

PATTERN PERFORMANCE OF SCHIZOPHRENIC PATIENTS ON LURIA-NEBRASKA NEURO-PSYCHOLOGICAL BATTERY

B.P. MISHRA, V.GUPTA, R. MAHAJAN & R.L. NARANG

ABSTRACT

Luria-Nebraska Neuro-psychological Battery, is now an established tool to assess brain damage in recent years. This test battery has been reported to be very useful to find out functional organization of the brain. The biological basis of psychiatry is also now well explained. The present study is directed towards the neuro-psychological functioning of schizophrenic disorder, and the findings are discussed in the light of biological researches. The pattern of performance of schizophrenia on Luria-Nebraska Neuro-psychological battery is indicating the possibility of combined cerebral dysfunction, more towards left hemisphere functions. No single localization was found responsible for this illness. Limitations of present study, and need for well organized further research is indicated using advance technology of brain imaging techniques and neuro-psychological profile of brain functioning, would be helpful for the rehabilitation purposes and to understand the illness better.

Key words: Neuro-psychology, schizophrenia, Luria-Nebraska Battery.

For long the Luria-Nebraska Neuropsychological Battery (LNNB) has been an area of active investigation to find out cognitive deficits associated with organic and non-organic brain disorder. Its use in schizophrenia, to find deficits and correlate with biological measures of an anatomical and physiological abnormalities has not been fully exploited. The radiological measures of regional brain structure and function have provided criterion measures against which to validate the LNNB measures. Initial attempts to identify cognitive deficits in schizophrenia were directed toward comparison of these psychotic patient groups with criterion neurological patients to determine the efficacy of LNNB to differentiate these groups by their level of performance on the

cognitive measures. Subsequent researchers have reported the effects of demographic, diagnostic, chronicity, and medication variables in schizophrenia on the LNNB performance level.

Golden et al. (1980) studied the cerebral ventricular size and neuropsychological impairment in young chronic schizophrenics. They found significant correlation with the ventricular brain ratio and luria scores. The overall ventricular brain ratio for the schizophrenics was significantly more than that found in normal population. Moses (1983) reported significantly different profiles of schizophrenics whose neurological examination were normal.

Attempt has also been made in India to find out schizophrenic performance on

neuropsychological tools. Nizamie (1983) used Christensen's Luria's neuropsychological investigation on a group of leucotomized and nonleucotomized schizophrenic patients. Panda (1988), reported significantly different neuropsychological performance of the schizophrenic patients on Luria's test, when compared with normal controls. Most of these studies were comparisons of schizophrenics performance levels with level of performance of other non-schizophrenic groups, none of them indicated specific performance pattern of the schizophrenic cognitive functioning. The present study is directed towards the cognitive functioning pattern of schizophrenics, and its difference from normal population.

MATERIAL AND METHOD

All the schizophrenic patients were diagnosed as per the ICD-9 criteria. The duration of illness was more than two years, and less than five years. All patients were on maintenance medication with antipsychotics.

All the subjects were evaluated on Luria-Nebraska Neuropsychological Battery, Form-1 (Golden et al., 1985), and scoring was done as per the manual. The final conversion of raw score in to T-score was done according to Moses, 1983 for all cases, to avoid examiner's variation, and minimize chance factors. The schizophrenic patients were kept one day off the medicines before evaluation on the LNNB.

The LNNB clinical and summary scale is divided in to four bands i.e. sensori-motor band, speech band, conceptual band, and summary band. The one tailed t-test was computed to compare the means of two groups for all fourteen scales (C1 to C11 with S1, S2, and S3). To illustrate the pattern of performance of the mean T-score of each scale for both the groups is presented through a graph.

RESULTS

The study sample consisted of two groups.

The first group comprised of 30 male schizophrenic subjects and the second group of 30 male normal controls who were matched for age and years of schooling. The two groups were matched for age and education variables because these two variables are considered to influence cognitive functioning, the most. The mean age and s.d. of controls, who were not having any medical or psychiatric problems, was 30.967 years and 8.419 years (range: 20 years to 55 years) whereas, the mean and age s.d. of schizophrenics, who were diagnosed by one psychiatrist and confirmed by two other psychiatrists, was 32.4 years and 8.774 (range: 20 years to 55 years). The mean education level of control group was 11.63 years of schooling with s.d. of 1.56 years, whereas, the mean education level of schizophrenics was 11.4 years of schooling with the s.d. of 1.38 years.

