International Journal of Enhanced Research in Medicines & Dental Care (IJERMDC),
ISSN: 2349-1590, Vol. 5 Issue 6, June-2018, Impact Factor: 1.338

Value of CT scan in Detecting the Incidence of Stroke in Diabetic Patients

Wadhah M. Hammo[1], Nashee N. Al-Hafidh[2]

[1,2]M.B. Ch. B. D.M.R.D., X. Ray Department in Ibn Sina Teaching Hospital, Mosul/IRAQ

ABSTRACT

To study the value of Computed tomography (CT) scan in detecting the incidence of stroke in diabetic patients. The Study was conducted in the spiral CT. scan unit in Ibn-Sena teaching hospital from November 2005 to June 2006. Three hundred fifty patients was analyzed who had stroke features of all age groups .Method: All patients examined by spiral CT. scan (siemens soma torn plus 4). Also patients examined for blood glucose and serum cholesterol levels. Result: Out of 350 patients, 182 patients (52%) male, 168 patients (48%) female male/female ratio is 1.1 /1. CT. scan provide that 256 patients (73.14%) were ischemic infarction, 22 patients (6.28%) were Hemorrhagic infarction, and 39 patients (11.14%) were intracerebral hemorrhage. 136 patients (38.8%) were diabetic, in 90 cases of diabetics patients the level of blood glucose was above 10.1mmol/L . and 80 patients(22.8%) were the blood cholesterol level >or =220 mg/100 ml..Conclusion: CT. scan is an established tool for diagnosis of ischemic or hemorrhagic stroke. Diabetes mellitus, hypertension and hypercholesterolemia are clearly the most important risk factor for acute stroke.

Keywords: Value of CT. , Diabetic and hypertension patients, risk factor.

INTRODUCTION

Definitions were as follows: Stroke due to cerebral infarction: acute onset of a focal neurological deficit lasting longer than 24 hours, in which Computed tomography (CT) scan excludes causes other than cerebral infarction, Those with deficits lasting less than 24 hours , CT scan or magnetic resonance imaging evidence of infarction were not included [1]

Vascular Distribution:

The arterial supply of the brain is derived from the internal carotid and vertebral arteries, Internal carotid arteries in the brain give the following branches Anterior cerebral artery Pass medially Supply medial and superolateral of cerebral hemisphere, Middle cerebral artery Pass laterally supply internal surface of cerebral hemisphere. Vertebral arteries Originating from the subclavian arteries, the basilar artery form by junction of two vertebral arteries just above the foramen magnum , the posterior cerebral artery terminal branch of the basilar artery. The anastomosis between right and left internal carotid arteries, their branches and posterior cerebral arteries form circle of Willis [2].

Patho Physiology:

Eighty percent of strokes are ischemic and 15% hemorrhagic. The Clinical examination alone cannot distinguish ischemic from hemorrhagic stroke; CT scan or magnetic resonance brain imaging is required [3].The Cerebral edema due to ischemia is initially cytotoxic, characterized by intracellular water accumulation, and later vasogenic, in which water moves across the blood-brain-barrier (BBB) into the extra cellular interstitial space[4]). Energy is produced in the brain from the oxidative metabolism of the glucose. This requires constant supply of both glucose and oxygen. An interruption of blood flow decrease oxygen delivery to the brain cells result decrease adenosine triphosphate (ATP) production, the ATP- dependent membrane -based ion pump fails, leading to influx of sodium (Na), calcium (Ca) and extra cellular free water. This leads to development of cytotoxic edema[5] Computed tomography findings of hypoattenuation are thought to represent an increase in the net water content of the involved brain parenchyma. This increase in water content could be related to cytotoxic edema, vasogenic edema, or both [6].Computed tomography reflects some underlying patho- physiological process (such as cellular edema or severity

of cell damage) that influences outcome, or is it simply a marker of the severity or size of the stroke[7] Today, a wide range of traumatic and nontraumatic emergency conditions are quickly and accurately diagnosed with helical computed tomography [8]

The role of neuroimaging for acute stroke has been one of exclusion of lesions that mimic ischemic stroke (eg, intracerebral hemorrhage, subdural hematoma, cerebritis, tumors and arteriovenous malformations) [9'18'11].

