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Original Article

Psychiatry

MRI changes in patients with psychotic disorders

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ABSTRACT

Background: Schizophrenia is one of the most serious and debilitating psychiatric disorders. that cause basic changes within the human brain.

Objective: to evaluate MRI brain changes in patients with psychotic disorders

Methodology: This cross sectional study was conducted on 50 patients aged from 15-40 years of both sexes. The patients were recruited from Al-Azhar University hospitals all of them were applied to Complete psychiatric history and examination, Structured Clinical Interview for DSM-IV (SCID-I), Positive and Negative Syndrome Scale(PANSS), Wechsler Adult Intelligence Scale, Brain magnetic resonance imaging.

Results: In the current study, MRI brain changes among the studied group were 40%.There was also no measurable critical relationship (p-value > 0.05) between MRI results and the following parameters (age, positive scale, general scale, duration of disease and duration of treatment). Statistically significant correlation(p-value < 0.05) between MRI brain results and negative scale and total PANSS was present.

Conclusion: There is a relation between psychotic disorders such as schizophrenia and MRI brain changes. Patients with negative symptom are more inclined to have brain changes. Antipsychotic medication has no role in brain changes in schizophrenia with no difference between first generation antipsychotic and second generation antipsychotic.

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INTRODUCTION

Schizophrenia is one of the most serious and debilitating psychiatric disorders with a worldwide frequency of 1% [1]. It could be a serious mental wellbeing marked by delusions, hallucinations, disorganized speech or behavior, and decreased cognitive capacity. Grey matter investigation is a critical theme in schizophrenia research. When comparing schizophrenia patients to healthy members, grey matter variations from the normal within the run of 2–4% have been recognized [2].

The volumetric impairments in first-episode patients are mild. generally influencing regions of the frontal, parietal, and temporal cortices [3]. Investigate prove from an efficient survey and meta-analysis has shown that brain tissue losses are persistently progressive in chronic schizophrenia patients; the annualized rate grey matter volume (GMV) drop in chronic schizophrenia patients is 0.5% compared to healthy individuals [1].

Antipsychotic medication intake (cumulatively) is a significant confounding factor in neuroimaging studies in general, and studies examining brain volume change over time in particular. Antipsychotic drug exposure has been linked to structural alterations in the cortical and subcortical brain [4]. This study was conducted to evaluate MRI brain changes in patients with psychotic disorders

SUBJECTS AND METHODS

This cross-sectional study was conducted on 50 patients aged 15-40 years of both sexes who meeting inclusion and exclusion criteria.. They were recruited from psychiatry outpatient clinic, Al- Azhar University hospitals, Cairo, Egypt. The study was carried out during the period from March 2021 to September 2021. A written informed consent was taken from all participants after proper explanation of the study aim and methodology.

Inclusion criteria

Both males and females, aged 15-40 years, educated and non-educated, with psychotic disorders were included. The age range15-40 years was selected because patients below 15 years may have psychoses due to autistic feature or mental retardation and patients

above 40 years may have vascular dementia and this may produce brain changes and confuse results,

Exclusion criteria

Patients below 15 years old and above 40 years, patients with neurological disease, patients with IQ less than70, patients with any psychiatric disease rather than psychotic disorders, and patients MRI is contraindicated were excluded from the study.

Sampling technique

Sample type

All patients who met the inclusion criteria and agreed to participate in the study were included regardless of illness duration.

Sample size

Sample size was taken according to the number of patients coming to psychiatry outpatient clinic on two fixed days chosen randomly during 6 months (study period) (as there was no documentation of patient flow rate at the clinic) at Al-Zahraa university .

