Meta Analysis the Effect of Acupuncture Therapy on Pain Reduction in Osteoarthritis Patients

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ABSTRACT

Background: Osteoarthritis (OA) is the most common joint condition and is characterized by progressive erosion of the articular cartilage. Based on data from Basic Health Research (2018) the prevalence of joint disease in Indonesia is recorded at around 7.3% and osteoarthritis (OA) or arthritis is a common joint disease. As the two main non-surgical methods, physiotherapy and acupuncture have been shown to be safe and effective in the therapy of osteoarthritis.

Subjects and Method: This was a systematic review and meta-analysis study. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. The articles used in this study were those published from 2000-2020. The article search was carried out by considering the eligibility criteria defined using the PICO model. The population in the study were patients with osteoarthritis complaints with intervention in the form of acupuncture therapy, the comparison was the sham acupuncture outcome in the form of pain reduction. The keywords for finding articles are as follows: "Acupuncture" OR "Osteoarthritis" AND "Randomized Controlled Trials". The articles included in this study are full text articles with an observational study design. Articles were collected using PRISMA flow diagrams. Articles were analyzed using the Review Manager 5.3 application.

Results: A total of 9 articles were reviewed in this study. A meta-analysis of 9 randomized control trials showed that acupuncture therapy reduced pain in osteoarthritis patients (SMD= -0. 49; 95% CI= -0.88 to -0.10; p= 0.01).

Conclusion: Acupuncture therapy reduces pain in osteoarthritis patients.

Keywords: acupuncture, osteoarthritis, acupuncture osteoarthritis, randomized contro trial

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BACKGROUND

Osteoarthritis (OA) is the most common joint condition and is characterized by progressive erosion of the articular cartilage. Clinically, patients who experience pain due to excessive pressure or physical exertion are relieved by rest, but in the final stages, patients experience pain even at rest, they lose function, with limited movement and difficulty in carrying out daily activities (Ralph Plaster, 2014).

Based on data from Basic Health Research (2018) the prevalence of joint disease in Indonesia is recorded at around

7.3% and osteoarthritis (OA) or arthritis is a common joint disease.

The number of primary studies examining the effect of acupuncture therapy on pain reduction in osteoarthritis patients encouraged researchers to conduct a more comprehensive study of these primary studies. The data obtained were analyzed using a systematic review and meta-analysis by synthesizing the results of studies conducted to reduce bias.

SUBJECTS AND METHOD

1. Study Design
This was a systematic review and meta-analysis study. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. The keywords for finding articles are as follows: "acupuncture" OR "osteoartritis" AND "randomized controlled trials"

2. Inclusion Criteria
The articles included in this study are full paper articles with a Randomized Control Trial study design, in Indonesian and English. Appropriate articles should mention acupuncture therapeutic interventions with pain reduction outcomes.

The article used an appropriate population of patients with osteoarthritis complaints.

3. Exclusion Criteria
The articles published in this study were articles that have been carried out by meta-analysis. Articles published before 1999 and not full-papers.

4. Operational Definition
Article searches were carried out by considering the eligibility criteria defined using the PICO model. The population of patients with osteoarthritis conditions with intervention in the form of acupuncture therapy, comparison of sham acupuncture outcomes in the form of pain reduction.

Knee osteoarthritis is a degenerative disease of cartilage, but recent evidence has shown that OA is multifactorial. It involves several factors such as trauma, inflammation, biochemical reactions and metabolic damage (Mora, 2018).

Acupuncture therapy is a therapeutic treatment by inserting needles into acupuncture points in the human body. Another technique of acupuncture therapy is acupressure therapy which is a therapy by doing massage using the fingers of the acupoints that have been mapped on the human body (Saputra and Sudirman, 2009).

5. Data Analysis
Data processing was carried out by the Review Manager (RevMan 5.3) by calculating the effect size and heterogeneity to determine which study models were combined and formed the final meta-analysis result.

RESULTS

The process articles search was done by searching through a database with journals that can be seen in Figure 1. Figure 2 shows the areas where articles were taken according to the inclusion criteria. Articles obtained from 4 continents, namely Asia, America, Europe and Australia.

