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## Risk factors for medical complications of acute hemorrhagic stroke

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### ABSTRACT

**Objective:** To assess the risk factors leading to medical complications of hemorrhagic stroke.

**Methods:** We conducted an observational study in neurology, emergency and general medicine wards at a tertiary care teaching hospital in Kadapa. We recruited hemorrhagic stroke patients, and excluded the patients have evidence of trauma or brain tumor as the cause of hemorrhage. We observed the subjects throughout their hospital stay to assess the risk factors and complications.

**Results:** During period of 12 months, 288 subjects included in the study, 89% of them identified at least 1 prespecified risk factor for their admission in hospital and 75% of them experienced at least 1 prespecified complication during their stay in hospital. Around 47% of subjects deceased, among which 64% were females.

**Conclusions:** Our study has assessed that hypertension followed by diabetes mellitus are the major risk factors for medical complications of hemorrhagic stroke. Female mortality rate was more when compared to males.

## 1. Introduction

Stroke is traditionally defined as a clinical syndrome characterized by an acute loss of focal brain function with symptoms lasting more than 24 h or leading to (earlier) death, and it is due to inadequate blood supply to a part of the brain (ischemic stroke) or spontaneous hemorrhage into a part of the brain (primary intracerebral hemorrhage) or over the surface of the brain (subarachnoid hemorrhage)<sup>[1]</sup>. Haemorrhagic stroke (HS) is caused by bleeding of a blood vessel supplying the brain. Subarachnoid hemorrhage, which usually occurs due to rupturing of an aneurysm, may also lead to stroke. It tends to more severe and associated with higher early mortality<sup>[2]</sup>. HS most commonly occur in association with hypertension. Several factors identified as associated with an increased risk of stroke; see [Table 1](#)<sup>[3]</sup>.

The hospital mortality and morbidity rate of patients with acute stroke ranges from 7.6% to 30%. From these, neurological deaths constitute about 80% and non-neurological deaths constitute about 17%<sup>[4]</sup>. Neurological deaths such as progressive increased intracranial pressure and subsequent herniation were the most common causes of death in both groups within the first 4 days of admission<sup>[5]</sup>.

Medical complications after stroke are common, present barriers to optimal recovery or related to poor outcomes and are potentially preventable or treatable<sup>[6]</sup>. Estimates of frequency of complications range from 40% to 96% of patients, with severity of stroke as the most important risk factor<sup>[7]</sup>. The complications have been fatal in some cases, contributing to the hospital mortality<sup>[8]</sup>.

## 2. Materials and methods

The departments included General medicine, Emergency medicine and Neurology. Patients required from each department had at least 18 years of age or older and clinical diagnoses of hemorrhagic stroke with a measurable neurological deficit occurring within 7 days and reviewed their progress on a weekly

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**Table 1**  
Risk factors for stroke.

| Classification   | Factors   |
|------------------|---|
| Sociodemographic | Age<br>Sex: slightly higher risk in men<br>Ethnicity: higher risk in African Caribbean and South Asian populations<br>Socio-economic status: increasing deprivation is associated with increased risk   |
| Biological       | Raised blood pressure: doubling in risk of death from stroke for every 10 mmHg increase in diastolic blood pressure or 20 mmHg increase in systolic blood pressure<br>Hypercholesterolaemia<br>Hyperhomocysteinaemia  |
| Lifestyle        | Smoking: 50% increase in risk<br>Excessive alcohol consumption: 50%–100% increase in risk<br>Physical inactivity: 2.5-fold increase in risk<br>Diet: obesity; low potassium; high salt; low fruit and vegetable intake  |
| Other conditions | Diabetes mellitus: doubling of risk<br>Atrial fibrillation: 5-fold increase in risk<br>Ischemic heart disease: doubling in risk<br>Cardiac sources of thromboembolism<br>Hematological disorders: sickle cell disease; raised packed cell volume; hypercoagulability<br>Carotid artery stenosis<br>Migraine |
| Other factors    | Oral contraception: doubling of risk<br>Hormone replacement therapy: doubling of risk<br>Major life events<br>Influenza and other intercurrent infections   |

basis until discharge from the hospital. Eligible patients had seen and consecutively approached for enrollment, with a target enrollment of 20 patients from all departments. We excluded patients with trauma, brain tumor as the cause of hemorrhage and patient with incomplete follow-ups. Evidence or clinical

suspicions of ischemic stroke patients were also excluded. Each participating site obtained institutional review board approval before the study initiation, and each patient provided written informed consent prior the enrollment. Duration of study participation for each patient was a single site visit. Enrolled patients had clinical and laboratory information abstracted from their medical records by office staff. We utilized a data collection form to assess risk factors and monitor the incidence of complications. Information abstracted from the chart included: sex, age, race, date of recruitment, diabetes, hypertension, hypercholesterolemia, elevated triglyceride levels, low density lipoprotein, current smoker and significant alcohol intake. Glasgow Coma Scale and modified Rankin scale were also recorded.

