient suddenly felt wrist pain on the right side. But at that time the action taken to reduce pain, namely massage by the patient's husband, was still ignored and had not been given physiotherapy. This is often done when the pain recurs. After that, gradually the wrist pain spread to the patient's left hand until 2022. Finally, on April 2, 2022 the patient did physiotherapy at the Wonosari Hospital.

The objectives to be achieved in this study are to reduce the pain complained of by the patient, increase the strength of the muscles around the wrist and optimize the increase in daily functional activities in household work activities.



### Physical Examination

The physical examination includes examination of vital signs, inspection, and palpation. The findings produced on examination of vital signs are normal on examination of blood pressure, pulse. Respiratory rate, temperature, height, and weight. Then on inspection, it was found that there was atrophy of the thenar muscles of both right and left hands, unable to perform left finger opposition movements, unable to grip perfectly, limited motion and pain when performing finger flexion and extension movements. From the results of palpation, it was found that there was a warm temperature in both the right and left palms, tenderness in the carpal bones.

Tabel 1. Vital Sign

<b>Blood pressure</b>	120/68 mmHg
<b>Pulse</b>	80 kali/menit
<b>Respiratory rate</b>	20 kali/menit
<b>Temperature</b>	36,5°C
<b>Height</b>	150 cm
<b>Weight</b>	48 kg

Basic movement examination was carried out by passive, active, and isometric examinations. On examination of passive and active motion, it was found that there was limited range of motion (LGS) in palmar flexion and dorsal flexion movements with marked pain in these movements. Then on isometric examination found pain and unable to resist resistance and tremors appear when moving against resistance.

Specific tests for the diagnosis of carpal tunnel syndrome are by performing a Tinel sign, Phalen's test, and compression test. Based on the results of the specific examination, positive results will be found in the form of a tingling sensation that radiates from the first, second, third, and partly to the fourth finger. In order to ensure the validity of the examination, it is necessary to know the value of the validity and reliability of some of these examinations. The study found that the sensitivity of the Phalant's examination was 68% with a specificity of 73%, Tinel's sign with a sensitivity of 50% with a specificity of 77% and a compression test with a sensitivity of 80% with a specificity of 92% (Duckworth et al., 2014).

Pain assessment using Numerical Rating Scale (NRS), muscle strength measurement using Manual Muscle Testing (MMT), sensory examination using graphthesia and tactile sensation. Then the examination of activity and functional ability using the Boston Questionnaire Carpal Tunnel Syndrome (BQCTS).

Pain measurement was carried out using the Numerical Rating Scale (NRS). This pain measurement instrument allows patients to self-assess the pain they are experiencing, namely with a pain classification consisting of a score of 0-10, where 0 is no pain and 10 is the worst pain.

Examination of muscle strength using Manual Muscle Testing (MMT) on most wrist muscle strength is normal with a value of 5, in flexors, extensors, adductors, thumb abduction values 4 which means the patient is able to resist light resistance.

Sensory examination of the patient was performed using a tactile examination which showed decreased sensation. This examination is carried out in a way that the patient is instructed to distinguish between coarse and fine, sharp and blunt. A graphesthetic examination can also show the patient has decreased sensation when the therapist tries to write a letter on the patient's palm.

The BCTSQ questionnaire is used to assess the general symptoms that appear in patients with CTS complaints by providing 11 questions. Questions such as pain felt at night related to quality and frequency, impaired sensation felt by the patient in certain areas, muscle weakness, difficulty in carrying out certain activities with the patient's hands. While the functional assessment is in the form of writing, buttoning clothes, closing bottles, etc.

### **Management and Outcome**

The physiotherapy program is carried out for the patient as long as the patient follows all therapy sessions at the hospital. This study was conducted for 4 sessions. The purpose of the intervention is to reduce pain complaints, increase sensory sensation in the patient, increase muscle strength, and improve the patient's functional ability. The table below describes the interventions and dosages performed.

Tabel 2. Intervention Plan

<b>Intervention</b>	<b>Dosage</b>
<b>Ultrasound Therapy</b>	F : 2x/week I : 3 MHz ultrasound, 1,0 W/cm <sup>2</sup> T : 5 menit
<b>Stretching Exercise</b>	F : 2x/week
- Wrist extension stretch	I : according to patient's
- Wrist flexion stretch	T : 3 sets of 8 reps, hold for 10 seconds while stretching

<b>Strengthening Exercise</b>	F : 2x/week
- Hand Exercise with ball	I : according to patient's T : 3 sets of 8 reps
<b>Manual Therapy</b>	F : 2x/week
- Median nerve mobilization	I : -
- Nerve and tendon gliding	T : 1 sets of 8 reps

## RESULTS

After carrying out a physiotherapy program at Wonosari Hospital for 2 weeks with 4 interventions, the measurement results obtained are: the results of measuring pain with NRS, results of measuring functional ability with BCTSQ, and results of measuring muscle strength with MMT.

