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A Cross Sectional Study of Factors Influencing Severity of Developmental Delay and Its Co Morbidities

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Abstract:
Background-Developmental delay (DD) is one of the commonest conditions seen by paediatrician with many preventable factors contributing to it and affecting its long term prognosis.
Aim-To study the factors associated with severity of developmental delay and its co-morbidities.
Methods-162 patients attending the child guidance clinic who fulfilled the inclusion criteria were selected for study by purposive sampling from a tertiary referral centre. Detailed physical and psychological evaluation was done for the patients. Developmental quotient (DQ) was assessed by the clinical psychologist using Denver's developmental screening test. Comorbidities were assessed. Data, thus obtained was statistically evaluated.
Results and discussion- Of the 162 patients studied, the diagnosis was mild DD in 50.61%; moderate DD in 27.8%; severe DD in 17.9% and profound DD in 4.3%. Majority was less than 20 months age; 1st or 2nd birth order; males; coming from a low socioeconomic status; rural, joint family background with low parental literacy; product of consanguineous, full term spontaneous vaginal delivery. Age of child and Mothers literacy was significantly associated with DQ of the child. Perinatal factors of statistical significance included neonatal seizures(NNS), neonatal jaundice(NNJ), septicaemia. NNS and HIE were significantly correlated with seizures later in life. Co morbidities significantly associated with DD included seizures, Down's syndrome, cerebral palsy, autism and behavioural problems. Other co-morbidities included microcephaly, hydrocephalus, congenital talipes equno varus, cleft palate, congenital heart disease, visual and hearing impairment.
Limitations-It was a cross sectional hospital based study on a small number of patients. Long term effects of intervention were not studied.
Conclusions and Future directions- Increasing awareness for prevention and early identification with a multi disciplinary approach for the management of the developmentally delayed child will improve the long term prognosis.

Keywords: *Developmental delay, co-morbidities, perinatal factors, early intervention services*

1. Introduction

Global developmental delay (GDD) is defined as a significant delay in 2 or more developmental domains (gross/fine motor, cognition, speech/language, personal/social, or activities of daily living). Significant delay was defined as performance that was 2or more standard deviations (SD) below the mean on norm referenced developmental screening or assessment tests. [1]
It was observed that more than 200 million children under 5 years of age in developing countries do not reach their developmental potential.[2] Developmental delay was estimated to constitute between 2% and 10% of the paediatric population.[3]Indian studies revealed a prevalence of 7.5% in one study,[4] and 2.5 % in children under 2 years from deprived urban settlements of Hyderabad city.[5] Bodhankar reported prevalence of developmental disorders to be 5.4% to 15.3% in isolated macro and micro prevalence surveys.[6] Research revealed that about 50% cases of developmental disabilities are missed by their paediatricians.[7] There are many factors causing developmental delay. They, being genetic disorders, pregnancy related causes, complications of labour, neonatal

problems, postnatal causes and unknown aetiology. [8]Apart from these, nutritional, environmental, socioeconomic and cultural factors also influence developmental process. [9]. Investigators have opined that multiple factors (genetic and environmental) play a role in the ultimate developmental potential of a child and this interplay of nature vs. nurture renders identification a difficult task.[10] It was stressed that early identification and timely intervention of established at risk population will significantly improve their functional capacity.[11,12]

Majnemar observed that early identification had implications for genetic counselling, estimation of risk of recurrence, management of possible associated conditions, prognostication and prevention at the individual and community level. [1]Primary prevention of developmental delay is to reduce the occurrence of risk factors such as low birth weight, malnutrition and family awareness that child development can be influenced by their efforts. [13] In the secondary prevention of developmental delay; goal is to reduce the extent of manifested childhood disability and shorten its duration. Infant stimulation and remediation programs operate at this level. In tertiary prevention, the aim is to prevent or reduce complications of disability (physical and behavioural) that leads to a need for institutionalization. [13]

With this background, this study was undertaken to find the factors associated with developmental delay and its co-morbidities in a tertiary care centre in a metropolitan city.

1.1. Aims

To study the factors associated with severity of development delay and associated co morbidity.