Study tools

1. **Complete psychiatric history and examination Including the following**: sociodemographic data including age, gender, marital status, educational level, residence, and employment status, past history, family history and personal history, age at onset of illness, duration of illness; number of episodes.
2. **Structured clinical interview for DSM-IV (SCID-I)**: SCID-I is a semi-structured diagnostic interview utilized to affirm the diagnosis of psychotic diseases and rule out any concomitant psychiatric disorders of episodes [5]. The Arabic version of the instrument was administered by a qualified researcher with experience [6].
3. **Positive and negative syndrome scale** (PANSS): The positive and negative syndrome sale (PANSS) is a semi-structured clinical interview, which is well characterized and standardized for clinical evaluation of schizophrenia symptoms [7]. For evaluating the severity of schizophrenia symptoms, the PANSS may be a dependable and substantial instrument. It has 30 measures that span three symptom domains: positive symptoms (e.g., delusions and hallucinatory behavior; seven items), negative symptoms (e.g., emotional withdrawal, blunted affect,; seven items), and general psychopathology (e.g., tension, disorientation; 16 items). The test has a high level of interoperability
4. **Wechsler adult intelligence scale (**WAIS)**:** The WAIS is a widely used test for assessing general intelligence and measuring broad cognitive function in adults [8].The Arabic translation by Melika was used in this investigation. This test is regarded as a valid and trustworthy indicator of general intelligence[9].
5. **Brain magnetic resonance imaging** (MRI): Hippocampal shrinkage and medial temporal lobe atrophy are measured using coronal-oblique T1-weighted images. They're taken in a plane that's parallel to the brainstem and orthogonal to the hippocampus's long axis. Images of thin sections should be used. FLAIR images are used to assess global cortical atrophy (GCA), vascular white matter hyper intensity, and infarctions. T2-weighted images are used to assess infarctions, particularly lacunar infarctions in the thalamus and basal ganglia, which FLAIR scans are prone to missing. We must score for global and focal atrophy in a systematic manner when reviewing MR images. The standardized assessment of the MRI findings includes; GCA-scale for global cortical atrophy, MTA-scale for medial temporal lobe atrophy, and Koedman score for parietal atrophy [10].

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 24. Quantitative data were expressed as mean± standard deviation (SD) for normally distributed data and median (IQR) for abnormally distributed data. Independent-samples student t-test was used when comparing between two means for normally distributed data. Mann-Whitney U test was used when comparing between two means (for abnormal distributed data).Chi-square test was used when comparing between qualitative data. The probability (p) value was considered significant at p value <0.05 (95% confidence interval).

RESULTS

Regarding age, 25 patients (50%) of the studied aged 15 - 30 years and 25 patients (50%) aged 31 - 40 years. The mean ± SD of age of studied patients was 29.9 ± 7.3 years. There were a male predominance among the studied patients (70%) than females (30%). More than half of the studied patients were single (54%), 42% were married and 4% were divorced. Moreover, most of them were educated (84%) and 16% were not educated. Regarding residences, 64% of the studied patients were resident in rural areas and 36% were resident in urban areas. Nearly half of them were occupied (48%) and 52% were not occupied. 80% of them were chronic patients and 20% were have first episode of psychoses. The mean± SD of IQ of the studied patients was 90.9 ± 10.1 (range 70-103). Most of the of the studied patients were on second generation antipsychotic (SGA) and 30% patients were on SGA + Haloperidol (HAL) (table 1).

The mean ± SD of total PANSS score was 55.06±12.2, the mean ± SD of positive subscale was, 19.2±5.03, the mean ± SD of negative subscale was 12.7±5.03 and the mean ± SD of general psychopathology subscale was 23.06±5.02 (table 2).

There was statistically significant relation between MRI findings and negative scale and total PANSS ($p < 0.05$). There was no statistically significant correlation between MRI findings and age, positive scale, general scale, duration of disease and duration of treatment ($p > 0.05$) (table 3).