Based on the results of the forest plot (Figure 3), acupuncture therapy reduced pain in osteoarthritis patients by -0. 49 and it was statistically significant (p= 0.01). The heterogeneity of the study data showed $I^2=$ 94%. The distribution of the data was stated to be heterogeneous (random effect model). The funnel plot (Figure 4) showed that there was a publication bias which was characterized by asymmetry of the two plots. On the left there were 3 plots, in the middle of the line there was 1 plot and on the right there were 5 plots.

Based on the assessment of the quality of the study using the critical appraisal checklist for Randomized Control Trial, 9 articles included in the quantitative synthesis of the meta-analysis of the majority qualify in the assessment of study quality.

| Identified articles through a database search (n= 1630) | → | Removed duplicate data (n= 523) |

| Filtered articles (n= 1107) | → | Published articles (n = 445)
Irrelevant title = 386
Not RCT = 18
Articles not in Indonesian and English = 6
non-full text article = 35 |

| Complete articles deemed eligible (n= 662) | → | Complete article issued with reasons (n= 649)
The article that did not list Mean = 486
Intervention non-therapeutic acupuncture and sham acupuncture = 73
Pain reduction outcome = 90 |

| Articles included in qualitative synthesis (n= 13) |

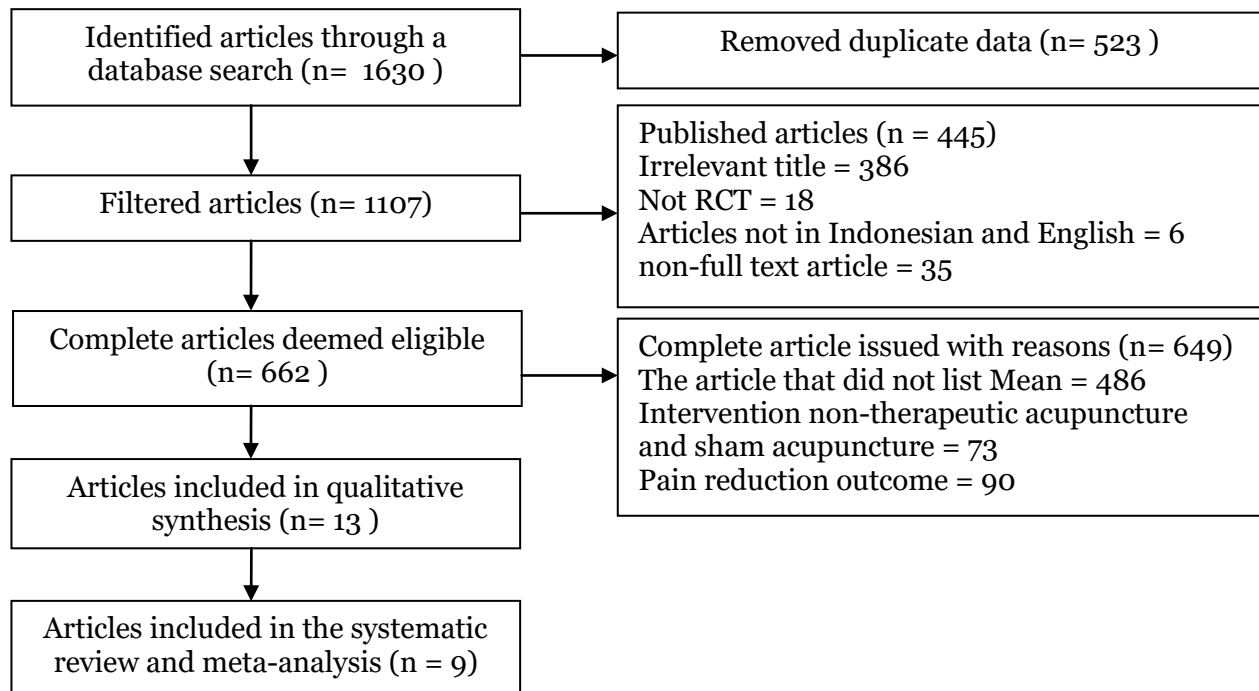| Articles included in the systematic review and meta-analysis (n = 9) |

