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Original Research Article

EXTERNAL VENTRICULAR DRAINAGE VERSUS OMMAYA RESERVOIR IN INTRAVENTRICULAR HEMORRHAGE: RETROSPECTIVE ANALYSIS OF 22 PATIENTS AT A TERTIARY HOSPITAL

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ABSTRACT

Background: Intraventricular hemorrhage (IVH) is a serious neurological condition associated with severe morbidity and mortality. External Ventricular Drainage (EVD) is the conventional treatment; however, Ommaya reservoir insertion is now an alternative that reduces complications and improves patient outcomes. The study aims to compare the clinical outcomes and complications between patients with IVH managed by either EVD, Ommaya, or the combination of both.
Materials and Methods: A retrospective study was conducted at XXXX in 22 IVH patients confirmed radiologically. The patients were divided into three groups such as EVD, Ommaya, and the combination of both. The clinical parameters such as Glasgow Coma Scale (GCS), Modified Graeb Score (mGS), Glasgow Outcomes Scale (GOS), complications, duration of hospital stay, and survival were analysed using ANOVA<, Chi-square test, and Kruskal-Wallis tests. The p-values <0.05 were considered statistically significant.
Results: A total of 22 patients were included in the study, where most of the patients were between 40- 60 years, with male predominance. The combined group had significantly lower admission GCS (7.7 ± 1.6) and higher mGS (22.4 ± 7.4) ($p < 0.001$). The survival rate was significantly higher in the Ommaya group (88.9%) compared to the combined group (75%) and EVD (33.3%) ($p = 0.041$). Complications such as ventriculitis (11.1%) and blockage (77.7%) were predominantly observed in EVD patients.
Conclusion: The Ommaya reservoir or both EVD and Ommaya demonstrated superior survival, fewer complications, and reduced the need for re-intervention compared to the EVD group.
Keywords: Intraventricular haemorrhage, Ommaya reservoir, External ventricular drainage, Glasgow coma scale, modified Graeb score.

INTRODUCTION

Intraventricular hemorrhage (IVH) is a severe and potentially fatal complication of intracerebral hemorrhage (ICH) that occurs when blood enters the ventricular system. More than 50% of all patients with ICH develop IVH, which is associated with poor outcomes. IVH can be classified as primary or secondary, depending on the source of bleeding (Gluski et al., 2021).[1] The volume of blood in the ventricular system is the predominant predictor of poor outcome. The common neurological deterioration in these patients is due to rapid obstruction of cerebrospinal fluid (CSF) flow, mass effect from the hematoma, increased intracranial pressure, and reduced cerebral perfusion (Stretz et al., 2018).[2] IVH can lead to mechanical disruption, distension of ventricular walls, hypertensive hydrocephalus, and toxic metabolic injury to the ependymal lining. Given its profound association with morbidity and mortality, several treatment strategies have been used (Wang et al., 2025).[3] The most common treatment is the urgent placement of an external ventricular drain (EVD), which alleviates hydrocephalus, evacuates intraventricular blood, and restores intracranial pressure to the normal range (Reger et al., 2022).[4]

The Ommaya reservoir was initially created for administering antifungal agents into the cerebrospinal fluid (CSF) (Szvalb et al., 2014).[5] The Ommaya reservoir has become common for the administration of chemotherapy within the central nervous system and for the sampling of CSF. It has successfully supplanted multiple intrathecal lumbar or suboccipital injections during antineoplastic therapy with a single device (Dossani et al., 2017).[6] The Ommaya reservoir provides the ability to administer chemotherapeutic agents repeatedly with no need for lumbar punctures, obtain CSF samples for dose adjustment, and maintain a consistent intrathecal drug concentration over time. The development of C-TO-Guided stereotactic implantation of the Ommaya in patients with small or normal-sized ventricles was foundational to contemporary neuronavigation of devices (Panigrahi et al., 2021).[7] Today, with the introduction of advanced imaging and navigation technologies, the insertion of intraventricular catheters incorporates several modalities, such as optical tracking frameless stereotaxy, electromagnetic and frame-based tracking, and fluoroscopy, ultrasound, robot, and endoscope-assisted implantation techniques (Sáez-Alegre et al., 2022).[8]

Despite these advancements, comparative data analyzing the outcomes of EVD versus Ommaya reservoir in IVH remain scarce, especially among small retrospective cohorts in tertiary care centers. There is an urgent need to determine if the Ommaya system offers real benefits in terms of neurological recovery, complication rates, and patient survival compared to standard EVD. Since IVH has a high morbidity and mortality, comparative studies are critical for informing clinical decision-making and improving outcomes.

