doi: 10.31674/mjmr. 2019. v03i01.008

MJMR

HYPERBILIRUBINEMIA IN THE NEONATAL PERIOD RELATED TO THE DEVELOPMENT OF CHILDREN OF AGE TODDLER

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ABSTRACT

Hyperbilirubinemia is often found in the first week after birth. The most common cause of hyperbilirubinemia is an increase in serum indirect bilirubin levels. This research is motivated by several studies and theories which suggest that one of the causes of developmental disorders in children is the result of hyperbilirubinemia in the neonatal period. The aim of the study was to determine the effect of hyperbilirubinemia in the neonatal period on the level of development of toddler age children in the Tasikmalaya City area. The benefits of research as evidence-based practice about the effect of hyperbilirubinemia in the neonatal period on the level of development of toddler age children.

The study design used cohort with retrospective approach. The population of all toddler-age children in the city of Tasikmalaya with a sample of toddler age children who had a history of hyperbilirubinemia in the period 2013 to 2015. The sample consisted of 56 children who did not experience hyperbilirubinemia in the neonatal period and 32 children who experienced hyperbilirubinemia in the neonatal period. By using chi-square data analysis is to see whether there is a relationship or threat to see the contribution of confounding factors.

The results showed that there was a significant effect of hyperbilirubinemia in the neonatal period on the level of development of toddler age children (*p value*= 0.00). Confounding variables that contribute are developmental stimulation and phototherapy. Suggestions for health workers, especially nurses, should improve the detection of babies with hyperbilirubinemia so that they can be treated early.

Keywords: Hyperbilirubinemia, Neonate, Toddler Age

INTRODUCTION

Hyperbilirubinemia is a common occurrence in the first week after birth. Hyperbilirubinemia is defined as serum total bilirubin level (BTS)>5mg/dL(86 micromol/L).The most common cause of hyperbilirubinemia is due to an increase in serum indirect bilirubin (BIS) levels. In general, a baby is considered 'problematic' if the BIS level is ≥10 mg / dL, generally, it can be found the cause of pathological jaundice in these babies. Clinically hyperbilirubinemia appears as jaundice, i.e., yellow staining of the skin and mucosa caused by deposition of the product of heme catabolism. In some institutions, babies are found to suffer from hyperbilirubinemia if the BTS level is ≥12 mg / dL in term infants, whereas in preterm infants if the level is ≥10 mg / dL. At this level, tests that lead to a pathological process must be carried out.

The incidence of hyperbilirubinemia babies differs from one place to another. This is caused by differences in the causes and management factors. In Indonesia, jaundice is still a problem in newborns which is often faced by health workers in around 25-50% of term infants and higher in less-term neonates. The incidence of hyperbilirubinemia in infants varies greatly. At the RSCM Jakarta in 2007, the percentage of hyperbilirubinemia in term infants was 32.1% and in infants less than 42.95%. The mortality rate associated with hyperbilirubinemia is 13.1% (Sastroasmoro, 2004).

Bilirubin is a problem in the baby that is neurotoxic (bilirubin toxicity), which can then be developed into bilirubin encephalopathy/*Kern Icterik* (Porter & Dennis, 2002). Biliary encephalopathy is the most severe complication of neonatal jaundice. In addition to having a high mortality rate, it can also cause sequelae such as cerebral palsy, deafness high notes, paralysis and dental dysplasia which greatly affect the quality of life. Exposure to bilirubin in brain cells will cause interference with neurodevelopment. Although very high reported hyperbilirubinemia (> 30 mg/dl) in newborn infants without hemolytic disease compared

to low bilirubin levels (<8 mg/dl) is not significantly associated with deterioration of central nervous system function. Influence on the development of CNS in infants with bilirubin levels of intermediate or moderate who gets phototherapy is not known clearly (Paludetto *et al*., 2002).

In general, abnormalities in the central nerve may arise if the Indirect Bilirubin level is more than 20 mg/dl. Neurological Development Disorder (GPN) is a failure to have the ability to have neurological functions that should be possessed, which is caused by a brain defect that occurs in the early period of brain growth. One of the causes of GPN in children is the condition of hyperbilirubinemia in the neonatal phase (Hutahaean, 2007). To prevent various things that arise due to complications from hyperbilirubinemia, health workers including nurses are important to detect the presence of hyperbilirubinemia experienced by neonates.

