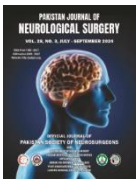

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Original Research

Long-Term Outcomes of Aneurysm Management in Elderly Patients with Subarachnoid Hemorrhage

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ABSTRACT

Objective: To analyze the long-term outcomes of patients with poor-grade aneurysm management of elderly patients with subarachnoid hemorrhage (aSAH).

Materials & Methods: A prospective study was conducted at Shahida Islam Medical College and Hospital, Lodhran, Pakistan from March 2023 to February 2024. The study enrolled patients aged 65-85 years who were admitted to the hospital with a diagnosis of poor-grade aneurysmal subarachnoid hemorrhage. Evaluations involved clinical examinations, imaging studies, and standardized outcome measures such as the modified Rankin Scale (mRS) to assess neurological and functional outcomes.

Results: At the 3-month follow-up, 23.8% of patients had an mRS score of ≤ 3, while 76.2% had an mRS score of > 3. Among those with an mRS score of ≤ 3, 44.8% were aged 65-75 years, and 55.2% were aged 76-85 years. Similarly, at the 12-month follow-up, 26.2% of patients had an mRS score of ≤ 3, and 73.8% had an mRS score of > 3. Among patients with mRS score of ≤ 3, 37.5% were aged 65-75 years. Among those with an mRS score of > 3, 43.3% were in the 65-75-year age group and 56.7% were in the 76-85-year age group.

Conclusion: Long-term outcomes gradually improved even among elderly patients with severe subarachnoid hemorrhage (SAH) if they were provided with aneurysm repair as surgical management. Patients with older age having SAH should not be ignored for surgical management based on their age.

Keywords: Subarachnoid hemorrhage, Elderly Patients, Aneurysm Repair, Long Term Follow-Up, mRS Score.

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INTRODUCTION

A subarachnoid hemorrhage (SAH) in elderly patients is primarily caused by the rupture of cerebral aneurysms, which are weak, bulging spots on the wall of brain arteries.[1] Hypertension, or high blood pressure, is a significant risk factor, as it can weaken arterial walls over time. Another important cause is trauma to the head, which can result from falls or accidents, more common in older adults due to balance and mobility issues.[2] In addition, the risk factors of SAH include smoking or tobacco use that can damage the vessels and contribute to the development of aneurysm and rupture of the vessel. Another factor is the use of alcohol and its relevant products, which may lead to an increase in blood pressure and diminish the vascular health status.[3]

Family history of aneurysm and genetic predisposition also increase the risk of SAH followed by plaque buildup, atherosclerosis, and the use of anticoagulants have contributed to bleed risk.[4] Furthermore, older age itself is a risk factor that can cause vascular elasticity and strength loss and make it prone to rupture.[5]

Management of aneurysmal SAH in old age patients many considerations must be kept in mind.[6] First, the choice between endovascular coiling and surgical clipping, comorbid conditions, the overall health of patients, and the end morphology and location of aneurysm.[7] Usually, endovascular coiling is preferred over open surgical approaches because of its minimal invasiveness and reduced perioperative risks.[8]

Conservative treatment in such cases is also essential including prevention of bleeding, blood control, considering and addressing complications, and management of intracranial pressure that can delay the cerebral ischemia chances.[9] The risk of vasospasm is usually reduced with the use of Nimodipine which is a calcium channel blocker. Maintaining cerebral perfusion and euvolemia are also vital components and supportive in additional care.[10]

This study will help significantly to increase. clinical relevance and have the potential to contribute to understanding the scientific reasons for SAH in elderly patients. Focusing on a population that is often underrepresented in research, provides deep knowledge that can lead to improved outcomes and better quality of life for older adults suffering from this severe condition.

MATERIALS & METHODS

Study Design, Duration, and Place

A prospective study was conducted at Shahida Islam Medical College and Hospital, Lodhran, Pakistan from March 2023 to February 2024.

Inclusion Criteria

The study enrolled patients aged 65-85 years who were admitted to the hospital with a diagnosis of poor-grade aneurysmal SAH, defined as Hunt and Hess grades IV and V. Patients were included in the study after obtaining informed consent from themselves or their legal representatives.

Exclusion Criteria

Patients other than aneurysm repair and without endovascular evaluation were excluded from the study.

Sampling Technique and Sample Size and Patient's Consent

The sampling technique was non-probability consecutive sampling. The sample size was calculated by using openepi.com software with a 95% confidence limit, 80% power of the study, and 23% patients having mRs score > 3 at 12 months.[11] Written informed consent was taken from patients before inclusion in the study.

Ethical Declaration

An institutional review board of Shahida Islam Medical and Dental College granted the ethical

approval certificate [SIMC/ET.C./10005/23]and the procedure was conducted in line with the Helsinki Declaration method. The collected data were securely stored and managed using a dedicated database, with access restricted to authorized personnel to maintain confidentiality and data integrity.

