Original Research Article

A study of outcome of patients with ischemic CVA in relation to carotid lesions

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Abstract

Background: There is high probability of future CVA in patient with TIA and previous CVA. The clinical outcome in patients with stroke associated with internal carotid artery (ICA) occlusion is poor. Therefore, it would be beneficial to investigate such patients, if there are methods of preventing further stroke. The purpose of the current study was to assess predictive factors of adverse outcomes such as death and disability in patients with ischemic CVA in relation to carotid lesions. **Material and Methods:** The present study was carried out on 50 consecutive cases with the diagnosis of ischemic stroke or TIA. All patients underwent non contrast CT scan on admission, the scan was repeated after 48 hours only in those patients, where initial scan was not showing any hypodense lesions. **Results:** Out of 50 cases, 41(82%) patients showed clinical improvement, 07(14%) patients had progression of stroke, while 02(4%) patients had recurrence of symptoms. Out of 7 cases of progression (worsening), 6 (85.7%) had severe carotid stenosis, out of which 3(16.6%) patients had total occlusion, while 1(14.3%) case had non severe stenosis. **Discussion:** Carotid doppler can be used as best noninvasive tool in patients with acute stroke, to detect severity of stenosis and 'high risk plaques', so that stroke event rate (progression and recurrence) can be minimized by selecting these 'high risk' patients for carotid endartrectomy, while patients in other group can be followed, with continuing medical treatment along with modification of diet and risk factors.

Key Words: Cerebrovascular accident, transient ischemic attack, carotid Doppler, outcome.

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INTRODUCTION

Cerebrovascular accidents (CVA) are a major cause of hospital admissions in our country, particularly in older patients. Epidemiological studies have shown that, CVA is accounting for 10% of all mortalities[1]. Cerebral infarct, the majority due to atherosclerosis account for most of all CVA. Despite wide spread distribution of atherosclerosis only few of carotid lesions becomes symptomatic. Most patients with symptomatic carotid disease suffer either transient ischemic attack (TIA) or persistent focal neurodefecit called ischemic stroke[2]. There is high probability of future CVA in patient with TIA and amaurosisfugax and previous CVA. Therefore, it would be beneficial to investigate such patients, if there are methods of preventing further stroke. Patients with transient or minor symptoms of cerebral ischemia ipsilateral to carotid occlusion have an annual risk of ischemic stroke of approximately 5–7% and an annual death rate of approximately 6% per year. If patients have a compromised cerebral blood flow, the prognosis is even worse with annual risk of stroke 12.5%[3,4]. Though the various surgical and medical modalities are available, for prevention of CVA, considering their high cost, and limited resources and financial limitations in developing country like us, the main attention has been focused on prevention of this illness by risk factor modification. The purpose of the current study was to assess predictive

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factors of adverse outcomes such as death and disability in patients with ischemic CVA in relation to carotid lesions.

MATERIAL AND METHODS

The present study was carried out on 50 consecutive cases admitted to Medical Intensive Care Unit as emergencies, with the diagnosis of ischemic stroke or TIA. The patients with ischemic stroke in vertebrobasilar system and with cardioembolic cause for stroke were excluded from the study. Ischemic stroke was defined as clinical signs of focal disturbance of cerebral function, lasting more than 24 hours, with no apparent cause other than of ischemic origin. TIA was defined as episode of focal cerebral dysfunction, presumably ischemic in origin, lasting less than 24 hours. Demographic data regarding age and sex was collected in all patients. Data regarding history of symptoms and various risk factors like diabetes, hypertension, smoking, alcoholism and hyperlipedemia was collected in all patients from reliable relatives. Information regarding diet habit whether vegeterian or mixed was obtained in all patients. All patients were subjected to general and detail neurological examination. For localization of lesion carotids were auscultated near upper portion of thyroid cartilage, for presence or absence of bruit. All patients underwent routine investigations like haemogram. All patients underwent non contrast CT scan on admission, the scan was repeated after 48 hours only in those patients, where initial scan was not showing any hypodense lesions. According to CT scan reports, the infarcts were divided intocortical infarct i.e., any infarct involving cortical surface and subcortical infarct i.e., involving basal ganglia, thalamus, internal capsule, sparing cortical surface. The carotid arteries were evaluated by expert radiologist in our hospital with a high resolution linear array transducer equipped with a pulsed Doppler spectral analyser (SONOACE –8800 MEDISON). Three longitudinal images of ICA obtained from anterior, lateral and posterior part of neck respectively. The images of ICA included the carotid bulb and initial 10 mm artery distal to bulb. The extent of atherosclerosis was first determined from Doppler spectra. The percentage of stenosis was determined in proximal part of ICA and from the ratio of residual lumen diameter to lumen diameter of artery distal to stenosis. Peak systolic velocities were measured in ICA. Velocities of 1.5m/sec to 2m/sec were considered to represent 50 to 70% stenosis, whereas, velocities more than 2m/sec correspond to more than 70% stenosis. If velocities were less than 1.5m/sec, the artery was evaluated on gray scale image, categorizing the percentage of stenosis into one of three remaining categories 0, 1 to 24% and 25 to 49% stenosis, occlusion was defined as absence of velocity signal in ICA. Stenosis less than 70% was considered as non-severe while more than 71% as severe. The appearance of largest focal lesion was classified by surface characteristics, echogenicity and morphology. All patients were treated with heparin, and antiplatelet drugs. Signs and symptoms were continuously supervised at least three times daily till discharge. Progression and recurrent stroke were looked for in particular. Progression was defined as worsening of neurodefecit from same arterial distribution and there should be no other plausible cause for deterioration, patients with new symptoms from other arterial distribution or new neurodefecit after a period of normal neurological status were considered to have recurrent stroke.