Neurodevelopmental neonates far affected prenatal factors, perinatal and post-natal. One factor perinatal is Hiperbilirubin condition. Conceptually Hiperbilirubin can cause disturbances in neurological development including developmental disorder of motorik. This condition can also be influenced by the nutritional status of neonates in this case breastfeeding, phototherapy actions performed and developmental stimulation. Phototherapy and exchange transfusion are important actions to prevent developmental disorders in children. Early in life, babies need adequate nutrition for their growth, so they can optimize their entire growth process. For babies to develop properly, they need stimulation in various parts of the body and sensory devices (Hurlock, 2004). Lack of stimulation often increases developmental delay.

RESEARCH METHODOLOGY

The study design used was a cohort with approach retrospective. The observed changes were made to the developmental aspects of toddler age children who were included in the exposed and unexposed groups. Research location in the Tasikmalaya City Region. Samples of toddler age (1-3 years) with a history of hyperbilirubinemia in the neonatal period in the Tasikmalaya City area. The sampling technique was purposive sampling, with inclusion criteria: **1)** Children had been treated in the Perinatology Room, NICU,Ponek or RAB RSUD Dr. Soekardjo, Tasikmalaya City, which in the period of April 2013 to August 2015, 2) Levels of bilirubin in the neonatal period ranged from 10-20 mg / dl**. 3)** Children are in the Tasikmalaya City area. 4) Children do not experience mental or cerebral retardation. palsy. Data collection begins with identifying children who have been treated at Dr. Soekardjo of Tasikmalaya City for indications of hyperbilirubinemia in the April 2013 period to April 2015. Based on medical records, these children were followed through home visits to carry out development checks through the Developmental Pre-screen Card instrument and the results compared with other normal children's developmental levels without history hyperbilirubinemia during neonate. The bivariate analysis used in this study was the Chi-Square Test for the intervention group and the control group. The ANCOVA test was conducted to identify the contribution of the confounding variables to the dependent variable.

RESULTS

Description of respondent's characteristics include hyperbilirubinemia, phototherapy, stimulation of growth and development and nutrition.

Table 1: Overview of respondents' characteristics

Variables	Control		Group Cases	
	n	%	*n*	%
Hyperbilirubinemia				
1. Yes	0	0	32	100
2. No	56	100	0	0
Total	**56**	**100**	**32**	**100**
Phototherapy				
1. Yes	0	0	32	100
2. No	56	100	0	0
Total	**56**	**100**	**32**	**100**
Stimulation				
1. Not conducted	13	23.2	16	50
2. Conducted	43	76.8	16	50
Total	**56**	**100**	**32**	**100**
Nutrition				
1. PASI	8	14.3	12	37.5
2. Exclusive breastfeeding	48	85.7	20	62, 5
Total	**56**	**100**	**32**	**100**

Based on table 1 above it can be seen that the proportion of respondents based on cases of hyperbilirubinemia found 32 respondents who were exposed to hyperbilirubinemia in the neonatal period, while those who were not exposed were 56 respondents. For growth stimulation in the control group, most of them were done as many as 43 people (76.8%) and in the case group balanced between respondents who were stimulated and those who were not stimulated were 16 people (50%). Respondents mostly breastfed exclusion of the first 6 months as many as 48 people (85.7%) in the control group and 20 persons(62,5%) in the case group.

Table 2: Overview of the level of development

The level of development	Control		Group Case Group	
	n	%	*n*	%
1. Deviating	0	0	16	50
2. Doubtful	11	19.6	4	12.5
3. Corresponding	45	80.4	12	37.5
Total	**56**	**100**	**32**	**100**

Table 2 shows that in the group control of the majority of respondents was at the level of development in accordance with his age as many as 45 people (80.4%) and doubts as many as 11 people (19.6%) while in the case group of respondents the majority of respondents experienced a level of development which deviated 16 people 50%), doubting as many as 4 people (12.5%) and according to 12 people (37.5%).

