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Cost of illness of epilepsy per patient per year in a tertiary care hospital in New Delhi: A Prospective Observational study

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ABSTRACT

Background: Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures that imposes heavy burden on individuals, families, and also on healthcare systems. As the better understanding of economic aspects of epilepsy will lead to better development of epilepsy care this study was conducted to estimate the cost of illness in epilepsy per patient per year in a tertiary care hospital in New Delhi. **Aims and Objectives:** The aim of study was to study the direct, indirect and total cost of illness in epilepsy per patient per year in a tertiary care hospital. **Materials and Methods:** Patients with epilepsy attending the Department of Neurology at Batra Hospital and Medical Research Centre in New Delhi were included in this study. All epilepsy patients fulfilling the inclusion and exclusion criteria were included in the study. The cost of illness was estimated as total, direct and indirect costs of illness per year for each patient. The information was collected on a properly formed format which consists of the demographic details of the patient, general biodata of patient, information about the direct medical costs and direct non-medical costs and information about indirect costs. The results are presented in Mean ± SD frequencies and percentages. The Kruskal-Wallis test was used to compare the costs of illness among different strata. The Mann-Whitney U test was used to compare the costs of illness between strata. The p-value < 0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA). **Results:** A total of 70 patients were included in the study. The median age of patients was 28.50 years and the mean age was 33.36 years. The total indirect and direct cost of illness was Rs. 5265.30 ± 6363.42 and Rs. 25249.38 ± 14480.09 respectively. The total cost of illness was Rs. 26808.42 ± 16108.05. The highest mean cost was for Carbamazepine (Rs. 14500.00), followed by Levetiracetam (Rs.13300.00) and rest by the other commonly used drugs. **Conclusion:** We concluded that economic burden of epilepsy on the family and patients can be decreased by decreasing the hospitalization rates of patients, avoiding poly therapy as much as possible and rationalizing the investigations.

Key words: Epilepsy; costs; Predisposition; Economic; Burden; year

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INTRODUCTION

Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological, and social consequences of this condition epilepsy is the second most common and frequently encountered neurological condition that imposes heavy burden on individuals, families, and also on healthcare systems. Worldwide 70 million people have epilepsy and nearly 90% of them are found in developing regions.[1] Cost of epilepsy had been estimated in several developed countries.[2-6] In developing countries very few studies have estimated the cost of epilepsy.[7,8,9] Developing countries carry 90% of the financial burden of epilepsy, as 85% of world's 50 million people with epilepsy live in developing countries.[10] Estimates of the costs of epilepsy

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are increasingly required by governmental agencies and private institutions for the best allocation of resources and for assessing the cost-benefit and cost-effectiveness ratios of diagnostic and therapeutic interventions. As the better understanding of economic aspects of epilepsy will lead to better development of epilepsy care [11] this study was conducted to estimate the cost of illness in epilepsy per patient per year in a tertiary care hospital in New Delhi.

AIMS AND OBJECTIVES

The aim of study was to study the direct, indirect and total cost of illness in epilepsy per patient per year in a tertiary care hospital.

MATERIALS AND METHODS

Patients with epilepsy attending the Department of Neurology at Batra Hospital and Medical Research Centre in New Delhi were included in this study. All epilepsy patients fulfilling the inclusion and exclusion criteria, attending the Epilepsy Clinic of our hospital were included in the study.

Inclusion criteria

Patients with at least two unprovoked seizures occurring >24 h apart.

Exclusion criteria

Patients with a single seizure, patients in remission not requiring AEDs, patients who had undergone epilepsy surgery, patients with psychogenic seizures, patients with epilepsy syndromes and patients with other major neurologic disabilities such as mental retardation, stroke, aphasia, or motor deficits were excluded from the study.

Methodology

The costs of illness for epilepsy were estimated by dividing the cost into direct costs and indirect costs.

