

Mental Disorders with Brain Tumors

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ABSTRACT

Several previous studies have shown that intracranial tumors have a high incidence of mental symptoms.

A study was carried out to show how mental disorders could be screened for and measured in a way that would suggest a hypothesis of the biology of mental disorders and mental functions.

The results lead us to hypothesize the role of the limbic system as a nucleus or a common pathway, that is functioning under the control of external stimuli and the neocortex, on a background of arousal maintained by the ascending reticular system, which is also controlled by a descending reticular system from the neocortex and the limbic system.

These three units of the system are functioning in a cybernetic system of loops.

INTRODUCTION

It has long been known that intracranial tumors have a high incidence of mental symptoms consisting of personality changes, emotional disturbances and intellectual defects (Malamud, 1967). The largest series of cases was reported by Keschner et al. (1938) who found an incidence of mental symptoms in 94% of cases with tumors of the temporal lobes, in 90% of cases with tumors of the frontal lobes, and in 47% of cases with infratentorial tumors.

Many observations concerning special regional effects can be offset by negative findings as the majority of tumors are progressive and present changing mental pictures during their evaluation. Moreover there are complicating variables such as raised intracranial pressure, cerebral in-

volvement at a distance from the tumor due to distortion of the brain, displacements of parts through bony and dural openings or obstruction of free arterial supply and venous drainage (Lishman, 1978). However special associations between site of tumor and certain aspects of psychiatric disturbances have frequently emerged. Focal cognitive defects with parietal tumors and focal amnesic syndromes with tumors of the diencephalon have emerged.

Material and Method :

The subjects of the study were 18 inpatients proved to have an intracranial tumor and admitted to the neuro-psychiatric department, Ain-Shams University hospital.

Subjects were examined and fully investigated to localize the site of the tumor and to measure any mental disturbance. Subjects were 10 males and 8 females with age ranging from 19 to 60 years (Mean 34.7, S.D. 25.3).

The control group was matched with the patients group for sex and age and taken from other hospital wards. The main bulk were cases of paraplegia due to local spinal causes, and of hepato-splenomegaly of mild nature and without cerebral symptomatology.

1. Full neurologic examination according to a systematic schema.
2. EEG, Angiogram and CAT when necessary as diagnostic measures to localize the brain tumor and to detect any possibility of increased intracranial tension.
3. Full psychiatric examination according to a specially designed schema for mental state examination in organic group of patients.
4. Present State Examination (PSE) Cairo Version of Nottingham Screening version of the original P.S.E. prepared by Okasha and Ashour (1980).

RESULTS

The results will be presented under two headings (1) a descriptive case — control study and (2) inter group insights. Under the first heading the descriptive data of the cases along with the control group. Under the other heading are included comparative data between different groups among the subjects in search for meaningful etiological relationships.

Descriptive case-control study

Number : subjects 18 and controls 18.

Sex : 10 males and 8 females for both groups.

Age : Subjects from 19 to 60 (mean 34.7 S.D. 25.3)

Controls from 19 to 60 (mean 35.5 S.D. 12.5)

Final diagnosis (Localization)

- One parasellar meningioma.
- One right sphenoid wing meningioma
- Five left parietal gliomas
- Three fronto-parietal meningiomas (two right and one left)
- Two right olfactory groove meningiomas
- One falx meningioma
- One pituitary adenoma
- One pituitary adenoma
- One left acoustic neuroma
- One right temporal lobe tumor.

TABLE I

**Relevant Neurological
Manifestations**

Variant	Patients with variant	
	No.	%
1. Papilloedema	15	83.3
2. Incontinence	3	16.7
3. Hydrocephalus	10	55.6

TABLE II

Mental Status

Function	Subjects			Controls		
	No. tested	No. affected	%	No. tested	No. affected	%
Consciousness	18	5	27.8	18	0	0
Vigilance	18	7	38.9	18	2	11.1
Frontal lobe t.	17	5	29.4	18	0	0
Language	18	2	11.1	18	0	0
Remote memory	18	0	0	18	0	0
New learning	18	14	77.8	18	8	44.4
Construction	18	9	50	18	0	0
Proverb interpretation	18	6	33.3	18	0	0
Calculation	18	13	72.2	18	12	66.7
Insight	18	4	22.2	18	0	0
Related Cortical functions	18	2	11.1	18	0	0
Mood	18	13	72.2	18	10	55.5
Thought disorder	18	1	5.5	18	0	0
Behavioral disorder		3	16.7	18	0	0
Social deterioration	18	3	16.7	18	0	0
Hallucinations	18	1	5.5	18	0	0
	No. tested	Mean	S.D.	No. tested	Mean	S.D.
New learning £	18	3.28	0.69	18	1.25	0.4
Calculation £	18	1.9	1.07	18	1	0.67

£ these scores are our suggestion for scoring these 2 subtests.

