Correlation Between the Stroke Site and Depression

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ABSTRACT:

BACKGROUND:

Post stroke depression is a common neuropsychiatric consequence of stroke. Some studies show that left hemisphere lesions may be associated with a higher incidence of depression. Others found no significant correlation between lesion location and depressive alterations after stroke.

OBJECTIVE:

To determine whether post stroke depression is correlated with the site of stroke lesion and to evaluate other determinants for the development of depression post stroke.

METHODOLOGY :

A cross sectional study was conducted at Baghdad teaching hospital on 50 patients with single demarcated unilateral lesions was selected according to CT scan of the brain, psychiatric assessment were performed to assess the presence of depression according to DSM-IV criteria. The severity of functional impairment of all patients was performed on the modified Rankin scale (mRS).

RESULTS :

The study showed that 54% of stroke patients were depressed and 46% of them had no depression. Patients with higher functional impairment score were more likely to have depression rather than those with lower score. No significant association had been found between depression with all other variables including site of stroke lesion.

CONCLUSION:

There is no correlation between the sites of stroke lesion and post stroke depression in patients with stroke.

KEY WORDS:stroke site, CT scan, depression.

INTRODUCTION:

Post stroke depression is a common psychiatric consequence of stroke and has been reported to negatively affect functional and cognitive recovery [(1),] and is associated with social withdrawal after stroke [(2)] as well as increased mortality.[(3)]

More than a hundred year ago, Meyer postulated that depression may be the consequence of the combined effect of brain injury, affecting mainly the left frontal lobe as well as other lobar convexities, and psychosocial vulnerability such as past psychiatric history.[(4)]

Although the association of depression with stroke has been recognized clinically for several decades, only in the past 35 years systematic studies on this subject have been conducted.[(5)]

According to the World Health Organization (WHO), stroke is the most common severe neurological disorder and the third leading cause of mortality among adults, with 15 million people worldwide suffering stroke annually.[(6)] A recent review reported a markedly stable frequency of depressive symptoms in 33% of all stroke survivors at any time during the follow-up.[(7)] In addition, stroke survivors have more than six fold higher risk of developing clinically overt depression even two or more years after stroke compared to age-matched controls.[(8)]

Depression is significantly more likely after stroke than other illnesses with comparable disability and adversely affects both short-term recovery and long-term rehabilitation[1].This means that the brain lesion itself could influence mood.[(9)]

The possibility that the risk of depression after stroke is related to lesion location was developed in the mid-seventies at John Hopkins

University and originated the concept of post-stroke depression (PSD).[(10)]

Several studies suggested a link between PSD and macro-vascular lesions in various brain regions such as the left frontal lobe, bilateral prefrontal cortex, left anterior and right occipital cortex.[(11)]Despite these research efforts, the relationships between vascular lesions and the occurrence of depression remain a matter of debate.[(12)]

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Equally debating are the recent contradictory results on the location of brain lesions in PSD.[13]
The association between the location of brain lesion as a result of stroke and PSD has been the topic of much research. However, this complex association is not well understood despite the large number of studies that have examined the association.[14]
Robinson identified specific relationships between the locations of brain injury and the character and severity of post stroke mood disturbances. He suggested that left anterior cerebral lesions were associated with significantly higher depression scores than left posterior lesions. Diagnosable depressive disorders were found in approximately 70% of stroke patients with left frontal brain injuries. Robinson estimated that only 15% of the variance in depression could be explained by the severity of intellectual impairment, physical impairment, quality of social support, or age, whereas the site of the lesion explained 50% of the variance.[15]
Some groups were able to replicate these findings[16]; others found no significant correlation between lesion location and depressive alterations after stroke.[17,18] Also Carson et al found that when data from 34 primary studies were pooled in a systematic review, lesion location was not associated with depression.[11]
On the other hand, some data indicate a higher incidence of depression after right hemisphere lesions.[19,20].

Lesion location in PSD: the contribution of structural neuroimaging:

After the pioneering work of Robinson and Szetela[21] who reported a significant inverse correlation between the severity of PSD and distance of the anterior border of the lesion from the frontal pole, several MRI studies attempted to explore the neuroanatomical background of PSD leading to conflicting data. A first observation in this field concerns the predominance of left hemisphere lesions in patients with PSD.[22] This right–left difference was present both for cortical and subcortical lesions and seems to be more robust for left anterior lesions.[23]
MRI-documented infarcts in hippocampus, basal ganglia and frontal areas have been classically associated with PSD.[24,25,26]
In another study, the mean frequency of infarcts in the genu of the internal capsule on the left side and bilateral pallidum as well as the mean volume of infarcts in the right occipital lobe were independent determinants of PSD.[27]

AIM OF THE STUDY

Study hypothesis:

Post stroke depression is correlated with the site of stroke lesion.