Study Variables and Data Collection

Initial assessments were conducted to gather baseline demographic data, medical history, and clinical status at the time of admission, including neurological examinations and imaging studies such as CT or MRI scans to confirm the diagnosis and assess the extent of hemorrhage.

The vascular team selected the appropriate aneurysm treatment based on the characteristics of the patient's general condition and ruptured aneurysm. Patients with aneurysms in mid cerebral artery and intracranial hemorrhage were managed with surgical clipping.

Clinical & Surgical Management

Elderly patients having age above 80 years and presented in the outpatient department with an aneurysm located in posterior circulation were treated with endovascular coiling. Microsurgical and endovascular management was done in the ictus acute condition. External drainage was placed intraoperatively and hemicraniectomy or decompression of brain swelling was performed with a microsurgical procedure. However, in endovascular patients, cerebrospinal drainage was done post-operatively.

Both surgical techniques endovascular and surgical were documented, and follow-up was done at 3,6, and 12 months' duration and annually after that. Evaluation of imaging studies, clinical examinations, modified Rankin Scale, outcome measures, and at the end of functional outcomes. Accuracy and consistency of data collection were ensured by giving tasks to trained staff.

Data Analysis

Data analysis was performed on outcomes based on factors like age, initial clinical grade, and treatment modality used. Primary data consist of long-term outcomes, and secondary outcomes include survival rate, complication rate, and quality of life. Frequency and percentage were calculated for categorical variables like sex, WFNS, aneurysm treatment, discharge status, and mRS scores. The chi-square test of significance was applied to these categorical variables to check the significance and association. Mean and standard deviation were calculated for numeric variables like age and length of hospital stays, independent samples t-test was applied to these numerical variables to check the significance of the two means. The significant p-value was below and equal to 0.05.

RESULTS

Age Distribution

Overall, 122 patients were included in this study, with a mean age of 75.91±4.32 years. There were 51 (41.8%) patients between 65-75 years and 71 (58.2%) were between 76-85 years. Cross tabulation was done with respect to age groups 65-75 years and 76-85 years in Table 1.

Gender Distribution

There were 29 (56.9%) males and 22 (43.1%) females in the 65-75 years age group whereas there were 45 (63.4%) males and 26 (36.6%) females in the 76-85 years age group. The difference was not statistically significant, (p=0.467).

Grades

World Federation of Neurosurgical Societies grade IV and grade V were observed in 16 (31.4%) and 35 (68.6%), respectively, in 65-75 years age group, whereas World Federation of Neurosurgical Societies grade IV and grade V was observed in 29

(40.8%) and 42 (59.2%), respectively, in 76-85 years of age group. The difference was not statistically significant, (p=0.285).

Treatments

Aneurysm treatment clipping was performed on 36 (70.6%) patients and coiling was performed on 15 (29.4%) to 65-75 years age group. Whereas aneurysm treatment clipping was performed at 44 (62.0%) patients and coiling was performed at 27 (38.0%) to 76-85 years age group. The difference was not statistically significant, (p=0.323). There were 27 (38.0%) patients who died in the 65-75 years age group, and 14 (19.7%) patients died in the 76-85 years age group. The difference was not statistically significant, (p=0.638).

Table 1 Comparison of baseline profile with respect to age groups.

Variable	Age Groups 65-75 years 51 (41.8%)	Age Groups 76-85 years 71 (58.2%)	Chi-Square Test/t-Test
Male	29 (56.9)	45 (63.4)	χ^2=0.528, df=1
Female	22 (43.1)	26 (36.6)	p=0.467
Grade IV	16 (31.4)	29 (40.8)	χ^2=1.14, df=1
Grade V	35 (68.6)	42 (59.2)	p=0.285
Clipping	36 (70.6)	44 (62.0)	χ^2=0.323, df=1
Coiling	15 (29.4)	27 (38.0)	p=0.323
Home	1 (2.0)	5 (7.0)	
Rehabilitation	30 (58.8)	39 (54.9)	χ^2=1.69, df=3
Hospital	9 (17.6)	13 (18.3)	p=0.638
Died	11 (21.6)	14 (19.7)	
Length of stay in hospital (days)	25.59±5.92	24.54±4.68	t=1.096, df=120 p=0.275 C.I (95%): 24.04, 25.91

Hospital Stay

The mean length of stay in hospitals of 65-75 years and 76-85 years age groups was 25.59±5.92 days and 24.54±4.68 days, respectively. The difference was not statistically significant, (p=0.275) (Table 1).