CT. features of stroke:

Specific CT patterns of findings are typically seen in ischemic stroke and can be analyzed more accurately with the combined use of multisection CT and MR imaging**[12].** Computed tomography findings obtained within the first (three to six) hours of cerebral ischemia, when present, are often subtle. Computed tomography will differentiate infarct from hemorrhage up to at least five days after stroke. There is some uncertainty as to how quickly small hemorrhage lose their characteristic whiteness and become isodense and then hypo dense compared with normal brain, and so indistinguishable from an infarct. Certainly by 10 days, small hemorrhage will be indistinguishable from infarcts. Recent hemorrhage are hyperdensity area (white) and usually rounded and space occupying. Infarction is usually hypodensity lesion in the territory area of the occluded vessels associated with edema, normal CT. scan excludes hemorrhage and, in the absence of an alternative, infarction is assumed called clinical stage infarction. Intravenous contrast is not normally required and may cause confusion **[13].** Computed tomography is the primary imaging technique for cases of acute stroke and it was used to exclude intracranial hemorrhage before the allocated treatment was administered[14,15,16].

It is important that radiologists be adept at recognizing the subtle findings of cerebral infarction in the first few hours after symptom onset(17). Nonetheless, at most institutions, CT remains the initial imaging study for evaluation of acute stroke because it is widely accessible, convenient, has a short imaging time, and is sensitive for detection of hemorrhage **[18,19].** Other findings include hypodensity with loss of gray-white differentiation and effacement of sulci. Computed tomography indicators of acute ischemia are related to edema, which causes a decrease in the attenuation of involved structures. Density changes have been found to be the most frequent sign of early ischemia (20). The important CT findings during the early stages of cerebral ischemia can be classified as:

(a).Hypo attenuating appearance of gray matter structures,(b), Mass effect, and ,c ,Presence of one or more hyper attenuating arteries.

Any combination of these findings may be present, or all may be absent (clinical stage)(21). Hemorrhagic infarction (Intracerebral hemorrhage) CT scan demonstrated an area of hyperdensity within the brain parenchyma with or without extension into the ventricles or subarachnoid space or, for scans performed beyond (1) week, an area of attenuation with ring enhancement after injection of contrast due to hyperemia between normal and abnormal brain tissue(22,23).

PATIENT AND METHODS

The availability of spiral computed tomography (CT) has revolutionized the diagnostic approach to patients suspected stroke. Three hundred fifty patients of stroke covering all age groups, were examined by CT. in the department of radiology CT. unit in Ibn-Sena teaching hospital in Mosul city between November 2005 to June 2006, the level of fasting blood sugar and serum cholesterol were examined in laboratory of the same hospital .

The spiral CT scanner used was (siemens somatom plus 4) made in Germany, Multislice helical CT. the body from many angles producing three dimensional images. the patient lying on the CT. table and the head examined on supine position. The procedure takes few minutes, so rapid scanner minimize the risk of movement artifact, gives a marked improved spatial resolution. Sedation was used for children under 6 years of age or general anesthesia if needed.

RESLUTS

Spiral CT scan examination was performed on three hundred fifty cases of stroke of all age groups. Most of the cases of the stroke occurs in old age group 232 patients (66.28%) were above 60 years of age, 121 patients (34.57%) were between (60-69) years of age and 111 patients (31.71%) were more than 70 years of age (Table:1). The mean age standard deviation of the stroke was (60±13.4) years and the risk incidence rate of the age was (1.09/10) years.

Regarding Sex distribution 182 patients (52%) who had stroke were male, and 168 patients (48%) were female so male to female ratio was 1.1:1 (Table: 2). Regarding the CT. scan finding showing that 256 patients (73.14%) were ischemic infarction, 22 patients (6.28%)

were hemorrhagic infarction,39 patients (11.14%) were had intracerebral hemorrhage and 33 patients (9.44%) were negative finding(Table:3). The study showing 268 patients (84.6%) of infarction were unilateral (128 patients 40.0%in the left and 140 patients 44. 6% in the right) and 49 patients (15.4%) were bilateral (Table 4).

Other finding associated with stroke patients ,136 patients (38.8%) were diabetic, 144 patients (41.1%) were hypertensive(the blood pressure >or =140/100 mmHg ,80 patients (22.8%) have high cholesterol level > 220mg/100 ml. and 75 patients (21.4%) have history of smoking ,15 patients (4.28%) have no history of any disease (Table: 5). The result of blood glucose level in diabetic patients, 90 patients range > 10 mmol/L. (Table:6).

