

OUTCOME OF PATIENTS IN EARLY SURGICAL INTERVENTION IN SPONTANEOUS INTRACEREBRAL HEMORRHAGE

Dr. Kanwal Ali^{*1}, Dr. Etizaz Ahmed², Dr. Riaz Ahmed Raja³, Dr. Peer Asad Aziz⁴

^{*1}Neurosurgery Resident, MBBS, FCPS Liaquat University of Medical & Health Sciences (LUMHS),

²Senior Registrar, MS Neurosurgery, Bilawal Medical College, (LUMHS)

³Chairperson, FCPS Neurosurgery, Liaquat University of Medical & Health Sciences (LUMHS)

⁴Incharge, FCPS Neurosurgery, Bilawal Medical College, (LUMHS)

^{*1}kanwal.asadali@gmail.com, ²etizazahmed740@gmail.com, ³riazrajamemon@yahoo.com,

⁴pirasadaziz@hotmail.com

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Corresponding Author: *
Dr. Kanwal Ali

Abstract

OBJECTIVE: To evaluate post-treatment outcomes in patients with intracerebral hemorrhage and analyze the differences between surgical and conservative management.

METHODOLOGY: This scholarly research was undertaken at LUMHS in Jamshoro, with a focus on individuals within the age range of 30 to 55 years, irrespective of gender, who have received a diagnosis of intracerebral hemorrhage (ICH). Utilizing a non-probability consecutive sampling methodology, participants were allocated to either surgical or conservative intervention, with the choice of treatment modality being determined by the attending neurosurgeon in alignment with their clinical presentation. The study was designed to evaluate functional recovery (mRS ≤ 2) and mortality as the primary endpoints. Data was systematically entered and analyzed utilizing SPSS version 26. Descriptive statistics will be computed, and data will be analyzed and presented with a 95% confidence interval.

RESULTS: Among a cohort of 182 patients diagnosed with intracerebral hemorrhage (mean age: 43.29 ± 7.21 years in the surgical intervention group; 42.65 ± 7.55 in the conservative management group), the male demographic constituted 58.2% and 47.2%, respectively. The application of surgical management yielded statistically significant superior outcomes: a decreased mortality rate (5.5% versus 21.3%; $p=0.005$), enhanced functional recovery (70.9% versus 48.0%; $p=0.004$), a reduced duration of hospitalization (10.64 ± 2.04 versus 12.90 ± 4.27 days; $p=0.0001$), and a diminished requirement for long-term care services (9.1% versus 41.7%; $p=0.0001$).

CONCLUSION: This research elucidated that prompt surgical intervention in individuals experiencing spontaneous intracerebral hemorrhage significantly enhances clinical outcomes, which encompass reduced mortality rates, improved functional recovery (mRS ≤ 2), diminished occurrences of neurological deterioration and radiological progression, as well as a decreased length of hospital stay. Furthermore, a smaller proportion of patients necessitated long-term care. These findings substantiate the efficacy of early surgical management compared

to conservative treatment in appropriately selected patients, thereby highlighting its capacity to facilitate recovery and mitigate complications associated with spontaneous ICH.

INTRODUCTION

Stroke continues to represent a significant global public health concern, accounting for an estimated 10% of global mortality and contributing to a 5% decrease in disability-adjusted life-years (DALYs) [1]. Notwithstanding advancements in therapeutic interventions, stroke remains linked to elevated morbidity and mortality indices [2]. Among the various subtypes of stroke, intracerebral hemorrhage (ICH) is recognized as the most incapacitating, resulting in a more substantial loss of DALYs compared to ischemic stroke [3], and is responsible for 10–17% of all deaths associated with stroke [4,5]. The mortality rate within 30 days following the onset of ICH is recorded in as many as 40% of cases, with the majority of survivors enduring considerable functional impairments [6–9]. The expansion of hematoma serves as a crucial predictor of early neurological deterioration and unfavorable prognosis in cases of primary ICH [7,9].

