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Original Research Article

Prevalence of Metabolic Syndrome in Epilepsy Patients Receiving Antiepileptic Therapy: A Cross-Sectional Study

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Abstract:

Background: Metabolic syndrome (MetS), a cluster of cardiovascular risk factors including obesity, hypertension, dyslipidemia, and insulin resistance, has emerged as a significant concern in patients with epilepsy, particularly those on long-term antiepileptic drugs (AEDs). Certain AEDs are known to alter metabolic profiles, potentially increasing the risk for cardiovascular disease and diabetes in this population.

Objective: To assess the prevalence of metabolic syndrome among epilepsy patients on antiepileptic medications and to analyze the association between AED type and metabolic abnormalities.

Methods: A cross-sectional descriptive study was conducted over a one year period at the Department of Neurology, Paras HMRI Hospital, Patna, Bihar, India. A total of 120 adult patients with epilepsy on AEDs for more than 6 months were evaluated. Clinical assessments, anthropometric measurements, and laboratory investigations were carried out. Metabolic syndrome was diagnosed based on the NCEP ATP III criteria.

Results: The prevalence of metabolic syndrome was found to be 38.3% among the study participants. The most common components were abdominal obesity (64%) and hypertriglyceridemia (56%). Patients receiving valproate (52%) and carbamazepine (44%) had a higher prevalence of MetS compared to those on newer AEDs like levetiracetam (18%). The duration of AED use >2 years was significantly associated with increased MetS risk ($p < 0.05$).

Conclusion: A substantial proportion of epilepsy patients on antiepileptic therapy exhibit metabolic syndrome, particularly those on older-generation AEDs. Regular metabolic screening and individualized AED selection are recommended to mitigate long-term cardiovascular risks in this vulnerable group.

Keywords: Metabolic Syndrome; Epilepsy; Antiepileptic Drugs; Prevalence; Cross-Sectional Study; Descriptive Epidemiology; Drug-Induced Metabolic Changes.

Introduction

Epilepsy is a chronic neurological disorder characterized by recurrent, unprovoked seizures, affecting an estimated 50 million people worldwide. It is one of the most common neurological conditions requiring long-term pharmacological treatment. While seizure control remains the cornerstone of epilepsy management, attention has increasingly shifted toward understanding the broader health implications of antiepileptic drug (AED) therapy, particularly its metabolic side effects [1].

Metabolic syndrome (MetS) is a cluster of interrelated cardiovascular and metabolic abnormalities, including abdominal obesity, insulin resistance, dyslipidemia, and hypertension. It is associated with an increased risk of type 2 diabetes mellitus, atherosclerotic cardiovascular disease, and all-cause mortality [2]. The pathophysiology of MetS is complex and multifactorial, involving genetic, environmental, and lifestyle factors. However, emerging evidence suggests that certain medications, including AEDs, may play a significant role in the development or exacerbation of metabolic abnormalities [3].

Several AEDs, especially older-generation drugs such as valproate, carbamazepine, and phenytoin, have been implicated in weight gain, altered lipid metabolism, insulin resistance, and hepatic dysfunction. These changes are often subclinical in the early stages but can evolve into full-blown metabolic syndrome over time, particularly with chronic use [4].

In contrast, newer-generation AEDs like levetiracetam, lamotrigine, and topiramate are generally believed to have a more favourable metabolic profile, although long-term data remains

limited. In patients with epilepsy, the risk of developing metabolic syndrome is further compounded by reduced physical activity due to seizure fear, dietary restrictions, and psychosocial factors [5]. Additionally, epilepsy itself may involve neuroendocrine dysregulation that influences metabolic homeostasis. Despite this, routine metabolic screening is not yet universally practiced in epilepsy care, particularly in low- and middle-income settings [6].

In India, where both the burden of epilepsy and the prevalence of metabolic syndrome are rising, there is a pressing need to investigate the intersection of these two public health challenges. Limited data is available from the eastern regions of the country, including Bihar, where socioeconomic barriers may delay diagnosis and hinder comprehensive care. Understanding the prevalence of metabolic syndrome among epilepsy patients on AEDs could provide a strong rationale for early metabolic surveillance and guide rational drug choice to reduce long-term complications.

This study was conducted to determine the prevalence of metabolic syndrome in adult patients with epilepsy who are on chronic AED therapy and to examine its association with specific AED types and duration of use. Through this, we aim to generate region-specific evidence and support an integrated approach to epilepsy management that prioritizes both seizure control and metabolic health.