Table (1): Description of demographic data in all studied patients

Item		Studied patients (n = 50)
Age categories	15-30 years	25 (50%
	31-40 years	25 (50%
Age categories	Mean ±SD	29.9 ± 7.3
	Range	15 – 40
Sex	Male	35 (70%)
	Female	15 (30%)
Marital status	Single	27 (54%)
	Married	21 (42%)
	Divorced	2 (4%)
Education	Not educated	8 (16%)
	Educated	42 (84%)
Residence	Rural	32 (64%)
	Urban	18 (36%)
Family history	Negative	50 (100%)
	Positive	0 (0%)
Occupation	No	26 (52%)
	Yes	24 (48%)
State of disease	Chronic	40 (80%)
	FEP	10 (20%)
IQ	Mean ±SD	90.9 ± 10.1
	Range	70 – 103
Type of antipsychotic drugs	SGA	35 (70%)
	SGA + HAL	15 (30%)

FEP: First episode psychosis, SGA: second generation antipsychotic, HAL: Haloperidol

Table (2): Description of PANSS results in all studied patients

PANSS score		Studied patients (n = 50)
Positive scale	Mean ±SD	19.2 ± 5.03
	Range	10 – 30
Negative scale	Mean ±SD	12.7 ± 5.03
	Range	7 – 26
General scale	Mean ±SD	23.06 ± 5.02
	Range	16 – 30
Total PANSS score	Mean ±SD	55.06 ± 12.2
	Range	33 – 86

PANSS: Positive and negative syndrome scale

Table (3): Relation between MRI results and studied data

Studied variable		MRI results		Stat. test	P-value
		Negative (n = 30)	Positive (n = 20)		
Age	15 - 30 y	13 (43.3%)	12 (60%)	X^2 = 1.33	0.248
	31 - 40 y	17 (56.7%)	8 (40%)		
Positive scale	Mean ± SD	20.2 ± 5.2	17.8 ± 4.5	t = 1.7	0.095
Negative scale	Median (IQR)	14.5 (7 – 17)	10 (7 - 13.8)	MW = 192.5	0.03*
General scale	Median (IQR)	24.5 (20 – 30)	21 (16 -25.8)	MW = 230.5	0.163
Total PANSS	Mean ± SD	58.2 ± 12.3	50.4 ± 10.3	t = 2.3	0.025*
Duration of disease	Median (IQR)	4 (2 - 6.25)	6 (2 - 7.75)	MW = 256.5	0.386
Duration of treatment	Median (IQR)	4 (2-5)	5.5 (2.25-6)	MW = 235.5	0.198

X^2: chi-square test, T: independent sample T test, MW: Mann Whitney U test, *: Significant p value.

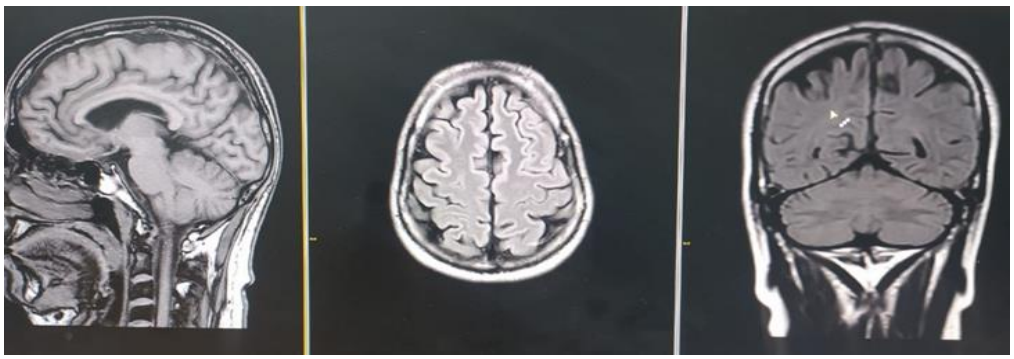

Figure (1): Sagittal T1-, axial FLAIR- and coronal FLAIR -weighted images illustrating the Koedam scale of partial atrophy. Minimal widening of the posterior cingulate and parieto-occipital sulci in a patient with grade 1 parietal atrophy, more at right side.

