Physical Stimulation For Hiperbilirubin

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Abstract. Exercise is a natural way for caregivers to improve health, cardiovascular status, increases bone mineralization, nutrition intake and body weight in neonates. We aimed to investigate the effects of physical stimulation on neonates with jaundice who are also receiving phototherapy. Full term neonates with jaundice, admitted for phototherapy at a rural hospital. The design study is quasi eksperiment pretest-posttest design with control group, analysis use paired t test and chi-square test. The medical information for each neonate, including total feeding amount, body weight, defecation frequency, and icteric grade was collected and compared between two groups. A total of 34 patients were enrolled in the study. This included 17 neonates in the control group and 17 in the experimental group. On the third day, the stimulation group showed significantly lower bilirubin levels (icteric grade) ($p=0.013$) compared with the control group. Physical stimulation could help to reduce bilirubin levels (icteric grade) and increase defecation frequency in neonates receiving phototherapy for jaundice.

Keywords: hiperbilirubin, physical stimulation, neonates, phototherapy
1. Introduction

Nearly 90% of low birth weight babies (LBW) experience neonatal jaundice. Neonatal jaundice is a clinical condition in infants characterized by yellow staining of the skin and sclera due to the accumulation of excess unconjugated bilirubin. Clinical jaundice will begin to appear in newborns when blood bilirubin levels reach 5-7 mg/dL [1]. Bilirubin encephalopathy (kernicterus) is the most severe complication of neonatal jaundice. Apart from having a high mortality rate, it can also cause sequelae in the form of cerebral palsy, high-tone deafness, paralysis and dental dysplasia which greatly affects quality of life [2]. Kernikterus is a clinical manifestation arising from the toxic effects of bilirubin on the central nervous system in the basal ganglia and several brain stem nuclei [3].

Hiperbilirubin (jaundice neonatorum) is the leading cause of death in life in 60% - 80% of newborns [4]. Based on the Basic Health Research of the Indonesian Ministry of Health [5] the incidence of neonatal jaundice is the second leading cause of death after asphyxia, which is 6%. While based on nurses' statements and surveys conducted in the Melati Room (Perinatology) of Prof. RSUD Dr. MargonoSoekarjo, the incidence of neonatal jaundice increased from the incidence of January to April, which was 50%. Handling of neonatal jaundice is done in various ways according to the type. Pathological neonatal jaundice will be treated in several ways, namely: drug administration, exchange transfusion and phototherapy carried out for 2 x 24 hours to 3 x 24 hours in the hospital [6]. The effectiveness of phototherapy depends on the intensity of the light produced by the light source. Light intensity is the number of photons given per centimeter of the exposed surface of the body.

Physical stimulation therapy is a therapy adapted from the Moyer-Mileur protocol, which consists of passive ROM movements and soft compression movements in the 6 large joints of the extremity which includes the shoulders, elbows, wrists, hips, knees and ankles [7]. Based on research conducted by Lin et al. massage therapy (physical movement) can stimulate the vagus nerve which will increase intestinal movement and reduce enterohepatic circulation, thereby increasing excretion of bilirubin [8]. Increased bowel movement can also increase the frequency of defecation which allows the baby to release large amounts of meconium which also contains bilirubin. Basiri et al. Stated that physical movements in infants can facilitate the excretion of meconium, shortening the time for changes in bilirubin and reabsorption into the blood through the liver transport system thereby reducing the incidence of hiperbilirubin [9]. Therefore, based on evidence based above, the authors are interested in knowing the effect of physical stimulation therapy on neonatal jaundice.

