

Study Of Siriraj Stroke Score And Computed Tomography Scan Brain In Acute Stroke Cases At Tertiary Care Centre Of Southern Bihar

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Abstract

Introduction: Stroke Is A Leading Cause Of Mortality, But It Also Causes A Variety Of Long-Term Disabilities, Such As Physical Dependence, Dementia, And Depression, In Its Victims. Computed Tomography (Ct) Scanning Of The Brain Is Expensive In Both The Equity Purchase And Maintenance Costs, But It Is The Most Accurate And Safe Method That Is Regularly Used As An Investigative Tool For Stroke To Distinguish Between Haemorrhage And Infarction. With The Use Of The Siriraj Scoring System, It Is Possible To Differentiate Between An Infarction And A Haemorrhage On The Basis Of Clinical Evidence.

Material And Methods: This Longitudinal Cross Sectional Observation Study Was Conducted Among 170 Patients (Female=64, Male=106) Who Were Admitted With An Acute Onset Of Neurological Deficit In The Tertiary Care Centre For 2 Years. The Data Were Consolidated And Entered In Microsoft Excel And Software. Fischer Exact Test Was Used Instead Of Chi Square Test Because Frequencies Were Considerably Small. A P-Value Of <0.05 Is Considered To Be A Statistically Significant Result.

Result: The Sensitivity Of Siriraj Stroke Score In Our Study For Haemorrhage And Infarction 91.07% And 84.21, Specificity Of Siriraj Score For Haemorrhagic Stroke And Infarction From Our Study Was Found To Be 84.21% And 91.07% Respectively With Overall Accuracy 88.3% Is Closer In Comparison With Other Studies.

Conclusion: Based On Clinical Variables Such As Level Of Consciousness, Blood Pressure, Atheroma Markers And The Presence Of Headache And Vomiting, Siriraj Stroke Score, A Clinical Scoring Can Be Used For The Bedside Diagnosis Of The Nature Of The Lesion In Stroke Patients Where Ct Scan Is Not Available Immediately. But It Should Be Supported By Physician Decision By Considering The Disease's Health Risk If Treatment Is Not Started Immediately And The Patients' Health Service Cost For Ct Scan.

Keywords : Siriraj Stroke Score, Haemorrhage, Infarction

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I. INTRODUCTION

Cerebrovascular accidents (CVA) have been known since ancient times because of the striking clinical picture they produce. 'Indriya sthana' of 'Charaka samhita' comprises of 12 chapters which deals with prognostication of life expectancy based on 'Arishta lakshanas' (fatal signs and symptoms which indicates imminent death). Acharya Charak has described Pakshaghata (stroke) in vata nanatmaj vyadhi and Acharya Sushrut has mention in mahavatvyadhi^[7] and also Acharya Charak & Sushrut has given treatment protocol of Pakshaghata(stoke) which is snehana, swedana, mridu virechana, basti karma, murdhani taila accordingly treatment in these patients.^{1,2,3}

A total of 6.2 million deaths occurred from stroke in 2011, making it the second highest cause of death worldwide. Stroke is a leading cause of mortality, but it also causes a variety of long-term disabilities, such as physical dependence, dementia, and depression, in its victims. According to estimates, stroke caused 6.5 million fatalities and 113 million Disability Adjusted Life Years (DALY) in 2013.⁴ Almost two-thirds of these fatalities occurred in underdeveloped countries. By 2050, it is estimated that 15 million additional strokes will occur worldwide, with low- and middle-income nations accounting for more than 80% of those cases.^{5,6,7}

According to research studies, there are between 116 to 163 strokes per 100,000 persons in India. According to a report recently published by ICMR titled "India: Health of the Nation's States," stroke was the fifth most frequent cause of Disability Adjusted Life Years (DALY) and the fourth most frequent cause of death in 2016.^{8,9}

Computed tomography (CT) scanning of the brain is expensive in both the equity purchase and maintenance costs, but it is the most accurate and safe method that is regularly used as an investigative tool for stroke to distinguish between haemorrhage and infarction. Cost and supply issues prevent its widespread usage, particularly in rural regions, in developing nations like India.

Clinical stroke scores were developed in order to get over these restrictions. With the use of the Siriraj Scoring System, it is possible to differentiate between an infarction and a haemorrhage on the basis of clinical evidence. Bihar has predominantly poor rural population where brain CT scan, which is most often advised investigation in patients of stroke, may not always be available, doctors in these settings may rely on bedside sign evaluations, where the Siriraj Stroke Score (SSS) may be useful.