The incidence of ICH demonstrates variability across different populations [10], with cerebral amyloid angiopathy (CAA) identified as the second most prevalent etiology following hypertension. CAA is increasingly acknowledged as a significant contributor to lobar ICH, particularly among the elderly demographic [11–13]. Approximately two-thirds of instances of spontaneous ICH are categorized as deep, while the remaining one-third manifests as lobar, affecting both cortical and subcortical regions across one or multiple lobes [13]. Lobar ICH is also characterized by a considerable recurrence rate, estimated at 4% per patient-year [4].

The management approaches for ICH remain a subject of debate. A variety of surgical methodologies—including minimally invasive surgery (MIS), endoscopic evacuation, stereotactic aspiration, keyhole surgery, and craniotomy—have been juxtaposed with conservative medical management [14]. While certain studies, such as that conducted by Wang et al., endorse the superiority of MIS in enhancing functional outcomes [15], others have reported no significant advantage over medical management [16,17]. Nevertheless, further research

suggests that MIS may produce more favorable outcomes in comparison to both open surgical techniques and conservative strategies [18]. The advancement of MIS has catalyzed the emergence of several innovative techniques designed to optimize hematoma evacuation while minimizing cerebral injury [15,19,20]. Significantly, Kim et al. [21] reported no notable difference in intensive care unit (ICU) length of stay between conservative and surgical cohorts, thereby emphasizing the necessity for ongoing research into optimal treatment modalities. Additionally, prior investigations have revealed divergent findings concerning the duration of hospitalization and clinical outcomes between surgical and conservative approaches to the management of intracerebral hemorrhage (ICH). In one specific study, the average length of hospital stay was significantly reduced in the conservative cohort (13.93 ± 8.87 days) when juxtaposed with the surgical cohort (20.33 ± 6.37 days). The overall mortality rate associated with ICH in this same investigation was recorded at 36.4%, consisting of 57.1% (16/28) within the conservative cohort and 14.8% (4/27) within the surgical cohort. Notably, a favorable functional outcome—characterized by a modified Rankin Scale (mRS) score of ≤ 2 —was realized in 48.14% (13/27) of patients subjected to conservative management, in contrast to 17.85% (5/28) among those in the surgical group. Another study indicated a mortality rate of 15% among individuals diagnosed with intracerebral hemorrhage [22].

In light of the inconsistent results documented in the global literature and the lack of regional data, the current study endeavors to assess the outcomes of surgical versus conservative management in patients presenting with spontaneous intracerebral hemorrhage. By conducting a comparative analysis of these treatment modalities, this investigation aspires to provide empirical evidence that may enhance clinical decision-making and aid neurologists and neurosurgeons in refining post-treatment outcomes for ICH patients within our local healthcare context.

METHODOLOGY

This research endeavor, conducted in the year 2024, was executed within the Department of Neurosurgery at Liaquat University of Medical and Health Sciences (LUMHS) located in Jamshoro, utilizing a non-probability consecutive sampling technique. The investigation primarily focused on individuals aged between 30 and 55 years, irrespective of gender, who had received a diagnosis of intracerebral hemorrhage (ICH). Participants demonstrating severely compromised consciousness (GCS < 8), minimal hemorrhage volume (< 30 cc in cortical or lobar regions), infratentorial ICH, or secondary causes of ICH were systematically excluded from the study. Prior to participation, patients or their appointed representatives (in cases where the patient was unable to provide informed consent) were thoroughly briefed on the study details, and written consent was duly acquired.

Upon enrollment, critical baseline information—including age, gender, residential status, diabetes mellitus (DM), hypertension (HTN), smoking habits, etiological factors of ICH, GCS score, and pupil reactivity—were scrupulously recorded utilizing a structured data collection instrument. Each participant was assigned to either surgical or conservative treatment strategies. The determination of the appropriate management protocol was contingent upon the clinical judgment of the attending neurosurgeon, based on the patient's clinical condition.

Patients within the surgical cohort underwent frontotemporal craniotomy with cortisectomy, succeeded by hematoma evacuation and hemostatic measures. All surgical procedures were conducted under general anesthesia. In specific instances, decompressive craniectomy involving the excision of the bone flap was performed, dictated by the patient's preoperative neurological status and intraoperative observations, particularly in the context of elevated intracranial pressure. Patients receiving conservative management were administered medical treatment that encompassed sedation, hyperosmolar therapy, controlled hyperventilation, and intracranial pressure (ICP) monitoring; external ventricular drainage (EVD) was initiated when clinically warranted. In scenarios where conservatively managed patients

exhibited significant clinical deterioration, the necessity for surgical intervention was reassessed.