The current study was designed to address this gap by retrospectively analyzing 22 patients with IVH, who were treated either with EVD or Ommaya reservoir in a tertiary care hospital. Outcomes will be assessed by examining variables such as initial Glasgow Coma Scale (GCS), Modified Glasgow Coma Scale (mGCS), Glasgow Outcome Scale (GOS), complication rate, and length of stay to determine which modality provides better functional recovery, survival, and procedural safety. The results are intended to impact and influence the changing neurosurgical practice of managing IVH and also help clarify patient selection for EVD or Ommaya reservoir drainage procedures. The aim of the study was to evaluate the clinical outcomes and the complications between the patients having IVH managed with EVD and Ommaya reservoir.

MATERIALS AND METHODS

A retrospective observational study was conducted in a tertiary care hospital XXXXX to compare the outcome of external ventricular drainage (EVD) and Ommaya reservoir placement with intraventricular hemorrhage (IVH). The study included medical records for 22 patients who were admitted between _______ and _______ and underwent either of these interventions as part of their management. The study design followed the Declaration of Helsinki principles, and ethical approval (XXXXX) for the intervention had been obtained prior to data collection and analysis. Informed consent was obtained from the patients.

Inclusion and exclusion criteria:

Patients with the following criteria were included in the study

1. Diagnosed with IVH confirmed on CT and MRI
2. Underwent either EVD or Ommaya reservoir insertion, or both, during the course of management
3. The availability of demographic and clinical data, including GCS at admission and mGS, and GOS at 1 month.

The patients were excluded based on the following criteria

1. If the patient had traumatic IVH or post-surgical IVH
2. Patients having incomplete clinical and radiological records
3. Underwent prior ventriculoperitoneal shunting before the onset of IVH

A total of 22 patients were included in the study, assigned to three groups based on the type of cerebrospinal fluid (CSF) diversion procedure. Group I, the EVD group, contained nine patients who underwent external ventricular drainage. Group II, the Ommaya group, included nine patients who underwent Ommaya reservoir insertion. Group III, a Combined group, consisted of four patients who required Ommaya reservoir and EVD placement in succession based on clinical necessity, such as persistent hydrocephalus or inadequate drainage.

Data collection: All patient details were collected to obtain the baseline demographic, clinical, radiological, procedural, and outcome information. The demographic variables captured included the patients' age and sex. The clinical variables at the time of admission included the day of presentation (the interval in days between the onset of clinical symptoms and admission to the hospital) and the initial Glasgow Coma Scale (GCS) score, which was used to assess neurological status. The mean duration of cerebrospinal fluid (CSF) drainage was also documented.

The radiological parameters were obtained from the patients' initial non-contrast CT scans and follow-up scans. To ascertain the volume and distribution of intraventricular blood, the Modified Graeb Score (mGS) was calculated for each patient. This scoring system assesses the degree of involvement of the ventricles and clot burden in the lateral, third, and fourth ventricles, ranging from 0 (no blood) to 32 (complete casting of all ventricles). The survival status at 1 month was recorded.

Statistical analysis: Statistical analysis was performed using IBM SPSS Statistics v26.0. Continuous variables were summarized by mean ± SD for normally distributed data, while frequency and percentage were calculated for categorical data. Comparative analyses between two independent groups were done with either the Mann–Whitney U test (non-parametric data) or the Student's t-test (parametric data). For comparison among three groups (External Ventricular Drainage (EVD), Ommaya reservoir, Ommaya + EVD), we used the Kruskal–Wallis test or one-way ANOVA, depending on the data distribution. Categorical variables (e.g., complication rates, survival, and shunt conversion) were analyzed with a Chi-square test or Fisher's Exact test.

RESULTS

A total of 22 patients were included in the study with intraventricular haemorrhage, which were categorised into three groups: EVD (n=9), Ommaya reservoir (n=9), and both EVD+Ommaya (n=4). Most of the patients were between 40-60 years. Age and gender have no significant differences among the groups. The mean hospital presentation differs significantly among the groups (p 0.009), indicating the combined group (EVD + Ommaya), i.e, 4.6 ± 1.8, presents later than those with only EVD (4.36±1.9) or Ommaya (4.1 ± 1.9). However, the combined group had a lower GCS score, while those with Ommaya and EVD had a higher GCS score (p = 0.001) [Table 1]. The duration of CSF drainage was similar in all three groups, with no statistically significant difference.