Table 2: Comparison of mRS score after subarachnoid hemorrhage at 3 and 12 months in age groups.

mRS score	Age Groups 65-75 years 51 (41.8%)	Age Groups 76-85 years 71 (58.2%)	Total	Chi-Square Test
mRS score at 3 months of follow-up				
≤3	13 (44.8)	16 (55.2)	29 (23.8%)	χ^2=0.143, df=1
>3	38 (40.9)	55 (59.1)	93 (76.2%)	p=0.705
mRS score at 12 months of follow-up				
≤3	12 (37.5)	20 (62.5)	32 (26.2%)	χ^2=0.330, df=1
>3	39 (43.3)	51 (56.7)	90 (73.8%)	p=0.566

Outcomes Variables

At 3 months of follow-up, there were 29 (23.8%) patients had ≤ 3 mRS scores, and 93 (76.2%) patients had >3 mRS scores. For ≤ 3 mRS score, there were 13 (44.8%) patients 65-75 years of age group and 16 (55.2%) in the 76-85 years age group. For > 3 mRS score, there were 38 (40.9%) patients 65-75 years of age group and 55 (59.1%) in the 76-85 years age group. χ^2=0.143, df=1, p=0.705 (Table 2).

Similarly, at 12 months of follow-up, there were 32 (26.2%) patients had ≤ 3 mRS scores and 90 (73.8%) patients had >3 mRS scores. For ≤ 3 mRS score, there were 12 (37.5%) patients between 65-75 years and 20 (62.5%) in the 76-85 years age group. For > 3 mRS score, there were 39 (43.3%) patients between 65-75 years and 51 (56.7%) in the 76-85 years age group. χ^2=0.330, df=1, p=0.566 (Table 2).

DISCUSSION

The treatment of aneurysms in elderly or poor-grade subarachnoid hemorrhage (SAH) patients must be approached with great caution due to their generally poor prognosis. However, emerging evidence from various studies indicates that surgical intervention and comprehensive neurointensive care can be effective for these patients. Despite the inherent risks, these treatments have demonstrated potential benefits, suggesting that, with careful patient selection and management, positive outcomes can be achieved even in this high-risk population.[12]

In this study, the modified Rankin Scale (mRS) score at the 12-month follow-up showed significant improvement compared to the 3-month follow-up. This finding aligns with previous research conducted by Shimamura et al[13] and Goldberg et al,[14] which reported that long-term outcomes for patients with subarachnoid hemorrhage (SAH) tend to improve over time. These studies highlighted that even elderly patients exhibit better outcomes at longer follow-up intervals, such as one year, compared to their condition at discharge.

In this study, no significant difference was found between clipping and coil embolization at 3 and 12 months. However, previous studies by Ryttlefors et al[15] and Garbossa et al,[16] have demonstrated that clipping in elderly patients is associated with a worse prognosis compared to coil embolization. This discrepancy might be attributed to our treatment strategy, which involves selecting microsurgical clipping or endovascular coiling based on the specific characteristics of the ruptured aneurysm and the patient's overall condition.

An international study conducted by Johansson et al,[17] observed post-SAH outcomes in adult and old age patients and reported that these patients' outcomes improved with the passage of time and even in severe illness. Elderly SAH patients could benefit from enhanced neurointensive care options. These options should be tailored based on recovery, patient preferences, and family wishes.

Garbossa et al.[18] reported that in patients undergoing aneurysm management in an invasive way, clipping was slightly more prevalent than coiling until the age of 79, whereas coiling significantly dominated in older patients. Some investigators recommend endovascular aneurysm treatment due to its less invasive nature, especially for elderly patients.

In a study conducted by Nieuwkamp et al.[19] it was found that among patients older than 75 years with poor-grade status, a staggering 95% (57 out of 60) did not undergo aneurysm treatment. This lack of intervention resulted in a remarkably high mortality rate of 93%, with only 7% of patients experiencing severe disability within 2 to 4 months after suffering from aneurysmal subarachnoid hemorrhage (aSAH).

In previous studies Fortuny et al.[20] and Inagawa et al,[21] reported that in formulating a final recommendation for the management of the elderly, it is important to determine an age threshold where the risk of death and poor outcomes notably rises; this threshold has been a topic of ongoing debate and has shifted over the last decades from 50 to 79 years, a change largely attributed to ongoing technical advancements and refined treatment protocols.

Scholar et al,[22] conducted a study and found that endovascular or conservative aneurysm treatment was applied more frequently with increasing age ($p < 0.006$). The 1-year survival rates were 78%, 65%, and 38% in the three respective age groups.

CONCLUSION

The findings of this study demonstrated that the long-term prognosis gradually improved even among elderly patients with severe subarachnoid hemorrhage (SAH) if they received aneurysmal repair and the best postoperative treatment.

Despite evaluating a challenging treatment group, several cases had a good prognosis. Therefore, patients with older age having SAH should not be ignored for surgical management based on their older age.

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Additional Information

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Syeda Khoula Azmat	1. Study design and methodology.
2.	Badar Uddin Ujjan	2. Paper writing.
3.	Habib Ullah	3. Data collection and calculations.
4.	Muhammad Aqeel Natt	4. Analysis of data and interpretation of results.
5.	Usamah Bin Waheed	5. Literature review and referencing.
6.	Waqas Mughis	6. Editing and quality insurer.