Original Article

Effect of Abdominal Massage on Feeding Intolerance among Premature Baby With Mechanical Ventilation in Neonatal Intensive Care Unit in Indonesia

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Abstract

Background: Feeding intolerance in premature infants is due to the immaturity of the gastrointestinal system which is aggravated by the installation of mechanical ventilation. The impact of premature babies is delaying enteral nutrition, NEC, the risk due to parenteral nutrition and the high cost of care. Abdominal massage is one of the recommended actions to prevent it.
Objective: The study aimed to determine the effect of abdominal massage on feeding intolerance in premature infants with mechanical ventilation in the NICU.
Methods: This study was conducted using quasi-experimental with nonequivalent control group pretest and posttest design in the neonatal intensive care unit (NICU). The study was conducted on 34 premature infants, 17 groups who did abdominal massage and 17 as a control group. Feeding intolerance is determined by the presence of one or more symptoms such as increased gastric residue, abdominal distension and frequency of vomiting observed on the first (pre) and fifth (post) days. Abdominal massage is carried out twice a day for 15 minutes in a 5 day period. Data can be seen the difference on the first day and the last day.
Results: The results showed a decrease in average gastric residue difference of 0.65 cc and abdominal distension of 0.59 cm in the intervention group ($p < 0.05$). Whereas in the control group gastric residue increased 3.59 cc and abdominal distension 1.88 cm ($p < 0.05$). The mean difference in vomiting frequency decreased in both groups, a decrease of 0.118 in the intervention group and 0.18 in the control group ($p = 0.63$). There was a significant difference in the occurrence of feeding intolerance between groups after the intervention ($p = 0.05$), where the incidence of feeding intolerance did not increase (0%) in the intervention group, while the control group increased by 9 (52.9%) respondents. There was a significant contribution to the confounding factor of the type of mechanical ventilation in the amount of gastric residue after the intervention ($p = 0.02$).
Conclusion: There is an effect of abdominal massage on the incidence of feeding inolerance in premature infants with mechanical ventilation, so researchers recommend SPO abdominal massage to be considered as a treatment for intolerance feeding in premature infants with mechanical ventilation in the NICU.

Keywords: abdominal massage, feeding intolerance, gastric residue, premature, mechanical ventilation

Introduction

The problem that often occurs in premature infants is immaturity of the gastrointestinal system (Guzoglu, Eras, Uras & Dilmen, 2016). Physiologically, intestinal motility is regular at 27 to 30 weeks of birth and progresses to a more mature pattern at 33 to 34 weeks, so infants <37 weeks of age are at risk of developing gastrointestinal problems (Neu & Nan, 2003). This was also conveyed in Neu's study (2007) which states that one of the most critical problems in premature infants and very low birth weight (BBLSR) is gastrointestinal problems caused by intestinal motor immaturity.

The problem of gastrointestinal immaturity that often occurs in NICU is feeding intolerance (Moore & Wilson, 2011). Feeding intolerance is the baby's inability to maintain enteral nutrition which is characterized by one or more symptoms of increased gastric residue, abdominal distension and vomiting (Moore & Wilson, 2011). Criteria for the increase in gastric residue are characterized by the presence of green or red residues and or the amount of residue of 5 ml / kg or> 50% of previous drinking (Dutta et al. 2015; Kairamkonda et al. 2008; Khashu et al. 2006). Whereas abdominal distension is characterized by an increase in acute abdominal circumference ≥2 cm from the previous examination. In addition, Moore and Wilson (2011), Dutta et al (2015), Rudiger et al (2008) stated that vomiting with a frequency ≥3x / day is also another symptom of feeding intolerance.

In many cases in the NICU, infants who experience intolerance feeding often experience enteral delays in nutrition, so nutrition must be given parenterally with some risks and complications such as sepsis, intestinal atrophy, infection and thrombus (Neu, 2007; Tan-Dy &Ohlsson , 2005). Another impact of feeding intolerance is the development of necrotizing enterocolitis (NEC). NEC is a condition where there is inadequate oxygen (ischemic) transport to the intestine which causes accumulation of gas and inflammation in the intestine (Gomella et al. 2013; Thompson & Bizzarro, 2008; Bombell & McGuire, 2009; Gephart, Wetzel, & Krisman, 2014; Agnoni &Amendola, 2017).