OBJECTIVES:

1. To determine whether post stroke depression is correlated with the site of stroke lesion as shown in CT scan.
2. To evaluate other determinants for the development of depression post stroke.

PATIENTS AND METHOD

A cross sectional study was conducted on 15thof May through 15thof December 2012, at Baghdad teaching hospital in Baghdad city/Iraq, on a consecutive series of 70 stroke patients attended outpatient clinic, a subgroup of 50 patients with single demarcated unilateral lesions was selected according to CT scan of the brain which was performed to confirm the diagnosis of ischemic stroke. Psychiatric assessment was performed on patients with at least 6 months period after acute stroke to assess the presence of depression according to DSM-IV criteria. The severity of functional impairment of all patients was performed on the modified Rankin scale (mRS).

Inclusion criteria:

1) Positive brain CT scan (evidence of infarction).
2) Duration of stroke should be 6 months and more.
3) No clinical evidence of aphasia.
4) Absence of previous history of pre stroke depression.
5) No evidence of marked disability according to mRS.
6) No history of psychiatric diagnosis or alcohol or drug abuse.
7) First single unilateral stroke event.
8) No severe concomitant disease.

Exclusion criteria:

1) Duration of stroke less than 6 months.
2) Recurrent or bilateral stroke events.
3) Marked disability.

The group consisted of 27 male and 23 female patients, 26 suffered from R. hemisphere and 24 from L. hemisphere stroke. The median age was 59 year. All patients gave a verbal consent to participate in this study. CT scanning was performed on all patients and all images were assessed by a consultant radiologist who fulfilled the following neuro-radiological criteria in the patients:

(1) All patients showed a single clearly demarcated lesion and no other signs of brain disease.

(2) The hemisphere contra lateral to the lesion was not affected (no signs of space occupation due to midline shift or edema).

(3) All CT scans had been done without contrast.
All participants were interviewed to answer two pre-constructed Arabic language questionnaires:

1. The first one contains two parts:

a) Demographic factors (name, age, marital status, occupation, level of education, previous psychiatric history, medical history and drug history).

b) Modified Rankin scale(mRS) to assess the extent of disability after a stroke.The Rankin Scale (RS) was developed in 1957 to assess the extent of disability after a stroke[28]; it was later modified (mRS) to a 6-point scale from 0 to 5.[29] Patients with no impairment or symptoms receive the best score of 0, while patients with severe disability who are bedridden, incontinent, and require constant nursing care and attention receive the worst score of 5; death can be rated 6 in the mRS. The modified scale has moderate to excellent inter-rater reliability.[30,31] The mRS has been shown to be valid,[32]and is considered more powerful as a primary endpoint in clinical trials of stroke therapy.[33,34] The Arabic version of this scale was presented to a number of experts and they assert its validity for use in research.

2. The second one contain semi-structure interview DSM-IV. It was devised for a project of studying the psychiatric morbidity in several medical specialties. Items of this semi-structured interview are based on the Arabic version of DSM-IV.

Statistical analysis:

Patients' data were entered into computerized statistical software to make a database and checked for any errors or inconsistency. Variables were coded with a specific code for each variable.

SPSS, (Statistical package for social science) version 18 software for windows, was used to perform statistical analysis and management of data, tables had been conducted accordingly. Descriptive statistics were presented as mean ± standard deviation for continuous variable (Age, duration) and as frequencies and proportions (percent) for categorical variables (all other variables under study).

Statistical tests had been used according to the types of variables, Chi square test was used to evaluate the statistical significance of comparison of frequencies and proportions, Fisher's exact test was used alternatively, when chi square inapplicable.

Bivariate and multivariate analysis were used to find the significance of correlations among variables.

Student (t) test was used to compare in between two means (Age) while ANOVA (analysis of variances) test was used for comparison of more than two means.

Level of significance (P value) of < 0.05 was considered statistically significant. Data and results were presented in tables' and\or figures.

RESULTS:

There were 50 patients enrolled in this study, the socio-demographic characteristics of them presented in table 1 as followed:

Age distribution:

The mean age of patients was (59 ± 11.5) years, the youngest patient aged 25 years and the oldest one aged 80 years, the age group distribution of patients is shown in table1; the more prevalent age group was (51 - 60) years; 16 (32%) of patients, and the least prevalent was the age ≤ 40 years; only 2 (4%), table 1.

Sex distribution: Males were 27 (54%) versus 23 (46%) females with a male to female ratio of 1.2 to 1, no significant difference had been found within sex distribution, table 1.

Marital status: Majority of cases were married; 41 (82%) compared to 8 (16%) widowed and only one single patient, table 1.

