## Clinical Profile and Outcome of Stroke in Elderly Patients versus Younger Patients

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**Abstract**

**Background:** National data on the clinical profile and outcomes of ischemic stroke in younger adults are still infrequent.

**Objectives**: We aimed to analyze clinical characteristics and outcomes of young patients with first-ever ischemic stroke compared to older patients.

**Patients and methods:** A prospective cohort study in which Patients 51–84 years of age were compared with younger persons 50 years of age and under in terms of risk factors, clinical presentation, severity, etiology, and outcomes of stroke. For every age group, a logistic model was constructed to predict stroke outcomes.

**Results:** Among patients 50 years of age and under, 146 cases of first-ever ischemic stroke were identified, while 854 cases were people 51–84 years of age. Younger individuals were 49.5% male, 47.3% currently smoked, and 7.4% had a history of stroke in their family. They more likely to arrive at the hospital independently and tended to appear with less frequent stroke symptoms, such headaches or sensory abnormalities. The majority of young adults (69.9%) had a favorable outcome (mRS $\leq 1$) and 18% had an in-hospital complication

**Conclusion:** Our findings demonstrate the relatively high rate of smoking and family history of stroke, and the lower rate of hospital arrival by ambulance among young adults. This calls for increasing awareness of the possibility of stroke among young adults and for better prevention, especially smoking cessation.

**Keywords:** Epidemiology; Young patients; Old patients.

**Introduction**

The second greatest cause of mortality and disability worldwide is ischemic stroke. Stroke is more prevalent in older people, but it has serious health and economic effects for younger persons, their families, and society **(Katan et al., 2018).** Changes in risk factors including diabetes, obesity, and hypercholesterolemia may explain rising ischemic stroke rates in younger persons. Younger stroke patients have diverse risk factors and etiologies, although stroke research has mostly concentrated on older persons **(Tan et al., 2022).**

Nearly two-thirds of strokes occur in poor nations, highlighting the need to address this problem internationally. Young adults have different ischemic stroke causes than older people, and regional distribution affects etiological subtyping **(Jacob et al., 2022).** Preventing stroke in young people requires identifying the causes. Ischemic stroke risk factors and subtypes in younger individuals are little studied **(George., 2020).**

Age-related vascular alterations and comorbidities make older persons more susceptible to stroke. Age and chronic conditions affect stroke severity and outcomes in this age range. Understanding the risk factors, clinical features, and outcomes of younger and older stroke patients may help explain the disease's pathogenesis and how age affects stroke presentation and prognosis. Knowledge may help adapt stroke therapy and improve acute and secondary prevention initiatives **(van Alebeek et al., 2018).**

Our research compared baseline characteristics, stroke severity at admission, stroke etiology, and stroke outcomes of younger persons (18–50 years) to patients 51–84 years old.

**Patients and Methods**

*Study Design and Population*

The prospective cohort research included 1000 acute ischemic stroke patients hospitalized in Qena University Hospital's neurology department from January 2022 to December 2023. The local ethics committee approved the study, and written informed consent was obtained from all subjects before inclusion in the study. There were two categories of patients: Group (1) contained younger persons aged 18- 50 years, whereas Group (2) contained patients 51–84 years old. Exclusion criteria include modified Rankin Scale scores higher than two and patients under 18, Patients with cerebral hemorrhage, mass effect, brain edema, or uncontrolled hypertension, also the research excluded individuals with arterial dissection, vasculitis, transient ischemic attack, and subarachnoid hemorrhage.

*Operative design and outcomes measurement*

In the study, stroke was defined according to the World Health Organization (WHO) as a syndrome characterized by rapidly developing clinical signs of focal or global cerebral function disturbance, with symptoms lasting for 24 hours or longer and having no apparent cause other than vascular origin. The NIHSS (National Institutes of Health Stroke Scale) **(Zöllner et al., 2020; Kanai et al., 2020)** was used to measure stroke severity within 48 hours after admission. (NIHSS) assessed neurological function in 14 categories within 48 hours after admission to determine stroke severity. These include awareness, eye movements, visual field integrity, face movements, arm and leg muscular strength, feeling, coordination, language, speech, and neglect. Each domain's impairment was graded on a 0–2–3–4 ordinal scale. Summarizing the item scores yielded a total NIHSS score from 0 to 42, with higher scores indicating more severe strokes. Stroke outcome was evaluated within 48 hours of admission and by the end of three months (90days) by two scales: Modified Rankin Scale (MRS)

**(Ibrahim et al., 2020)** and Barthel Index (BI) **(Kumar et al., 2017)**. The modified Rankin scale evaluates stroke disability and function, whereas the NIHSS score measures stroke severity. Stroke severity and functional recovery were compared among groups across three time periods.

