SCREENING OF ORGANIC BRAIN DYSFUNCTION*

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SUMMARY

One hundred eighty adult patients (age 20 to 50 years) referred to Psychology section for differential diagnosis of brain pathology from 1976 to 1980 and where at least two of the three cognitive functions—intelligence, memory, and percepto motor ability, were tested and clinical diagnosis arrived at follow-ups, etc. were included. Nineteen psychological test variables were rescored to minimize the effect of age and education. Frequency distributions, separately for brain damage and non-brain damage patients for each variable were obtained and ogives prepared to find out points of maximum differentiations. Scores were assigned ratings of 0, 2 & 3 for average to low scores, and combined rating could identify about 2/3rd of organics correctly amongst the difficult to diagnose cases.

Interest in the neuropsychological testing developed nearly half a century earlier. In the beginning psychological investigations were considered to be useful in arriving at a decision whether a particular patient is suffering from the brain pathology or it is a functional pathology. With the advent of the sophisticated radiological diagnostic procedures such as C. A. T-Scan, neuropsychological testing has come to stay as an important ancillary procedure in neurological diagnostic evaluations (Heaton and Pendleton, 1981). The results of such psychological testing are rarely considered sufficient by themselves to make diagnoses, but its role has increased in the initial screening and understanding of the patients ability to provide rehabilitatory measures.

There has been at least two main psychological approaches to determine neurological dysfunctions known as comprehensive or newer and unitary or traditional. The comprehensive approach is based on the premise that brain has hemispheric functions and lobes have differential functions. This is a weak assumption. Reviewing the literature, Wyke (1982) in an editorial, concluded that the functional specialization of the two hemispheres did not necessarily imply total independence. At present, the functioning of the two hemispheres are poorly understood and with available knowledge it seems plausible that brain works as a unit with compensatory mechanism. Similar comments were offered by Morgan (1966). On the other hand measures of cognitive abilities as a neuropsychological examinations have been largely abandoned. This approach, however may resurface because of following reasons:

(i) Tests of cognitive abilities are valid measures and based on relatively realistic assumptions.

(ii) Factors influencing the test scores have been identified and in some of the tests, norms have

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been prepared separately for homogenous groups of subjects (Pershad, 1977; Verma et al., 1983).

(iii) Central question in clinical psychiatry pertains to functioning of the individuals and initial suggestions of organic brain dysfunctions of referring a patient for modern sensitive neuro-radiographic techniques.

(iv) More emphasis is being placed on rehabilitatory measure because of the knowledge that only about 15% of the organic cases have a possibility of correctable disease. Over 60-65 per cent of all patients will not be amenable to routine treatment (Wells, 1977), and

(v) there is a need for simple tests which could be administered on even illiterate subjects, having poor psychological sophistication, where little deviation in the administration to yield maximum information is the rule rather than exception, and need is to evolve short, less time consuming tests to handle the work load with limited trained manpower and other resources. The present situation is likely to remain so for many years to come, at least in the developing countries like ours.

With the above in view the so called traditional approach was selected and applied to determine whether it can help in identifying organics. In the test battery only those functions were included which were well documented to screen out the organic cases from psychiatric population and only those tests were selected where investigators had confidence and worked out local norms on homogenous groups of subjects.

MATERIAL AND METHOD

Sample: All the adult patients who were referred to the psychology section of the department of psychiatry, Postgraduate Institute of Medical Education and Research, Chandigarh, for the differential diagnosis of organic brain dysfunction during the years from 1976—1980 and where at least two of the three viz., intelligence, memory and percepto-motor functions were assessed, formed the subject matter of the study. Files of these cases were traced and reviewed for the psychometric records and the clinical diagnosis by the attending psychiatrist following the manual of International Classification of Diseases in vogue. Cases who were above 50 years of age, whose files could not be traced even with extra efforts, where clinical diagnosis was associated with mental retardation and where diagnosis remained as ‘deferred’ even on follow-up, were excluded. Also the study does not include those cases who were easy to diagnose as organic brain syndromes. These were 180 subjects which included 55 cases of organic brain dysfunction (17 Non-Psychotic conditions) and 125 cases of functional psychiatric conditions (41 cases of neurosis and 84 cases of psychoses). Psychometric records of those subjects were rescored wherever necessary for the following test variables.