II. MATERIALS AND METHOD

STUDY POPULATION:

This study was conducted among 170 patients who were admitted with an acute onset of neurological deficit in the Department of Medicine in Tertiary care centre, Sasaram.

Inclusion criteria:

- Patients whose deficit lasted for more than 24 hours
- CT scan showed cerebral infarction or intra-cerebral hemorrhage
- Patients of both sex
- Patients age > 18 years

Exclusion criteria:

- Age < 18 years
- Duration of stroke > 14 days because of the possibility of missing an ICH
- Causes of focal neurological deficit other than stroke (tuberculosis, tumor or trauma, transient ischemic attack)
- Patients on anti-coagulation therapy
- Patients in whom CT scan could not be done
- Patients admitted 72 hours after the onset of neurological deficit
- Patients with sub-arachnoid hemorrhage
- Repeat or recurrent stroke

DATA COLLECTION: Upon admission, detailed medical history and thorough clinical examination including neurological assessment will be carried out. The patient's level of consciousness was assessed using Glasgow Coma Scale (GCS).

SAMPLE SIZE- 170

(The sample size was estimated by using the formula: $n = z^2pq/L^2$)

DESIGN OF STUDY: Cross Sectional Study

PERIOD OF STUDY: Two years

COLLABORATING DEPARTMENTS: Department of General Medicine and Department of Radiology

RADIOLOGICAL INVESTIGATION: Computed Tomography scan (CT scan) Brain

STUDY PROTOCOL: On admission detailed history and thorough clinical examination including neurological assessment will be carried out. Patients will be assumed to be fully conscious if they have a score of more than 13 on the Glasgow Coma Scale (GCS), drowsy if they have a GCS score of 8–13 and unconscious if the score is less than 7. Siriraj Stroke Score calculated and compared with the CT findings done at admission. Radiologist from the hospital will classify the CT scan of brain as either infarction or haemorrhage.

ANALYSIS: The data were consolidated and entered in Microsoft Excel and Software. Fischer exact test was used instead of chi square test because frequencies were considerably small. A p-value of <0.05 is considered to be a statistically significant result.

CONFLICT OF INTEREST : Nil

The Siriraj Stroke Score (SSS)

Variable	Clinical feature	Score
1. Consciousness	Alert	0
	Drowsy, stupor	1
	Semicoma, coma	2
2. Vomiting	No	0
	Yes	1
3. Headache (within 2hrs of onset)	No	0
	Yes	1
4. Diastolic BP	-	In mm of Hg
5. Atheroma marker (Diabetes, Angina, Intermittent claudication)	None	0
	≥1	1

Calculation:

$$SSS = (2.5 \times \text{level of consciousness}) + (2 \times \text{headache}) + (2 \times \text{vomiting}) + (0.1 \times \text{Diastolic BP}) - (3 \times \text{atheroma markers}) - 12[\text{constant}]$$

A score > +1 indicates supratentorial hemorrhage.

A score < -1 indicates infarction.

A score between +1 and -1 is taken as equivocal and will require imaging to decide the diagnosis

Scores were calculated by obtaining details of each clinical variable. If any variable was not available, e.g., if the patient was unconscious, information was obtained from the patient’s relatives. If the relatives were unaware of a particular variable, then the variable score was adjusted as zero.

III. OBSERVATION AND RESULT

Table - 1

	No of Subjects	Percentage
18-30	2	01.2
31-40	17	10.0
41- 50	24	14.1
51-60	44	25.9
61-70	47	27.6
>70	36	21.2
Total	170	100.00

