IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 12, Issue 2 Ser. IV (Mar. – Apr. 2023), PP 43-50
www.iosrjournals.org

Effects of Antiepileptic Drugs on Serumlipid Profile and Serum Electrolytes in Children

1. Dr. R.D. Dutt, M.D., *P.G.D.D.N., M.B.A. (Hospital Management), Professor of Pediatrics, Department of Pediatrics, G.R. Medical College &Kamla Raja Hospital, Gwalior (M.P.). Mob. 9755315530,*
2. P.Haritha, *P.G. Student, Department of Pediatrics, G.R. Medical College &Kamla Raja Hospital, Gwalior (M.P.). Mob. 8099267624,*
3. Dr. Ajay Gaur, *M.D. Ph.D., F.I.A.P., Professor and Head, Department of Pediatrics, G.R. Medical College &Kamla Raja Hospital, Gwalior (M.P.). Mob. 9425112229,*
4. Dr. ChandrakalaDutt, *M.S., Associate Professor, Department of Surgery, G.R. Medical College & J.A Group of Hospitals, Gwalior (M.P.). Mob. 9425341209,*
5. Dr. TarushiDutt, *Bonded Medical Officer, P.H.C., Porsa, District, Morena, M.P. Mob. 8827684067*
Corresponding address: Dr. ChandrakalaDutt, 112 Tansen Nagar, Gwalior, Mob. 9425341209,

Abstract
BACKGROUND: *Antiepileptic drugs can cause changes in lipid by inducing the p45 enzyme system. It also effects serum electrolytes.*
AIMS AND OBJECTIONS: *To estimate the serum lipid levels and serum electrolytes in children and anti-epileptic drugs between 1 to 15 years of age.*
MATERIAL AND METHODS: *This study was conducted from 2020 in Department of Pediatrics, Kamla Raja Hospital, G.R.M.C., Gwalior.*
Setting: Out Patient Department and Children Medical Wards
Study design: *Prospective case control study*
Sample size: *100 (50 cases and 50 controls)*
Duration of study: *2 years*
Statistical analysis: *SPSS version 25*
RESULTS AND CONCLUSION: *Total 100 children were included in study with 50 cases and 50 controls. Out of 100, 29 (58%) were male and 21 (53%) females were in control groups while 21 (42%) cases were in female ground and 28 (56%) cases in control group. Maximum number of cases were in age group 1-3 years. Total cholesterol increase was seen among phenytoin (262.95/dl) and valpropate group (263.1/dl. VLDL was increase in patient treated onlevetiracetam, Phenobarbitone, phenytoin and valproate. LDL were higher in phenobarbitone, levetiracetam and combination therapy of phenytoin and valproate. HDL level was low in phenytoin and valproate drugs.*
Hyponatremia was observed in children taking phenytoin and valproate drugs. Hypocalcemia was reported in phenytoin and valproate therapy. Potassium level was normal in all groups.
Keywords: *AED, hypocalcemia, hypokalemia, hyponatremia, hypernatremia.*

Date of Submission: 03-04-2023 Date of Acceptance: 14-04-2023

I. INTRODUCTION

Epilepsy is defined as a disorder characterized by two or more unprovoked seizures occurring more than in 24 hours. Antiepileptic drugs (AEDs) are the mainstay of treatment in epilepsy used for a minimum period of 1-2years to many years.

AEDs can cause hyperlipidemia by inducing the p450 enzyme system in the liver. Hyperlipidemia in young children is an important risk factor for the development of coronary heart disease in later life.

Many studies have shown significant relationship between serum lipid levels and antiepileptic drugs especially enzyme inducers like Phenytoin, Sodium valproate, Levetiracetam and Phenobarbitone. The severity of these abnormalities increases as the duration of therapy and number of drugs increases. If it is proved that there is significant association between antiepileptic drugs and serum lipid profile, they can be judiciously used in patients with preexisting risk factors for metabolic syndromes.

Antiepileptic drug effects on sodium, potassium and calcium are also being observed. Ashyponatremia, hypernatremia, hypokalemia, hyperkalemia, hypocalcaemia &hypercalcaemia may cause seizures by affecting brain activity. Therefore, we have to select the safest drug to prevent these complications.

GABA (γ-aminobutyric acid) is a major inhibitory neurotransmitter in the central nervous system .GABA- A receptor functions as a chloride ion channel and is activated by the inhibitory neurotransmitter GABA.

