

PREVALENCE OF SOFT NEUROLOGICAL SIGNS : A STUDY AMONG INDIAN SCHOOL BOYS

DHRUBA JYOTI BAGCHI, RAKESH KHANNA, S.S. RAJU,

ABSTRACT

"PANESS" battery was administered to a total sample of 120 students of five age specific groups of children from two schools catering to the needs of different socio-economic classes.

Most commonly observed item was overflow/higher movements (5, N = 24) followed by motor inco-ordination and dysdiadochokinesia, maximally present in the age group of 7 to 8 (6, N = 24). Further results suggest different patterns across various age groups and that there may be a significant correlation between handedness and soft neurological signs. The implications of these findings have been discussed in the paper.

Key words : Soft Neurological Signs, Overflow movements, Handedness.

Bender (1956) introduced the concept of 'Soft Neurological Signs' (SNS) (synonym: Minor Neurological Dysfunction) which are defined as non normative performance on a variety of motor and / or sensory tasks by people not mentally retarded and without focal neurological deficits. (Shaffer, 1978). The presence of soft neurological signs as an index for cognitive and behavioural dysfunction have been studied by many workers. (Hertzog et al 1966, Quitkin et al 1976, Kolakowska et al 1985)

Among child psychiatric disorders the link between soft neurological signs and hyperkinetic disorders, enuresis, autism and learning disability has been well documented (Mikkelsen et al 1982, Shaffer et al 1985). Most child neurologists and psychiatrists view them as subtle developmental immaturities (Shapiro et al 1979, Lunswing et al 1992).

Denckla (1985) described norms for a western sample and cautioned that those were not meant for universal use. It is recommended that for each research unit, a set of local socioeconomically and demographically appropriate norms be obtained, specially when used as a research instrument. The present study is an initial attempt to look for demographically and socioeconomically appropriate age related preva-

lence of soft neurological signs among Indian school going boys.

Material and Method

Subjects for the present study were drawn from two boys' schools of Kanke. These two schools were chosen because of their proximity to the Central Institute of Psychiatry. One is a government school where no tuition fee is charged. The other is a private school run by missionaries. Broadly speaking, the first largely caters to the needs of social class V and the other to social classes III and IV.

Five age specific groups were taken up for study. Group I: 5-6 years, Group II: 7-8 years, Group III: 9-10 years, Group IV: 11-12 years and Group V : 13-14 years. Initially assessment of scholastic performance and adaptive functioning was done by going through the results of the previous examination and seeking the opinion of the class teacher. Subjects with any possibility of mental retardation were excluded. Subsequently, a clinical examination was performed which consisted of a brief neurological examination to exclude any focal or gross neurological deficits. A random sample of 12 subjects for each of the 5 age groups were taken from each of the two schools.

The assessment tool used was the "Physical and Neurological Examination For Soft Signs" (PANESS) which consists of 21 items and is the revised schedule for neurological examination for subtle signs appropriate for the age range of 5-16 years (Denckla, 1985). A score of '0' indicates that soft signs are absent. A score of '1' indicates that soft sign is present. It has been used by various researchers and has a high degree of validity and interrater reliability.

Before applying the PANESS battery, rapport was established with the subject by engaging him in neutral conversation for a few minutes. Each subject was given time to acclimatize to the test situation by asking them to do one or two simple unscored tasks with questions such as "Can you show me your right hand" and so on. Two trials of various scored items on PANESS were also given in case the child found any difficulty in the understanding and performance of these tasks. An encouraging non-punitive atmosphere was maintained throughout the test procedure. Initially 20 students were assessed by two raters in order to find the interrater reliability. After a period of 4 weeks 'PANESS' was readministered on 20 boys to obtain test-retest reliability.

RESULTS

For obtaining interrater and test-retest reliability on 'PANESS', correlation coefficient was obtained which showed a near perfect agreement for timed score items, (foot tap $r = 0.97$, alternate heel toe movements $r = 0.98$, finger tap $r = 0.97$, hand pats $r = 0.97$, alternate hand movements $r = 0.97$, successive finger movements $r = 0.99$).

Table 1 shows the presence of 'Soft Neurological Signs' in various age groups. The most commonly occurring item on 'PANESS' was overflow mirror movements. Next commonly observed item in our study was motor incoordination (gait and balance items, impersistence score, involuntary movement score) which was most often present in the age group of 7 to 8 years (6 out of 24).