2. Materials and Methods

Type of research used was Quasi-experimental pretest-posttest design with control group. This research carried out for 8 months in the Perinatology Room of Prof. RSUD Dr. MargonoSoekarjoPurwokerto. Previous research has received ethical testing from the hospital ethics commission. A total of 34 patients were enrolled in the study. This included 17 neonates in the control group and 17 in the experimental group. The inclusion criteria in this study were gestational age 34-41 weeks, APGAR score at birth 8-10 and get phototherapy because of hiperbilirubin. Exclusion criteria for this study include the presence of congenital abnormalities, infections, and obstruction of the digestive tract. Physical stimulation is a therapy adapted from the Moyer-Mileur protocol, which consists of passive ROM movements and soft compression movements on the 6 large joints of the extremities which include the shoulders, elbows, wrists, hips, knees and ankles. The condition of jaundice that occurs in infants where there is an increase in bilirubin levels in extravascular tissue, especially visible yellow in the skin, conjunctiva, mucosa and other body parts. The measuring instrument used is jaundice according to Kramer (1969), which is the determination of the jaundice degree based on the division of the body zone [10]. This measure consists of Derivation of Kramer 1, namely the area of jaundice in the head and neck, degree of cramps 2, namely the area of jaundice in the upper body + 1, degree of cramps 3, namely the area of jaundice 1,2 + lower body and limb, cremated degree 4 namely the area of regional jaundice is 1,2,3 + arms and battery below the knee, and the degree of cramps 5 is the area 1,2,3,4 + hands and feet (8,9). Analysis to find out differences
before and after given physical stimulation therapy data was analyzed by chi-square test. Statistical tests were carried out with a level of confidence 95% (α = 0.05).

3. Result
A total of 36 patients with jaundice were initially enrolled. But, 2 neonates were excluded because of their hospital stay were less 3 days. Therefore, 34 patients were included in the final study and were divided into 2 groups in the study (17 control groups and 17 group interventions). Table 1 shows the characteristics of respondents.

| Variables                      | Item                  | Stimulation (n = 17) | Non physical stimulation (n = 17) |
|--------------------------------|-----------------------|----------------------|----------------------------------|
| Gender                         | Male                  | 10 (58.8%)           | 7 (41.2%)                        |
|                                | Female                | 7 (41.2%)            | 10 (58.8%)                       |
| Type of fluid intake           | breast milk           | 0 (0%)               | 0 (0%)                           |
|                                | Formulamilk           | 1 (5.9%)             | 2 (11.8%)                        |
|                                | Mix                   | 16 (94.1%)           | 15 (88.2%)                       |
| Type of delivery               | Caesarean section     | 10 (58.8%)           | 7 (41.2%)                        |
|                                | Spontan               | 3 (17.6%)            | 7 (41.2%)                        |
|                                | Vacuum Extract        | 4 (23.5%)            | 3 (17.6%)                        |
| Age Gestation (weeks)          | 38.68 ± 1.40          | 39.3 ± 1.56          |                                 |
| Birth body length (cm)         | 49.24 ± 1.56          | 48.06 ± 2.045        |                                 |
| Birth weight (grams)           | 3189.71 ± 395.55      | 3068.82 ± 555.08     |                                 |
| Body weight during intervention| 3049.12 ± 382.09      | 2904.12 ± 571.11     |                                 |
| Duration of phototherapy (hours / 3 days) | 44.94 ± 20.42 | 63.88 ± 22.64 | |
| Total fluid intake (cc / 3 days) | 1076.47 ± 276.76 | 951.18 ± 310.38 | |
| Number of defecations (times / 3 days) | 11.29 ± 4.37 | 5.18 ± 1.62 | |
| Weight (grams)                 | Day 1                 | 3049.12 ± 382.09     | 2904.12 ± 571.11                 |
|                                | Day 2                 | 3084.12 ±            | 2899.71 ± 580.47                 |
|                                | Day 3                 | 3107.35 ± 397.59     | 2910.59 ± 551.04                 |

Table 1 shows the characteristics of respondents. Male babies dominated in the stimulation group, while female babies dominated in the control group. Majority of respondents in both groups receive combination of breast milk and formula. The stimulation group defecated two times more frequent than the control group. The stimulation group also showed a higher weight gain on day three.