Tabel 3 . Pain measurement results with Numerical Rating Scale (NRS)

	Right		Left	
	T1	T(end)	T1	T(end)
<b>Silent Pain</b>	3/10	2/10	3/10	2/10
<b>Motion Pain</b>	7/10	6/10	7/10	5/10
<b>Pressure Pain</b>	7/10	6/10	7/10	5/10

The results obtained on the pain scale measurement instrument with NRS from the first meeting to the last meeting were a decrease in pain in silent pain, tenderness, and motion pain.

Tabel 4. The results of measuring muscle strength with MMT

Muscle Region	Right		Left	
	T1	T(end)	T1	T(end)
<b>Palmar flexor</b>	3	4	3	4
<b>Dorsal flexor</b>	3	4	3	4
<b>Radial deviation</b>	3	4	3	4
<b>Ulnar deviation</b>	3	4	3	4
<b>MCP flexor</b>	3	3	3	3

<b>MCP extensor</b>	3	3	3	3
<b>Flexor thumb</b>	3	3	3	3
<b>Thumb extension</b>	3	3	3	3

Based on the results of the table measuring muscle strength with MMT, there was an increase in muscle strength from the first meeting of therapy to the fourth (last) meeting.

Tabel 5. Functional ability measurement results with BCTSQ

<b>BCTSQ</b>	<b>T1</b>	<b>T(end)</b>
<b>Symptom severity scale</b>	2,63	2,54
<b>Fuctional status scale</b>	3,57	3,28

Based on the results of measuring functional ability with the BCTSQ for four meetings, it was found that there was a decrease in the degree of pain and an increase in functional ability. Specifically, the degree of pain decreased when the hand or wrist was sore during the day. While the increase in functional ability in the activity of holding a book while reading and holding a telephone receiver.

## **Discussion**

The physiotherapy program carried out on patients with Bilateral Carpal Tunnel Syndrome complaints is to reduce pain, increase muscle strength and improve functional abilities. Interventions include Ultrasound Therapy, Stretching Exercises, Strengthening Exercises and Manual Therapy.

Ultrasound Therapy used during therapy uses an intensity of 1.0 W/cm<sup>2</sup> with a time of 5 minutes. Biological effects in the use of ultrasound can produce a warm effect so that there is an increase in blood circulation and will reduce pressure on the median nerve which can reduce pain (Zaraliev et al., 2020).

Strengthening Exercise by using hand exercise with ball can improve muscle strength, balance, and blood flow to the hand, wrist, and elbow. This exercise may have a positive

effect on CTS by facilitating venous return or edema of the median nerve by stretching and lengthening the restrictive flexor muscles "closing" the hand and strengthening and shortening the extensor muscle by "opening" the hand, the carpal tunnel can return to its normal size. In addition, it can reduce adhesions to the tendon and median nerve and prevent friction (Unver & Akyolcu, 2018).

Manual therapy that is used is median nerve mobilization and nerve and tendon gliding which is done 1 set and held for 8 counts. This exercise aims to reduce pressure on the median nerve at the wrist by returning the anatomical structure to its original position (Hornig et al., 2011).

Nerve gliding exercise aims to increase axonal and vascular supply to the vasa nervorum. The pain that appears in cases of CTS is usually due to compression of the median nerve. One of the most influential movements is when the hand is in a fist position because the fist position pushes the superficial flexor digitorum tendon and the flexor digitorum profundus tendon, thereby reducing compression on the median nerve (Sim et al., 2019).

Tendon gliding exercise is an intervention used to prevent adhesions on the tendons. The movement in this exercise will distribute the maximum compression point on the median nerve in the carpal canal, thereby reducing adhesions in the carpal tunnel, reducing tenosynovial oedema, increasing venous return from the nerve, and reducing pressure in the carpal tunnel (Atya Mohamed, 2011).

Nerve mobilization can facilitate movement between neural structures and their surroundings through manual techniques or exercise. Research shows that nerve mobilization can produce a mechanical effect in stretching the nerve, resulting in increased blood flow to the radial artery, reducing swelling of the nerve, and reducing thermal and mechanical hyperalgesia, increasing the immune response and restoring nerve function (Basson et al., 2017).

## **Conclusion**

Physiotherapy programs for Bilateral Carpal Tunnel Syndrome patients using Ultrasound Therapy, Stretching Exercises, Strengthening Exercises and Manual Therapy interventions can reduce pain, increase muscle strength and improve functional abilities.



## Acknowledgments

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