Subjects as contrasted to controls showed significant discrimination as regards : new learning ability, calculation, intellectual deterioration, consciousness, vigilance, frontal lobe tests, construction, proverb interpretation, insight, behavioural disorders and social deterioration.

TABLE III

Wechsler Belvue test

Function	Subjects			Controls		
	No. tested	Mean	S.D.	No. tested	Mean	S.D.
Digit forward	15*	4.93	1.23	18	5	0.78
Digit backward	15	3.73	1.39	18	3	1.75
Comprehension	15	7.26	3.27	18	7	4.38
Similarities	15	6.73	2.77	18	6.67	2.98
Construction	12†	4.9	3.5	18	5.33	2.18

	No. tested	No. affected	%	No. tested	No. affected	%
Intellectual deterioration	12	3	25	18	0	0

* 3 subjects were not tested due to recent previous testing.
 — 3 other patients were untestable due to their disability.

Subjects obtained a score of (mean 78.92 S.D. 7.73), while controls obtained (mean 75.92 S.D. 19.37). 25% of subjects showed intellectual deterioration, and none of the controls ($p < 0.05$).

Present state examination : Figure I shows the general profile of psy-

chiatric symptoms in the subjects and controls. The subjects obtained a total score of symptoms (mean 18.5 S.D. 8.47), while the controls obtained score of (mean 11 S.D. 9.19) ($p < 0.001$).

Inter-group study

This study was carried on three parameters (intracranial hypertension, dominance and the site of the tumor).

In each parameter the subjects were divided into two groups as follows :

- Subjects with increased intracranial tension and subjects without.
- Subjects with major hemispheric tumors and subjects with minor hemispheric tumors.
- Subjects with tumors present mainly about the brain lateral surfaces (convexity group) and subjects with tumors mainly occupying the prefrontal lobe, the basal frontal surface and the limbic system on the medial side of the brain including other diencephalic related areas (non-convexity group).

DISCUSSION

Subjects as contrasted to controls showed a higher degree of psychiatric symptomatology on the PSE.

The following procedures proved to be useful as diagnostic aids for brain tumors : discrepancy between verbal and performance I.Q. in W/B., tests for vigilance, new learning, calculation, frontal lobe tests, for concentration ability. These tests of course may be suggestive of brain lesion, and again each test was shown to be more vulnerable to other factors than the mere presence of the brain tumor i.e. depending on the site and the presence of intracranial hypertension.

