Original Article

Risk factors associated with Borderline Intelligence in Schoolchildren: A Case-Control Study

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ABSTRACT

Objective: To determine risk factors associated with borderline intelligence during intra-uterine life, delivery and the neonatal periods.

Methodology: In a case-control study, 200 school children in first grade, age six years were recruited. A standard intelligence quotient (IQ) test was used for psychometric testing. Cases had a borderline intelligence (70 to 84 score) and normal controls had an IQ of 85 or above scores. Cases and controls were matched for gender.

Results: Regression analysis showed that mother's illiteracy (Adjusted OR=2.7, 95% CI, 1.6-4.2, p=0.001), familial history of mental retardation (AOR=2.1, 95% CI, 1.4-3.5, p=0.002) and maternal drug consumption during pregnancy (AOR=1.7, 95% CI, 1.1-2.5, p=0.003) were the main adjusted risk factors associated with borderline intelligence in childhood. No significant association was found between adverse birth outcomes including low birth weight and prematurity and borderline intelligence in children.

Conclusions: Intelligence quotient (IQ) of schoolchildren is affected by both prenatal and postnatal factors as well as social determinants such as parental education. Controlling these factors has important implications for preventive strategies in psychological, maternal and child health programs worldwide.

KEY WORDS: Borderline, Intelligence, School children.

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INTRODUCTION

The majority of functional impairments are presented early in life; more subtle learning difficulties may not be detected until school entry. Mental retardation is characterized by sub average intellectual functioning, existing concurrently with limitations in conceptual, social, and practical adaptive skills.[1] Although these conditions may be considered ''mild'' at the individual level, their impact might be very substantial.[2] Borderline intelligence (slow learning) defined as an intelligence quotient (IQ) of between 70 to 84 scores is a function below the average range, but still is not categorized as mental retardation. Children with borderline intelligence may be labeled dull and stupid by their classmates, and their parents might think they are lazy and don't want to study.[3,4] However, these children may show normal development in early childhood.[5] For children living in disadvantaged families, adverse experiences during infancy can lead to intellectual impairments.[6] Consequently, these children face daunting educational, social, and mental health challenges.[7]

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The incidence of borderline intelligence range from 14% to 27% in different studies with higher rates in low birth weight children[1,3], whereas a prevalence rate of 6% has been reported for Americans.[7]

Birth-related factors such as prematurity, low birth weight, asphyxia, and childhood diseases such as meningitis, high fevers, epilepsy and encephalitis may increase risk of childhood mental disorders.[8] Meanwhile, maternal habits during pregnancy including excessive alcohol consumption, cigarette smoking and drug abuse might be involved.[9] Cultural deprivation, psychological and environmental factors and low socioeconomic status are also reported to affect childhood intelligence.[10,11]

The present study aimed to determine the risk factors associated with borderline intelligence during intra-uterine life, delivery and the neonatal periods among first grade school children in Sanadaj City, Kurdistan Province in Western Iran. The ability to predict such impairments may have important implications for preventive strategies in maternal and child health departments worldwide.

METHODOLOGY

Throughout a case-control study, 200 school children in first grade were recruited in Sanandaj City in the centre of Kurdistan Province, during 2007-2008. Kurdistan province is located in Western Iran with a population of 1.5 million of which four hundred thousand (400,000) are living in the centre of province. There are appropriate health facilities and the literacy rate is 76% for men and 63% for women.[12] Economically, Kurdistan is one of the least developed provinces in Iran. A prevalence rate of 3% has recently been reported for borderline intelligence in Kurdistan in 2007.[13]

Using a standard IQ test (Wechsler Intelligence Scale, WISC, provided by the Iranian Ministry of Education), overall 200 school children age six years including 100 cases with IQ in borderline range (70-84) and 100 normal controls with IQ ranging between 90-110 were recruited. Cases and controls were randomly selected from the same schools using cluster random sampling method. This included random selection of five schools in any district of education administration, two classrooms from each school and 10 students from each classroom. Cases and controls were matched for gender. A checklist was used for data collection which was completed by interviewing mothers of children.

SPSS software version 17 was used for all analysis. Statistically significant differences were determined using T-test and chi square or a Fisher's exact test. Probability values of 0.05 or less were considered significant. Odds ratio (OR) and 95% confidence intervals were calculated for risk measurements. A backward stepwise logistic regression was conducted to find the main risk factors associated with borderline IQ after adjusting for significant variables in the univariate analysis.

A written consent was obtained from each participant mother. Children and their parents were free to participate into the study or to withdraw from it whenever they requested. All personal data are secret anonymously. The proposal of this study was approved by the Kurdistan University of Medical Sciences Ethical Committee.