The problem of feeding intolerance can also occur while aggravating the installation of mechanical ventilation, such as non-invasive ventilation (NIV) especially the use of nasal continuous positive airway pressure (nCPAP) will have an impact on increasing the incidence of feeding intolerance (Mezzacappa & Collares, 2005; Guzoglu, Eras, Uras & Uras & Dilmen, 2016). The occurrence of feeding intolerance is due to the provision of positive end-expiratory pressure (PEEP) which results in decreased superior mesentric artery blood flow velocity (SMA BFV) (Harvanek, Madramootoo & Carver, 2007; Dutta et al. 2015). Besides the presence of air entering through the pharynx which causes accumulation of air in the stomach, resulting in abdominal distension and some cases appear bowel loops that are not related to the pathological process of the gastrointestinal system (Carter, 2012).

Nursing interventions in dealing with research-based feeding intolerance were still focused on prevention and monitoring of symptoms caused (Carter, 2012). Research on massage aimed at the problem of feeding intolerance was first carried out by Tekginduz et al. (2014). The results showed that abdominal massage performed on premature infants with a gestational age of 28-34 weeks significantly influence the prevention of symptoms of intolerance feeding. This is based on an increase in gastrointestinal function such as increased parasympathetic dysfunction, gastric and intestinal motility and increased production of digestive hormones (Diego et al, 2007; Diego, Field & Hernandez-Reif, 2005; Field et al. 2008).

However, these studies have not been conducted in preterm infants with increased risk factors for feeding intolerance such as babies with mechanical ventilation. Therefore researchers are interested in examining the effect of abdominal massage on feeding intolerance in premature infants with mechanical ventilation as a novelty and development, as well as reinforcement of previous studies.

Methods

Research Design and Sample: This study was conducted using a quasi-experimental method with the nonequivalent control group pretest and posttest approach in NICU General Hospital. Dr. Hasan Sadikin Bandung 2018. The study was conducted on 34 respondents, 17 in the intervention group and 17 in the control group with inclusion criteria including: Stable infants with gestational age 28-34 weeks and body weight 1000 - 1750 grams, received drinking through naso / orogastric tube and attached mechanical ventilation both invasive intubated using a ventilator or noninvasive ≥24 hours

without experiencing intolerance feeding, receiving drinking with the continuous method, suffering from obstruction in digestion, post op abdominal surgery, NEC / history of NEC, congenital disease (congenital heart disease, digestive system anomalies), suspected sepsis or sepsis.

Intervention Procedure: Premature infants receive abdominal massage from certified nurses. Abdominal massage interventions are given 2 times / day at 09.00 and 14.00 for 5 days with a duration of 15 minutes each given massage. When the massage is done 30 minutes after the infants was given a drink with a head up position of 30-45o. This aims to prevent regurgitation at the time of the intervention. The abdminal massage procedure was adopted from Tekgunduz et al. (2014) and Shaeri et al. (2017). Abdominal massage uses moderate pressure massage techniques using baby oil which is carried out in the abdomen area, following the procedure: 1). Hold your hand so your pinkie finger's edge can move like a paddle across your infant's belly. Starting at the base of the rib cage, stroke downwards with one hand and then the other in a paddle-wheel-like motion. 2). Massage the abdomen with your fingertips in a circular, clockwise motion. 3). Do the "I Love U" movement: Trace the letter I down your infant's left side. Then trace an inverted L, moving across the belly along the base of her ribs from her right side to her left and down. Trace an inverted U, moving from low on the infant's right side, up and around the navel, and down the left side. 4). Walk your fingers around the navel, clockwise. 5). Hold the knees and feet together and gently press the knees up toward the abdomen. Rotate the infant's hips around a few times to the right. 6). Place your hand on the tummy horizontally and rock your hand from side to side a few times. Note: avoid massaging the tummy if the cord has not completely healed.

