Original Research Paper Radiology

EVALUATION OF THE ROLE OF NCT IN ACUTE STROKE

Dr.Pawan Soni	associate Proffesor,Department of Radiodiagnosis, DRPGMC Tanda(kangra)H.P.
Dr.Lokesh Rana	Senior Resident, Department of Radiodiagnosis, DRPGMC Tanda(Kangra)H.P.
Dr.Dinesh Sood	professor,Department of Radiodiagnosis, DRPGMC Tanda(kangra)H.P.
Dr.Khanak k.Nandolia	Resident,Department of Radiodiagnosis,DRPGMC Tanda(Kangra)H.P.
Dr.Khanak k.Nandolia	Resident,Department of Radiodiagnosis,DRPGMC Tanda(Kangra)H.P.
Dr.Pranshu Kumar	Resident,Department of Radiodiagnosis,DRPGMC Tanda(Kangra)H.P.

ABSTRACT Objective: To study the incidence of patients seeking medical help with in thrombolytic window period in stroke. Findings on NECT in acute stroke and confirmation with Perfusion CT.Methods: We studied 30 cases, 14 males & 16 females who attended the emergency department within 24 hours of developing symptoms of stroke. The 75% patients were above the age of 65years. All patients had NCCT within 15-30 minutes on their arrival in hospital followed by PCT.

Results: Six (20%) patients presented within 3 hours (thrombolytic window period). Out of these 6 patients 4 had normal NCCT and the other 2 had early signs of ischemia: hypo density with sulcal effacement was observed in these 2 patients. Fifteen (50%) cases presented with in 3 to 6 hours of symptoms.

Conclusion: Only 6(20%) patients presented within 3 hours of symptoms and out of these 4 patients had normal NCCT and 2 patients had early signs of Ischemia. The sensitivity of NCCT in detecting Ischemia within 3 hours was only 33.33 %.

KEYWORDS : NCCT, PCT, Acute infarct, Window period.

Introduction

Stroke is a medical emergency which result from disruption of normal cerebral blood flow leading to derangements of cerebral function and can cause permanent neurological damage . Apart being the third major cause of death, stroke causes morbidity in survivors [1]. Stroke can be classified into two categories: ischemic and hemorrhagic. The ischemic stroke accounts for an estimated 80-85% of cases[2]. Since nerve cells are highly intolerant to ischemia, stroke requires early diagnosis and treatment to prevent the permanent disability and deaths in stroke patients. Pilot phase of National program for prevention and control of Cancer, Diabetes, CVD &Stroke (NPCDCS) was launched by Government of India in 2008 with the objective of : Risk reduction for prevention of NCDs (Diabetes, CVD and Stroke) & Early diagnosis and appropriate management of Diabetes, Cardiovascular Diseases and Stroke. With the same objective a prospective present study was carried out.

Material & Methods:

We studied 30 patients of stroke in DRPGMC, Kangra at Tanda, in the hilly state of Himachal Pradesh , in North India with predominantly rural population after the approval of ethical committee in a period of one year .The patients presenting with symptoms suggestive of acute stroke, acute neurological deficit and aged more than 18 years were included in the study. Patients with history of renal insufficiency or adverse reaction to iodinated contrast agent, history of percutaneous vascular intervention or surgical bypass & bleeding disorders were excluded from study.

All the patients had undergone NCCT Head first using MDCT scanner (BRILLIANCE 16 SLICE PHILIPS). The CT images were acquired by using a 120-kV and 500-mAs technique. Images were reconstructed into a contiguous 5-mm axial dataset by using a standard algorithm. After unenhanced CT of the whole brain, four adjacent 5-mm-thick sections were selected starting at the level of the basal ganglia. At this level, all three supratentorial vascular territories were visualized with 50 millilitres of a non-ionic contrast agent (350 mg of iodine per millilitre) which was injected at a rate of 4 ml/sec, 5 seconds after initiation of the injection, a cine (continuous) scan was initiated with the following technique: 120 kVp, 150 mA, 4 × 5-mm sections, 1-second per rotation for duration of 40 seconds. CT perfusion data was analyzed at an imaging workstation equipped with commercially available software.