Table : 1 (presence of soft neurological signs in various age groups)

ITEMS:-	AGE GROUPS (N=120, 24 IN EACH AGE GROUP)				
	5-6 (N=24)	7-8	9-10	11-12	13-14
PRESENCE OF					
Soft Neurological Signs	6(25%)	8(33%)	7(29.1%)	7(29.1%)	6(25%)
Motor incoordination	3(12.5%)	6(25%)	2(8.3%)	5(20.8%)	2(8.3%)
Dysdiadochokinesis	2(8.3%)	5(20.8%)	3(12.5%)	2(8.3%)	0(0)
Overflow/Mirror Movements	3(12.5%)	5(20.8%)	5(20.8%)	3(12.5%)	3(12.5%)
Sensory Integration	0(0)	0(0)	1(4.1%)	1(4.1%)	1(4.1%)
SCORES					
(Mean+SD)					
SWS	.79+1.47	1.04+1.96	.79+1.41	.58+.97	.45+.91
Motor Incoordination	.20+0.58	.58+1.19	.12+0.44	.66+2.25	.12+4.4
Dysdiadochokinesis	.25+0.89	.25+0.60	.16+0.48	.12+0.44	0
Overflow/Mirror Movements	.33+0.91	.33+0.76	.41+0.88	.16+0.48	.16+4.0
Sensory Integration	0	0	.08+0.40	.04+0.20	.08+4.0

Another significant item in our study on 'PANESS' was dysdiadochokinesia (quality of movement, dysrhythmic errors, repetitive speed of movement score) which was maximally observed in the age group of 7 to 8 years (4 out of 24), but absent in the 13 to 14 age group.

Table 2 show differences on the timed items in various age groups on the right (2A) and left (2B) sides. When age groups 5 to 6, and 7 to 8 years were compared, significant differences were found in all timed score items of PANESS except for repetitive hand pat movements. Similarly between age group of 7 to 8, and 9 to 10 years, except for foot tap, all scored items showed

a significant level of difference. But in contrast, between age group of 9 to 10, and 11 to 12 years only 3 items showed significant difference in right sided performance and 2 in left sided performance. In keeping with this trend the difference in scores were statistically significant on only 2 items (Alternate Heel Toe Movements and Successive Finger Movements) when the age groups of 11 to 12, and 13 to 14 years were compared.

Table 2 A : Mean + SD scores on Timed items in various age groups

ITEM	AGE GROUPS (in years)				
	5-6	7-8	9-10	11-12	13-14
TIME TO PERFORM					
TWENTY					
Alternate hand movements	9.54 \$	8.72 *	* 6.61	5.61	5.65
	+79	+1.07	+55	+6.6	+1.03
Repetitive finger movements	7.01 \$	6.29 \$	5.38	4.97	4.55
	+48	+62	+56	+46	+62
Foot tap	8.24 *	5.63	5.37+	4.94	5.24
	+74	+64	.54	+74	+1.11
Alternate heel toe movements	15.73*	12.35*	8.38	9.56*	7.77
	+57	+1.32	+1.45	+1.25	+1.46
Hand pat	5.91	5.75*	4.97+	4.29	4.27
	+43	+44	+93	+45	+63
Successive finger movements	15.53 \$	12.85 \$	9.64	10.15 \$	8.08
	+73	+1.86	+95	+1.03	+1.87

Superscript denotes p values (* $<.01$, + $<.02$, \$ $<.05$ level) Each age group is compared with the next age group. For example superscript '\$' in 5-6 years denotes that the difference in score for 5-6 group was significantly different compared to the age group 7-8 years.

Table 2 B: Mean + SD scores on Timed items in various age groups - Left side

ITEM	AGE GROUPS (in years)				
	5-6	7-8	9-10	11-12	13-14
TIME TO PERFORM					
TWENTY					
Alternate hand movements	9.77 *	9.10 *	6.80 *	5.85	5.85
	+82	+93	+55	+72	+1.15
Repetitive finger movements	7.19 \$	6.25 \$	5.48	5.16	4.74
	+50	+63	+57	+6.45	+73
Foot tap	8.44 *	5.99	5.58	5.15+.79	5.45+1.0
	+73	+67	+59		7
Alternate heel toe movements	15.97*	12.72*	8.77	9.90 *	8.11
	+52	+1.92	+1.47	+1.36	+1.51
Hand pat	6.15	5.94 *	5.12 +	4.38	4.42
	+45	+42	+1.02	+47	+64
Successive finger movements	15.90 \$	13.17 \$	9.86	10.49 \$	8.41
	+79	+1.86	+93	+1.05	+1.92

DISCUSSION

Our results of interrater and test-retest reliability are in keeping with the findings of Werry and Aman (1976) who showed that there was striking agreement when the examiners were asked to give a global (4 point scale) rating of neurological functioning.

The origins of soft signs remain shrouded in controversy. They are generally considered to be of developmental origin, and hence disappear with age. Hertzog (1982) studied a neurologically deviant population and observed that although there was a diminution in the amplitude and range of signs found in an individual child, children with a sign at one age are likely to show signs, not necessarily the same ones, five years later. Shaffer et al (1985) found that a large proportion of children who had soft sign at age 7 continued to show such signs at age 17.