RESULTS

Majority of the patients i.e., 25 (50%) were between61 to 70 years and only 02(4%) cases had age less than 40 years and 01(2%) had age more than 70 years. Out of 50 cases, 30(60%) were males and 20(40%) were females.40(80%) were consuming mixed diet, 10(20%) patients were pure vegetarian. Regarding risk factors, 25(50%) patients had previous history of hypertension. 20(40%) patients were chronic smokers, 16(32%) were chronic alcoholic, while 14(28%) patients had diabetes and hyperlipedemia each (Table 1).

Table 1: Baseline patient characteristics (n=50)

Patient characteristics	No. of patients (%)
Age in years	
<40	02 (4%)
41-50	12 (24%)
51-60	10 (20%)
61-70	25 (50%)
>71	01 (2%)
Sex	
Male	30 (60%)
Female	20 (40%)
Type of diet	
Mixed	40 (80%)
Veg	10 (20%)
Risk factors	
Hypertension	25 (50%)
Smoking	20 (40%)
Alcohol	16 (32%)
Diabetes	14 (28%)
Hyperlipedemia	14 (28%)

Out of 50 cases, 27 (54%) patients had severe stenosis of ICA, while 23(46%) had non severe stenosis. According to percentage of stenosis, 03 (06%) patients had <50% stenosis, 20 (40%) patients had 51 to 70% stenosis, 24 (48%) had 71 to 99% stenosis, while 3 (6%) patients had total (100%) occlusion. Out of 50 cases, 24 (48%) patients had carotid bruit. 13 (48.14%) patients out of 27 cases with severe stenosis had bruit, while 11(47.82%)

out of 23 cases with non severe stenosis had bruit, so sensitivity of carotid bruit for severity of stenosis was 48.14% and specificity of 52.18%. Out of 50 cases, 33 (66%) patients had stroke, while 17 (34%) patients had TIA. Out of 33 cases with stroke 23 (69.69%) patients had hemiplegia alone and 10 (30.30%) patients had hemiplegia with aphasia out of 17 patients with TIA, 7 (41.17%) patients had hemiparesis, 6 (35.29%) patients had hemiparesis along with slurring of speech and 4(23.52%) patients had fascio-brachial paresis. All the patients in study were right handed. Out of 50 cases, 19(38%) patients had cortical infarct, 14 (28%) patients had subcortical infarct and 17 (34%) patients had normal scan. Out of 19 patients with cortical infarct 14 (73.68%) patients had severe stenosis while 5 (26.32%) patients had non severe stenosis. Out of 14 patients with subcortical infarct 10 (71.42%) patients had non severe and 4 (28.57%) patients non severe stenosis. Out of 50 cases, 29(58%) had heterogeneous plaque, while 21 (42%) had homogeneous plaque. According to surface characters, 17 (34%) had smooth surface, 24(48%) had irregular surface, while 9 (18%) had ulcerative plaque surface. According to echogenicity 25 (50%) had hyperechoic plaques, 23 (46%) had isoechoic and 02 (4%) had hyperechoic plaques. Out of 7 cases of progression (worsening), 6 (85.7%) had severe carotid stenosis, out of which 3 (16.6%) patients had total occlusion, while 1 (14.3%) case had non severe stenosis. 6 (85.7%) had heterogeneous plaque, only 1 (14.3%) had homogenous plaque. 4 (57.2%) had ulcerative surface, 2 (28.6%) had irregular surface and only 1 (14.3%) case had smooth surface. 5 (71.4%) cases had hyperechoic plaque while 2 (28.6%) had isoechoic plaque. Out of 2 cases of recurrence, both had total occlusion of carotid, heterogeneous morphology and ulcerative surface. 1 (50%) patient had hyperechoic plaque while other had isoechoic plaque (Table 2).

