

## Effect of Combination of Slow Deep Breathing and Ice Therapy towards Comfort Level in Arteriovenous Fistula Insertion of Hemodialysis Patients in PKU Muhammadiyah Hospital Yogyakarta

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### Abstract

Patients with chronic renal disease undergoing hemodialysis will have arteriovenous (AV) fistula insertion for 2–3 times a week or an average of ten punctures per month. Intervention of comfort technical with combination of slow deep breathing and ice therapy help to reduce discomfort due to AV fistula insertion. The objective of this research was to determine the effect of combination of slow deep breathing and ice therapy on comfort level of AV fistula insertion. This research was conducted from January until February 2015 at PKU Muhammadiyah Hospital Yogyakarta. Type of this research is a quasi experiment with only post test group design with control group. The sample was divided into 20 patients in intervention group and 20 patients in control groups through simple random sampling technique. For each group, discomfort level was measured using Visual Analog Scale after AV fistula insertion. In intervention group, respondents were given a combination of deep breathing and ice therapy on acupuncture points LI4 10 minutes before insertion. The data were collected twice and analyzed of the difference between intervention group and control group using Chi-Square, Wilcoxon and Mann-Whitney test. There was a significant difference between intervention group and control group using Visual Analog Scale discomfort with  $p=0.000$ . Provision of comfort technical intervention with combination of slow deep breathing and ice therapy proved to improve the comfort of hemodialysis patients while undergoing insertion of AV fistula.

**Keywords:** AV fistula insertion, combination of slow deep breathing and ice therapy, comfort level

## Pengaruh Kombinasi Nafas Dalam dan Terapi Es terhadap Level Kenyamanan Insersi Fistula Arteri-vena Pasien Hemodialisis di Rumah Sakit PKU Muhammadiyah Yogyakarta

### Abstrak

Pasien penyakit ginjal kronik yang menjalani hemodialisis akan mengalami insersi fistula arteri-vena (AV fistula) selama 2–3 kali seminggu atau rata-rata akan mengalami sepuluh tusukan setiap bulan. Intervensi *comfort technical* dengan kombinasi nafas dalam dan terapi es membantu mengurangi ketidaknyamanan akibat insersi AV fistula. Penelitian ini bertujuan untuk mengetahui pengaruh kombinasi nafas dalam dan terapi es terhadap level kenyamanan insersi AV-Fistula. Penelitian dilakukan di Rumah Sakit PKU Muhammadiyah Yogyakarta pada bulan Januari sampai Februari 2015. Jenis penelitian ini yaitu quasi eksperimental dengan *only post test group design with control group*. Sampel dibagi menjadi 20 pasien kelompok intervensi dan 20 pasien kelompok kontrol melalui teknik *simple random sampling*. Masing-masing kelompok dilakukan pengukuran ketidaknyamanan menggunakan *Visual Analog Scale* setelah insersi AV fistula. Pada kelompok intervensi, diberikan kombinasi nafas dalam dan terapi es pada titik akupunktur LI4 10 menit sebelum insersi. Pengambilan data dilakukan dua kali dan dianalisis perbedaan antara kelompok intervensi dan kontrol menggunakan uji *Chi-Square*, *Wilcoxon* dan *Mann-Whitney*. Terdapat perbedaan yang signifikan antara kelompok intervensi dan kelompok kontrol dengan menggunakan skala ketidaknyamanan *Visual Analog Scale* dengan nilai  $p=0,000$ . Pemberian intervensi *comfort technical* dengan kombinasi nafas dalam dan terapi es terbukti dapat meningkatkan kenyamanan pasien hemodialisis saat menjalani insersi AV-Fistula.

**Kata kunci:** Insersi AV fistula, kombinasi nafas dalam dan terapi es, level kenyamanan

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## Introduction

Hemodialysis (HD) is a major kidney function replacement in patients with endstage renal diseases (ESRD) before proceeding with the transplant.<sup>1</sup> A successful hemodialysis requires access to safe, durable and reliable vessels.<sup>2</sup> One best way to access the blood stream is through fistula.<sup>3</sup> The installation of arteriovenous fistula (AV shunt/AV fistula) is the standard for vascular access in patients undergoing HD therapy.<sup>4</sup> A study stated that most patients claimed to suffer severe pain, and most common cause is pain associated with arteriovenous access, headache, and also musculoskeletal pain.<sup>5</sup> Study of 70 patients undergoing HD and measured by Visual Analogue Scale (VAS) during moderate pain reported that AV fistula insertion in 58.5% of the patients increased sharply at 30% and lightly at 11.5%. It is also mentioned that there is no relationship between occurrence of gender-related pain, shifts and time of HD,<sup>6</sup> and the study concluded the need for pracannulation analgesia in order to improve comfortness during HD therapy procedures. Patients undergoing HD averagely experience ten AV fistula insertion every month and continuously until renal replacement therapy in the form of transplantation.<sup>7</sup>

