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ORIGINAL ARTICLE

Frequency of ruptured cerebral aneurysms as a cause of intracerebral bleed.

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ABSTRACT… Objective: To determine the frequency of ruptured aneurysms in patients with intracerebral bleed presenting to Shifa International Hospital Islamabad. **Study Design:** Cross sectional study. **Setting:** Department of Radiology, Shifa International Hospital Islamabad. **Period:** September'25 to February'26. **Methods:** 140 Patients aged from 18 to 70 years of either gender and presentation with Intracerebral bleeding whereas all cases with history of head trauma and craniotomy were excluded from the study. Every patient undergo a CT scan, and the presence of ruptured aneurysms checked via CTA (CT noncontrast shows hemorrhage prominent at well-defined round, slightly hyper attenuating lesion) were documented. **Results:** Of 140 patients (61.4%) were aged above 50 years, while 38.6% were 50 years or younger. Females predominated (55.0%) compared to males (45.0%). Overall, 46 patients (32.9%) were found to have ruptured aneurysms, while 94 (67.1%) had unruptured aneurysms. Regarding the location of aneurysms, hemorrhagic stroke (HS) was the most frequent presentation (50.7%), followed by subarachnoid hemorrhage (SAH) in 30.7% and combined SAH + HS in 18.6% of cases. **Conclusion:** We concluded that aneurysm rupture is a multifactorial process governed by anatomic factors (size, location, multiplicity) and patient-specific vessel vulnerability rather than by single metabolic parameters.

Key words: Aneurysms, Factors, Intracerebral Bleed, Rupture.

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INTRODUCTION

Cerebral aneurysms are dilatations appearing on weakened parts of arterial circulation within the brain. They can be of variable sizes: small (less than 0.5 mm), medium (between 6 and 25 mm), and giant (more than 25 mm).[1] The majority are saccular (berries), which are characterized by a very thin or lacking tunica medium and lost or greatly fragmented internal elastic lamina. Contrary to this, there are the fusiform (circumferential) and mycotic (infectious) aneurysms, which are a minority. Asymptomatic brain aneurysms are the norm and are discovered incidentally on neuroimaging or during post-mortem examination. Approximately 85% of the aneurysms are situated within the anterior circulation, almost exclusively at junctions or bifurcations within the circle of Willis. Subarachnoid haemorrhage (SAH) typically follows rupture and has a high incidence of morbidity and mortality.[2]

The incidence of cerebral haemorrhage increases with age, whereas the survival of the affected patients worsens, giving rise to a high fatality rate.[3] Three Out of every 80 strokes, 80 are ischaemic, and 15-20 are hemorrhagic.[4] Hemorrhagic strokes are due to the rupture of cranial arteries, leading to intracranial haemorrhage. Bilaterally spontaneous cerebral haemorrhages are twice as common as subarachnoid haemorrhages.[5] One has to recognize the fact that most of the ischaemic or hemorrhagic strokes happening in the subarachnoid space are fatal.[6]

The pre-contrast computed tomographic (CT) scan remains the first-line imaging modality in the diagnosis of intracerebral haemorrhage. Acute haematoma is diagnosed by pre-contrast computed tomography as a region of high density.[7] CT scans can identify acute intracerebral haemorrhage of as small a diameter as 2 mm, due to the contrast between the dense blood clot and the low density of the neighbouring brain tissue.[7]

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A study conducted by Dolati P et al. reported that ruptured aneurysms were identified in 37% of patients presenting with intracerebral hemorrhage. The authors concluded that small aneurysms represent a frequent underlying cause of aneurysmal subarachnoid hemorrhage.[8]

This study will examine individuals with intracerebral haemorrhage to elucidate the importance of aneurysm rupture and intracerebral haemorrhage. Notwithstanding progress in the therapy and treatment of intracerebral haemorrhage, this condition remains critically significant; thus, evaluating patients' brain imaging findings for spontaneous intracerebral haemorrhage might facilitate timely diagnosis and intervention. Due to the scarcity of local data on this topic, my research will facilitate the confirmation of aneurysm rupture in individuals with intracerebral haemorrhage, warranting additional examination within our general population.

