

DEVELOPMENTAL ASSESSMENT IN HIGH RISK INFANTS AS COMPARED TO NORMAL INFANTS UPTIL 1 YEAR OF AGE AT TERTIARY CARE CENTRE

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Abstract

A "high-risk infant" is a newborn who needs more attention and care than the average healthy term baby. Following up on high risk cases is crucial because it can help identify and intervene in those infants who need special care, such as those with prematurity, LBW, HIE, sepsis, pathological jaundice, hypoglycemia, etc.

Materials and Methods: In this prospective study 222 newborns who had been delivered at Dr. D.Y Patil Medical College, Hospital, Pimpri, Pune were enrolled and those who came to follow up in well baby clinic and high risk OPD were assessed using HINE and DASII

Results: HIE was present in 5.1% in term babies compared to 15.8% in preterm. Birth weight <1800gm was more common in preterm (84%) and in term, it was only 6.3%. Sepsis occurred in 26.3% in preterm and 3.2% in term babies. PPHN was diagnosed in 7.9% of preterm babies and 5.1% term babies. HMD was common in preterm (36.8%) compared to 4.4% in term babies. Among the babies with high-risk, 69 (72%) were in the borderline (71-90) and among normal babies, 26 (26%) were in borderline mental DQ classification. Among the babies with high-risk, 73 (76%) were in the borderline (71-90) and among normal babies, 44 (44%) were in borderline motor DQ classification. The proportion of babies in borderline was quite high in high-risk group when compared to normal and this was significant with the p value of <0.001. Among babies with high risk 36(37.5) had HINE of less than 70 at 6 months. There was a significant difference between the high-risk and normal group with a p value of <0.001.

Conclusion: Developmental assessment must be carried out in conjunction with a medical assessment in high risk babies for appropriate additional testing and interventions.

Introduction

A "high-risk infant" ⁽¹⁾ is a newborn who needs more attention and care than the average healthy term baby. Babies who are born prematurely or late in the term range are also considered high-risk, as are those who have abnormal growth for their gestational age or show signs of metabolic issues, or congenital anomalies. Following up on high risk cases is crucial because it can help identify infants who need special care, such as those with prematurity, LBW, HIE, sepsis, pathological jaundice, hypoglycemia, etc. Follow-up enables early corrective

actions to be taken to decrease risk factors' negative effects on development. Additionally, it will enable us to comprehend the consequences of different percussions during the perinatal period.

Aim:

Developmental assessment in high-risk infants as compared to normal infants upto 1 year of age at a tertiary care center

Objectives:

To look for the neurodevelopmental delay in high risk infants

Materials and Methods:

In this prospective study, 222 newborns who had been delivered at Dr.D.Y Patil Medical College, Hospital, Pimpri, Pune during the period of September 2020 to September 2021 were enrolled and those who came to follow up in well baby clinic and high risk OPD were assessed using HINE and DASII for one year

Inclusion criteria

Newborn babies with less than 37 wks gestation,

Major morbidities such as CLD, IVH and PVL.

Perinatal asphyxia - Apgar score 3 or less at 5 min and/or HIE

SGA (<3rd centile) and LGA (>90th centile), Mechanical ventilation for more than 24 hours,

Hypoglycemia and hypocalcemia, Seizures, Meningitis, Shock

Infants born to HIV-positive mothers, TTTS, Kernicterus, hyperbilirubinemia, Abnormal neurological examination at discharge born in D.Y Patil Hospital and has been admitted to NICU were taken into consideration

Exclusion criteria

Severe multiple congenital anomalies, Dysmorphic infants! Congenital heart disease! Metabolic etiologies, Metabolic encephalopathy

Methodology

Babies fulfilling inclusion criteria were enrolled. Purpose of the study was explained to parents/caretaker and a written informed consent was taken after assuring them about the confidentiality of data. Clinical details were documented in structured clinical proforma.

Neurological assessment was done using HINE at 3, 6 months and validated by a neonatologist. Developmental assessment was done using DASII at 12 months and authenticity was checked by child psychologist trained in DASII.

Results and Observations

Data was collected using preformed data collection form. HINE score was applied at 3,6 months of age and DASII Scoring was done at one year of age and was analysed using SPSS Software. Qualitative data was presented as frequency and percentage. Categorical data between groups were compared using chi square test. A P value of less than 0.05 was considered significant.