	Mean	SD	Median	Min	Max	Valid N
AGE (in years)	60.32	14.30	60.00	30.00	90.00	170

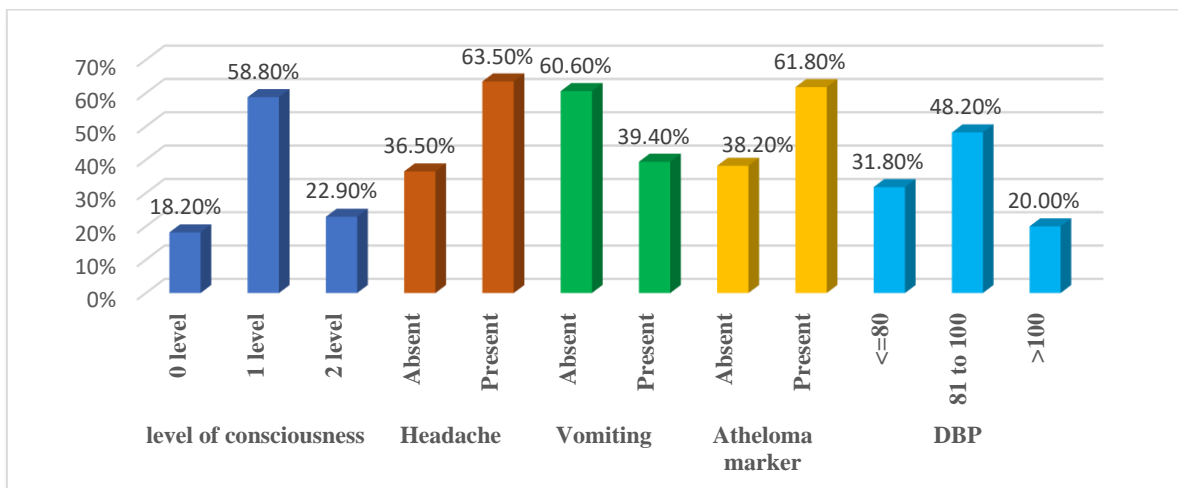
In this study, the mean age is 60 ±14.30, majority of study subjects were in the age range of 61-70 yrs (i.e 47 out of 170) and 51 -60yrs (44 out of 170) respectively.

Table – 2

Sex and CT Scan Cross Tabulation of Stroke findings:				
Sex	Findings			Percentage
Female	NCCT HEAD	INFARCTION	41	64.1%
		HAEMORRHAGE	23	35.9%
	TOTAL		64	100%
Male	NCCT HEAD	INFARCTION	62	58.5%
		HAEMORRHAGE	44	41.5%
	TOTAL		106	100%

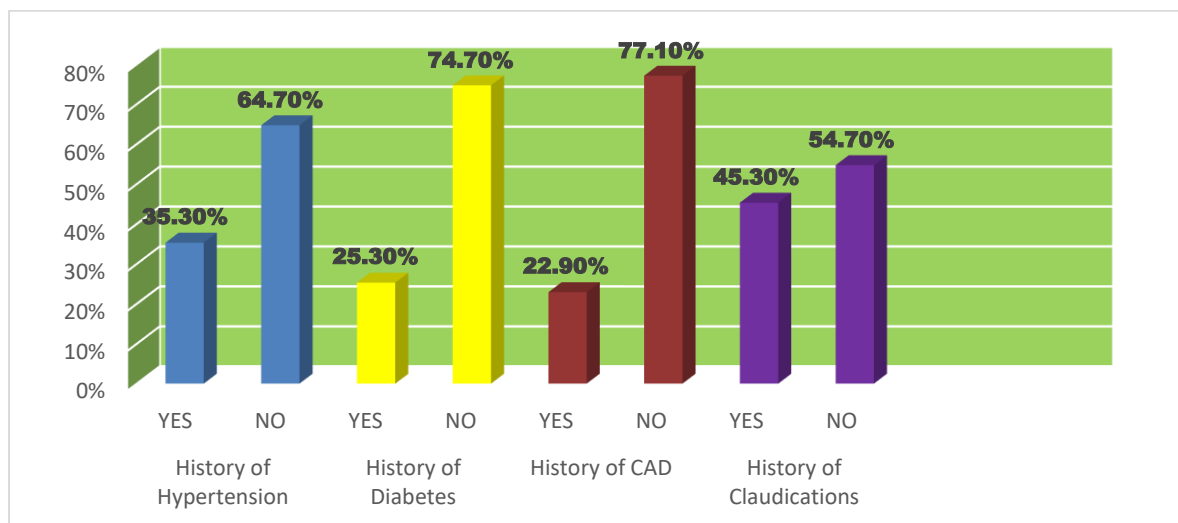
Chi-square value- 0.519 , p-value – 0.47 (non significant)

Above table shows that infarction is more in both male and female in compare to haemorrhage, but haemorrhage is more prominent in male.