One alternative way to overcome the pain due to insertion of AV fistula is to provide an independent action with comfort technical intervention through deep breathing relaxation technique. Deep breathing relaxation results in a stimulus input of incoming oxygen that can increase lung ventilation and hence induce relaxation. The relaxation eventually increase the homeostatic body and consequently reduce the pain due to AV fistula insertion.<sup>8</sup> Research shows that the way of breathing affects autonomously and pain management.<sup>9,10</sup>

Provision of ice therapy is also required in addition to inhalation to obtain anesthetic effects on the stabbing area, as the use of

cold sensation in ice therapy can inhibit pain in the nociceptor (skin pain receptors). The use of this cold sensation will also cause the pain transmembrane protein to not release the action potential as long as there is still a cold transducer. The cold effect will perform a competitive inhibitory action against pain due to insertion of AV fistula so that pain perception will decrease.<sup>11</sup> Giving ice therapy takes about 10 minutes with an area of 10–15 cm with ice temperature of 13.60 °C.<sup>12</sup>

Combination of deep breathing relaxation and ice therapy is needed to get the maximum effect in reducing pain.<sup>13</sup> Pain management with deep breathing relaxation technique is useful for relaxing muscle skeletal spasms primarily due to increased prostaglandins. The effect will lead to vasodilation of blood vessels and increase blood flow to spasm and ischemic areas, hence stimulating body to release endogenous opioids, endorphins and enkephalin.<sup>14</sup> Ice therapy placed at the point of large intestine 4 for 10 minutes before stabbing in the ipsilateral area may inhibit pain in the nociceptor part due to anesthesia effects.<sup>8,7,15</sup>

Stimulation at the meridian points not only improves general circulation and circulation in certain organs, but also alters the skin's microcirculation in the area. When a meridian point is stimulated, the blood perfusion at this point will increase whereas at non-acupoint point the blood perfusion only changes slightly.<sup>16</sup> The purpose of this study was to determine the effect of combination of deep breath and ice therapy on pain and comfort of arteriovenous fistula insertion of patients with chronic kidney disease and undergoing hemodialysis (HD) in PKU Muhammadiyah Hospital Yogyakarta.

## Methods

This research is a quantitative research using quasi-experimental method with only post-test group design. This research has passed

the ethical test which is proven by getting the certificate of ethical research ethics with ref number: 993/EP-FKIK-UMY/XII/2014. Total samples in this study were 40 patients, divided into 20 patients of intervention group and 20 patients of control group. Sampling technique used was probability sampling and simple random sampling models. Inclusion criteria in this study were patients in the age of 16–60 years undergoing hemodialysis three times a week, were awake and cooperative, arteriovenous patients with fistula, and did not experience pathological pain and the pain due to procedures outside of hemodialysis therapy. Exclusion criteria were patients who required more than one time in arteriovenous fistula insertion due to vascular disorders, and patients with neuropathy.

This study used two instruments: Numeric Rating Scale (NRS) to assess pain, and Visual Analogue Scale (VAS) to assess the discomfort. Data collection in both groups was conducted twice before they were categorized, tabulated, and summarized. Descriptive statistics used in the study was frequency, percentage, mean, and standard deviation. Wilcoxon and Mann-Whitney test were used to compare between the two groups with significance value of  $p < 0.05$ .

## Results

Characteristics of respondents by age, gender, education, employment, and long history of the disease undergoing hemodialysis therapy in intervention and control group is shown in Table 1. Number of respondents between men and women are equal, which is 50% of male sex and 50% female. Most of the respondents were taking high school education (40%), did not work (57.5%), and had hypertension as their disease history (52.5%).

Table 2 shows result of pain scale (NRS) and discomfort (VAS) analysis in intervention and control group. In intervention group,

NRS on the first and second day had p-value of  $p=0.034$  and VAS of  $p=0.046$ , meanwhile in control group, NRS on first and second day had p-value of  $p=0.180$  and VAS of  $p=0.317$ . Comparison of AV fistula pain scale (NRS) between the intervention group and control group had significance value of  $p=0.000$  and VAS of  $p=0.000$  (Table 3).

## Discussion

Mann-Whitney test result using NRS scale showed significant differences in intervention and control group ( $p=0.000$ ). Measurement using VAS assessment of Kolcaba discomfort also obtained the same p-value, which means that there are significant differences between control group and the inconvenience of the intervention group.

