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Original Research Article

EVALUATION OF ANTI-EPILEPTIC DRUG USE IN NEUROSURGICAL PATIENTS: A TERTIARY CENTER EXPERIENCE IN CENTRAL INDIA

Shivam Sharma[1], Anupam Sharma[2], Avinash Sharma[3], Aviral Sharma[4]

[1]M.Ch Resident, Department of Neurosurgery, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India
[2]Professor, Department of Pharmacology, F.H. Medical College, Etmadpur, Uttar Pradesh, India
[3]Professor & Head, Department of Neurosurgery, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India
[4]Final Year MBBS Student, Grant Government Medical College and Sir J.J. Group of Hospitals, Mumbai, Maharashtra, India

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Corresponding Author:
Dr. Shivam Sharma,
Email: sharmashivam17@gmail.com

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ABSTRACT

Background: Epilepsy and seizure prophylaxis are common in neurosurgical practice. Appropriate selection and monitoring of anti-epileptic drugs (AEDs) are crucial. The objective is to evaluate the efficacy, side effects, and compliance of AEDs in neurosurgical inpatients and outpatients. **Materials and Methods:** Prospective observational study involving patients attending the neurosurgery OPD and admitted in IPD, receiving AEDs for seizure control or prophylaxis. **Result:** A total of 1500 neurosurgical patients were enrolled over a one-year period. The cohort included both inpatients and outpatients receiving anti-epileptic drugs (AEDs) for seizure prophylaxis or treatment. Data was analysed based on demographics, AEDs prescribed, Monotherapy vs polytherapy, side effects, seizure-free rate at 1/3/6 months and compliance. **Conclusion:** This study highlights real-world AED usage patterns and provides insights into optimizing epilepsy management in neurosurgical settings.

INTRODUCTION

Seizures represent a significant neurological complication among neurosurgical patients, arising across a broad clinical spectrum that includes traumatic brain injury, intracranial neoplasms, central nervous system infections, and postoperative states. The occurrence of seizures in such contexts not only increases morbidity but also complicates both acute and long-term management, thereby impacting functional recovery and quality of life. The use of anti-epileptic drugs (AEDs) in neurosurgical practice is thus well-established, serving both prophylactic and therapeutic purposes depending on the underlying pathology and risk profile. Treatment decisions in epilepsy need to be individualized on the basis of careful analysis of the risk-benefit ratio of each available option.[1]

Despite their clinical utility, the implementation of AED therapy in real-world neurosurgical settings is fraught with challenges. These include adverse drug reactions, variable patient compliance, and complex pharmacodynamic and pharmacokinetic interactions, particularly in polypharmacy scenarios. Striking an optimal balance between seizure control and treatment tolerability remains a key therapeutic goal. This underscores the necessity for individualized AED selection, guided by evidence-based protocols and tailored to the specific clinical scenario. Antiepileptic drugs are routinely given after craniotomy. Though phenytoin is still the most commonly used agent, levetiracetam is increasingly administered for this purpose.[2]

Prophylactic AEDs have been investigated in several studies to see if they could change the course of post-neurosurgical epilepsy and if they could prevent the onset of chronic epilepsy.[3,4] Numerous studies found no statistically significant difference in the incidence of post-operative seizures between patients who received prophylactic antiepileptic treatment and those who did not, but these same studies occasionally found a high incidence of adverse drug reactions in the treated group.[5-7] The present study aims to evaluate the prescribing patterns, side effect profiles, patient compliance, and seizure-free outcomes associated with AED use among both inpatient and outpatient neurosurgical populations at a tertiary care center in Madhya Pradesh, India. By analyzing real-world data, this study seeks to inform more rational, effective, and patient-centric AED strategies in neurosurgical practice.