The demographic matching of the two groups is shown in table-1. The t-value of age and education wise distribution of the sample was found to be non-significant ($p < 0.05$). This shows that the two groups are well matched for their age and education.

**TABLE-1
AGE AND EDUCATION WISE DISTRIBUTION
OF THE SAMPLE (N=60)**

| Variables | Controls N=30 | Schizophrenics (N=30) |
|----------------------------------|------------------------|--------------------------|
| Age (in yrs.) | | |
| Mean (s.d.) | 34.97 (8.42) | 32.40 (8.78) |
| Range | 20-55 | 20-55 |
| | t=0.15, d.f.= 58, N.S. | |
| Education (Schooling in yrs.) | | |
| Mean (s.d.) | 11.63 (1.56) | 11.40 (1.38) |
| Range | 9-15 | 9-15 |
| | t=0.60, d.f.=58, N.S. | |

The subsequent band wise analysis of two groups is shown from table-2 to table 5. Comparison on almost all the scales was found to be highly significant statistically. The t-value and significance level are indicated in each table. The pattern of the performance of the two groups are presented in the graph.

PATTERN PERFORMANCE OF SCHIZOPHRENIC PATIENTS ON LNNB

TABLE 2
COMPARISON ON SENSORIMOTOR BAND OF LNNB

| Scales | Controls (N=30) | | Schizophrenics (N=30) | | t-value (d.f.=58) |
|-----------------------|--------------------|------|--------------------------|-------|----------------------|
| | Mean T-score | S.D. | Mean T-score | S.D. | |
| C1, Motor Functions | 30.7 | 2.15 | 40.0 | 9.35 | 5.30** |
| C2, Rhythm Functions | 29.97 | 1.97 | 50.97 | 18.75 | 6.10** |
| C3, Tactile Functions | 37.27 | 3.02 | 52.50 | 10.17 | 7.86** |
| C4, Visual Functions | 34.97 | 2.65 | 51.77 | 7.37 | 11.75*** |

=Significant at 0.01 level, *=Significant at 0.005 level

TABLE 3
COMPARISON ON SPEECH BAND OF LNNB

| Scales | Controls (N=30) | | Schizophrenics (N=30) | | t-value (d.f.=58) |
|-----------------------|--------------------|------|--------------------------|------|----------------------|
| | Mean T-score | S.D. | Mean T-score | S.D. | |
| C5, Receptive Speech | 30.67 | 5.66 | 54.73 | 7.13 | 14.47*** |
| C6, Expressive Speech | 32.23 | 4.19 | 40.60 | 9.84 | 16.34*** |
| C7, Writing Function | 38.55 | 1.20 | 47.11 | 5.74 | 7.99** |
| C8, Reading Functions | 40.27 | 1.98 | 45.10 | 4.97 | 4.95** |

=Significant at 0.01 level, *=Significant at 0.005 level

All the scales included in sensory-motor band i.e. motor functioning, rhythm, tactile functioning, and visual functioning, were able to differentiate the two groups on the basis of their performance on these scales ($p < 0.001$) as shown in table-2. The schizophrenic subjects were showing significantly more deficits as compared to control group. Though the scores of this band is not elevated above 60-T-score, the nature of pattern performance of this band (which is more affected area in schizophrenic group than other bands except receptive scale of speech band) reveals tactile functions (C_3) are highest followed by visual functions and rhythm. The items involved

in this scale are identification of touch and nature of touch, with stereognostic perception. The visual functions (C_4) scale of the LNNB basically measures the range of visual functions which are mainly sensitive to right hemisphere functions, but can also show deficits in left hemispheric problems. This finding is consistent with other findings reported in the literature (Golden, 1980; Golden et al., 1985). In the present study, none of the two group's mean score of any scale was elevated above 60 T-score. This confirms the diagnostic efficacy of LNNB, to differentiate Schizophrenic groups from brain damage category and normal control group and confirms again the findings reported in the literature (Moses et al., 1988).

TABLE 4
COMPARISON ON CONCEPTUAL BAND OF LNNB

| Scales | Controls (N=30) | | Schizophrenics (N=30) | | t-value (d.f.=58) |
|-----------------------------|--------------------|------|--------------------------|-------|----------------------|
| | Mean T-score | S.D. | Mean T-score | S.D. | |
| C9, Arithmetic functions | 43.83 | 2.72 | 46.07 | 5.39 | 2.12* |
| C10, Memory Functions | 37.00 | 2.94 | 49.03 | 9.864 | 6.406** |
| C11, Intellectual Functions | 32.80 | 4.03 | 45.67 | 6.99 | 8.73** |

*=Significant at 0.05 level, **=Significant at 0.01 level

The speech band comparison of the LNNB between two groups again shows highly significant difference in the level of performance. The schizophrenics have shown more deficits on speech parameter of the LNNB than the control group (table-3). Most of the items in speech band scales involve hearing commands and then performing the task, and subjects with schizophrenic disorders were failed to do so.