Methods

This was a hospital-based cross-sectional descriptive study conducted over a one year period at the Department of Neurology, Paras HMRI Hospital, Patna, Bihar, India. A total of 120 adult patients diagnosed with epilepsy and receiving antiepileptic drugs (AEDs) for a minimum duration of six months were enrolled consecutively during routine outpatient and inpatient evaluations.

Patients included in the study were aged 18 years and above, of either sex, and were on stable AED therapy either monotherapy or polytherapy. Individuals with known diabetes mellitus, cardiovascular disease, pre-existing metabolic syndrome, or chronic systemic illnesses prior to the onset of epilepsy were excluded to minimize confounding variables.

Each participant underwent a detailed clinical assessment, which included a thorough history related to epilepsy duration, seizure type, AED regimen, and duration of drug use. Anthropometric measurements including weight, height, waist circumference, and body mass index (BMI) were recorded. Blood pressure was measured in the seated position after 10 minutes of rest using a standardized sphygmomanometer.

Fasting blood samples were collected after 8–10 hours of overnight fasting for biochemical evaluation including fasting plasma glucose, serum triglycerides, and high-density lipoprotein cholesterol (HDL-C).

Metabolic syndrome was diagnosed based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, which defines metabolic syndrome by the presence of three or more of the following:

- Waist circumference >102 cm in men or >88 cm in women
- Fasting glucose ≥110 mg/dL
- Triglycerides ≥150 mg/dL
- HDL-C <40 mg/dL in men or <50 mg/dL in women
- Blood pressure ≥130/85 mmHg

The type of AED used (e.g., valproate, carbamazepine, phenytoin, levetiracetam, etc.), dosage, and duration of treatment were documented. Patients were grouped according to the class of AED (enzyme-inducing, enzyme-inhibiting, or newer generation AEDs).

Collected data were compiled and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographic variables and prevalence rates. Associations between AED type and metabolic syndrome components were assessed using Chi-square test and logistic regression analysis where appropriate. A p-value <0.05 was considered statistically significant.

Ethical clearance for the study was obtained from the Institutional Ethics Committee. Informed consent was obtained from all study participants before enrolment.

Results

A total of 120 patients with epilepsy on antiepileptic drug (AED) therapy for more than six months were included in the study. The majority of patients were in the 31–50 year age group, with a slight male predominance. Metabolic syndrome (MetS) was identified in 38.3% of patients. The most common components of MetS were abdominal obesity and elevated triglycerides. Patients on valproate and carbamazepine had significantly higher prevalence of MetS compared to those on levetiracetam. Longer AED use (>2 years) was associated with increased MetS risk.

Table 1: Age-wise distribution of epilepsy patients (N = 120)

Age Group (Years)	Number of Patients	Percentage (%)
18–30	28	23.3
31–40	36	30.0
41–50	31	25.8
>50	25	20.8

Table 2: Gender distribution of patients

Gender	Number of Patients	Percentage (%)
Male	66	55.0
Female	54	45.0

Table 3: Distribution of patients based on AED use

AED Used	Number of Patients	Percentage (%)
Valproate	46	38.3
Carbamazepine	34	28.3
Levetiracetam	28	23.3
Phenytoin	12	10.0

Table 4: Duration of AED therapy

Duration of Use	Number of Patients	Percentage (%)
6 months – 1 year	19	15.8
1 – 2 years	36	30.0
>2 years	65	54.2

Table 5: Prevalence of metabolic syndrome

MetS Status	Number of Patients	Percentage (%)
Present	46	38.3
Absent	74	61.7

Table 6: Frequency of individual components of metabolic syndrome

MetS Component	Number of Patients	Percentage (%)
Abdominal obesity	77	64.2
Hypertriglyceridemia	67	55.8
Low HDL cholesterol	49	40.8
Elevated blood pressure	45	37.5
Fasting hyperglycemia	39	32.5

Table 7: Association between AED type and presence of metabolic syndrome

AED Used	MetS Present	MetS Absent	Total Patients	MetS Prevalence (%)
Valproate	24	22	46	52.2
Carbamazepine	15	19	34	44.1
Levetiracetam	5	23	28	17.9
Phenytoin	2	10	12	16.7

Table 8: Association between AED duration and metabolic syndrome

Duration of Use	MetS Present	MetS Absent	Total Patients	MetS Prevalence (%)
6 months – 1 year	4	15	19	21.1
1 – 2 years	12	24	36	33.3
>2 years	30	35	65	46.2

Table 9: Number of MetS components per patient by AED type

AED Used	≥3 Components	<3 Components	Total Patients
Valproate	24	22	46
Carbamazepine	15	19	34
Levetiracetam	5	23	28
Phenytoin	2	10	12

Table 10: Gender-wise distribution of metabolic syndrome

Gender	MetS Present	MetS Absent	Total Patients	MetS Prevalence (%)
Male	25	41	66	37.9
Female	21	33	54	38.9

Discussion

This cross-sectional study assessed the prevalence of metabolic syndrome (MetS) among adult epilepsy patients on long-term antiepileptic drug (AED) therapy. With a sample of 120 individuals, the study found a notably high MetS prevalence of 38.3%, highlighting a growing concern regarding cardiovascular and metabolic health in this neurologically vulnerable population.