Methods-This cross sectional study was done in a tertiary child psychiatry referral centre of a metropolitan city. Appropriate permission was taken from the authorities to conduct the study. Children attending the child guidance clinic and early intervention department were selected by purposive sampling. Informed consent was obtained from the parents/guardians. A psychologist assessed the child for developmental delay (DD) using Denver's development screening test. Inclusion criteria included children with developmental delay [Developmental quotient (DQ) of 70 and below], age 5 years and below and consenting caregivers. Exclusion criteria included children aged above 5 years; DQ of child above 70 and caregivers not giving consent for the study. 162 children fulfilled the inclusion criteria and were selected for our study. Sociodemographic data, including details about the parent's age, occupation, education, income; details about the antenatal, natal and postnatal history was obtained from each and entered into a semi structured intake proforma. Details about the presenting complaint, physical and psychological examination (including DQ levels) findings of each patient were recorded. Detailed physical examination was done to look for evidence of congenital anomalies. The data was entered into an excel sheet and subjected to statistical tests .The level of significance was set at $P \leq 0.05$.

2. Results

Parameter	Mild DD n=82	Moderate DD n=45	Severe/Profound DD n=35	Chi-square (df)
Age of Child(months)				
0-10(43)	27(62.7%)	11(25.58%)	5(11.6%)	**0.002(10)***
11-20(42)	25(59.5%)	3(7.14%)	14(33.3%)	
21-30(23)	9(39.13%)	12(52.1%)	2(8.69%)	
31-40(16)	5(31.25%)	4(25%)	7(43.75%)	
41-50(17)	7(41.17%)	6(35.29%)	4(23.52%)	
51-60(21)	9(42.85%)	9(42.85%)	3(14.28%)	
Gender				
Female(64)	31(48.4%)	19(29.68%)	14(21.8%)	0.886(2)
Male(98)	51(52.0%)	26(26.53%)	21(21.4%)	
Birth Order				
1(97)	41(42.3%)	29(29.9%)	27(27.8%)	0.169(8)
2(42)	29(69%)	10(23.8%)	3(7.1%)	
3(17)	8(47.1%)	5(29.4%)	4(23.5%)	
4(5)	3(60%)	1(20%)	1(20%)	
5(1)	1(100%)	0(0%)	0(0%)	
Age of mother in years				
17-29(141)	72(51.0%)	38(26.95%)	31(21.98%)	0.52(4)
30-39(17)	7(41.17%)	7(41.17%)	3(17.64%)	
40-49(4)	3(75%)	0(0%)	1(25%)	
Age of father in years				
17-29(75)	34(45.3%)	17(22.7%)	24(32.0%)	**0.03(6)***
30-39(76)	44(57.9%)	25(32.9%)	7(9.2%)	
40-49(9)	3(33.3%)	3(33.3%)	3(33.3%)	
>50(2)	1(50.0%)	0(0%)	1(50.0%)	

Mothers Education				
Illiterate(128)	59(46.1%)	38(29.7%)	31(24.2%)	0.07(2)
Literate(34)	23(67.6%)	7(20.6%)	4(11.8%)	
Fathers Education				
Illiterate(105)	49(46.7%)	30(28.6%)	26(24.8%)	0.30(2)
Literate(57)	33(57.9%)	15(26.3)	9(15.8%)	
Mothers Occupation				
Housewives(18)	9(50.0%)	4(22.2%)	5(27.8%)	0.12(4)
Unskilled(125)	59(47.2%)	36(28.8%)	30(24.0%)	
Skilled(19)	14(73.7%)	5(26.3%)	0(0%)	
Fathers occupation				
Unskilled(111)	53(47.7%)	31(27.9%)	27(24.3%)	0.410(2)
Skilled(51)	29(56.9%)	14(27.5%)	8(15.7%)	
Family Income(Rupees)				
1600-8009(18)	9(50.0%)	4(22.2%)	5(27.8%)	0.278(4)
8010-16019(124)	59(47.6%)	36(29.0%)	29(23.4%)	
>16019(20)	14(70.0%)	5(25.0%)	1(5.0%)	
Socio economic status				
Upper(4)	2(50.0%)	0(0%)	2(50%)	0.42(4)
Middle(49)	28(57.1%)	12(24.5%)	9(18.4%)	
Lower(109)	52(47.7%)	33(30.3%)	24(22%)	
Background				
Rural(136)	69(50.7%)	37(27.2%)	30(22.1%)	0.913(2)
Urban(26)	13(50%)	8(30.8%)	5(19.2%)	
Family Type				
Joint(90)	44(48.8%)	25(27.77%)	21(23.33%)	0.819(2)
Nuclear(72)	38(52.7%)	20(27.77%)	14(19.44%)	
Consanguineous(CM)/Non consanguineous marriage(NCM)				
CM(66)	35(53%)	16(24.2%)	15(22.7%)	0.707(2)
NCM(96)	47(48.9)	29(30.2%)	20(20.8%)	

