Indonesian Journal of Medicine (2021), 06(04): 399-411
Masters Program in Public Health, Universitas Sebelas Maret

Meta-Analysis

Meta Analysis the Effect of Acupunctur Therapy and Ultrasound Therapy to Reduce Pain Caused by Carpal Tunnel Syndrome

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ABSTRACT

Background: Carpal tunnel syndrome is a condition of health problems in the form of pain, numbness, and tingling that occurs in a person's hands. This sensation can be felt in the thumb, index finger, middle finger, and 1/2 ring finger on the radial side, this occurs when the median nerve that passes through the carpal tunnel at the wrist is compressed or compressed. This study aims to estimate the effect of acupuncture therapy and ultrasound therapy on reducing pain in carpal tunnel syndrome cases.
Subjects and Method: This was a systematic review and meta-analysis conducted using PRISMA flow diagrams. Article searches through journal databases include: PubMed, Science Direct, Scopus, Google Scholar, Springer Link, Hindawi, BMC. The PICOs of this study were, Population: carpal tunnel syndrome sufferers, Intervention: acupuncture therapy and ultrasound therapy, Comparison: no acupuncture and ultrasound therapy, Outcome: pain reduction. Using search keywords: ("acupuncture" OR "acupuncture therapy") AND ("carpal tunnel syndrome" OR "cts") AND ("ultrasound" OR "ultrasound therapy") AND ("randomized controlled trial") AND (" acupuncture for carpal tunnel syndrome") AND ("ultrasound for carpal tunnel syndrome"). Inclusion criteria were full paper articles with Randomized Controlled Trial (RCT) research method, the relationship measure used was Mean SD, the intervention given was acupuncture and ultrasound, study subjects were aged 18-85 years. Eligible articles were analyzed using the Revman 5.3 app.
Results: Meta-analysis of 16 articles showed acupuncture treatment outcome of -0.34 units compared with other interventions or no intervention (SMD -0.34; 95% CI= -0.83 to 0.16; p=0.180), I2=78%, and treatment outcome. ultrasound as much as -0.76 units compared with other interventions or no intervention, and statistically significant value (SMD -0.76; 95% CI= -1.37 to -0.16; p=0.001), I2= 92%.
Conclusion: Acupuncture therapy and ultrasound therapy have an effect on reducing pain in cases of carpal tunnel syndrome.

Keywords: Acupuncture, ultrasound, carpal tunnel syndrome

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Cite this as:
Noer A, Rahardjo SS, Prasetya H (2021). Meta Analysis the Effect of Acupunctur Therapy and Ultrasound Therapy to Reduce Pain Caused by Carpal Tunnel Syndrome. Indones J Med. 06(04): 399-411. https://doi.org/10.26911/theijmed.2021.06.04.06.

BACKGROUND

The wrist and fingers are formed by muscles, tendons, joints and nerves. The wrist and fingers have more complex functions than other parts of the body. Its functions include being a communicator, strong and sensitive sensory organs and having a wide range of motion. Thus problems with the wrist and fingers easily occur. One of the problems that

often occurs is carpal tunnel syndrome (CTS) (Genova et al., 2020).

Carpal tunnel syndrome is a condition of health problems in the form of pain, numbness, and tingling that occurs in a person's hands. This sensation can be felt in the thumb, index finger, middle finger, and 1/2 of the ring finger on the radial side, this occurs when the median nerve through the carpal tunnel at the wrist is compressed or compressed. Symptoms of carpal tunnel syndrome vary from patient to patient, thus they are classified into mild, moderate, and severe categories (Genova et al., 2020).

According to (Alhusain et al., 2019) people who perform repetitive activities and use their hands with sufficient force, the prevalence for the occurrence of carpal tunnel syndrome will be higher. Populations who work with repetitive hand maneuvers and use extra hand strength have a high risk. The prevalence of carpal tunnel syndrome in the general population ranges from 3% to 6%, the working population is more at risk of developing carpal tunnel syndrome than the population who does not have a job.

The results of a study revealed that 2/3 of the incidence of carpal tunnel syndrome was work-related, while 1/3 of the incidence of carpal tunnel syndrome was not work-related (Baker, 2017). Carpal tunnel syndrome is a pressure disorder neuropathy that accounts for about 90% of various other neuropathic disorders.