Following the work by Langhorne *et al.*, modified predefined complications were utilized to monitor the occurrence of complications (Table 2)<sup>[3]</sup>. These complications monitored on daily by the physician. The selected potentially life threatening complications are as follows: acute congestive aspiration pneumonia, cardiac arrhythmias, chest infections, deep vein thrombosis, epileptic seizure, falls, heart failure, pulmonary embolism and recurrent stroke. The patient's condition, whether he survived or succumbed to his illness, was noted upon discharge.

**3. Results**

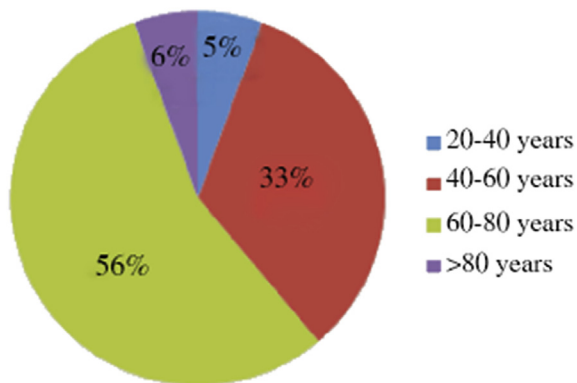
Two hundred and eighty eight consecutive patients recruited from all departments. There were 152 (52.8%) males. Mean age was (71.0 ± 9.2) years and 218 (75.7%) had their first-ever stroke. Most of these patients were in the age group of 60–80 years (Figure 1). One hundred and twenty three (42.7%) patients admitted to a general neurology, 89 (31%) to an emergency ward and 76 (26.4%) to a general medical ward.

**3.1. Risk factors for admission**

On admission, the following risk factors were noted among the subjects: hypertension in 217 (75.35%), diabetes mellitus in 76 (26.39%), alcohol consumption > 30 g/day in 88 (30.56%) and current cigarette smoking in 92 (31.94%). One hundred and eighty nine (65.6%) had a Glasgow Coma Scale score ≥ 8. A total of 257 patients (89.23%) experienced at least 1 prespecified

**Table 2**  
Modified predefined complications.

| Complications | Follow-up in hospital   |
|---------------|---|
| Neurological  | Recurrent stroke<br>Epileptic seizure   |
| Infection     | Urinary tract infection<br>Chest infection<br>Other infection   |
| Immobility    | Falls<br>Pressure sore/skin break   |
| Psychological | Depression  |
| Miscellaneous | Any pyrexial illness lasting more than 24 h.<br>Any documented falls regardless of cause.<br>Any skin break or necrosis resulting from either pressure or trivial trauma.<br>Low mood considered to interfere with daily activities or require pharmacological or psychiatric intervention.<br>Any documented complication resulting in a specific medical or surgical intervention (e.g. Gastrointestinal hemorrhage, constipation, episodes of cardiac failure, cardiac arrhythmias and arthritis). |



**Figure 1.** Patient distribution based on age group.

risk factor for their admission in hospital. The main risk factors showed in Table 3. Among these hypertension is a major risk factor for causing stroke, the proportion of hypertension in HS patients showed in Table 4 (along with summary results from previous retrospective of HS patients).

### 3.2. Complications in hospital

A total of 216 (75%) complications were seen in this cohort of patients. Among the neurological complications, 36 (12.50%) patients developed recurrent stroke and 24 (8.33%) had epileptic seizure. Among the non-neurologic complications, the most commonly encountered were diabetes, constipation, and chest infections with a rate of 11%, 7.63%, and 6.25% respectively.

Recurrent stroke and seizure were more frequent during the first week. Chest infection was the most common complication during the entire two weeks of observation, with a peak incidence during the first week. The main complications of our study showed in Table 5.