Table 3: Cross table of the effect of hyperbilirubinemia on toddler age

Developmental level	Not Hyper bilirubin		Hyper bilirubin		*P value*
	n	%	n	%	
1. Deviate	0	0	16	50	0.00
2. Doubtful	11	19.6	4	12.5	
3. Corresponding	45	80.4	12	37,5	
Total	**56**	**100**	**32**	**100**	

The results of the analysis of the relationship between infants with hyperbilirubinemia and the level of development of children at the age of toddlers found that as many as 16 children with a history of hyperbilirubinemia in the newborn period experienced the level of development of distorted or not in accordance with his age, while children who are not exposed to hyperbilirubinemia in future any of the neonates experienced a deviant development level or 0%. The statistical test results obtained $p = 0.00$, it can be concluded that there is a difference in the proportion of developmental events between children who have been exposed to hyperbilirubinemia and children who are not exposed to hyperbilirubinemia in the neonatal period, RR cannot be calculated because the development variable is more than 2 cells.

Table 4: Results of Analysis of Covariance (ANCOVA)

Parameter	B	Sig.	Partial eta squared
Intercept	535.102	0.00	4189.522
Phototherapy	17.558	0.00	137.472
Stimulating growth	25.578	0.00	200.261
Nutrition	0.032	0.616	0.032
Hyperbilirubinemia	0.00	0.0128	0.253

From the table above it can be seen that the parameters of *hyperbilirubinemia* in the newborn period has a *p*-value of 0.0128, which means that there is a significant effect of cases of hyperbilirubinemia in the neonatal period on the level of development of children at toddler age, variable *confounding* phototherapy, stimulation of growth and development, and nutrition each has a *p*-value of 0.00; 0.00 and 0.616 where all of them are only nutritional variables which are not significant to the level of development of toddler age children who experience hyperbilirubinemia in the neonatal period.

DISCUSSION

Hyperbilirubinemia in the neonatal period and its influence on the level of development of toddler age children

In the research that was conducted, respondents consisted of 56 children who did not experience hyperbilirubinemia and 32 respondents experienced hyperbilirubinemia in the neonatal period. Of the total respondents who experienced hyperbilirubinemia, all were carried out phototherapy. It is not known exactly which bilirubin levels are experienced but based on data collection most babies who have hyperbilirubinemia and phototherapy are babies born less than a month (preterm). Theoretically, it is said that until now there have been no clear criteria for the level of bilirubin that can cause developmental disorders. This cannot be answered solely by numbers only, because serum bilirubin levels are one of several factors that cause the risk of developmental disorders in children, except in cases where levels are very high (Hutahaean, 2007). The toxicity of bilirubin that occurs cannot be proportional to the serum bilirubin concentration. This is due to bilirubin toxicity determined by the concentration of bilirubin in brain tissue and the duration of exposure to bilirubin in tissues (Shapiro, 2003; Hansen, 2002).

From the results of the developmental examination of toddler age children who had hyperbilirubinemia in the neonatal period, it was found that 16 people (50%) experienced deviations in the level of development, doubted 4 people (12.5%) and 12 people (37.5%) experienced a level of development that suits your age. The statistical test results obtained $p = 0.00$, it can be concluded that there is a difference in the proportion of deviant developmental events between children who have been exposed to hyperbilirubinemia and children who are not exposed to hyperbilirubinemia in the neonatal period.

This result is in line with research conducted by Hutahaean (2007) which states that the average serum bilirubin level in infants with neurological developmental disorders is higher compared to infants who do not experience developmental disorders. It is also said that the higher the serum bilirubin level, the risk of neurological developmental disorders in children will appear earlier. Bilirubin toxicity causes lesions, especially in the basal ganglia, which regulates the body's tonus and motor movements, especially rough movements. Pathologically the anatomy is found in the area of the basal ganglia which is typical of yellow staining due to attachment of indirect bilirubin. In this area, there is a process of loss of neurons, reactive gliosis and fiber atrophy (Newman & Klebanoff, 2002). This is in accordance with the results of a study by Hutahaean (2007) which states that neurological developmental disorders occur mainly in the expressive neurological sector which indicates the occurrence of basal ganglia disorders.