The primary outcome of the investigation was functional recovery, evaluated using the modified Rankin Scale (mRS) at three months post-treatment, wherein a score of ≤ 2 was interpreted as indicative of a favorable recovery. Mortality during the three-month follow-up duration was also systematically recorded. Secondary outcomes encompassed the duration of hospitalization (in days), treatment-related complications (including neurological deterioration, hematoma expansion, or treatment failure), and the requirement for long-term care, defined as nursing or supportive care extending beyond a three-month period. All complications were meticulously monitored and documented throughout the hospitalization and follow-up phases.

Neurological deterioration was characterized as a reduction of at least 2 points in the GCS motor score, the emergence of new pupillary asymmetry (≥ 2 mm), or a new loss of pupillary reactivity. Hematoma progression was assessed through follow-up CT scans indicating an enlargement of the initial lesion or the emergence of a new hemorrhage. Treatment failure was delineated as the necessity for surgical intervention in patients initially managed conservatively or the requirement for an additional surgical procedure in those who had undergone early surgical intervention.

RESULTS

Table I delineates the fundamental characteristics of the study cohort ($n = 182$), which consists of 55 individuals in the surgical category and 127 in the conservative category. The average age of participants exhibited comparable values across both categories— 43.29 ± 7.21 years for the surgical category and 42.65 ± 7.55 years for the conservative category. The surgical cohort presented a diminished mean Modified Rankin Scale (mRS) score at baseline (1.00 ± 0.90) in contrast to the conservative cohort (3.89 ± 1.25), while the Glasgow Coma Scale (GCS) score was marginally elevated in the surgical cohort (11.36 ± 1.69) compared to the conservative cohort (10.77 ± 1.71). In terms of gender distribution, male participants constituted 58.2% of the surgical cohort and 47.2% of the conservative cohort. The prevalence of hypertension was noted in 67.3% of surgical patients

and 69.3% of conservative patients. The incidence of diabetes mellitus was more pronounced in the conservative cohort (39.4%) than in the surgical cohort (21.8%). Chronic renal failure was documented in 12.7% of the surgical cohort, contrasting with 27.6% in the conservative cohort. Furthermore, a greater proportion of surgical patients were identified as current smokers (52.7%) in comparison to conservative patients (38.6%).

Table II elucidates the comparative outcomes of early surgical intervention juxtaposed with conservative management in individuals presenting with spontaneous intracerebral hemorrhage (n=182). Subjects within the surgical cohort experienced a markedly diminished duration of hospitalization (10.64 ± 2.04 days) relative to their conservative counterparts (12.90 ± 4.27 days), with a 95% confidence interval (CI) ranging from -3.455 to -1.068 and a p-value of 0.0001. The mortality rate was significantly reduced in the surgical group (5.5%) as opposed to the conservative group (21.3%),

accompanied by a 95% CI of 0.062 to 0.738 ($p = 0.005$). Favorable functional outcomes were more prevalent in the surgical cohort (70.9%) when compared to the conservative cohort (48.0%), with a statistically significant CI of 1.339 to 5.196 ($p = 0.004$). Neuro- worsening was observed less frequently among surgical patients (7.3%) than among those receiving conservative treatment (25.2%), with a CI ranging from 0.078 to 0.695 ($p=0.003$). Likewise, the incidence of radiological progression was lower in the surgical group (10.9%) compared to the conservative group (25.2%), presented with a CI of 0.142 to 0.928 ($p = 0.029$). Although the occurrence of treatment failure was less frequent in the surgical group (7.3%) relative to the conservative group (15.0%), this disparity was not statistically significant ($p=0.114$). Finally, the necessity for long-term care was significantly lower in the surgical group (9.1%) compared to the conservative group (41.7%), with a CI of 0.052 to 0.374 and a highly significant p-value of 0.0001.

