



CROSS-SECTIONAL STUDY- CHILDREN BORN PRETERM GREATER RISK OF ABNORMAL VISUAL AND NEUROLOGICAL FUNCTIONING

Ophthalmology

Dr. Subhash Kumar Mishra	Department of Ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka ,Raipur- 492001 C.G
Dr. Anand Saxena*	Department of Ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka ,Raipur- 492001 C.G*Corresponding Author
Dr. Neerja Saxena	Department of Ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka ,Raipur- 492001 C.G
Dr. Meekshi Maseeh	Department of Ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka ,Raipur- 492001 C.G
Dr. Moneesh Saxena	Department of Ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka ,Raipur- 492001 C.G

ABSTRACT

OBJECTIVES AND METHODS: To examine and see the abnormal visual and neurological functioning in preterm children. Sample for the study includes 120 preterm children (boys 74 (62%) and girls 46 (38%) between the age group of 8 to 12 months were recruited based on random sampling from Raipur from August 2017 to February 2019 (18 months) **RESULTS:** On Bayley Developmental Screening Scale –III, Cognition scale preterm babies scored low mean 30.43 std. deviation 18.375, t value 18.138, Language (Receptive and Expressive) scale preterm babies scored low, mean 39.11, std. deviation 23.912, t value 17.916, Motor (Fine /Gross) scale preterm babies scored low, mean 42.12 std. deviation 23.341, t value 19.766 are statistically significant at the level of <0.05. Major visual problems that are common in babies under age of 4 to 5 years cortical visual impairment is more prevalent among preterm babies, An Analysis of variance showed on strabismus (crossed eyes), mean score is .29, Std. deviation .042 and t- value 7.000. Nystagmus, mean score is .21, Std. deviation .408 and t- value 5.596, Amblyopia (known as "lazy eye") mean score is .55, Std. deviation .500 and t- value 12.060 are statistically significant at < 0.05 level. **CONCLUSIONS:** Children born preterm are at a greater risk of abnormal visual and neurological functioning when compared to children born at full term, Visual functions associated with the visual processing stream such as global motion perception and visual-motor integration, impaired by preterm birth. These visual impairments contribute to the difficulties in learning, attention, behaviour, speech and cognition. Improvements in understanding the human mechanisms by which preterm babies affected. Improvement in understanding of underlying issues will inform future screening and interventions for deficits in these areas.

KEYWORDS

Bayley developmental screening scale –III, Social awareness, Counselling.

INTRODUCTION-

Infants born preterm are at greater risk of developing motor, cognitive, language, and behavioral impairments compared with infants born at term Delobel- Ayoub M. et.al. (2009), Stephens BE, Vohr BR. (2009). Thus, many previous studies have investigated neurodevelopmental outcomes in infants born preterm. A premature birth is a birth that takes place more than two or three weeks before the baby's estimated due date. In other words, a premature birth is one that occurs before the start of the 37th week of pregnancy. They suggest hypoxia-mimetic agents might restore neurogenesis, enhance cortical growth, and improve neurodevelopmental outcome of premature infants. Children born preterm are at risk of visual impairment due to cerebral visual impairment, which is caused by damage to the geniculocalcarine pathways and is related to the severity of white matter injury G. Mirabella et.al. (2006).

Those final weeks in the womb are crucial for healthy weight gain and for the full development of various vital organs, including the brain and lungs. This is why premature babies may have more medical problems and may require a longer hospital stay. They may also have long-term health issues, such as ADHD, language difficulties, gross motor skills, fine motor skills, social skills, mental illness or physical issues.

Some of the health issues that may affect premature babies include vision and hearing problems. This is because the final stages of vision and hearing development occur in the last few weeks of pregnancy. Many experts noted premature birth is responsible for 35 percent of instances of vision impairment, cognitive and hearing impairment.

Retinopathy of Prematurity, referred to as ROP, is likely the most common eye issue in preterm babies, particularly those weighing less than 2 kg. The condition, caused by abnormal blood vessel growth, usually in both eyes, can lead to lifelong vision problems and even

blindness. Amongst the visual problems associated with immaturity, retinopathy of prematurity (ROP) has been widely studied and is known to be the most handicapping- Vohr BR et.al. (1985), and Hungerford J. et.al. (1986).

Many researchers believe that premature exposure to oxygen (which is needed for other organs to grow properly outside the womb) makes blood vessels in the retina grow too quickly, causing scar tissue and bleeding. Babies born at less than 32 weeks of gestation, and those who weigh 1.5/ 2Kg or less, are most at risk. This means that the earlier a baby is born, the more likely they are to experience eye problems. While the eyes might look normal, you may notice that your baby doesn't respond to objects or changes in light. These abnormalities may be signs of a vision problem or an eye defect. Strabismus (crossed eyes) is an eye condition that's common in children under the age of 4-to-5 years old. It causes misalignment of one or both of the eyes. It can lead to permanent vision problems if it isn't diagnosed and treated early.

