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Management physiotherapy for cervical root syndrome with ultrasound, nerve mobilization and exercise: a case report

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ABSTRACT

Cervical Root Syndrome (CRS) is an abnormal condition caused by irritation or compensation of the cervical nerve roots, which can occur due to trauma. Arthritis, or compression of the intervertebral discs in the neck area. This research is to determine the benefits of providing ultrasound (US) modalities, nerve mobilization, isometric exercises, and stretching in CRS cases. The measurements used are pain measurement using the Numerical Rating Scale (NRS), Range of Motion (ROM) measurement using a goniometer, muscle strength measurement using Manual Muscle Testing (MMT), and functional activity measurement using the Neck Disability Index (NDI). The research was carried out directly on a patient with CRS condition by administering therapy in three meetings with physiotherapy intervention. After 3 therapy meetings carried out by the physiotherapy program for Cervical Root Syndrome with physiotherapy modalities in the form of US, nerve mobilization, isometric exercises and stretching, significant changes were seen in reducing pain, increasing joint range of motion, muscle strength and functional ability.

1. Introduction

Neck pain is on of the most common complaints in society [1]. The causes of neck pain are diverse and involve various related risk factors. Several jobs such as office workers in

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several studies have been found to have an incidence of neck pain [2]. Various terms are used for neck pain, one of which is Cervical Root Syndrome (CRS).

Cervical Root Syndrome is an abnormal condition caused by irritation or compensation of the cervical nerve roots, which can occur due to trauma. Arthritis, or compression of the intervertebral discs in the neck area [3]. Symptoms experienced by CRS sufferers result in complaints of CRS, namely muscle tension, pain radiating to the arms and tingling, numbness in the hands and limited range of motion in the joints which causes a decrease in the patient's functional activity [4].

According to Health & Medicine (2016), the reported prevalence of CRS is 64/100,000 women and 107/100,000 men, occurring in people aged 50 to 54 years. In Indonesia, every year around 16.6% of the adult population complains of discomfort in the neck which then develops into severe neck pain [5].

Physiotherapy has a role in treating CRS which aims to reduce pain, muscle tension, increase joint range of motion and functional ability. Physiotherapy has intervention modalities that aim to reduce the problems experienced by patients with CRS cases such as Ultrasound, nerve mobilization, isometric exercise, stretching.

Ultrasound (US) is an invasive physiotherapy modality that is often used in soft tissue lesions. US is used in the form of acoustic compression waves to induce physiological changes in targeted tissues through thermal and mechanical effects [6]. The mechanical effects of US cause biochemical changes that stimulate tissue repair. Thermal physiological changes include local increases in tissue temperature, accelerated blood flow and increased muscle elasticity. Previous research has revealed that US can reduce muscle stiffness and increase joint range of motion [7]. However, the application of US for CRS has not been widely studied. In research conducted by Reda & Eman in 2016, the effectiveness of US together with stretching was greater in increasing the range of motion of joints, as well as reducing neck pain compared to US followed by stretching [8].

Nerve mobilization can affect axoplasmic flow, movement of nerves and their connective tissue and nerve circulation through changes in pressure in the nervous system and the spread of intraneural edema. Nerve mobilization is used to assess increased mechanical sensitivity of the nervous system and to restore changes in homeostasis in and around the nervous system using movement or palpation [9]. Many studies have been conducted to treat CRS. However, most of these studies do not provide clear conclusions regarding appropriate and effective treatment options in treating this pathology. Research conducted by Rafiq et al in 2022 showed that the addition of nerve mobilization accompanied by isometric exercises in cases of cervical radiculopathy was effective because pain could be reduced more quickly than isometric exercises alone [10].

Stretching in CRS cases is carried out on the upper trapezius, anterior/middle/posterior scalenes, levator scapula, interspinous, pectoralis major and pectoralis minor muscles which are effective in increasing extension, right rotation and lateral flexion of the cervical A-ROM. Stretching the muscles suppresses the excitability of monosynaptic spinal reflexes which causes an increase in muscle tissue extensibility [11].