(A) Direct Costs include OPD costs, IPD costs, Emergency visit costs, drug costs, investigation costs, transportation costs, home care costs, special equipment costs, etc.
(B) Indirect costs include cost of lost working days of patient, cost of lost working days of attendant and cost of early retirement.

The cost of illness was estimated as cost of illness per year for each patient. Actual costs of all parameters were taken into account for all patients. The information was collected on a properly formed format which consists of the demographic details of the patient, general biodata of patient, information about the direct medical costs and direct non-medical costs and information about indirect costs. The interview was taken from the patient directly or from the attending relative in case of patient being illiterate or a minor.

The OPD costs were estimated by cost of each visit, number of OPD visits per year and total years on follow up. Similarly the hospitalization costs and emergency visit costs were estimated by the cost of each day of hospital stay or cost of emergency visit, number of admission days or emergency visits per year and total years on follow up. However the drug costs were estimated by the cost of each drug per month and the total number of years patient has taken or has been on a particular drug. The costs of all the AEDs received by the patient during the entire follow up were accordingly estimated. Similarly the costs of all the investigations carried out during the entire follow up were estimated by cost of each investigation and number of times the investigation was performed in the patient. The costs applied to the patients while estimating OPD costs, hospitalization costs and emergency visit costs were extrapolated from the rates applicable to patients at the time of study irrespective of the duration of follow up. In the similar way the costs applied while estimating the drug and investigation costs were extrapolated from the costs of each drug and each investigation applicable to patients at the time of study. The costs of drugs and investigations applied to patient in our hospital were comparable to most other hospitals in the state.

The direct non medical costs like transportation costs were estimated by costs of each visit to hospital, number of visits per year and total years of follow up. The cost of lost working days of patient or the attendant was estimated by loss per day and the total number of days lost during entire follow up. The loss per day was in turn estimated from the self declared monthly income. It was the actual loss of wages which was estimated in the patients or the attendants. The cost was not estimated for patients and attendants who were not working (children, housewives, students, and other dependants of family) and also costs were not estimated for those working patients and attendants who can avail a sick or earned leave from the employer.

RESULTS

A total of 70 patients were included in the study. The median age of patients was 28.50 years and the mean age was 33.36 years. About one third of patients were between 20-40 years (35.7%) followed by < 20 (31.4%), 41-60 (22.9%) and >60 (10%) years. About half of patients were males (51.4%). While classifying the patients on the basis

of family income per month we found that about one third of patients had family income above Rs. 40,000 (32.9%) followed by Rs.10,000-20,000 (24.3%), Rs. 20,001-30,000 (15.7%), < Rs. 10, 000 (14.3%) and 30,000-40,000 (12.9%) as shown in Figure 1.

More than half of patients were unemployed (60%) and about (51.4%) patients were unmarried. The mean duration of disease (epilepsy) was 3.60 ±3.69 years. Table 1 shows the distribution of patients with respect to the duration of epilepsy and other parameters.

Table 2 shows the distribution of direct costs of epilepsy per patient per year. The highest direct medical cost included cost of hospitalization (Rs. 8740.70±5310.31) and minimum being emergency cost (Rs. 2259.30±1403.09). The highest direct non-medical cost included home care costs (Rs. 14622.00±11372.61) and lowest being transportation (Rs. 923.91±604.25). The special education costs were Rs. 10000.00±0.00.

Table- 3 shows the distribution of total direct costs of epilepsy per patient per year. The direct medical cost and direct non-medical costs was Rs. 23048.00±13502.08 and Rs. 2485.30±5643.23respectively. The total direct cost was Rs. 25249.38±14480.09.

Table-4 shows the distribution of indirect costs of epilepsy per patient per year. The cost of lost working days of patient and attendant was Rs. 4558.30±5101.24 and Rs. 3172.70±6628.48 respectively.