The incidence rate of carpal tunnel syndrome in the world reaches 12,267 people out of 100,000 population with an incidence of 9.2% in women and 6% in men (Sekarsari et al., 2017). According to the National Health Interview Survey (NHIS), the incidence of carpal tunnel syndrome in the adult population is 1.55% or 2.6 million people (Basuki et al., 2015). In Indonesia, in the East OKU area in South Sumatra, research on the incidence of carpal tunnel syndrome was carried out on 101 rubber farmers, from the sample there were 68 people or 67.3% who were positive for carpal tunnel syndrome (Selviyati et al., 2016).

Complaints of carpal tunnel syndrome can be overcome with pharmacological measures, including: analgesic drugs, non-steroidal anti-inflammatory drugs to steroid injections. However, if the condition is severe, surgery must be carried out on the area of the complaint. Acupuncture therapy can be used as a pain relief and healing therapy in cases of carpal tunnel syndrome (Ho et al., 2014).

Acupuncture therapy is one of the oldest medical therapies that has existed since 2,500 years BC. Various health problems can be managed with acupuncture including various cases of pain such as osteoarthritis, low back pain, wrist pain and even autoimmune. Based on research, acupuncture therapy has been proven to be safe and effective in the treatment of pain cases, where acupuncture is able to reduce or even eliminate pain in patients. Acupuncture therapy can reduce pain by stimulating acupuncture points in the body to deliver and expedite Qi (energy) and balance Yin Yang (Susilo et al., 2021).

The use of acupuncture as pain relief therapy has been carried out since 4,700 years ago, researchers found that acupuncture treatment was useful for pain relief due to carpal tunnel syndrome. WHO and the National Health Interview Studies (NHIS) state that acupuncture is useful as a treatment for various pain complaints from various diseases. These two organizations also revealed that acupuncture is not problematic when combined with other drugs as a pain reliever (Li et al., 2015).

A study conducted by (Hadianfard et al., 2015) in Shiraz, showed that carpal tunnel syndrome patients who were treated with acupuncture therapy experienced a greater improvement in reducing pain, numbness and tingling by more than 50%. And the frequency of patients waking up because of these complaints is much less. In addition to acupuncture therapy, treatment of carpal

tunnel syndrome can be done with the use of ultrasound therapy.

Ultrasound therapy was chosen because it can accelerate the healing process in damaged tissue with a heating effect that penetrates deeply, so that it can cause vasodilation of blood vessels followed by an increase in oxygen supply for repair of damaged tissue so that pain in the carpal can be reduced (Ono et al. al., 2011).

Based on the number of cases of carpal tunnel syndrome that occur and the need for appropriate intervention, the researchers are interested in studying the effect of acupuncture and ultrasound therapy on reducing pain in cases of carpal tunnel syndrome. The data obtained will be analyzed using meta-analysis by synthesizing the results of studies conducted to reduce bias.

SUBJECTS AND METHOD

1. Study Design

This study uses a systematic review and meta analysis study design. Using the PRISMA flow chart guidelines. Article searches were carried out using journal databases includeing: PubMed, Science Direct, Scopus, Google Scholar, Springer Link, Hindawi, BMC articles in the 2000-2021 vulnerable years using the search keywords: ("acupuncture" OR "acupuncture therapy") AND ("carpal tunnel syndrome" OR "cts") AND ("ultrasound" OR "ultrasound therapy") AND ("randomized controlled trial") AND ("acupuncture for carpal tunnel syndrome") AND ("ultrasound for carpal tunnel syndrome").

2. Inclusion Criteria

This study has inclusion criteria, including: Full paper article with a Randomized Controlled Trial (RCT) study design, articles published in Indonesian and English, the measure of the relationship used with Mean SD, the interventions given were acupuncture and ultrasound, research subjects aged 18-85 years and pain measurement using VAS.

3. Exclusion Criteria

This study has exclusion criteria, including: the article was published before 2000 and the article was published in addition to using Indonesian and English.

4. Variable Operational Definition

The formulation of the problem in this study was carried out by considering the eligibility criteria defined using the PICO, namely, Population: carpal tunnel syndrome sufferers, Intervention: acupuncture therapy and ultrasound therapy, Comparison: no acupuncture and ultrasound therapy, and Outcome: decreased pain levels.