Results:

In the present study, the patients ranged from 33 to 80 years of age. Twenty (66.67%) patients were above 65 years of age .Out of 30, 16 (53.33%) were female and 14 (46.67%) were male patients with a sex ratio of M: F 1:1.14. The most common presentation was hemiparesis in 66.6% of patients. Out of 30 patients, 25 (83.33%) had hyper tension while 9 (30%) had diabetes mellitus, among these 4(13.3%) had both diabetes mellitus & hypertension.

Out of 30 patients, 21 (70%) presented in within 6 hours of developing the symptoms, 6(20%) of these 21patients presented within 3 hours whereas another 15 (50%) presented within 3-6 hours. Rest of the 9(30%) reached the hospital after 6 hours of developing stroke symptoms. Table 1 shows details of duration of presentation.

Table1

STRATIFICATION OF PATIENTS IN DIFFERENT GROUPS ACCORDING TO: DURATION OF SYMPTOMS & PATTERN OF NCCT FINDINGS

NCCT FINDINGS	DURATION OF SYMPTOMS IN HOURS <3HRS 3-6 HOURS >6HOURS NO OF PATIENTS NO OF PATIENTS NO PATIENTS	TOTAL NUMBER OF PATIENTS		
Number of patients in each group & % of patients in parenthesis	6 (20%)	15 (50%)	9(30%)	30 (100 %)

Normal	4 (66.67%)	3 (20%)	1 (11.11%)	8 (26.7%)
Signs of Ischemia	2 (33.33%)	10 (66.67%)	3 (33.33%)	15 (50%)
Well-formed infarct	0 (0%)	2 (13.33%)	5 (55.55%)	7 (23.3%)

Out of the 6(20%) patients who reached the hospital with in period of 3 hours, 4 had normal NCCT and 2 had subtle focal hypo density with sulcal effacement in the effected part of brain parenchyma (figure1)and all lesions were in the supratentorial in location in our study. There was decreased in CBF, CBV and increase in MTT, TTP to the tissue at risk in the effected cerebral hemisphere as compare to normal contra-lateral hemisphere on perfusion CT figure3). All 6 (100%) patient had significant (>50%) tissue at risk (penumbra). Details of various parameters are shown in tables-2.

Table 2: Showing findings of PCT in the patients presenting in < 3hours duration of developing symptoms having evidence of ECI on NCCT

Brain Tissue	Tissue at Risk in effected hemisphere				CONTRALATERALNORMAL CEREBRALHEMISPHERE			
Parameter	CBF	CBV	MTT	TTP	CBF	CBV	MTT	TTP
PATIENT-1	41.42	2.5	7.61	7.18	69.59	4	5.3	6.99
PATIENT-2	34.72	1.92	7.01	8.98	56.63	3.4	3.1	2.29

Out of 15 (50%) patients who presented within 3- 6 hrs of symptoms (table1), 3 (20%) of these had normal NCCT, 10(66.67%) had changes of ischemia and 2 (13.33%) had well-formed infarct on NCCT. Obscuration of lentiform nucleus (figure 2) and dense MCA (figure 3) were the most common among findings of ischemia in 4 (19.04%) patients each followed by loss of grey- white differentiation, insular ribbon sign were seen in one (4.76%) patient each, detailed in Table3.

Table3 FINDINGS ON NCCT HEAD IN PATIENTS OF STROKE UP TO 6HOURS DURATION OF SYMPTOMS:

Finding	No. of Patients (percentage)	<3hrs	3-6hrs
Normal study	7 (33.33%)	4	3
Obscuration of lentiform nucleus	4 (19.04%)	0	4
Dense MCA	4 (19.04%)	0	4
Hypodensity with Sulcal effacement	2 (9.5%)	2	0
Loss of grey- white differentiation	1(4.76%)	0	1
Insular ribbon sign	1 (4.76%)	0	1
Well-formed infarct	2 (9.5%)	0	2