In the research that has been done, the development is measured using the KPSP instrument wherein it contains gross motoric aspects, fine motoric, language, and personal social but not separate means that the four aspects become a single unit of assessment. Developmental deviations are assessed if the child can only do or have abilities less than 7 points from 10 or 9 points observed. Of the respondents who experienced hyperbilirubinemia in the newborn period developmental disorders that occur primarily on gross motor and language aspects, where children in the inability to deliver the activities related to the activitiesv large muscle and expression.

The results of this study are not consistent with research that has been done before by Nugroho, Ismail & Surjono (2006), which identifies the level of development of children aged 3-5 years based on criteria hyperbilirubinemia and non-hyperbilirubinemia in the newborn period using instruments DDST and cohort approach retrospective. The results obtained there were no significant differences in the level of development for children suspected of hyperbilirubinemia and in hyperbilirubinemia in the neonatal period (*p value*= 0.09, RR = 4.46).

Phototherapy, nutrition, and stimulation of growth factors for toddler age development Confounding

variables studied were phototherapy, developmental stimulation, and nutrition, each obtained *p value*= 0.00 for phototherapy; *p value*= 0.00 for developmental stimulation, and *p value*= 0.616 for nutrition where from the whole only nutritional variables are not significant to the level of development of toddler age children who have hyperbilirubinemia in the neonatal period.

Phototherapy and exchange transfusion are important actions to prevent developmental disorders in children. Phototherapy is used so that the bilirubin level does not increase to a level that requires exchange transfusions. During this time phototherapy has been known as a safe and effective action and can reduce the need for exchange transfusion measures (Hockenberry & Wilson, 2009). In the research that has been done, respondents who experienced hyperbilirubinemia during the whole neonatal period received phototherapy. The results of the statistical analysis obtained *p-value* 0.00 so it can be concluded that there was a contribution from phototherapy to the effect of hyperbilirubinemia in the neonatal period on the development of toddler age children.

Early in life, babies need adequate nutrition for their growth, so they can optimize their entire growth process. ASI (Mother's Milk) is a complex biological liquid that contains all the nutrients needed by the child's body. Its nature is very easily absorbed by the baby's body, making it the main nutrient that best meets the requirements for infant growth and development (Putriani, 2012). Breast milk is also the best nutrition for the growth and development of the child's brain because in breast milk there is a higher fat content than formula milk. This high-fat level is needed to support rapid brain growth during infancy. During birth, the baby's brain has not fully developed and will continue to grow and develop, then make important relationships between cells that exist until about 3 years after birth. If this process gets complete, brain cells will die, and no new cells will form (Putriani, 2012). As explained in the theory that baby's motor skills are greatly affected by the development of his brain (Hurlock, 2004). It is the brain that runs every movement the child does. The maturation of the development of the brain's nervous system that regulates muscles allows the development of children's competence or motor skills. Thus, the ASI provides significant benefits for the development of the baby's brain which later also affects the motor development.

In the research that has been done, giving ASI to children when babies give less significant results to the developmental aspects of toddler age children (*p-value* 0.616). This is probably due to the fact that children who experience irregularities in their development are mostly getting breast milk during their baby's life. Theoretically, aspects of child development are determined by many factors not only from nutritional factors even though nutrition also contributes greatly to

the growth and development of children later.

The literature states that for babies to develop properly they need stimulation in various parts of the body and sensory devices (Hurlock, 2004). Lack of stimulation often increases developmental delays and further increases the attitude of parents who are less pleasant, then a vicious circle occurs and the baby becomes an innocent victim due to the developmental delay experienced. From the results of the research conducted, stimulation from parents or family has a significant influence on the development of toddler age children with a *p-value of* 0.00.

CONCLUSION

There is a significant difference in the level of development of toddler age children in the group who experienced hyperbilirubinemia in the neonatal period with children who did not experience hyperbilirubinemia (*p-value* 0.00). Phototherapy and stimulation of growth and development significantly contributed to the development level of toddlers who had experienced hyperbilirubinemia during the neonatal period while nutrition did not significantly contribute to the development of toddlers who had experienced hyperbilirubinemia in the neonatal period.

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