Acupuncture is a therapy originating from China which is commonly called TCM (Traditional Chinese Medicine), acupuncture therapy is a treatment method by inserting needles at acupuncture points on the body to treat disease. Acupuncture is done by stimulating certain points on the body using various techniques, such as hand and/or electrical stimulation (Wijaya, 2013).

Ultrasound is one of the therapeutic modalities of physiotherapy that uses sound waves with mechanical vibrations to produce longitudinal waves that travel through a certain medium with varying or different frequencies. From this understanding, ultrasound is a treatment using vibrations from sound waves that have a frequency of more than 20,000 Hz (Purnomo, 2017).

Pain is a multidimensional sensory experience, which is associated with actual and potential tissue damage or described in terms of tissue damage. This phenomenon can differ in intensity (mild, moderate, severe), quality (blunt, burning, sharp), duration (transient, intermittent, persistent), and spread (superficial or deep, localized or diffuse).

5. Instrument

The instrument in this study used the Visual Analog Scale (VAS) as a pain gauge in carpal tunnel syndrome.

6. Data Analysis

Data analysis in this study used the Review Manager application (RevMan 5.3). Data

were analyzed based on variations between studies by determining the use of random effects analysis models. In this study, I^2 was used to quantify the dispersion. The results of data analysis are in the form of the effect size value of the heterogeneity of the study which later results from the data that has been analyzed and interpreted in the form of forest plots and funnel plots.

RESULTS

Research from a primary study related to the effect of acupuncture therapy and ultrasound therapy on pain in carpal tunnel syndrome cases contained 16 articles with a total sample of 946 participants, 475 participants for intervention and 471 participants as comparison. Articles were obtained from 3 continents, namely, 9 studies came from the Asian continent, 6 studies came from the European continent and 1 research came from the Americas. Each study had a sample of less than 100 participants. The outcome for some articles is that there is a decrease in the level of carpal tunnel syndrome pain after being given the intervention of acupuncture therapy and ultrasound therapy. The search for articles was carried out using a database based on the PRISMA flow diagram, which can be seen in Figure 1. The study quality assessment was carried out qualitatively and quantitatively. Assessment of research quality using the Critical Appraisal Skills Program (CASP) can be seen in Table 1. Each of the 11 questions was answered with the answer choices: Yes, No and Unclear. After assessing the quality of the study, 16 articles that were included in the quantitative synthesis process of the meta-analysis were analyzed using RevMan 5.3.