Research on postoperative appendicitis patients with pre-post method showed average pain scale difference in pretest-posttest of control group was 2.30, while average pain scale difference of intervention group before and after the administration of engineering deep breathing and relaxation massage was 3.50. Result of statistical test of intervention and control group was  $p=0.000$  ( $p < 0.05$ ).<sup>17</sup>

Result of a supporting research in which relaxation breathing techniques was given in less than 10 beats per minute and given long inhalation phase in patients with mild head injury who experienced an acute headache showed significant mean differences of acute headache intensity patients with mild head injury between intervention and control groups after the breathing techniques in the value of  $p=0.000$  ( $p < 0.05$ ).<sup>10</sup>

Mechanism of deep breathing relaxation exercises to decrease pain intensity due to AV fistulas insertion in patients undergoing HD is associated with conscious action to regulate breathing deeply and slowly. Slow breathing can stimulate autonomic nervous response via neurotransmitter to release endorphins affecting

**Table 1 Distribution of Respondents in Hemodialysis Room PKU Muhammadiyah Hospital of Yogyakarta**

| Variable                    | Intervention (n=20) |    | Control (n=20) |    | Total | Percentage (%) |
|-----------------------------|---------------------|----|----------------|----|-------|----------------|
|                             | n                   | %  | n              | %  |       |                |
| <b>Age</b>                  |                     |    |                |    |       |                |
| 20–30                       | 1                   | 5  | 2              | 10 | 3     | 7.5            |
| 31–40                       | 3                   | 15 | 4              | 20 | 7     | 17.5           |
| 41–50                       | 4                   | 20 | 6              | 30 | 10    | 25             |
| 51–60                       | 12                  | 60 | 8              | 40 | 20    | 50             |
| <b>Gender</b>               |                     |    |                |    |       |                |
| Male                        | 13                  | 65 | 7              | 35 | 20    | 50             |
| Female                      | 7                   | 35 | 13             | 65 | 20    | 50             |
| <b>Education</b>            |                     |    |                |    |       |                |
| Elementary School           | 3                   | 15 | 6              | 30 | 9     | 22.5           |
| Junior High School          | 4                   | 20 | 3              | 15 | 7     | 17.5           |
| Senior High School          | 8                   | 40 | 8              | 40 | 16    | 40             |
| Academician                 | 5                   | 25 | 3              | 15 | 8     | 20             |
| <b>Occupation</b>           |                     |    |                |    |       |                |
| Civil Servant               | 2                   | 10 | -              | -  | 2     | 5              |
| Private Employee            | 1                   | 5  | 1              | 5  | 2     | 5              |
| Entrepreneur                | 3                   | 15 | 1              | 5  | 4     | 10             |
| Retired                     | 5                   | 25 | 4              | 20 | 9     | 22.5           |
| Unemployed                  | 9                   | 45 | 14             | 70 | 23    | 57.5           |
| <b>Story Disease</b>        |                     |    |                |    |       |                |
| Diabetes Mellitus           | 5                   | 25 | 3              | 15 | 8     | 20             |
| Hypertension                | 7                   | 35 | 14             | 70 | 21    | 52.5           |
| Supplement Drink            | 3                   | 15 | 2              | 10 | 5     | 12.5           |
| Drug                        | 1                   | 5  | -              | -  | 1     | 2.5            |
| Urolithiasis                | -                   | -  | 1              | 5  | 1     | 2.5            |
| Others                      | 4                   | 20 | -              | -  | 4     | 10             |
| <b>Time of Hemodialysis</b> |                     |    |                |    |       |                |
| 1–3 <sup>th</sup>           | 7                   | 35 | 10             | 50 | 17    | 42.5           |
| 4–6 <sup>th</sup>           | 7                   | 35 | 7              | 35 | 14    | 35             |
| 7–10 <sup>th</sup>          | 4                   | 20 | 2              | 10 | 6     | 15             |
| >10 <sup>th</sup>           | 2                   | 10 | 1              | 5  | 3     | 7.5            |

sympathetic nerve responses to decrease and increase parasympathetic response.<sup>14</sup>

Ice therapy combination which was given to maximize the effect of anesthetic arising from cold sensation can inhibit pain in the nociceptors (pain receptors in the skin) so that the transmembrane protein pain can not be put out of action potentials during cold there transducer. Through competitive inhibition action, cold sensation will inhibit pain transmission.<sup>11</sup>