Control group, same as the intervention group, but abdominal massage was carried out on the fifth day after posttest data retrieval. During the 5 day period, respondents received routine care.

Measurement: Gastric residue in this study is the result of measuring the amount of residual gastric fluid by aspiration using a 5 cc syringe in NGT or OGT which was previously given 0.5-1 cc of air along with checking using a stethoscope on the gastric section. During gastric fluid withdrawal is done slowly and repeatedly to ensure empty gastric contents. Abdominal circumference measurements are measured using a metline ranging from the umbilical around the abdomen to back to the umbilical. While the measurement of drinking frequency is done by observation. The three symptoms are done on the first day as a pretest and the fifth day as a posttest.

Determination of intolerance feeding criteria if there are one or more symptoms of intolerance feeding that matches the criteria. Criteria for gastric residue if> 5 ml / kg body weight or 50% of the previous drinking amount. Abdominal distension if the increase ≥2 cm is significant from the previous examination and vomiting criteria if it occurs> 3 times / 24 hours.

Data collection: This research was conducted an ethical feasibility test from the Research Ethics Committee of RSUP. Hasan Sadikin Bandungwith ethical number LB.04.01/A05/EC/131/V/2018. Researchers and research assistants conducted an assessment of the symptoms of feeding intolerance as a pre-test on the first day. Then abdominal massage is done as much as 2 times / day every hour 09.00 and 14.00 WIB for 15 minutes. Abdominal massage is done for 5 days. To reduce the risk of vomiting when giving an abdominal massage, an abdominal massage is performed 30 minutes after being given a drink in which the baby is in a position of head-up 30-45^{o} during the abdominal massage. At the time of the abdominal massage, the intervention group respondents continued to do hemodynamic monitoring. Abdominal massage is done in an incubator by adjusting the temperature at 36-38^{o}C or adjusting to the Neutral Temperature Environment (NTE). On day 5, the second data collection regarding data on symptoms of feeding intolerance (gastric residue, abdominal distension and vomiting) and the incidence of feeding intolerance were measured again as a posttest.

Data Analysis: Univariate analysis was performed to find out the characteristics of the research subjects of each group. The variables which were carried out by the univariate analysis in this study were gestational age, weight, type of drinking and type of mechanical ventilation. Normality and homogeneity test and Wilcoxon test were used to analyze differences in symptoms of feeding intolerance before and after each group. The Mann-Whitney test was used to analyze the difference in mean and difference in

symptoms of feeding intolerance after intervention between the intervention group and the control group. Then the Chi Square test was used to analyze the differences in the incidence of feeding intolerance after an intervention in the intervention group with controls.

Results

Characteristics of respondents based on gestational age, weight, type of drinking and type of mechanical ventilation. The following characteristics of respondents based on gestational age, weight, type of drink and type of mechanical ventilation are presented in table 1 below:

Gestational age in the intervention group had a mean of 30.65 ± 1.935, while the control group was 31.71 ± 1.649. Body weight in the intervention group had an average of 1360.53 ± 251.998, whereas in the control group 1371.06 ± 195.465. The type of intervention group was dominated by the type of breastfeeding drink accompanied by P type formula milk, namely 9 infants (52.9%), the same as the control group, where the type of drinking was still dominated by breast milk accompanied by P type formula milk for 13 infants (76.5%). Characteristics of respondents for this type of mechanical ventilation, the intervention group was dominated by the use of invasive mechanical ventilation, 10 infants (58.8%), while the control group was dominated by the use of non-invasive mechanical ventilation, 10 infants (58.8%).

