Evaluation of Motor & Cognitive Milestones in Preterm and Full Term Neonates with Hyperbilirubinemia

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Abstract

Background: Hyperbilirubinemia is the most common cause of neonatal admission during first week of life, so it should be considered to follow up its hazards on development.

Objective: To detect the possible occurrence of motor& mental delay in infants as a complication of neonatal hyperbilirubinemia.

Subjects and method: A prospective longitudinal case control study was done by using Bailey scale III to evaluate and follow up motor& mental developmental parameters in 2 groups, cases group (group I) which is subdivided into group (Ia) that includes 55 jaundiced full- term neonates and group (Ib) that represent 54 jaundiced preterm neonates, these 109 (preterm& full- term) jaundiced neonates were admitted in Neonatal Intensive Care Unit, New Cairo Hospital, and control group (group II) which includes 52 non jaundiced fullterm neonates attending Health Center of The Ministry of Health in New Cairo.

Results: In the present study cases had lower Bailey III mental assessment scores compared to controls as there was a statistically significant difference between both groups, as cases group had a significant negative correlation between Total Serum Bilirubin level and Bailey scale scores for mental assessment at 2^{nd}, 4^{th}, 6^{th}, 9^{th}& 12^{th} months was proved.

Despite the previous results, there was no statistically significant difference between both groups as regard mental assessment at the age of 18 months. The study also showed a significant difference between both groups (cases& control), as regard a row scores of motor scales of Bailey, as cases group achieved lower scores in motor assessment in comparison to control group. There is a statistically significant negative correlation between Total Serum Bilirubin and Bailey scores for motor assessment at 2^{nd}, 4^{th}, 6^{th}, 9^{th}, 12^{th}& 18^{th} Months. These findings depicted that there was a significant relationship between neonatal hyperbilirubinemia and further developmental delays (motor and mental) in infancy ($P < 0.05$).

Conclusion: Neonatal jaundice should be considered and followed up for motor and mental skills during infancy, as identification of early developmental delay can be effective in preventing susceptible developmental problems later on through interventional programs.

Keywords: Neonatal Jaundice, developmental delay, Bailey III scale.

تقييم الحركية والمعرفية فى الولدان الخدج وكاملى المدة مع فرط بيليروبين الدم

الخلفية: أجريت هذه الدراسة للكشف عن التأخر الحركى والإدراكى فى الأطفال الرضع الذين أدخلوا فى وحدة الرعاية المركزة للمواليد الذين يعانون من فرط البيليروبين لمقارنة معدلات النمو للرضع مكتملى النمو والرضع الخدج. هذه الدراسة دراسة طولية ولقد تم اجراء هذه الدراسة فى "وحدة العناية المركزة" للأطفال حديثى الولادة وعيادة الأطفال المبتسرين بمستشفى القاهرة الجديدة. ولقد تم استخدام مقياس بيلى فى عمر شهرين، واربعة، وستة، وتسعة، واثنى عشر، وثمانى عشرة أشهر وقد انقسمت مجموعات الدراسة إلى ثلاث مجموعات (المجموعة الاولى أ) المواليد الناضجين مع فرط بيليروبين الدم،، وعددهم ٥٥ حالة. (المجموعة الاولى ب) المواليد الخدج مع فرط بيليروبين الدم، وعددهم ٥٤ حالة (المجموعة الضابطة) المواليد العادية مكتملى النضج وعددهم ٥٢ حالة. ولقد تم استبعاد المواليد ذوى المشكلات التالية (التشوهات الخلقية التى قد تؤثر على المعالم التنموية وحديثى الولادة مع نقص الاكسجة الدماغية وحديثى الولادة مع الأمهات المصابة بمرض السكري).

النتائج: أثبتت الدراسة ان هناك فرق ذو دلالة احصائية بين المجموعات الخاضعة للدراسة حيث كانت دلالات تقييم النمو العقلى والحركى فى المواليد ذوى فرط البيليروبين منخفضة مقارنة مع الولدان الأصحاء، اى ان العلاقة كانت سلبية فى عمر شهرين واربعة أشهر وستة اشهر وتسعة اشهر واثنى عشر شهر. ولم تظهر هذه الدراسة فرقا ذو دلالة إحصائية بين المجموعتين فيما يتعلق بالتقييم الذهنى فى سن ثمانية عشر شهر. وعلى الجانب الأخر كانت العلاقة سلبية فيما يتعلق بالتقييم الحركى فى سن ثمانية عشر شهر.

الخلاصة: وقد بينت النتائج التى توصلنا إليها ان هناك علاقة ايجابية ملحوظة هامه بين فرط بيليروبين المواليد والتأخر فى النمو (الحركى والعقلي). لذلك ينبغى النظر فى اليرقان حديثى الولادة ومتابعته للمهارات الحركية والعقلية اثناء الرضاعة، لان الاكتشاف المبكر للتأخر يكون له دور ايجابى وفعال فى منع التأخر العقلى والحركى من خلال البرامج التدخلية.