MATERIAL AND METHODS

The aim of the present study was to assess children born preterm a greater risk of abnormal visual and neurological functioning. One hundred twenty preterm babies born preterm are came for regular medical evaluation at Shri Aurobindo Medical and Research Centre, Pachpedi Naka, Raipur were included. Conducted during August 2017 to February 2019 (18 months). Inclusion criteria- Preterm babies and birth weight less than 2.000KG, Exclusion criteria- full term and post term babies are not including in this study. The gestation was calculated from the last menstrual period of the mother and confirmed by clinical examination. The birth weight and birth history of the babies were recorded. Before and after pregnancy history was recorded. These babies were examined at 8 to 12 months of age for ocular morbidity in addition to developmental assessment. The

developmental assessment was done by the Bayley Developmental Screening Scale –III. Bayley-III, a tool used to determine the degree of development in infants aged 1–42 months, consists of tests for cognition, language (receptive and expressive), motor skills (fine/gross), and social-emotion and adaptive behaviours. The test was conducted in accordance with standard guidelines. The raw scores for respective items were converted into scaled scores, then converted into composite score. Screening for (ROP) -Thorough eye examination is the only way to detect retinopathy of prematurity. Premature babies particularly those born at 32 weeks or less and weighing less than 2000g should be undergo ophthalmic examination. Parents should consult the doctor whether or not the eye exam should be done for the baby. If the doctor does feel that the baby needs a ROP test, it should be done between 8 to 12 months after the baby's birth. After the eye exam, the doctor will let you know whether treatment would be required or you will need to come for follow ups

STATISTICAL ANALYSIS

The obtained data was statistically analyzed by applying descriptive (Mean, Standard Deviation, single t-value) of significance in term of various variable. We have entered all data and further Statistical Analysis was done with the help of IBM- SPSS-25 software.

RESULTS

Out of the 120 preterm babies, 62% were boys and 38% girls. Majority (24%) of the babies weighed between 800-900g at birth, (16%) of the babies weighed between 1000-1200g at birth, (27%) of the babies weighed between 1300-1500g at birth, (20%) of the babies weighed between 1500-2000g at birth and (13%) of the babies weighed between 800-900g at birth.

Extremely preterm (less than 28 weeks) around 30.83% , very preterm (28 to 32 weeks) 40.83% ,and moderate to late preterm (32 to 37 weeks) 28.00% infants. Certain medical conditions, including some that occur only during pregnancy, also place a woman at higher risk for preterm labour and delivery. Around 25% Urinary tract infections, 31% Certain vaginal infections, such as bacterial vaginosis and trichomoniasis , 43% High blood pressure, 38% Bleeding from the vagina, 15% done x-ray during pregnancy, 20% Certain developmental abnormalities in the fetus, 42% Being underweight or obese before pregnancy, 45% Short time period between pregnancies (less than 6 months between a birth and the beginning of the next pregnancy), 36% genetic, 15% Diabetes (high blood sugar) and gestational diabetes (which occurs only during pregnancy) 37% Blood clotting problems Mothers younger than age 20 are more likely to have a preterm delivery around 32% mothers reported young age of delivery, 28% mothers reported average age 22 to 28 years and 41% mothers reported older age 35 or above are also at risk of having preterm infants , 32% shows negative lifestyle and environmental factors, including, 42% shows late or no health care (healthy diet) during pregnancy, 10% mothers drink and smoke, Tabaco, 52% mother facing domestic violence, including physical, sexual, or emotional abuse, 37% lack of social support, 76% facing Stresses , 68% mothers work day and night with long periods of standing.

Table No.1- Socio-Demographic Profile of Study Population.

AREAS	PARAMETERS	COUNT & PERCENTAGE
Gender	Boys	74 (62%)
	Girls	46 (38%)
Mother Age of Pregnancy	Less than 20 years	38 (32%)
	Average 22-28 Years	33 (28%)
	Above 35 Years	49 (41%)
Preterm Type		
	Extremely Preterm (less than 28 Weeks)	37 (30.83%)
	Very Preterm (28 to 32 Weeks)	49 (40.83%)
	Moderate to Late Preterm (32 to 37 Weeks)	34 (28.00%)

Birth Weight (grm)		
	800-900	29 (24%)
	1000- 1200	19 (16%)
	1300- 1500	32 (27%)
	1500-2000	24 (20%)
	2000-2500	16 (13%)

Cognition scale preterm babies scored low mean 30.43 std. deviation 18.375, t value 18.138 statistically significant at the level of <0.05 level. Language (Receptive and Expressive) scale preterm babies scored low, mean 39.11, std. deviation 23.912 , t value 17.916 statistically significant at the level of <0.05 level. Motor (Fine /Gross) scale preterm babies scored low, mean 42.12 std. deviation 23.341 , t value 19.766 statistically significant at the level of <0.05 level. Statistically significantly lower function levels in cognitive, language, and motor areas compared with full-term babies. According to Evensen KA et.al. (2009), Bhutta AT et.al. (2002), Stolt S et.al. (2009), and Sun J et.al. (2009) study has revealed that preterm infants demonstrate cognitive, language, and motor delays during the first postnatal year and into adolescence.

