Assessment of neurological complications of acute ischemic stroke in Egyptian patients

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Abstract: Background: Recent years have witnessed increasing recognition and interest in stroke as a major public health problem. Medical complications are also known to be common in stroke patients, although the implications of these complications have less frequently been studied. Aim of the work: the aim of this study is to estimate the incidence of post stroke neurological complications occurring within 3 months from the initial onset in a sample of Egyptian patients, with determination of incidence, most common complications and their possible risk factors. Material and methods: a prospective study done over a period of six months that included established cases of stroke diagnosed on the basis of clinical history, examination and neuroimaging, This is an observational hospital based study was done in university hospitals (Al-Hussien & Bab Alshaaria) of Neurology Department AL Azhar University and Arab Contractors Medical Center, during the period from July (2015) to December (2015). The data was analyzed using Chi-square test using SPSS (Statistical package for social science) software. Results: The present study was conducted on 84 patients and according to their gender they classified as 46 males (55 %) and 38 females (45%) with acute ischemic stroke, the most common complication was headache 25 cases 30% and it was common in posterior fossa lesions (cerebellar edema), followed by brain and cerebellar edema 23 cases 27% and age was an important factor for development of complications. Atrial fibrillation also, was the most powerful risk factor for developing hemorrhagic transformation Conclusion: post stroke neurologic complications are seen in the set of post-acute stroke phaseoweing to lake of definite treatment of acute ischemic stroke, little evidence-based data to guide management, mortality and lifelong morbidity, so, a teamwork specialized in the field of prevention of neurologic and non-neurologic of early or late complications in the setting of acute stroke phase to set optimum proper treatments, focus, widen the scope and differential diagnoses taking in consideration patient's complaints, comorbid conditions and clinical presentation. Recommendations: Therefore, close monitoring of patients with acute ischemic stroke must be done in all patients who are admitted with stroke and efforts must be made to prevent these serious medical complications in order to properly manage such patients thereby decreasing the morbidity and mortality rate.

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1. Introduction:

According to the World Health Organization (WHO), 15 million people suffer stroke worldwide each year. Of these, 5 million die and another 5 million are left permanently disabled (MacKay & Mensah, 2013). Stroke is a major public health problem. It is globally well distributed and is considered as the second top cause of death around the world. Stroke causes a great impact on disability rate. Stroke also has enormous contribution to economic and social burden for patients and their families. (WHO, 2005). Common complications after acute stroke include neurological complications like recurrent stroke and seizures and medical complications like chest infection, UTI, bowel or bladder dysfunction, deep vein thrombosis, pulmonary embolism, upper gastrointestinal bleeding, aspiration, bedsores, falls, malnutrition etc. (Navarro, et al., 2008).

Arterial hypertension is the most important modifiable risk factor for stroke and all forms of vascular dementia**.** At least 25% of the adult population has arterial hypertension, defined as systolic blood pressure (SBP) greater than 140 mm Hg or diastolic blood pressure (DBP) greater than 90 mm Hg (Chobanian et al., 2003). The different incidences of stroke observed in different parts of the world may be explained by Socio-economic factors, dietary and lifestyle behaviors, different patterns of risk factors, and environmental conditions (Biller et al., 2012). Medical complications are also known to be common in stroke patients, although the implications of these complications have less frequently been studied, Davenport et al., 1999, retrospectively reported complication rates in 597 stroke patients (ischemic and hemorrhagic), they found 59% had complications and 23% died in the hospital. Silver et al., 1990, reported that approximately 40% of deaths were from medical

complications in a series of nearly 1000 ischemic stroke patients. They also noted that while most deaths occurring in the first week were due to brain edema associated with stroke, most deaths in the second and third weeks after stroke could be attributed to medical complications. In a retrospective autopsy review from 1966 to 1975, Bounds et al., 1998, found that >50% of deaths occurred secondary to medical complications. Kalra et al., 2011, reported medical complications occurring in 60% of the 245 patients involved in a stroke rehabilitation program (Viitanen et al., 2011). Patients with acute ischemic stroke are at a high risk of stroke recurrence in the first week, although this risk declines over time. The early risk of recurrence is about 10% at 1 week, between 2% and 4% at 1 month, and about 5% yearly thereafter (Mohan et al., 2015). The risk of recurrent stroke can vary substantially among patients according to the underlying pathological changes, lifestyles factors, and comorbidities (Lovett et al., 2013). The major risk factors for recurrent stroke include old age (Pendlebury et al., 2015), previous stroke (Feng et al., 2015), diabetes mellitus, hypertension, atrial fibrillation, cardiac diseases, smoking, and carotid stenosis (Johnston et al., 2015).

In hemispheric edema the overall risk of cerebral edema in patients with anterior circulation ischemic stroke is estimated to be (10–20%) and in patients with major anterior circulation occlusion such as MCA stem occlusion, cerebral edema tends to appear within the first 4 days after stroke onset and patients with large cerebral infarction, especially when complicated by brain edema, often present in coma (Diringer et al., 2013). The overall mortality rate for acute MCA infarctions caused by cerebral herniation secondary to brain edema ranges between 7% and 23%, whereas that of malignant MCA infarction (defined as greater than two-thirds of the MCA territory) is estimated to be between 40%-70% and up to 80% in untreated patients. In cerebellar edema is a common complication in 17–54% of patients with cerebellar infarction and can induce brainstem compression, descending (trans-foraminal) or ascending (trans-tentorial) herniation and obstructive hydrocephalus and usually peaks on the third day after the infarction, although it can occur any time after ischemia (Baldauf et al., 2015).

Hemorrhagic transformation (HT) is a frequent complication of acute ischemic stroke that is especially common after thrombolytic therapy and can significantly worsen prognosis. Hemorrhagic transformation of brain infarction is a common and potentially serious complication of acute ischemic stroke occurring in 30–40% of clinical cases. The main causes of hemorrhagic conversion are the loss of micro-vascular integrity and disruption of neurovascular homoeostasis (Wang and Lo, 2014). Factors have been identified as treatment with alteplase, aquaporin, matrix metalloproteinase, inflammation, vascular endothelial growth factor, nitric oxide synthase, and free radicals. The frequency of symptomatic hemorrhagic transformation is higher in patients treated with intravenous alteplase 6% (Furlan et al., 2010). It should be noted that the term hemorrhagic transformation is a little variably used and collectively refers to two different processes, which have different incidence, appearance and prognostic implications. With regard to the type of hemorrhage, HT can be divided into 1- Hemorrhagic infarction (HI) and 2- Parenchymal hematoma (PH). HI is a heterogeneous hyperdensity occupying a portion of an ischemic infarct zone on computed tomography (CT) images (Sussman and Connolly, 2015). Atrial fibrillation and cerebral embolism are associated with an increased risk of HT, the blockage of intracranial vessels as a result of atrial fibrillation is one of the major causes of cardio-embolic cerebral infarction, the embolus can then be dislodged with thrombolytic therapy or on its own leading to recanalization of the previously occluded vessels, ischemia-impaired occlusion vessels and undeveloped neovascularization increase the probability of HT, atrial fibrillation is associated with higher volumes of more severe baseline hypoperfusion, leading to greater infarct growth more frequent severe HT and worse stroke outcomes (Campbell and Christensen, 2014).