Table-5 shows the distribution of total cost of illness per patient per year. The total indirect and direct cost of illness was Rs. 5265.30±6363.42 and Rs. 25249.38±14480.09 respectively. The total cost of illness was Rs. 26808.42±16108.05.

While finding the cost of different drugs used in the treatment of epilepsy the highest mean cost was for Carbamazepine (Rs. 14500.00), followed by Levetiracetam (Rs. 13300.00), Valproate (Rs. 11900.00), Lacosamide (Rs. 8752.39), Oxcarbamazipene (Rs. 6465.80), clobazam

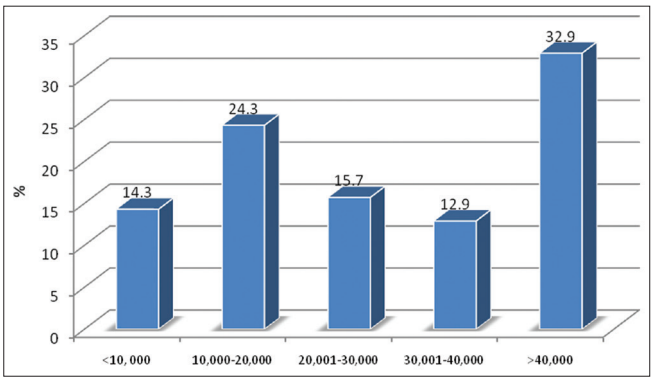

Figure 1: Distribution of patients according to family income per month

Table 1: Showing the various parameters of patients and their percentage

No. of OPD visits per year	Number (n=70)	Percentage
One	9	12.9
Two	22	31.4
Three	19	27.1
Four	9	12.9
≥Five	11	15.7
Mean±SD	2.93±1.37	
No. of emergency visits per year	**No. (n=70)**	**%**
None	43	61.4
One	23	32.9
>One	4	5.7
Mean±SD	0.44±0.60	
No. of hospitalization in days per year	**No. (n=70)**	**%**
None	43	61.4
One	1	1.4
Two	11	15.7
Three	9	12.9
Four	3	4.3
Five	3	4.3
Mean±SD	1.10±1.54	
Reasons for hospitalization	**No. (n=27)**	**%**
Because of seizure	14	51.9
Status epilepticus	7	25.9
For investigations	6	22.2
Total number of AEDs used in entire illness	**No. (n=70)**	**%**
One	12	17.1
Two	35	50.0
Three	16	22.9
>Three	7	10.0
Mean±SD	2.26±0.86	
No. of days from school/work lost per year of patient	**No. (n=70)**	**%**
None	4	5.7
1-5	38	54.3
6-10	17	24.3
>10	11	15.7
Mean±SD	5.57±4.60	
No. of days of work lost of attendant per year	**No. (n=70)**	**%**
None	5	7.1
1-5	37	52.9
6-10	17	24.3
>10	11	15.7
Mean±SD	5.50±4.65	
Duration of epilepsy in years	**Number (n=70)**	**Percentage (%)**
1 year	18	25.7
2 years	19	27.1
3 years	13	18.6
≥ 4years	20	28.6
Mean ±SD	3.60±3.69	

(Rs. 6438.30), Phenytoin (Rs. 4368.61), Phenobarbitone (Rs. 3963.33) and the least was for Clonazepam (Rs.1162.00) (Table 6).

Table 2: Distribution of Direct costs per patient per year

Direct costs	Mean±SD
Direct medical cost	
OPD cost (n=70) (per OPD per year)	2110.00±1952.79
Cost of hospitalization (27)	8740.70±5310.31
Emergency cost (n=27)	2259.30±1403.09
Total cost of drugs (70)	8543.60±4209.08
Total cost of investigations (70)	7995.20±4852.27
Total direct medical cost (n=70)	23048.00±13502.08
Direct Non-medical Costs	
Transportation cost (n=61)	923.91±604.25
Home care costs (n=6)	14622.00±11372.61
Special education costs (n=1)	10000.00±0.00
Total direct Non-medical cost (n=62)	2485.30±5643.23