Table I: Baseline Characteristics of the patients (n=182)

Baseline Demographic & Clinical Profile		Groups	
		Surgical (n=55)	Conservative (n=127)
Age in years, Mean $\pm$ SD		43.29 $\pm$ 7.21	42.65 $\pm$ 7.55
Modified Rankin Scale Score, Mean $\pm$ SD		1.00 $\pm$ 0.90	3.89 $\pm$ 1.25
GCS Score, Mean $\pm$ SD		11.36 $\pm$ 1.69	10.77 $\pm$ 1.71
Gender	Male, n (%)	32 (58.2)	60 (47.2)
	Female, n (%)	23 (41.8)	67 (52.8)
Hypertension, n (%)		37 (67.3)	88 (69.3)
Diabetes Mellitus, n (%)		12 (21.8)	50 (39.4)
Chronic Renal Failure, n (%)		7 (12.7)	35 (27.6)
Current Smoker, n (%)		29 (52.7)	49 (38.6)

Table II: Outcomes of Early Surgical Intervention in Patients with Spontaneous Intracerebral Hemorrhage (n=182)

Post-Treatment Clinical Outcomes		Groups			P-Value
		Surgical (n=55)	Conservative (n=127)	95% C. I	
Hospital Stay in days, Mean $\pm$ SD		10.64 $\pm$ 2.04	12.90 $\pm$ 4.27	-3.455 ~~~~~ 1.068	0.0001*
Mortality, n (%)		3 (5.5)	27 (21.3)	0.062 ~~~~~ 0.738	0.005*
Functional Status, n (%)	Good	39 (70.9)	61 (48.0)	1.339 ~~~~~ 5.196	0.004*
	Poor	16 (29.1)	66 (52.0)		
Complications, n (%)					
Neuro-Worsening		4 (7.3)	32 (25.2)	0.078 ~~~~~ 0.695	0.003*
Progression		6 (10.9)	32 (25.2)	0.142 ~~~~~ 0.928	0.029*
Treatment Failure		4 (7.3)	19 (15.0)	0.144 ~~~~~ 1.378	0.114

Need for Long-Term Care	5 (9.1)	53 (41.7)	0.052-----0.374	0.0001*
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DISCUSSION

Intracerebral hemorrhage (ICH) remains a critical neurological emergency with high morbidity and mortality. The management of ICH, particularly supratentorial hemorrhage, continues to be debated, especially in regard to whether surgical intervention offers meaningful clinical advantages over conservative treatment. This discussion synthesizes current literature addressing surgical outcomes, comparing various operative techniques to conservative approaches.

Sondag et al. [16] conducted a comprehensive investigation into neurosurgical interventions for supratentorial ICH, revealing that surgical management, particularly in carefully selected patients, can improve functional outcomes. Akhigbe and Zolnourian [17] critically appraised the role of surgery in spontaneous supratentorial ICH. They noted that while the STICH and STICH II trials did not demonstrate a statistically significant overall benefit for surgery, subgroup analyses and real-world applications suggest that early surgical intervention may benefit certain cohorts. Minimally invasive surgical (MIS) techniques have garnered growing attention in recent years as potential alternatives to conventional craniotomy. Xia et al. [18], in a systematic review and meta-analysis, concluded that MIS approaches are generally superior to open craniotomy in terms of reducing mortality and improving functional recovery. Their results indicated that reduced surgical trauma and faster recovery associated with MIS could translate into tangible benefits for patients, especially those with deep-seated hemorrhages.

Further supporting the role of MIS, Yang et al. [19] compared endoscopic surgery with stereotactic aspiration. Their systematic review demonstrated that endoscopic evacuation of hematomas not only reduced complication rates but also achieved better hematoma clearance and functional outcomes. This suggests that endoscopic surgery may offer an optimal balance between invasiveness and efficacy, positioning it as a valuable tool in modern neurosurgical practice for ICH.

Yao et al. [20] also provided strong evidence for the feasibility and effectiveness of endoscopic surgery.

