Interpretation of abnormal responses to the Quality Extinction Test in schizophrenia

ORSOLA GAMBINI, CARLO LORENZO CAZZULLO, SILVIO SCARONE

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SUMMARY The Quality Extinction Test (QET) has proved to be valuable for detecting abnormal hemisphere functioning in neurological as well as psychiatric patients. The present and other studies have shown a higher frequency of left side extinction in schizophrenics. This has been attributed either to contralateral parietal malfunction or to ipsilateral frontal abnormality. To evaluate the role of different brain regions in determining tactile extinctions in schizophrenic patients, a population of 70 such subjects were subgrouped according to their QET scores (left, right, left/right, and non-extinguishers) and their neuropsychological task performance profiles were compared. Right extinguishers had QET scores similar to those of non-extinguishers; left/right extinguishers were closer to left extinguishers. Non-extinguishers were the best performers and left extinguishers the poorest, particularly where right hemisphere-dependent tasks were concerned.

During the last 15 years many investigators have suggested a causal link between dominant hemisphere malfunction and schizophrenia.1 Many explanations of this relationship have been given, but the specific type of impairment involved still is not clear. Despite the fact that the existing data are not completely consistent, it is difficult to ignore the evidence on the various alterations of hemisphere asymmetry in many schizophrenic patients. In fact, the instruments used to detect localized cerebral malfunction in neurological patients repeatedly have served to show impaired performance in schizophrenics, with test results mainly having been interpreted as dominant hemisphere abnormality in chronic schizophrenia.2-4 When young schizophrenic patients have been tested, however, interpretations of the results are somewhat less consistent. Some recent reports even suggest a prevalent non-dominant malfunctioning.5 6 Schwartz's Quality Extinction test,7 originally used for interpreting hemisphere malfunction in neurological patients, also has proved to be extremely useful in psychiatric patients.8 Taking the organisation of the central tactile sensitivity pathways into account, the QET is able to discriminate between specific parietal and/or frontal area malfunction and more general unspecific central area damage to a subcortical attention mechanism.9 Both the repetitiveness of contralateral extinctions in neurological patients with temporal-parietal pathology and the high rate of ipsilateral left extinctions in those with left frontal lesions seem to argue in favour of the first of the above impairments.10 Nonetheless, the role of parietal and frontal area relationships in determining QET abnormalities required a better understanding.

With this in view, the present study evaluated 70 schizophrenic patients in relation to their QET results and neuropsychological task performance profiles obtained from the Luria-Nebraska Neuropsychological Battery (LNNB). The latter has been proved to be a reliable instrument for measuring localised hemisphere malfunction in both neurological and psychiatric patients.11

Subjects and methods

The 70 study patients were diagnosed as schizophrenic by means of standardised criteria12 by two senior psychiatrists. The majority were out-patients and all had been treated with neuroleptics for at least six months prior to the study and continued their regimes throughout it. A standardised questionnaire13 to determine handedness was administered: all subjects were right handed.

Both the QET and LNNB test were administered to all subjects. The QET evaluates the verbal answers of blind-

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folded subjects to the simultaneous brushing of the palm of each hand with two different common materials: the original work suggests tests with common materials such as sandpaper, wire-mesh, carpeting, tinfoil, velvet and foam rubber. One trial is made with only one of the materials ("whole items"), and a second with two different materials by side ("half and half items"). Before the test the subject is shown only the whole item, is allowed to examine them and given their names for later identification by touch. He also is told that he will be touched on both hands at the same time, and should report what he feels. The brushing is carried out only once for each pair of materials with a total of 24 simultaneous brushing administered (six "whole items"; 18 "half and half" trials).

The test score is calculated by subtracting the number of omissions relative to the more accurate hand from the number of omissions relating to the other (omissions = verbal no reaction to the sensory stimulus applied).

The QET scores (extinction rates) made it possible to identify four distinct patient subgroups: left side extinguishers (LSE), right side extinguishers (RSE), left and right extinguishing subjects (LRSE) and those who did not extinguish at all, non-extinguishers (NE).

In his original work Schwartz classified both non-extinguishers and right/left side extinguishers as non-extinguishers. Because of a possible difference in the kind of neurofunctional impairment involved, however, the present investigators preferred to consider those subjects as two different subgroups.

The LNNB is a standardised neuropsychological testing instrument which attempts to incorporate both quantitative and qualitative approach so as to provide ready and reliable empirical data that also allow for qualitative analysis. Its battery of 269 independent tasks, some of which represent alternative ways of measuring the same behaviour are grouped into 14 clinical scales delineating as many skill areas: motor, memory, tactile, visual, writing etc. and into eight localisation scales. The latter were developed empirically and are designed to assist the formulation of hypotheses about the nature of cortical malfunctioning.

The LNNB was administered in accordance with the standard instructions given in the test manual. The criteria used for classifying neuropsychological impairment were those recommended by Moses et al. The subjects' scores on the 14 clinical scales of the eight localisation scales were analysed statistically.