Table 2: Distribution of cases according to outcome of patient and characteristics of carotid lesion

Characteristics of lesion	Progression (n = 7)		Recurrence (n = 2)	
	Cases	%	Cases	%
Degree of Stenosis				
Non severe	1	14.3	0	0
Severe	6	85.7	2	100
Plaque Morphology				
Homogeneous	1	14.3	0	0
Heterogeneous	6	85.7	2	100
Surface				
Smooth	1	14.3	0	0
Irregular	2	28.6	0	0
Ulcerative	4	57.2	2	100
Echogencity				
Hyper	5	71.4	1	50
ISO	2	28.6	1	50

Out of 50 cases, 41 (82%) patients showed clinical improvement, 07 (14%) patients had progression of stroke, while 02 (4%) patients had recurrence of symptoms.

Table 3: Distribution of cases according to the outcome of patient

Outcome	No. of cases	Percentage
Improvement	41	82
Progression	07	14
Recurrence	02	04
Death	0	0

DISCUSSION

Doppler ultrasonography is a rapid, noninvasive, relatively inexpensive and accurate means of detecting carotid disease. The present study included 50 consecutive patients with ischemic CVA. Very limited data is available on study of carotid doppler in acute ischemic CVA. There were 25 (50%) cases with age between 61 to 70 years, followed by 12 (24%) and 10 (24%) patients in age between 41 to 50 years and 51 to 60 years, respectively. Only 02(4%) cases had age less than 40 years and 01(2%) patient had age more than 71 years. According to studies conducted by Pollack *et al*[5], Nayak *et al*[6] and Jullig *et al*[7], commonest age group of ischemic stroke was 60 to 65 years. Our findings are consistent with these previous studies. Male to female ratio in our study was 3:2. Similar observations were found in study conducted by Nayak *et al*[6], Bassiauny *et al*[8] and OSACA study[9]. The high M: F ratio may be related to higher incidence of multiple risk factors like alcohol, smoking in males. In our study 40 (80%) patients had mixed diet pattern, while 90 (20%) patients were vegetarian. Our findings are similar to Chicago-western electric data study[10]. Commonest risk factors in our study were hypertension (50%), smoking (40%), alcoholism (32%) followed by diabetes and hyperlipedemia (28%) each our findings are comparable to previous studies. Hypertension as a commonest risk factor for ischemic CVA was found in studies conducted by Boyson *et al*[11], Urstad *et al*[12] and Shridharan *et al*[13]. Smoking was the comments risk factor found in studies conducted by Boyson *et al*[11] and Mast *et al*[14]. Alcohol was the commonest risk factor in studies conducted by Aitken HD *et al*[15] and Boysan *et al*[11]. Hyperlipedemiawas the commonest risk factor in studies conducted by Shridharan *et al*[13] and Denti *et al*[16]. In present study 27 (54%) cases had severe stenosis while 23(46%) had non severe stenosis of ICA 3 (6%) patients had total occlusion of ICA. Our study showed higher percentage of cases with severe stenosis, as compared to previous studies, but the percentage of cases with total occlusion is consistent with previous studies. Carotid bruit has been correlated to occlusive atherosclerotic