Table 1: Comparison between Development delay (DD) and sociodemographic factors
** -Significant*

The total number of patients was 162 with diagnosis of mild DD in 50.61%; moderate DD in 27.8%; severe DD in 17.9% and profound DD in 4.3% . Severe and profound DD together represented 22.2% cases. 26.54% patients of the total were in the age range between 0-10months of which 62.79% had mild DD; 25.58% moderate and 11.6% severe/profound DD.25.92% were in the age range 11-20 months of which 59.52%, 7.14% and 33.31% had mild, moderate and severe/profound DD.12.96% were in the range 51-60 months of which 42.85% each had mild and moderate DD and 14.28% had severe/profound DD. There was statistically significant difference when age range of the patient was compared with diagnosis. Majority of the patients were males (60.49%) of which 52.04%, 26.53% and 21.4% had mild, moderate and severe/profound DD respectively. However the gender distribution across the diagnosis was not statistically significant.97 patients (59.87%) were 1st in birth order; 25.92% were 2nd; 10.49% were 3rd; 3% were 4th and only 1 case was 5th in birth order. There was no difference when birth order was compared.

Majority of the mothers were illiterate representing 128(79.01 %) out of 162.Rest were literate with varying levels of literacy. However, there was no statistically significant difference between the groups when compared with diagnosis. Majority (105 cases) of the fathers were illiterate (64.82 %) and literates were 57 in number (35.18%). However the difference was not statistically significant. Majority (125 cases) of the mothers were unskilled workers (77.16 %).There was no statistically significant difference between the groups. Majority (68.51%) of the fathers were unskilled employers, but there was no difference statistically between the groups when compared with diagnosis. Majority (76.54%) had a family income between Rs 8010 -Rs16019. But this difference was not statistically significant. Maximum number of patients were from low Socioeconomic status (SES) representing 109 (67.28 %) patients out of 162 of which 47.7% had a diagnosis of mild DD 30.3% had moderate DD and 22 % had combined severe and profound DD. Next was middle SES with 49 cases(30.24 %) and Upper SES with 4 (2.4 %) cases. However, there was no statistically significant difference between the groups. There were 136 (83.95%) cases from rural background of which 50.7% had mild developmental delay and 26 (16.04%) cases from urban background of which 50% had mild developmental delay. However, there was no significant difference when compared with the three diagnoses. There was statistically significant difference between the groups when the age range of father was compared with diagnosis. Majority, being in the age range 17 years to 39 years. Majority of the mothers were between 17-29 years (87.03%).But there was no significant difference between the groups. The majority of the fathers was between 17-39 years (93.20%). There was statistically significant difference between the groups. Patients belonged to joint families in 55.55% cases. But there was no significant difference across the diagnoses.Consanguinity was present in 40.74% patients, of which 53%, 24.25% and

22.7% had mild, moderate and severe/profound DD respectively.96 patients (59.26%) were products of non consanguineous marriage. There was no significant difference when consanguinity was compared across diagnosis.

Parameter	Mild DD(82)	Moderate DD(45)	Severe/Profound DD(35)	Chi-square(df)
Antenatal History				
Uncomplicated(147)	72(48.97%)	42(28.57%)	33(22.44%)	0.565(4)
Foetal distress(3)	2(66.66%)	0(0%)	1(33.33%)	
PIH†(12)	8(66.66%)	3(25%)	1(8.33%)	
Term of pregnancy				
Full term(149)	73(49%)	43(28.85%)	33(22.14%)	0.367(2)
Preterm(13)	9(69.23%)	2(15.38%)	2(15.38%)	
Type of delivery				
Caesarean (59)	31(52.54%)	18(30.5%)	10(16.94%)	0.536(2)
SVD‡ (103)	51(49.51%)	27((26.21%)	25(24.27%)	
Birth Asphyxia				
Absent(89)	46(51.7%)	27(30.3%)	16(18%)	0.425(2)
Present((73)	36(49.3%)	18(24.7%)	19(26%)	
Neonatal seizures				
Absent(119)	65(54.6%)	37(31.1%)	17(14.3%)	**0.001(2)***
Present(43)	17(39.5%)	8(18.6%)	18(41.9%)	
Neonatal jaundice				
Absent(152)	81(53.3%)	40(26.3%)	31(20.4%)	**0.03(2)***
Present(10)	1(10.0%)	5(50.0%)	4(40.0%)	
Septicaemia				
Absent(152)	79(52.0%)	44(28.9%)	29(19.1%)	**0.009(2)***
Present(10)	3(30.0%)	1(10.0%)	6(60.0%)	
Hypoxic Ischemic Encephalopathy(HIE)				
Grade 1 (31)	18(58.1%)	9(29.0%)	4(12.9%)	0.17(6)
Grade 2 (28)	15(53.6%)	4(14.3%)	9(32.1%)	
Grade 3(1)	0(0%)	0(0.%)	1(100.0%)	
Absent(102)	49(48.0%)	32(31.4%)	21(20.6%)	