Psychological test variables

(a) Intelligence

Bhatia Battery Short Scale of Performance Tests consisting of Koh’s Block and Alexander’s Pass-a-long tests (Murthy, 1966) were administered following the manual. Performance I. Q. was calculated multiplying the sum of the
scores by 2.5 and consulting appropriate tables of norms. A subject was considered literate if he was able to read and write even without formal schooling, whenever scores fell short to arrive at an I. Q. point, an interpolation was done to determine I. Q. Ratio of Pass-a-long and Koh's block design tests was also determined for each protocol \((100 \times \text{Score on Pass-a-long} – \text{score on Koh's Block})\).

Hindi WAIS—R Verbal consisting of four subtests—Information, Digit span, Arithmetic and Comprehension (Pershad and Verma 1978, 1980) was used. I. Q's depending upon subjects' age, education and sex were determined now using tables of norms (I. C. M. R.—report, Verma et al., 1983) for each of the four tests and verbal I. Q. was calculated. A difference between verbal and performance I. Q. was also calculated.

(b) Memory

P. G. I. Memory scale (Pershad, 1977) consisting of ten subtests was administered. Raw scores on each of the subtests were assigned Quintile scores separately for the subjects of different education. A score of 2 was assigned when a score fell below 20th percentile and 4, 6, 8 when scores fell below 40th, 60th and 80th percentile respectively.

(c) Percepto-motor acuity

Two tests—Bender visual motor gestalt test (Bender, 1938) and Nahor-Benson test of organicity (Nahor and Benson, 1970 ; Pershad and Verma, 1978) were administered. The first test was scored following Hain's (1964) method and second test was scored on the basis of 'all or none' i.e. either a reproduction is correct or incorrect.

Brain Dysfunction Rating

All the psychological test scores were not available in all the 180 (55 organic brain dysfunction—'BD' and 125 non organic brain dysfunction—'NBD') cases. Various test scores were available in 37 to 48 cases of BD and 73 to 116 NBD cases, and all the scores for each subject were available only in 87 (27 BD and 60 NBD) cases.

Frequency distributions of each of the 19 test scores were prepared, separately for B. D. and NBD cases and ogives were plotted. Points of maximum differentiations were located. These points/scores were then assigned arbitrary, numerical ratings indicating—'no deviation', 'deviation', and 'great deviation'. Different models were tried for this. For example, greatly deviant on each test variable a rating of 3 deviant a rating of 2 and no deviation a rating of 1 or ratings of 3/2/0 or 2/1/0 respectively. Rating of 3, 2, 0 was found to be more useful. Sum of ratings on all the 19 test variables so scored was called total brain damage score (B.D.S.).

RESULTS

The ratings for each of the 19 test variables for their different raw scores are given below. The patients whose scores on the 19 variables were available were taken hereafter for finding out cut-off points for three main psychological functions included here.

### TABLE 1—Rating Sheet of Organic Brain Dysfunction Battery

| Sl. No. | Test Variables | Rating Scale |
|---------|----------------|--------------|
|         | Subtests       | 3 | 2 | 0 |
| 1.      | *P—× 100       | 251+ 200-250 | upto 199 |
|         | K               |              |    |
| 2.      | Performance     | 60 | 61-80 | 81+ |
|         | Intelligence    |              |    |
| 3.      | Information     | 60 | 61-80 | 81+ |
| 4.      | Digit Span      | 60 | 61-80 | 81+ |
5. Arithmetic 60 61-80 81+
6. Comprehension 60 61-80 81+
7. Difference of Perf. and Verbal I. Q. 24+ 15-23 up to 14
8. Nahor & Benson test 6+ 4-5 0-3
9. Bender-Gestalt Test 9+ 5-8 0-4
10. Remote Memory 0-2 5-4 5+
11. Recent Memory 0-2 3-4 5+
12. Mental Balance 0-2 3-4 5+
13. Attention and Concentration 0-2 3-4 5+
14. Delayed recall 0-2 3-4 5+
15. Immediate recall 0-2 3-4 5+
16. Retention for similar pairs 0-2 3-4 5+
17. Retention for dissimilar pairs 0-2 3-4 5+
18. Visual retention 0-2 3-4 5+
19. Recognition 0-2 3-4 5+

Total of Rating

\[ P + K = \left( \frac{S_1 - S_2}{s_1 + s_2} \right) \times 100 \]

*While calculating difference between performance and verbal I. Q., the sign is not taken into consideration.