Graph 1: Distribution of variables of Siriraj stroke score

We found that the majority of the patients with infarction were either alert (31) or drowsy(100) at presentation, while 39 of them were found to be comatose. Majority of the patients with hemorrhage were either comatose or drowsy (4 each), while 2 were alert at presentation.



Graph 2: Distribution of different Atheroma markers history

Table - 4

		NCCT head findings		Total
		HEMORRHAGE	INFARCTION	
Siriraj stroke score interpretation	HEMORRHAGE (Score > +1)	51	15	66
		91.07%	15.8%	43.7%
	INFARCTION (Score < -1)	5	80	85
		8.93%	84.2%	56.3%
Total		56	95	151
		100.0%	100.0%	100.0%

IV. DISCUSSION

Two hundred and eighty adult subjects were admitted into the medical wards with stroke during the 2-year period of the study. One hundred and seventy of the two hundred eighty subjects admitted with the diagnosis of stroke satisfied the inclusion criteria for our study.

Comparison of age of the cases of stroke:

In the present study mean age of the cases involved overall was 60.32 years with S.D. ± 14.30 , which is similar to study done by Padmanabhan KN et al.¹⁰ mean age of the study population was 56.4 ± 7.61 years, and the majority were males (58.8%). In a study by Somasundaran et al.¹², most participants belonged to the age group 61 to 70 years, and the majority were males (55.4%) that is similar to our outcome. The mean age of the patients was 63.65 ± 10.2 years by Sajjad Ali Khan et al.¹¹ 59.28 ± 11.91 years in a Pakistani study. Raghuram, P.M et al.¹³ study having mean age of 61 years. All these study having comparable results with age group in stroke.

Comparison of sex of the cases of stroke:

Overall majority of stroke cases are male, in the previous studies like Padmanabhan KN et al.¹⁰ by Badam et al.¹⁴, 75% by Somasundaran et al.¹², 63% by Kochar et al.¹⁵ study on stroke had similar results. In our study both male and female having higher rate of ischemic strokes than haemorrhagic. In this study Infarction (Female 64.1% , Male 58.5%) and Haemorrhage (Female 35.9% , Male 41.5%) .

Comparison of Headache of the cases of stroke:

Headache though a common complaint was found more in cases of haemorrhage 73.1% and ischemic cases exhibited less of it, thus headache is more likely to be associated with haemorrhage (p value is non significant). Previous study conducted by 75% by Somasundaran et al.¹², 73% by Shah et al.¹⁶, Pongvarin N et al.¹⁸, Padmanabhan KN¹⁰ et al, by Pavan MR et al.²⁰, by Badam et al.¹⁴, having the same reports.

Comparison of vomiting of the cases of stroke:

Vomiting was seen more in haemorrhagic stroke, in our study in 92.5% cases of haemorrhagic stroke presented with vomiting episodes though only few cases of ischemic exhibited vomiting, indicating likelihood of vomiting more in haemorrhagic stroke. Padmanabhan KN et al.¹⁰ , A study by study by Wadhvani et al.¹⁷ , Badam et al.¹⁴ , Somasundaran et al.¹² , Shah et al.¹⁶. also similar findings.

Comparison of Atheroma marker of the cases of stroke:

Atheroma markers namely diabetes, angina and intermittent transient ischemic attack were found to be more as age increased and in those who had ischemic stroke.

The majority of the present study participants had hypertension (35.3%), followed by diabetes mellitus (25.3%). The findings of an earlier study showed that hypertension was a major risk factor for both stroke subtypes, while diabetes mellitus was considered to be a risk factor for ischemic stroke. Previous study with other reports of higher prevalence of hemorrhagic stroke in patients from poorer countries. One author attributes this to inadequate control of blood pressure as well as a high occurrence of aneurysms and arteriovenous malformations in poorer countries. Need further study for a better correlation with underlying disease conditions and stroke outcome.

Comparison of siriraj stroke score with NCCT head :

The sensitivity of Siriraj stroke score in our study for Haemorrhage 91.07%, is closer in comparison with other studies.