| Degrees (n, %) | 0 | 1 | 2 | 3 | 4 | 5 | p-value |
|---------------|---|---|---|---|---|---|--------|
| Day 1         |   |   |   |   |   |   | 0.093  |
| Stimulation   | 0 (0%) | 0 (0%) | 1 (5.9%) | 9 (52.9%) | 5 (29.4%) | 2 (11.8%) |       |
| Non stimulation | 0 (0%) | 0 (0%) | 0 (0%) | 3 (17.6%) | 9 (52.9%) | 5 (29.4%) |       |
| Day 2         |   |   |   |   |   |   | 0.129  |
| Stimulation   | 2 (11.8%) | 3 (17.6%) | 7 (41.2%) | 5 (29.4%) | 0 (0%) | 0 (0%) |       |
| Non stimulation | 0 (0%) | 0 (0%) | 7 (41.2%) | 9 (52.9%) | 1 (5.9%) | 0 (0%) |       |
| Day 3         |   |   |   |   |   |   | 0.013  *|

Table 2: Data distribution decreases the degree of icteric
Distribution of data for decreasing icteric degrees in research respondents can be seen in table 4. The microbilirubin level was significantly decreased for all participating neonates during hospitalization ($p < 0.013$).

4. Discussion

The phototherapy procedure is carried out for 2 x 24 hours to 3 x 24 hours, but at Margono Hospital General Hospital phototherapy is done in the duration of 2 x 6 hours, the next 6 hours breaks and the next 6 hours is done again phototherapy, so that phototherapy is at 6 hour intervals. After the baby gets 36 hours of phototherapy, the bilirubin level is evaluated. If the bilirubin level is still above normal, phototherapy will continue but if the bilirubin level is normal then phototherapy will be stopped. The value of normal blood bilirubin is $<12 \text{ mg/dL}$ or icteric degree 5 [11].

On the third day of hospitalization, the microbilirubin level was significantly lower in the stimulation group than in the control group. The effectiveness of phototherapy depends on the intensity of the light produced by the light source. Light intensity is the number of photons given per centimeter of the exposed surface of the body. Standard phototherapy must provide $8-10 \mu\text{W/cm}^2/\text{nm}$ beam intensity and wavelengths of 430 to 490 nm. AAP defines intensive phototherapy as phototherapy which produces light intensities of at least 30-40 $\mu\text{W/cm}^2/\text{nm}$ and wavelengths that can cover the entire body surface of the neonates[12,13]. The intensity given determines the effectiveness of phototherapy, the higher the intensity of the light, the faster the decrease in serum bilirubin levels.

Physical stimulation is therapy adapted from the Moyer-Mileur protocol, which was established from passive ROM movements and soft compression movements on the 6 large joints of the extremities which include the shoulders, elbows, wrists, hips, knees and ankles[9]. Based on research conducted by Lin et.al, massage therapy (physical movement) is able to stimulate vagus nerve which will increase intestinal movement and reduce enterohepatic circulation, thereby increasing excretion of bilirubin. Increased bowel movement can also increase the frequency of defecation which allows the baby to release large amounts of meconium which also contains bilirubin[14,15]. Physiologically, the therapeutic effect on subcutaneous tissue is to increase blood circulation, lymph and fluids in tissues which will increase the collection and removal of unused body waste products such as bilirubin.

Basiri et al. Stated that physical movements in infants can facilitate excretion of meconium, shortening the time for changes in bilirubin and reabsorption into the blood through the liver transport system thereby reducing the incidence of hiperbilirubin[9]. Physical stimulation will stimulate bone formation and increase bone mineral density. Physical stimulation of premature babies in hospitals can also increase bone demineralization and osteopenia prematurity so that it will increase growth, bone mass, and weight. Other studies suggest that passive physical stimulation of the range of motion (ROM) can increase muscle mass and help early maturation of the neuromuscular system in premature infants [10].

5. Conclusion

This study added a new evidence that physical movement in babies undergoing phototherapy for hiperbilirubin is able to decrease blood bilirubin level through the more frequent defecation that therefore release more meconium. The physical movement should be carefully performed during the phototherapy break. In combination with phototherapy, physical movement facilitates the decrease of blood bilirubin level. Therefore, physical movement can be taken as consideration when treating babies with hiperbilirubin. Further study needs to measure physical movement effect on vital sign besides bilirubin level.

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