ORIGINAL ARTICLE

PHYSICAL FEATURES AND NEURODEVELOPMENTAL OUTCOME IN HIGH RISK NEWBORN

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Abstract

Objectives: We hypothesized that high risk babies having physical features described by Amiel Tison have poor neurological outcome as compare to babies with no such features. The objective of the study was to find the proportion of high risk babies with abnormal physical features and to compare their outcome with high risk babies without such features.

Methods and Materials: Two hundred and twenty one high risk babies were studied from birth to 1 year of life. Babies were called weekly till 6 weeks after that they come at 10 weeks, 14 weeks and then once a month. Every week, growth assessment, development assessment and neurological examination was done. Development was assessed using Denver development screening test.

Results: Ninety six (43.5%) of high risk babies had physical features described by Amiel Tison. Developmental delay, neurodeficit, vision problem and multiple problems were significantly more in these babies. This observation is also noticed in preterm and small for gestational age babies.

Conclusion: Presence of physical features described by Amiel Tison predicts poor neurodevelopmental outcome at 1 year of age.

Key Words: high risk newborn, neurodevelopmental outcome, physical features in newborn

Introduction

High risk newborns are newborns which are at risk for developmental delay or neurodevelopmental problems (1). Usually newborns are labeled as high risk newborns based on maternal and neonatal problems. Amiel Tison has described physical criteria which if present at birth or at discharge are associated with long term poor neurological outcome (2). Present study compares the performance of high risk newborns with or without features described by Amiel Tison. This will help us to further identify those high risk babies who really need early intervention and follow up. This approach will specially be helpful in resourcing facilities in developing world.

Patients and Methods

This study was a prospective longitudinal comparative study conducted at Acharya Vinoba Bhave Rural hospital from June 2008 to July 2010. High risk newborns (1) having following features were included in this study: 1) Babies with less than 1800gm birth weight or gestational age less than 37 weeks. 2) Small for date babies (less than 3rd percentile) and large for date babies (more than 97th percentile). 3) Perinatal asphyxia - APGAR score less than 7 at 5 mins or hypoxic ischemic encephalopathy. 4) Mechanically ventilated baby. 5) Metabolic problems-symptomatic hypoglycemia and hypocalcemia. 6) Seizures in neonatal period. 7) Infections-meningitis or culture positive sepsis. 8) Shock requiring ionotropic or vasopressor support. 9) Major morbidities such as chronic lung disease, intraventricular hemorrhage and periventricular leucomalacia. 10) Infants born to HIV positive mothers. 11) Twin with intrauterine death of co-twin. 12) Twin to twin transfusion. 13) Hyperbilirubinemia >17mg/dl or requirement of exchange transfusion. 14) Major malformations or multiple minor malformations. 15) Inborn errors of metabolism or other genetic disorders. 16) Abnormal neurological examination at discharge. 17) Any reason requiring neonatal intensive care unit (NICU) stay > 24 hrs.

Newborns staying in NICU for < 24 hours (staying for observation), mothers not able to come for follow up for one year and newborns who died during NICU stay were excluded from this study.

Following were considered as abnormal classical features described by Amiel Tison (2) - abnormal skull shape, ridges of sutures present specially squamous suture, high arched palate, cortical thumb, weak or excessive cry, nystagmus, erratic eye movement, strabismus, sunset sign present, not alert, asymmetrical movement of extremities, hyperexcitability.

All the babies were studied from birth to 1 year of life. Babies were called weekly till 6 weeks after that they came at 10 weeks, 14 weeks and then once a month. Every week growth assessment, development assessment and neurological examination was done. Informal hearing assessment was done by observing baby's orientation to sound of bell. (3) Informal vision assessment was done assessing light perception and fixation which were assessed according to the Amiel Tison & Gosselin guideline. (2) Vision was assessed by Fix and Track method. Denver development screening test was used to assess the development of babies according to the Denver development screening test module. (4)