MATERIALS AND METHODS

Study Design

- Prospective observational study
- Duration: 1 year

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- Location: Department of Neurosurgery, Gajra Raja Medical College, Gwalior, Madhya Pradesh

Inclusion Criteria:
- Patients (IPD and OPD) receiving AEDs

Exclusion Criteria:
- Patients with non-compliance from Day 1
- Non-neurosurgical epilepsy cases

Data Collected:
- Demographics: age, sex, diagnosis
- AEDs prescribed
- Monotherapy vs polytherapy
- Side effects
- Seizure-free rate at 1/3/6 months
- Compliance (pill count, self-reporting)

Ethical Considerations

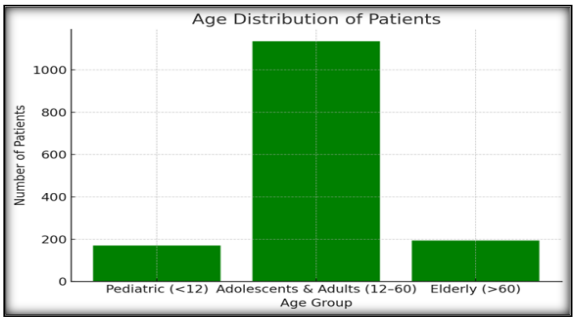
The study was conducted in accordance with the principles outlined in the Declaration of Helsinki and adhered to the ethical standards of human research. Written informed consent was obtained from all participants or their legal guardians after explaining the purpose, procedures, potential benefits, and risks involved in the study. Confidentiality of patient information was strictly maintained, and data were anonymized before analysis.

Participation in the study did not affect the standard of care provided to the patients. Patients were free to withdraw from the study at any point without any compromise in their ongoing treatment or follow-up care.

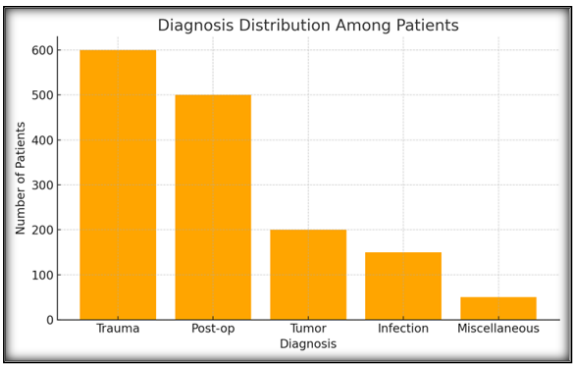
RESULTS

A total of 1500 neurosurgical patients were enrolled over a one-year period. The cohort included both inpatients and outpatients receiving anti-epileptic drugs (AEDs) for seizure prophylaxis or treatment.

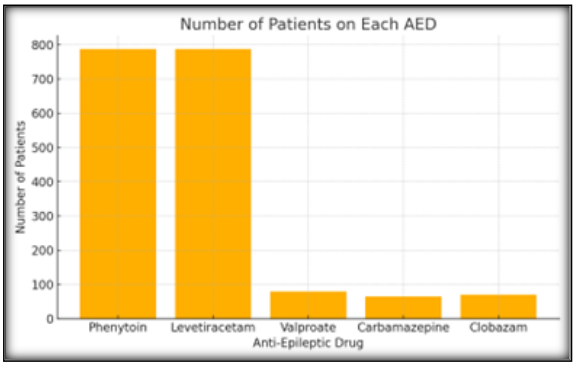
Demographic Profile: The mean age of the patients was 37.8 ± 14.2 years, ranging from 3 months to 82 years. Males comprised 62.4% (936 patients), and females 37.6% (564 patients). Pediatric patients (under 12 years) accounted for 11.3% (170 patients) of the total cohort.



Diagnosis Distribution
- Traumatic brain injury – 600 patients (40%)
- Post-operative seizure prophylaxis – 500 patients (33.3%)
- Intracranial tumors – 200 patients (13.3%)
- Central nervous system infections – 150 patients (10%)
- Miscellaneous conditions – 50 patients (3.3%)



AED Usage Patterns
- Phenytoin – 788 patients (52.5%)
- Levetiracetam – 788 patients (52.5%)
- Valproate – 80 patients (5.3%)
- Carbamazepine – 65 patients (4.3%)
- Clobazam – 70 patients (4.7%)
- Polytherapy was required in 495 patients (33%), while 1005 patients (67%) were successfully managed on monotherapy.