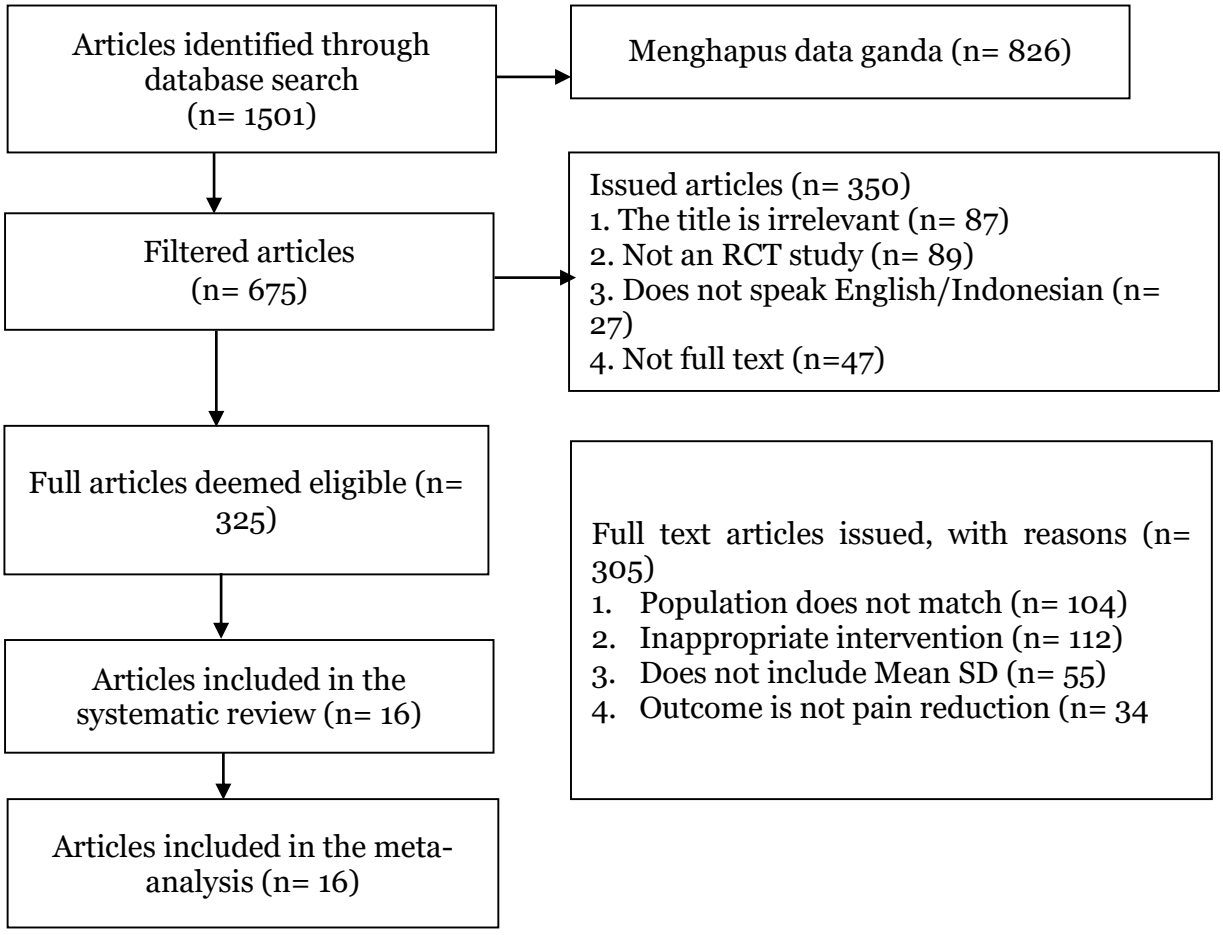

Figure 1. PRISMA flow diagram

Table 1. Assessment of Research Quality The Effect of Acupuncture on Carpal Tunnel Syndrome Pain

No.	Question	Chi Wen et al., (2019)	Yang et al., (2009)	Hadianfard et al., (2014)	Kumnerddee et al., (2015)	Salehi et al., (2019)
		Score	Score	Score	Score	Score
1.	Does the experiment answer the clinical problem clearly?	1	1	1	1	1
2.	Was the intervention given to the patient randomized?	1	1	1	1	0
3.	Are there blinding of patients, health workers, and researchers?	1	1	1	1	1
4.	Were the study groups similar at the start of the study?	1	1	1	1	1
5.	Outside of the intervention under study, were the study groups treated equally?	1	1	1	1	1
6.	Were all patients included in the study properly accounted for in the conclusions? were all patients analyzed according to the randomized study groups?	1	1	1	1	1
7.	Is the effect of the intervention large enough?	1	0	0	1	1
8.	How precise is the estimation of the effect of the intervention?	1	1	1	1	0
9.	Are the results applicable to the context of practice or local populations?	1	1	0	1	1
10.	Are all other clinically important outcomes considered in this article?	0	1	1	0	1
11.	Do the benefits provided by the intervention outweigh the costs and disadvantages?	1	1	1	1	0

Table 2. Research Quality Assessment of the Effect of Ultrasound on Carpal Tunnel Syndrome Pain

No.	Question	Jothi *et al.*, (2019)	Schrier *et al.*, (2020)	Chang *et al.*, (2014)	Bakhtiary *et al.*, (2004)	Armagan *et al.*, (2014)	Chen *et al.*, (2015)	Fuente *et al.*, (2021)	Catalbas *et al.*, (2018)	Bartkowiak *et al.*, (2019)	Dincer *et al.*, (2019)	Saeed *et al.*, (2012)
		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
1.	Does the experiment answer the clinical problem clearly?	1	1	1	1	1	1	1	1	1	1	1
2.	Was the intervention given to the patient randomized?	1	1	1	1	1	1	1	1	1	1	0
3.	Are there blinding of patients, health workers, and researchers?	1	1	1	1	1	1	1	1	0	1	1
4.	Were the study groups similar at the start of the study?	1	1	1	1	1	1	1	1	1	0	1