Table 1 shows the demographic, clinical and neuropsychological characteristics of the study population. The mean age and the LNNB critical level, which represents the highest score that can be considered normal for the test (adjusted for age and education) did not differ significantly in the four patient subgroups.

### Statistical analysis

A one-way analysis of variance and Scheffe's statistic were used to test the differences between the mean scores of the

### Table 1  Demographic, clinical and neuropsychological characteristics of the study population

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Sex</th>
<th>Age (M + SD)</th>
<th>Diagnostic subtype</th>
<th>Chronicity</th>
<th>LNNB critical level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(yr)</td>
<td>Paranoid</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Hebeplenic</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Undifferentiated</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Acute</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chronic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left side extinguishers (LSE)</td>
<td>25</td>
<td>15 M</td>
<td>29·1 ± 12·2</td>
<td>4 9 12</td>
<td>5 20</td>
<td>60 ± 6 ± 4·7</td>
</tr>
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<td></td>
<td></td>
<td>10 F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right side extinguishers (RSE)</td>
<td>9</td>
<td>7 M</td>
<td>28·3 ± 10·3</td>
<td>3 2 4</td>
<td>2 7</td>
<td>57·2 ± 7·6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left/right side extinguishers (LRSE)</td>
<td>14</td>
<td>8 M</td>
<td>34·5 ± 13·2</td>
<td>5 5 4</td>
<td>4 10</td>
<td>61·8 ± 6·0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non extinguishers (NE)</td>
<td>22</td>
<td>11 M</td>
<td>28·8 ± 13·7</td>
<td>3 5 14</td>
<td>6 16</td>
<td>58·0 ± 4·4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 F</td>
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</tbody>
</table>

### Table 2  Mean LNNB clinical scales scores of 70 schizophrenic patients according to their QET test-determined "sidedness"

<table>
<thead>
<tr>
<th>QET sidedness</th>
<th>LSE</th>
<th>RSE</th>
<th>LRSE</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical scales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>21·6 ± 11·3</td>
<td>14·3 ± 5·3</td>
<td>18·6 ± 8·7</td>
<td>13·2 ± 2·4*</td>
</tr>
<tr>
<td>Rhythm</td>
<td>10·8 ± 4·3</td>
<td>6·5 ± 5·0</td>
<td>8·7 ± 3·2</td>
<td>6·0 ± 3·9</td>
</tr>
<tr>
<td>Tactile</td>
<td>4·7 ± 5·0</td>
<td>3·4 ± 2·7</td>
<td>5·7 ± 5·1</td>
<td>2·5 ± 1·9</td>
</tr>
<tr>
<td>Visual</td>
<td>11·8 ± 4·5</td>
<td>9·2 ± 2·8</td>
<td>10·9 ± 4·1</td>
<td>8·1 ± 3·4</td>
</tr>
<tr>
<td>Receptive</td>
<td>9·8 ± 6·0</td>
<td>4·6 ± 3·0</td>
<td>9·6 ± 5·3</td>
<td>7·3 ± 5·3</td>
</tr>
<tr>
<td>Expressive</td>
<td>10·2 ± 5·4</td>
<td>7·6 ± 4·7</td>
<td>10·2 ± 5·2</td>
<td>7·8 ± 4·3</td>
</tr>
<tr>
<td>Writing</td>
<td>3·2 ± 3·2</td>
<td>2·4 ± 3·7</td>
<td>3·2 ± 2·9</td>
<td>2·0 ± 2·2</td>
</tr>
<tr>
<td>Reading</td>
<td>2·2 ± 1·9</td>
<td>2·4 ± 3·6</td>
<td>2·9 ± 2·4</td>
<td>2·1 ± 2·5</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>4·6 ± 5·0</td>
<td>2·8 ± 3·1</td>
<td>6·5 ± 5·5</td>
<td>4·1 ± 5·3</td>
</tr>
<tr>
<td>Memory</td>
<td>12·1 ± 4·6</td>
<td>9·8 ± 4·6</td>
<td>10·3 ± 4·3</td>
<td>8·2 ± 4·8</td>
</tr>
<tr>
<td>Intelligence</td>
<td>28·6 ± 10·2</td>
<td>23·5 ± 6·9</td>
<td>30·2 ± 10·0</td>
<td>24·2 ± 10·0</td>
</tr>
<tr>
<td>Pathognomonic</td>
<td>14·5 ± 5·7</td>
<td>11·6 ± 5·0</td>
<td>14·3 ± 4·6</td>
<td>9·7 ± 4·4</td>
</tr>
</tbody>
</table>

* F (3.66) = 3·95, p < 0·025: LSE vs NE, p < 0·025
† F (3.66) = 3·89, p < 0·01: LSE vs NE, p < 0·025
‡ F (3.66) = 3·75, p < 0·025: LSE vs NE, p < 0·05
§ F (3.66) = 4·10, p < 0·01: LSE vs NE, p < 0·05
LNNB clinical and localisation scales in the four QET-derived patient subgroups.