**Ethical code**: (SVU-MED-NAP020-1-22-1-305)

**Statistical analysis**

The data was examined using SPSS 22.0. Continuous variables were represented by means, medians, and SD. For categorical variables, proportions and frequencies are used. The Pearson c2 test or Fisher exact test was used to compare the frequencies or proportions between the two groups, and the independent t-test or Mann-Whitney test was used to analyze mean differences. In every analysis, a P-value of less than 0.05 is considered statistically significant.

**Results**

*Patient Characteristics*

We examined 1000 individuals with a mean age of 63.4 ± 12.7 years (range: 15–91 years). 146 (14.6%) were under 50, while 854 (85.4%) were over 50. 495 men (49.5%) and 505 females (50.5%) were in the research, with 712 (71.2%) living in rural regions and 288 (28.8%) in urban areas. Hypertension (HTN) was found in 715 patients (71.5%), diabetes mellitus (DM) in 452 patients (45.2%), ischemic heart disease (IHD) in 407 patients (40.7%), rheumatic heart disease (RHD) in 86 patients (8.6%), cardiomyopathy in 116 patients (11.6%), hyperlipidemia in 395 patients (39.5%), and smokers in 473 patients (47.3%) (**Table.1**).

The distribution of sex was not significantly different between patients under 50 and those over 50. Rural patients were more likely to be elderly. Patients over 50 had greater rates of hypertension (HTN), diabetes mellitus (DM), ischemic heart disease (IHD), cardiomyopathy, and hyperlipidemia than those under 50. RHD was much lower in those over 50. Smoking prevalence was similar across age groups (**Table.2**).

*Scales outcomes*

Table (5) shows that NIHSS ratings before treatment were significantly higher in those over 50 (20.1 ± 8.4) than under 50 (16.9 ± 6.3). 46.8% of patients over 50 had severe strokes, compared to 22.6% of those under 50. Before treatment, the above-50 group had 42.7 percent of patients in the moderate impairment category, compared to 56.2% in the below-50 group. Finally, the table on pre-treatment BI scores demonstrated a significantly significant drop in functional independence in patients over 50 (63.8 ± 18.2) compared to those under 50 (71.2 ± 12.7). BI ratings also showed significant differences, with more patients in the severe dependency category in the above-50 years group (43.4%) than the below-50 years group (26.7%). These data imply that stroke patients over 50 had greater initial stroke severity and worse functional independence than younger persons.

Older patients exhibited significantly higher NIHSS scores (21.6 ± 10.1) than younger patients (13.9 ± 6.8). NIHSS evaluations also showed significant differences, with more severe stroke patients in the above-50 years group (50.6%) than the below-50 years group (15.8%). individuals over 50 showed substantially poorer functional independence based on BI (Barthel Index) scores (59.1 ± 23.9) than those under 50 (80.2 ± 14.1). The above-50 group had more patients in the entire and severe dependency categories than the below-50 group. After treatment, stroke patients over 50 had greater stroke severity, disability, and lower functional independence than younger patients (**Table.3**).

**Table 1. Demographic data in all studied patients.**

| Variables | | Studied patients (N = 1000) | |
|---|---|---|---|
| **Sex** | **Male** | 495 | 49.5% |
| | **Female** | 505 | 50.5% |
| **Age (years)** | **Mean ±SD** | 63.4 ± 12.7 | |
| | **Min - Max** | 15 – 91 | |
| **Age categories** | **≤ 50 years** | 146 | 14.6% |
| | **> 50 years** | 854 | 85.4% |
| **Residence** | **Rural** | 712 | 71.2% |
| | **Urban** | 288 | 28.8% |
| **Risk factors** | **HTN** | 715 | 71.5% |
| | **DM** | 452 | 45.2% |
| | **IHD** | 407 | 40.7% |
| | **RHD** | 86 | 8.6% |
| | **Cardiomyopathy** | 116 | 11.6% |
| | **Hyperlipidemia** | 395 | 39.5% |
| | **Smoking** | 473 | 47.3% |