Table 3: Distribution of Total direct costs per patient per year

Direct cost	Mean±SD
Direct medical cost (n=70)	23048.00±13502.08
Direct non-medical cost (n=62)	2485.30±5643.23
Total direct cost (n=70)	25249.38±14480.09

Table 4: Distribution of Indirect costs per patient per year

Indirect cost	Mean±SD
Cost of lost working days of patient	4558.30±5101.24
Cost of lost working days of attendant	3172.70±6628.48
Total indirect cost	5265.30±6363.42

Table 5: Distribution of total cost of illness per patient per year

Total cost	Mean±SD
Total indirect cost	5265.30±6363.42
Total direct cost	25249.38±14480.09
Total cost of illness	26808.42±16108.05

Table 6: Distribution of costs of different drugs used in the treatment of epilepsy per person

Drugs	Cost in Rs. (Mean)	SD
Phenobarbitone	3963.33	2232.76
Phenytoin	4368.61	3599.66
Carbamazepine	14500.00	8563.63
Valproate	11900.00	9212.37
Clobazam	6438.30	3884.47
Clonazepam	1162.00	653.22
Oxcarbamazipene	6465.80	2046.31
Gabapentin	0.00	0.00
Lamotrigine	0.00	0.00
Lacosamide	8752.39	4638.79
Levetiracetam	13300.00	7415.61

Statistical analysis

The results are presented in Mean ± SD frequencies and percentages. The Kruskal-Wallis test was used to compare the costs of illness among different strata. The Mann-Whitney U test was used to compare the costs of illness between strata. The quartiles of the costs were also calculated. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

DISCUSSION

The present study was conducted in the Department of Neurology, Batra Hospital and Medical Research, New Delhi with the objective to study the direct cost, indirect cost and total cost of illness in epilepsy per patient per year in a tertiary care hospital. A total of 70 patients were included in our study out of which about half of patients were males (51.4%) and the rest were females (48.6%). This was almost comparable to other studies which showed males and females were 45.4 to 52.6% and 47.4 to 54.6% respectively.[12,13] The mean age of patients in our study was 33.36 years with about one third of patients were between 20-40 years (35.7%). The age in our study was also comparable to other multiple studies conducted by Thomas SV et al.,[8] Zhen Hong et al.,[12] Ettore Beghi et al.,[14] and Antonio Pato-Pato[13] which showed the mean age ranged from 22.6 to 41.6 years. The mean duration of epilepsy in our study was 3.6 years. The duration of epilepsy was one year (25.7%), two years (27.1%), three years (18.6%) and ≥ 4 years (28.6%) The mean duration of epilepsy in study by Zhen Hong et al.,[12] was 5 years which is nearer to our study group but in studies carried out by Thomas SV et al.,[8] and Antonio Pato-Pato[13] the mean was 8 years and 15.3 years respectively. The mean seizure frequency in our study was 2.37 per year. The seizure frequency was one per year (32.9%), two seizures per year (32.9%), three seizures per year (14.3%) and ≥ 4 seizures per year (20%) while Antonio Pato-Pato[13] found that 39.8% had no seizures during the study and 60.2% had seizures, although only 22.8% suffered more than two seizures. The mean duration of treatment was 3.01 years of which about one third of patients had one year duration of treatment (30%) followed by two years (28.6%), three years (17.1%) and more than three years (24.3%).