Table1: Shows the age distribution of the 350 cases of acute stroke patients Examine by CT. scan

Percentage	No of cases	Age
0.28%	**1**	**0-9 year**
0.85%	3	**10-19 year**
2.8%	10	**20-29 year**
4.57%	16	**30-39 year**
7.14%	25	**40-49 year**
18 %	63	**50-59 year**
34.57%	121	**60-69 year**
31.71%	111	**70 > year**
100%	**350**	**Total**

Table 2: Shows the gender distribution of the 350 patients with acute stroke Examine by CT. scan

Percentage	No. of cases	Sex
52%	182	**male**
48%	168	**female**
100%	350	**Total**

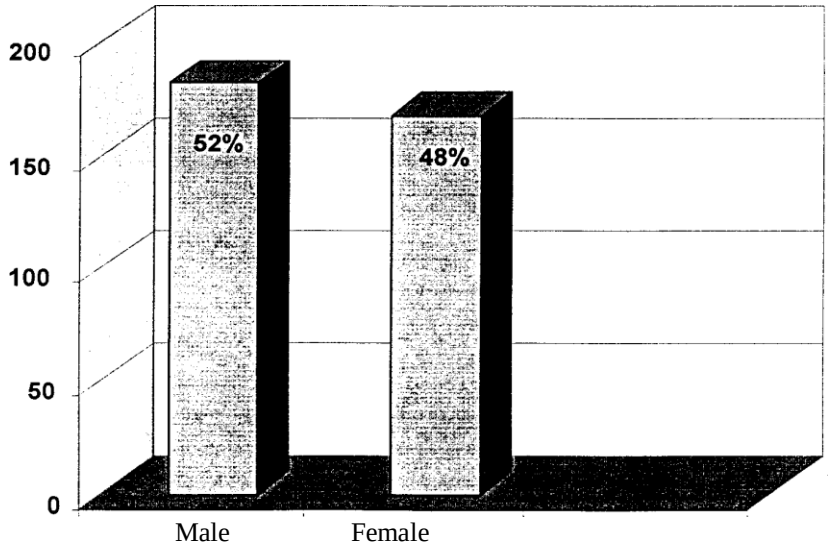

Fig. (1): Histogram shows gender distribution of 350 stroke patients

Table 3: CT scan finding of 350 acute stroke patients

Percentage	No of cases	CT scan finding
73.14%	256	**Ischemic infarction**
6.28%	22	**Hemorrhagic infarction**
11.14%	39	**intracerebral hemorrhage**
9.44%	33	**Negative finding**
100%	350	**Total**

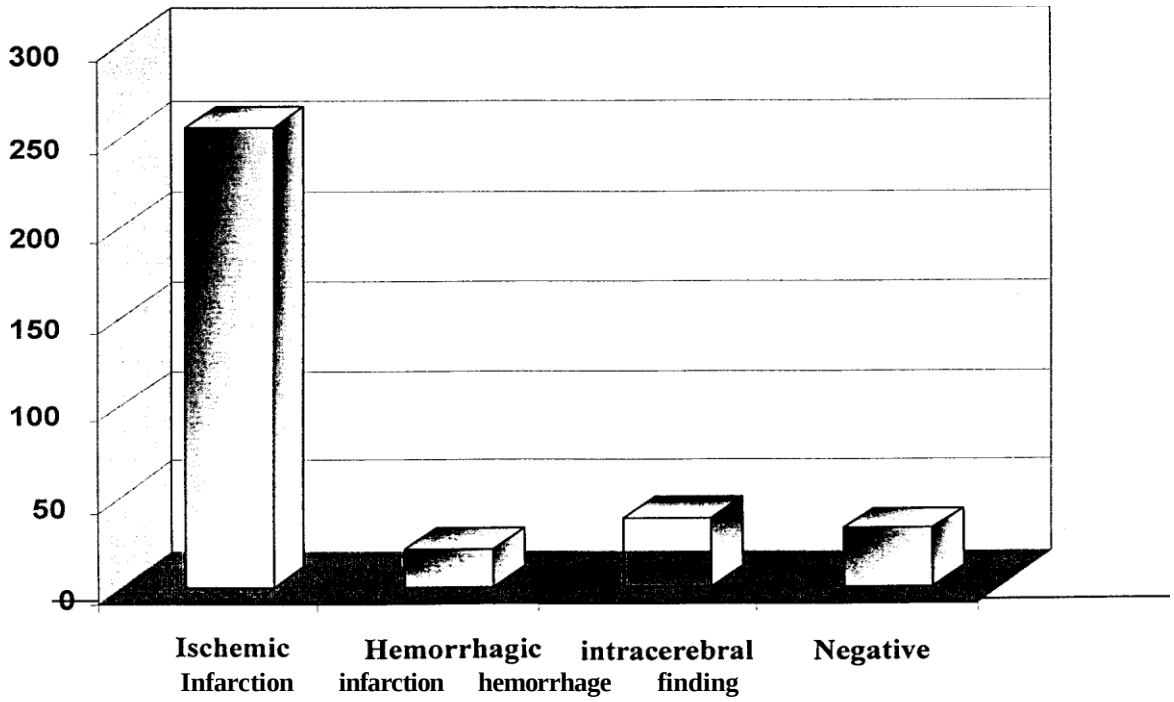

Fig. (2): Histogram shows subtype of acute stroke of 350 patients examined by CT. scan