Wadhvani et al.¹⁷ study shows sensitivity of Siriraj Stroke Score was 92.54% for infarction and 87% for haemorrhage (equivocal and infratentorial cases were excluded) and its overall accuracy was 91.11% [16]. Pavan et al.²⁰. study detected sensitivity of Siriraj score for detecting haemorrhage was 77.27%. The overall accuracy of Siriraj stroke score was 85% [7]. Siriraj stroke score the diagnostic sensitivities of the score for cerebral haemorrhage and cerebral infarction were 89.3% and 93.2% respectively, with an overall predictive accuracy of 90.3% by N Pongvarin, A Viriyavejakul, C Komontri et al.¹⁸ . Sensitivity of Siriraj score for stroke was reported 96.92% by Padmanabhan KN et al.¹⁰., Badam et al.¹⁴ study of siriraj score discriminated haemorrhage from infarction with a sensitivity of 78.5% and specificity of 71%. A study by by Kochar et al.¹⁵ showed that sensitivity of Siriraj score for ischemic stroke was 73%, 78% by Badam et al.¹⁴, 75% by Somasundaran et al.¹², 73% by Shah et al.¹⁶. All these figures are comparable to results in our study.

Specificity of Siriraj score for haemorrhagic stroke and infarction from our study was found to be 84.21% and 91.07% respectively and which was also favoured by results from other studies. Specificity was reported 90% by Shah et al.¹⁶, 81% Somasundaran et al.¹², 94.2% by Sherin et al.¹⁹, 93.42% by Wadhvani et al.¹⁷ and specificity was 97.1 % by Kochar et al.¹⁵, 71% by Badam et al.¹⁴ and Pavan et al.²⁰ study detected infarction specificity was 77.27%. These studies are comparable to results in our study.

Positive p value of Siriraj score from our study was found to be 85.22%. Predictive accuracy of 86.75% in a study conducted by Pavan et al.²⁰. study of Siriraj Score showed positive predictive value of 80.64% for ischemic stroke and negative predictive value of 78.57% for Haemorrhagic stroke and the P value is

0.015(Significant). A Nigerian study²¹ showed that SSS was highly predictive of both acute ischemic stroke and acute hemorrhagic stroke with a PPV of 97% and 86%, respectively, with an overall predictive accuracy of 93%, also similar results were reported 83% by Shah et al.¹⁶, and 84% by Sherin et al.¹⁹.

V. LIMITATIONS

The single center study and the sample size is relatively small. A larger sample size, preferably involving many centers, is desirable.

Many patients did not have CT scan done and were thus excluded. This could have affected the result of the study.

VI. SUMMARY AND CONCLUSION

Based on clinical variables such as level of consciousness, blood pressure, atheroma markers and the presence of headache and vomiting, Siriraj Stroke Score, a clinical scoring can be used for the bedside diagnosis of the nature of the lesion in stroke patients where CT scan is not available immediately. This study found that the Siriraj stroke score had low specificity but fair overall accuracy for differentiating ischemic and hemorrhagic stroke. This suggests that the Siriraj score might be used to diagnose ischemic/hemorrhagic stroke in places where CT scans are not available, including rural underdeveloped regions, but it should be supported by physician decision by considering the disease's health risk if treatment is not started immediately and the patients' health service cost for CT scan.

References:

- [1]. Mamidi P, Gupta K. Neurological Conditions In Charaka Indriya Sthana - An Explorative Study. *Int J Complement Alt Med*. 2020;13(3):107–119.
- [2]. Agnivesha. Charakasamhita. Panday Kashinnath & Chaturvedi Gorakhnath, Editor. Sutrasthana, 20/11. Varanasi: Cukhambha Sanhaskrit Seriesoffice; 2013.P-399. P-795.
- [3]. Susruta. Susrutasamhita. Shri Dalhanacharya, Editor. Chikitsasthana, 5/19, Varanasi: Chaukhambhasurbharti Publisher; 2018. P-43.
- [4]. Feigin VL, Forouzanfar MH, Krishnamurthi R, Et Al. Global And Regional Burden Of Stroke During 1990–2010: Findings From The Global Burden Of Disease Study 2010. *Lancet* 2014; 383: 245–255.
- [5]. Global Burden Of Disease 2017. Causes Of Death Collaborators. Global, Regional, And National Age-Sex-Specific Mortality For 282 Causes Of Death In 195 Countries And Territories, 1980-2017: A Systematic Analysis For The Global Burden Of Disease Study 2017. *Lancet* 2018; 392: 1736–1788.
- [6]. GBD 2016 Stroke Collaborators. Global, Regional, And National Burden Of Stroke, 1990–2016: A Systematic Analysis For The Global Burden Of Disease Study 2016. *Lancet Neurol* 2019; 48: 439–458.
- [7]. Stroup DF, Berlin JA, Morton SC, Et Al. Meta-Analysis Of Observational Studies In Epidemiology: A Proposal For Reporting. *JAMA* 2000; 283: 2008–2012.
- [8]. Kamalakannan, Sureshkumar Et Al. "Incidence & Prevalence Of Stroke In India: A Systematic Review." *The Indian Journal Of Medical Research* Vol. 146,2 (2017): 175-185. Doi:10.4103/ijmr. IJMR_516_15
- [9]. Guidelines For Prevention And Management Of Stroke ; Directorate General Of Health Services ,Ministry Of Health And Family Welfare, Government Of India 2019
- [10]. Padmanabhan KN, Dominic M, Chidambaram HH, Vp C, Rajkumar RK, Sirajudeen SA. Comparison Of Siriraj Stroke Score With Computed Tomography To Differentiate Acute Embolic And Hemorrhagic Stroke In A Tertiary Care-Teaching Center. *Eurasian J Emerg Med* 2022;21:62-67.
- [11]. Khan, M Ishaq; Khan, Junaid I; Ahmed, Sheikh I; And Ali, Sajjad (2019) "Retracted: The Epidemiology Of Stroke In A Developing Country (Pakistan)," *Pakistan Journal Of Neurological Sciences (PJNS)*: Vol. 13: Iss. 3, Article 9.
- [12]. Somasundaran, Abhilash & Mohammed, Hashik & Kezhukatt, Jayaraj & George, Alvin & Potty, S. (2017). Accuracy Of Siriraj Stroke Scale In The Diagnosis Of Stroke Subtypes Among Stroke Patients. *International Journal Of Research In Medical Sciences*. 5. 1084. 10.18203/2320-6012.Ijrms20170666.
- [13]. Raghuram, P.M. & Biradar, Mallanagouda & Jeganathan, J.. (2012). Comparison Of The Siriraj Stroke Score And The Guy's Hospital Score In South India. *Journal Of Clinical And Diagnostic Research*. 6. 851-854.
- [14]. Priya Badam, Vaishali Solao, Madhukar Pai, S.P.Kalanthri. *The National Medical Journal Of India*. Vol. 16, No. 1, 2003.
- [15]. Kochar DK, Joshi A, Agarwal N, Aseri S, Sharma BV, Agarwal TD. Poor Diagnostic Accuracy And Applicability Of Siriraj Stroke Score, Allen Score And Their Combination In Differentiating Acute Haemorrhagic And Thrombotic Stroke. *J Assoc Physicians India* 2000; 48: 584 – 588.
- [16]. Shah FU, Salih M, Saeed MA, Tariq M. Validity Of Siriraj Stroke Scoring. *J Coll Physicians Surg Pak* 2003;13(7):391-3.
- [17]. Wadhawani J, Hussain R, Raman PG. Nature Of Lesion Of Cerebro Vascular Stroke Patients, Clinical Stroke Score And Computed Tomography Scan Brain Correlation. *J Assoc Physicians India* 2002; 50: 777-781.
- [18]. Pougavarin N, Viriyavejakul A, Kpomontric C. Siriraj-Stroke And Validation Study To Distinguish Supratentorial Intracerebral Haemorrhage From Infraction. *BMJ*. 1991;302:1565–1567.
- [19]. Sherin A, Khan A, Rehman S, Shah NH, Shabbier G, Zarif M. Comparability And Validity Of Siriraj Stroke Score And Allen Stroke Score In Differentiation Of Acute Ischemic And Haemorrhagic Stroke. *J Postgrad Med Inst* 2011; 25(3):206-16.
- [20]. Comparison Of Siriraj Stroke Score With Computerized Tomography In Ascertaining Stroke Type Among South Indians. Pavan MR , Madi MD , Achappa B , Unnikrishnan B. *Int J Biol Med Res*. 2012; 3(3): 1930-1933 [Journal Homepage: Www.Biomedscidirect.com](http://www.biomedscidirect.com)
- [21]. Chukwuonye II, Chuku A, Onyeonoro UU, Okpechi IG, Madukwe OO, Ogah OS. Prevalence Of Abdominal Obesity In Abia State, Nigeria: Results Of A Population-Based House-To-House Survey. *Diabetes Metab Syndr Obes*. 2013;6:285–291.