Table 1 Characteristics of respondents based on gestational age, weight, type of drinking and type of mechanical ventilation

Variabel	Intervention group	Control group
Gestation age	30.65±1.935	31.71±1.649
Weight	1360.53±251.99	1371.06±195.46
Drinking type		
breast milk + S type formula milk	8 (47.1%)	4 (23.3%)
breast milk + P type formula milk	9 (52.9%)	13 (76.5%)
Type of Mechanical Ventilation		
Non Invasive Ventilation	7 (41.2%)	10 (58.8%)
Invasive Ventilation	10 (5.8%)	7 (41.2%)

Table 2 Comparison of the average number of gastric residues, abdominal distension and frequency of vomiting before and after the intervention

Variabel	Intervention group		p	Control group		p
	First day	Last day		First day	Last day	
Gastric Residue	0.65±1.057	0.00±0.000	0.026	0.06±0.243	3.65±1.967	0.000
Abdomen Distension	22.76±2.016	22.59±2.033	0.414	23.35±1.115	25.24±1.821	0.001
Vomiting Frequency	0.12±0.332	0.00±0.000	0.157	0.53±0.514	0.35±0.493	0.317

Based on table 2 shows the average number of gastric residues of the intervention group, where the first day showed 0.65 ± 1.057 and decreased on the fifth day 0.00 ± 0.000. In the average abdominal distension (abdominal circumference) before the intervention showed 22.76 ± 2.016, then after being given abdominal massage decreased to 22.59 ± 2.033. Similar to the frequency of vomiting, the average vomiting frequency was 0.12 ± 0.332, then after being given an abdominal massage it decreased to 0.00 ± 0.000. Wilcoxon test results in the intervention group showed no significant difference in mean abdominal distension and vomiting frequency before and after the intervention (p value> 0.05). However, the difference was significant in mean gastric residue (p = 0.026).

In the control group, the average gastric residue before the intervention was 0.06 ± 0.243 and increased on the fifth day to 3.65 ± 1.967. Similar to the measurement of abdominal distension, the mean abdominal distension (abdominal girth) before the intervention was 23.35 ± 1.115, then increased on the fifth day to 3.65 ± 1.967. In contrast to the two symptoms, a decrease in the frequency of vomiting occurred in both groups, where the average frequency of vomiting before the intervention was 0.53 ± 0.514 and decreased by 0.35 ± 0.493. Wilcoxon test results in the intervention group showed that there were significant differences in average gastric residue and abdominal distension before and after the intervention (p value <0.05). But there was no significant difference in the average frequency of vomiting (p = 0.317).

Mann Whitney analysis was used to analyze differences in symptoms of feeding intolerance after an intervention in the intervention group with the control group. When the number of gastric residues was analyzed, the difference between the intervention and control groups showed a significant difference with the average number of gastric residues of the control group being higher than the intervention group (p = 0.000). Similar to abdominal distension and frequency of vomiting, both symptoms showed higher rates in the control group. When both were analyzed differences in the intervention and control groups showed significant differences (p <0.05).

Chi Square analysis was used to analyze differences in the occurrence of feeding intolerance after an intervention in the intervention group with the control group. When the analysis was done, there was no feeding intolerance in the intervention group (0%). But different results were seen in the control group, where there were 9 respondents (52.9%) experienced intolerance feeding. The results of further analysis showed that there were significant differences in feeding intolerance between the intervention group and the control group (p value = 0.05).

Discussion

Feeding intolerance is the problem most often found in premature infants. The problem of feeding intolerance is proven not only to be affected by prematurity of the gastrointestinal system, but the use of mechanical ventilation has several risks associated with feeding intolerance (Neu, 2007; Stevanovic, 2011; Carter, 2012; Li et al. 2014). Feeding intolerance is the inability of the gastrointestinal system to absorb enteral nutrition which is characterized by one or more symptoms of increased gastric residue, abdominal distension and emesis or vomiting (Moore & Wilson, 2011; Dutta et al. 2015). In this study gastric ressidual volume (GRV) was found in all infants with an average number of gastric residues on the first day in the intervention group 0.65 cc and the control group 0.06. However, after the intervention was carried out GRV was not found in the intervention group. The decrease in the amount of gastric residue in infants who received abdominal massage showed a significant difference (Table 2).