[Table 2] depicts that the average length of hospital stay varied significantly among groups (p 0.02); patients with both EVD + Ommaya group had the minimal hospital stay, followed by the Ommaya group. The need for new EVD insertion was required in more than half of the patients in the EVD group, whereas no additional procedure was needed in many reservoirs or in the combined or shunt conversion groups (p = 0.009). This shows the higher rate of treatment failure, blockage, and catheter malfunction [Table 2]. The ROC curve indicates the proportion of survivors and non-survivors in each treatment group, which depicts that Omamaya and the combined group had a significantly better survival rate than the EVD group [Figure 1]. [Figure 2] demonstrates the initial severity of IVH and meningitis among the three groups. Patients managed with both EVD + Ommaya have slightly lower baseline GCS and higher mGS, which reflects more initial clinical severity.

Table 1: Demographic and clinical characteristics of patients with IVH managed by EVD, Ommaya, and combined EVD + Ommaya.

Characteristics	EVD (n=9)	Ommaya (n=9)	EVD+ Ommaya (n=4)	P value
Age				0.14
<40 years	0	1	2	
40-60 years	5	5	2	
>60 years	4	3	0	
Gender				0.77
Male	5	5	3	
Female	4	4	1	
Mean Day of presentation	4.36±1.9	4.1 ± 1.9	4.6 ± 1.8	0.009
GCS at admission	8.2 ± 1.9	8.3 ± 1.8	7.7 ± 1.6	0.001
mGS	21.4 ± 7.0	20.6 ± 7.1	22.4 ± 7.4	<0.000
CSF drainage	5.2 ± 1.8	5.2 ± 1.7	5.2 ± 1.7	0.89
Associated haemorrhage				0.34
Isolated ICH	4	2	3	
SAH	2	2	1	
ICH+SAH	2	1	0	
Not associated	1	4	0	

Table 2: Clinical outcomes of patients managed with EVD, Ommaya, and the combined group.

Characteristics	Ommaya (n=9)	EVD (n=9)	Ommaya ± EVD (n=4)	Converted to shunt (n= 3)	P value
Survived	8	3	3	3	0.041
Hospital stay duration	14 ± 3	13 ± 5	10 ± 4	16 ± 2	0.028
New EVD required	0	5	0	0	0.009

The patients who underwent treatment with an EVD experienced complications more frequently than those with an Ommaya reservoir. Ventricluitis was observed only in EVD patients; however, this is not statistically significant due to the small sample size. Meningitis and cardiac arrest blockage were also mostly found in the EVD group [Table 3].

Table 3: Complications across groups

Complications	EVD (n=9)	Ommaya (n=9)	P value
Ventriculitis	1	0	0.05
Meningitis	7	3	
Blockage	7	2	
Accidental pull out	5	0	

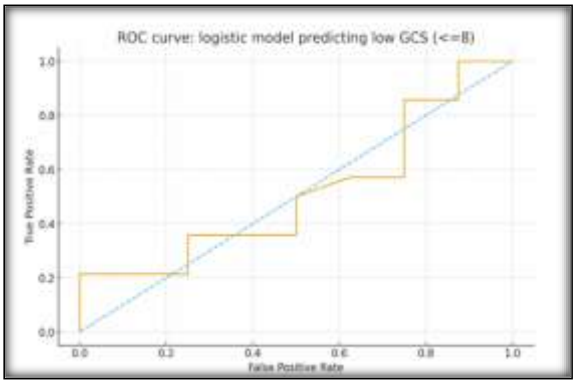

Figure 1: Distribution of survival outcomes among IVD patients (servicer vs nonsurvivors).

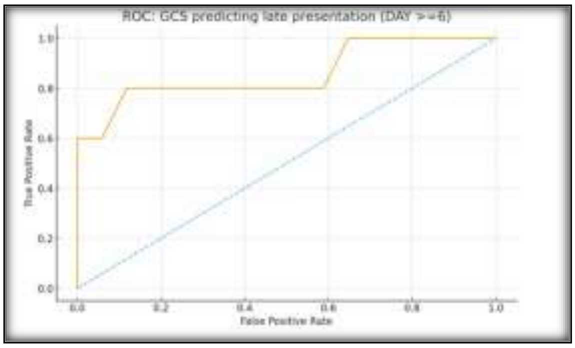

Figure 2: Comparison of mGS and GCS at admission in the treatment group.