Table 4: Shows the side and distribution of the infraction in NO. of cases

Total unilateral **268**	128	Left side infarction
	140	Right side infarction
	49	***Bilateral***
	33	Negative finding

Table 5: Shows the predictor risk factor of acute stroke

percentage	No of cases	Predictor risk factor
38.8%	136	**Diabetic fasting glucose level >6.1 mmol/liter**
41.1%	144	**Hypertension blood pressure >140/100mmHg**
22.8%	80	**Hypercholesterolemia serum cholesterol level > 220mg/100m1.**
21.4%	75	**Smoking**
4.28%	15	**Normal patients**
100%	350	total

Table 6: Distribution of diabetic patients according to blood glucose level out of 350 patients

percentage%	No, of cases	m mol/L.	Blood glucose level
7.35%	**10**		**6.1-8**
26.47%	36		**8.1 -10**
66.17%	90		10.1>
100%	136		**Total**

DISCUSSION

Computed tomography (CT) examination is highly specific in the detection of irreversible ischemic brain damage within the first hours of stroke onset [24] . The ability to rapidly and accurately depict the location and extent of acute brain ischemia is of major clinical importance, beside the prognostic value of depicting acute brain ischemia it also affects the therapeutic decision in particular regarding the risk-to-benefit ratio of possible thrombolytic therapy [28] . CT. scan Imaging of the brain is the currently recommended imaging technique for establishing the diagnosis of stroke because of speed, ability to exclude hemorrhage ,wide available and clinician familiarity with the procedure [25,26]. The best time to image stroke routinely with CT scan is as soon as possible after the event to confirm the diagnosis ; nothing is gained by waiting ,and much may be lost [27] . Regarding the age, it is well known that age is important risk factor of stroke. During the CT. scan examination of the 350 stroke patients found that the incidence of stroke double each decade over the age of 45 years this has been suggestive that age is proxy marker for duration of risk factor exposure.

Studies by Helen et al [27], Kazunari et al. [28], Davis et al. [29] ,Barry et al [30] is showing that age-adjusted stroke incidence risk rate are (1.06/year, 1.9/10 years, odd ratio of 1.00-1.29/year and 1.65/5year) respectively. In our study the result was 1.09/ 10 years which is more or less the mean results of the above authors .Study by H Tohgi et al. [31], salah-eddine et al. [32] and wade et al[25] showed that the mean age standard deviation for stroke is (65±12 years, 71±12.6 years and 71±14.7 years) respectively. In our study the result was 60±13 years (Table:7),which is slightly lower than above authors .Regarding the sex distribution study by Amanda et al. [22], Toshiyuki et al [33] showed that male/female incidence ratio rate 1.34:1 and 1.8:1 respectively CT. scan examination of the stroke patients found that in our study the gender ratio male/female 1.1:1 similar to result of above authors. CT. scan finding of the acute stroke patients, was most of the cases of the brain infarction were ischemic about 70% to 80% of acute stroke[34] and intracerebral hemorrhage account approximately 10% of all strokes(35). Study by Amanda et al.[22], shows that 72.5% ischemic infarction and Our study presented 256 patients (73.14%) were ischemic infarction . Study by yuriko et al. [37], Amanda et a1.[22], Thomas et al.[38] and Joanna et al.[3],is showing that incidence of intracerebral hemorrhage in acute stroke is(13.5%,10%,14.5%,13.7%,and 6%)respectively. In our series the result was 39patients (11.14%) (Table: 8). Study by H Tohgi et al.[31] show that the site of the cerebral infarction was 88% unilateral and 12% bilateral.

In CT. scan examination of the stroke patients the result in our study was268 patients (84.6%) the infarction unilateral and 49 patients (15.4%) the infarction bilateral.Diabetes mellitus is well established risk factor for stroke[38]. Diabetic subject has a 3-to 6- fold increased risk for stroke compared with non diabetic subject [39]. The role of diabetes in developing stroke has been well documented in general population in particular the elderly patients (I)* Diabetes promote cerebral atherosclerosis and may increase hypertension and coronary heart disease which are the major risk factor for stroke [40]. Diabetes, especially uncontrolled or untreated diabetes, can cause damage to both the large and small blood vessels, resulting in the blood vessel walls becoming stiff, narrow and furred atherosclerosis.