Table No. 2 - Means and SD of Preterm Babies (Cognition, Language, and Motor) along with their statistical significance of Means on Bayley Scales of Infant Development, Third Edition –III.

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Cognition	120	30.43	18.375	1.677
Language	120	39.11	23.912	2.183
Motor	120	42.12	23.341	2.131

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Cognition	18.138	119	.000	30.425	27.10	33.75
Language	17.916	119	.000	39.108	34.79	43.43
Motor	19.766	119	.000	42.117	37.90	46.34

At 8-12 months, none of the preterm babies had normal vision. Extremely Preterm (less than 28 Weeks) pre term babies report shows 9 % in anisometropia. 8% Myopia , 6% Emmetropia and 8% Hypermetropia, Very Preterm (28 to 32 Weeks) pre term babies report shows 8 % in anisometropia. 8% Myopia , 15% Emmetropia and 12% Hypermetropia, and Moderate to Late Preterm (32 to 37 Weeks) pre term babies report shows 7 % in anisometropia. 12% Myopia , 4% Emmetropia and 6% Hypermetropia. See Table no.3.

Table No.3 - Percentages of Visual Conditions (Anisometropia, Myopia, Emmetropia, Hypermetropia) of Preterm Babies.

AREAS	ANISOMETR OPIA	MYOPIA	EMMETR OPIA	HYPERMETR OPIA
Extremely Preterm (less than 28 Weeks)	11 (9%)	10 (8%)	7 (6%)	9 (8%)
Very Preterm (28 to 32 Weeks)	10 (8%)	9 (8%)	18 (15%)	12 (10%)
Moderate to Late Preterm (32 to 37 Weeks)	8 (7%)	14 (12%)	5 (4%)	7 (6%)
Total	29 (24%)	33 (28%)	30 (25%)	28 (23%)

According to a recent study, Major visual problems that's common in babies under age of 4 to 5 years cortical visual impairment is more prevalent among preterm babies, An Analysis of variance showed on strabismus (crossed eyes), mean score is .29, Std. deviation .042 and t-value 7.000 is statistically significant at < 0.05 level. According to M.

G. Pike et.al. (1994), Pennefather PM et.al. (1995) study reported in children born prematurely, regardless of the presence of ROP. Nystagmus, mean score is .21, Std. deviation .408 and t- value 5.596 is statistically significant at < 0.05 level. Amblyopia (known as "lazy eye") means score is .55, Std. deviation .500 and t- value 12.060 is statistically significant at < 0.05 level. Patients with amblyopia are more likely to become visually disabled because of an increased risk of their sound eye becoming visually impaired according to Tommila V et.al (1981), and Dr jugnoo S. Rathi (2002) . Childhood Glaucoma that begins before the child is three years old is called infantile or congenital (present at birth) glaucoma. Present study shows Glaucoma mean score is .17, Std. deviation .374 and t- value 4.879 is statistically significant at < 0.05 level. and On Cataract mean score is .10, Std. deviation .301 and t- value 3.636 is statistically significant at < 0.05 level. Which associated with congenital infections or malformations and neurological disorders. Severe intraventricular hemorrhage is strongly associated with poor acuity. Present study shows that other visual problems such as strabismus (crossed eyes) 29.2%, nystagmus 20.8%, amblyopia 55.0%, glaucoma 16.7% and cataract 10.0% present in preterm babies.

Table No.4. Means and SD of Preterm Babies Major Visual Problems Along with their Statistical Significance means

One-Sample Statistics						
	Frequency	Percent	N	Mean	Std. Deviation	Std. Error Mean
Strabismus (crossed eyes)	35	29.2%	120	.29	.456	.042
Nystagmus	25	20.8 %	120	.21	.408	.037
Amblyopia	66	55.0 %	120	.55	.500	.046
Glaucoma	20	16.7 %	120	.17	.374	.034
Cataract	12	10.0%	120	.10	.301	.028

One-Sample Test						
Test Value = 0						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Strabismus (crossed eyes)	7.000	119	.000	.292	.21	.37
Nystagmus	5.596	119	.000	.208	.13	.28
Amblyopia	12.060	119	.000	.550	.46	.64
Glaucoma	4.879	119	.000	.167	.10	.23
Cataract	3.636	119	.000	.100	.05	.15

CONCLUSION –

Children born preterm are at a greater risk of abnormal visual and neurological functioning when compared to children born at full term, Visual functions associated with the visual processing stream such as global motion perception and visual-motor integration, impaired by preterm birth. These visual impairments contribute to the difficulties in learning, attention, behaviour, speech and cognition. Improvements in understanding the human mechanisms by which preterm babies affected. Improvement in understanding of underlying issues will inform future screening and interventions for deficits in these areas.

