

# Functional Outcome of Ischemic Stroke in Diabetics

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**Objective:** Objective was to determine whether the outcome of ischemic stroke is different or not in diabetics than nondiabetics. **Study Design:** Prospective observational-analytical study Study place and Duration; It was conducted in medical unit-2 Bahawal Victoria Hospital, affiliated with Quaid-e-Azam Medical College Bahawalpur from October 1, 2004 to September 30, 2005. **Patients and methods:** 132 patients of ischemic stroke, confirmed by CT scan, were enrolled during one year study period. The patients of hemorrhagic stroke, TIA, focal deficits of non-vascular origin and infratentorial lesions were excluded. Patients were divided into two groups; diabetics and nondiabetics and were studied regarding their in hospital outcome according to the modified Rankin Scale. The variables applied were age, sex, hypertension and type of infarct (lacunar/cerebral). **Results:** Out of 132 ischemic stroke patients 36 (27%) were diabetics and 96 were nondiabetics. Hypertension was present in 83 (62%). Overall mortality was 11.3%. Mortality was significantly more frequent in diabetics than nondiabetics (16.6% Vs 9.3%  $p < 0.05$ ). Disability was also more frequent in diabetics (25% Vs 13.5%  $p < 0.05$ ). In diabetic group good recovery (8.8% Vs 12.5%) as well as partial recovery (50% Vs 64.5%) was less frequent. Patients  $< 40$  years were few in number with good recovery in both diabetics as well as nondiabetics. Diabetics of 40-60 years were found to have significantly high number of deaths (15.3% Vs 7%  $p < 0.05$ ) and disability (15.3% Vs 10.7%  $p < 0.05$ ) than non-diabetics. Similar pattern was seen in patients  $> 60$  years. Increasing age was found to be associated with poor outcome in both the groups but poorer in diabetics. Sex did not discriminate the poor outcome in diabetics. The presence of hypertension worsened the out come in both the groups but more in the diabetic group both in term of mortality (20.8% Vs 11.8%  $p < 0.05$ ) as well as disability (33.3% Vs 15.2%  $p < 0.05$ ). Lacunar infarct was found in few patient with good prognosis while cerebral infarct was associated with poor prognosis and put the diabetics at higher risk in term of mortality (17.6% Vs 9.8%  $p < 0.05$ ) as well as disability (26.4% Vs 14.2%  $p < 0.05$ ). **Conclusion:** Diabetes Mellitus is associated with poor outcome of ischemic stroke patients both in terms of mortality and morbidity during acute hospitalization. Hypertension, increasing age and large infarct size further worsens the outcome.

**Key words:** stroke, diabetes mellitus, hypertension, cerebral infarct

Diabetes mellitus (DM) is modern day pandemic. Pakistan ranked eighth in world for the number of patients afflicted with diabetes mellitus in 1995, had 4.3 millions diabetics at that time. Pakistan will be fourth in 2025 with projected number of 14.5 millions<sup>1</sup>, God forbid, if the present situation continues. Prevalence of DM in Pakistan is 6.3-16.2%<sup>2,3</sup>. Diabetics are more prone to develop vascular diseases, including stroke.

Stroke is second most common cause of death worldwide<sup>4</sup>. Annually 5.5 millions people died of this dreadful disease<sup>5</sup>. Many of the victims are left with disability and dependency increasing in cost and burden on community. DM is found in one fifth to one third of stroke patients<sup>6,7,8</sup>. The increased relative risk in diabetics ranges from 1.8 to 6-fold<sup>9</sup>. The other major risk factor is hypertension<sup>8</sup>. DM not only significantly increases the risk of stroke but also negatively affects the outcome. Higher mortality in diabetics is reported in many studies during acute hospitalization<sup>7,10</sup> and later<sup>10,11</sup> but not in all<sup>12</sup>. Recovery is also reported slower and incomplete in diabetics than non-diabetics<sup>13</sup> but other study did not support in hospital difference<sup>12</sup>.

Objective was to determine whether the outcome of ischemic stroke is different or not in diabetics than nondiabetics.

## Patients and methods:

**Study setting and Design:** This is a prospective observational analytical study.

**Study place and Duration:** It was conducted in medical unit-2 Bahawal Victoria Hospital, affiliated with Quaid-e-Azam Medical College Bahawalpur from October 1, 2004 to September 30, 2005

### Inclusion criteria:

1. All adult patients with clinical diagnosis of stroke.
2. Stroke diagnosis was confirmed by CT scan of brain.

### Exclusion criteria:

1. The patients of hemorrhagic stroke
2. TIA
3. Infra-tentorial lesion
4. Focal neurological deficits secondary to non-vascular origin.

These patients were studied regarding their age, sex, risk factors especially diabetes mellitus and hypertension, subtypes of infarcts, mortality and extent of recovery during their hospital stay.

Broadly these patients were divided into two groups; diabetics and non-diabetics. In each group short term outcome (hospitalized period = 3-33 days, average 13 days) was recorded in terms of number of deaths, extent of recovery and disability. Outcome in each group was further analyzed according to their age, sex, hypertension and type of infarct (lacunar or cerebral).