The 'brain damage' rating scores on intelligence, memory, perception separately and as a whole are given below in percentage frequency Tables 2-5.

**Table 2—Percentage Frequency distribution of 'Brain damage score' (BDS) on Intelligence in BD and NBD subjects.**

| BDS on Intelligence | BD (N=27) | NBD (N=60) |
|---------------------|-----------|------------|
| 15-17               | 3.7       | 1.7        |
| 12-14               | 18.5      | 2.3        |
| 9-11                | 7.4       | 20.0       |
| 6-8                 | 40.8      | 21.7       |
| 3-5                 | 18.5      | 21.7       |
| 0-2                 | 11.1      | 31.7       |
| Mean                | 7.46      | 5.41       |
| S. D.               | 4.05      | 3.87       |

\( t=2.20, p<.05 \)

Brain damage score (BDS) on intelligence ranges from 0 to 21.

**Table 3—Percentage Frequency distribution of 'Brain damage score' on memory, in BD and NBD subjects.**

| BDS on Memory | BD (N=27) | NBD (N=60) |
|---------------|-----------|------------|
| 25-29         | 14.8      | 3.0        |
| 20-24         | 18.5      | 6.7        |
| 15-19         | 22.2      | 18.3       |
| 10-14         | 14.8      | 15.0       |
| 5-9           | 25.9      | 30.6       |
| 0-4           | 3.7       | 25.0       |

Mean 15.51 10.34

\( t=3.00, p<.01 \)

Brain damage score (BDS) on memory ranges from 0 to 30.

**Table 4—Percentage Frequency Distribution of 'Brain damage score' on perception in BD and NBD subjects.**

| BDS on Perception | BD (N=27) | NBD (N=60) |
|-------------------|-----------|------------|
| 6                 | 11.1      | 3.3        |
| 5                 | 18.5      | 0.0        |
| 4                 | 7.4       | 1.7        |
| 3                 | 0.0       | 1.7        |
| 2                 | 22.2      | 13.3       |
| 1                 | 00.0      | 0.0        |
| 0                 | 40.7      | 80.0       |

Mean 2.42 0.54

\( t=5.66, p<.01 \)

Brain damage score (BDS) on perception ranges from 0 to 6.
It showed that the 60% to 70% of the B. D. subjects obtained brain damage score above cut off points. When a chi square test with equal probabilities was applied, no significant difference was found. Classification based on total score, however, appeared to be a little better, as is also suggested by the inter-correlation of each of three test variables with total brain damage score (Table 7).

TABLE 5—Percentage Frequency Distribution of Total 'Brain damage score' in BD and NBD subjects.

| Total BDS | BD (N=27) | NBD (N=60) |
|-----------|-----------|------------|
| 40-49     | 14.8      | 1.7        |
| 30-39     | 18.5      | 6.7        |
| 20-29     | 33.3      | 26.7       |
| 10-19     | 29.6      | 33.3       |
| 0-9       | 3.7       | 31.7       |
| Mean      | 25.46     | 15.34      |
| S.D.      | 11.54     | 9.57       |
| t=3.98, p<.01 |

Total brain damage score on Psychological test variables ranges from 0 to 57.

From the frequency distribution of the brain damage score on intelligence, memory and perception, a cut off point with maximum differentiation was taken on each of the variables and are shown below in Table 6.

TABLE 6—Percentage Distribution of the subjects above and below cut-off point with maximum differentiation on three psychological variables

| Variables with cut off point | BD (N=27) | NBD (N=60) | X² |
|-----------------------------|-----------|------------|----|
| Intelligence 6 and above    | 70.4      | 46.6       | 4.19 |
| 0 to 5                     | 29.6      | 53.4       | p<.05 |
| Memory 10 and above         | 70.4      | 45.0       | 4.76 |
| 0 to 9                     | 29.6      | 55.0       | p<.05 |
| Perception 2 and above      | 59.3      | 20.0       | 13.11|
| 0—1                        | 40.7      | 80.0       | p<.01 |
| Total Score 20 and above    | 66.7      | 35.0       | 7.56 |
| 0 to 19                    | 33.3      | 65.0       | p<.01 |