Table 2: Comparison of Antenatal, natal and postnatal factors with developmental delay (DD)
**-Significant*
†-Pregnancy induced hypertension
‡-Spontaneous vaginal delivery

In 147(90.7%) patients the antenatal period was uncomplicated.7.4% had a history of pregnancy induced hypertension (PIH) amongst which 66.6% had mild developmental delay and rest had moderate/severe/profound developmental delay. Foetal distress was reported in only 1.9% cases. But there was no significant difference when compared between groups. Preterm delivery was reported in 8% patients of which 69% had mild developmental delay and 15.3% each had moderate and severe/profound developmental delay. Majority were products of full term pregnancy (91.97%).However there was no statistically significant difference when compared. In 36.4% cases delivery was by caesarean section of which 52.5% patients had mild DD; 30.5% had moderate DD and 16.9% had severe/profound DD.There was no statistical significance between the groups when type of delivery was compared. Birth Asphyxia was present in 45% cases, of which 49.3% had mild development delay, 24.7% had moderate and 26% had severe/profound development delay. There was no significant difference statistically. Majority were products of full term pregnancy (91.97%). There was no statistically significant difference when compared with diagnosis. 26.54% of patients had history of NNS with mild Developmental delay in 39.5% ;severe/profound in41.9% and moderate DD in 18.6%. NNS history was absent in 73.45% patients. There was statistically significant difference when NNS were compared with diagnosis. There was significant difference when diagnosis was compared with the presence or absence of Neonatal Jaundice (NNJ). 50% of patients and 40% of patients with a history of NNJ had moderate and severe/profound developmental delay respectively. 53.3% of patients without a history of NNJ had a mild developmental delay. There was statistically significant difference when the diagnosis was compared with the presence or absence of septicaemia. 60% of patients with history of a septicaemia had a diagnosis of severe/profound developmental delay. Septicaemia was absent in 93.82 % cases. 63% patients had no history of Hypoxic ischemic encephalopathy (HIE). HIE was present in 19.13% of which 58.1% had mild developmental delay, 29 % had moderate DD and rest had severe/profound DD.17.28% patients had grade 2 HIE of which 53.6% had mild DD, 32.1% had severe/profound DD and 14.3% had moderate DD. Only 1 patient with profound DD had grade 3 HIE. There was no statistically significant difference when diagnosis was compared with HIE. History of meningitis/encephalitis was present in13 cases, of which 46.2% had mild developmental delay; 38.5% had moderate and 15.4% had severe/profound developmental delay. There was no statistically significant difference observed.