Research on 30 patients undergoing HD which divided into three groups: placebo, no intervention, and ice therapy administration, found that use of ice therapy is more effective

in reducing pain than the other two groups with value of  $p=0.00$ .<sup>7</sup> Research with the use of cryotherapy in the contralateral area prior to insertion of AV fistula at the point of large intestine 4 for 10 minutes in the two groups of respondents obtained the value of  $p=0.001$  and significantly reduced pain in the experimental group performed cryotherapy.<sup>15</sup>

Another research showed that using ice massage with acupressure energy meridian points large intestine 4 (LI4) is effective in reducing labor pain during contractions. Our body can tolerate temperatures within a certain range. Normal skin surface temperature is 34 °C, but the temperature receptors can adapt

**Table 2 Comparison of Scale of Pain (NRS) and Discomfort (VAS) on First (I) and Second (II) Day in Intervention and Control Group**

| Group        | n  | Variable     | Mean | Z      | p-value |
|--------------|----|--------------|------|--------|---------|
| Intervention | 20 | NRS I–NRS II | 3.00 | –2.121 | 0.034*  |
|              |    | VAS I–VAS II | 2.50 | –2.000 | 0.046*  |
| Group        | 20 | NRS I–NRS II | 3.00 | –1.342 | 0.180   |
|              |    | VAS I–VAS II | 1.00 | –1.000 | 0.317   |

\*p&lt;0.05

to the local temperature in which between 15–45 °C. This study used ice cubes with 13.6 °C temperature and diameter of 2–3 cm, then it was put into gloves and tied after placed in the area of large intestine, after four respondents were instructed to perform deep breathing relaxation beforehand.<sup>18</sup>

Rational use of cold is to inhibit pain sensation, which is based on the principles of anatomy and physiology of nociceptors (pain) on the skin. When the sensory nerve fibers exposed to something extreme, the sensory nerve fibers will give pain signals to the brain to interpret the presence of pain.<sup>11</sup> Ice therapy will induce on location of ice massage and also will affect the spinal marrow through the neurological and vascular mechanisms. Therapy using ice with a depth of two to four inches will lower the threshold activation and network nociceptor pain nerve conduction velocity signal and will produce a local anesthetic effect called cold induced neuropraxia.<sup>7</sup>

Li point 4 or often called the Hegu point is a point located between the index finger and thumb of one lane meridian points. A theory of modern Chinese traditional acupuncture (TCM) mentioned that one of the effects of acupuncture is to do a special

sensation meridian points on the same side (ipsilateral) associated with changes in blood perfusion in the meridians. Stimulation of the meridian points not only improve the general circulation and circulation in certain organs, but also changing the microcirculation of the skin in that area. When a meridian points are stimulated, the blood perfusion at this point will increase while at the point of non-acupoint blood perfusion changes little.<sup>16</sup>

Combination of two pain management techniques: deep breathing relaxation technique and ice therapy, is needed to get the maximum effect in reducing pain. Research showed that deep breathing relaxation combined with a cold compress is more effective to reduce pain in the active phase of the first stage compared with relaxation breathing only (p=0.00213). Pain management with breathing relaxation technique is useful to relax skeletal muscles that experiencing spasms caused by increased prostaglandin causing vasodilation of blood vessels, thereby increasing the blood flow to the areas experiencing spasms and ischemic and believed to stimulate the body to release endorphins that endogenous opioids and enkephalin.<sup>8</sup> Meanwhile ice therapy through providing ice packs which placed in the large intestine point 4 for ten minutes before the

**Table 3 Distribution Ratio of Scale of Pain (NRS) and Discomfort (VAS) of AV Fistula Insertion in Intervention and Control Group**

| Variable | Group        | n  | Mean  | Z      | p-value |
|----------|--------------|----|-------|--------|---------|
| NRS      | Intervention | 20 | 10.50 | –5.502 | 0.000   |
|          | Control      |    | 30.50 |        |         |
| VAS      | Intervention | 20 | 10.60 | –5.489 | 0.000   |
|          | Control      |    | 30.40 |        |         |

\*p&lt;0.05

stabbing in ipsilateral area is able to inhibit pain in the nociceptors as its effect can induce anesthesia.<sup>7,15</sup>

Giving comfort technical intervention with combination of breathing relaxation and ice therapy proved to be effective in reducing the level of pain and discomfort due to insertion of AV fistula. Relaxation breathing resulted in stimulus input of oxygen into the lungs can increase ventilation so as to cause relaxation. The relaxation will increase the homeostasis of the body so that the effects can reduce the pain caused by the insertion of AV fistula.<sup>8</sup>

### Conclusion

Combination of slow deep breathing relaxation and ice therapy affect the pain and discomfort of AV fistula insertion in patients with chronic renal failure undergoing hemodialysis therapy.

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### Conflict of Interest

All authors state that there is no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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