Results

Figure no. 1 shows the results at a glance. Total 96 children (43.4%) had abnormal physical features. Among them, 35 (36.5%) were term and 61 (63.5%) were preterm. Among term babies, 12 (34.3%) were appropriate for gestational age (AGA) and 23 (65.7%) were small for gestational age (SGA). Among preterm babies 28 (45.9%) were AGA and 33 (54.1%) were SGA. Ridging of squamous suture and abnormal skull shape were most common abnormal features. Abnormal ridges of suture ($z = 2.15$ & $p = 0.01$), abnormal skull shape ($z = 2.00$ & $p = 0.022$), cortical thumb ($z = 2.10$ & $p = 0.017$), high arched palate ($z = 2.53$ & $p = 0.005$) and strabismus ($z = 2.09$ & $p = 0.01$) were significantly more in preterm babies than term babies. (Table 1) Abnormal palate shape (66%) and strabismus (30%) was more common in preterm SGA babies. Among SGA babies abnormal skull shape ($z = 7.41$ & $p = 0.06$), high arched palate ($z = 9.14$ & $p = 0.001$) and cortical thumb ($z = 5.82$ & $p = 0.015$) are significantly more common in preterm babies than

Table: 1 Showing Abnormal Features at discharge

Disease	Term			Preterm			Total (96)
	AGA (12)	SGA (23)	Total (35)	AGA (28)	SGA (33)	Total (61)	
Ridges of sutures	8 (75%)	13 (56.5%)	21 (60%)	20 (71.4%)	29 (87.9%)	49 (80.3%)	70 (72.9%)
Abnormal skull shape	3 (25%)	12 (52.2%)	15 (42.9%)	11 (39.3%)	28 (84.9%)	39 (63.9%)	54 (56.3%)
Cortical thumb	2 (16.7%)	7 (30.4%)	9 (25.7%)	8 (28.6%)	21 (63.6%)	29 (47.5%)	38 (39.6%)
High arched palate	3 (25%)	4 (17.4%)	7 (20%)	6 (21.4%)	22 (66.7%)	28 (45.9%)	35 (36.5%)
Weak or excessive cry	3 (25%)	6 (26.1%)	9 (25.7%)	5 (17.8%)	6 (18.2%)	11 (18.0%)	20 (20.8%)
Strabismus	1 (8.3%)	2 (8.7%)	3 (8.6%)	2 (7.1%)	10 (30.3%)	12 (19.7%)	15 (15.6%)
Nystagmus	2 (16.7%)	3 (13.0%)	5 (14.3%)	4 (14.3%)	6 (18.2%)	10 (16.4%)	15 (15.6%)
Abnormal extremity movement	2 (16.7%)	3 (13.0%)	5 (14.3%)	3 (10.7%)	5 (15.2%)	8 (13.1%)	13 (13.5%)
Abnormal eye movement	2 (16.7%)	3 (13.0%)	5 (14.3%)	3 (10.7%)	4 (12.1%)	7 (11.5%)	12 (12.5%)
Sunset sign	2 (16.7%)	2 (8.7%)	4 (11.4%)	3 (10.7%)	3 (9.1%)	6 (9.8%)	10 (10.4%)
Not alert	2 (16.7%)	2 (8.7%)	4 (11.4%)	2 (7.1%)	3 (9.1%)	5 (8.2%)	9 (9.4%)
Hyperexcitability	1 (8.3%)	2 (8.7%)	3 (8.6%)	2 (7.1%)	3 (9.1%)	5 (8.2%)	8 (8.3%)

AGA= appropriate for gestational age, SGA = small for gestational age

term babies. (Table 1)

Table 2 signifies that abnormal outcome is more common in babies with abnormal features described by Amiel Tison except hearing where statistical significance was not found.