Stroke-related seizures are not only observed in patients with a cerebral infarct or a bleeding, but also those without visible brain lesions (Alexandrov and Bellavance, 2009). Stroke-related seizures are a neglected topic and generally considered as a benign and a harmless complication occurring in the course of a long standing and progressive cerebral and cardiovascular disease (Silverman et al., 2011). The reported frequency of early seizures after ischemic stroke ranges from 2% to 23% and that of late seizures is between 3% and 67%, depending on the study design, sample sizes, and length of follow-up, epilepsy(recurrent seizures) develops in only 2·5–4% of patients (Camilo and Goldstein, 2013). intra - cerebral hemorrhage were found to have a higher incidence of seizures (10.6%) than those with an ischemic stroke (8.6%), while in those with a subarachnoid bleeding the incidence was similar to that in patients with a brain infarction, low incidence of 2.5% of seizures was observed in patients with lacunar strokes, due to the fact that ischemic strokes are far more frequent than hemorrhagic ones, the majority of stroke-related epileptic insults are due to cerebral infarction (Moulin, 2010). Headache is a well-known symptom at stroke onset and has been reported in 9.3%–38% of patients. Persistent headache

following stroke has, however, been described in only a few studies with an incidence of 10.8%–23.3% within two years after stroke (Portenoy et al., 2004). Central post-stroke pain (CPSP) or Thalamic Pain Syndrome, is a central neuropathic disorder characterized by constant or intermittent pain. It is associated with sensory abnormalities, particularly of thermal sensation, in the painful body part. While the pain is frequently described as burning, scalding, or burning and freezing. One study found that up to 8% of people who have had a stroke will develop Central Post-stroke Pain and that the pain will be moderate to severe in 5% of whom affected, while 12% incidence in most of another studies (Andersen et al., 2014).

2. Material and methods:

This is a prospective study done over a period of six months on a sample of (70) Patients recruited from neurology departments of Al-Azhar University Hospitals (Al-Hussein and Bab –Al Sharea Hospitals) and Arab Contractor Medical center, within the first 3 months of their symptoms, during the study during the period from January (2016) to June (2016).

Inclusion criteria:

1. Patients with definite diagnosis of ischemic stroke, evident by clinical examination and radiological imaging.
2. Age > 18 yrs.

Exclusion criteria:

1. Patient with sign and symptoms similar to ischemic stroke, but without definite radiological clues.

2. Patient with hemorrhagic stroke.

3. Patient with sign and symptoms similar to stroke, but duo to any other medical etiology.

4. Patient with psychiatric disorders.

5. Patient with any neurological structural disorders, eg. (Space occupying lesion, hydrocephalus, cerebral aneurysm….etc).

6. Patient with past history of ischemic or hemorrhagic stroke.

7. Patient with past history of epilepsy or ICT.

8. Patient taking cytotoxic or immune-suppressive drugs.

9. Patient with known autoimmune diseases, cancer, hematological disease and severe renal or liver diseases.

Methodology:

All patients were subjected to:

1-Full neurologic and medical history, with special stress on the following points, Diabetes mellitus, Hypertension, Dyslipidemia, coronary artery disease, cardiac arrhythmia, previous similar attacks.

2- Full neurological and clinical examination, with special stress on assessment of the patient's score according to National Institutes of Health Stroke Scale (NIHSS).

3- Routine laboratory investigations including, complete Blood Count, BUN, and Creatinine…etc).

4- Non-contrast Computed tomography (CT) study of the brain.

5- Magnetic resonance Imaging (MRI) of brain.

6- Duplex study of both carotids and vertebro-basilar systems.

7- ECG & Echocardiography of the heart.

8- Any further investigation as needed.

9- Follow up after 3 months.

a)- National Institutes of Health Stroke Scale (NIHSS): The National Institutes of Health Stroke Scale or NIH Stroke Scale (NIHSS) (see appendix). Is a tool used by healthcare providers to objectively quantify the impairment caused by a stroke. The NIHSS is composed of 11 items, each of which scores a specific ability between a 0 and 4. For each item, a score of 0 typically indicates normal function in that specific ability, while a higher score is indicative of some level of impairment. The individual scores from each item are summed in order to calculate a patient's total NIHSS score. The maximum possible score is 42, with the minimum score being a 0 scores (The National Institute of Health and Neurological Disorders, 2001). The scale assesses level of consciousness, extra-ocular movements, visual fields, facial muscle function, extremity strength, sensory function, coordination (ataxia), language (aphasia), speech (dysarthria), and hemi-inattention (neglect) (Schlegel et al., 2003).

b)- Computed Tomography (CT) in Acute Ischemic Stroke: Computed tomographic (CT) images of the brain are produced by scanning a collimated beam of x-rays through the brain in thin, sequential slices. The x-ray output is counted, analysed and reconstructed for clinical interpretation. The newer generation scans use spiral technology, where the imaging is performed in a continuous helical fashion instead of the conventional slice-by-slice method. CT scanning is still the preferred method for imaging hyper-acute stroke (McManus et al., 2014).

c)- Magnetic Resonance Imaging In Acute Ischemic Stroke: The most important service that imaging provides to patients with ischemic stroke is to rapidly identify those patients who are most likely to benefit from immediate treatment. This group includes patients who have severe neurological symptoms due to an occlusion of a major artery, and who are candidates for recanalization using intravenous thrombolysis or intra-arterial intervention to remove the occlusion (Mackey et al., 2014).

d)-Pain Assessment Scale: Following a stroke, patients can experience a range of painful conditions, headaches, musculoskeletal pain and cramps. One

significant pain problem is central post stroke pain (CPSP) which affects about 12% of those affected by stroke. It is also known as thalamic syndrome or thalamic pain syndrome, is a neurological disorder and is extremely difficult to treat, (National Organization for Rare Disorders, 2014). The thalamus or parietal lobe processes sensory stimuli like heat, cold and touch and as a result of damage the brain registers all stimuli as pain. It is often misdiagnosed as a musculoskeletal condition and for effective management, diagnosis and early evidence based management is extremely important. Where guidelines have included both assessment and management, the guideline link will be posted in both sections (Henriette et al., 2014). The Numeric Rating Scale (NRS-11) is an 11–point scale for patient self-reporting of pain. It is for adults and children 10 years old or older (National Institutes of Health – Warren Grant Magnuson Clinical Center, 2012). Table (1): Numeric Rating Scale11. (See appendix).

Statistical analysis:

Data management and analysis were performed using commercially available software (SPSS version 21.0, SPSS, Inc., Chicago, IL, USA). The numerical data were statistically presented in terms of range, mean and standard deviation. The mean was used as a measure of the average value for a given number of data values. These values were compared using student t-test. Results were evaluated for each group and data were compared using different tests according to the type of the data to be compared to obtain:

1. Descriptive Statistics:
- Mean (M).
- Standard deviation (± SD).
- Range (minimum - maximum).
- Number and percentage (quantitative data).

2. Analytical Statistics:

a- Quantitative data:

- Student "t" test: to compare between two independent means.

b- Qualitative Data:

- X2 (Chi - Square) test: used to compare qualitative data.
- P- value: indicates level of significance:
  - P > 0.05 = non-significant.
  - P < 0.05 = significant.

P < 0.01 = highly significant.

3. Result:

The present study was conducted on 84 cases with Acute Ischemic Stroke (46 males (55 %) and 38 females (45%), aged from (87 to 45 year) with mean age 66 ± 8 years and re-evaluated three months after the acute stroke onset to determine percentage and incidence of neurological complications in this time period. As showed in table (25) and figure (2).

From table below, the most common post-ischemic stroke neurological complications was headache 25 cases 30% about one third of all studied cases, followed by brain and cerebellar edema 19 cases 23 %, recurrent stroke and hemorrhagic transformation each one 10 cases 12%, post-stroke epilepsy and central post stroke pain each of them 8 cases 10% and finally cerebellar edema 4 cases 5%. As showed in table (25) and figure (3).

From table (26) below, showing ages of studied group, the maximum age at presentation was 87 year and the minimum age at presentation was 39 year, in recurrent stroke (RS), the ages of studied group between (45-79) year, with average 58.3 year, in brain edema (BE), the ages between (39-87) year with average 64.2 year, in cerebellar edema (CE), between (60-82) year with average age 73.7 year, in post-stroke epilepsy (PSE), between (85-74) year, with average age 65.7 year, in hemorrhagic transformation (HT), between (39-86) year with average age 62.3 year, in headache, between (39-87) year with average age 66.7 year and central post-stroke pain (CPSP), between (45-67) year with average age 55.8 year. In addition there was a significant statistical value between ages of development of complications and ages of the studied cases, being old ages are directly proportional to development of post stroke neurological complication (when age increase incidence of complications also increase) P Value=0.001, which is highly significant. As showed in table (26) and figure (3).