Parameter	Mild DD(82)	Moderate DD(45)	Severe/Profound DD(35)	Chi-square(df)
Seizures				
Absent(130)	71(54.61%)	38(29.23%)	21(16.15%)	
Present(32)	11(34.37%)	7(21.87%)	14(43.75%)	**0.003(2)** *
Meningitis/Encephalitis				
Absent(149)	76(51%)	40(26.8%)	33(22.1%)	0.641(2)
Present(13)	6(46.2%)	5(38.5%)	2(15.4%)	
Downs				
Absent154)	74(48.05%)	45(29.22%)	35(22.72%)	**0.016(2)***
Present(8)	8(100%)	0(0%)	0(0%)	
Cerebral Palsy				
Absent(135)	74(54.81%)	37(27.40%)	24(17.77%)	
Present(27)	8(29.62%)	8(29.62%)	11(40.74%)	**0.015(2)***
Congenital anomalies				
Absent(126)	65(51.6%)	37(29.4%)	24(19%)	
CHD† (4)	1(25%)	2(50%)	1(25%)	
Microcephaly(24)	12(50%)	3(12.5%)	9(37.5%)	
Cleft palate(2)	1(50%)	1(50%)	0(0%)	0.165(10)
CTEV‡(2)	0(0%)	2(100%)	0(0%)	
Hydrocephalus(4)	3(75%)	0(0%)	1(25%)	
Visual/Hearing Impairment				
Absent(96)	52(54.16%)	24(25%)	20(20.8%)	
Visual Impairment(16)	6(37.5%)	4(25%)	6(37.5%)	
Hearing Impairment(6)	1(16.6%)	3(50%)	2(33.3%)	
Both Visual &Hearing (4)	2(50%)	1(25%)	1(25%)	
Squint(40)	21(52.5%)	13(32.55%)	6(15%)	0.537(8)
Associated Autism/Behavioural problems				
Autism(10)	6(60%)	4(40%)	0(0%)	
Behaviour problems(38)	13(34.2%)	11(28.9%)	14(36.8%)	
Nil(114)	63(55.3%)	30(26.3%)	21(18.4%)	**0.039(4)** *

Table 3: Comparison of developmental delay (DD) with co-morbidities
**-Significant*
†-Congenital heart disease
‡-Congenital talipes equino varus

In 19.75% cases co morbid seizures was present of which 34.37% had mild DD;21.87% had moderate DD and 43.75% had severe/profound DD.There was a significant difference between the groups when compared with seizures. History of meningitis/encephalitis was present in13 cases (8.02%) of which 46.2% had mild developmental delay; 38.5% had moderate and 15.4% had severe/profound development delay. There was no statistically significant difference observed. Down syndrome was present in 5% of patients .All had mild developmental delay. Downs syndrome was absent in 95% of patients. There was statistically significant difference between the groups on comparison. Cerebral palsy was present in 16.66% cases of which 29.62% each had mild and moderate DD and 40.745 had severe/profound DD. There was statistically significant difference between the groups on comparison. Microcephaly was present in 24 cases of which 50% had mild DD,12.5% moderate and 37.5% had severe/profound DD.CHD was reported in 4 cases, cleft palate and CTEV in 2 cases each and Hydrocephalus in 4 cases. However there was no significant difference when congenital anomalies was compared with diagnosis.9.8% of cases had Visual impairment of which 37.5% each had mild and severe DD and 25% had moderate DD. Hearing impairment was in 9.8% of cases of which 16.6% had mild DD; 50% had moderate DD and 33.3% had severe/profound DD.2.4% cases had both visual and hearing impairment. Squint was present in 24.69% cases, of which 52.5%, 32.5% and 15% had mild; moderate and severe/profound DD respectively. However, there was no significant difference found.

There was a statistically significant difference when associated autism/behaviour problems was compared with diagnosis.38(23.46%)patients had behavioural problems of which 34.2% had mild DD; 28.9% had moderate and 36.8% had severe/profound DD.10 patients(6.2%) had autism of which 60% had mild developmental delay and 40% had moderate DD.114 patients did not have associated autism/behavioural problems.

Postnatal factor	Seizures Absent	Seizures present	Chi-square(df)
Hypoxic ischemic Encephalopathy(HIE)			
Absent(102)	85(83.3%)	17(16.7%)	**0.00(1)***
Grade 1(31)	29(93.5%)	2(6.5%)	
Grade 2(29)	16(55.2%)	13(44.8%)	
Neonatal seizures(NNS)			
Absent(119)	106(89.1%)	13(10.9%)	**0.00(1)***
Present(43)	24(55.8%)	19(44.2%)	
Septicaemia			
Absent(152)	123(80.9%)	29(19.1%)	0.401(1)
Present(10)	7(70%)	3(30%)	
Birth Asphyxia(BA)			
Absent(89)	75(84.3%)	14(15.7%)	0.156(1)
Present(73)	55(75.3%)	18(24.7%)	
Meningitis/Encephalitis			
Absent(149)	119(79.9)	30(20.1)	0.68(1)
Present(13)	11(84.6)	2(15.4)	

Table 4: Comparison between presence and absence of seizures with Post natal factors
**-Significant*

Seizures were present in 6.5% cases with grade 1 HIE ;44.8% in grade 2 HIE and in 16.7% with no HIE.This difference was statistically significant.44.2% of patients with NNS had seizures whereas only 10.9% patients without NNS had seizures. This difference was statistically significant. Seizures were present in 30% of patients with septicaemia, 19.2% with no septicaemia; 24.7% with birth asphyxia, 15.7%without birth asphyxia; 15.4% with meningitis/encephalitis and 20.1% without history of meningitis/encephalitis. But the above 3 factors were not statistically significant. When postnatal events were compared with presence or absence of seizures it was found that HIE and NNS were statistically significant predictors of seizures.

