

The Clinical Importance of Therapeutic Drug Monitoring in the Emergency Department and a Contemporary Perspective on Antiepileptic Drug Monitoring

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Introduction

Therapeutic Drug Monitoring (TDM) is the measurement of drug concentrations in blood and other body fluids, primarily performed to ensure appropriate treatment with drugs that have a narrow therapeutic range. Traditionally, TDM has been used to minimize drug toxicity. In addition, increasing interest in personalized pharmacotherapy in modern medicine has led to a broader application of TDM.¹ Situated at the intersection of clinical pharmacology, toxicology, and emergency medicine, TDM holds critical importance in patients presenting to the emergency department with symptoms such as altered mental status, cardiac arrhythmias, and seizures.

Which drugs require TDM?

TDM is routinely applied for drugs with a narrow therapeutic index, including antiepileptics (AED), antidepressants, antineoplastics, antibiotics, cardioactive agents, and immunosuppressants.² While this approach plays an important role in disease management across various

clinical settings, it is particularly vital in the diagnostic and therapeutic processes within emergency departments.

Epileptic seizures and drug level monitoring in the emergency setting

The number of patients presenting to the emergency department due to epileptic seizures is significant. Kamppi et al. reported that 3.3% of emergency visits between 2015 and 2018 were related to epileptic seizures and highlighted a substantial patient population within neurological emergency services.³ In certain cases, rapid clinical decision-making is essential, requiring prompt treatment guided by rapid diagnostic tests. For this purpose, serum level measurements of older generation antiepileptic drugs such as phenytoin, carbamazepine, and valproic acid—are commonly employed. However, newer generation antiepileptics, including lamotrigine, levetiracetam, and topiramate, exhibit more predictable pharmacokinetic properties, thus reducing the routine need for TDM.⁴ Possibly for this reason, serum level monitoring for newer antiepileptic drugs is not available in every healthcare institution. Nevertheless,

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in special circumstances such as drug interactions, patient non-adherence, pregnancy, or impaired renal function, measuring drug concentrations of these agents may still be beneficial. Several studies in the literature also support that therapeutic drug monitoring (TDM) of newer antiepileptic drugs contributes to clinical decision-making and offers additional benefits in the real-world management of epilepsy. These findings emphasize that TDM should not be limited to classical AEDs but should also be considered for newer agents when appropriate.⁵ Increasing the availability of such tests in healthcare settings should be a priority in the near future.

Conclusion

TDM remains a valuable approach, especially for optimizing therapy with drugs that have a narrow therapeutic window, and its use is expanding in the field of personalized pharmacotherapy. In emergency visits particularly those due to epileptic seizures monitoring of serum drug levels is crucial and is still more commonly performed for older generation antiepileptics. The accessibility of TDM for newer antiepileptic agents, as a key tool in individualized treatment strategies, deserves increased attention. In conclusion, awareness of both older and newer AED monitoring can enhance acute care decisions.

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