In our study we enrolled a total of 222 babies ,out of which 196 babies were followed till one year of age as per protocol and 26 babies were lost to follow up.Among the study population with male, 52.4% of them had normal and among high-risk population, those gestational age between **28-32weeks**, 20.2% of them were female, 4.9% of them were Male. And those gestational age between **33-36 weeks**, 6.9% of them were male, 5.3% of them were female.

Of all the babies with high risk, 60 (62.5%) were born in term and 36 (37.5%) were pre-term. Among the normal babies, 98% were born in term and 2% were pre-term. There was a significant association observed between the risk of the baby and gestational age at delivery (p<0.001).

HIE was present in 5.1% in term babies compared to 15.8% in preterm. Occurrence of hypoglycaemia was almost equal in term and preterm babies (3.2% vs 2.6%). NNJ without DVET was seen in 17.7% in term babies compared to 5.3% in preterm. Birth weight <1800gm was more common in preterm (84%) and in term, it was only 6.3%. Sepsis occurred in 26.3% in preterm and 3.2% in term babies. PPHN was diagnosed in 7.9% of preterm babies and 5.1% term babies. HMD was common in preterm (36.8%) compared to 4.4% in term babies.

Table 1: Mental DQ classification

DQ mental	High risk		Healthy babies	
	n	%	n	%
Normal (91-100)	27	28.1	74	74.0
Borderline (71-90)	69	71.9	26	26.0
Mild (50-70)	0	0.0	0	0.0
Total	96		100	
Chi square test P value<0.001				

Among the babies with high-risk, 69 (72%) were in the borderline (71-90) and among normal babies 26 (26%) were in borderline mental DQ classification. There was a difference of 45% between the high-risk and normal group and this difference was significant with the p value of <0.001

Table 2: Motor DQ classification

DQ motor	High risk		Healthy babies	
	n	%	n	%
Normal (91-100)	19	19.8	56	56.0
Borderline (71-90)	73	76.0	44	44.0

Mild (50-70)	4	4.2	0	0.0
Total	96		100	
Chi square test P value<0.001				

Among the babies with high-risk, 73 (76%) were in the borderline (71-90) and among normal babies 44 (44%) were in borderline motor DQ classification. The proportion of babies in borderline was quite high in high-risk group when compared to normal and this was significant with the p value of <0.001

Table 3: HINE at 3 months (<67)

HINE at 3 months	High risk		Normal	
	n	%	n	%
<67	19	19.8	0	0.0
≥67	77	80.2	100	100.0
Total	96		100	
Chi square test P value<0.001				

Table 4: HINE at 6 months (<70)

HINE at 6 months	High risk		Normal	
	n	%	n	%
<70	36	37.5	0	0.0
≥70	60	62.5	100	100.0
Total	96		100	
Chi square test P value<0.001				

Among the babies with high-risk 19 (19.8%) had HINE score of less than 67, 77 (80.2%) had HINE score of ≥67 and among normal babies all had the score of ≥67. There was a difference of 20% between the high-risk and normal group and this difference was significant with the p value of <0.001. Among babies with high risk 36(37.5) had HINE of less than 70. All the babies (100%) in normal group and 62.5% of babies in high-risk group had HINE score of ≥70. There was a significant association observed between the risk of the baby and HINE scoring at 6 months.

Table 5: Risk factors (DQ Motor)

Risk factors	Mild (50-70)		Borderline (71-90)		Normal (91-100)		P value
	n=4	%	n=73	%	n=19	%	
HIE	2	50.0	14	19.2	0	0.0	0.026
Hypoglycemia	0	0.0	6	8.2	0	0.0	0.365
NNJ	0	0.0	19	26.0	13	68.4	0.001
Birth weight <1800g	2	50.0	30	41.1	6	31.6	0.684
Sepsis	2	50.0	13	17.8	0	0.0	0.025
PPHN	0	0.0	11	15.1	0	0.0	0.141
HMD	1	25.0	15	20.5	5	26.3	0.853

The difference between the borderline group and the mild group (HIE prevalence of 50% vs. 19%; $P=0.026$) was statistically significant. With a statistically significant difference ($P=0.001$), NNJ was more prevalent in the normal group (68.4%) than in the borderline group (only 26%). As contrast to the 17.8% in the borderline group, 50% of the mild group got sepsis, and this difference was statistically significant ($P=0.025$). HMD was comparable between groups, and the P value ($P=0.853$) did not indicate any significance.