METHODS

This Cross Sectional Study was designed at Radiology Department of Shifa International Hospital Islamabad. The Study was conducted over a period of six months (September'25 to February'26), after the approval from the CPSP and the Institutional Ethics Review Board (IRB No: 367-25, Dated: 03/ Sept/2025).

This Study included age range of the subjects from 18 to 70 years of either gender and presentation with Intracerebral bleeding (regions of hyperdensity within the cerebellar hemispheres on CT scan) whereas all cases with history of head trauma and craniotomy were excluded from the study. We estimated sample size of 140 cases through the World Health Organization software designed for sample size computation, based on a 95% confidence level, an 8% margin of absolute precision, and an expected frequency of ruptured aneurysms of 37% among patients with intracerebral hemorrhage.[8] The used sampling technique was Non-probability convenience sampling.

After getting approval of this study by ethical committee of the hospital, basic demographics like age, gender, duration of complaints, hypertension(A participant was classified as hypertensive if any of the following conditions are met: systolic blood pressure averaging 140 mmHg or above, diastolic blood pressure averaging 90 mmHg or greater, or documentation of antihypertensive drug intake reported within the preceding two weeks), smoking, past history of stroke, diabetes (An individual will be considered diabetic if one or more of the following conditions are present: fasting plasma glucose of 126 mg/dL or higher measured after an overnight fast, a random plasma glucose level of 200 mg/dL or above verified on laboratory testing, or recorded evidence of treatment with glucose-lowering medication in the medical file) and residential status was recorded. Informed consent was taken from all patients.

All examinations were conducted on a multidetector spiral CT scanner following a uniform protocol. For computed tomographic angiography in the assessment of aneurysms, the scanning settings comprised a rotation duration of 1 second, a table movement of 15.4 mm per cycle, image reconstruction at 0.6 mm using Kernel H20, tube potential of 120 kV, current of 260 mAs, a total acquisition time of 9 seconds, and coverage extending from the C1 vertebra to the cranial vertex, oriented along the orbitomeatal line. The parameters related to contrast medium administration were not altered. Every patient undergo a CTA to check the presence of ruptured aneurysms (CT noncontrast shows hemorrhage prominent at well-defined round, slightly hyperattenuating lesion) were documented. All relevant information was systematically entered into a purpose-designed proforma. The data analysis was conducted using SPSS version 26. Quantitative variables, such as size, age and duration of symptoms, were summarized as mean values with corresponding standard deviations. Frequencies and percentages were computed for qualitative variables like gender, smoking, hypertension, diabetes, residential status, ruptured aneurysms and location of ruptured aneurysms (Subarachnoid hemorrhage/ Hemorrhagic stroke).

RESULTS

A total of 140 patients were included in the study. The mean age of participants was 51.46 ± 16.22 years. Most patients (61.4%) were aged above

50 years, while 38.6% were 50 years or younger. Females predominated (55.0%) compared to males (45.0%). All participants were from urban areas. Among comorbid conditions, hypertension was present in 70.0% of patients and diabetes mellitus in 20.0%. Smoking history was observed in 12.1% of the cohort, whereas 7.1% had a previous history of stroke. Overall, 46 patients (32.9%) were found to have ruptured aneurysms, while 94 (67.1%) had unruptured aneurysms. Regarding aneurysms, hemorrhagic stroke (HS) was the most frequent presentation (50.7%), followed by subarachnoid hemorrhage (SAH) in 30.7% and combined SAH + HS in 18.6% of cases. (Table-I)

When comparing patients with ruptured and unruptured aneurysms, younger age and female gender were significantly associated with aneurysm rupture. Patients aged ≤50 years had a higher proportion of ruptured aneurysms (56.5%) compared to those aged >50 years (43.5%), with a Chi-square p-value of 0.002. Similarly, female patients showed a higher frequency of rupture (69.6%) than males (30.4%), which was also statistically significant (p = 0.015, Chi-square test). No significant associations were found between rupture status and hypertension (p = 0.753), diabetes mellitus (p = 0.150), or history of stroke (p = 0.498, Fisher's Exact test). Interestingly, smoking showed a significant relationship with aneurysm rupture (p = 0.001, Fisher's Exact test), as none of the ruptured cases had a smoking history, while 18.1% of unruptured cases did. Presentation of aneurysm (SAH, HS, or combined SAH + HS) was not significantly associated with rupture status (p = 0.311, Chi-square test). (Table-II)

DISCUSSION

In the present study, the mean age of participants was 51.46 ± 16.22 years, with a predominance of females (55%) and a greater frequency of ruptured aneurysms among younger and female patients. These findings align with global epidemiologic patterns suggesting that intracranial aneurysm rupture is more frequent in middle-aged individuals and women. Faropoulos et al[9] similarly observed a variable age distribution among patients presenting with aneurysmal subarachnoid hemorrhage (aSAH), most cases occurring in adults in their fifth and sixth decades.