Level of education: Illiterate patients were 14 (28%), read and write 4 (8%), primary school 12 (24%) intermediate 16 (32%) and 4 (8%) had higher than intermediate school education, table 1.

Occupation: Housewives represented 18 (36%) of cases, employee were 7 (14%), retired 14 (28%), officers 8 (16%) while other jobs (teacher, farmer and driver) only 3 (6%), table 1.

Medical history: showed that the commonest associated chronic medical disease in patients with stroke is hypertension in 65% of cases followed by Diabetes in 38% and ischemic heart disease in 12%.

Depression: It was present in 27 patients giving a prevalence among patients of (54%) versus 23 (46%) with no depression, nonetheless, the difference is not significant.

Functional impairment: 80% of patients had functional impairment of 2 and more compared to 20% with 0 and 1, table 2.

It had been significantly found that females with stroke were more likely to have depression rather than males; out of 27 patient with depression 16 were females versus 11 male, P< 0.05.

With functional impairment: patients with higher functional impairment score were more likely to have depression rather than those with lower score, table 6, P <0.05

No significant association had been found between depression with all other variables, P > 0.05.

Table 1: Socio-demographic characteristics of study patients. (N=50).

Characteristic		Number	Percent
Age	Mean ± Std*	59 ± 11.5	-
Age group	≤ 40	2	4.0%
	41 – 50	11	22.0%
	51 – 60	16	32.0%
	61 – 70	13	26.0%
	71 – 80	8	16.0%
Sex	Male	27	54.0%
	Female	23	46.0%
Marital status	Married	41	82.0%
	Widowed	8	16.0%
	Single	1	2.0%
Level of education	Illiterate	14	28.0%
	Read and write	4	8.0%
	Primary	12	24.0%
	Intermediate	16	32.0%
	Higher	4	8.0%
Occupation	Housewife	18	36.0%
	Employee	7	14.0%
	Retired	14	28.0%
	Officer	8	16.0%
	Others; (driver, famer, teacher)	3	6.0%

Table 2: Distribution of depression and functional impairment among patients. (N=50).

Variable		Number	Percent	P.value
Depression	Present	27	54%	0.72 not significant
	Absent	23	46%	
	Total	50	100%	
Functional impairment	0	2	4.0%	0.003 significant
	1	8	16.0%	
	2	16	32.0%	
	3	17	34.0%	
	4	7	14.0%	
	Total	50	100%	

Table 3:Association between depression and site of stroke in patients with left side lesions (N=25) .

Site	Depression	No depression	Total*
L.frontal	1	0	1
	2.0%	.0%	2.0%
L.frontoparietal	0	2	2
	.0%	4.0%	4.0%
L.occipital	1	0	1
	2.0%	.0%	2.0%
L.parietal	5	6	11
	10.0%	12.0%	22.0%
L.parietofrontal	1	0	1
	2.0%	.0%	2.0%
L.parietooccipital	1	0	1
	2.0%	.0%	2.0%
L.temporal	2	1	3
	4.0%	2.0%	6.0%
L.temporoparietal	0	1	1
	.0%	2.0%	2.0%
L.temprooccipital	2	0	2
	4.0%	.0%	4.0%
Other	2	0	2
	4.0%	.0%	4.0%
Total	15	10	25
	30%	20%	50%

*percentage calculated from total number (N=50)

Table 4: Association between depression and site of stroke in patients with right side lesions (N=25).

Site	Depression	No depression	Total*
R.frontal lesion	1	0	1
	2.0%	.0%	2.0%
R.frontoparietal	2	1	3
	4.0%	2.0%	6.0%
R.internal cap.	1	0	1
	2.0%	.0%	2.0%
R.occipital	2	2	4
	4.0%	4.0%	8.0%
R.occipitoparietal	1	0	1
	2.0%	.0%	2.0%
R.parietal	3	5	8
	6.0%	10.0%	16.0%
R.parietofrontotempor	1	0	1
	2.0%	.0%	2.0%
R.parietooccipital	1	0	1
	2.0%	.0%	2.0%
R.temoral	0	1	1
	.0%	2.0%	2.0%
R.temporal	0	1	1
	.0%	2.0%	2.0%

R.temporoparietal	0	1	1
	.0%	2.0%	2.0%
R.thalamic	0	2	2
	.0%	4.0%	4.0%
Total	12	13	25
	24%	26%	50%

*percentage calculated from total number (N=50)

Table 5: Correlation of side of lesion with depression

Side	Depression	No depression	Total*
Left	15	10	25
	30%	20%	50%
Right	12	13	25
	24%	26%	50%
Total	27	23	50
	54%	46%	100%
P.value = 0.57 not significant			

Table 6: Association between depression and functional impairment of stroke.