In table (27) below, as regard recurrent stroke as a complication of acute ischemic stroke, the total number of affected cases was 10 cases (7 females 70% and 3 males 30%), in brain edema, the total number of affected cases was 19 cases (12 females 63.2 % and 7 males 36.8%), in cerebellar edema 4 cases (3 males 75% and 1 female 25%), in post-stroke epilepsy, the total number of affected cases was 8 case (6 males 75% and 2 females 25%), in hemorrhagic transformation, the total number of affected cases was 10 cases (5 males 50% and 5 females 50%), in headache, the total number of affected cases was 25 cases (13 males 52% and 12 females 48%), in central post-stroke pain, the total number of affected cases was 8 cases (5 females 62.5 % and 3 males 37.8 %) and there was no statistical significance between incidence of complications and sex distributions in the present study, P value 0.36, which is non-significant. As showed in table (28) and figure (4).

As regard recurrent stroke as a neurologic post-stroke complication there was, number of cases developed recurrent stroke defined by own specific criteria were 10 patients, it constituents about (14.2

%), and risk factors for stroke recurrence were as the following, diabetes mellitus affected cases by 60%, hypertension by 30%, smoking by 10%, dyslipidemia by 40%, atrial fibrillation by30% and old age (> 65 year) and diabetes mellitus by 60% being the highest incidence as a risk factors for stroke recurrence 60% of cases, followed by dyslipidemia 40%, hypertension 30% and atrial fibrillation 30%. As showed in table (30) and figure (5).

As regard brain (cerebral) edema as a neurologic post-stroke complication there was, number of cases developed brain edema were 19 patients, it constituents about (27%), and risk factors for brain edema were as the following, diabetes mellitus affected 15 cases (78.9%), hypertension affected 10 cases (52%), smoking affected 1 case (5.3%), dyslipidemia affected 5 cases (26.3%), atrial fibrillation affected 5 cases (26.3%) and old age affected 7 cases (36.8%) and vasculitis affected 2 cases (10.5%) being the highest incidence as a risk factor for brain edema was diabetes mellitus 78.9% of cases, the second was hypertension 52.6%, followed by age 36.8%, and atrial fibrillation and dyslipidemia 26.3%, also there was significant statistical correlation between increased age and development of brain edema as P value = 0.05 which is significant. As showed in table (31) and figure (7).

As regard cerebellar edema as a catastrophic neurologic post-stroke complication there was, number of cases developed cerebellar edema were 4 patients, it constituents about (5.5%) and risk factors for cerebellar edema were as the following, diabetes mellitus affected 2 cases (50%), old age affected 4 cases (100%), smoking affected 1 case (25%), dyslipidemia affected 1cases (25%) and atrial fibrillation plus hypertension affected 0 cases for each (0%). Also, old age being the highest incidence as a risk factor for cerebellar edema 100% of cases and there was statistical significance as P Value = 0.05. As showed in table (32) and figure (8).

As regard post-stroke epilepsy (PSE) as a neurologic post-stroke complication there was, number of cases developed PSE were 8 patients, it constituents about (11.5%), and risk factors for PSE were as the following, diabetes mellitus and hypertension affected 5 cases each (62.5%), smoking affected 1 case (5.3%), dyslipidemia affected 5 cases (26.3%), atrial fibrillation affected 6 cases (75%), old age affected 3 cases (37.5%) and vasculitis affected 6 cases (75%). Being the highest incidence as a risk factor for PSE were atrial fibrillation and vasculitis 6 cases (75%) for each. As showed in table (33) and figure (9).

As regard hemorrhagic transformation (HT), as a neurologic post-stroke complication there was, number of cases developed HT were 10 patients, it constituents about (14.2%), and risk factors for HT were as the following, diabetes mellitus affected 6 cases (60%) and hypertension affected 7 cases each (70%), smoking affected 0 case (0%), dyslipidemia affected 2 cases (20%), atrial fibrillation affected 6 cases (60%), old age affected 6 cases (60%) and vasculitis affected cases (20%). Being the highest incidence as a risk factor for HT were hypertension and atrial fibrillation 7 cases (70%) for each, followed by old age 6 cases 60%. As showed in table (34) and figure (10).

As regard headache as a neurologic post-stroke complication there was, number of cases developed headache were 25 patients, it constituents about (35.7%), and risk factors for this were as the following, diabetes mellitus affected 9 cases (60%) and hypertension affected 7 cases each (70%), smoking affected 5 case (20%), dyslipidemia affected 6 cases (24%), atrial fibrillation affected 5 cases (20%), old age affected 14 cases (56%) and vasculitis affected 1 cases (4%). Being the highest incidence as a risk factor for HT were hypertension and atrial fibrillation 7 cases (70%) for each, followed by old age 6 cases 60% [Table (35), Figure (11)].

As regard central post-stroke pain (CPSP), as a neurologic post-stroke complication there was, number of cases developed CPSP were 8 patients, it constituents about (11.4%), and risk factors for CPSP were as the following, diabetes mellitus affected 3 cases (37.5%) and hypertension affected 2cases each (25%), smoking affected 1 case (12.5%), dyslipidemia affected 2 cases (25%), atrial fibrillation affected 0 cases (0%), old age affected 2 cases (25%) and vasculitis affected 4 cases (50%). Being the highest incidence as a risk factor for CPSP was vasculitis (50%) and there was high statistical significance as P Value = 0.001. As showed in table (36) and figure (12).

As regard stroke subtype, in recurrent stroke was 7 cases 70% thrombotic and embolic in 3 cases 30%, in brain edema 16 cases 84.3% and 3 cases 15.8% embolic, in cerebellar edema 4 cases 75% thrombotic and 1 case 25% embolic, in post-stroke epilepsy 5 cases 62.5% thrombotic and 3 cases 37.5% embolic, in hemorrhagic transformation 6 cases 60% thrombotic and 4 cases 40% embolic, in headache 19 cases 76% and 6 cases 24% embolic and in central post-stroke pain 6 cases 75% and 2 cases 25% embolic. As showed in table (37) and figure (13).

As regard stroke size in centimeter in the study group, in RS (2-6) centimeter (cm) with mean 3.5 cm, in BE (1-6) cm with mean 3.37 cm, in CE (2-5)cm with mean 3 cm, in PSE (1-5)cm with average 2.8 cm, in HT (2-6)cm with mean 4.8 cm, in Headache (1-6)cm with mean 3.56 cm and in CPSP (1-6) cm with average 4.1 cm. there was a significant statistical

significant between size of strokes and development of complications as P Value =0.001 highly significant. As showed in table (38) and figure (14).

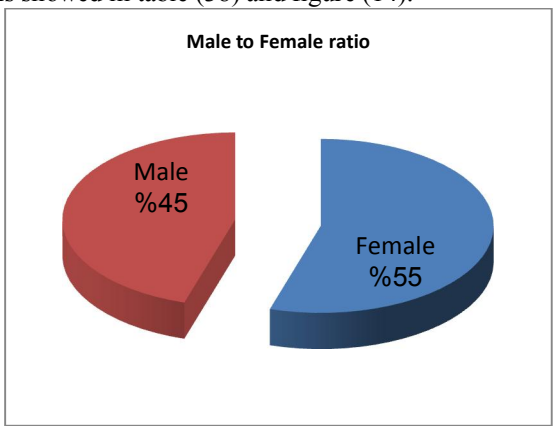

Figure (2): Male to female percentage.

Table (25): Numbers and percentages of post-ischemic stroke complications.