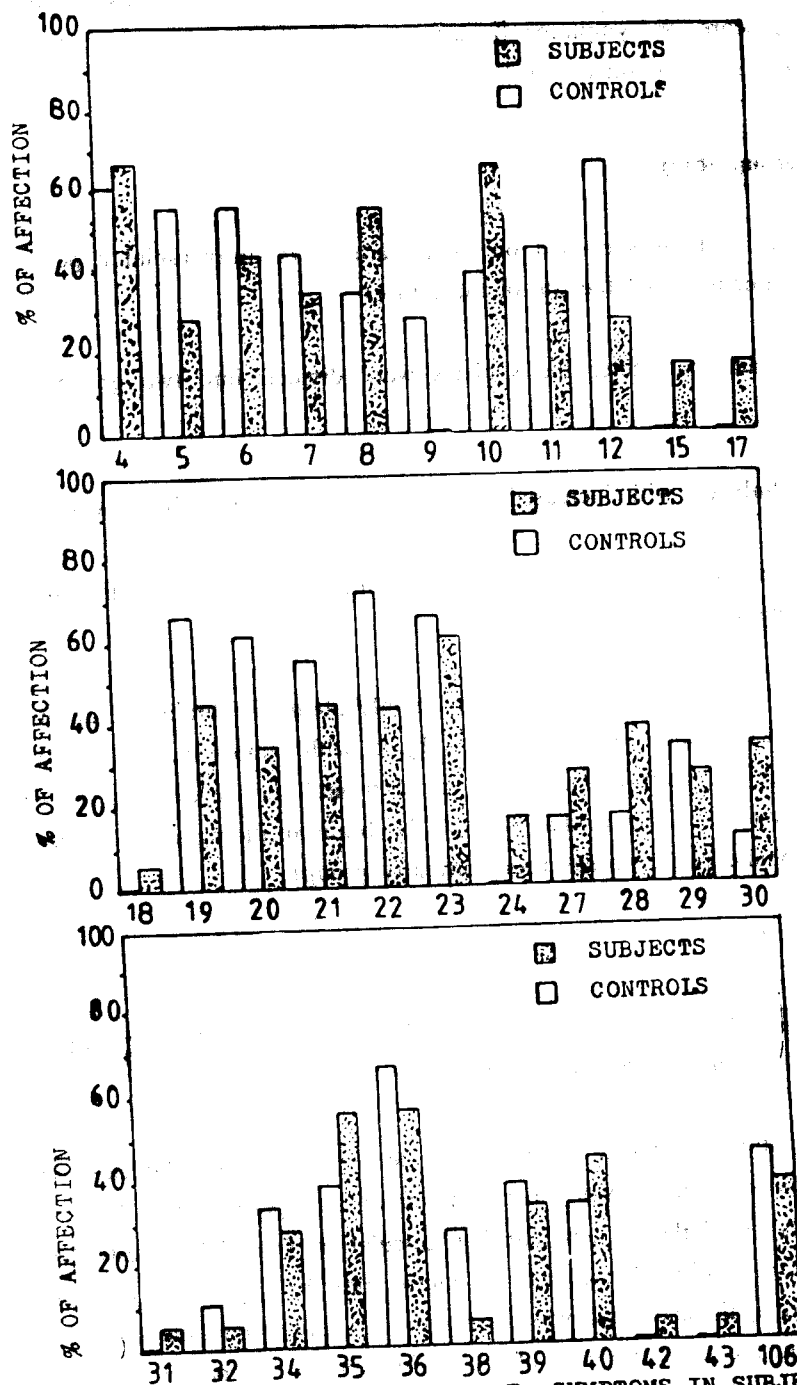


Fig. 1: PROFILE OF P.S.E. SYMPTOMS IN SUBJECTS AND CONTROLS (N.B. NUMBERS SHOWN ARE THE CODS OF SYMPTOMS).

Table (4) shows the overall results.

TABLE IV
Results according to increased intracranial tension

Function	Subject with increased ICT			Subject without increased ICT			Controls		
	No. tested	Mean	S.D.	No. tested	Mean	S.D.	No. tested	Mean	S.D.
Digit forwards	13**	4.8	1.18	2**	6	1	18	5	0.78
Digit backwards	13	2.7	1.32	2	4.5	0.5	18	3	1.75
Comprehension	13	7	3.44	2	10.5	1.5	18	7	4.38
Similarities	13	6.5	2.53	2	8.5	3.5	18	6.67	2.98
Block design	10£	4.4	3.47	2	7.5	2.5	18	4.2	2.18
New learning	15	2.4	1.58	3	3.3	0.5	18	1.25	0.4
Calculation	15	1.6	1.25	3	0.66	0.5	18	1	0.67
	No. tested	No. affected	%	No. tested	No. affected	%	No. tested	No. affected	%
Consciousness	15	5	33.3	3	0	0	18	0	0
Vigilance	15	10	66.6	3	1	33.3	18	2	11.1
Frontal lobe test	15	5	33.3	3	1	33.3	18	0	0
Language	15	1	6.6	3	1	33.3	18	0	0
New learning	15	11	73.3	3	3	100	18	8	44.4
Construction	15	9	60	3	0	0	18	0	0
Proverb interpretation	15	5	33.3	3	1	33.3	18	0	0
Calculation	15	12	80	3	2	66.6	18	12	66.7
Insight	15	4	26.6	3	0	0	18	0	0
Related Cortical function	15	2	13.3	3	1	33.3	18	0	0
Mood	15	11	73.3	3	3	100	18	10	55.5
Thought disorders	15	2	13.3	3	0	0	18	0	0
Behavioral disorders	15	3	20	3	0	0	18	0	0
Social deterioration	15	3	20	3	0	0	18	0	0
Hallucinations	15	1	6.6	3	0	0	18	0	0

* 2 subjects were dropped.

** 1 subject was dropped.

£ 3 other subjects were untestable.