5.	Outside of the intervention under study, were the study groups treated equally?	0	0	1	1	1	1	0	1	1	1	1
6.	Were all patients included in the study properly accounted for in the conclusions? were all patients analyzed according to the randomized study groups?	1	1	1	1	1	1	1	1	1	1	1
7.	Is the effect of the intervention large enough?	1	0	1	1	1	1	1	1	1	1	1
8.	How precise is the estimation of the effect of the intervention?	1	1	1	1	1	1	1	1	1	1	1
9.	Are the results applicable to the context of practice or local populations?	1	1	1	1	1	1	1	1	0	1	1
10.	Are all other clinically important outcomes considered in this article?	0	1	1	1	1	1	1	1	1	0	0
11.	Do the benefits provided by the intervention outweigh the costs and disadvantages?	1	1	1	0	1	1	1	1	1	1	1

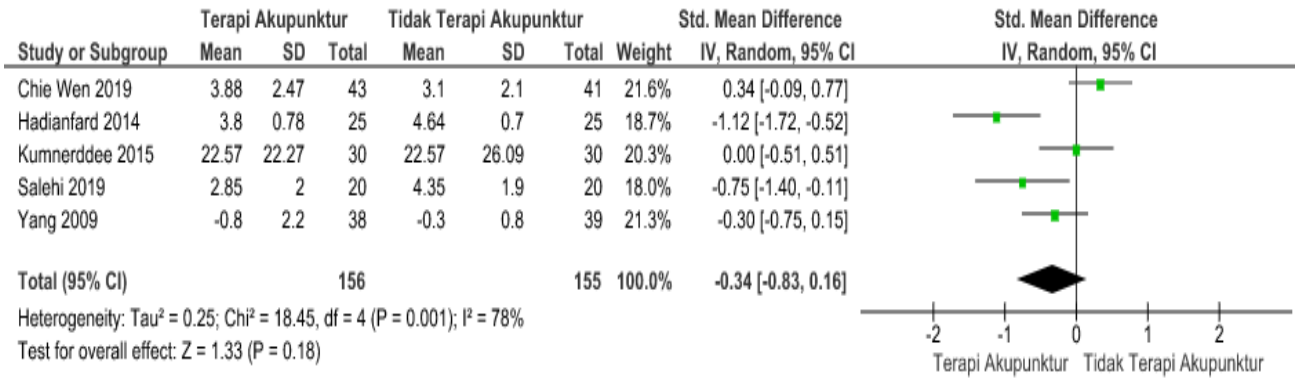

Figure 2. Forest plot of Acupuncture Therapy

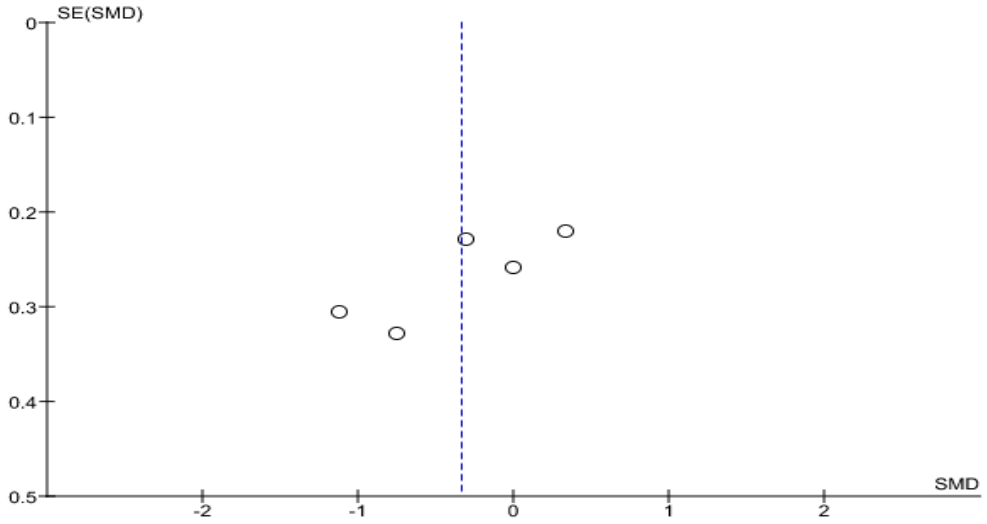

Figure 3. Funnel plot of Acupuncture Therapy

1. Effect of Acupuncture on Carpal Tunnel Syndrome Pain

a. Forest plot of acupuncture on carpal tunnel syndrome pain

Interpretation of the results of the meta-analysis process can be seen through the forest plot. Figure 2 shows as many as 5 articles of acupuncture can reduce carpal tunnel syndrome pain compared to other intervenetions or no intervention. Meanwhile, there was high heterogeneity between experiments (I2=78%; p=0.001). Thus, the Random Effect Model (REM) was used to analyze the data in the forest plot. The results of the analysis of the acupuncture intervention found that -0.34 times the effect of reducing carpal tunnel syndrome pain compared to other interventions or no intervention, but statistically not significant (SMD -0.34; 95% CI = -0.83 to 0.16; p = 0.180) .

b. Funnel plot of acupuncture against carpal tunnel syndrome pain

A funnel plot is a plot that represents the approximate size of the effect of each study on its estimated accuracy, which is usually the standard error. Figure 3. funnel plot acupuncture therapy for carpal tunnel syndrome pain, the results showed that there was no publication bias because the distance between the right and left plots was the same.