This research using the case report method aims to determine the effectiveness of providing ultrasound, nerve mobilization, isometric exercises and stretching in Cervical Root Syndrome patients.

2. Method

This research uses the case report method (case study) which was carried out at RSJ Prof. Dr. Soerojo Magelang in September 2024. Respondents to this research were patients Mrs. U is 46 years old with a diagnosis of Cervical Root Syndrome. The patient is a cashier employee. The patient came with complaints of pain in the back of the neck extending to the fingers of the right hand, a prickling sensation and the fingers felt weak when grasping or picking up objects. The pain has been felt since 3 months ago. The patient has been checked into Soerojo Magelang Hospital in August 2024 and an x-ray was carried out and it was found that there was a clamped nerve in the cervical C5-C7.

The patient has had physiotherapy 3 meetings with administration. In this study, intervention was given to patients with ultrasound to reduce muscle tension in m. upper trapezius for 5 minutes, stretching with the patient sitting position then stretching the muscles with movement towards flexion then lateral side extension, feeling until there is a sensation of stretching the muscles, nerve mobilization with the patient sitting position and mobilizing the median nerve, isometric exercises are given with the patient sitting position by providing resistance to the flexors and cervical extensors.

The outcome of this study was to evaluate the degree of pain using the Numeric Rating Scale (NRS) with a reliability value of (ICC = 0.67; [0.27 to 0.84]. Meanwhile, the validity value of the NRS in chronic pain ranges from 0.86 to 0.95 [12]. Measurement of the range of motion of the cervical joints using a goniometer with a reliability value of ICC in sessions (ICC 2.1 = 0.83 to 0.98) and between sessions (ICC = 0.79 to 0.97) [13]. Measurement of muscle strength using Manual Muscle Testing (MMT) with a value of 0 (no contraction or muscle tone at all), a value of 1 (there is contraction but no movement at all), a value of 2 (able to make movements but not yet able to fight gravity), a value of 3 (able to move fully with LGS and against gravity but able to resist minimal resistance), value 4 (able to move fully against gravity and against moderate resistance), value 5 (able against gravity and able to resist maximum resistance). Cervical functional ability is measured using the Neck Disability Index (NDI) with score interpretation, namely 0-20% (mild), 20-40% (moderate), 40-60% (severe), 60-80% (paralyzed), 80-100% (~). The reliability value of NDI is ICC = 0.88; [0.63 to 0.95] [12].

3. Results and Discussion

Case report study, physiotherapy provided interventions to patients in the form of ultrasound, nerve mobilization, isometric exercises and stretching during 3 physiotherapy sessions (D0-D2). Based on the results of the evaluation conducted, the following results were obtained :

3.1. Evaluate pain using the Numeric Rating Scale (NRS)

Table 1. Pain with NRS

Pain	D0	D1	D2	D3

Rest pain	3	3	3	2
Tenderness (m.upper trapezius)	3	3	3	2
Movement pain (flexi, rotation, lateral flexi cervical dextra)	5	5	4	2

There was a decrease in pain from D0-D2. At D0 there were 3 rest pain, 3 tenderness, and 2 movement pain. D2 had 2 rest pain, 2 tenderness, 2 movement pain.

3.2. Evaluation of joint range of motion using a Goniometer

Table 2. ROM with goniometer

Cervical Movement	D0	D1	D2	D3
Flexion	S 0°-30°	S 0°-30°	S 0°-35°	S 0°-35°
Extention	S 0°-45°	S 0°-45°	S 0°-45°	S 0°-45°
Lateral flexi dextra	F 0°-40°	F 0°-40°	F 0°-40°	F 0°-40°
Lateral flexi sinistra	F 0°-45°	F 0°-45°	F 0°-45°	F 0°-45°
Rotation dextra	R 0°-45°	R 0°-45°	R 0°-50°	R 0°-50°
Rotation sinistra	R 0°-55°	R 0°-55°	R 0°-55°	R 0°-55°

Based on the evaluation of three meetings by measuring the cervical region movement, namely during flexion, extension, lateral flexion right and left, rotation right and left. In this measurement there is an increase in the range of motion of the cervical joints during flexion D0 0 ° -30 ° , and the last meeting D3 0 ° -35 °. At the time of rotation right D0 0 ° -45 ° , and the final meeting reaches D3 0 ° -55 °.