In our study while estimating the direct medical costs of illness per patient per year we found that the OPD cost was Rs. 2110.00±1952.79, Cost of hospitalization was Rs. 8740.70±5310.31, Emergency visit cost was Rs. 2259.30±1403.09, cost of drugs was Rs. 8543.60±4209.08

and cost of investigations was Rs. 7995.20±4852.27. We found that the highest direct medical cost included cost of hospitalization (Rs. 8740.70±5310.31) and minimum being emergency cost (Rs. 2259.30±1403.09). In the study by Thomas SV et al.,[8] the direct medical costs included outpatient expenses (INR 329.25), hospitalization charges (INR 316), cost of AEDs (INR 2,150) and the cost of diagnostic workup INR 271.25. Also we found that the highest direct non-medical cost included home care costs (Rs. 14622.00±11372.61) and lowest being transportation (Rs. 923.91±604.25). The special education costs were Rs. 10000.00±0.00. Anand Krishnan et al.,[15] has found in his study that the transportation costs were 6% of the total costs which amounted to be Rs. 682.34(USD 10.53). No studies have estimated the home care and special education costs. However the direct nonmedical cost was INR 659 per year in the study by Thomas SV et al.,[8] which mainly included the transportation costs.

Our study also showed that the mean direct medical cost per patient per year was much higher (Rs. 23048.00) than mean direct non-medical costs (Rs. 2485.30). The mean total direct cost per patient per year was Rs. 25249.38. Antonio Pato-Pato [13] also found that the mean direct medical cost per patient per year for the control of epilepsy was much higher than the direct non-medical costs per patient per year. The higher direct medical costs can be explained by the high hospitalization costs, more frequent use of newer generation costlier drugs and easy availability of all investigations. The main indirect costs in our study were the cost of lost working days of patient and attendant. There was no cost of illness found due to early retirement in our study. The indirect cost of illness per patient per year was Rs. 5265.30 but in the study by Thomas SV et al., [8] the indirect costs were higher (Rs.10,031) and were mainly due to lost working days because of seizure and travel to hospital. The lower indirect costs in our study could be likely due to lesser seizure frequency in our patients and subsequent less work days lost.

In our study we found that the total cost of illness per patient per year was Rs. 26808.42. The direct cost of illness was higher (Rs. 25249.38) and the indirect cost of illness was lower (Rs.5265.30). Multiple studies favour our results of higher direct costs and lower indirect costs. In the study by Zhen Hong et al.,[12] the total annual cost per patient in their series was approximately RMB 5,253 (Rs. 48999.6). The Direct costs were higher RMB 483 (Rs. 4520.88) and indirect costs were lower RMB 289 (Rs. 2705.04). Other studies showing similar results were done by Gessner U et al.,[4] Cockerell OC et al.,[5] and Murray MJ et al.[6] The higher direct costs can be explained by the high hospitalization costs, more frequent use of newer generation costlier drugs and easy availability of all investigations.

We also found in our study that the mean cost of drugs per year was highest for carbamazepine (Rs. 14500.00), followed by Levetiracetam (Rs. 13300.00), Valproate (Rs. 11900.00), Lacosamide (Rs. 8752.39), Oxcarbamazipene (Rs. 6465.80), clobazam (Rs. 6438.30), Phenytoin (Rs. 4368.61), Phenobarbitone (Rs. 3963.33) and the least was for Clonazepam (Rs.1162.00). In a related study by Anand Krishnan et al.,[15] mean annual drug cost per patient was highest for Valproate, followed by carbamazepine, phenytoin and phenobarbitone in that order. These results in both the studies revealed higher costs of newer generation drugs likely because of their more frequent use owing to better tolerability.

CONCLUSIONS

After this study we would like to conclude that epilepsy is a neurological condition affecting all age groups and requiring long term treatment having economic burden on the patient and the family in terms of various costs. The direct costs are the main costs which can be decreased by decreasing the hospitalization rates of patients, avoiding polytherapy as much as possible and rationalizing the investigations.

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Author's contribution:
Dar MA - Concept and design of the study; prepared first draft of the study; interpreted the results and reviewed the literature and manuscript preparation, statistical analysis and interpretation; **EAB-** Review of literature and manuscript preparation; **PALS-**Review of literature; **FJ-**Review of literature and manuscript preparation.

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