Complain	No	%
RS	10	12%
BE	23	28%
PSE	8	10%
HT	10	12%
Headache	25	30%
CPSP	8	10%
CE	4	5%
Total	84	100%

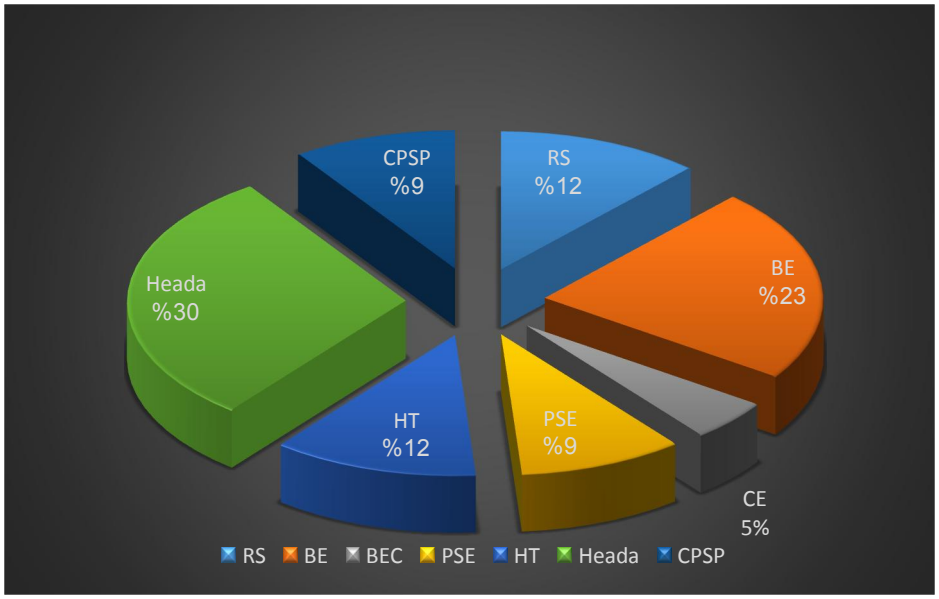

Figure (3): Numbers and percentages of post-ischemic stroke complications.

Table (26): shows ages distributions in the studied cases.

Com. \ Ages		N	min	max	Mean	SD	P. value
RS		10	45	79	58.3	11.88	0.001**
BE	BE	19	39	87	64.26	12.76	
	CE	4	60	82	73.75	9.95	
PSE		8	45	84	65.75	13.54	
HT		10	39	86	62.3	14.78	
Headache		25	39	87	66.72	12.79	
CPSP		8	45	67	55.8	9.76	

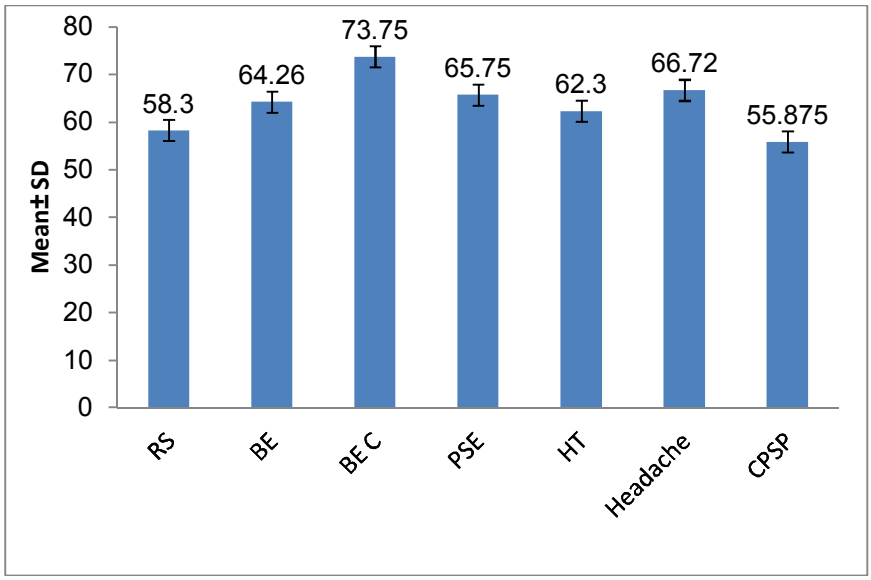

Figure (3): Mean of ages in the study group.

Table (28): Sex distributions in the studied cases.

Sex	Female		Male		Total	P.. value
	No	%	No	%		
RS	7	70.0%	3	30.0%	10	0.09
BE	12	63.2%	7	36.8%	19	0.1
BE C	1	25.0%	3	75.0%	4	
PSE	2	25.0%	6	75.0%	8	0.2
HT	5	50.0%	5	50.0%	10	0.8
Headache	12	48.0%	13	52.0%	25	0.7
CPSP	5	62.5%	3	37.5%	8	0.3

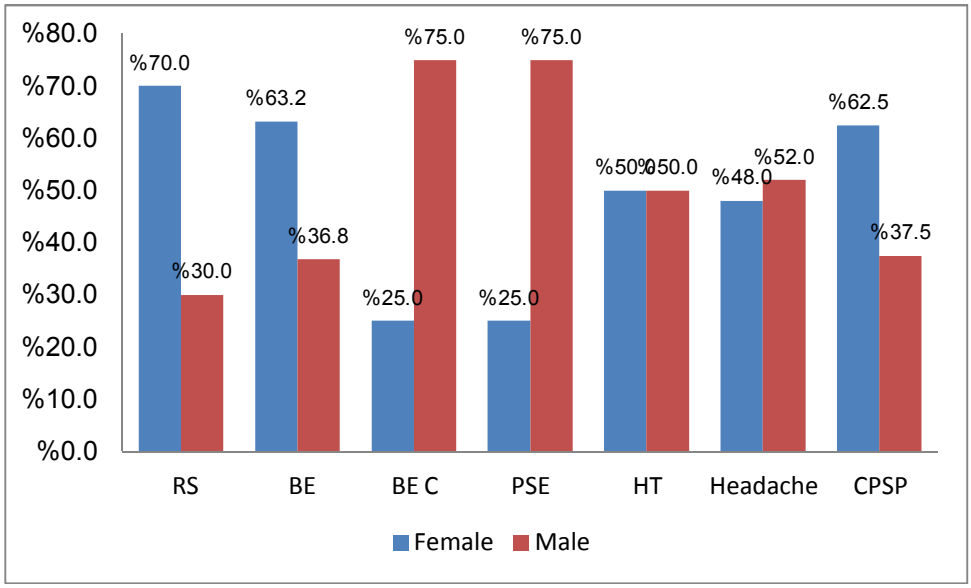

Figure (4): Percentages of sex differences in study group.

Table (29): Percentages of presenting complaints in acute ischemic stroke phase.

Sy. / Com.	Weakness		Ataxia		Aphasia		Behavior		Sensory		Anarthria		Convulsion		Total	p. value
	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
RS	8	80.0%	0	0.0%	0	0.0%	0	0.0%	2	20.0%	0	0.0%	0	0.0%	10	0.4
BE	10	52.6%	3	15.8%	0	0.0%	0	0.0%	4	21.1%	0	0.0%	2	10.5%	19	0.1
BE C	1	25.0%	3	75.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4	
PSE	3	37.5%	0	0.0%	2	25.0%	1	12.5%	0	0.0%	0	0.0%	2	25.0%	8	0.01*
HT	3	30.0%	1	10.0%	1	10.0%	0	0.0%	4	40.0%	0	0.0%	1	10.0%	10	0.2
Head.	11	44.0%	5	20.0%	2	8.0%	0	0.0%	5	20.0%	0	0.0%	2	8.0%	25	0.5
CPSP	2	25.0%	0	0.0%	0	0.0%	0	0.0%	6	75.0%	0	0.0%	0	0.0%	8	0.001**