**Table 2. Comparison of demographic data between both groups**

| Variables | | Age | | | | $X^2$ | P-value |
|---|---|---|---|---|---|---|---|
| | | **≤ 50 years (N = 146)** | | **> 50 years (N = 854)** | | | |
| **Sex** | **Male** | 68 | 46.6% | 427 | 50% | 0.58 | 0.444 |
| | **Female** | 78 | 53.4% | 427 | 50% | | |
| **Residence** | **Rural** | 82 | 56.2% | 630 | 73.8% | **18.8** | **< 0.001** |
| | **Urban** | 64 | 43.8% | 224 | 26.2% | | |
| **Risk factors** | **HTN** | 58 | 39.7% | 657 | 76.9% | **84.7** | **< 0.001** |
| | **DM** | 39 | 26.7% | 413 | 48.4% | **23.5** | **< 0.001** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **IHD** | 31 | 21.2% | 376 | 44% | **26.8** | **< 0.001** |
| **RHD** | 67 | 45.9% | 19 | 2.2% | **302.4** | **< 0.001** |
| **Cardiomyopathy** | 2 | 1.4% | 114 | 13.3% | **17.4** | **< 0.001** |
| **Hyperlipidemia** | 38 | 26% | 357 | 41.8% | **12.9** | **< 0.001** |
| **Smoking** | 62 | 42.5% | 411 | 48.1% | 1.6 | 0.206 |

$X^2$: Chi-square test.

### Table 3. Stroke outcomes in young and old patients .

| Variables | | ≤ 50 years (N = 146) | | > 50 years (N = 854) | | Test | P-value |
|---|---|---|---|---|---|---|---|
| **NIHSS** | **Mean** | 13.9 | | 21.6 | | **MW = 33634** | **< 0.001** |
| | **±SD** | 6.8 | | 10.1 | | | |
| **NIHSS** | **Minor stroke** | 12 | 8.2% | 50 | 5.9% | **$X^2$ = 94** | **< 0.001** |
| | **Mod. Stroke** | 91 | 62.3% | 212 | 24.8% | | |
| | **Mod : severe stroke** | 20 | 13.7% | 160 | 18.7% | | |
| | **Severe stroke** | 23 | 15.8% | 432 | 50.6% | | |
| **MRS** | **No Sig. disability** | 18 | 12.3% | 54 | 6.3% | **$X^2$ = 157** | **< 0.001** |
| | **Slight disability** | 83 | 56.8% | 145 | 17% | | |
| | **Moderate disability** | 38 | 26% | 200 | 23.4% | | |
| | **Mod : severe disability** | 5 | 3.4% | 257 | 30.1% | | |
| | **Severe disability** | 2 | 1.4% | 198 | 23.2% | | |
| **BI** | **Mean** | 80.2 | | 59.1 | | **MW = 28911.5** | **< 0.001** |
| | **±SD** | 14.1 | | 23.9 | | | |
| | **Total dependency** | 6 | 4.1% | 94 | 11% | **$X^2$ = 12.09** | **0.007** |
| | **Severe dependency** | 71 | 48.6% | 312 | 36.6% | | |
| | **Moderate dependency** | 59 | 40.4% | 399 | 46.8% | | |
| | **Slight dependency** | 10 | 6.8% | 48 | 5.6% | | |

**MRS**: Modified Rankin Scale , **NIHSS**: National Institutes of Health Stroke Scale    **BI**: Barthel Index; **MW**: Mann Whitney U test. **$X^2$**: Chi-square test.

**Discussion**

Stroke has a significant global impact on morbidity and mortality, affecting young adults in economically productive years and older adults with age-related vascular changes and comorbidities. Etiologies of ischemic strokes differ in young and older adults, making it crucial to identify causative factors for effective prevention.

Limited research exists on the etiology and risk factors in young stroke patients. Comparing risk factors and outcomes between age groups can enhance stroke management and inform tailored treatment approaches, including acute interventions and secondary prevention measures. Understanding age-related differences in stroke presentation and prognosis is essential for improving stroke care and outcomes.