Fig. 1: Study subjects at a glance

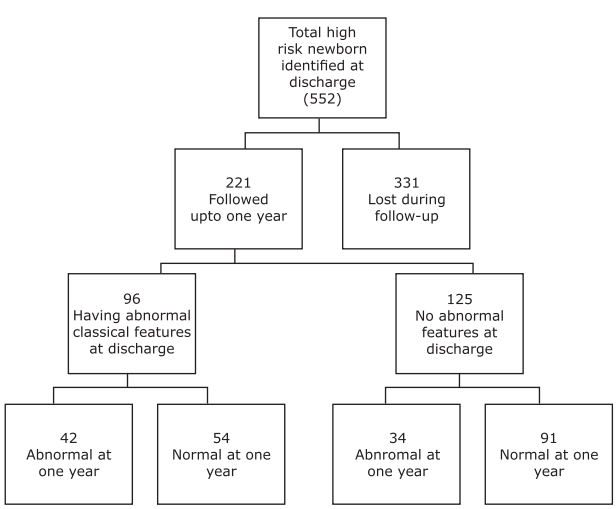

Table 2: Showing outcome of abnormal features at discharge

Child with abnormal outcome	Abnormal feature (n = 96)	No abnormal feature (n = 125)	p value
DDST	39 (40.6%)	29 (23.2%)	0.002
Neurodeficit	36 (37.5%)	26 (20.8%)	0.003
Vision	16 (16.7%)	9 (7.2%)	0.013
Hearing	12 (12.5%)	10 (8%)	0.135
Multiple problems	42 (43.7%)	34 (27.2%)	0.005

DDST = Denver development screening test

Preterm and SGA babies with abnormal features had significantly higher abnormal outcome at the time of discharge (Table 3). Table 4 signifies that more the number of abnormalities worse is the outcome.

Table 3: Outcome of Preterm and SGA by abnormal physical features at discharge

Category	Abnormal outcome	P value
Preterm with abnormal features (n =38)	29 (76.3%)	0.01
Preterm without features (n =23)	11 (47.8%)	
SGA with abnormal features (n = 33)	24 (72.7%)	0.005
SGA without features (n = 23)	9 (39.1%)	

Table 4: Correlation of number of abnormal features with outcome

No. of Abnormalities	Abnormal
< 4 (n = 64)	22 (34.4%)
4 - 8 (n = 24)	12 (50%)
8 - 12 (n = 8)	8 (100%)

Discussion

It is a huge and difficult task to follow-up high risk newborns because it involves many aspects like growth and developmental assessment, hearing and vision assessment, detection of neurodeficit and early intervention. Among high risk newborns if we can predict which baby is at a higher risk for poor long term outcome the program will be manageable and cost effective. A lot of work (5-8) has been done to assess the predictability of long term outcome. Godbole et al (5) tested items like axillary suspension, head support, social smile, disappearance of primitive reflexes at 3 months and items like pull to sit, rolling over, momentary sitting, transfer and reach for an object at 6 months. If above tests failed at 3 and 6 months the child was delayed at 1 year with 100% specificity and positive predictability. In this method prediction is delayed till 6 months. Ellenberg et al (6) could predict cerebral palsy at 4 months. These methods delay the predictability and need periodic examination for detection. The prediction is also at the mercy of parents who should bring the child periodically which is difficult in rural children and children staying far from facility. Amiel Tison features can be detected at discharge from nursery which allows early prediction. Peter et al (7) used some features in neonatal period like fits in first few days, failure to suck continuously, persistence of signs of brain damage for more than 4 days to predict long term outcome. These features were mainly in birth asphyxia children and absence did not indicate better outcome. El- Dib et al (8) used neuroimaging features like infarction, periventricular leucomalacia, and hemorrhagic necrosis to predict cerebral palsy. Neonatal EEG also was thought to be predictive by some authors. (9)

Features described by Amiel Tison are easy to detect, does not need extensive training and inexpensive as does not need any equipment. Any peripheral worker also can easily identify most of the features. Presence of more than 4 features together doubles the predictability. In our study, around 43.5% of high risk babies had physical features described by Amiel Tison. Developmental delay, neurodeficit, vision problem and multiple problems were significantly more in these babies as compare to babies without features. This difference was also seen in preterms and SGA babies separately. This shows that presence of physical features described by Amiel Tison predicts poor outcome at 1 year of age. Hence babies with these features need good follow up for early detection of problems.

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