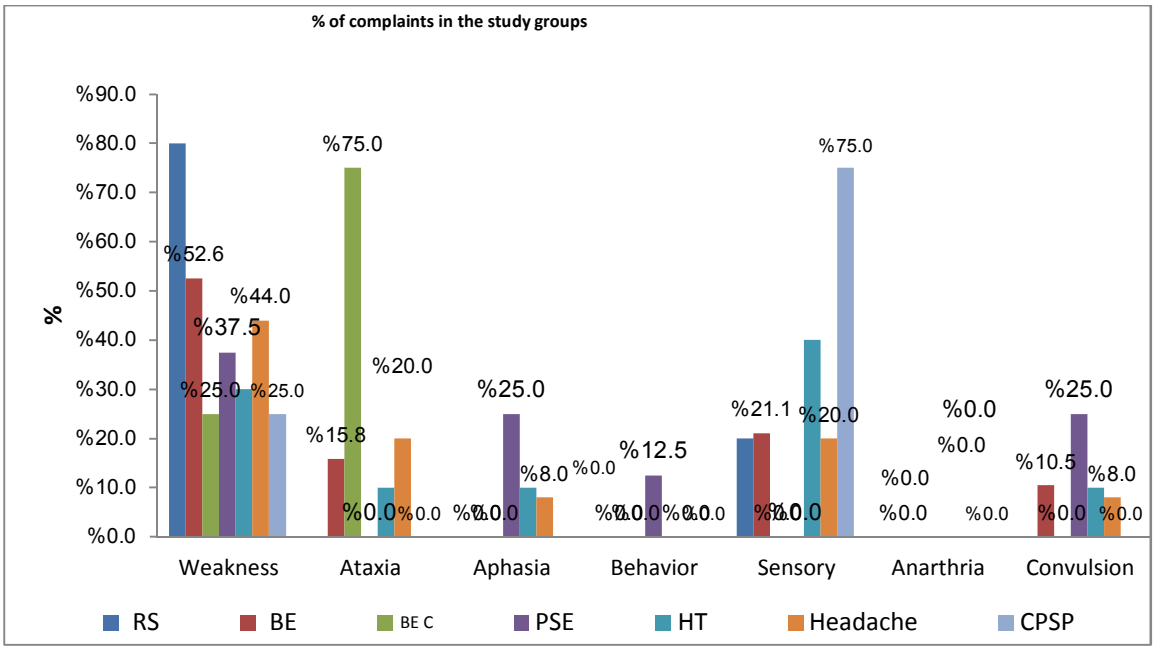

Figure (5) Percentages of presenting complaints in acute ischemic stroke phase.

Table (30): Numbers and percentages of risk factors in recurrent stroke as a neurologic post-ischemic stroke complication.

Recurrent Stroke	No		Yes		Total
	No	%	No	%	
DM	5	40.0%	6	60.0%	10
HTN	7	70.0%	3	30.0%	10
Smoking	9	90.0%	1	10.0%	10
Dyslipidemia	6	60.0%	4	40.0%	10
AF	7	70.0%	3	30.0%	10
Age	4	40.0%	6	60.0%	10

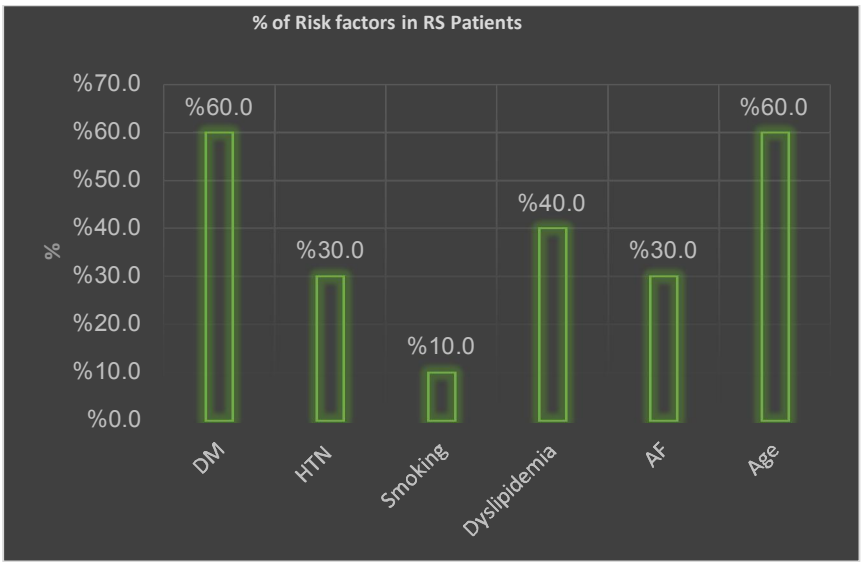

Figure (6): Percentages of risk factors of recurrent stroke as a neurologic post-ischemic stroke complication.

Table (31): Numbers and percentages of risk factors in brain edema as a neurologic post-ischemic stroke complication.

BE / RF	No		Yes		Total	P. value
	No	%	No	%		
DM	4	21.1%	15	78.9%	19	0.1
HTN	9	47.4%	10	52.6%	19	0.1
Smoker	18	94.7%	1	5.3%	19	0.1
Dyslip.	14	73.7%	5	26.3%	19	0.9
AF	14	73.7%	5	26.3%	19	0.2
Age	12	63.2%	7	36.8%	19	0.05*
Vasc	17	89.5%	2	10.5%	19	0.7

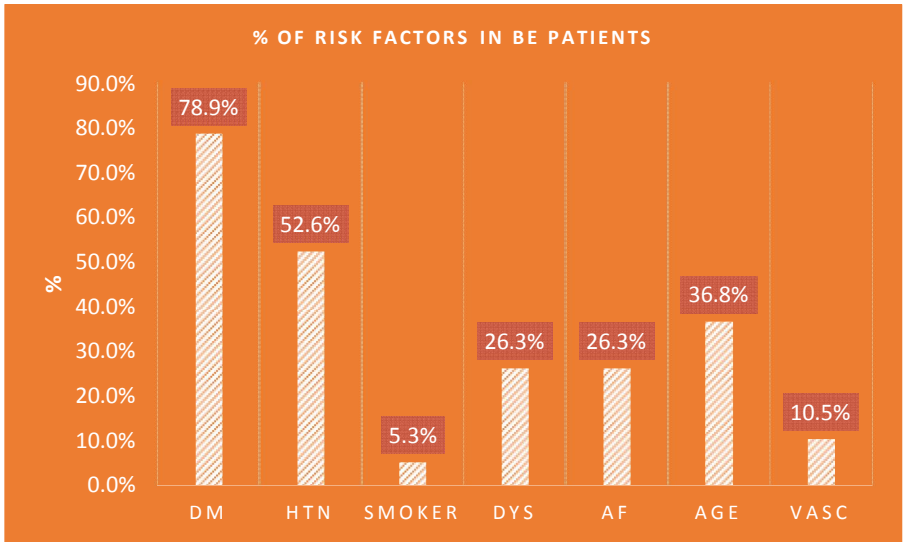

Figure (7): Percentages of risk factors of brain edema as a neurologic post-ischemic stroke complication.

Table (32): Numbers and percentages of risk factors in cerebellar edema as a neurologic post-ischemic stroke complication.

CE / RF	No		Yes		Total	p. value
	No	%	No	%		
DM	2	50.0%	2	50.0%	4	0.1
HTN	4	100.0%	0	0.0%	4	0.1
Smoker	3	75.0%	1	25.0%	4	0.1
Dyslipidemia	3	75.0%	1	25.0%	4	0.9
AF	4	100.0%	0	0.0%	4	0.2
Age	0	0.0%	4	100.0%	4	0.05*
Vacuities	4	100.0%	0	0.0%	4	0.7

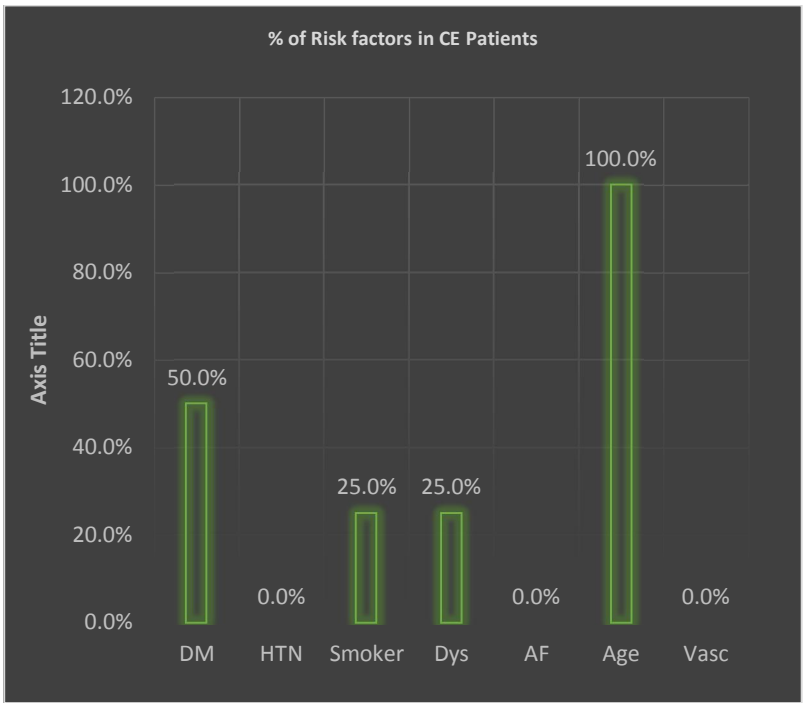

Figure (8): Percentages of risk factors of cerebellar edema as a neurologic post-ischemic stroke complication.