Both the groups were given standard treatment. Every patient was followed up daily regarding outcome in both the groups according to the Modified Rankin Scale and entries were made in the questionnaire. The consent was taken from the relative after giving the relative talk and slight understanding.

All information collected was fed and analyzed through computer software SPSS version 10. Different frequencies were calculated and are represented in tables. The difference of relationship of various variables with the outcome, in both the groups, was calculated. As the variables were qualitative in nature, so Chi-square test was used to calculate the statistical significance if any between the calculated variables. The level of confidence fixed was 95%.

Stroke was defined according to WHO criteria<sup>14</sup> as rapidly developing symptoms and/signs of focal and at times global loss of cerebral function with no apparent cause other than the vascular origin.

Diabetes mellitus was defined as known diabetics taking anti-diabetic drugs or newly diagnosed according to WHO criteria as two readings of raised blood sugar either random > 11mmol/L or fasting > 7mmol/L.

Hypertension was defined as known hypertensive on anti-hypertensive medication, two or more readings of 140mmHg systolic and 90mmHg diastolic blood pressure or the evidence of left ventricular hypertrophy clinically/ on ECG. Cerebral infarct was labeled as a hypo-dense area of more than one centimeter on CT scan corresponding to the clinical features and less than one centimeter area was labeled as lacunar infarct

The functional outcome was assessed according to the Modified Rankin Scale<sup>15</sup> which scores from 0-6.

Scores----- Description

Score 0- no symptoms at all.

Score 1- no significant disability despite symptom; able to carry out all usual duties and activities.

Score 2- slight disability; unable to carry out all previous activities but able to look after own affairs without assistant.

Score 3- moderate disability; requiring some help but able to walk without assistance. Score 4- moderately severe disability; unable to walk without assistance and unable to attend to own body needs without assistance.

Score 5- severe disability; bedridden, incontinent and requiring constant nursing care. Score 6- dead.

Good recovery was labeled to score 0 & 1, partial recovery to score 2 & 3 while score 4 & 5 were labeled as disability.

## Results:

In one year study period, total 198 patients were admitted with stroke. Out of these 132 patients were suffering from ischemic stroke and were further evaluated. Out of 132 male patients were 84 (66.6%) and female patients were 48 (33.3%). Average age was 59 years. The diabetics were 27% while hypertension was found in 62%. Lacunar infarcts were fewer (5.3%) and overall mortality was 11.3%. The salient features of these patients are shown in table No.1.

Table 1: Salient features of ischemic stroke patients (T=132) (Male: 84 & Female 48)

Features	Total	Males	Females
Age range (years)	25-80	25-80	36-70
Average age (years)	59	61	55.5
Diabetics	36(27%)	24 (28.5%)	12 (25%)
Hypertensives	83(62%)	50 (59.5%)	33 (68.7%)
Lacunar infarcts	7(5.3%)	4 (4.7%)	3 (6.2%)
Cerebral infarcts	125(94.6%)	80 (95.2%)	43 (93.7%)
Deaths	15(11.3%)	10 (11.9%)	5 (10.4%)
Disabled	22(16.6%)	14 (16.6%)	8 (16.6%)
Recovered	95(72%)	60 (71.4%)	35 (72.9%)

Comparison of the outcome revealed that deaths were more frequent in diabetics than non-diabetics (16.6% Vs 9.3% p<0.05). Diabetics were more disabled and fewer recovered than non-diabetics (Table 2).

Patients <40 years were few in number with good recovery in both diabetics as well as nondiabetics. Diabetics of 40-60 years were found to have significantly high number of deaths (15.3% Vs 7% p<0.05) and disability (15.3% Vs 10.7% p<0.05) than non-diabetics. Similar pattern was seen in patients >60 years. Increasing age was found to be associated with poor outcome in both the groups but poorer in diabetics. Sex did not discriminate the poor outcome in diabetics (Table 2).

The presence of hypertension worsened the outcome in both the groups but more in the diabetic group both in term of mortality (20.8% Vs 11.8% p<0.05) as well as disability (33.3% Vs 15.2% p<0.05) as can be seen in table No.2. Lacunar infarct was found in few patient with good prognosis while cerebral infarct was associated with poor prognosis and put the diabetics at higher risk in term of mortality (17.6% Vs 9.8% p<0.05) as well as disability (26.4% Vs 14.2% p<0.05) (Table 2).