Table 6: Risk factors (DQ Mental)

Risk factors	Mild (50-70)		Borderline (71-90)		Normal (91-100)		P value
	n=0	%	n=69	%	n=27	%	
HIE			16	23.2	0	0.0	0.006
Hypoglycemia			6	8.7	0	0.0	0.114
NNJ			11	15.9	21	77.8	<0.001
Birth weight <1800g			35	50.7	3	11.1	<0.001
Sepsis			15	21.7	0	0.0	0.008
PPHN			11	15.9	0	0.0	0.027
HMD			19	27.5	2	7.4	0.032

As opposed to none in the normal group, 23.2% of those in the borderline group developed HIE, and this difference was statistically significant ($P=0.006$). The difference between the prevalence of NNJ in the normal group (77.8%) and the borderline group (15.9%) was statistically significant ($P=0.001$). When compared to the normal group, the borderline group had a higher prevalence of birth weights under 1800 grammes (50.7% vs. 11.1%), and this difference was statistically significant ($P=0.001$). Sepsis was diagnosed in 21.7% of the borderline group while none was diagnosed in the normal group; this difference was statistically significant

(P=0.008). Similar to this, there were 15.9% PPHN cases in the borderline group compared to none in the normal group, and this difference was statistically significant (P=0.027). HMD was observed in 27.5% of the borderline group as opposed to 7.4% of the normal group, and the P value (P=0.032) was significant.

Table 7: Risk factors (DQ Motor) in term babies

Risk factors	Mild (50-70)		Borderline (71-90)		Normal (91-100)		P value
	n=2	%	n=45	%	n=13	%	
HIE	2	100.0	8	17.8	0	0.0	0.002
Hypoglycemia	0	0.0	5	11.1	0	0.0	0.403
NNJ	0	0.0	18	40.0	11	84.	0.007
Birth weight <1800g	0	0.0	7	15.6	0	0.0	0.267
Sepsis	0	0.0	5	11.1	0	0.0	0.403
PPHN	0	0.0	7	15.6	0	0.0	0.267
HMD	1	50.0	3	6.7	2	15.4	0.104

It was statistically significant (P=0.002) that 100% of the mild group had HIE compared to 17.8% of the borderline group. NNJ was prevalent in the normal group (84%) and in the borderline group (40%), with a statistically significant difference (P=0.007). For hypoglycemia, birthweight 1800gm, sepsis, PPHN, and HMD, there was no statistically significant connection between the groups.

Table 8: Risk factors (DQ Mental) in term babies

Risk factors	Borderline (71-90)		Normal (91-100)		P value
	n=36	%	n=24	%	
HIE	10	27.8	0	0.0	0.005
Hypoglycemia	5	13.9	0	0.0	0.057
NNJ	8	22.2	21	87.5	<0.001
Birth weight <1800g	7	19.4	0	0.0	0.022
Sepsis	5	13.9	0	0.0	0.057
PPHN	7	19.4	0	0.0	0.022
HMD	5	13.9	1	4.2	0.219

As opposed to none in the normal group, 27.8% of those in the borderline group developed HIE, and the difference was statistically significant (P=0.005). 13.9% of newborns in the borderline group had hypoglycemia, compared to none in the normal group. The difference between the prevalence of NNJ in the normal group (87.5%) and the borderline group (22.2%) was statistically significant (P 0.001). Compared to none in the normal group, 19.4% of infants in the borderline group had birth weights under 1800 grams (P=0.022). Compared to none in the normal group, 13.9% of people in the borderline group experienced sepsis, although the difference was not statistically significant (P=0.057). Similar to this, 19.4% of the borderline group developed PPHN whereas none of the normal group did, and this difference was statistically significant (P=0.022). HMD was seen in 13.9% in borderline group compared to 4.2% in normal group and P value was not significant (P=0.219).