### 3.3. Mortality

One hundred and fifty two (52.78%) were discharged alive and 136 (47.2%) died during confinement. Most of these deaths

**Table 3**

Risk factors in HS patients.

| Risk factor       | Number | Percentage (%) |
|-------------------|--------|----------------|
| Hypertension      | 217    | 75.35          |
| Diabetes mellitus | 76     | 26.39          |
| Smoker            | 92     | 31.94          |
| Alcohol           | 88     | 30.56          |
| Obese             | 16     | 5.55           |

**Table 4**

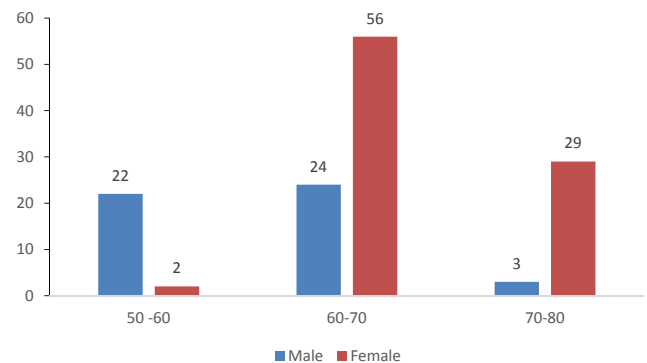
Proportion of hypertension among HS.

|                 | Hypertension in current study [n (%)] | Hypertension from pervious retrospective study (%) (Syed Zulfiqar AS et al.) |
|-----------------|---------------------------------------|--|
| Men (n = 152)   | 105 (69.07)                           | 62.1   |
| Women (n = 136) | 112 (82.70)                           | 64.7   |

**Table 5**

Complications after admission in hospital.

| Complication                     | Number | Percentage |
|----------------------------------|--------|------------|
| Recurrent stroke                 | 36     | 12.50      |
| Epileptic seizure                | 24     | 8.33       |
| Fall                             | 65     | 22.57      |
| Pain                             | 12     | 4.17       |
| Depression                       | 8      | 2.78       |
| Loss of muscle control/paralysis | 112    | 38.89      |
| Speech problems                  | 103    | 35.76      |
| Swallowing problems              | 63     | 21.88      |
| Deaths                           | 136    | 47.22      |
| Diabetes mellitus                | 32     | 11.11      |
| Hypertension                     | 11     | 3.82       |
| Constipation                     | 22     | 7.63       |
| Urinary tract infection          | 13     | 4.51       |
| Chest infection                  | 18     | 6.25       |



**Figure 2.** Distribution of HS mortality.

occurred during the first week from admission. Among 87 (64%) were females in the age group of 50–80 years shown in Figure 2.

## 4. Discussion

This study conducted among the patients attending in RIMS, Kadapa to ascertain the risk factors for causing complications of HS in adults. Out of 288 patients male ratio was slightly increased when compared to women, similarly in a cohort study showed 57% male ratio<sup>[4]</sup>. Most people fall in the age group of 60–80 years.

### 4.1. Risk factors

Hypertension is a major risk factor common to both coronary heart disease and stroke, in our study the rate was 75.34%. There is prolific evidence, both from cohort studies and case-control studies, shows that hypertension is the single most important risk factor for intracerebral hemorrhage<sup>[9,10]</sup>. Out of 217 hypertension patient shows 203 patients were having blood pressure > 160/90 shows almost 7 fold increased risk for HS when compared to normotensives. Similarly a meta-analysis showed that self-reported hypertension or a measured blood pressure of > 160/90 increased the risk of ICH more than nine fold<sup>[9]</sup>. The proportion of hypertension in our study was more in women but in a study the rate was very similar in men<sup>[11]</sup>.

Diabetes mellitus, smoking and alcohol were showing similar risk for HS. Smoking studies have consistently shown tobacco

use as a risk factor for ICH, though the effect size is not as large as for hypertension<sup>[12,13]</sup>. There is compelling evidence relating high alcohol intake with a higher risk of ICH<sup>[10,12]</sup>.

#### 4.2. Complications

In our study the complications after occurrence of stroke was 75%, similarly earlier studies have demonstrated that complications after the occurrence of stroke showed range from 40% to 96%<sup>[5,8]</sup>. Among these death (47.2%), loss of muscle control (38.9%) and speech problem (35.7%) were the major complications following occurrence of stroke. Our findings that approximately 8.33% of patients were shows seizures after admission in hospital, similarly some studies reported range from 1.4% to 17%<sup>[14]</sup>. Hypertension and diabetes mellitus were the major comorbid conditions in our study.

#### 4.3. Mortality

Patients with HS are generally at high risk for mortality<sup>[15,16]</sup>. In our study the mortality rate was 47.2%. The mortality rate was high in our study, when compared to other studies the ranges from 7.6% to 30%<sup>[17]</sup>. Hematoma expansions, edema formation, and intra-ventricular hemorrhage leading to increased intracranial pressure are likely contributors to the acute excess mortality<sup>[18–20]</sup>.

In adults hypertension followed by diabetes mellitus are the major risk factors for medical complications of HS. Female mortality rate was more in hemorrhagic stroke compared to men. Females are more prone to hemorrhagic stroke because of high risk of hypertension.

#### Conflict of interest statement

The authors report no conflict of interest.

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