Results

Significant difference among patient subgroups were found relative to four out of the 14 LNNB clinical scales: the motor, visual, rhythm and pathognomonic. Left extinguishers performed most poorly (had the highest scores) on all four. Non-extinguishers were the most successful performers (having had the lowest scores). No significant differences were found when the other subgroups were compared with each other (table 2).

Table 3 shows the relationship between the patients’ QET scores and their LNNB localisation scale scores. Left extinguishing subjects scored highest on the right sensory-motor scales and the right parietal-occipital and left temporal scales and therefore were significantly different from non-extinguishers.

Right frontal scales results were poorest among left and left/right extinguishers and were statistically different from those of the non-extinguishers. The left/right extinguishers also had the least satisfactory performances on both the right and left parietal-occipital scales and the left sensory-motor scale, with scores significantly different from those of the non-extinguishing subjects.

Discussion

The LNNB scores obtained from the present study population indicate that non-extinguishers were the best performers on all the clinical scales and on all but one of the localisation scales (left temporal). Consequently, it may be argued that LNNB and QET performance scores are equally sensitive detectors of the degree of impairment in schizophrenic patients. Statistically significant differences among the four patient groups were found with respect to their scores on four of the clinical and all but one of the localisation scales of the LNNB.

Left extinguishers scored highest (most poorly) on four (out of eleven) clinical and three (out of eight) localisation scales. These results suggest that a higher degree of impairment can be expected among patients of this kind. In fact, left extinguishing patients’ clinical scale profiles seem to indicate malfunction of the right hemisphere. Further, their higher (poorest) scores on the rhythm motor and visual scale would suggest specific right hemisphere pathology. On the other hand, the left extinguishers’ very poor handling of the pathognomonic scale might reflect a non-specific impairment in cerebral functioning. On the basis of the findings reported here, left extinguishing schizophrenic patients may be defined as those with a higher degree of cerebral malfunction, particularly with respect to the right hemisphere. The various LNNB localisation scale results obtained appear to support this hypothesis. High impairment levels were found when the left extinguishers were scored on the right frontal, right parietal-occipital and right sensory-motor scales. Consequently, it would seem that abnormal left side QET responses not only reflect a malfunction of the contralateral parietal area but also widespread functional disturbance in the right hemisphere. The involvement of the anterior part of the corpus callosum in the tactile sensitivity pathways might explain disturbed function in the outermost anterior regions of the CNS. The well known reciprocity between the parietal and occipital regions could justify the assumption that the posterio regions also are involved in hemisphere disorders. The very poor (high) left temporal LNNB scores of left extinguishers cannot be interpreted unequivocally; however, this particular deficit...
might reflect the widely documented comprehension deficits of schizophrenia.\textsuperscript{14}

The fact that left extinguishing subjects had a higher degree of deficiency on the left temporal scale might attest to the presence of impairment in the hemisphere ipsilateral to the side of their extinctions, thus lending some support to the hypothesis of central ipsilateral damage in this type of patient.\textsuperscript{18} In view of the well-known anatomical-functional relationships between the temporal-limbic regions and ipsilateral-frontal area\textsuperscript{18} it is also possible to say that this finding offers support for a further hypothesis, namely that there is a critical abnormal impairment of the left frontal regions in left extinguishing patients.

The left/right extinguishing subjects scored higher (most poorly) on some LNNB localisation scales the left parietal-occipital, right temporal and right frontal ones. This might indicate a bilateral impairment of central functioning. Further, since these patients’ performances were different from those of the non-extinguishers, a modification of Schwartz’s grouping might be warranted, that is, a redivision of non-extinguishers into two distinct groups; non-extinguishers and subjects with an equal number of left and right extinctions. This would yield even more precise information on the neurofunctional dynamics at work in the hemispheres.

The assessment of right extinguishing patients has shown that they are similar to the non-extinguishing ones. Moreover, when compared to the other QET types right extinguishers did not give any evidence of a heightened degree of contralateral impairment in their dominant hemisphere. The small number of patients that were in this group requires that the findings relative to it be interpreted cautiously. Nonetheless, it can be argued that the abnormalities in their tactile sensitivity pathways are not as severe as those in their contralateral hemisphere. This is consistent with Schwartz’s findings that tactile sensitivity neuron pathways directed to the dominant hemisphere are less vulnerable.\textsuperscript{19} It also is possible to suggest that the LNNB pattern differences in left vs right extinguishers reflect the diversity in the organisation of each group’s hemispheres, with the left less affected than the right.

In concluding, it is important to mention that the mean age of the subjects in this study was relatively low (this also was the case in other similar studies conducted by the same investigators). Both the present findings and those reported in some of recent literature in this field\textsuperscript{17,19,20} consistently support the possibility that young schizophrenic patients are more susceptible to the development of non-dominant hemisphere dysfunction. Further study will be required if the phenomenon of tactile extinction in functional disorders of the central nervous system is to be more fully understood.

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References


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