Table 9: Risk factors (DQ Motor) in pre-term babies

Risk factors	Mild (50-70)		Borderline (71-90)		Normal (91-100)		P value
	n=2	%	n=28	%	n=6	%	
HIE	0	0.0	6	21.4	0	0.0	0.358
Hypoglycemia	0	0.0	1	3.6	0	0.0	0.863
NNJ	0	0.0	1	3.6	2	33.3	0.052
Birth weight <1800g	2	100.0	23	82.1	6	100.0	0.436
Sepsis	2	100.0	8	28.6	0	0.0	0.023
PPHN	0	0.0	4	14.3	0	0.0	0.526
HMD	0	0.0	12	42.9	3	50.0	0.446

As opposed to 28.6% in the borderline group and none in the normal group, 100% of those in the mild group got sepsis; this difference was statistically significant (P=0.023). HMD was prevalent in the normal group (50%) and the borderline group (42.9%), although there was no statistically significant difference between the two groups (P=0.446). Other risk variables as HIE, hypoglycemia, birthweight 1800gm, andPPHN showed no statistically significant connection between the groups.

Table 10: Risk factors (DQ Mental) in pre-term babies

Risk factors	Borderline (71-90)		Normal (91-100)		P value
	n=33	%	n=3	%	
HIE	6	18.2	0	0.0	0.418
Hypoglycemia	1	3.0	0	0.0	0.760
NNJ	3	9.1	0	0.0	0.585

Birth weight <1800g	28	84.8	3	100.0	0.468
Sepsis	10	30.3	0	0.0	0.262
PPHN	4	12.1	0	0.0	0.522
HMD	14	42.4	1	33.3	0.760

Compared to the normal group, which had 100% of babies with birth weights under 1800 grams, only 84.8% of those in the borderline group had this circumstance (P=0.468). The difference between the two groups was not statistically significant (P=0.262), however in the borderline group, 30.3% of patients got sepsis as opposed to none in the normal group. Other risk factors did not significantly differ.

Table 11: Developmental delay comparison between IUGR and AGA babies

Variable	Mild (50-70)		Borderline (71-90)		Normal (91-100)		P value
	n	%	n	%	n	%	
DQ Motor	2		89		67		
IUGR	0	0.0	26	29.2	9	13.4	0.047
AGA	2	100.0	63	70.8	58	86.6	
DQ Mental	0		61		97		
IUGR	0		18	29.5	17	17.5	0.077
AGA	0		43	70.5	80	82.5	

Compared to 29.2% IUGR in the borderline group and 13.4% IUGR in the normal group, 100% of the newborns in the mild group with DQ Motor status were AGA; this difference was statistically significant (P=0.047). DQ Mental status was not statistically significant (P=0.077).

Discussion

In present study, among the babies with high-risk, 69(72%) were in the borderline in mental DQ classification, 73(76%) were in the borderline (71-90) in motor DQ classification. The proportion of babies in borderline was high in high-risk group in both modalities when compared to normal and this was significant with the p-value of <0.001.

In Chattopadhyay et al which studied developmental outcomes using various methods like DDST. Amiel Tison in high-risk newborns had a developmental delay of 31.6 % in study population. In preterms, LBW babies and identical twins had higher prevalence of neurodevelopmental delay. Among 134 children with developmental delay 61 were preterm 80 were LBW and 50 had history of sepsis ,14 had convulsions at birth ,39 had birth asphyxia and 14 had jaundice. ⁽²⁾

In Shrabani mandal et al study which done a observational follow up study on high risk newborns showed higher developmental delay in cases of high risk newborns. ⁽³⁾

In present study where HINE was performed at 3 months and 6 months the children who had HINE scores less than 67 which is a suboptimal value progressed to further delay at 6 months. Among the babies with high-risk 19 (19.8%) had HINE score of less than 67 at 3 months and at 6 months 36(37.5) had HINE of less than 70. There was a difference between the high-risk and normal group and this difference was significant with the p value of <0.001.

In the Domenico M.M. Romeo et al study, which validated the HINE score prediction for neurological outcomes in SNCU graduates, all infants with motor delays scored between 40 and 66 at three months of age. Few infants only increased their scores by 3 and 6%, respectively, at 9 and 12 months. The infants with CP had the lowest scores overall, with a median score ranging from 35.5 at 3 months to 45.5 at 12 months. None of them reached the ideal scores of 73 at 9 or 12 months. ⁽⁴⁾

In the present study, high-risk babies with HIE in the motor component showed mild developmental delay in 2 of them, and borderline developmental delay in 14 of them, with a significant p value of 0.026. With a significant p value of 0.001, 19 high-risk newborns with jaundice had borderline delays, while 13 had no delays. In neonates at high risk for sepsis, 2 showed a mild delay and 13, with a significant p value of 0.025, showed a borderline delay.