Parameter(n)	Mean	Std deviation	F value	P value
DQ vs. Socioeconomic status				
Upper(4)	45.00	20.314	1.438	0.24
Middle(49)	49.94	15.531		
Lower(109)	45.85	13.385		
DQ vs. Mothers Education				
Illiterate(128)	45.70	14.226	5.750	**0.018***
Literate(34)	52.21	13.380		
DQ vs. Mothers Occupation				
Housewives(18)	46.11	17.194	3.383	. **0.036***
Unskilled(125)	46.01	14.130		
Skilled(19)	54.95	9.507		
DQ vs. Fathers Education				
Illiterate(105)	45.72	14.33	2.67	0.10
Literate(57)	49.54	13.91		
DQ vs. Fathers occupation				
Unskilled(111)	46.10	14.410	1.633	0.203
Skilled(51)	49.18	13.837		
DQ vs. Family income				
1600-8009(18)	46.61	16.553	2.148	0.12
8010- 16019(124)	46.15	14.266		
>16019(20)	53.20	10.744		
Age vs. Developmental delay				
Mild (82)	22.49	17.840	3.663	**0.028***
Moderate (45)	31.44	18.646		
Severe/Profound(35)	26.31	16.949		

Table 5: Comparison between Development Quotient (DQ) scores and Age of child with parameters

Mean DQ scores were 45, 49.94 and 45.85 in upper; middle and lower SES group respectively. There was no statistically significant difference between the groups when SES was considered in toto. But there was a difference when maternal education and occupation

was compared. Comparing level of maternal literacy with DQ score revealed a significant difference between the groups. Mean DQ in Illiterate mother groups were 45.70 and in Literate group was 52.21. There was statistically significant difference between the groups when DQ was compared with Maternal employment status. Mean DQ of children of housewives and unskilled workers was 46 and of skilled workers 54.95. Literate mothers were more likely to be in skilled jobs. There was no significant difference between the groups when DQ levels were compared with Family income. There was statistically significant difference when the age of the child in months was compared with diagnosis. The mean age of the child with mild development delay was 22.49 months; 31.44 months in patients with moderate developmental delay and 26.31 months in patients with severe/profound development delay.

3. Discussion

Of the 162 patients 60.49% were males in our study. Similar findings were observed in earlier studies.[8,14,15,16,17]Nearly all developmental disorders are more common in boys than girls for which Geschwind and Galaburda suggested that the influence of testosterone is to delay maturation of specific processes within the brain.[18] Other studies have shown a neurobiological difference between the brains of the males and females, indicating that the brain of the female foetus is protected from hypoxic ischemic lesions due to the effects of oestrogens.[19]It was proposed that there was culturally based gender bias in Indian families where male children are better tended and nurtured .[8]This issue has to be addressed and government and NGOs have already taken up various measures for "save girl child" in India .

In our study most of the patients belonged to rural background unlike other studies who found urban predominance; who ascribed it to ignorance and stigma fears in the rural population. [8] Ours being a paediatric tertiary referral centre maybe the stigma aspect was not there but that factor was not studied.

In previous studies it was observed that children in developing countries under age 5 years were not reaching their developmental potential because of poverty, malnutrition, high rates of infection, instability at home and lack of stimulation and education. [20,21] In our study 55.5% patients belonged to joint family; low SES with majority of the mothers and fathers being unskilled labourers reflecting the socioeconomic status of patients catered for in a government hospital. In the study done by N de Souza,[22] nuclear families with two children were majority; housewives represented 90%, most of the fathers were either skilled/unskilled workers(75%) and majority of the parents had not completed primary school.[22]Sadat also reported housewives being more than daily wage labourers in his study who further found that maternal educational level and family income were positively correlated with language and problem solving skills in child with income being additionally positively correlated with gross motor development of child.[14] Other studies also reported that poor maternal education predicted poor developmental outcome along with other variables.[4,12] In our study we found significant association between maternal literacy and DQ scores which was not seen with paternal education. Maternal schooling was believed to affect children's cognitive development by means of environmental organization, parental expectations and practices, provision of materials for child's cognitive stimulation, and variety in daily stimulation .[23] Hence measures need to be undertaken to improve education. History of consanguinity was present in 40.7% and it was not significantly associated with developmental delay or its co-morbidities in our study, unlike earlier study where it was the predictor of poor development performance [4]. Consanguinity was varyingly reported in 3% cases[24] and 61.3%cases[25] where it was attributed to cultural factors of marrying within families. We have not studied the correlation between consanguinity and genetic disorders/ dysmorphic syndromes which needs to be done from the genetic premarital counselling point of view.