This greatly increases the risk of stroke. In fact, stroke is responsible for about 15 percent of deaths in people with non insulin dependent diabetes[41]. Several studies have found increased risk of stroke in daibetic patients compared with non diabetic. Studies by karl et al.[42], Toshiyuki et al.[33], Milton Alter et al.[43], Tohgi et al.[31], Salah-Eddine et al.[32],Brett M. Kissela et al.[44] and H Jorgensen et a1.[45] showing that percentage of the diabetic in stroke patients was (20.2%, 16.9%, 31.3%, 16%, 21%, 37-42% and 20%) respectively, In our series the result was 136 patients (38.8%).(Table: **9).** This is due to diabetes mellitus which is common in our population and it is prevalence rate increase with age [46]. The high prevalence of non insulin dependent diabetes mellitus is consistently associated with a high prevalence of obesity in Arab societies [47]. The CT. scan examination results of our study was most of the diabetic stroke patients the blood glucose level> 10. mmol/L (Table:6) .This result is similar to Sarah.E et al.[48] study found that the stroke risk was nearly doubled in patients with impaired glucose tolerance level between (7.5-llm mol/L)and nearly tripled in diabetic patients > 11 mmolfL. For the cholesterol level The concentration of cholesterol matters, because the higher it is the more of it is deposited as waxy plaques on the walls of arteries cause narrowing of these arteries . This can affect any blood vessel and if it is an artery to the brain, then a stroke can happen. Elevated cholesrol levels have been found to be a risk factor for stroke in meta-analysis.

The association between serum cholestrol and different types of stroke has been shown to be negative for cerebral hemorrhage and positive for cerebral infarction [49,50] . Study by Dr. Anushka [51] showed that the higher level of cholesterol in 25% increased risk of (fatal or non fatal) ischemic stroke. H Tohgi [31] estimated that hypercholesrolemia increase the risk of stroke in 11%, In our study the result is 80 patients (22.8%) of the stroke patients have high cholesterol level >220 mg/m1.(Table:5). Hypertension is the most powerful risk factor of stroke and antihypertensive treatment effectively reduce the risk of stroke in hypertensive patients [36,52,53,54] .Studies by Toshiyuki et al. [33], Helen et al. [27], H Tohgi et al [31] and Tsong—hai et al.[55] found that percentage of hypertensive in stroke patients was (46.6%,45.6%, 45% and 45.8%) respectively. In our series the result was 144 patients(41.1%). (Table: 10). This due to habit of alcohol drinking is very low in our population compare with other

European countries, alcohol has been strongly associated with increase blood pressure in epidemiological studies [56'5758].

Table 7: Comparison between the present study and other studies regarding incidence of mean age standard deviation of stroke

Standard deviation	Mean age in years	Study by author
±12year	65	H Tohgi
±12.6year	71.7	Salah-eddine
±14.7year	71	Wade S.
±13.5year	**60**	**Our study**

Table8: Comparison between the present study and other studies regarding the percentage of the intracerebral hemorrhage in stroke patients

Percentage of intracerebral hemorrhage%	Study by author
13.5%	Yuriko
10%	Ashraf
14.5%	Amanda
13.7%	Thomas
6%	Joanna
11.14%	**Our study**

Table 9: Comparison between the present study and other studies regarding diabetic in stroke patients

Percentage%	Diabetic patients	Total stroke	Study by author
16.9%	37	219	Toshiyuki
31.3%	198	621	Milton Alter
20.2%	238	48	Karl Matz
16%	298	48	H . Tohgi
21%	4537	937	Salsh-Eddine
37-42%			Brett M .kissela
20%	1135	233	H Jorgensen
38.8%	**350**	**136**	**Our study**

Table 10: Comparison between the present study and other studies regarding the percentage of the hypertensive in stroke patients

percentage of the hypertensive in stroke patients	Total patients no	Study by author
64.6%	219	Toshiyuki
45.6%	329	Helen
45%	298	H Tohgi
45.8%	241	Tsong -hai
41.1%	**350**	**Our study**

CONCLUSIONS

- CT. Scan is an established tool for diagnosis of ischemic or hemorrhagic stroke. it is rapid and readily available and has high sensitivity for intracranial hemorrhage contrast enhanced CT .and perfusion imaging provide additional information.
- CT. Scan can detect early sign of infarction.
- Diabetes mellitus ,hypertension and high cholesterol level are clearly the most important factor for acute stroke, diabetes promote cerebral atherosclerosis .