In some literature, the mechanism of abdominal massage action will initially be perceived as sensory stimulation, where the basis of this massage is the provision of tactile stimulation such as touch and pressure which can further improve gastrointestinal function (Travagli et al. 2003; Tortora & Derrickson, 2013; Guyton & Hall , 2015). Improved gastrointestinal function by abdominal massage is related to its effect on increased vagal and motor activity and parasympathetic nervous system activity (Diego, Field & Hernandez-Reif, 2005; Diego et al. 2007). Field and Diego's research (2008) on 42 premature infants with an average gestational age of 34.6 weeks with an average body weight of 1237 grams. use moderate pre-massage 3x15 minutes for 5 days. The results showed that massage was significantly affected by stimulation of vagal activity (stimulation of

parasympathetic nerve activity) and was significantly associated with weight gain.

Other massage mechanisms that aim to overcome symptoms of feeding intolerance are influenced by digestive hormone expenditure (Vickers et al, 2004; Field et al, 2008; Diego, Field & Hernandez-Reif, 2014; Field et al. 2008; Kim & Bang, 2017) . In a study conducted by Field, Diego and Hernandez-Reif (2010) revealed that the use of moderate pressure massage was reported to have an effect on increasing vagal activity, gastric motility, insulin levels and IGF-1. Other studies conducted by Field et al. (2008) where the massage which was carried out 2x15 minutes for 5 days with moderate pressure significantly affected the increase in the hormone insulin (p value 0.001), the increase in the IGF-1 hormone. Correlation analysis in this study also showed a relationship between weight gain and an increase in the two hormones (p value 0.05).

The massage technique used in this study is moderate pressure massage where this technique sees a change in the color of the abdominal skin during massage from pink to white (Diego, Field & Hernandez-Reif, 2014; Field et al. 2010; Kim & Bang, 2017). Another mechanism was also reported by Field (2017), where an increase in gastrointestinal function marked by weight gain not only mediates the effects of massage therapy on vagal activity and gastric motility and the increased production of digestive hormones, but there is a relationship with a decrease in excess energy use or conservation energy, so feeding intolerance can be prevented by increasing the use of nutrients in premature infants.

In this study, measurement of abdominal circumference is an indication for determining abdominal distension. in the massage and control groups, researchers compared abdominal distension (abdominal girth). It was concluded that there were no significant differences in the mean abdominal distension in the two groups. However, in the abdominal massage group, the mean abdominal distension (abdominal circumference) showed a decrease compared to the control group which experienced an increase on the last day of examination. Several studies have shown the same results. such as research conducted by Tekgunduz et al. (2014) in 27 premature infants aged 28-32 weeks and body weight 1000-1750 grams. The results show that abdominal massage has an effect on decreasing abdominal distension. In addition, other FI symptoms also decreased, such as decreased GRV and frequency of vomiting.

Vomiting is another criterion for determining intolerance feeding and is a serious complication of enteral feeding (Gomella, 2013). On the first day of examination, the average vomiting frequency was 0.12 ± 0.332, then after being given an abdominal massage it decreased to 0.00 ± 0,000. This also shows the same results where in the control group also decreased. Similar research was carried out by Fazli et al. (2017). The results showed abdominal massage can reduce the incidence of vomiting in premature babies (pvalue 0.01). Similar results were also reported by Shaeri et al. (2017) and Field (2017) where both of the results of the study found symptoms of intolerance feeding can be reduced and prevented by doing abdominal massage.

Conclussion: Abdominal massage has an effect on reducing the risk of feeding intolerance in premature infants with mechanical ventilation. Abdominal massage can reduce the amount of gastric residue, abdominal distension and vomiting frequency, so that premature infants with mechanical ventilation do not experience feeding intolerance. There is a need for further research with a larger sample size regarding the effect of abdominal massage on feeding intolerance in premature infants with mechanical ventilation with randomized control trial designs and measurements of each symptom of intolerance feeding are repeated (repeted measured) continuously (time series) to produce research which is more applicable in the NICU room in Indonesia. In addition, further research is needed on the effectiveness of the effect of abdominal massage on reducing feeding intolerance in premature infants with mechanical ventilation or not.

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