3.3. Evaluation of muscle strength with MMT

Table 3. Muscle strength with MMT

Region	Muscle group	D0	D1	D2	D3
Cervical	Flexor	3	3	4	5
	Extensor	4	4	4	4
	Lateral flexion right	4	4	4	4
	Left lateral flexion	5	5	5	5
	Dextra rotation	3	3	4	5
	Left rotation	5	5	5	5

In measuring muscle strength in the cervical region, the first meeting with the flexor and right rotation muscle groups obtained a value of 3, which means being able to move with minimal resistance, while the last meeting obtained a value of 5, which means being able to move fully against gravity with maximum resistance.

3.4. Evaluation of functional activity with Neck Disability Index (NDI)

Table 4. Functional Activities with NDI

NO	PART	D0	D1	D2	D3
1	Pain Levels	1	1	1	1
2	Self Care	2	2	2	2
3	Lifting Activities	3	3	3	1
4	Reading Activities	0	0	0	0
5	Headache	1	1	1	1
6	Concentration	1	1	1	1
7	Work Activities	1	1	1	1
8	Driving	2	2	1	1
9	Sleep	0	0	0	0
10	Recreation/Sports	1	1	1	1
	Amount	**12**	**12**	**11**	**8**
	Total score	**26%**	**26%**	**22%**	**18%**

Measurement of functional activity ability using the Neck Disability Index (NDI) obtained a score at the first meeting of 26% (moderate), and at the last meeting the result was 18% (mild).

Physiotherapy programs performed in cases of Cervical Root Syndrome (CRS) aim to reduce pain, increase range of motion, reduce muscle tension, and improve daily functional abilities. Interventions provided include US, nerve mobilization, isometric exercises, and stretching.

Figure 1. Pain evaluation

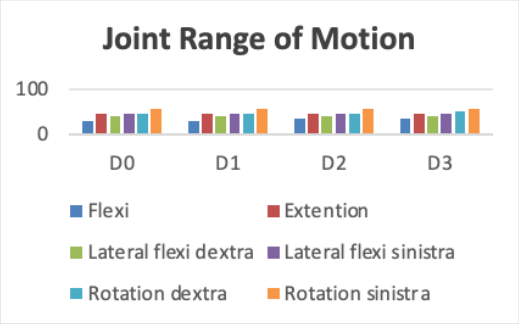

Figure 2. ROM evaluation

In Figure 1, silent pain, tenderness shows results at D0 to D2 and motion pain at D0 to D1, there has been no change in pain reduction. Then silent and pressing pain at D2 to D3 there is a decrease in silent and pressing pain from 3 to 2. Motion pain also experienced a decrease in pain at D1 to D3 from 5 to 2. The decrease in pain is not too significant because it is influenced by the nerve roots in the cervical which are still under pressure. In Figure 2, ROM shows D0 to D1 in flexion and right rotation movements , there has been no increase in the degree of ROM because there is still pain, especially during movement, at D2 to D3 there is an increase ROM where motion pain decreases so that it can affect the increase in ROM. The decrease in the degree of pain and the increase in the range of joint motion are influenced by Ultrasound (US) [7]. In a study by Reda & Eman in 2016, it was stated that US combined with physiotherapy can have a positive effect on pain intensity. Furthermore, the application of US before or during stretching reduces pain, increases LGS and functional activity. However, greater improvements were obtained when US was performed simultaneously with stretching [8]. This is because it can trigger physiological changes in the targeted tissue through mechanical and thermal effects. US provides mechanical effects that cause biochemical changes that stimulate tissue changes. Thermal physiological changes include local increases in tissue temperature, acceleration of blood flow and increased muscle elasticity where the range of motion of the joints can increase due to these effects [14].

