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PREMATURITY AND NEUROLOGICAL DISORDERS*

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INTRODUCTION

Prematurity has long been considered to be a handicap in respect to both motor and mental development. The purpose of this paper is to show the relationship of prematurity to various neurological disorders of obscure etiology, such as, mental deficiency, epilepsy, and cerebral palsy. In this study prematurity is considered to be present when the birth weight of a given infant was fewer than 2500 grams and the gestational age was fewer than 40 weeks. It has already been shown that prematurity is a highly significant factor in spastic diplegia, to such an extent as to indicate a causal, though not necessarily direct, relationship between prematurity and the disease.¹ There is an association between prematurity and mental deficiency if a premature infant is defined as one weighing fewer than 2500 grams at birth. However, if the criteria of prematurity are based on gestational age as well as birth weight, the association of prematurity with mental deficiency is obscure.

METHOD OF PROCEDURE

We wished to inquire further into the relationship of prematurity to other neurological disorders. In the present study the cases in the cohort were assigned to one of the following series on the basis of their clinical manifestation:

1. Cases with I.Q. over 90, physically and neurologically negative, but may have headache or various psychological or behavioral disorders.
2. Cases with mental deficiency (I.Q. below 70) as the sole problem.
3. Cases with mild mental deficiency (I.Q. 70 to, and including 89) as the sole problem.
4. Deafness with or without mental deficiency.
5. Mental deficiency with seizures.
6. Convulsive states. The series of convulsive states was originally considered with regard to the three separate conditions; seizures, type undetermined, "idiopathic" epilepsy, and focal cerebral seizures. It was apparent from our statistical data that prematurity was not a significant factor in any of these three groups and was no more significant in any one than the other two conditions. These three disorders were then grouped together for statistical comparison with the normal series.
7. Hemiplegic cerebral palsy, with or without seizures.

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8. Spastic diplegic cerebral palsy.
9. Complex diplegic cerebral palsy.
10. Athetoid cerebral palsy.
11. Hyperkinetic impulse disorder.

Over the past five years the authors have made a systematic collection of data regarding the factors of gestation and delivery of all children brought by their mothers for neurologic consultation. Histories were obtained item for item in the same manner in all cases, regardless of the presenting complaints. Requests for prenatal and perinatal histories were sent to the hospital of birth. Information was obtained from approximately 15% of the cases. The majority of the patients came from middle income families in Detroit and its environs. As a group, the mothers of these children were intelligent, interested in the welfare of their children, and were quite well informed regarding prenatal care and child health. None were deprived of the means to obtain adequate diet or necessities of life. All but eleven children in the entire cohort were born in this hospital. To determine the magnitude of error in histories, a determination of concordance between the mother's history and hospital records was made in regard to birth weight and gestational age in those cases where hospital records were obtained. This was done in cases with mental deficiency, epilepsy and spastic diplegia. Hospital records were available in 37 cases of mental deficiency and of these discordances between the mother's history and hospital record in regard to birth weight occurred in only 2 (5%). Hospital records were available in 80 cases with epilepsy. In this group discordances were observed in 10 cases (13%). Hospital records were available in 16 cases with spastic diplegia. In this group, discordance was observed in one case (6.25%). The average age of the patients with mental deficiency when first seen was 4.5 years, the average age of the patients with epilepsy was 8.0 years, and the average age of patients with spastic diplegia was 4.8 years. The discordance between the mother's history and hospital record in the mental deficiency series, the epilepsy series, and the spastic diplegia series could be attributed to errors in recall due to lapse of time. Nevertheless, it should be apparent that the discordances were minor. In respect to the concordance of hospital and mother's history concerning gestational age, the series of cases with mental deficiency had a discordance rate of 10%, the epilepsy series a discordance rate of 13%, and the spastic diplegia series a discordance rate of 6.25%.

Each patient was subjected to a systematic neurologic examination. The findings were recorded on data collection forms at the time of examination. Psychometric tests performed by a psychologist who did not know the patient's birth history or about this work, were obtained in most of the patients who were suspected of having mental deficiency. Psychometric tests were not obtained in some of the severely defective and in many of the obviously normal children.

ANALYSIS OF DATA

The cohort totaled 1245 cases. There were 212 in the neurologically normal group, including 13 (6.1%) prematures. There were 17 (8.1%) prematures in 191

mental deficiency cases, 3 (7.3%) prematures in 41 mild mental deficiency cases, 10 (29%) prematures in 34 cases of deafness with or without mental deficiency, 8 (18%) prematures in 45 cases of mental deficiency with seizures, 29 (7.3%) prematures in 398 cases of convulsive states, 11 (12.4%) prematures in 89 cases of hemiplegic cerebral palsy, 64 (78%) prematures in 82 cases of spastic diplegic cerebral palsy, 14 (16.3%) prematures in 86 cases of complex diplegic cerebral palsy, 6 (13.0%) prematures in 46 cases of athetoid cerebral palsy, 2 (9.5%) prematures in 21 cases of hyperkinetic impulse disorder. The Chi square test was carried out to determine the statistical significance of the numbers of prematures in each group. As shown in Table I, the Chi square was significant, that is, P was less than .001, in the two series, deafness with or without mental deficiency and spastic diplegic cerebral palsy. The mean weight of each series and the mean weight of the prematures in each series are shown in Table I.