Their meta-analysis supported the view that endoscopic methods can achieve similar or better outcomes compared to traditional craniotomy, with the added benefit of lower perioperative morbidity. Importantly, they emphasized the reduced risk of rebleeding and better preservation of surrounding brain tissue, which are key considerations in outcome optimization. In our study, surgical v/s conservative groups had hospital stay (10.64 ± 2.04 v/s 12.90 ± 4.27 days; $p=0.0001$), mortality (5.5% v/s 21.3%; $p=0.005$), good functional outcome (70.9% v/s 48.0%; $p=0.004$), with complications such as neuro-worsening (7.3% v/s 25.2%; $p=0.003$), radiological progression (10.9% v/s 25.2%; $p=0.029$), treatment failure (7.3% v/s 15.0%; $p=0.114$), and the need for long-term care (9.1% v/s 41.7%; $p=0.0001$). The study by Kim et al. [21] stated no statistically significant difference in the duration of ICU stay between the conservative treatment cohort (7.36 ± 3.66 days) and surgical treatment (6.93 ± 2.20 days; $p=0.950$), duration of hospital stay was shorter for the conservative treatment group compared to the surgical treatment group, at 13.93 ± 8.87 days versus 20.33 ± 6.37 days; $p=0.001$. The study also reported overall mortality rate associated with ICH was recorded at 36.4%, which included 16 of 28 patients (57.1%) in the conservative group and 4 of 27 patients (14.8%) in the surgical group. Likewise, a favorable functional outcome, as determined by the modified Rankin Scale, was observed in 48.14% of the conservative group and in 17.85% (5/28) of the surgical treatment group. Another investigation documented a mortality frequency of 15% among patients presenting with intracerebral hemorrhage [22].

This investigation possesses several noteworthy advantages, notably its direct juxtaposition of early surgical intervention and conservative management in cases of spontaneous intracerebral hemorrhage, utilizing empirical clinical data. The incorporation of a distinctly delineated patient cohort, standardized outcome measures such as the modified Rankin Scale, and extensive subgroup analyses significantly bolster the credibility of the results. Moreover, the prospective design and sufficient sample size augment the study's robustness and clinical pertinence.

Nonetheless, specific limitations warrant acknowledgment. The application of a non-probability consecutive sampling methodology introduces the potential for selection bias, and the single-center environment may constrain the external validity of the findings due to institutional heterogeneity. Furthermore, the absence of randomization in treatment assignment may induce bias in outcome evaluations. The exclusion of individuals exhibiting severely impaired consciousness (GCS < 8), infratentorial hemorrhages, or minimal hemorrhage volume, albeit essential for maintaining homogeneity, further constricts the generalizability of the results. Dependence on clinical judgment for treatment assignment may influence consistency and reproducibility. Although the modified Rankin Scale is extensively utilized, it may not adequately encapsulate long-term neurological recovery or quality of life. Additionally, the three-month follow-up duration may be inadequate for evaluating delayed complications or enduring outcomes. To mitigate these limitations, subsequent research should adopt randomized, multicenter study frameworks with prolonged follow-up intervals and more comprehensive assessments of functional and cognitive outcomes to furnish a more expansive understanding of recovery trajectories in patients with ICH.