Stretching of the muscle suppresses the monosynaptic spinal reflex excitability leading to increased muscle tissue extensibility. Passive stretching has been shown to reduce muscle pain and stiffness [15]. The mechanism behind the pain-reducing effects of stretching is thought to be reduced firing of neurons with inhibitory caner (GTO). Acute changes in the tension-length relationship in muscle tissue lead to greater flexibility, influenced by individual stretching tolerance and possibly changes in muscle viscoelasticity [16].

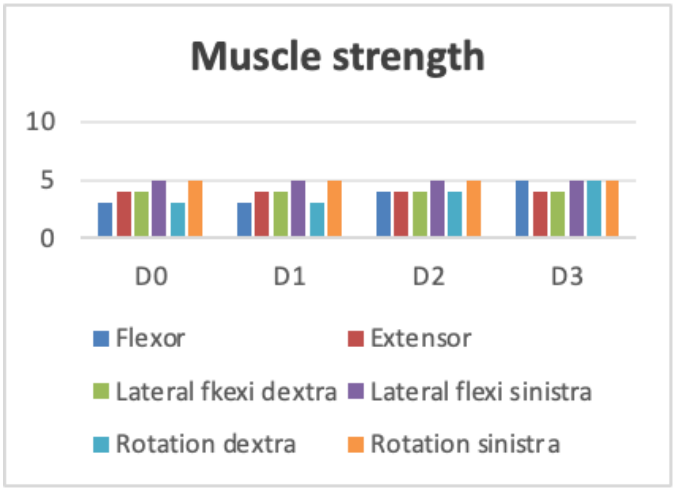

Figure 3. Muscle strength evaluation

In Figure 3, muscle strength shows D0 to D1 in the flexion and rotation muscle groups, there has been no increase in muscle strength. This is influenced by ROM, where at D0-D1 there has been no increase in ROM flexion or rotation movements, so there has been no increase in muscle strength in the flexors or rotation. At D1-D2, there is an increase in muscle strength, this is also influenced by an increase in LGS in flexion and rotation. Providing intervention with nerve mobilization combined with isometric exercises can also affect increased muscle strength. A study according to Basson et al in 2020, showed that nerve mobilization combined with isometric exercises in CRS cases is effective because pain decreases more quickly and muscle strength increases [17]. Providing nerve mobilization will provide a nerve mobilization technique that can significantly increase the flow of axoplasm in and around the myelin sheath, with increased axoplasmic can reduce sensory and motor deficits in the involved limbs so that there will be a decrease in symptoms such as pain, tingling, and muscle tension [9]. Isometric exercises are good for patients who are unable to tolerate repetitive joint movements, for example painful and inflamed joints. This causes isometric exercises to be able to reduce the pain scale in patients with Cervical Root Syndrome [18]. In addition, isometric exercises can gain strength in muscles without any changes. Isometric exercises can trigger reactions in the Golgi tendons of people in the muscles. Afferent nerve impulses from the Golgi tendons enter the dorsal spinal cord and meet the inhibitory efferent motor neurons and cause muscle relaxation. When the muscles are relaxed, the muscles can be stretched maximally so that they can increase the range of motion of the joints in the neck [19].

4. Conclusion

Cervical Root Syndrome (CRS) is a condition caused by irritation or compression of the cervical nerve roots, which can occur due to trauma, arthritis, or disc compression in the neck. This study evaluated the benefits of ultrasound (US), *nerve mobilization*, isometric exercises, and stretching in CRS patients by measuring NRS, ROM, MMT, and NDI during three therapy sessions. The results showed that muscle strength began to increase at D1–D2 along with an increase in ROM, while no changes were apparent from D0–D1. The combination of *nerve mobilization* and isometric exercises helped reduce pain, increase axoplasmic flow, relax muscles, and improve ROM. Overall, after three therapy sessions,

there was a significant reduction in pain and an increase in ROM, muscle strength, and neck function.

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