TABLE-I

Baseline characteristics of study participants (N = 140)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	≤50 years	54	38.6
	>50 years	86	61.4
Gender	Male	63	45.0
	Female	77	55.0
Residential Status	Urban	140	100.0
Hypertension	Yes	98	70.0
	No	42	30.0
Diabetes Mellitus	Yes	28	20.0
	No	112	80.0
Smoking	Yes	17	12.1
	No	123	87.9
History of Stroke	Yes	10	7.1
	No	130	92.9
Ruptured Aneurysm	Yes	46	32.9
	No	94	67.1
Location of Aneurysm	Subarachnoid hemorrhage (SAH)	43	30.7
	Hemorrhagic stroke (HS)	71	50.7
	SAH + HS	26	18.6

Mean Age: 51.46 ± 16.22 years

TABLE-II

Association between demographic/clinical variables and ruptured aneurysm (N = 140)

Variable	Groups	Ruptured (n=46)	Unruptured (n=94)	P-Value (Test Used)
Age Group	≤50 years	26 (56.5%)	28 (29.8%)	0.002 (Chi-square)
	>50 years	20 (43.5%)	66 (70.2%)	
Gender	Male	14 (30.4%)	49 (52.1%)	0.015 (Chi-square)
	Female	32 (69.6%)	45 (47.9%)	
Residential Status	Urban	46 (100%)	94 (100%)	—
Hypertension	Yes	33 (71.7%)	65 (69.1%)	0.753 (Chi-square)
	No	13 (28.3%)	29 (30.9%)	
Diabetes Mellitus	Yes	6 (13.0%)	22 (23.4%)	0.150 (Chi-square)
	No	40 (87.0%)	72 (76.6%)	
Smoking	Yes	0 (0.0%)	17 (18.1%)	0.001 (Fisher's Exact)
	No	46 (100%)	77 (81.9%)	
History of Stroke	Yes	2 (4.3%)	8 (8.5%)	0.498 (Fisher's Exact)
	No	44 (95.7%)	86 (91.5%)	
Presentation of Aneurysm	SAH	18 (39.1%)	25 (26.6%)	0.311 (Chi-square)
	HS	20 (43.5%)	51 (54.3%)	
	SAH + HS	8 (17.4%)	18 (19.1%)	

*Chi-square test reported when all expected cell counts ≥5 for a 2×2 or r×c table.
Fisher's Exact test was used when any expected cell count <5 or when a zero cell occurred (e.g., Smoking). Statistical significance defined as two-sided $p < 0.05$.

However, their study did not report a clear sex predilection, instead emphasizing temporal and environmental associations—specifically, an increased incidence of rupture on Mondays and a link between atmospheric dust levels and the severity of aSAH. While our study was hospital-based and not designed to evaluate meteorological influences, both analyses underscore that extrinsic and intrinsic risk factors jointly contribute to aneurysm rupture dynamics.

Daskalov et al[10] reported an average patient age of 56.1 ± 10.3 years, consistent with the older subset in our sample (>50 years, 61.4%). Interestingly, they found that ruptured aneurysms were significantly more common in male patients (84.4%) compared to females (62.5%), which contrasts with our findings where rupture was significantly higher in females ($p = 0.015$). Such sex-related differences may reflect variations in hormonal influences, vascular wall structure, or population-specific exposure to modifiable risk factors. Moreover, Daskalov's study confirmed hypertension as the leading comorbidity (86.3%), similar to our observation of 70% prevalence, reinforcing its central role as a modifiable determinant in aneurysm pathophysiology.