Figure 1. PRSMA Flow Diagram

Table1. Primary study descriptions included in the meta-analysis

Author (year)	Articles Title	Country	Sample	Population	Comparison Intervention	Outcome
Scharf HP, et al 2006	Acupuncture and Knee Osteoarthritis A Three-Armed Randomized Trial	German	1007	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Foster NE et al, 2007	Acupuncture as an adjunct to exercise based physiotherapy for osteoarthritis of the knee: randomised controlled trial	Midlands, England	352	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Almazor MES et al, 2010	A Randomized Controlled Trial of Acupuncture for Osteoarthritis of the Knee: Effects of Patient Provider Communication	Texas, America	455	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Witt C et al, 2005	Acupuncture in patients with osteoarthritis of the knee: a randomised trial	Berlin, German	294	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Berman MB et al, 2004	Effectiveness of Acupuncture as Adjunctive Therapy in Osteoarthritis of the Knee	Maryland, North America	570	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Hinman RS et al, 2014	Acupuncture for Chronic Knee Pain A Randomized Clinical Trial	Australia	282	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Lin LL et al, 2018	Effectiveness and feasibility of acupuncture for knee osteoarthritis: a pilot randomized controlled trial	Beijing, China	42	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Liu et al , 2020	Efficacy of intensive acupuncture versus sham acupuncture in knee osteoarthritis: A randomized controlled trial	Beijing, China	442	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction
Xu Hong, Ryan DJ, Li K, 2007	Acupuncture in the Management of the Symptoms of Osteoarthritis of the Knee: A Preliminary, Single-blind and Sham-controlled Study	Australia	36	People with knee osteoarthritis	I : Acupuncture C: Sham Acupuncture	Pain reduction

*Variables included in the meta-analysis study

Table 2. Study Quality Assessment of Randomized Control Trial

Checklist Questions	Publication (Author and Year)								
	Scharf et al. (2006)	Foster et al. (2007)	Almazor et al. (2010)	Witt et al. (2005)	Berman et al. (2004)	Hinman et al. (2014)	Lin et al. (2018)	Liu et al. (2020)	Xu et al. (2007)
Does this study address a clear study focus?	1	1	1	1	1	1	1	1	1
Is the Randomized Controlled Trial study method suitable for answering study questions?	1	1	1	1	1	1	1	1	1
Are there enough subjects in the study to establish that the findings were not made by chance?	1	1	1	1	1	1	1	1	1
Are subjects randomly allocated to the experimental and control groups? If not, could this be biased?	1	1	0	1	1	1	1	1	1
Are inclusion/exclusion criteria used?	1	1	1	1	1	1	1	1	1
Are the two groups comparable at study entry?	0	0	0	0	0	0	0	0	0
Are objective and unbiased outcome criteria?	1	1	1	1	1	1	1	1	1
Are objective and validated measurement methods used to measure the results? If not, were the results scored by someone who did not know the group assignment (i.e. was the grading blended)?	1	1	1	1	1	1	1	1	1
Is the effect size practically relevant?	1	1	1	1	1	1	1	1	1
How precise is the estimated effect? Is there a confidence interval?	1	1	1	1	1	1	1	1	1
Could there be confounding factors that have not been taken into account?	0	1	0	1	0	0	1	0	1
Are the results applicable to your study?	1	1	1	1	1	1	1	1	1
Total	10	12	9	11	10	10	11	10	11