DISCUSSION

The current research compared clinical outcomes, adverse effects, and mortality in patients with intraventricular hemorrhage (IVH) treated with external ventricular drainage (EVD), Ommaya reservoir placement, or a combination of both. The main results indicated that patients treated with Ommaya alone or with both methods combined demonstrated greater survival, reduced hospital stay duration, and reduced catheter-related complications compared with patients treated with OVD alone. The results are consistent with research aiming to determine whether Ommaya adds value over conventional OVD in IVH treatment.

In this study, the patients managed by both EVD and Ommaya exhibited more significant neurological impairment, indicated by lower GCS and elevated mGS scores. However, they experienced a better survival rate and shorter hospital stay. This suggests that Ommaya may have better therapeutic benefits in severe cases. The need for the new EVD insertion was higher in the EVD group, while none of the patients from the Ommaya and combined groups required the same, indicating that malfunction and blockage of the devices were lower. These findings align with those of Zhu et al (2024),[9] who indicated that Ommaya was most commonly used in patients with severe IVH. It significantly reduces the clot burden, as shown in the postoperative convergence of mGS score between the Ommaya and non-Ommaya groups (Zhu et al., 2024).[10] Their work indicated that the functional outcome did not improve significantly with the use of Ommaya alone and was primarily associated with the GSC preoperatively and primary clot volume.

EVD remains the standard treatment procedure for acute IVH with hydrocephalus due to rapidly reducing the intracranial pressure and restoring he flow of CSF. However, its efficacy is contraindicated by frequent complications, including infection, accidental dislodgement, and blockage. The study by Gu et al., with 436 IVH patients, found EVD-associated complications in 38.8%of cases, with total blockage in 17.2% and ventriculitis in 7.1% (Gu C et al., 2025).[11] These results reflect our findings that indicate EVD patients experienced a higher rate of obstruction and infection as compared to the Ommaya and combined groups. Moreover, Gu et al. (Gu C et al., 2025) documented a 3—day mortality rate of 28.9%, which aligns with other studies based on EVD, but is higher than the survival rates noted in our Ommaya and combined cohort findings (Wang C et al., 2024).[12,13]

The survival benefit found in the Ommaya and combined groups likely stems from intermittent CSF drainage rather than exclusive continuous external drainage. In a study conducted by Jha et al., patients who suffered aneurysmal SAH and were treated with EVD and later had limited, intermittent drainage to an Ommaya reservoir showed lower dependence on shunts, shorter durations in the ICU, and superior Glasgow Outcome Scores compared to patients with EVD alone (Jha et al., 2022). They suggested that intermittent Ommaya drainage facilitates the preservation of natural cerebrospinal fluid reabsorption routes, hence averting long-term reliance on shunting. This mechanistic explanation corroborates the reduced hospital stays noted in our combined group (10 ± 4 days) relative to EVD (13 ± 5 days).[14,15]

Research conducted by Chowdhury et al. and Rashid et al. indicates that external ventricular drainage (EVD) decreases mortality relative to conservative treatment, although it does not markedly enhance functional recovery (Chowdhury SN et al., 2021; Rashid et al., 2021). This is reflected in our finding that EVD alone was associated with worse survival and more complications despite comparable baseline GCS between the Ommaya and EVD groups. New CSF diversion techniques, like modified ventriculoperitoneal shunting (mVPS) for temporary external drainage, show promise. potential. Lin et al. indicated that mVPS exhibited less problems and extended drainage duration compared to normal EVD or Ommaya-based EVD, hence diminishing the necessity for repeated catheterization (Lin Z et al., 2024).[16,17]

The study highlights the direct comparison of EVD and Ommaya in a single-center cohort to examine meaningful observations on survival, complications, and resource utilization. Limitations include a small study sample size (n=22), a retrospective design, and a single-center setting, which may limit generalizability. It is also likely that the 1-month outcomes may underestimate long-term shunt dependence and neurological recovery.

CONCLUSION

The research supports the use of Ommany reservoir or both EVD and Ommaya in selective IVH patients, specifically those with higher clot burden and lower GCS. The placement of the Ommaya reservoir reduced issues such as catheter obstruction and ventriculitis, leading to better outcomes compared to modern EVD therapy alone. These findings align with international data indicating that although EVD is crucial for acute hydrocephalus, the use of supplementary Ommaya devices facilitates safer, extended CSF diversion with improved outcomes. Future multicenter prospective research and randomized trials are crucial for establishing consistent selection criteria, determining the optimal timing of Ommaya implantation, and evaluating long-term outcomes.

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