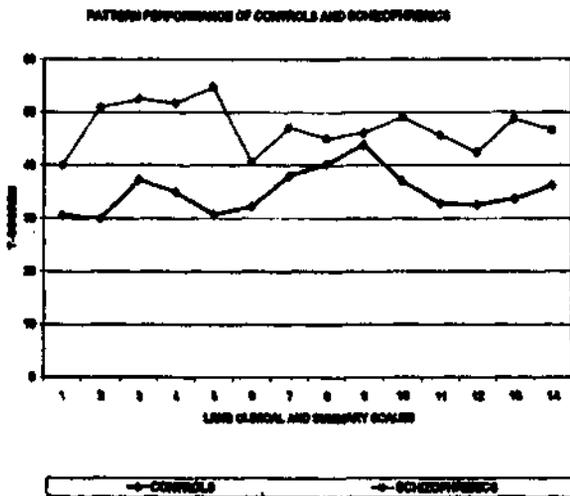
On conceptual band analysis (Table-4), though both the groups are performing differently on all scales (C_9 to C_{11}), but difference on reading, memory, and intellectual functioning were found to be highly significant ($p < 0.01$). As far as

summary scale is concerned, the two groups are again performing differently. The left hemisphere functions of Schizophrenics are more affected than any other scale (S₂).

TABLE 5
COMPARISON ON SUMMARY BAND OF LNNB

| Scales | Controls (N=30) | | Schizophrenics (N=30) | | t-value (d.f.=58) |
|------------------------------|-----------------|------|-----------------------|------|-------------------|
| | Mean T-score | S.D. | Mean T-score | S.D. | |
| S1 Pathognomonic | 32.50 | 3.97 | 42.43 | 8.22 | 5.96 ** |
| S2 Left Hemisphere functions | 33.70 | 1.27 | 48.77 | 7.68 | 10.60** |
| S3 Right Hemisphere function | 36.20 | 4.48 | 46.57 | 7.52 | 6.49** |

**=Significant at 0.01 level.



DISCUSSION

Schizophrenia is a disorder whose cause remains unknown. The role of genetic factor in schizophrenia is well established (Gottesman, 1991). Its patho-physiology may lie in circuit malfunctions rather than in a specific anatomical

defect (Andreasen, 1997). It has been suggested that abnormal functioning of limbic neurons and their connections may underlie the characteristics perceptual delusions and hallucinations of schizophrenia (Bogerts, 1997).

There is now a strong evidence from brain imaging studies of the presence of structural brain abnormalities in schizophrenia, particularly ventricular enlargement (Gur & Pearlson, 1993). However, the distribution of the structural brain abnormalities in people with schizophrenia overlap considerably with that in healthy subjects (Raz & Raz, 1990). This overlap could be due to random genetic variability among unrelated individuals. It has also proved difficult to consistently link structural finding with the key clinical features of schizophrenia (Lawrie et al., 1995). The ventricular enlargement of the left temporal horns than the right side (Crow, 1990; Bogerts et al., 1990). An increase in the left temporal horn volume raises the possibility of a loss of left temporal lobe tissue. A degree of selectivity is suggested by reduction in the volume of the superior temporal gyrus on the left side and lack of a similar alteration in the inferior and middle temporal gyri. These observations add to the case that the primary structural change in schizophrenia relates to cerebral asymmetry (Crow, 1997). In addition functional neuro-imaging studies of schizophrenia report two forms of hypofrontality: a) as reduced pre-frontal blood flow and metabolism in people with schizophrenia at rest (Sabri et al., 1997) and b) relative failure of activation of pre-frontal cortex (relative to rest), when patients perform cognitive tasks.