In mental component high risk babies with HIE,16 had borderline developmental delay with a significant p value of 0.006. Among babies with jaundice,11 had borderline developmental delay,21 had no developmental delay with a significant p value of less than 0.001. Among babies with birth weight less than 1800 gms,35 had borderline developmental delay,3 had no delay with a significant p-value of less than 0.001. Among babies with sepsis,15 had borderline developmental delay with a significant p value of 0.008. Among babies with PPHN,11 had borderline delay with a significant p value of 0.027.

A prospective observational follow-up study of high-risk infants was conducted by Shrabani Mandal et al. In the current study, we found that perinatal asphyxia (severe HIE) was associated with a higher frequency of developmental delay, with 5 out of 5 neonates (100%) showing such delay at the end of a year. Preterm births, with 3 out of 9 babies (33.3%), sepsis with 5 out of 19 babies (26.3%), sepsis with meningitis with 1 out of 4 babies (25%), with 1 out of 4 babies (25%) being physiological jaundice without DVET, and birth weight less than 1800 grams, with 4 out of 19 babies (21.05%).⁽³⁾

In Chattopadhyay et al studied developmental outcomes using various methods like DDST. Amiel Tison in high-risk newborns. Among 134 children with developmental delay 61 were preterm 80 were LBW and 50 had history of sepsis, 39 had birth asphyxia and 14 had jaundice.⁽⁴⁾

In present study, in preterms all the babies who had sepsis either had a mild or borderline delay, the difference was statistically significant (P=0.023) in motor component of DASII.

In Barbara J. Stoll et al study which was a prospective study done to look at neurodevelopmental outcomes in preterm babies who were infected and those who were not. Infants in infected groups were significantly more likely than those in uninfected groups to experience negative neurodevelopmental outcomes at follow-up, including cerebral palsy (range of significant odds ratios [ORs], 1.4- 1.7), low mental and psychomotor development index scores on the Bayley Scales of Infant Development II (ORs, 1.3-1.6), and vision impairment (ORs, 1.5-2.4). (ORs, 1.3-2.2). A established predictor of poor neurodevelopmental outcomes, reduced head growth was also linked to infection throughout the newborn period. ⁽⁵⁾

In present study among term IUGR babies 29.2 percent had borderline motor delay and 29.5 percent had borderline mental delay. Motor delay was significant with p value of 0.047.

Nandita Chattopadhyay et al which assessed neuro developmental outcome of high-risk babies discharged from NICU in a rural district in India. According to this study, low birth weight and prematurity are significant factors for neuro-developmental delay. Infants weighing between 1.5 and 2.0 kg (42.6%) had the highest incidence of developmental delay, and infants weighing more than 2.5 kg (19.4%) had the lowest incidence. ⁽²⁾

In present study there is borderline delay in healthy babies in both mental and motor components with percentage of 26% and 44%. The delay in normal babies could be because of the stress during COVID pandemic, intra natal insult and social isolation.

The COVID-19 pandemic and infants' neurodevelopment between the ages of six months and one year were the subjects of a study by Peiyuvan Huan et al. At one year of age, patients with COVID-19 were more likely to have delays in communication and fine motor skills (adjusted OR [aOR]: 1.13, 95% CI: 1.02, 1.25) than non-patients. ⁽⁶⁾

Conclusion

High risk babies with developmental delay are usually identified much later, when little can be done. Therefore, if delay is detected earlier, developmental follow-up, prompt tailored interventions, and compliance can be ensured. To determine the cause of the delay and plan the interventions, developmental tests must be conducted in conjunction with a medical assessment. Parents must be involved in the discussion about the developmental test's interpretation. Most follow-up studies just keep an eye on the child for a brief while (18-24 months). However, there is significant evidence that unfavorable effects continue throughout adolescence and school age. Only after a longer period of follow-up many of the cognitive, learning, and behavioral issues that are more prevalent in at-risk newborns become apparent.

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