REFERENCES

[1]. Roger X. you John J. McNeil, Heather M.O' Malley, Stephen M Davis, Amanda G. Thrift, Geoffrey A .Donnas . Risk factor for stroke due to cerebral infarction in young adult. stroke. 1997;28: 1913-1918.
[2]. David Sutton. textbook of Radiology and Imaging. 7th edition, chapter 55 David Sutton and john Stevens. vascular imaging in neuroradiology. Chirchill livingstone London;2002. p. 1679-1687.
[3]. Joanna M. Wardllaw, Janelle Seymour, John Carins, Sarah Keir, Steff Lewis, Peter Sandercock .Immediate computed tomography scanning of acute stroke is cost-effective and improve quality of life stroke 2004;35:2477.
[4]. Derk W. Krieger, Andrew M. Demchuk, Scott E. Kasner, Marek Jauss, Ludwig Hantson. Early Clinical and Radiological Predictors of Fatal Brain Swelling in Ischemic Stroke . Stroke 1999;30:287-292
[5]. Robert A. Zmmerman,Wendell A. Gibby ,Raymond F. Carmody Neuroimmaging clinical and physical principle 3rdedition chapter 20 David M.medina and Raymond F. Carmody . stroke. Springer new York 2000., p.765-767.
[6]. Diederik M. Somford, Michael P. Marks, Vincent N. Thijs and David C.. Tong. Association of Early CT Abnormalities, Infarct Size, and Apparent Diffusion Coefficient Reduction in Acute Ischemic Stroke American Journal of Neuroradiology June-July 2004 25:933-938.
[7]. J.M.Wardlaw, S.C. Lewis, M.S. Dennis,C. Counsell, M. Mc Dowals Visible Infarction on Computed Tomography Associated With an Adverse Prognosis in Acute Ischemic Stroke. Stroke. 1998;29:1315-1319.
[8]. Robert A.Novelline, James T. Rhea, Patrick M. Rao, and Jeffrey L. Stuk. Helical CT in Emergency Radiology *Radiology*. 1999;213:321-339.
[9]. James M. Provenzale, Reza Jahan, Thomas P. Naidich, and Allan J. Fox. Assessment of the Patient with Hyperacute Stroke Imaging and Therapy Radiology2003 ;229:347359
[10]. Michael P. Marks, Eric B. Holmgren, Allan J. Fox; Suresh Patel, Rudiger von Kumm and Juergen Froehlich.Evaluation of Early Computed Tomographic Findings in Acute Ischemic Stroke. Stroke. 1999;30:389-392
[11]. James C.Grotta, david Chiu, Mei LU, Suresh Patel, Steven R. Levine, Barbara C. Tilley etal. Agreement and variability in the interpretation of early CT changes in stroke patients qualifying stroke .1999 ;30:1528-1533.
[12]. Bernd F. Tomandl, Ernst Klotz, Dipl ,Rene Handschu, Brigitte Stemper, Frank Reinhardt, Walter J. Huk etal .Comprehensive Imaging of Ischemic Stroke with Multisection CT Radiographics. 2003;23:565-592.
[13]. J M Wardlaw RADIOLOGY OF STROKE Neurol Neurosurg Psychiatry April 2001;70(Suppl 1):i7-ill.
[14]. Andrew M. DEMCHUK, Michael D. Hill, Philip A.Barber, Brian Silver, suresh C. Patel etal. Importance of early ischemic computed tomography changes. stroke 2005 ;36:2110.
[15]. DG Na, HS Byun, KH Lee, CS Chung, EY Kim, DW Ro etal. Acute occlusion of the middle cerebral artery: early evaluation with triphasic helical CT-preliminary results. Radiology North America 1998;vol 207, 113-122.