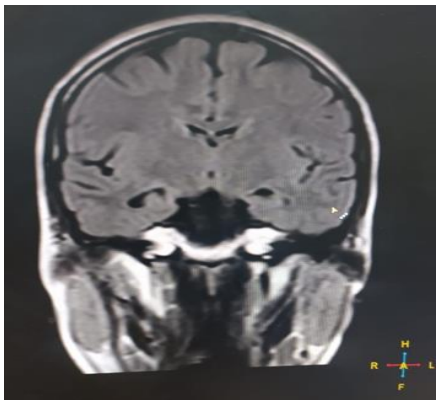

Figure (2): Coronal FLAIR image illustrating score 1 medial temporal lobe atrophy; only widening of choroid fissure according to MTA-scale for medial temporal lobe atrophy.

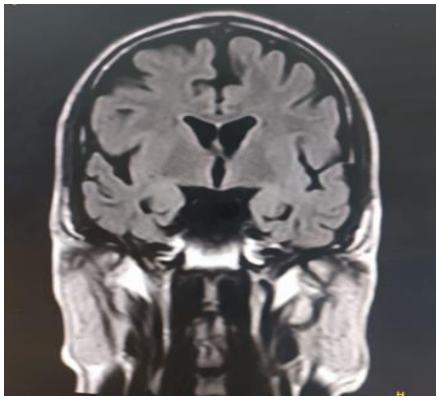

Figure (3): Coronal FLAIR image illustrating according to GCA-scale for global cortical atrophy: score 2 moderate atrophy in form of widening of ventricular system, cortical sulci and Sylvain fissure with moderate volume loss of gyri especially on right superior temporal gyrus**.**

DISCUSSION

We found that schizophrenia was more common among males than females with male to female ratio 35/15 which about 70% males and 30% female of all studied sample**.** Our results agree with Ochoa et al. [11] who found that females have a lower incidence of schizophrenia and first-episode psychosis than males, as well as a better prognosis for the illness, social functioning, and therapeutic responsiveness. According to the majority of the studies reviewed, this could be due to the fact that women have an older age of onset than men, allowing them to respond better to community demands. The estrogen hypothesis tries to explain why women have an older age of onset

According to genetic factor the incidence of schizophrenia in our study shows that family history is negative in all sample group which is inconsistent with Austin et al. [12] who studied genetics in schizophrenic patients, there's a strong impact of heredity on schizophrenia. First-degree relatives (children, guardians or kin) of an influenced person have almost a10-fold increment in hazard of creating schizophrenia or schizophrenia range clutters (schizotypal personality disorder, paranoid personality disorder, schizoaffective disorder). In contrast to our results Krishna et al. established that genetic characteristics play an important role in the pathogenesis of schizophrenia. Studies have revealed that a first-degree relative has a 10% probability of getting sick and a second-degree relative has 3% likelihood. In monozygotic twins, the risk of one twin developing schizophrenia is 48 percent if the other has the

disorder, whereas in dizygotic twins, the risk is 12 percent to 14 percent. If both parents have schizophrenia, the chances of having a kid with schizophrenia are about 40% [13]. This inconsistence between our study and the others mostly because number of patients was limited in comparison to other studies (using thousands of persons and person follow up for the risk of incidence of schizophrenia over years) we do not have accurate registrations for psychiatric patients which attributed to in accurate data from the family who denying any psychiatric illness as they deal with it as a stigma.

In our study we found that about 40% of patients in our sample have MRI brain changes in the form of cortical atrophy, temporal lobe Atrophy, parietal lobe atrophy and widening of choroid fissure measured by GCS , MTI scale and koedman scale using conventional MRI technique. Our findings matched those of Wright et al. who looked at global and territorial grey matter alterations over the entire brain using baseline MRI data from 42 schizophrenia patients and 52 healthy controls. They discovered significant reductions in territorial grey matter in the medial temporal lobe [14] and agree with Khodaei et al., who compared the brain volumes of 12 schizophrenia patients with an equal number of healthy people using MRI data. They observed a decrease in brain volume in the schizophrenic group [15]. Our results differ from Bora et al., who demonstrated a decrease in GM volume in dorsal and rostral front cingulate cortex, left sidelong prefrontal regions, predominant frontal gyrus, and orbitofrontal and fusiform district [16].