كلمات مفتاحية: فرط بيليروبين المواليد والتأخر فى النمو ومقياس بيلي.

Introduction

Neonates are children from birth to the age of 28 days of postnatal life.[1]

Developmental history is usually organized by domains of development, areas to be included are gross motor skills, fine motor skills, social interaction, language and behavioral development.[1]

Child Development is the process of change in which a child comes to master more and more complex levels of physical activity, thinking, feeling, communicating and interacting with people and objects. This is sometimes expressed as physical, cognitive, emotional and social development.[2]

Early detection of developmental disability is important. So early complete head- to- toe examination is important to identify abnormalities that may have an impact on a child's development. The examination begins with accurate measurement of growth parameters, Weight, height, and head circumference should be documented routinely and plotted on standard growth forms.[3]

When a child is born prematurely, the adjusted age may be used for plotting these growth parameters.[3]

Neurological assessment should be considered to provide information regarding motor function and sensory integrity which are important to identify abnormalities.[4]

The Bailey Scales of Infant Development (BSID) measure the mental and motor development and test the behavior of infants from one to 42 months of age.[4]

The BSID are used to describe the current developmental functioning of infants and to assist in diagnosis and treatment planning for infants with developmental delays or disabilities.[4]

Neonatal hyperbilirubinemia (HB) is a well- recognized risk factor for severe neurological disability,[4] is the most common clinical condition requiring evaluation and treatment in the newborn and the most common cause for hospital admission.[5]

Neonatal Hyperbilirubinemia clinically has been defined as TSB levels> 95th percentile for age in hours, which may require follow- up and treatment.[5]

Aim:

Aim of the study to detect the possible occurrence of motor& mental delay in infants as a complication of neonatal hyperbilirubinemia.

Subjects& Methods:

A prospective longitudinal case control study was done by using Bailey scale to evaluate and follow up motor& mental developmental parameters in group I as 109 neonates which are divided into [group Ia to include 55 full- term neonates with jaundice and group Ib which represented preterm jaundiced neonates] as a sample pool of (cases group) admitted in Neonatal Intensive Care Unit in New Cairo Hospital and to follow up motor and mental developmental parameters in 52 non jaundiced neonates attended Health Center of The Ministry of Health in New Cairo as (control group), neonates with Congenital anomalies were excluded as they might affect developmental milestones, Neonates with hypoxic ischemic encephalopathy and Neonates with maternal risk factors as in Infant of diabetic mother (IDM).

The study was performed according to criteria of ethical committee of scientific research of Faculty of Post- Graduate Childhood Studies, Informed written consent was taken from the parents after explaining the nature of assessment included in the present study.

For each neonate participated in the study was subjected to:

1. History taking: Laying stress on (Antenatal& natal) history& family history of any diseases with delayed motor or mental presentations.
2. General and clinical examination with special emphasis on estimation of gestational age using Ballard score& Auxological assessment.[6]
3. Anthropometric examination for measurement of length, weight& occipitofrontal circumference of all neonates at time of examination.[7]
4. Laboratory investigations as blood samples for total serum bilirubin level assessment at time of examination.
5. Bailey III Scale was used at the age of (2, 4, 6, 12& 18) months of life as follow up tool to assess mental& motor developmental delay.

Developmental delay was classified "at risk" if a Bailey III score was below 85 on any of the cognitive or motor scales, and as a "delayed" if a Bailey III score was below 70 on any of the subscales. The mean (standard deviation) of the original normative Bailey population was 100.[8]

There was some limitations in our study due to difficulty of follow up of the cases for 18 months so drop out of cases was noticed especially in control group.

Results:

This study represented follow up study for motor and mental parameters in cases group (group I) and control group (group II).

Cases group was subdivided into 2 groups, group Ia which included 55 full term jaundiced neonates with average total serum bilirubin of (9.8- 19.9) mg./ dl., and weight average (2.7- 4.2) Kg., group Ib Total serum bilirubin within range (11.8- 19.9) mg./ dl. And weight average (1.7- 2.4) Kg., and on the other hand control group which represented nonjaundiced neonates were with average weight (2.7- 4.2) Kg.

Table (1) Comparison between groups according to mental scales.

Mental Scales		Group Ia fullterm Jaundiced) (N= 55)	Group Ib Preterm Jaundiced (N= 54)	GroupII Fullterm Nonjaundiced II (N= 52)	ANOVA	P- Value
At 2m.	Mean±SD	110.16±12.81	102.02±14.40	122.27±15.82	22.531	<0.001**
	Range	86- 140	77- 140	81- 141		
At 4m.	Mean±SD	109.16±11.54	104.91±13.75	116.38±16.88	7.472	<0.001**
	Range	90- 137	80- 131	80- 142		
At 6m.	Mean±SD	111.29±12.34	109.07±16.71	118.36±16.92	4.425	0.014*
	Range	88- 135	77- 138	85- 145		
At 9m.	Mean±SD	113.24±15.36	111.33±13.92	120.62±18.09	4.292	0.016*
	Range	85- 141	90- 138	85- 190		
At 12m.	Mean±SD	117.33±15.35	109.80±15.86	117.82±15.42	3.766	0.026*
	Range	80- 140	85- 140	88- 140		
At 18m.	Mean±SD	120.69±14.45	114.71±14.56	119.96±17.14	2.009	0.138
	Range	83- 139	85- 142	76- 145		

F: ANOVA test; *p- value <0.05 significant; **p- value <0.001 highly significant

This table shows statistically significant difference between groups according to mental scales from 2m to 12m. but there was no statistically significant difference between groups at age of 18 m.