disease and ischemic CVA. In our study 13 (48.14%) patients out of 27 patients with severe stenosis had carotid bruit, while 11 (47.82%) patients out of 23 patients with non severe stenosis had carotid bruit with sensitivity of 44.4% and specificity of 56.52%. Ghilardi *et al*[17] has found poor sensitivity of carotid bruit for serve stenosis, but they found high specificity. Findings regarding specificity in our study are not matching with this study. In our study 33 (66%) patients had stroke and 17 (34%) patients had TIA, so incidence of stoke was more common than TIA. Our findings are consistent with studies conducted by Mournier *et al*[18] and Pratap RC *et al*[19], but our findings are in contrast to study conducted by Colon EJetal[20]. Low incidence of TIA in our study may be correlated to transient nature of symptoms in TIA, which prevents the patients to refer to tertiary care hospital like us.Out of 33 patients with stroke, 23 (69.69%) patients had hemiplegia of left side without aphasia suggesting an infarction in the right middle cerebral artery territory. 10 (30.31%) patients have right sided hemiplegia with aphasia suggesting infarction in left middle cerebral artery territory. All the patients with stroke were right handed. In 17 patients with TIA, 4 (23.52%) had faciobrachial paresis 6 (35.29%) had difficulty in speech with hemiparesis and 7 (41.17%) patients had only hemiparesis. Colon *et al*[20], in his study found that hemiparesis and hemihypaesthesia was commonest presentation of stroke, accounting for 94% cases. Amongst patients with TIA, hemiparesis was commonest presentation (71%), followed by amaurosisfugax (16%) and aphasia (4%). Our findings of clinical features of stroke are comparable to this study, however we did not find amaurosisfugax in any of our patients. In our study out of 17 patients with TIA, 9 (52.94%) patients had serve stenosis, 11 (64%) patients had heterogeneous plaques 12 (70%) patients had irregular surface including ulceration and 9 (52.94%) patients had hyperechoic plaques. Out of 33 stroke patients 18 (56.54%) had severe stenosis, 15 (53.5%) patients had heterogeneous plaques, 21 (63.6%) patients had irregular surface including ulceration and 16 (48.48%) had hyperchoic plaques. Thus, in present study high grade stenosis, heterogeneous plaques, irregular surface and ulceration and hyperechoic plaques were more common in stroke and TIA patients. In our study out of total 33 cases with stroke 19 (57.57%) patients had cortical infarct and 14 (42.4%) patients had subcortical infract. All subcortical infarcts were small (size less than 15 mm). 14 (73.68%) out of 19 patients with cortical Infarct had severe carotid stenosis, and 4 (28.52%) out of 14 patients with subcortical infarct had severe stenosis, suggesting that ipsilateral severe carotid stenosis was more common with large cortical infract on the same side. The subcortical infarct may be due to associated small vessel disease pathology like lipohyalinosis. Similar findings were observed byMounier-Vehier *et al*[18]. In our study, 25 (92.59%) out of 27 cases with severe stenosis had heterogeneous plaques as compared to 4 (17.39%) cases out of 23 patients with non severe stenosis, had heterogeneous plaques. So, there is significant association between heterogenicity of plaque and severity of stenosis. ($p<0.001$) which is consistent with study conducted by Polack *et al*[5]. In present study, 16 (53.21%) of 27 patients with severe stenosis had irregular surface and 9 (33.34%) patients had ulcerative plaques, while 8 (35.75%) out 23 patients with non severe stenosis had irregular surface and no case had ulcerative plaque. So, there is significant association between irregularity of plaque surface and severity of stenosis ($p<0.001$). Out of 50 patients, 7 (14.0%) cases had progression of neurodefecit while 2 (4%) patients had recurrent stroke. So, the stroke event rate was 18%, median stay of hospitalization was 11 days (range 3-30 day). All progression or recurrence occurred within 4 days of admission. Recurrence rate in our study is comparable to study conducted by Jullig Roden *et al*[7]. However, the progression rate was lower in our study as compared to previous study. In our study amongst 7 case with progression, 6 (85.71%) had severe carotid stenosis, out of which 1 (16.6%) had occlusion. All cases with recurrence had occlusion. This high risk of recurrence or progression with severe stenosis, is consistent with observations of studies conducted by Handa *et al*[9], but findings were in contrast to RodenJulling*et al* study[7] where no significant difference was found in rate of progression or recurrence between severe and non severe stenosis. In our study out of 7 cases with progression, 4 (57.20%) patients had ulcerative surface, while 2 (28.71%) patients had irregular surface and 1 (14.3%) had smooth surface while all cases with recurrence had ulcerative surface. This high risk of recurrence or progression with ulcerative / irregular surface was also observed in study conducted by Handa *et al*[9]. In conclusion, carotid doppler can be used as best noninvasive tool in patients with acute stroke, to detect severity of stenosis and 'high risk plaques', so that stroke event rate (progression and recurrence) can be minimized by selecting these 'high risk' patients for carotid endartrectomy, while patients in other group can be followed, with continuing medical treatment along with modification of diet and risk factors.

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