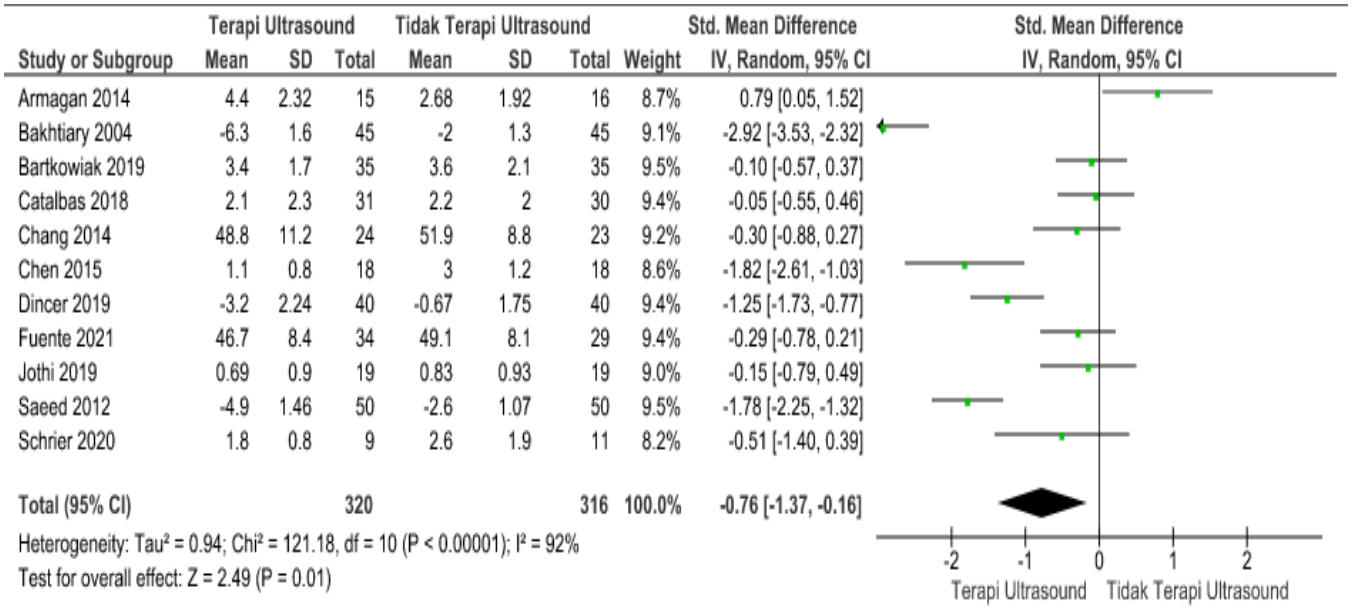

Figure 4. Forest plot of Ultrasound Therapy

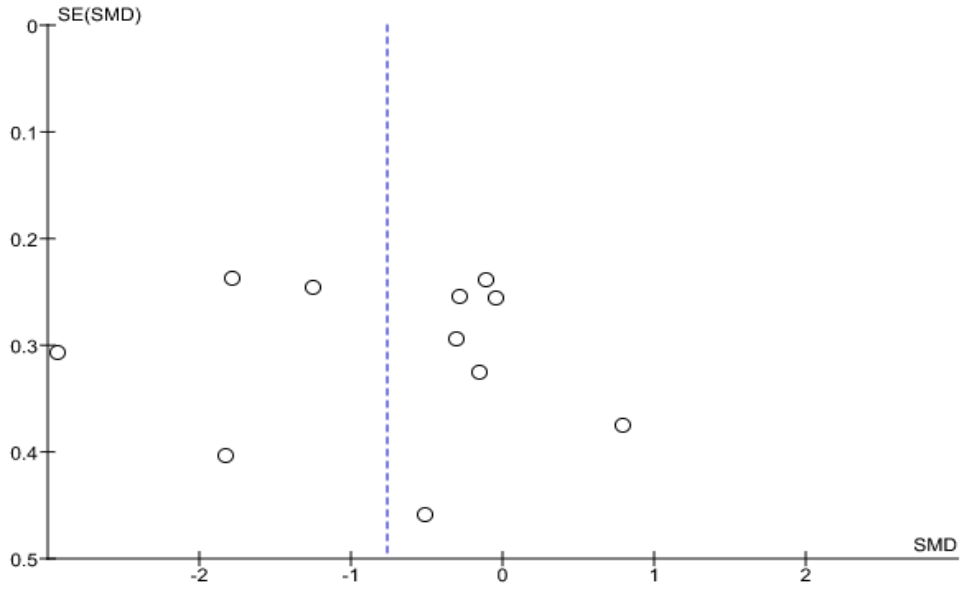

Figure 5. Funnel plot of Ultrasound Therapy

2. Effect of ultrasound on carpal tunnel syndrome pain

a. Forest plot ultrasound against carpal tunnel syndrome pain

Interpretation of the results of the meta-analysis process can be seen through the forest plot. Figure 4 shows as many as 11 articles reporting that ultrasound therapy can reduce carpal tunnel syndrome pain compared to other interventions or no intervention. Meanwhile, there was high heterogeneity between experiments (I2= 92%; p<0.001).

Thus, the Random Effect Model (REM) was used to analyze the data in the forest plot. The results of the analysis of the intervention of ultrasound therapy were found that -0.76 times had an effect on reducing carpal tunnel syndrome pain compared to other interventions or no intervention, and the results were statistically significant (SMD -0.76; 95% CI= -1.37 to -0.16; p= 0.001).

b. Funnel Plot Ultrasound for carpal tunnel syndrome pain

Figure 5. Ultrasound funnel plot on reducing carpal tunnel syndrome pain, shows that there is an underestimate of publication bias which is indicated by the asymmetry of the right and left plots, where in the right plot there are 7 plots and the left plot there are 4 plots.

DISCUSSION

Pain is a condition in the form of unpleasant feelings that are very subjective because each person feels pain in terms of its scale or level, and only that person can explain or evaluate the pain he experiences (Wilson, 2014).