Functional impairment	Depression		
	Yes	No	Total
0	0	2	2
	.0%	8.7%	4.0%
1	3	5	8
	11.1%	21.7%	16.0%
2	9	7	16
	33.3%	30.4%	32.0%
3	9	8	17
	33.3%	34.8%	34.0%
4	6	1	7
	22.2%	4.3%	14.0%
Total	27	23	50
	54.0%	46.0%	100.0%
P.value = 0.037 *significant association*			

Table 7: Multivariate analysis of different study factors with depression

Source	Dependent Variable	Significance
Age	Depression	0.071
	Site	0.349
Sex	Depression	0.508
	Site	0.267
Marital	Depression	0.415
	Site	0.401
Education	Depression	0.677
	Site	0.213
Occupation	Depression	0.434
	Site	0.219
Functional impairment	Depression	0.037
	Site	0.97
Chronic disease	Depression	0.12
	Site	0.3

DISCUSSION:

In this study we enrolled patients with stroke duration of six months and more while many of other previous studies enrolled patients with early onset PSD (less than 6 months), this is to rule out the psychological effect of sudden onset functional impairment. Also we assess the stroke patients with mRS to exclude patients with high score functional impairment in whom depression may be caused by psychological effect of functional disability. The selection of first single stroke was decided on the account that the results of previous studies showed that recurrent multiple strokes were associated with high risk for developing depression and this may be due to psychological or biological effect of stroke.

In this study there is no correlation between site of stroke and development of depression regarding the side and site of the lesion and this is similar to that study conducted in Rome at 1999 by Gainotti et al. They found that a psychological model is more consistent than a neurological model of PSD.[35]Also a study conducted in China at 2011 by Tang.WK et al, they found that frontal sub-cortical circuits' infarcts are independent predictors of PSD.[36]A study done at 1995 in Germany by Manfred.H et al, found no significant differences in depression scores between patients with left and right hemisphere lesions.[37]

MRI was not performed to the stroke patients because:

a) Its time consuming.

b) Refusal of patients, some, because of claustrophobia and others because they did not want to do more investigations.

The absence of correlation between site of stroke and development of depression that have been found in this study, relative to other studies may be related to many factors:

1. Duration of stroke:

In this study duration of stroke was 6 months and more while in many of other studies it was less than 6 months.

2. The effect of society:

The societys' variation of the samples may play a role in differences of the results, only one study has been done in Iraq, which is that of Al Jadiry at 1999.[38]

The Iraqi society is characterized by presence of social support and believes in God which may make the patients accept the stroke and its consequences without much suffering.

3. The confounder effects:

The variance of the results found in this study from that done by Al Jadiry who found lesion location has significant correlation with PSD[38] may be due to the effects of other variables such as the sex, marital state, education, occupation

and functional impairment….ect. In this study we excluded the effect of other variables by multivariate analysis, so that there was no interference between these variables and the effect of lesion location on the development of depression.

4. Different methodology:
   There were methodological differences across the studies of PSD, some of them use DSM III criteria and others use DSM IV or ICD 10 criteria. In addition, some use scales to assess depression while others not. These differences may contribute to the discrepant findings in the association between lesion location and PSD.
5. Differences in the sample size:
   The sample size in many of the previous studies was larger than that adopted by this study while those done in Germany[37] and Thailand[39] had smaller size.
6. Differences in sample type :
   The patients in many of the other previous studies were sampled as inpatients while in this study were outpatients.
7. Difference in radiological examination :

In this study we used CT scan while some other studies had used MRI which is more sensitive in detecting stroke and more specific in determining the site of the lesion.

In patients with stroke enrolled in this study, there is no association between depression and other variables like age, marital status, level of education, occupation and medical history. This is similar to the results of Al Jadiry who found weak correlation between PSD and other variables like age and level of education.[38]

Also at first we found that female sex (table and functional impairment (table 2) are associated with the development of PSD, but after exclusion of the effect of other variables in this study by multivariate analysis we found that just functional impairment had association with depression, i.e. patients with high score functional impairment are more likely to develop depression (table 6) and this is similar to the results of Al Jadiry study.

In this study no association was found between sex and PSD which is different from Wongwandee M. In his study in Thailand he found that female gender and absence of hypertension may contribute to PSD,[39] and this may be due to the larger sample size and duration of stroke in our study compared to the small size sample (thirty nine) and early onset PSD of that study.

CONCLUSION:

This study is more consistent with a psychological than with neurological model of post-stroke depression, i.e. there is no correlation between site of stroke lesion and PSD.

RECOMMENDATIONS

1. Further studies are needed with larger samples and a longer time, as well as, enrolling patients that have low score of functional impairment (less than 2).
2. Further studies are needed using MRI.
3. Psychiatric referral of stroke patients should be considered more often for psychiatric assessment and treatment.

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