There was drop out of total number of cases and control groups, as group Ia was started with 80 cases and reached actual number of 55cases, and group Ib was 85 and the actual number reached 54& control group was 90 and was completed with actual number of 52 only.

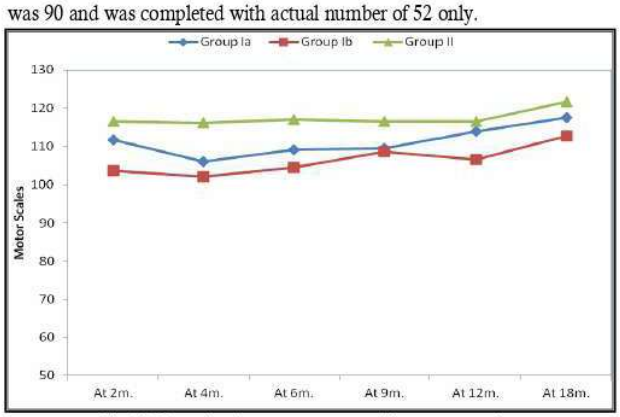

Fig. (1) Shows line between groups according to motor scales.

On the other hand this figure shows that there was statistically significant difference between cases and control group from (2- 18) months as regard motor milestones.

Discussion:

In the present study 109 (preterm& full- term) jaundiced neonates as a sample pool for cases group and 55 non jaundiced neonates represented control group were followed up using Bailey scale III for motor and mental assessment during first 18 months of life, and excluded neonates with, congenital anomalies which might affect developmental milestones, neonates with hypoxic ischemic encephalopathy and neonates with maternal risk factors as in infant of diabetic mother

Numerous retrospective studies have attempted to support or refuse the relationship of neonatal hyperbilirubinemia with neurodevelopmental outcomes.[9]

A particular challenge in understanding this relationship has been the use of varying measures of neurodevelopment. Such as the Bailey Scales of Infant Development (BSID), Previous results were evidenced Through the Collaborative Study in the National Institute of Neurological Diseases and Blindness as it showed that Neonatal hyperbilirubinemia affected neurological development represented by (motor& mental milestones) as 23.000 infants had been observed from birth through 18 months of age. The findings appear to indicate a positive relationship between neonatal hyperbilirubinemia with the incidence of low motor and/or mental scores.[9]

These data are more or less similar, as follow up study was conducted on the studied groups during (2nd, 4th, 6th, 9th& 12th) months of age using F; Anova test to compare between them as regard motor and mental development and showed a statistically significant negative correlation between TSB and BSID scores in the studied groups, as the range scores of group Ia, group Ib and control group as regard motor& mental Milestones.

This coincides with a cohort study of 50 infants with total serum/ plasma bilirubin (TB)> 400 mmol/L (23.4 mg/ dL) born in 1991 and 1992 in Bulawayo, Zimbabwe, which used the BSID to assess overall neurodevelopmental milestones at 1 year of age. This included a mixed population of preterm and term infants with jaundice from multiple causes. The authors found a statistically significant negative correlation between TSB and BSID scores among this group (0.59, P <0.001).[10][11]

Yet this study did not agree with a retrospective analysis performed by the National Institute of Child Health and Human Development (NICHD) Neonatal Research Network (NRN) as regard mental development index as they examined the association between peak TSB and neurodevelopmental outcome at 18- 22months of age among 2575 extremely low birth weight (ELBW) infants. This study found that peak TB directly correlated with significantly lower scores on the psychomotor index of the BSID, but no significant association between TB and scores in the mental development index (MDI).[12]

On the other hand the study done by the National Institute of Child Health and Human Development (NICHD) Neonatal Research Network (NRN) was in accordance with our study results of mental assessment at age of 18 months as there was no statistical difference between the studied groups as regard mental milestones at 18th months of age.

A prospective case- control study of 146 term and near- term infants with hyperbilirubinemia found no significant differences as regard motor examinations, or neurologic bases at 18 months of age, which disagree with the present study, which represented a significant association between TSB level and motor development.[13]

Conclusion& Recommendations:

Neonatal jaundice is associated with delayed motor and mental, milestones, during infancy, as Bailey motor and mental scores were lowest with neonates who had higher total serum bilirubin level& highest in, normal total serum bilirubin group, control group, so complications of neonatal hyperbilirubinemia as developmental delay should be survied and diagnosed early for early management& intervention through specialized programs.

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