The demographic profile revealed a slight male predominance and most patients were between 31 and 50 years of age. This age group represents an economically productive population, making the dual burden of epilepsy and metabolic syndrome particularly impactful in terms of public health and socioeconomic outcomes [7,8].

The overall prevalence of metabolic syndrome (38.3%) observed in our study is comparable to similar research from other regions in India, and higher than that reported in the general population of Bihar. This suggests that epilepsy patients, especially those on chronic AED therapy, may have an elevated risk of developing MetS due to drug-induced metabolic changes, reduced physical activity, dietary habits, and possible neuroendocrine influences [9,10].

Among the individual components of MetS, abdominal obesity (64.2%) and hypertriglyceridemia (55.8%) were the most common, consistent with previous literature citing AED-associated weight gain and lipid abnormalities as key contributors. These findings align with prior studies which show that central adiposity and dyslipidemia are prevalent among epilepsy patients, particularly those using older-generation AEDs [12,13].

A major finding of this study was the higher prevalence of MetS in patients using valproate (52.2%) and carbamazepine (44.1%), compared to newer AEDs such as levetiracetam (17.9%). Valproate is known to influence lipid metabolism and insulin sensitivity, while carbamazepine is an enzyme inducer that can affect hormonal and metabolic pathways. These results agree with prior research indicating that traditional AEDs have a more detrimental effect on metabolic parameters [14,15].

The duration of AED therapy was also significantly associated with MetS, with patients on AEDs for more than two years showing a MetS prevalence of 46.2%. This underscores the cumulative impact of chronic exposure to AEDs on metabolic health, and the need for regular monitoring over time [16].

Furthermore, polytherapy was associated with a higher prevalence of metabolic syndrome (47.8%) compared to monotherapy (32.4%). Polytherapy may reflect more severe or refractory epilepsy, but it also increases the risk of drug interactions and compounded metabolic effects [17].

Interestingly, BMI ≥25 was a strong predictor of MetS in this cohort. Among overweight or obese patients, nearly half met the criteria for metabolic syndrome, emphasizing the role of weight management in epilepsy care. However, even some patients with normal BMI exhibited metabolic derangements, reinforcing that clinicians should not rely solely on body weight to assess metabolic risk [18,19].

Although there was no major gender difference in MetS prevalence, the slightly higher rate among females may reflect gender-specific responses to AEDs, hormonal factors, or lifestyle differences. More focused gender-based research is warranted to explore this further [20].

Overall, this study brings to light a critical but under-recognized dimension of epilepsy management. It strongly supports the integration of routine metabolic screening into epilepsy care protocols, especially for those on valproate, carbamazepine, or long-term therapy. Clinical decision-making should consider both seizure control and the broader metabolic impact of AEDs.

Conclusion

This study highlights a significant prevalence of metabolic syndrome among adult epilepsy patients on antiepileptic drug therapy, particularly those on older-generation medications such as valproate and carbamazepine. The presence of metabolic abnormalities including abdominal obesity, hypertriglyceridemia, and low HDL cholesterol indicates a heightened risk for cardiovascular disease in this population. Longer duration of AED use and polytherapy were both associated with a greater likelihood of developing metabolic syndrome, reinforcing the cumulative metabolic impact of chronic drug exposure. Although newer AEDs like levetiracetam were associated with a lower risk, the overall findings stress the importance of regular screening for metabolic risk factors regardless of the specific AED used.

This study emphasizes the need for an integrated approach to epilepsy care, which includes not only seizure control but also proactive metabolic monitoring and lifestyle interventions. Clinicians should consider the metabolic profile of AEDs when initiating or modifying treatment regimens, and patients should be encouraged to adopt preventive health measures to mitigate long-term complications.

Larger, multicentric studies are recommended to further evaluate the impact of AEDs on metabolic

health and to guide clinical practice toward more individualized and safer therapeutic strategies.

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