Information:
Yes = 1
No = 0

1. The Effect of Acupuncture Therapy on Pain Reduction in Osteoarthritis Patients
a. ForestPlot

Study or Subgroup	Experimental			Control			Weight	Std. Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Almazor 2010	29.5	17.8	78	31.4	18.5	151	11.6%	-0.10 [-0.38, 0.17]
Bermann 2004	-3.15	0.29	169	-2.66	0.26	161	11.7%	-1.77 [-2.03, -1.52]
Foster 2007	1.28	2.4	112	1.95	2.6	115	11.7%	-0.27 [-0.53, -0.01]
Hinman 2014	-1.2	2.3	71	-0.1	2.3	70	11.3%	-0.48 [-0.81, -0.14]
Lin 2018	2.5	2.4	21	4.1	3.1	21	9.4%	-0.57 [-1.18, 0.05]
Liu 2020	4	2.06	145	4.29	2.54	146	11.8%	-0.13 [-0.36, 0.10]
Scharf 2006	3	2.77	326	3.3	3.06	365	12.1%	-0.10 [-0.25, 0.05]
Witt 2005	28.9	22.7	149	33.8	22.3	75	11.6%	-0.22 [-0.49, 0.06]
Xu 2007	1.83	1.6	16	3.89	2.46	16	8.6%	-0.97 [-1.71, -0.23]
Total (95% CI)			**1087**			**1120**	**100.0%**	**-0.49 [-0.88, -0.10]**

Heterogeneity: Tau² = 0.32; Chi² = 141.48, df = 8 (P < 0.00001); I² = 94%
Test for overall effect: Z = 2.49 (P = 0.01)
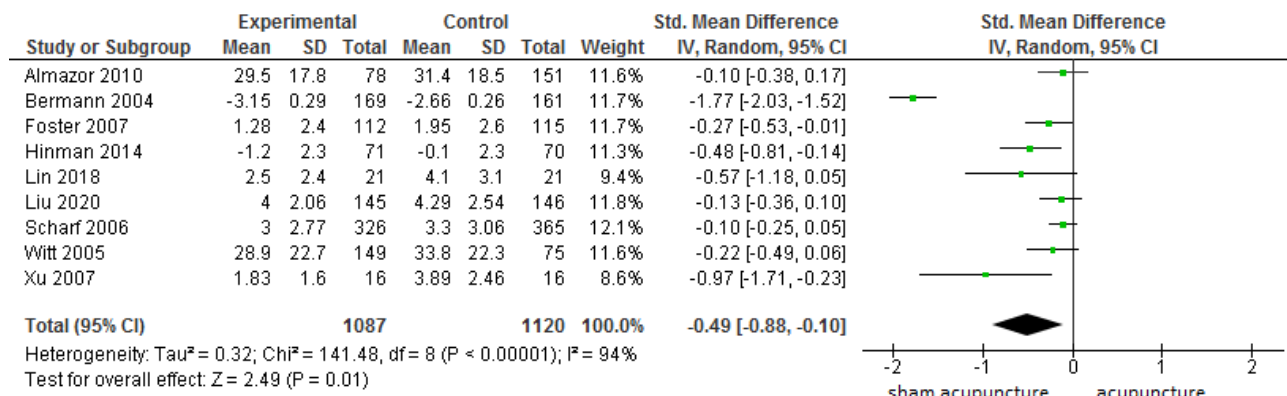
sham acupuncture   acupuncture

Figure 3.Forest Plot of the Effect of Acupuncture Therapy on Pain Reduction in Osteoarthritis Patients
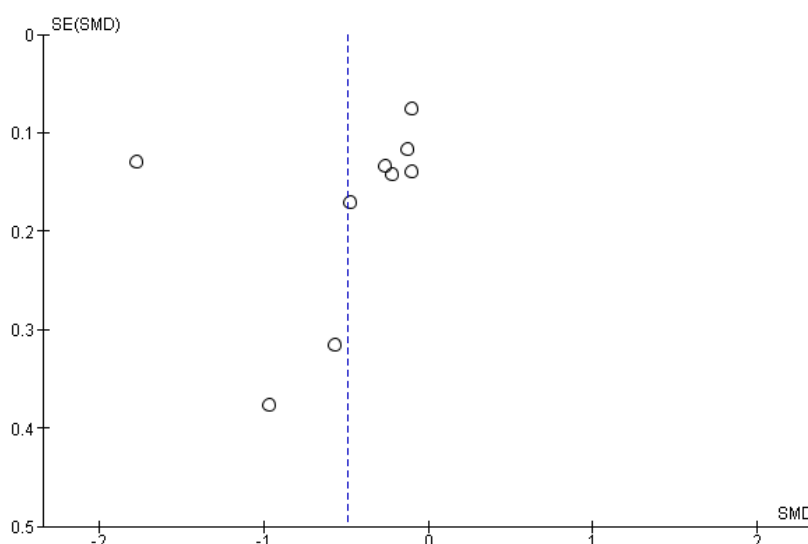
b. Funnel Plot