RESULTS

The mean age ± standard deviation was 6.7 ±0.4 years for cases and 6.6± 0.6 for normal controls with no significant difference. Results showed that both biological and socio-demographic factors were effective. Father's illiteracy (OR=6.0; 95% CI, 2.8-12.9, p=0.0001), mother's illiteracy (OR=5.5, 95% CI, 2.9-10.3, p=0.0001), birth order of 7th or more (OR=5.3, 95% CI, 1.5-12.0, p=0.01), familial history of psychosis (OR=5.7 95% CI, 2.6-23.8, p=0.003) and mental retardation (OR=8.0, 95% CI, 2.7-23.9, p=0.003), household low socioeconomic status (OR=1.9, 95% CI, 1.1-3.6, p=0.03), and presence of underlying disease in mothers, lack of prenatal care (OR=3.5, 95% CI, 1.7-7.0, p=0.001), loss of exclusively breast feeding alone (OR=2.3, 95% CI, 1.2-4.3, p=0.01), history of head trauma (OR=2.9, 95% CI, 1.2-7.9, p=0.02), stutter (OR=4.7, 95% CI, 1.7-13.1, p=0.001), and drug consumption in pregnancy (OR=3.5, 95% CI, 1.4-7.8, p=0.004) were significantly associated with borderline intelligence score and made differences between cases and controls as shown in Tables-I and II.

After adjusting for the significant variables in the univariate analysis presented in Tables I and II, regression analysis showed that Mother's literacy (Adjusted OR=2.7, 95% CI, 1.6-4.2, p=0.001), familial history of mental retardation (AOR=2.1, 95% CI, 1.4-3.5, p=0.002) and maternal drug consumption during pregnancy (AOR=1.7, 95% CI, 1.1-2.5, p=0.003) were the main adjusted risk factors associated with borderline intelligence in childhood. Other variables did not achieve the significant level in terms of range of confidence intervals.

On the other hand, familial marriage, mother's age, radiation, asphyxia, low birth weight and prematurity were not significantly associated with borderline intelligence.

Table-I: Risk factor analysis for borderline intelligence in 6-year old children in Iran.

Variables, n (%)		*Cases*	*Controls*	*OR (95% CI)*	*P value*
Father's literacy	Illiterate	40(80)	10(20)	6.0 (2.8-12.9	0.0001
	Literate	60(40)	90(60)		
Mother's literacy	Illiterate	78(66.7)	39(33.3)	5.6 (2.9-10.3)	0.0001
	Literate	22(26.5)	61(73.5)		
Birth order	1-6	86 (47.0)	97 (53.0)	5.3 (1.5-12.0)	0.01
	≥7	14 (82.4)	3 (17.6)		
History of psychosis	Yes	15(83.3)	3(16.7)	5.7 (2.6-23.8)	0.003
	No	85(46.7)	97(53.3)		
Familial history of MR	Yes	25(86.2)	4(13.8)	8.0 (2.7-23.9)	0.003
	No	75(43.90	96(56.1)		
Socioeconomic status	Low	74(55.6)	59(44.4)	1.9 (1.1-3.6)	0.03
	Upper	26(38.8)	41(61.2)		
Familial marriage	Yes	78(49.4)	80(50.6)	-	0.8*
	No	22(52.4)	20(47.6)		
Mother's age	<35	80(49.7)	81(50.3)	-	0.9*
	≥35	20(51.3)	19(48.7)		

*Not significance, Cl: Confidence Interval, MR: Mental retardation

DISCUSSION

The present study has achieved a participation rate of 97% which is remarkable. Cluster sampling, appropriate sample size, randomization and sex matching are the hall mark of the study. . To the best of our knowledge, this is the first study to examine the risk factors associated with borderline intelligence in Western Iran.

Mother's age in this study was not a significant risk factor for borderline intelligence, while O'Callaghan and colleagues have shown that younger but not older mothers were more likely to have children with borderline intelligence scores which is not consistent with the present study.[14] Previous studies have shown significant correlation between radiation and intelligence status[15], but no association was found between these two variables in the present study. In present study, no significant relationship was detected between low birth weight, prematurity and borderline intelligence. This might be due to using different definitions and cut off points of birth outcomes or sampling biases. However, there is a report implying that the mean IQ for children with low birth weight is within the average range.[1]

Familial marriage in the present study was not a significant risk factor for borderline intelligence. This finding is consistent with an epidemiologic study of mental retardation in Pakistan in which no association was found between consanguinity and mental retardation[16], but not in the study conducted by Durkin and colleagues in Bangladesh.[8]