Luria Nebraska Neuro-Psychological Battery is a battery of tests to assess neuropsychological function and our findings show that the performance of chronic and treated schizophrenics, various measures is impaired in comparison to normal matched controls. The areas of functioning which are impaired, would, primarily have anatomical correlation to those areas of brain, which have been found abnormal in imaging studies i.e. temporal, frontal, and limbic system. However, this does not clear the issue, nor is it an evidence for a direct connection of findings on

PATTERN PERFORMANCE OF SCHIZOPHRENIC PATIENTS ON LNNB

LNNB and neuro-imaging studies. We have not correlated this findings with duration of the illness, the type of schizophrenia, the treatment received, and a simultaneous neuro-imaging for each individual. But definitely, the pattern performance of schizophrenics are showing left hemisphere involvement on LNNB, supports the findings from neuro-imaging techniques, which needs further careful research design to reach to certain conclusion.

Shortcomings of these findings can be to some extent overcome by taking into account the various factors, before concluding that the findings of LNNB in schizophrenics suggest an underlying structural abnormality, which is specific to schizophrenia. Therefore LNNB is a reliable and economical alternative to expensive neuro-imaging studies.

REFERENCES

- Andreasen, N.C. (1997)** The role of the thalamus in schizophrenia. *Canadian Journal of Psychiatry*, 42, 27-33.
- Bogerts, B., Ashtari, M., Degreef, G., et al. (1990)** Reduce temporal limbic structure volumes on magnetic resonance images in first episode schizophrenia. *Psychiatry research: Neuroimaging*, 35, 1-13.
- Bogerts, B. (1997)** The temporo limbic system theory of positive schizophrenic symptoms. *Schizophrenia Bulletin*, 23, 423-435.
- Crow (1990)** Temporal lobe asymmetry as the key to the aetiology of schizophrenia. *Schizophrenia Bulletin*, 16, 433-443.
- Crow, T.J. (1997)** Schizophrenia as a failure of hemispheric dominance for language. *Trends in the Neurosciences*, 20, 339-343.
- Golden, C.J., Moses, J.A., Jr., Zelazowski, R., Graber, B., Zatz, L.M., Horvath, T.B., & Berger, P.A. (1980)** Cerebral ventricular size and neuro-psychological impairment in young chronic schizophrenics. *Archive of General Psychiatry*, 37, 619-623.
- Golden, C.J., Purisch, A.D., & Hammeke, T.A. (1985)** Luria-Nebraska Neuropsychological Battery: Forms I and II (Manual). Los Angeles: Western Psychological Services.
- Gottesman, I.I. (1991)** Schizophrenia Genesis: The origin of Madness. pp.296. New York: WH Freeman and Company.
- Gur, R.E. & Pearlson, G.D. (1993)** Neuroimaging in schizophrenia research. *Schizophrenia Bulletin*. 19, 337-353.
- Lawrie, S.M., Ingle, G.T., Santosh, C.G., et al (1995)** Magnetic resonance imaging and single photon emission tomography in treatment responsive and treatment resistant schizophrenia. *British Journal of Psychiatry*, 167, 202-210.
- Moses, J.A.Jr. (1983)** Schizophrenic subgroups with normal and abnormal cognitive functioning on the Luria-Nebraska Neuropsychological Battery. *International Journal of Neuroscience*, 21, 129-136.
- Moses, J.A., Jr. & Maruish, M.E. (1988)** A critical review of the Luria-Nebraska Neuropsychological Battery Literature: IV, Cognitive deficit in Schizophrenia and related disorders. *International Journal of Clinical Neuropsychology*, X (2), 51-62.
- Nizamie, A. (1983)** Neuropsychological findings in chronic lobectomized and non-lobectomized Schizophrenics using Luria's test. D.M. and S.P. Dissertation, Ranchi University, Ranchi, India.
- Panda, J.K. (1988)** The neuropsychological performance of the schizophrenics patients on Luria's test. *Indian Journal of Psychological*

Medicine, 11, 11-12.

Raz, S. & Raz, N. (1990) Structural brain abnormalities in the major psychoses: a quantitative review of the evidence from computerized imaging. *Psychological Bulletin*, 108, 93-108.

Sabri, O., Erkwoh, R., Schreckenberger, M., et al (1997) Correlation of positive symptoms exclusively to hyperperfusion or hypoperfusion of cerebral cortex in never-treated schizophrenics. *Lancet*, 349, 1735-1739.

B.P.MISHRA . Reader ,Clinical Psychology, V.GUPTA,Lecturer, Psychiatry, R. MAHAJAN, Lecturer, Psychiatry, R.L. NARANG. Professor, Psychiatry, Department of Psychiatry, Dayanand Medical College & Hospital, Ludhiana-141001.*

*** Correspondence**