[16]. Mark E. Mullins, Pamela W. Schaefer, A. Gregory Sorensen, Elkan F. Halpern, Hakan Ay,Julian He etal. CT and Conventional and Diffusion-weighted MR Imaging in Acute Stroke. Radiology 2002;224:353-360.
[17]. James M. Provenzale, Reza Jahan, Thomas P. Naidich, and Allan J. Fox. Assessment of the Patient with Hyperacute Stroke: Imaging and Therapyl. Radiology 2003;229:347-359.
[18]. Stephan P. Kloska, Darius G. Nabavi, Christiane Gaus, Eun-Mi Nam, Ernst Klotz, Dipl Phys, E. Bernd Ringeistein etal. Acute Stroke Assessment with CT: Do We Need Multimodal Evaluation? Radiology 2004;233:79-86.
[19]. Thomas E. Mayer, Gerhard F. Hamann, Jan Baranczyk, Bernhard Rosengarten, Erich Klotz, Martin Wiesmann et al .Dynamic CT Imaging of Acute Stroke. American Journal of Neuroradiology (8 2000);21:1441-1449
[20]. James M Provenzale,reza jahan, Thomas p.Naidicha and Allan J. Fox. Brain infarction in young adults: etiology and imaging findings American Journal of Roentgenology2003; Vol 169: 1161-1168.
[21]. Joseph A. Maldjiana, Julio Chalelaa, Scott E. Kasnera, David Liebeskinda and John A. Detrea. Automated CT Segmentation and Analysis for Acute Middle Cerebral Artery Stroke. American Journal of Neuroradiology (6 2001); 22:1050-1055.
[22]. Amanda G. Thrift, Helen M. Dewey, Richard A.L. Macdonell, John J. McNeil, Geoffrey A. Donnan. Incidence of the Major Stroke Subtypes. Stroke 2001;32:1732.
[23]. FJoseph, VOwens, P Weir, little and J A Barrett . Intracerebral hemorrhage masquerading as transient ischemic attach. Geriatric medicine 2003;5(3):124-126.
[24]. Yoshimitsu Ohgiya, Takehiko Gokan, Hiroshi Nobusawa, Masanori Hirose, Noritaka Seino, Hidefumi Fujisawa etal Acute Cerebral Infarction: Effect of JPEG Compression on Detection at CT Radiology 2003;227:124- 127.
[25]. Wade S. Smith,Heidi C.Roberts,Nathaniel A Chuang,Kenneth C Ong, Theodore J.Lee,S Claiborne Et al. Safety and feasibility of a CT protocol for acute stroke. American Journal of Neuroradiology April 2003;24:688-690 .
[26]. Bryson Borg, Brain R.Herts,Thomas J. Masaryk .Imaging in acute brain infarction journal of medicine july 2005;vol. 72 ,number7:579-585.
[27]. Helen Rodgers, Jane Greenaway, Tina Davies, Ruth Wood, Nicholas Steen, Richard Thomson.Risk Factors for First-Ever Stroke in Older People in the North East of England. Stroke 2004;35:7.
[28]. Kazunari matsumoto,Seibel miyake, mayumi tano,yukitaka ueki,atsushi miyazalki,koichi tominaga et al .Insulin resistance and classic risk factor in type 2 diabetic patients with different subtype of ischemic stroke diabetes carJuly 1999;vol. 22 number 7:1191-1195..
[29]. Davis PH, Dambrosia JM, Schoenberg BS, Schoenberg DG, Pritchard DA, Lilienfeld AM, et al. Risk factors for ischemic stroke. Neurology. 1987; 22: 319-327.
[30]. Barry R. Davis, Thomas Vogt, Philip H. Frost, Alfredo Burlando, Jerome Cohen, Alan Wilson, et al. Risk Factors for Stroke and Type of Stroke in Persons With Isolated Systolic Hypertension. Stroke. 1998;29:1333-1340.
[31]. H. Tohgi, S. Takahashi ,K Chiba and Y Hirata. Cerebral infarction clinical and neuroimaging analysis.stroke 1993;24:1697-1701.
[32]. Salh-Eddine megherbi, Chantal Milan ,Dominique minier, Gregory coureur,guy-victor osseby,Kate Tilling et al .Association between diabetes and stroke subtype on survival and function outcome3 month after stroke . stroke 2003;34:688.
[33]. Toshiyuki Uehara, Masayasu Tabuchi, Etsuro Mori.Risk Factors for Silent Cerebral Infarcts in Subcortical White Matter and Basal Ganglia Stroke1999;30:378-382.
[34]. Carma Ayala, Janet B. Croft,Kurt J. Greenlund, Nora L. Keenan, Ralph S. Donehoo, Ann M. Malarcher,etal .Sex Differences in US Mortality Rates for Stroke and Stroke Subtypes by Race/Ethnicity and Age Stroke 2002;33:1197.
[35]. Jose Luis Ruiz-Sandoval, Carlos Canna, Fernando
[36]. Barinagarrementeria . Intracerebral Hemorrhage in Young People Stroke 1999;30:537-541.
[37]. Yuriko Makino, Yuhei Kawano, Junichi Minami, Takenori and Shuichi Takishita. Risk of Stroke in Relation to Level of Blood Pressure and Other Risk Factors in Treated Hypertensive Patients Stroke 2000;31:48-52. 37-Ashraf EL-Mmitwalli, Marc D. Malk off. Intracerebral hemorrhage. The internal journal of emergency and intensive car medicine2001;vol 5:No.1 .
[38]. Thomas Hillen, Catherine Coshall, Kate Tilling, Anthony G. Rudd, Rory McGovern and Charles D.A. Wolfe. Cause of Stroke Recurrence Is Multifactorial: Patterns, Risk Factors. Stroke 2003;34:1457-1463 .
[39]. Bernt Lindath, Bo Dinesen, Mats Eliasson , Michail Roder AND Goran Hallnan. High Proinsulin Levels Precede First-Ever Stroke in a Nondiabetic Population .STROKE 2000;31:2936-2941.
[40]. L. und haheim holme, I hjermann and Leren . Nonfasting serum glucose and the risk of fatal stroke in diabetic and non diabetic patients . stroke 1995 ;26:774-777.
[41]. Stroke Association .Diabetes and stroke ;2006
[42]. Karl matz, katharina keresztes ,Ciaudia Tatschl, Monikallowotny, Alexandra Dachenhausen ,Michael brainin et al . Disorder of glucose metabolism in acute stroke patients . Diabetic car American 2006;29:792- 797.
[43]. Milton alter ,Sue-Min Lai,Gary Friday,Vineet Singh, Mangesh Kumer and Eugene Sobel .Stroke recurrence in diabetics. stroke 1997; 28:1153-1157.
[44]. Brett M. Kissela , jane khoury ,dawn kieindorfer,Daniel woo, Alexander schnieder,Katheen Awell et al epidemiology of ischemic stroke in patients with diabetes. Diabetic car American 2005; 28:355-359.
[45]. H. Jorgensen ,H. nakayama, HO . raaschou and Ts olsen . Stroke in patients with diabetes .stroke 1994;Vol.25 :1977-1984.
[46]. Waad-Allah Shareef Mula-Abed, Amjad Hazem Al-Naemi . PREVALENCE OF DIABETES MELLITUS IN MOSUL CITY. The 22nd Annual conference of ARABMED 2005.
[47]. Faisal Al-Mahroos. DIABETES MELLITUS IN THE ARABIAN PENINSULA .
[48]. Sarah E. Vermeer, Willemijn Sadee, Ale Algra, Peter J, Koudstaal, 1. Jaap Kappelle et al. Impaired glucose tolerance increase stroke risk in nondiabrtic patients with transient ischemic attach. stroke 2006 ;37:1413.
[49]. Birgitta Sttegmayr,Kjell Aspulund,Kari Kuulasmaa,Anna-Maija, M. Per Thorvaldsen and Jaakko Tuommilehto .Stroke incidence and mortality correlated to stroke risk factors .stroke 1997 ;28:1367-1374.
[50]. Mario Di Napli, Francesca Papa, and Vittorio bocola. C-Reactive protein in Ischemic Stroke . Stroke 2001;32:917.