Parental education level has already been confirmed as a significant predictor of child's intelligence. This study showed that illiteracy of parents was associated with risk of borderline intelligence in their children. Illiterate fathers had six fold increased risk of having children with low IQ as compared with educated fathers (OR=6.0; 95% CI, 2.8-12.9, p=0.0001). The corresponding risk for illiterate mothers was (Adjusted OR=2.7, 95% CI, 1.6-4.2, p=0.001). These results were consistence with recent reports.[14] A study from Karachi, Pakistan has also found that low level of literacy among mothers increased the risk of having lower intelligence in children by 3.2 folds.[16]

Maternal care during pregnancy is associated with increase levels of intelligence among children (OR= 3.5, 95% CI, 1.7-7.0, p=0.003). This result is also consistent with Durkin's study.[8]

The breastfeeding during the first six months along with standard pregnancy care was found to be protective regarding borderline intelligence.[8] Low socioeconomic status in the households increased risk of low intelligence in children (OR=1.9, 95% CI, 1.1-3.6, p=0.03). It has been reported that mothers of children with borderline intelligence have exhibited less positive and less sensitive parenting styles and were least likely to display a style of positive engagement.[17]

Table-II: Pregnancy-related risk factor analysis and borderline intelligence in children.

Variables, n (%)		*Cases*	*Controls*	*OR (95% CI)*	*P value*
Breast feeding (BF)	Yes	64(44.4)	80(55.6)	2.3 (1.2-4.3)	0.01
	No	36(64.3)	20(35.7)		
Prenatal care (PC)	Yes	66(43.1)	87(56.90	3.5 (1.7-7.0)	0.001
	No	34(72.3)	13(27.7)		
History of head trauma	Yes	16(72.2)	6(27.30	2.9 (1.2-7.9)	0.02
	No	84(47.2)	94(52.8)		
Complicated pregnancy	Yes	10(83.2)	2(16.7)	5.7 (1.7-9.8)	0.001
	No	90(47.9)	98(52.1)		
History of stutter	Yes	20(80.0)	5(20.0)	4.7 (1.7-13.1)	0.001
	No	80(45.7)	95(54.3)		
Drug consumption	Yes	21(75.0)	7(25.0)	3.5 (1.4-7.8)	0.004
	No	79(45.9)	93(54.1)		
Maternal disease	Yes	43(78.2)	12(21.8)	5.0 (2.5-10.2)	0.001
	No	57(39.3)	88(60.7)		
Childhood serious disease	Yes	31(66.0)	16(34.0)	2.3 (1.2-4.6)	0.01
	No	69(45.1)	84(54.9)		
Radiation exposure	Yes	7(58.3)	5(42.7)	-	0.8*
	No	93(49.5)	95(50.5)		
Cesarean delivery	Yes	42(49.4)	43(50.6)	-	1.0*
	No	58(50.4)	57(49.6)		
Prematurity	Yes	5(62.5)	3(37.5)	-	0.7*
	No	95(49.5)	97(50.5)		
Low birth weight	Yes	18(52.9)	16(47.1)	-	0.6*
	No	82(49.7)	83(50.3)		

*Not significance, Cl: Confidence Interval

Low family income has previously been shown in other studies to be associated with an increased likelihood of borderline intelligence. Experience with early intervention suggests that such efforts can result in enhanced development of children, particularly in children whose mothers had a lower level of education or were otherwise disadvantaged. Under stimulation of intellect during childhood may also be the cause.[13,14] Drug consumption during the first trimester of pregnancy was also associated with risk of borderline intelligence (AOR=1.7, 95% CI, 1.1-2.5, p=0.003). A similar finding has already been reported.[18] Alcohol consumption during pregnancy was rare in the present study due to Islamic and Kurdish culture in Kurdistan community.

In present study, birth order (7th and more) was associated with increased risk of childhood borderline intelligence (OR=5.3, 95% CI, 1.5-12.0, p=0.01). Number of live births is an indicator of family size; which has been identified in many studies as a risk factor associated with decreased intelligence.[8,16]

In this study, history of psychosis and other psychiatric diseases in the family, familial history of mental retardation, history of head trauma during childhood, history of stuttering, presence of underling disease in mothers before and during pregnancy, presence of serious disease in children and pregnancy complications were associated with increased risk of borderline intelligence. Similar findings have been reported in previous studies.[8,15,18]

This study supports strong association between social, environmental and biologic factors and intelligence status in children. Intelligence quotient of children in school age was affected by both prenatal and postnatal factors as well as social determinants including parents' education and socioeconomic status.

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