Table (33): Numbers and percentages of risk factors in post-stroke epilepsy as a neurologic post-ischemic stroke complication.

PSE	No		Yes		Total	p. value
	No	%	No	%		
DM	3	37.5%	5	62.5%	8	0.8
HTN	3	37.5%	5	62.5%	8	0.5
Smoker	7	87.5%	1	12.5%	8	0.001**
Dyslipidemia	6	75.0%	2	25.0%	8	0.7
AF	2	5.0%	6	75.0%	8	0.4
Age	5	62.5%	3	37.5%	8	0.7
Vasculitis	2	25%	6	75%	8	0.3

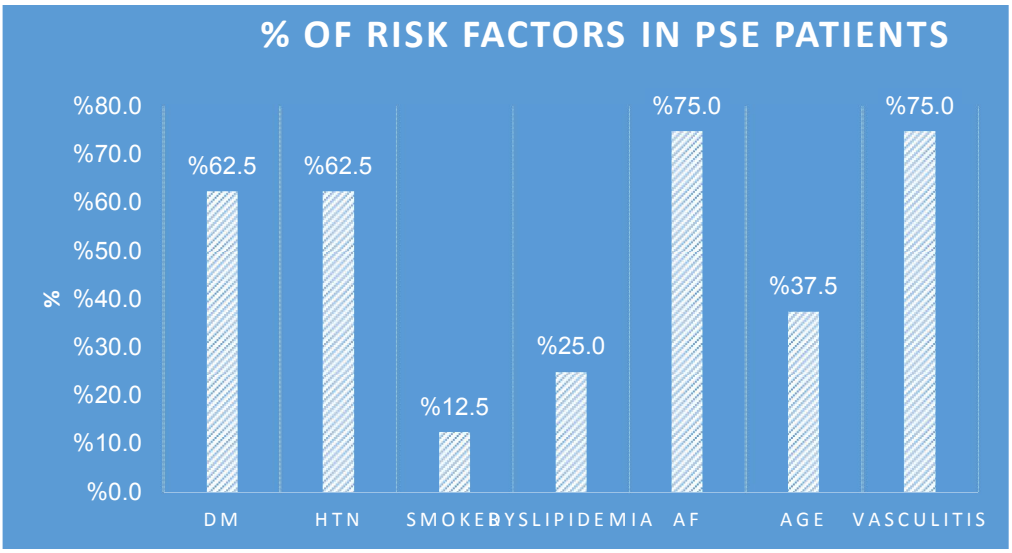

Figure (7): Percentages of risk factors of post-stroke epilepsy as a neurologic post-ischemic stroke complication.

Table (29): Numbers and percentages of risk factors in hemorrhagic transformation as a neurologic post-ischemic stroke complication.

Hemorrhagic Transformation	No		Yes		Total	P Value
	No	%	No	%		
DM	4	40.0%	6	60.0%	10	0.1
HTN	3	40.0%	7	70.0%	10	0.5
Smoking	10	100.0%	0	0.0%	10	0.05*
Dyslipidemia	8	80.0%	2	20.0%	10	0.8
AF	**3**	**30%**	**7**	**70%**	**10**	**0.5**
Age	4	40.0%	6	60.0%	10	0.2
Vasculitis	8	80.0%	2	20.0%	10	0.1

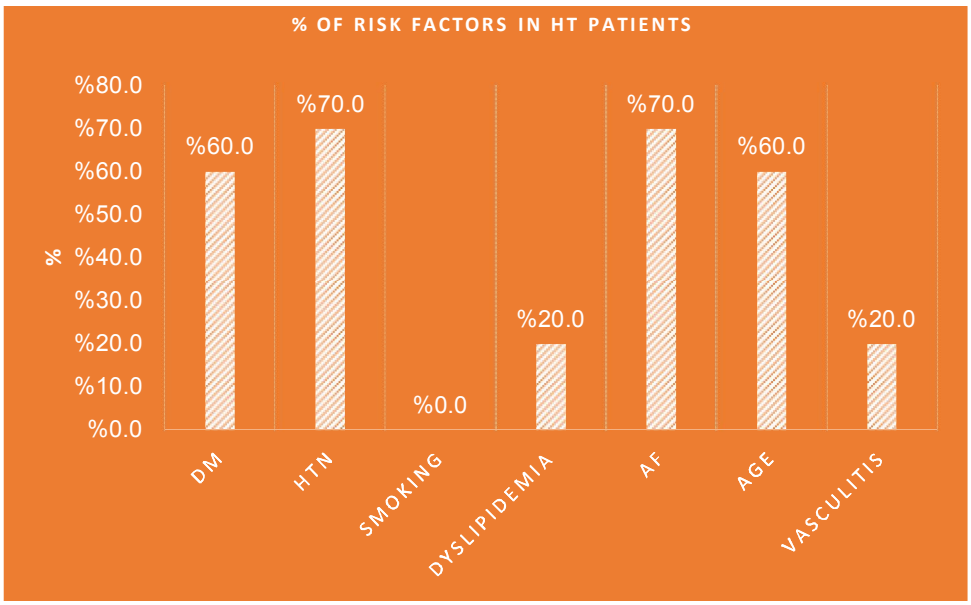

Figure (7): Percentages of risk factors of hemorrhagic transformation as a neurologic post-ischemic stroke complication.

Table (35): Numbers and percentages of risk factors in headache as a neurologic post-ischemic stroke complication.

Headache	No		Yes		Total	p. value
	No	%	No	%		
DM	16	40%	9	60%	25	0.7
HTN	9	48.0%	16	52.0%	25	0.9
Smoking	20	80.0%	5	20.0%	25	0.8
Dyslipidemia	19	76.0%	6	24.0%	25	0.7
AF	3	30%	7	70.0%	25	0.4
Age	11	44.0%	14	56.0%	25	0.05*
Vasculitis	24	96.0%	1	4.0%	25	0.3

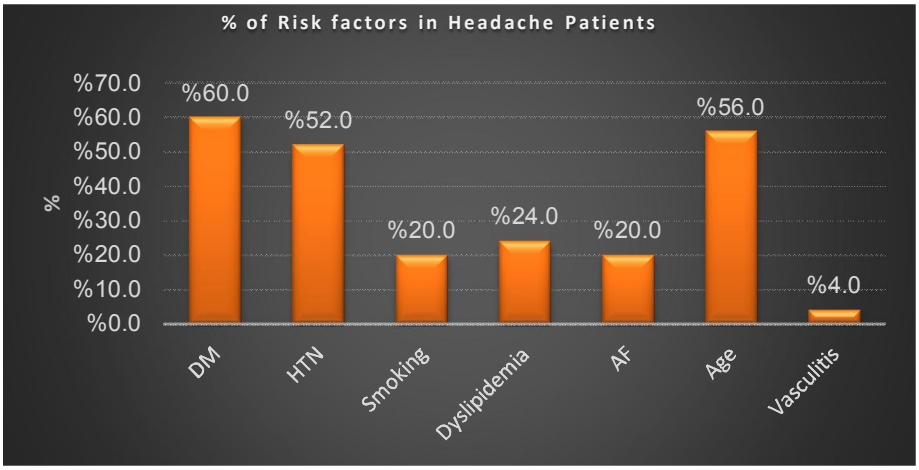

Figure (11): Percentages of risk factors of headache as a neurologic post-ischemic stroke complication.