Puberty may lead to a decrement of minor neurological dysfunction. Though the mechanism of this change is not very clear, it may be due to increased central myelination in the corti-

cal association areas and the formatio reticularis and changes in the intracortical micro-circuitary which in turn play a role in the increase in central conduction velocity. (Yakovlev et al, 1967, Muller et al, 1991).

It is not possible to directly compare our findings with those reported by Denckla. Denckla used a narrow age range (5 to 10 years) only but took equal number of children for each age. In the present study the age range was expanded to include the age range of 5 to 14 years. However, subjects were clubbed into two consecutive age groups such as 5-6, 7-8 and so on. The results show a trend for the scores to be different in the two studies. For example in the study by Denckla (1985) the time to complete 20 successive finger movements ranged from 16.70+4.08 at age 5 to 10.22 + 2.74 at age 10, whereas in our study it ranged from 15.53 + 0.73 in 5 to 6 age group to 9.64 + 0.95 in 9 to 10 age group. On almost all items the scores are slightly lower in our sample compared to those reported by Denckla (1985), suggesting a somewhat earlier disappearance of SNS, and hence perhaps faster neuronal integration. Thus the need for having separate norms is substantiated. There are some obvious limitations in this study, The sample size was small and included only boys. Thus there is a need for further study on a larger sample of both sexes from more varied socio-cultural background. The present study underlines the need for such a study by reporting several similarities as well as differences in our sample compared to those reported in other communities.

REFERENCES:

- Bender, L. (1956)** Psychopathology of children with organic brain disorder, Spring Field, Charles C Thomas.
- Denckla, M.B. (1985)** Revised Neurological Examination for Subtle Signs. *Psychopharmacology Bulletin*. 21, 773-789.
- Hertzlg, M.E. and Birch, H.G (1966)** Neurologic organization in psychiatrically disturbed adolescent girls. *Archives of General Psychiatry*. 15, 590-598.
- Kolakowska, T.; Williams, A.O.; Tambor, K. and Ardern M. (1985)** Schizophrenia with good and poor outcome III : Neurological soft signs, cognitive impairment and their clinical significance. *British Journal of Psychiatry*, 146, 348-357.
- Lunswing, R.J.; Algra, M.H.; Juisjes, H.J. and Touwen, B.C.L. (1992)** 'Minor Neurological Dysfunction' from birth to 12 years. II Puberty is related to decreased dysfunction. *Developmental Medicine and Child Neurology*. 34, 404-409.
- Mikkelsen, E.J.; G.K. and Minichiello, M.D. (1982)** "Neurologic status in hyperactive, enuretic, encopretic and normal boys. *Journal of the American Academy of Child Psychiatry*. 21, 75-81.
- Muller, K.; Homberg, V. and Jonnard, H.G. (1991)** Magnetic stimulation of motor cortex and nerve roots in children. Maturation of corticomotorneuronal projections, *Electroencephalography and Clinical Neurophysiology*. 81, 63-70.
- Quitkin, F.; Rifkin, A. and Klein, D.F. (1976)** Neurological soft signs in schizophrenia and character disorders. *Archives of General Psychiatry*. 33, 845-853.
- Shaffer, D. (1978)** Soft neurological signs and later psychiatric disorder - a review. *Journal of Child Psychology and Psychiatry*. 19, 63-65.
- Shaffer, D.; Schonfield, I.S.; O'Connor, P.A.; Stokman, C.; Shaffer, S.C. and Ng, S. (1985)** Neurological soft signs and their relationship to psychiatric disorder and intelligence in childhood and adolescents. *Archives of General Psychiatry*. 42, 342-351.
- Shapiro, T.; Burkes, L.; Petti, T.A. and Panz, J. (1979)** Consistency of nonfocal neurological signs. *Journal of the American Academy of Child Psychiatry*. 17, 70-79.
- Taylor, D.C.; Powell, R.P.; Cherland, E.E. and Vaughan, C.M. (1988)** Overflow movements and cognitive motor and behaviour distur-

bance: a normative study of girls. *Developmental Medicine and Child Neurology*. 30, 759-768.

Werry, J.S. and Aman, M.G. (1976) The reliability and diagnostic validity of the Physical and Neurological Examination for Soft Signs. (PANESS) *Journal of Autism and Childhood*

Schizophrenia. 6, 253-263.

Yakovlev, P.I. and Lecours, A.R. (1967) The microgenetic cycles of regional maturation of the brain. In Mindowski, A. (Ed.) *Regional development of the brain in early life*. Oxford: Blackwell Scientific, pp. 3-70.

*Dhruba Jyoti Bagchi, D.P.M**, Resident in Psychiatry Rakesh Khanna, M.D, Associate Professor of Psychiatry S.S. Raju, M.D. Director and Medical Superintendent Central Institute of Psychiatry, Kanke, Ranchi - 834 006

*Correspondence