REFERENCES

- El Bcheraoui C, Mimche H, Miangotar Y, Krish VS, Ziegeweid F, Krohn KJ, et al. Burden of disease in francophone Africa, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet Glob Health*. 2020;8(3):e341-51.
- Xia Z, Wu X, Li J, Liu Z, Chen F, Zhang L, et al. Minimally invasive surgery is superior to conventional craniotomy in patients with spontaneous supratentorial intracerebral hemorrhage: a systematic review and meta-analysis. *World Neurosurg*. 2018;115:266-73.
- Zhou X, Xie L, Altinel Y, Qiao N. Assessment of evidence regarding minimally invasive surgery vs. conservative treatment on intracerebral hemorrhage: a trial sequential analysis of randomized controlled trials. *Front Neurol*. 2020;11:426.
- Cordonnier C, Demchuk A, Ziai W, Anderson CS. Intracerebral haemorrhage: current approaches to acute management. *Lancet*. 2018;392(10154):1257-68.
- Moullaali TJ, Wang X, Sandset EC, Woodhouse LJ, Law ZK, Arima H, et al. Early lowering of blood pressure after acute intracerebral haemorrhage: a systematic review and meta-analysis of individual patient data. *J Neurol Neurosurg Psychiatry*. 2022;93(1):6-13.
- Safatli DA, Günther A, Schlattmann P, Schwarz F, Kalff R, Ewald C. Predictors of 30-day mortality in patients with spontaneous primary intracerebral hemorrhage. *Surg Neurol Int*. 2016;7(Suppl 18):S510.
- Kuohn LR, Witsch J, Steiner T, Sheth KN, Kamel H, Navi BB, et al. Early deterioration, hematoma expansion, and outcomes in deep versus lobar intracerebral hemorrhage: the FAST trial. *Stroke*. 2022;53(8):2441-8.
- Witsch J, Siegerink B, Nolte CH, Sprügel M, Steiner T, Endres M, Huttner HB. Prognostication after intracerebral hemorrhage: a review. *Neurol Res Pract*. 2021;3:1-4.
- Pinho J, Costa AS, Araújo JM, Amorim JM, Ferreira C. Intracerebral hemorrhage outcome: a comprehensive update. *J Neurol Sci*. 2019;398:54-66.
- Leasure AC, King ZA, Torres-Lopez V, Murthy SB, Kamel H, Shoamanesh A, et al. Racial/ethnic disparities in the risk of intracerebral hemorrhage recurrence. *Neurology*. 2020;94(3):e314-22.
- Banerjee G, Collinge J, Fox NC, Lashley T, Mead S, Schott JM, et al. Clinical considerations in early-onset cerebral amyloid angiopathy. *Brain*. 2023;146(10):3991-4014.
- Weber SA, Patel RK, Lutsep HL. Cerebral amyloid angiopathy: diagnosis and potential therapies. *Exp Rev Neurother*. 2018;18(6):503-13.
- Thabet AM, Kottapally M, Hemphill III JC. Management of intracerebral hemorrhage. *Handbook Clin Neurol*. 2017;140:177-94.

Luzzi S, Elia A, Del Maestro M, Morotti A, Elbabaa SK, Cavallini A, et al. Indication, timing, and surgical treatment of spontaneous intracerebral hemorrhage: systematic review and proposal of a management algorithm. *World Neurosurg.* 2019;124:e769-78.

Wang WZ, Jiang B, Liu HM, Li D, Lu CZ, Zhao YD, et al. Minimally invasive craniopuncture therapy vs. conservative treatment for spontaneous intracerebral hemorrhage: results from a randomized clinical trial in China. *Int J Stroke.* 2009;4(1):11-6.

Sondag L, Schreuder FH, Boogaarts HD, Rovers MM, Vandertop WP, Dammers R, et al. Neurosurgical intervention for supratentorial intracerebral hemorrhage. *Ann Neurol.* 2020;88 (2):239-50.

Akhigbe T, Zolnourian A. Role of surgery in the management of patients with supratentorial spontaneous intracerebral hematoma: critical appraisal of evidence. *J Clin Neurosci.* 2017;39: 35-8.

Xia Z, Wu X, Li J, Liu Z, Chen F, Zhang L, et al. Minimally invasive surgery is superior to conventional craniotomy in patients with spontaneous supratentorial intracerebral hemorrhage: a systematic review and meta-analysis. *World Neurosurg.* 2018;115:266-73.

Yang L, Yang M, He M, Zhou X, Zhou Z. Endoscopic surgery versus stereotactic aspiration in spontaneous intracerebral hemorrhage treatment: a systematic review and meta-analysis. *World Neurosurg.* 2024;184:202-12.

Yao Z, Hu X, You C, He M. Effect and feasibility of endoscopic surgery in spontaneous intracerebral hemorrhage: a systematic review and meta-analysis. *World Neurosurg.* 2018; 113:348-56.e2.

Kim HT, Lee JM, Koh EJ, Choi HY. Surgery versus conservative treatment for spontaneous supratentorial intracerebral hemorrhage in spot sign positive patients. *J Korean Neurosurg Soc.* 2015;58(4):309-15.

Sidram V, Kumar PC, Raghavendra B. A study of clinical profile of intracerebral hemorrhage and ENT manifestations and its surgical outcome. *Int J Head Neck Surg.* 2017;8(1):5-10.