The study by Kwon et al.[11] found unruptured aneurysms present in 4.6% of liver transplant cases but our research focuses on factors that cause vascular damage. The study by Albrecht et al[12] focused on mycotic intracranial aneurysm patients who showed a 64% male prevalence and a median age of 44.7 years. The study population from Albrecht et al[12] shows different causes of aneurysms than our spontaneous aneurysm group but their patients developed vascular inflammation and wall weakness at similar young ages.

The study population from Albrecht et al[12] showed a 64% male prevalence and a median age of 44.7 years. The study results show that patients under 50 years old had a higher risk of rupture ($p = 0.002$). The similar pattern between our study and Albrecht et al[12] indicates that vascular inflammation and wall weakness from hemodynamic stress or infection tend to appear in patients at younger ages.

The study population shows age-related risk patterns that match worldwide studies but the gender distribution differs from specific international studies. The study results might stem from different lifestyle patterns in the region and higher rates of untreated high blood pressure among Pakistani women and possible male patient underdiagnosis until their condition reaches advanced stages. The study results show that female patients under 50 years old face the highest risk of aneurysm rupture so healthcare providers should focus on screening this specific population.

In our study analysis, 32.9% cases were found with unruptured intracranial aneurysms, whereas 67.1% remained unruptured. Younger age and female gender was more significantly associated with rupture while previous stroke history and diabetics/hypertensive cases had no remarkable association. These observations indicate that rupture of aneurysm is not purely correlated with the function of systemic comorbidity but hemodynamic/ structural determinants.

In a comparative analysis by Ma and co-workers[13], in the meta-analysis including 17000 cases documented that location of aneurysm and size especially at middle or anterior arteries had strong prediction of rupture. Their pooled data including gender, age, diabetes, hypertension and smoking were not remarkable risk factors which echoes our observations and suggest that vascular wall morphology and local flow dynamics play a pivotal role compared to the traditional metabolic factors.

Similarly, Deniwar[14] described an annual rupture rate of 0.7–1 % among unruptured cerebral aneurysms, increasing markedly in patients with multiple or large lesions. He identified advancing age, hypertension, and female sex as potential modifiers of rupture risk. Our data mirrors this observation, as female gender was more prone to the rupture, possibly due to decline in post-menopausal estrogen levels that may impair collagen stability and vascular elasticity.

A trial by Trakolis and Petridis[15] demonstrated that presence of rupture aneurysms is typically an acute neurological emergency situation requiring early diagnosis and its multidiscipline management. According to their clinical findings highlighting the importance of early diagnosis which is in agreement with our hypothesis that high-risk subgroups screening especially younger women with high blood pressure for prevention of catastrophic hemorrhage.

According to a recent study in 2025[16], it is concluded that distal anterior cerebral artery aneurysm presents with subdural hematoma but without subarachnoid hemorrhage. Their report indicates that the pathways of ruptured aneurysms are unpredictable and may not see on imaging modalities. However, our study reveals higher proportion of hemorrhagic stroke cases than isolated subarachnoid, the probable reason behind this difference may be comparable hemodynamic and anatomic variability in rupture mechanisms.

Tartarin and co authors[17] in a broader etiological insight clarifies uncommon causes of non-traumatic intracerebral hemorrhage emphasizing the conditions behond hypertension like amyloid angiopathy, vascular malformations or infection---contributing to the overall spectrum of rupture. Although we excluded all secondary/traumatic causes, Tartarin et al places our findings within broader etiological context.

Lastly, according the analysis of 194 cases with spontaneous intracerebral hemorrhage confirmed that antithrombotic use and hypertension are the major contributing factors following by uncontrolled diabetes mellitus and smoking. However, hypertension is considered as the most prevalent morbidity in our study by contributing 70%, however, it was not statistically significant to aneurysm rupture, it may be due to better control of the morbidity.