Majority of our patients were 1st or 2nd in birth order like in another study [14]. May be this reflects the changing trend in society where single child or only 2 children are preferred. An earlier study reported a bad obstetric history in 10%and maternal infections in 10%. [24] Another study reported maternal TORCH infections in 4% (2.7 % had CMV and 1.3 % had Toxoplasmosis); maternal hypertension in 6.7% and gestational diabetes in 4%. [25]. In our study Pregnancy induced hypertension was reported in7.4% .In most of our patients only birth related history was available. Most of them were not booked cases, hence actual antenatal history could not be commented upon because we had to rely on only what the parents remembered. Positive family history was reported in 19% by Anurag T, [24] and 14.7% in another study. [25] In our study 6 patients had sibling history of developmental delay; of which 1 patient had both siblings affected. The small number precluded any further statistical studies. It could be possible that informants did not reveal the true family history on either parent's side for fear of blaming and stigmatization. Majority(63.6%) had normal vaginal delivery at full term in our study like in another study.[8] Another study reported hospital delivery in 38% with 20% caesarean section.[24] In our study caesarean deliveries were in 36.4% cases and preterm delivery was in 8 %.Other studies reported preterm in 13% [8,24], 12 % [25], 16.5% [26] and 38.8%[27]. Prematurity was found to be a significant predictor of developmental delay.[4,11] Increased risk of developmental problems in premature babies was due to its significant association with hypothermia,hypoglycemia, hypocalcaemia, respiratory distress syndrome , kernicterus and intraventricular brain haemorrhage and consequential serious long-term effects .[27]Low birth weight was reported in 34.6%[25]; 46%[24] and 28%.[26] Birth weight could not be commented upon in our study because of inadequate information. Birth asphyxia was present in 45% of cases in our study. Other studies reported birth asphyxia in 37%[8] 20%[24] , and 14.7%.[25] Individually birth asphyxia did not correlate significantly with diagnosis in our study. It is possible that severity of birth asphyxia along with other factors like HIE, NNS will correlate with development delay. This aspect was not studied presently.

Majnemar and Shevell,[1] reported HIE being cause of mental retardation in 9-10% of cases. In our study HIE grade 1 and 2 was present in 36.41 % of cases, but no significant association was found when compared with diagnosis. Recurrent seizures in the neonatal or early childhood period can cause chronic brain hypoxia resulting in poor brain development.[4] Jensen EF in their study,[28] observed that seizures consequences in the developing brain are different when compared with mature brain resulting in irreversible alterations in neuronal connectivity. Hence it is very essential to identify the factors leading to seizures from a prevention point of

view. In a study by Shaheen Akhtar,[29] there was a significant association of epilepsy in infancy with developmental delay (OR 9.87).Similar finding was observed in our study; Seizures was present in 19.75% cases of which 43.75% had severe/profound DD. In our study presence of NNS and HIE in neonatal period was significantly associated with seizures in later life; but no significant association was found with the presence of meningitis/encephalitis/septicaemia or birth asphyxia. A larger sample needs to be studied to conclusively prove their association.

Neonatal jaundice (NNJ) present in 6.2 % was significantly associated with developmental delay in our study. Other studies reported NNJ in 12 % [24]; 3% [8] and 2.7% [25] Septicaemia present in 6.2% was significantly associated with diagnosis. Other studies reported septicaemia in 12%, [24] and1.3%. [25] Septicaemia an avoidable condition reflects poor hygiene and postnatal care. This needs to be addressed. Metabolic disorders were not reported in our study, maybe a larger sample is needed to study with routine metabolic screening for every child. Except for Downs other dysmorphic syndromes were not identified in our study. Diagnosis was mild in 50.6% cases moderate in27.8% cases and severe/profound in 21.6% in our study. In another study moderate delay was seen in 42%, severe in 33% and mild in 25% of the patients. [24] Tertiary referral centre studies may not actually reflect the prevalence in the population as there can be ascertainment bias, whereby patients with more severe disability are more likely to seek medical attention without fearing stigma.[15] Hence our statistics may not actually reflect the population prevalence.