[51]. Dr Anushka Patel . Cholesterol, coronary heart disease, and stroke in the Asia Pacific region International Journal of Epidemiology 2003;32:563-572.
[52]. Yumihiro Tanizaki, Yutaka Kiyohara, Isao Kato, Hiromitsu Iwamoto, Keizo Nakayama, Noriyasu Shinohara,etal. Incidence and Risk Factors for Subtypes of Cerebral Infarction in a General Population . Stroke. 2000;31:2616.
[53]. M. Nicolaou, L. DeStefano, I.Gavras, L.A. Cupples, A. J.Manolis, C.T. Baldwin etal. Genetioc predisposition to stroke in relatives hypertensives. Stroke 2000;31:487.
[54]. JP Whisnant, DO Wiebers, WM O'Fallon, JD Sicks And RL Frye.A population-based model of risk factors for ischemic stroke. Neurology, 1996 by American Vol 47, Issue 6 :1420-1428.
[55]. Tsong-Hai Lee, Wen-Chuin Hsu, Chi-Jen Chen and Sien-Tsong Chen, Etiologic Study of Young Ischemic Stroke in Taiwan. Stroke. 2002;33:1950
[56]. Yeong Sook, Sang Woo Oh, Hyun Wook Baik, Hye Soon and Wha Young .Alcohcl consumption and the metabolic syndrome in Korean adults. American journal of clinical nutrition 2004;Vol.80,No.1:217-224.
[57]. Metthew S. Freiberg, Howard J Carbal, Tim C .Heeren, Ramachandran S. Vasan and R. Curtis. Alcohol consumption and the prevalence of the metabolic syndrome in the U.S. .Diabetic Car 2004;27:2954-2959.
[58]. Xue Xin ,Jiang He, Maria G Frontini, Lorraine G. Ogden, Oaitse I. Mostsamai and Paul K.Whelton.Effect of alcohol reduction on blood pressure. Hypertension 2001;38:1112.