Compliance at 3 Months
- Good compliance (≥90% adherence): 1275 patients (85%)
- Moderate compliance (60–89%): 150 patients (10%)
- Poor compliance (<60% or missed follow-up): 75 patients (5%)

Non-compliance was higher in patients on polytherapy and in those with poor socioeconomic or educational backgrounds.

Seizure-Free Rates
- At 1 month: 1170 patients (78%)
- At 3 months: 1230 patients (82%)
- At 6 months: 1275 patients (85%)

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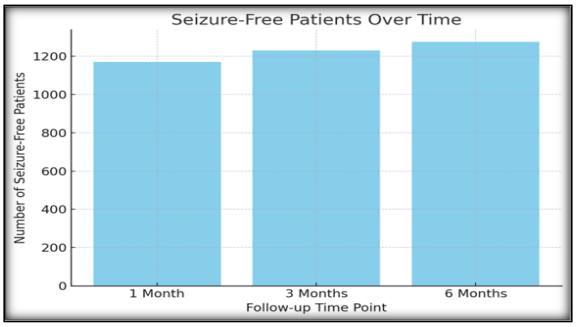

Seizure control was significantly better in patients on monotherapy, with levetiracetam showing the highest seizure-free conversion rate among the drugs used.

Adverse Drug Reactions (ADRs)

- **Phenytoin:**
  - Rash in 30 patients (3.8% of phenytoin users)
  - 1 case of Stevens - Johnson syndrome (0.1%)
  - Gum hypertrophy in 32 (4.1%)
  - Ataxia in 3 (0.4%)
- **Clobazam:**
  - Drowsiness in 15 patients (21.4%)
- **Carbamazepine:**
  - Mild rash and hyponatremia (sporadic, not quantifiable)
- **Valproate:**
  - Gastrointestinal discomfort and weight gain in a few patients

Pediatric Safety Note

Phenytoin syrup toxicity was observed in children <5 years due to confusion between concentrations (25 mg/mL vs. 30 mg/5 mL). As a result, the institution adopted syrup levetiracetam as the standard pediatric formulation to prevent dosing errors.

DISCUSSION

This study offers a robust real-world evaluation of AED use in a tertiary neurosurgical population. Phenytoin and levetiracetam were the dominant choices, driven by their established efficacy and availability. The side-effect burden of phenytoin—though well documented—remains a major limitation, particularly in long-term therapy and paediatric contexts.

Levetiracetam demonstrated an excellent safety profile and was well tolerated across age groups. Its widespread adoption, especially in paediatric protocols, reduced dosing errors and improved compliance. This institutional practice reflects a proactive approach to context-specific pharmacovigilance.

Clobazam, used predominantly in adjunctive settings, showed a higher-than-expected incidence of sedation, especially in elderly or cognitively active patients. The low but notable incidence of serious cutaneous reactions with phenytoin (including SJS) underscores the importance of genetic screening where feasible.

Compliance was generally high, particularly among patients on monotherapy. Patients receiving polytherapy reported more frequent adverse effects and had lower adherence, consistent with global literature on AED burden.

Seizure-free rates showed progressive improvement with time, highlighting the importance of ongoing therapy, regular follow-up, and patient education. These outcomes emphasize that with rational prescribing and careful monitoring, AED therapy can be both effective and safe in neurosurgical settings.

CONCLUSION

In conclusion, this study reinforces the need for individualized and monitored AED therapy in neurosurgical practice. While phenytoin remains a mainstay in acute and emergency settings, levetiracetam is emerging as the preferred agent due to its superior safety and ease of use, especially in paediatric and long-term care.

High compliance and favourable seizure control were achievable in the majority of patients, particularly with monotherapy regimens. The institution's shift to levetiracetam syrup in paediatric populations demonstrates how protocol-driven adaptations can mitigate preventable adverse events.

Continued surveillance of AED side effects, patient counselling, and region-specific prescribing protocols are crucial for optimizing neurological outcomes in both inpatient and outpatient neurosurgical populations.

Limitations

- Single-center study
- Self-reported compliance may be biased

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