The tingling pain in carpal tunnel syndrome is caused by entrapment of the median nerve in the carpal tunnel area, which is bounded by the carpal bones as well as the transverse carpal ligament. In the carpal tunnel area there is an increase in pressure so that there is a decrease in the function of the median nerve at that level. Sensory symptoms such as pain that are not treated immediately will result in impaired motor function (Adhani et al., 2021).

Management of carpal tunnel syndrome can be categorized into two, namely pharmacological and non-pharmacological. Pharmacological management is usually performed in patients who have multiple syndromes or severe symptoms of carpal tunnel syndrome, have constant symptoms, severe sensory disturbances and/or motor weakness in the hands.

Non-pharmacological management is usually carried out in patients with mild to moderate symptoms. Non-pharmacological management itself has a variety of interventions such as using wrist aids, electrotherapy modalities and/or manual therapy that incorporates neurodynamic techniques, as well as activities that have been modified to be ergonomic (Cazares et al., 2017).

One of the non-pharmacological therapies that can be done in cases of carpal tunnel syndrome is acupuncture therapy. Acupuncture therapy can be used as a pain relief and healing therapy in cases of carpal tunnel syndrome (Sim et al., 2014). In addition to acupuncture therapy, carpal tunnel syndrome can be treated with the use of ultrasound therapy. Ultrasound therapy was chosen because it can accelerate the healing process in damaged tissue.