In our Study, average age was 63.4 ± 12.7 years, ranging from 15 to 91. 85.4% of patients were over 50, 14.6% younger. 495 males (49.5%) and 505 women (50.5%) participated. Rural 71.2%, urban 28.8%. Hypertension (71.5%), diabetes mellitus (45.2%), ischemic heart disease (40.7%), rheumatic heart disease (8.6%), cardiomyopathy (11.6%), hyperlipidemia (39.5%), and smoking (47.3%) were the most frequent risk factors.

Our study focused on older adults due to their higher risk of ischemic stroke, which is associated with age-related hypertension, diabetes, and atherosclerosis **(Yousufuddin et al., 2019)** The participants were primarily from rural areas, where factors like smoking, lack of exercise, and poor diets may increase stroke risk **(Prior et al., 2023; Cheruvalath et al., 2022).** Hypertension and diabetes contribute to ischemic stroke risk by damaging arteries and causing clot formation **(Wu et al., 2022; Wang et al., 2022). Stevano et al. (2023)** and **Ibrahim et al. (2020)** had similar findings, observing the impact of

hypertension and diabetes in stroke patients, with hypertension being the most prevalent risk factor. Ibrahim et al. also noted a higher incidence of acute ischemic stroke in rural areas **(Ibrahem., 2020).** The research supports the link between risk factors and ischemic stroke prevalence in both older and younger populations, especially in rural settings.

Our study found a higher proportion of rural residents among patients over 50. Older patients had increased prevalence of hypertension, diabetes, ischemic heart disease, hyperlipidemia, and cardiomyopathy, while rheumatic heart disease decreased with age. These age-related differences in disease prevalence can be medically explained by risk factor exposure, physiological changes, and lifestyle choices **(Webb et al., 2022; Libruder et al., 2022).** Medical improvements and illness therapy have led to a decline in rheumatic heart disease among older individuals **(Vasconcelos et al., 2022; Benz et al., 2022). Ibrahim et al. (2020)** and **Vaidya et al. (2014)** also observed similar trends, with hypertension being higher in older individuals, supporting our study's findings.

The study used the NIHSS to evaluate stroke severity and neurological deficits. Older patients had higher NIHSS scores, indicating more severe brain impairment , and have a higher prevalence of moderate-to-severe strokes. Age appears to influence stroke severity and neurological outcomes after treatment due to factors like decreased cerebral reserve, vascular stiffness, and stroke-related comorbidities such as hypertension and diabetes. Age-related treatment response and recovery may also contribute to differences in NIHSS scores **(Zöllner et al., 2020; Kanai et al., 2020).** These findings align with **Stevano et al. (2023),** who also observed higher NIHSS scores in elderly stroke patients. **Chen et al.**

**2013)** reported that younger stroke patients had lower admission NIHSS scores.

The disability and dependency of stroke survivors were evaluated using the Modified Rankin Scale (MRS). Older patients displayed more moderate to severe impairment, with significant differences in MRS ratings between age groups after treatment. Age-related physiological changes, comorbidities, and decreased functional reserve contributed to higher MRS disability rates in older patients post-treatment, potentially hindering stroke recovery and rehabilitation. Individualized treatment and rehabilitation are essential for older stroke patients **(The et al., 2018; Denti et al., 2010).** Chen et al. found that younger stroke patients had better outcomes than older ones, with seniors experiencing greater disability at 3 months after discharge due to age, high entrance NIHSS scores, and medical comorbidities **(Chen et al., 2013).** Ibrahim et al. reported a near-significant difference in MRS disability ratings between age groups **(Ibrahim et al., 2020),** suggesting that seniors may have higher MRS scores, indicating more impairment, but further investigation is needed to confirm this. Kumar et al. observed that most young adult ischemic stroke patients had good functional outcomes at 3 months **(Kumar et al., 2017),** with a higher percentage of younger patients exhibiting superior functional independence, emphasizing their greater independence and functionality compared to older patients **(Chen et al., 2013).**

**Conclusion**

Age affects several features of ischemic stroke. Elderly individuals exhibited more significant comorbidities and severe stroke symptoms with higher NIHSS scores than young patients, and also high dependency and mortality by MRS and BI score at three months after stroke onset. So, elderly stroke patients need individualized care and rehabilitation programs.

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