Table (36): Numbers and percentages of risk factors in central post-stroke pain as a neurologic post-ischemic stroke complication.

CPSP	No		Yes		Total	p. value
	No	%	No	%		
DM	5	62.5%	3	37.5%	8	0.1
HTN	6	75.0%	2	25.0%	8	0.1
Smoking	7	87.5%	1	12.5%	8	0.5
Dyslipidemia	6	75.0%	2	25.0%	8	0.6
AF	8	100.0%	0	0.0%	8	0.1
Age	6	75.0%	2	25.0%	8	0.2
Vasculitis	4	50.0%	4	50.0%	8	0.001**

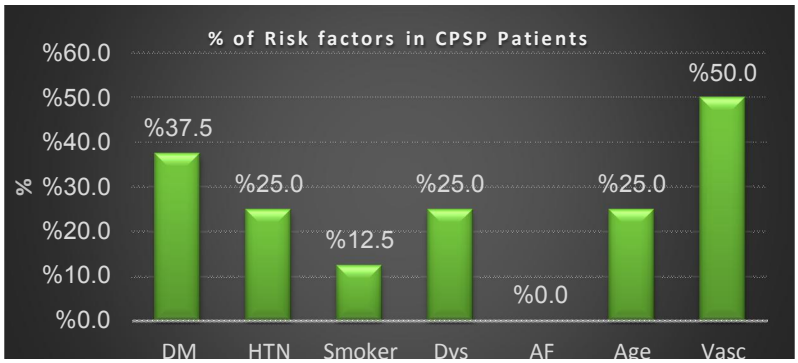

Figure (12): Percentages of risk factors of central post-stroke pain as a neurologic post-ischemic stroke complication.

Table (37): Shows number and percentages of acute stroke subtypes in the studied cases.

ST / Comp.	Thrombotic		Embolic		Total	P. value
	No	%	No	%		
RS	7	70.0%	3	30.0%	10	0.7
BE	16	84.2%	3	15.8%	19	0.4
CE	3	75.0%	1	25.0%	4	
PSE	5	62.5%	3	37.5%	8	0.4
HT	6	60.0%	4	40.0%	10	0.2
Head.	19	76.0%	6	24.0%	25	0.8
CPSP	6	75.0%	2	25.0%	8	0.9

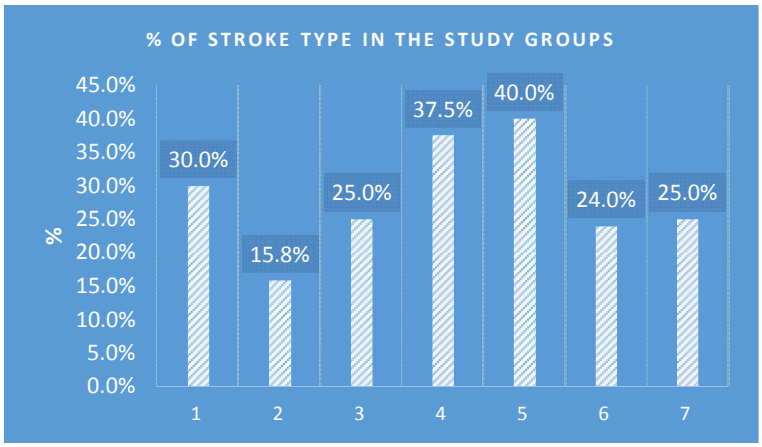

Figure (13): Shows percentages of acute stroke subtypes in the studied cases.

Table (38): Shows stroke size in centimeter in the studied cases.

Size in CM / Compl.		N	min	max	Mean	SD	P Value
RS		10	2	6	3.5	1.58	0.001**
BE	BE	19	1	6	3.37	1.6	
	CE	4	2	5	3	1.4	
PSE		8	1	5	2.88	1.55	
HT		10	2	6	4.8	1.3	
Headache		25	1	6	3.43	1.58	
CPSP		8	1	6	4.13	1.8	

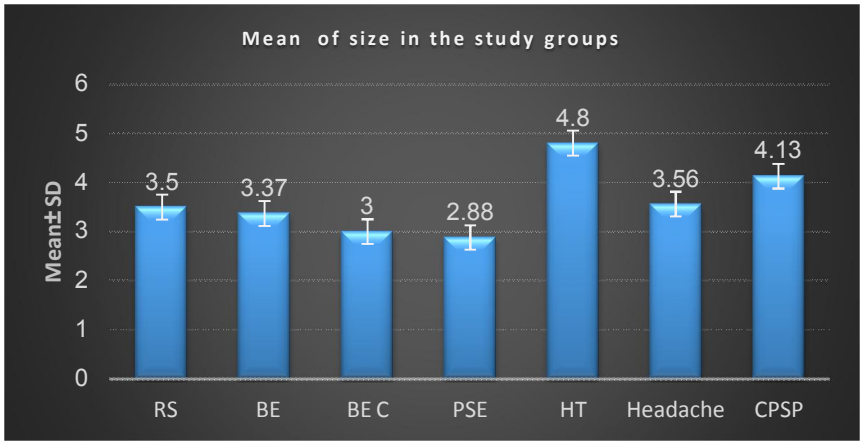

Figure (14): Shows mean stroke size in the studied cases.

4. Discussion:

This is observational retrospective study on 84 patients 46 males 55% and 38 females 54% who were recruited from neurology department of Al-Hussein and Bab Al Shaaria university hospitals and Arab Medical Center aged 45 to 87 years during period from January 2016 to June 2016. As male gender is a powerful risk factor for ischemic stroke, so number of males was more than females, this is in agreement in the study of (Towfighi & Saver, 2011), (Biller, 2012), (Roger et al., 2012) and (Feigin et al., 2014).

As regard age age whom developed post-ischemic stroke complications, age was the most common risk factor for these complications and also was the most important risk factor for developing recurrent stroke beside also, diabetes mellitus was common and important risk factor for stroke recurrence, this study in harmony with the study of, (Toni et al., 2005), (Sacco et al., 2012) and (Mohan et al., 2015).

As regard cerebral and cerebellar edema the most important risk factor the ischemic stroke size which indicate that when the size of stroke is large this leads to more percentage of developing cerebral or cerebellar and some cases were developed malignant middle cerebral artery edema and it was a sign of bad prognosis particularly in old age patients with diabetes mellitus and hypertension (particularly in cerebellar edema all patients were old ages), and there was a good and highly statistical significant relationship between development of cerebral edema and occurrence of post ischemic stroke complications, P Value was 0.001, this study going with studies of (Finlay and Benson, 2010), (Lindsberg and Roine, 2012), (Moseley et al., 2014) and (Baldauf et al., 2015).

In cases of post-ischemic stroke epilepsy was by 9 percent the most valuable and important risk factors was atrial fibrillation, this is true because atrial fibrillation is high risk factor of ischemic stroke occurrence in patient with rheumatic heart disease with or without mitral stenosis provided that enlargement left atrial dimensions and cardio-embolic stroke is small and usually dislodge and go away near the cortex which leads to cortical irritation and development of post-stroke seizures, this study in harmony with the studies of (Camilo and Goldstein, 2013), (Silverman et al., 2011), and early seizures recurrence were occurred with obvious cause except the theory of inflammatory mediators or post-stroke fibrosis and gliosis this is also agreed with the study of (Anderman et al., 2015).

In hemorrhagic transformation the main risk factors were size of the stroke in acute phase, degree of control of hypertension, the cardio-embolic stroke and age of patients during acute stroke event, in this study patient was affected by atrial fibrillation by 70%, by large size during admission and old age were affected by 60% and hypertension by 70%, so, our study in agreement with the studies of (Jaillard et al., 2009), (Kidwell et al., 2012), (Campbell and Christensen, 2014), (Hornig et al., 2014) and (Sussman and Connolly, 2014). But disagree with the study of (Silver et al., 2015), and this may be duo to short duration of our study or small number of the studied cases or limited area of research.