CONTRIBUTION BY THE AUTHORS

1. Dr. Subhash Kumar Mishra – Script Writing , Statistical Analysis
2. Dr. Anand Saxena- Data Collection , Statistical Analysis
3. Dr. Neerja Saxena- Data Collection
4. Dr. Meekshi Maseeh- Statistical Analysis
5. Dr. Moneesh Saxena- Data Collection

LIMITATION OF THE RESEARCH

Future research is required to further delineate and characterize the prevalence, frequency, and neurological functioning, and visual abnormality related to the preterm children.

Financial Support and Sponsorship- The authors have indicated they have no financial relationships relevant to this article to disclose.

Conflict of Interest- The authors declare that they have no conflict of interest.

ACKNOWLEDGEMENT

We are extremely grateful to all the participants and their families for cooperation and took part in this study, and the whole term work in this study, Dr. Subhash Kumar Mishra – script writing, statistical analysis, Dr. Anand Saxena- data collection, statistical analysis, Dr. Neerja Saxena- data collection, Dr. Meekshi Maseeh- statistical analysis, Dr. Moneesh Saxena- data collection, and volunteers. The department of ophthalmology- Shri Aurobindo Medical and Research Centre, Pachpedi Naka, Raipur, provide core support for us.

REFERENCES

1. Bhutta AT, Cleves MA, Casey PH, Cradock MM, Anand KJ. Cognitive and behavioral outcomes of school-aged children who were born preterm: a meta-analysis. *JAMA*. 2002; 288:728–737.
2. Delobel-Ayoub M, Arnaud C, White-Koning M, Casper C, Pierrat V, Garel M, et al.. Behavioral problems and cognitive performance at 5 years of age after very preterm birth: the EPIPAGE Study. *Pediatrics*. 2009; 123:1485–1492.
3. Dr. Jugnoo S. Rathi FRC Ophth, Stuart Logan MRCP, Christine Timms DBO(T), Isabelle Russell-Eggitt FRCS, David Taylor FRCS. Risk, causes and outcomes of visual impairment after loss of vision in the non-amblyopic eye: a population based study. *Lancet*. 2002; 360:597–602.
4. Evensen KA, Skranes J, Brubakk AM, Vik T. Predictive value of early motor evaluation in preterm very low birth weight and term small for gestational age children. *Early Hum Dev*. 2009; 85:511–518.
5. G. Mirabella, P. K. Kjaer, A. M. Norcia, W. V. Good, and A. Madan. "Visual development in very low birth weight infants," *Pediatric Research*, 2006; vol. 60, no. 4, pp. 435–439.
6. Hungerford J, Steward A, Hope P. Ocular sequelae of preterm birth and their relation to ultrasound evidence of cerebral damage. *Br J Ophthalmol*, 1986; 70: 463–468.
7. M.G. Pike, G. Holmstrom, L. S. de Vries, J. M. Pennock, K.J. Drew, P.M. Sonksen, L.M.S. Dubowitz. Patterns of visual impairment associated with lesions of the preterm infant brain. *Dev Med Child Neurol*, 1994; 36:849–862.
8. Pennefather PM, Clarke MP, Strong NP, Cottrell DG, Fritz S, Tin W. Ocular outcome in children born before 32 weeks gestation. *Eye* (Suppl) 1995; 26–30
9. Stolt S, Haataja L, Lapinleimu H, Lehtonen L. The early lexical development and its predictive value to language skills at 2 years in very-low-birth-weight children. *J Commun Disord*. 2009; 42:107–123.
10. Sun J, Mohay H, O'Callaghan M. A comparison of executive function in very preterm and term infants at 8 months corrected age. *Early Hum Dev*. 2009; 85:225–230.
11. Stephens BE, Vohr BR. Neurodevelopmental outcome of the premature infant. *Paediatric Clin North Am*. 2009; 56:631–646.
12. Tommila V, Tarkkanen A. *Br J Ophthalmol*. 1981; 65:575–577.
13. Vohr BR, Garcia Coll CT. Increased morbidity in low birth weight survivors with severe retrolental fibroplasia. *J Pediatr*. 1985; 106: 287–291.
14. World Health Organization, authors. Born Too Soon: The Global Action Report on Preterm Birth. June 6, 2012. Retrieved from http://www.who.int/pmnch/media/news/2012/201204_born_too_soon-report.pdf.