CONCLUSION

Collectively, our findings in addition to the other studies reinforce that aneurysm rupture is a multifactorial process governed by anatomic factors (size, location, multiplicity) and patient-specific vessel vulnerability rather than by single metabolic parameters. The consistent female predominance and younger age of ruptured cases in our study highlight a demographic pattern that warrants

targeted preventive imaging and early vascular evaluation in similar populations.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Malhotra A, Wu X, Gandhi D, Sanelli P. **The patient with thunderclap headache.** Neuroimaging Clin N Am. 2018; 28(3):335-51.
2. Toth G, Cerejo R. **Intracranial aneurysms: Review of current science and management.** Vasc Med. 2018; 23(3):276-88.
3. Roozpeykar S, Azizian M, Zamani Z, Farzan MR, Veshnavei HA, Tavoosi N, et al. **Contrast-enhanced weighted-T1 and FLAIR sequences in MRI of meningeal lesions.** Am J Nucl Med Mol Imaging. 2022; 12:63-70.
4. Doria JW, Forgacs PB. **Incidence, implications, and management of seizures following ischemic and hemorrhagic stroke.** Curr Neurol Neurosci Rep. 2019; 19:37.
5. Toyoda K, Yoshimura S, Nakai M, Koga M, Sasahara Y, Sonoda K, et al. **Twenty-year change in severity and outcome of ischemic and hemorrhagic strokes.** JAMA Neurol. 2022; 79:61-9.
6. de Oliveira Manoel AL. **Surgery for spontaneous intracerebral hemorrhage.** Crit Care. 2020; 24:45.
7. Naruto N, Itoh T, Noguchi K. **Dual energy computed tomography for the head.** Jpn J Radiol. 2018; 36:69-80.
8. Dolati P, Pittman D, Morrish WF, Wong J, Sutherland GR. **The frequency of subarachnoid hemorrhage from very small cerebral aneurysms (< 5 mm): A population-based study.** Cureus. 2015; 7(6):e279.
9. Faropoulos K, Kyriakou G, Kafritsa A, Papavasilopoulou A, Grzeczinski A, Artemiadis A. **The bleeding weather: association of environmental changes with intracranial aneurysms' rupture.** Acta Neurochirurgica. 2025 Mar 22; 167(1):86.
10. Daskalov D, Bundovska Kocev S, Aliji V, Kostovska ES. **Size, localization and risk factors in ruptured and unruptured brain aneurysms.** J Med Clin Res Rev. 2025; 9(1):1-7.
11. Kwon H-M, Jun I-G, Kim K-S, Moon Y-J, Huh IY, Lee J, et al. **Rupture risk of intracranial aneurysm and prediction of hemorrhagic stroke after liver transplant.** Brain Sci. 2021; 11(4):445.
12. Albrecht C, Sanchin A, Joerger AK, Delbridge C, Boeckh-Behrens T, Wantia N, et al. **Mycotic aneurysms as a rare cause of subarachnoid hemorrhage.** Scientific Reports. 2025 Sep 23; 15(1):32683.
13. Ma J, Zheng Y, Li P, Zhou T, Sun Z, Ju T, et al. **Risk factors for the rupture of intracranial aneurysms: A systematic review and meta-analysis.** Front Neurol. 2023 Dec 11; 14:1268438.
14. Deniwar MA. **Management of multiple and unruptured cerebral aneurysms.** Egypt J Neurosurg. 2022; 37:26.
15. Trakolis L, Petridis AK. **Clinical management of a ruptured intracranial aneurysm.** Front Stroke. 2024; 24:58-63.
16. Yamazaki M, Aoki T, Matano F, Murai Y. **Ruptured distal anterior cerebral artery aneurysm presenting with acute subdural hematoma without subarachnoid hemorrhage.** J Surg Case Rep. 2025 Jan; 2025(1):rjae843.
17. Tartarin H, Morotti A, Van Etten ES, Hausman-Kedem M. **Uncommon causes of nontraumatic intracerebral hemorrhage.** Stroke. 2024; 55:1416-27.
18. Ala Rashi M, Alkhateeb K, Altabbaa H, Alnehlawi O, Nakawah A, Hamzeh G. **Prevalence of risk factors in patients with spontaneous intracerebral hemorrhage in Damascus, Syria: A retrospective cross-sectional study.** Health Sci Rep. 2025 May 5; 8(5):e70781.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Amaima Gulzar:** Data collection, data analysis, writing.
2	**Sanam Khan:** Review of manuscript.
3	**Aiman Mahmood:** Data collection.
4	**Usama Shafiq:** Literature review.
5	**Aroosa Kanwal:** Data collection.