As regard post-stroke headache the number of affected cases were 25% it constituents about one third of cases 30% and this in harmony with the study of (Portenoy et al., 2004). Also the most common risk factor for post-stroke headache were hypertension and old age beside specially in patients with uncontrolled diabetes mellitus this in agreement with the studies of (Portenoy et al., 2004), (Cohen and Rothner, 2013).

In post-stroke central pain or central thalamic pain it was affect cases number 8 cases it constituents 9% this is in agreement with the study of (Segatore, 2006) and (Andersen et al., 2014). Also the most notable risk factors in developing central post-stroke pain was vasculitis because it evokes both central and peripheral pain pathways and diabetes mellitus affects cases by 37.4% and this is disagree with the study of (Costa and Silva, 2015) and this may be duo to small sample of the present study and lake of equipment to determine the exact time and quality of pains especially in old aged patients with diabetes mellitus.

Finally, from results in tables and figure above there is significant correlation between developing of post-stroke neurological complication and some risk factors like, age, diabetes mellitus, degree of control of hypertension by anti-hypertensive drugs presence of cardiac arrhythmia like atrial fibrillations. Dyslipidemia smoking and vasculitis were not a strong predictors of post-stroke neurological complication in the present study, so incidence, risk factors and orientation to these catastrophic complication is of paramount importance and this is the main purpose of our study.

Conclusion:

There is no argument that acute ischemic stroke often seen a lot in many medical clinics and ER, but very few versa properly diagnosed by general practitioners or non-neurologist owing to multiple clinical symptoms and signs during case presentation the increasing knowledge of these complications and managements of acute ischemic stroke either medical or neurological, for the purpose of early diagnosis and treatment of these complications. This is true because, these multiple neurologic complications make the

patients handicapped, out of action, crippled, detached from the surrounding environment and delay in full recovery, rehabilitations and bad quality of life.

Recommendation:

1- Because of lake of definite treatment of acute ischemic stroke, little evidence-based data to guide management, mortality and lifelong morbidity, a teamwork specialized in the field of prevention of neurologic and non-neurologic of early or late complications in the setting of acute stroke phase is recommended to set optimum proper treatments, focus, widen the scope and differential diagnoses taking in consideration patient's complaints and clinical presentation.

1- Neurologic complications after stroke are usually seen in medicine but are hardly to diagnose by non-experienced neurologist it is always necessary to find out the subtle neurological or general signs, whenever we observe. In addition, we recommend in another study that, it is a must to do a detailed premorbid history, risk factors and pathogenesis of these complications putting in mind strict guidelines for specific treatment of every complication per see. However, these neurologic complications cannot be predicted from neurologic course alone.

2- Early detection of factors influence stroke prognosis and mortality as stroke severity, stroke mechanism, infarct location, comorbid conditions, clinical findings and related complications of stroke. In addition, interventions such as thrombolysis, stroke unit care, and rehabilitations can play a major role in the outcome of ischemic stroke, not the neurologic complications alone.

3- Also, we recommend that to do another study with a large group number, further clinical studies with different variables, continuous and closely monitored follow-up of these patients in a longer time more than this our present study and detailed neurologic symptoms and signs taking in consideration relationships between neurologic findings and its impact on the patient quality of life.

4- We recommend use of advanced neuroimaging techniques such as functional MRIs and CT angiography and advanced laboratories for better understanding the pathogenesis and management of these complications.

5- By observation, Physical rehabilitations, psychiatrist, group therapy, occupational or speech therapy can be extremely beneficial for affected patients to improve psychological states, fast recovery and reinforce good quality of patient's life.

References

1. Anderman F, Olivier A, and Melanson D, (2015): Post-Stroke Seizures cases report. A study of 15 patients. In: Advances in Epileptology. New York, NY: Raven. 35–38.
2. Andersen G, Vestergaard K, Ingeman-Nielsen M, et al., (2005): Incidence of central post-stroke pain. Pain. 61:93-123.
3. Baldauf J, Oertel J, Gaab M, et al., (2015): Surgical and medical management of patients with massive cerebellar infarctions: results of the German-Austrian Cerebellar Infarction Study. J Neurol. 59: 45-124.
4. Bounds JV, Wiebers DO, Whisnant JP, et al., (2011): Mechanisms and timing of deaths from cerebral infarction. Stroke.12:474–678.
5. Camilo O and Goldstein L, (2013): Seizures and epilepsy after ischemic stroke. Stroke.35: 75-1276.
6. Cohen P and Rothner D, (2013): Incidence, types, and management of headache in Patients ischemic infarction versus benign brain tumors Oncology 3:23-38.
7. Cordonnier C, Henon H, Derambure P, et al., (20015): Early epileptic seizures after stroke are associated with increased risk of new-onset dementia. J Neurol Neurosurg: Psychiatry. 78:16-514.
8. Costa F and Silva A, (2015): Molecular and cellular mechanisms underlying the Expression of the keratinocyte lipid transporter ABCA12 in pain management after stroke in developing and reconstituted human brains. Am J Pathol.54:93-122.
9. Davenport J, Dennis M, Wellwood I, et al., (2009): Complications after acute stroke. Stroke. 3: 43-49.
10. Diringer S, Kasner S, Wolk A, et al., (2013: Middle cerebral artery territory infarction and early brain swelling, progression and effect of age on outcome. Mayo Clin Proc. 73: 36-453.
11. Feng W, Hendry M and Adams J, (2015): Risk of recurrent stroke, myocardial infarction, or death in hospitalized stroke patients. Neurology. 74: 76-294.
12. Furlan A, Higashida R, Wechsler L, et al., (2010): Intra-arterial alteplase for acute ischemic stroke. The PROACT II study: a randomized controlled trial. Prolyse in Acute Cerebral Thromboembolism. JAMA 282: 11-2003.
13. Johnston C, Gress R, Browner S., (2013): Short-term prognosis after emergency department diagnosis of TIA. JAMA. 284: 2901–06.
14. Kalra L, Yu G, Wilson K, et al., (2011): Medical complications during stroke rehabilitation, Stroke. 26:990–994.
15. Lovett K, Coull J and Rothwell M, (2013): Early risk of recurrence by subtype of ischaemic stroke

in population-based incidence studies. Neurology. 62:79-564.
16. Mackey J, Kleindorfer D, Sucharew H, et al., (2014): Population-based study of wake-up strokes. Neurology 76(19):1662–1667.
17. McManus J, Pathansali R, Stewart R, et al., (2014): Delirium post-stroke. Age Ageing 36: 18-623.
18. Mohan K, Wolfe D, Rudd G, et al., (2013): Risk and cumulative risk of stroke recurrence: a systematic review and meta-analysis. Stroke. 42:54-234.
19. Mohan K, Crichton L, Grieve P, et al., (2015): Frequency and predictors for the risk of stroke recurrence up to 10 years after stroke: theSouth London Stroke Register. J Neurol Neurosurg: Psychiatry.
20. Pendlebury T and Rothwell M, (2015): Risk of recurrent stroke, other vascular events and dementia after transient ischemic attack and stroke. Cerebrovasc Dis. 27 (suppl 3): 23-98.
21. Portenoy R, Abissi J, Lipton B, et al., (2004): Headache in cerebrovascular disease. Stroke. 15: 1009–1012.
22. Silverman E, Restrep L and Mathews C, (2014): Post stroke seizures. The Arch Neurology 6: 98-165.
23. The National Institute of The Neurological Disorders and Stroke (2000): rt- PA stroke Study Group. Intracerebral haemorrhage after intravenous t-PA therapy for ischemic stroke. Stroke. 28: 18-2105.
24. Vitanen M, Eriksson S and Asplund K, (2011): Risk of recurrent stroke. During long-term follow-up after stroke. Eur Neurol 8:27-31.
25. Von Kahds A, Ferry D, Lin B, et al., (2015) Spontaneous haemorrhagic transformations and common risk factors. J. Clin, Arca. 26-532.

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