There is a significantly high incidence of prematurity in the series of cases of deafness with or without mental deficiency (P is less than .001). A series of 39 deaf children has been previously reported, of whom 9 (23%) had birth weights under 2500 grams.²

Figure I compares with I.Q.'s of 64 premature spastic diplegic cerebral palsy cases to an I.Q. curve such as would be found in the general population. Statistical comparison of the I.Q.'s of the premature spastic diplegic cerebral palsy group and of the general population was done by the analysis of variants technique, where the variance ratio, $F = \frac{\text{"between" mean square}}{\text{"within" mean square}}$, gives the following result: $F=22.2, u_1=1, u_2=3246$. From this, P is far less than .001.

DISCUSSION

This study shows again that there is a very strong association between prematurity and spastic diplegia. There is no demonstrable association, however, between prematurity and mental deficiency or epilepsy in our case material. If we consider prematurity on the basis of birth weight only, then there is correlation between prematurity and mental deficiency. This correlation disappears when we consider gestational age as well as birth weight in defining prematurity.

It is interesting that the mean weight of the prematures in the mental deficiency series is significantly higher than the mean weight of the prematures in the spastic diplegia series (2213 as compared with 1520 grams); and is also higher, though not significantly so, than the mean weight of the prematures in the normal group (2009 grams).

We find a correlation between prematurity and deafness with or without mental deficiency, but no evidence as to the etiology of these conditions is suggested from this study.

The I.Q. distribution of our 64 premature spastic diplegia cases has been statistically compared to the I.Q. distribution found in the general population, and has been found to vary significantly, although not greatly, from the expected norm. It must

Table I

Comparison of Series with Different Neurologic Disorders
to a Neurologically Normal Series in Regard to Prematurity

SERIES	Cases	Premature	Percent Premature	Chi Square	P less than .001	Mean weight of Series	Mean weight of Prematures in Series
Normal	212	13	6.1	—	—	3242	2009
Mental Deficiency	191	17	8.9	.66	0	3000	2125
Mild Mental Deficiency	41	3	7.3	.29	0	3145	2291
Deafness (With or without M.D.)	34	10	29.0	18.74	+	2611	1775
M.D. + Sx	45	8	18.0	2.99	0	3081	2094
Convulsive States	398	29	7.3	.29	0	3223	2002
Hemiplegia	89	11	12.4	3.31	0	3220	1875
Spastic Diplegia	82	64	78.0	70.71	+	1863	1520
Complex Diplegia	86	14	16.3	7.65	0	2978	2054
Athetoid	46	6	13.0	2.65	0	3065	1947
Hyperkinetic	21	2	9.5	.36	0	3137	2000
Total	1245	177	14.2				

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be remembered too that psychometry of children with cerebral palsy is difficult, as these children with impairment of motor function cannot readily explore their environment, and they have difficulty communicating with others. The values shown indicate again that even very early prematurity is not strongly associated with mental deficiency.

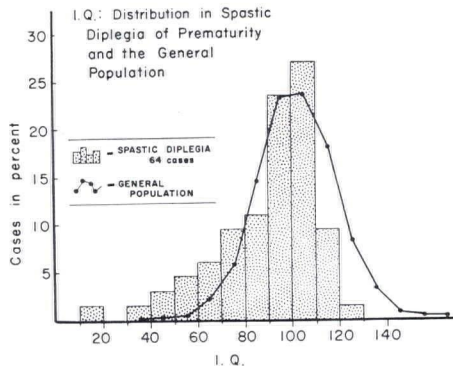


Figure 1

We have a series of seven cases of triplegic cerebral palsy. This series, however, was not included in Table I as the number was too small to be statistically significant. All of these seven cases were premature (mean birth weight 1518 grams). We believe that these seven cases had spastic diplegia of prematurity initially with the subsequent onset of hemiparesis, resulting in triplegia.

SUMMARY

When the criteria for prematurity are (a) gestational age of fewer than 40 weeks and (b) birth weight of fewer than 2500 grams, this study indicates the following:

1. Spastic diplegic cerebral palsy is strongly associated with prematurity.
2. Deafness with or without mental deficiency is strongly associated with prematurity.
3. Mental deficiency is weakly if at all associated with prematurity, but is associated with full term (i.e. 40 week gestational age) children with birth weight fewer than 2500 grams.
4. Epilepsy is not associated with prematurity.

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