1. Acupuncture therapy for carpal tunnel syndrome

There are 5 research articles with randomized controlled trials study design as a source of meta-analysis of the effect of acupuncture therapy in cases of carpal tunnel syndrome. The forest plot results showed that acupuncture therapy could reduce pain in carpal tunnel syndrome cases as much as -0.34 times compared to other interventions or no intervention, but it was not statistically significant (SMD -0.34; 95% CI= -0.83 to 0.16; p= 0.180).

This study is in line with the research of Sim et al. (2011) which aims to compare the effects of acupuncture therapy and steroid block therapy, with the results that the use of acupuncture therapy is effective in reducing complaints of carpal tunnel syndrome but not significantly, this is because acupuncture only reduces complaints of mild-moderate levels in a short time so it is not recommended to treat carpal tunnel syndrome. long-term treatment, and there was no significant difference between the two.

This statement is in line with the research of Sim et al. (2014) stated that the aim was to see the effect of acupuncture therapy compared to night splints with the aim of seeing how often awakened due to complaints of carpal tunnel syndrome, after being given an intervention for 2 months the complaints were reduced by about 58%, this is relevant to the increase in nerve conduction properties after acupuncture (Kumnerddee et al., 2010), but no significant effect was found between the two.

Research conducted by Chen et al., (2019) concluded that giving acupuncture therapy to patients with carpal tunnel syndrome can improve wound healing, peripheral nerve regeneration, pain relief, and for further reduction of inflammation, pain relief and improvement of hand function. patients with carpal tunnel syndrome for a period of up to 3 months, although not significant, because various factors can influence such as the patient's immune response in receiving the stabbing, the deqi effect caused and the patient's physiological condition when given the intervention.

This conclusion is in line with research (Khosrawi et al., 2011) which states that patients who received acupuncture therapy had a better improvement in clinical symptoms of carpal tunnel syndrome, among the electrophysiological characteristics, nerve conduction velocity (NCV) or nerve conduction velocity showed an increase. In the acupuncture intervention group compared to the control group.

Acupuncture treatment has superior effectiveness when compared to night splint plus sham acupuncture in treating subjective symptoms, with p value = 0.100. The pain felt by respondents varied in the treatment group and the control group.

2. Ultrasound therapy for carpal tunnel syndrome

There are 11 research articles with randomized controlled trials study design as a source of meta-analysis of the effect of ultrasound therapy in cases of carpal tunnel syndrome. The forest plot results showed that ultrasound therapy could reduce carpal tunnel syndrome pain as much as -0.76 times compared to other interventions or no intervention and was statistically significant (SMD -0.76; 95% CI = -1.37 to -0.16; p = 0.001).

This study is in line with the research of Roh et al., (2018) aimed at assessing the effectiveness and complications of using ultrasound compared to landmark-based injections in the treatment of carpal tunnel syndrome. Improvements in the severity of symptoms and it can be concluded that the use of ultrasound in cases of carpal tunnel syndrome there is no significant difference compared to the use of injections. Differences in results may be due to differences in study design and strength, participant characteristics (severity of disease), type of preparation, or sensory experience. The resulting score in the injection group, the result was p=0.002.

According to Zhang et al., (2013) comparing the use of ultrasound combined with miniscalpel-needle release in cases of carpal tunnel syndrome compared to the use of steroid injection alone, all parameters in both groups showed a statistical increase in terms of reducing pain in each week. 4th and 12th weeks, but the results were more significant in the intervention group with ultrasound therapy combined with meniscalpel-needle release, and steroid injection had a short-term effect. (Hameso & Bland, 2017) reported that maximal improvement in symptoms occurred 1 to 2 months after the use of steroid injections.

AUTHOR CONTRIBUTION

Afifah Noer is the main researcher who selects the topic, searches and collects research data. Setyo Sri Rahardjo and Hanung Prasetya analyzed data and reviewed research documents.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

ACKNOWLEDGEMENT

The researcher would like to thank all those who have helped in compiling this article and also thank the database providers:

PubMed, Science Direct, Scopus, Google Scholar, Springer Link, BMC and Hindawi.

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