Co morbidities observed in a previous study included Learning disorders, ADHD, behavioural problems (mainly temper tantrums and disobedience) and autism in 24%, 12%, 10% and 4% children respectively.[8] In the same study,50% had cerebral palsy, 25% had epilepsy and 26% had other co-morbid physical disorders.[8] In our study we found behaviour problems in 23.46 % and autism in 6.2%.Physical problems included seizures in 19.75 %; Cerebral palsy in 16.66% with statistically significant difference when compared with diagnosis. History of meningitis/Encephalitis was present in8.02% cases.

Downs syndrome was present in 4.9% cases only in our study with all having mild DD along with hypothyroidism.. This may be because of small sample size or lack of facilities for genetic studies for every patient. Hypothyroidism a treatable condition was reported in 3%cases by Anurag Tikaria,[24] who stressed the need for stringent neonatal screening in our country especially in idiopathic global developmental delay[24]. In our study hypothyroidism was reported in all the patients with downs syndrome (4.9%). This may be because children with downs syndrome were extensively investigated for other co-morbidities.

In our study, other co-morbidities included CHD in 4; Microcephaly in 24; Cleft palate in 2; CTEV in 2 and Hydrocephalus in 4 cases. Visual impairment was present in 9.8% cases, Hearing impairment in 9.8% cases and both visual and hearing impairment in 2.4%cases. Squint was present in 24.69% cases. Sandeep Sachdeva [4] found varying degrees of hearing loss and visual impairment in 3% cases each and dysmorphic syndromes in 9 %.Anurag T reported autism in 6% microcephaly in 34%,macrocephaly in 2 %;failure to thrive in 21%;dysmorphism in 70% and specific dysmorphism in 44%;increased tone in 29%;decreased tone in 20%.[24] Chromosomal disorders including Down syndrome 20%; hypoxic–ischemic encephalopathy15%; multiple malformation syndromes14%; and cerebral dysgenesis 11% most common aetiologies found by Anurag T.[24]

Other specialists like neurologist, cardiologist, ophthalmologist, Endocrinologist, Reconstructive surgeon, etc. should be available in addition to Psychiatrists and early intervention team for a comprehensive management of physical and psychological disorders in the developmentally delayed child.[8]

In one study 65% of the children enrolled were less than 2 years with mean age of referral being 23.6 months.[24] Mean age(SD) of the child in our study was 25 months(16.41) unlike a previous study where it was 4 years, where it was surmised that stigma associated with seeking help from a special institute could be reason for delay in seeking help.[8] Our child guidance department is located in a tertiary care paediatric referral centre; hence prompt referral for early intervention for high risk cases was advocated. In an earlier study by Monica Juneja,[30] it was found that early presenters had better parental literacy, small families, better immunization, more hospital deliveries and from urban backgrounds.[30]

Reason for attending the early intervention centre and expectation from the visit, was treatment in most cases (49%) with 12% families perceiving as a curable condition in one study. [8] Parents of delayed children were found to be more concerned about gross motor, expressive language delays, behaviour, social and medical concerns than global/cognitive concerns in another study.[31] Treatment was mostly sought for inability to speak in one study.[8] This was observed in our study also. It was suggested that families need to be educated about the realistic expectations about the child's recovery. [8] N d souza observed that early intervention programmes that go into homes have a greater chance of reaching high-risk infants, compared with those provided at a distant centre. [22]

3.1. Limitations

Ours was a cross sectional study with a small group of patients conducted in a tertiary referral centre which reflects only a small percentage of population with referral bias. Many aspects which have been highlighted in the discussion have not been studied due to limitation of resources. Long term effects of efficacy of intervention programmes were not studied. Extensive epidemiological studies will give a clearer picture.

4. Recommendations /Future Directions

There is a need for awareness and education programmes in the general public for prevention at all levels. Genetic counselling ;proper antenatal, natal and postnatal care with high risk cases being referred by obstetricians for early intervention ;early identification and prompt referrals and multidisciplinary approach for holistic treatment of the child is recommended.

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