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|-----------------------------|-----------|------------|----|
| Intelligence 6 and above    | 70.4      | 46.6       | 4.19 |
| 0 to 5                     | 29.6      | 53.4       | p<.05 |
| Memory 10 and above         | 70.4      | 45.0       | 4.76 |
| 0 to 9                     | 29.6      | 55.0       | p<.05 |
| Perception 2 and above      | 59.3      | 20.0       | 13.11|
| 0—1                        | 40.7      | 80.0       | p<.01 |
| Total Score 20 and above    | 66.7      | 35.0       | 7.56 |
| 0 to 19                    | 33.3      | 65.0       | p<.01 |

Linkage Analysis (McQuitty, 1957) was performed and it was found that the four scores (3 variables and sum of the three variables) formed one cluster in both groups of subjects. The nature of linkage, however, was different in two groups. In the B. D. group, brain damage scores of three variables were found to revolve around total brain damage score whereas in NBD cases total scores were found to be related with memory and intelligence, and perception scores had a distant relation with it via intelligence.

This strengthens the initial impression with which intelligence, memory and perceptuo-motor variables were selected as indicators of B. D. The linkage also confirmed that the total score is a valid composition of three variables but more so in B D cases rather than in NBD cases. If this is true then the screening of B D
subjects based on total cut off point should have been significantly better than on the basis of its individual component. This justification comes from the following table where subjects were categorised under various heads depending on how many variables they had obtained above cut off point scores.

**TABLE 8—Percentage of subjects obtaining scores beyond cut-off point**

| Group | Beyond cut-off point on |
|-------|------------------------|
|       | None | Any 1 | Any 2 | All the 3 | Total BDS |
| BD    | 11.1 | 26.0  | 18.5  | 44.4      | 66.7       |
| NBD   | 33.0 | 26.7  | 33.3  | 5.0       | 33.0       |

An attempt was also made to find out whether any specific diagnostic group is more prone to be mis-classified. It was observed that out of 11 false negatives there were 7 cases who were diagnosed as "non psychotic mental disorder following brain damage" and remaining four cases were those of "organic psychotic conditions". In the false positive, out of 18 cases 9 were those diagnosed as "affective psychosis". Among other 9, there were 2 of neurosis, and 7 of schizophrenia.

**TABLE 9—Diagnosis wise misclassifications in BD and NBD cases.**

| Diagnosis                                | N  | Number misclassified |
|------------------------------------------|----|---------------------|
| Non psychotic mental disorder following brain damage | 17  | 7                   |
| Organic psychotic conditions             | 10  | 4                   |
| Anxiety neurosis                         | 5   | —                   |
| Hysterical Neurosis                      | 6   | 2                   |
| Neurotic Depression                      | 5   | —                   |

**Other Neuroses**

| Diagnosis                  | N  | Number misclassified |
|----------------------------|----|---------------------|
| Schizophrenia              | 11 | 7                   |
| Psychotic depression       | 15 | 9                   |
| Hypomania                  | 2  | —                   |
| Other psychoses            | 15 | —                   |

**DISCUSSION**

It is difficult to imagine any measure of cognitive function which may be completely insensitive to anxiety, poor motivation and cooperation level as also to emotional turmoil one may be in at the moment. The result is the misclassification—both false positives and false negatives. However, their overall rate can be attempted to be kept at a relatively low level, as shown in the present study. Depending upon one's own inclinations and expectations, one may find the results as encouraging or discouraging. Improvements can always occur, but with present basic knowledge, the results of the present study should be considered as satisfactory and helpful, particularly in view of the fact that the present cases were not easily classifiable but were "difficult to diagnose cases" or puzzling cases that were sent to the clinical psychologists working in a general hospital psychiatric set up. Had only clear cut cases been taken and comparisons made with normal controls, the figures would have been largely inflated and flattering but of little practical value for the clinical psychologists who have to make quick decisions in a general hospital psychiatric set up or, in their private psychological clinics.

It is hoped that the present study would encourage many more studies in this area from our country and in future even more satisfactory and gratifying results would be achieved, the present results being limited to tools developed and standardized for group of patients from Hindi speaking areas only.
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