It's unclear if medications plays a protective or causal function in gray matter volume change. In a meta-analysis of over 18, 000 participants with schizophrenia, the antipsychotic drug dose at the time of scanning and the length of disease both linked strongly with grey matter volume reduction [4]. This last results were not in concordance with ours as in our sample there is negative correlation between duration of illness and duration of treatment, that may be explained by small sample size or short duration or using different MRI technique. Several investigations have failed to find a link between antipsychotic exposure and progressive GM alterations. There was no significant link between SGA therapy and brain alterations in children and adolescents with early onset schizophrenia over the course of two years [17].These previous results were consistent with our result which found that no correlation between MRI changes and antipsychotic treatment in both first episode psychosis and chronic schizophrenia.

There were studies illustrated that PANSS scores adversely connected with diminished FA within the corpus callosum of incessant schizophrenic patients and diminished FA in right front cingulum of early-onset schizophrenic patients [19]
This is disagreed with our result as there is Statistically significant correlation **(p-value < 0.05)** between MRI results and total PANS. Difference in comes about due to utilizing diverse methodology of MRI Tang et al. found that the loss of grey matter volume in the left middle and superior temporal gyrus was associated with PANSS-positive symptoms but not with PANSS-negative symptoms, PANSS-general psychopathology, or PANSS-total score in a VBM research, which is consistent with our findings [20].

CONCLUSION

There is relation between psychotic disorders such as schizophrenia and brain changes. Antipsychotic medication, duration of illness, duration of treatment and age of patients have no role in MRI brain changes.

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الملخص العربي

تغيرات الرنين المغناطيسي في مرضى الاضطرابات الذهانية

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ملخص البحث

المقدمة: يعتبر الفصام من أكثر الاضطرابات النفسية خطورةً وإضعافًا و التي تسبب تغييرات أساسية داخل الدماغ البشري.

الهدف: يهدف هذا العمل الى تقييم تغيرات الرنين المغناطيسي لدى مرضى الاضطرابات الذهانية

الطرق: أجريت هذه الدراسة المقطعية على 50 مريضاً تتراوح أعمارهم بين 15-40 سنة من كلا الجنسين. تم اخذ المرضى من مستشفيات جامعة الأزهر وتم تطبيق ما يلى عليهم :التاريخ النفسي الكامل والفحص ، المقابلة السريرية المنظمة لـ (DSM-IV -SCID-I) ، مقياس المتلازمة الإيجابية والسلبية (PANSS) ، مقياس ذكاء ويكسلار للبالغين ، التصوير بالرنين المغناطيسي.

النتائج: كشفت نتائج الدراسة ان 40٪ من المرضى يعانون من تغيرات بالرنين المغناطيسي ، كما لم تكن هناك علاقة ذو دلالة إحصائية (قيمة p> 0.05) بين نتائج التصوير بالرنين المغناطيسي والمعايير التالية (العمر ، المقياس الإيجابي ، المقياس العام ، مدة المرض و مدة العلاج وكان يوجد ارتباط ذو دلالة إحصائية (قيمة p <0.05) بين نتائج الرنين المغناطيسي والمقياس السلبي وإجمالي PANSS

الاستنتاجات: هناك علاقة بين الاضطرابات الذهانية مثل الفصام وتغيرات الدماغ بالرنين المغناطيسي. يميل المرضى الذين يعانون من أعراض سلبية إلى حدوث تغيرات في الدماغ. الأدوية المضادة للذهان ليس لها دور في تغيرات الدماغ في مرض الفصام مع عدم وجود فرق بين الجيل الأول من مضادات الذهان والجيل الثاني.

الكلمات المفتاحية: مضادات الذهان ، المادة الرمادية ، الرنين المغناطيسي، الفصام.

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