Figure4. Funnel Plot of the Effect of Acupuncture Therapy on Pain Reduction in Osteoarthritis Patients

DISCUSSION

As a type of joint disease osteoarthritis (OA) is characterized by the degradation of cartilage, which can occur in any joint, especially in weight-bearing joints. The knee joint is considered to be the most frequently complained place in the clinic. Two therapeutic methods can now be available to treat OA: surgery and nonsurgical therapy. However, surgery is reported to be suitable for patients at an advanced stage, and non-operative therapy, especially for patients at an early or middle stage. As the two main non-surgical methods, physiotherapy and acupuncture have been shown to be safe and effective in the treatment of OA (Zhang et al, 2016).

This systematic review and meta-analysis study raised the theme of the effect of acupuncture therapy on pain reduction

in osteoarthritis patients. This study discussed data on acupuncture therapy for osteoarthritis considered important because of its rarity. The number of relevant research published and accessible is still small and also has data access problems (data duplication) (Murti, 2018). Confounding factors affect the relationship or effect of exposure to the occurrence of disease estimated (estimated) by the study is not the same as the relationship or effect that actually occurs in the target population (invalid) study results (Murti, 2018). This systematic study and meta-analysis study used studies that has controlled for confounding factors which can be seen from the study inclusion requirements, namely the standardized mean difference.

Estimates of the combined effect of acupuncture therapy were processed by using RevMan 5.3 with the Continous method. This method was used to analyze the effect size or standardized mean difference in the bivariate data of two groups that had been controlled for confounding factors by randomization.

The results of the systematic study and meta-analysis are presented in the form of a forest plot and a funnel plot. The forest plo provide an overview of information from each of the studies investigated in the meta-analysis, and estimates of the overall results (Murti, 2018).

A funnel plot is a diagram in a meta-analysis used to demonstrate possible publication bias. Funnel plots show the relationship between funnel plots that visually show the amount of variation (heterogeneity) (Akobeng, 2005 in Murti, 2018). The funnel plot shows the relationship between the effect size of the study and the sample size of the various studies under study, which can be measured in a number of different ways (Murti, 2018).

There were 9 articles of randomized control trial as a source of meta-analysis of the effect of acupuncture therapy on pain reduction in osteoarthritis patients. The results of the meta-analysis showed that acupuncture therapy could reduce pain in osteoarthritis patients by - 0.49 times (CI 95% -0.88 to -10, p = 0. 01)

This is supported by Jubb et al. (2015) which stated that acupuncture reduced pain in osteoarthritis patients compared to sham acupuncture. In addition, acupuncture provides symptom improvement for patients with knee osteoarthritis, and is significantly superior to sham acupuncture.

This study is in line with Zhao et al., (2010) which stated that osteoarthritis patients who received acupuncture therapy experienced a decrease in pain compared to patients who received acupuncture sham. However, there was no significant differrence between the two groups in physical function scores.

Another study conducted by Manheimer et al., (2007) stated that compared to sham controls, acupuncture showed statistically significant, short-term osteoarthritis pain.

This study is confirmed that acupuncture can reduce pain by increasing the degeneration of mesenchymal cells in the bone marrow which functions to stimulate the proliferation or cell formation cycle in cartilage (chondrocytes) so that it can reduce inflammation or pain in the knee (Wang et al, 2020). Haryanto JT, et al (2017) stated that one of the most effective treatments to reduce the pain scale is by using acupuncture therapy.

The results of this study indicate that patients with osteoarthritis complaints show a decrease in pain after receiving acupuncture therapy. Knee pain scale reduction using acupuncture therapy Jin's 3 Needle by sticking the Xiyan (extra),

Xuehai (SP 10) and Liangqiu points (ST 34).

AUTHOR CONTRIBUTION

Fahmi is the main researcher who selected topics, searched and collected the data. Agus Kristiyanto and Hanung Prasetya have roles in analyzing data and reviewing study documents.

CONFLICT OF INTEREST

There was no conflict of interest in this study.

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