Table (5) shows the overall results of subjects with major hemispheric tumors Vs. subjects with minor hemispheric tumors as contrasted to the control.

TABLE V

Results according to Dominance

Function	Major hemisphere (6)			Minor hemisphere (8)			Controls (18)		
	No. tested	Mean	S.D.	No. tested	Mean	S.D.	No. tested	Mean	S.D.
Digit forwards	4	4.26	1.16	7	4	0.4	18	5	0.78
Digit backwards	4	2.75	0.4	7	2.3	1.5	18	3	1.75
Comprehension	4	6	3.9	7	6.4	2.7	18	7	4.38
Similarities	4	6	1.7	7	5	1.3	18	6.67	2.98
Block design	2	4.5	1.6	5	2.7	2	18	5.33	2.18
New learning	6	1.5	1.6	8	3.4	0.7	18	1.25	0.4
Calculation	6	1.5	1.28	8	1.4	-0.99	18	1	0.67

	No. tested	No. affected	%	No. tested	No. affected	%	No. tested	No. affected	%
Consciousness	6	2	33.3	8	2	25	18	0	0
Vigilance	6	4	66.6	8	4	50	18	2	11.1
Frontal lobe test	5	0	0	8	4	50	18	0	0
Language	6	2	33.3	8	0	0	18	0	0
New learning	6	3	50	8	7	87.5	18	8	44.4
Construction	5	2	33.3	8	5	62.5	18	0	0
Proverb interpretation	5	2	33.3	8	3	37.5	18	0	0
Calculation	6	5	83.3	8	6	75	18	12	66.7
Insight	6	0	0	8	4	50	18	0	0
Cortical functions	5	2	33.3	8	0	0	18	0	0
Mood	6	3	50	8	8	100	18	10	55.5
Thought disorders	6	0	0	8	2	25	18	0	0
Behavioral disorders	6	0	0	8	3	37.5	18	0	0
Social deterioration	6	0	0	8	3	37.5	18	0	0
Hallucinations	6	0	0	8	1	12.5	18	0	0

Table (6) shows the overall results of subjects with convexity tumors and subjects with non-convexity hemispheric tumors as contrasted to controls.

TABLE VI

Results according to the site of the tumor

Function	Non convexity hemispheric (6)			Convexity hemispheric (9)			Control (18)		
	No. tested	Mean	S.D.	No. tested	Mean	S.D.	No. tested	Mean	S.D.
Digit forwards	5	4.8	1	7	4	1	18	5	0.78
Digit backwards	5	3	1.7	7	2.4	1	18	3	1.75
Comprehension	5	6.8	1.8	7	6.3	3.8	18	7	4.38
Similarities	5	5.6	3.3	7	5.6	0.7	18	6.67	2.98
Block design	5	4.5	3.3	4	3.5	2	18	5.33	2.18
New learning	6	3.6	0.5	9	1.9	1.4	18	1.25	0.4
Calculation	6	1.5	1	9	1.2	1	18	1	0.67

	No. tested	No. affected	%	No. tested	No. affected	%	No. tested	No. affected	%
Consciousness	6	2	33.3	9	2	22.2	18	0	0
Vigilance	6	4	66.6	9	4	44.4	18	2	11.1
Frontal lobe test	6	4	66.6	9	0	0	18	0	0
Language	6	0	0	9	2	22.2	18	0	0
New learning	6	6	100	9	6	66.6	18	8	44.4
Construction	6	4	66.6	9	3	33.3	18	0	0
Proverbs interpretation	6	4	83.3	9	2	22.2	18	0	0
Calculation	6	5	66.6	9	7	77.7	18	12	66.7
Insight	6	4	66.6	9	0	0	18	0	0
Cortical functions	6	0	0	9	2	22.2	18	0	0
Mood	6	6	100	9	6	66.6	18	10	55.5
Thought disorders	6	2	33.3	9	0	0	18	0	0
Behavioral disorders	6	3	50	9	0	0	18	0	0
Social deterioration	6	3	50	9	0	0	18	0	0
Hallucinations	6	1	16.7	9	0	0	18	0	0

We failed to find W/B subtests useful in diagnosing brain tumor, this may be due to either the small number of subjects, or the obvious low I.Q. Wechsler scale is said to have the capacity to test different kinds of intellectual functions, but, it is also said that the subjects assess neither pure nor readily defined functions, nor do they facilitate the systemic examination of different functions (Lezak, 1976).