Among the 21 patients presenting within 6 hours of developing symptoms :7(33.3%)patients had normal NCCT, 12(57.1%) patients revealed signs of Ischemia (Table3) and 2(9.5%) had well formed infarcts, while in 9(30%) patients who presented > 6 hours of developing symptoms , 1(11.1%) patient had normal NCCT and 3 (33.3%)patients had early signs of Ischemia and 5(55.5%) patients had well-formed infarct. Diagnostic sensitivity rate of NCCT was 33.3% , 80% & 88.8% within <3 hours , ≤ 6hours and ≥6 hours respectively. (table4)

Table4: COMPARISON OF DIAGNOSTIC RATE of NCCT IN RELATION TO DURATION OF PRESENTATION AFTER DEVELOPING SYMPTOMS

Duration	Ischemic signs	Well formed infarct	Normal	Total patients
<3hours	2 (33.3%)	0	4(66.67%)	6
<6hour	10(66.67%)	2(13.33%)	3(20%)	15
>6hours	3(33.3%)	5(55.55%)	1(11.11%)	9

On perfusions (PCT) diagnostic sensitivity rates were 66.6% ≤3hours & diagnostic accuracy was 100% in patients presenting within 3-6 hours of developing symptoms. It confirmed the stroke in 80% of the cases and excluded the diagnosis of stroke in rest of 20% cases. PCT outlined the umbra & penumbra which was helpful in predicting the probable outcome of thrombolytic therapy. On PCT, 10(66 .6%) of 15 patients presenting between 3-6 hours of the symptoms had significant (>50%) penumbra while the 2 cases of infarct on NCCT had both non-viable area core (umbra) surrounded by area of tissue at risk, penumbra.

All 6 patients who reached within 3 hours either had normal NCCT head or had EIC on NCCT, were thrombolysed , revealed on post treatment haemorrhage had clinical improvement and improved NI HSS scores at admission & on 7th day of discharge,(table5).

Table5:NIHSS SCORING IN PATIENTS WHO RECEIVED THROMBOLYSIS

NCCT findings	NIHSS Score on Admission	NIHSS Score on 7th Day of Discharge
Normal	11	3
Normal	9	3
Normal	9	3
EIC	12	5
Normal	10	4
EIC	12	4

Discussion

NCCT was used as first line study to exclude haemorrhage, SOL & stroke mimickers in all patients suspected to have stroke . Apart from excluding these pathologies, it diagnosed early signs of ischemia in 33.3% in 6 patients presenting within 3 hours of study used as window period for thorombolysis ProvanzleJames Radiology2003 in our study period .NCCT was the first line of choice investigation for triage in the patients suspected to have suffered from stroke due to its availability, less time consuming and comparatively cheap Singer OC& Tanned in patients with in 3 hours of symptom which was used as window period for administering tPA in present study and by various authors in pastProvanzleJames Radiology2003. In present series 4(66.6) patients had normal NCCT and the normal NCCT did not rule out the possibility of salvageable tissue in these patients , so all these patients were thrombolysed .None of our patients had any symptoms of bleeding following thrombolytic therapy while European Cooperative Acute Stroke Study II, mentioned that the failure to recognize infarct on NCCT in more than one-third of the middle cerebral artery territory contributed to hemorrhagic complications after administration of systemic lytic therapyHacke1995 .Twentyone (70%) patients presented within 6 hours of symptoms, 14 (66.7%) showed early ischemic changes(EIC) on NCT which is similar to rate of 61%reported by JM Wardlaw et al (2005)67& M Koga et al (2003)66 whereas N Tomura et al (1988)68 has reports EIC changes in 92% of their 25 case studyon NCCT. Hypodense area with sulcul effacement was the earliest sign of iscemia in our study similar to that of M Koga et al (2003)66. Obscuration of lentiform nucleus and dense MCA were the most common findings of ischemia in 4(14.28%) patients each .Earliest findings of ischemia on NCCT seen were subtle hypo density of parenchyma with sulcul effacement in 2 (9.5%) patients , loss of grey-white matter differentiation and loss of insular ribbon sign Tuwit Radiology 1990 in 1 (4.76%) patients. Few patients showed multiple findings. However, N Tomura et al (1988)68 found that most common finding was obscured outline or partial disappearance of lentiform nucleus, which was seen in all 23 (92%) patients. These findings are different from our findings.