Table 2: Outcome of ischemic stroke patient with DM vs Non DM

Features	No. of Patients	Good recovery	Partial recovery	Dis- ability	Death
<b>Diabetic (n=36)</b>					
Total	36 (100 %)	3 (8.3%)	18 (50%)	9 (25%)	6 (16.6%)
Age <40years	1 (2.7%)	1 (100%)	-	-	-
40-60	13 (36%)	2 (15.3%)	7 (53.8%)	2 (15.3%)	2 (15.3%)
>60	22 (61%)	-	11 (50%)	7 (31.8%)	4 (18%)
Males	24 (66%)	2 (8.3%)	12 (50%)	6 (25%)	4 (16.6%)
Females	12 (33.3%)	1 (8.3%)	6 (50%)	3 (25%)	2 (16.6%)
HTN	24 (66.6%)	1 (4.1%)	10 (41.6%)	8 (33.3%)	5 (20.8%)
NTN	12 (33.3%)	2 (16.6%)	8 (66.6%)	1 (8.3%)	1 (8.3%)
Lacunar infarct	2 (8.3%)	2 (100%)	-	-	-
Cerebral infarct	34 (91.7%)	1 (3%)	18 (53%)	9 (26.4%)	6 (17.6%)
<b>Non diabetics (n=96)</b>					
Total	96 (100%)	12 (12.5%)	62 (64.5%)	13 (13.5%)	9 (9.3%)
Age <40years	5 (6.2%)	5 (100%)	-	-	-
40-60	28 (29%)	5 (18%)	18 (64%)	3 (10.7%)	2 (7%)
>60	63 (65.6%)	4 (6.3%)	42 (66%)	10 (15.8%)	7 (11%)
Males	60 (63.5%)	8 (13.3%)	38 (63.3%)	8 (13.3%)	6 (10%)
Females	36 (37.5%)	4 (11.1%)	24 (66.6%)	5 (13.8%)	3 (8.3%)
HTN	59 (61.4%)	7 (11.8%)	35 (59.3%)	9 (15.2%)	7 (11.8%)
NTN	37 (38.5%)	5 (13.5%)	27 (73%)	4 (10.8%)	2 (5.4%)
Lacunar infarct	5 (5.2%)	5 (100%)	-	-	-
Cerebral infarct	91 (94.8%)	7 (7.7%)	62 (68%)	13 (14.2%)	9 (9.8%)

Key: DM, diabetes mellitus, HTN: hypertension, NTN: normotensive. *p* value< 0.05 of all except sex.

### Discussion:

Diabetes mellitus was present in 27% of all ischemic stroke patients; literature reveals the DM frequency from 20% to 37.3%<sup>7,8,16</sup>. Hypertension was recorded in 62%, nearly same frequency (68%), recorded in a recent African study<sup>8</sup>. The overall mortality in our study was 11.3%. In hospital mortality has been reported to be 12%<sup>16</sup>, nearly equal to our figure.

Main aim of our study was to determine the difference of outcome, if any, in diabetics than nondiabetics. We found statistically significant difference. Mortality was more frequent in our diabetic patient than nondiabetics (16.6% Vs 9.3%,  $p < 0.05$ ), same pattern has been reported in most studies<sup>7,10,11,17,18,19,20,21</sup>. This can be seen in study of Davor Janculjak et al (22), who report case fatality 28.7% in diabetics Vs 22.2% in nondiabetics. One local study<sup>12</sup>, reported no difference in mortality, this might be because of the study design, where the comparison was made with hypertensive stroke patients who also show poor prognosis. Similarly survivors in diabetic group were left with incomplete recovery and more disability than nondiabetics, which is statistically significant (25% Vs 13.5%  $p < 0.05$ ). The similar finding has been reported e.g., disability (The Modified Rankin Score 4-5) in one study was 35% in diabetics Vs 24% in nondiabetics<sup>22</sup>. The same pattern has reported by other studies too<sup>18,23</sup>. The poor outcome in diabetics might be related to increased frequency of infarct volume expansion<sup>23</sup> leading to fatal brain edema and rapid death. The poor recovery in DM may be because of hyperglycemia exaggerating the damaging processes of; intracellular acidosis, accumulation of extra cellular

glutamate, brain edema formation, blood brain barrier disruption and tendency of hemorrhagic transformation<sup>21</sup>.

Hypertensive died more frequently and recovery was partial in the survivors in both the groups but worse outcome was in diabetics. This indicates that increased blood pressure in diabetics is a double trouble and must be controlled more efficiently. Poor outcome in hypertensive has been reported<sup>24, 25</sup>.

Aged people have been found to be at increased risk of death and disability in our study. This has been demonstrated by other studies<sup>18,26,27</sup>. This might be because advanced atherosclerosis, fewer types of collaterals and associated other medical diseases.

Lacunar infarcts were associated with good recovery while large cerebral infarcts resulted in poor outcome, more so in diabetics. The volume of infarct increases readily in large infarcts, not in lacunar, secondary to cerebral edema and this can be fatal<sup>20,21,23,28</sup>.

Because DM is strongly associated with poor outcome of stroke catastrophe, leading to huge health cost burden, there is urgent need to prevent stroke. Can this be achieved in diabetics? The UKPDS-35 study reveals that strict control of DM can decrease the frequency of stroke<sup>29</sup>. Control of hypertension in diabetics, a leading cause of stroke, also decreases the incidence of stroke as evidenced by The UKPDS-36 study; every 10 mmHg reduction in systolic blood pressure decreased the risk of stroke by 19%<sup>30</sup>.

### Conclusion:

Diabetes Mellitus is associated with poor outcome of ischemic stroke patients both in terms of mortality and

mortality during acute hospitalization. Hypertension, increasing age and large infarct size further worsens the outcome.

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