As regards the increased intracranial tension we found that on contrasting subjects with increased intracranial tension to controls, discrimination of high significance was apparent on testing for consciousness, vigilance, new learning, calculation, construction, proverb interpretation, insight and intellectual deterioration. This is in agreement with Lishman (1978).

Others, however, debate the role of the increased intracranial pressure (Bush, 1940). This controversy may be due to the rather global and non-specific way of regarding this factor.

As regards the localization we found that in subjects with non-convexity tumors when contrasted to subjects with convexity tumors, discrimination was highly significant on testing for new learning ability.

As regards the role of dominance, discriminations were significant when patients with minor hemispheric lesions were contrasted to patients with major hemispheric lesions on testing for; visuospatial perception and construction. Hubbard (1975) obtained the same results. Discriminations also suggest a more important role of the psychiatric symptoms including mood disturbances, thought disorders, social deterioration and hallucinations. However, analyzing the present material using New Castle University Computer revealed correlation between major hemispheric lesions, particularly temporal lobe with primary delusions and catatonic symptoms (Davison and Bagley, 1969). Many workers believe that major hemispheric lesions cause a schizophrenic-like picture, while minor hemispheric lesions cause a depressive-like picture, however many other workers debate this (Hunter, 1968 and Avery, 1971).

Many workers investigated the mental disorders in correlation with anatomic localization with overlapping and non-specific results. For example, Lishman (1978) stated that slowing and asponaneity seen with frontal lobe tumors have also been frequently reported with temporal lobe tumors.

Bleuler (1951) stated that the psychopathological picture in his survey of 600 patients with brain tumors was in fact very uniform. Because of this our view was to try to correlate mental function with a physiologic structure, and we found that the theoretical base held by Luria (1973) and others of regarding lesions affecting the brain surfaces in one hand, and those affecting the prefrontal lobe, the limbic system and reticular formation on the other hand, is the best way to understand the mental functions as well as their clinical implication. Our results favoured such suggestion.

Our study emphasizes the correlation between the gross brain lesions and the production of mental symptoms, and suggests the possible role of increased intracranial pressure in affecting arousal, the role of minor hemispheric lesions in the production of defective visuospatial perception and construction. Also the work suggests some association between minor hemispheric lesions and some psychiatric symptoms. Lastly it suggests the importance of integrity of the limbic system and the frontal lobes in mental functions.

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ABSTRAIT

Les troubles mentaux associés avec les tumeurs du cerveau.

Des études diverses précédentes ont signalé que les tumeurs du cerveau produisait avec une grande fréquence des symptômes mentaux. Dans l'étude présente dix-huit malades, chez qui on a prouvé l'existence des tumeurs du cerveau, ont été examinés, des investigations complètes ont été faites pour localiser l'emplacement des tumeurs et pour mesurer n'importe quel trouble mental.

Les résultats de cette étude font valoir la corrélation entre les lésions du cerveau et la production de symptômes mentaux. On suggère que, a) le rôle possible de l'augmentation de la pression intracrânienne influençant l'état de conscience, b) le rôle de lésions hémisphériques mineurs dans la production d'une perception spatio-visuelle déficiente et c) une certaine association entre les lésions hémisphériques et quelques symptômes psychiatriques.

L'étude présente pourrait aussi suggérer l'importance de l'intégrité du système limbique et des lobes frontaux.

الاضطرابات العقلية والمصاحبة لأورام المخ

أظهرت العديد من الدراسات السابقة أن الأورام داخل الدماغ يصاحبها نسبة تواتر عالية للأعراض العقلية ، وفي البحث الحالي قام الباحث بفحص ثمانية عشر حالة مريض مصاب بورم داخل الدماغ وتم الفحص بشكل كامل لتحديد موقع الورم وقياس أى اضطراب عقلي .

وقد أكدت نتائج البحث أهمية الارتباط بين التلف المخي الجسيم وبين الأعراض ، وقد اقترحت لذلك أسبابا منها (أ) الدور المحتمل لزيادة الضغط داخل الدماغ فيما يتعلق بتأثيره على اليقظة (ب) دور تلف النصف الكروي الأصغر في أحداث قصور في ادراك وبناء المجال البصري المكاني (ج) بعض الارتباط بين تلف النصف الكروي وبين الأعراض النفسية والعقلية .

ويجتمل أن يشير هذا البحث الى اقتراح بأهمية تكامل الجهاز الحرفي واللفصوص الجبهية في الوظائف العقلية .