In 83.33% cases hypertension was the single most important modifiable risk factor for ischemic stroke followed by diabetes mellitus in 30% of the cases which were no different from the previous studies having similar incidences of 81.5% & 33% of

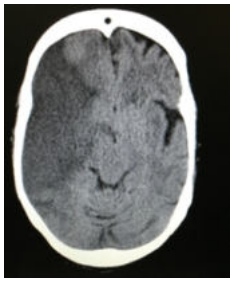
hypertension and diabetes mellitus respectively Fonarow GC et al (2010) in acute ischemic stroke.

PCT is being increasingly used in acute ischemic stroke to detect the salvageable tissue from non salvageable core as normal NCT did not rule out the possibility of salvageable tissue which was clearly diagnosed in 4/6 (66.6%) patients in our study ,similar results have been reported in Stroke. 2006;37:973-978.) & by Hopyan J, Ciarallo who found that review of perfusion CT maps increased correct stroke diagnosis four fold over that achieved by review of unenhanced CT studies alone for "early ischemic changes" (EICs).We advocate that PCT should be part of stroke protocol and time duration for thrombolytic therapy, benefit should be extended Lauraet al Radiographics2012 to all those patients having significant (>50%)penumbra on PCT as only 20% patients are able to reach with in 3hours window period while another 50% seeking the treatment reach within 3-6 hours can be benefitted by reducing the post stroke morbidity .

Conclusion:

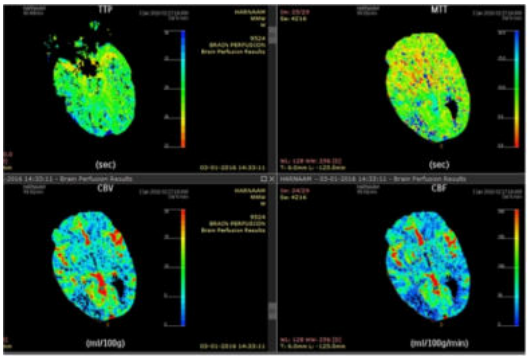
Our study reveals that only 20% of total stroke patients presented in hyper acute stage(< 3hours), 66.67% of these 20% had normal NCT and 33.33% had signs of early ischemia .Hypo density with effacement of sulci was the earliest sign of ischemia . Another 50% of the patients presenting between 3-6 hours, and the early signs of ischemia were the most common findings in 66.67% with infarct formation in 13.33 % .In patients presented after 6 hours well-formed infarct percentage increases to 55.55%.Perfusion CT is better investigation which reveals penumbra in patients with normal NCCT & shows both umbra & penumbra in patients with ischemic findings on NCCT.

1)

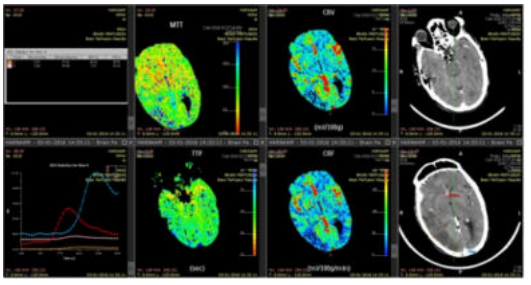


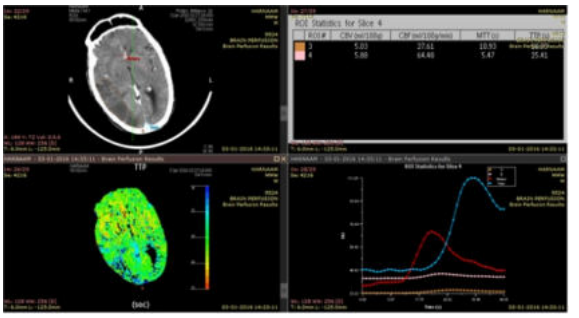
2)

3)



4)





56 year old male with history of acute stroke with left hemiparesis.NCCT brain(1,2) shows hypodense area involving the right MCA territory with "hyperdense MCA "sign. Perfusion CT images(3,4,5) showing decreased CBF,CBV and increased MTT and TPP.