Barbiturates binds to an allosteric regulatory site on the GABA A receptor and increase the duration of the GABA-gated chloridechannels and enhances membrane hyperpolarisation.

Levetiracetam binds selectively to the synaptic vesicular protein SV_2 A and modifies the synaptic release of glutamate and GABA.

Valproate acts as broad spectrum antiepileptic drug. Valproate blocks sustained high-frequency repetitive firing of neurons and is effective against partial seizures by blocking sodium channels and by prolongation of Na+ channel inactivation.

Antiepileptic drugs(AEDs) are metabolized by the p450 microsomal enzyme system in the liver. The p450 microsomal enzyme system also catalyzes the transformation of cholesterol into biliary acids.

II. MATERIAL AND METHODS

This prospective case control study is conducted at Government Urban Tertiary Care Hospital for a duration of 2 years. Written informed consent is taken from the parents.

SETTING: Out Patient Department and Children Medical Wards, Kamla Raja children Hospital, Gwalior, M.P.
STUDY DESIGN: Prospective case control study
SAMPLE SIZE: One hundred(50 cases and 50 controls)
DURATION OF STUDY: Two years
STUDY POPULATION:
INCLUSION CRITERIA:

- Children taking antiepileptic drugs for at-least one year as continuous therapy and admitted in Children Medical Ward of Government Urban Tertiary Care Hospital.

EXCLUSION CRITERIA:

- Children with diseases that alter the serum lipid profile for example nephrotic syndrome
- Children on drugs that affect the serum lipid profile for example corticosteroids
- Children having thyroid disorder or other endocrinopathies.

III. METHODOLOGY:

After obtaining the written and informed consent from the parent of the children, a clinical evaluation was performed as per predesigned proforma. The information regarding the age, sex, type of seizures, duration of the anti-epileptic drug therapy, dose of the anti-epileptic drug, any family history of stroke or cardiovascular disease or seizures were collected. The study population were divided into two groups. Cases include children receiving AEDs for more than 1 year and controls as healthy children of same age group. A blood sample (5 ml) is drawn after an overnight fast for total cholesterol, LDL, HDL, VLDL, serum electrolytes (Na^+, K^+, Ca^{++}) measurement, at first visit. Children are followed at 1 month and 3 months later. Blood samples for serum lipid parameters and electrolytes are drawn during this follow up period.Comparison of parameters was done between both cases and controls.

MACHINE: All these parameters were assessed by the COBAS C 311 Analyzer.

STATISCAL ANALYSIS:

Collected data were entered in the Microsoft excel 2016 for further analysis; Qualitative data was presented with frequency and proportion while quantitative data were expressed in the form of mean and standard deviation. Student t-test were used to observe mean difference between bivariate variable. while ANOVA was used to observe the mean difference among multiple variables. Spearman correlation coefficient was used to see the correlation between the variables. P-value <0.05 was considered as statistically significant at 5% level of significance. Statistical analysis was done with help of statistical package of SPSS version 25.

IV. RESULTS

Table 1 : Distribution of Gender between cases and controls

S.No	Gender	Group		Total	Chi-square/Fisher Exact	P-value
		Cases	Controls			
1.	Male	29(58.0%)	22(44%)	51(51%)	1.961	0.161
2	Female	21(42%)	28(56%)	49(49%)		
3.	Total	50(50%)	50(50%)	100(100%)		

Out of 100 children, 51(51%) children were males and 49(49%) children were females. P-value is insignificant.
37 children were included in the age group between 1-3years, 34 children in the age group between 3-6years, 18 children in the age group between 6-9 years and 11 children above 9 years. P-value was insignificant.
Out of 100 children,16(16%) children father were uneducated,9(9%) children father went to primary school, 54(54%) children father completed secondary education,14(14%) higher secondary education, 3(3%) were graduates and 2(2%) were post graduates. P-value is insignificant.
Among 100, 45% children mother completed secondary education , 26% children mother completed primary education and 22 % were uneducated. No significant correlation was observed in distribution of mother education when compared between cases and control.
Among 100, majority children father (58%) were farmers, 54% were private job holders, 40% were labourers and 6% were government employees. No significant difference was observed when distribution of father occupation was compared between cases and controls
Among 100, majority of children (78%) mothers were housewives,11% were farmers, 4% were laborers, 2% were private employees. P value is insignificant.
Among 50 cases, 78% children had generalized seizures,10% had focal seizures,10% had tonic seizures and 2% had atonic seizures.
Among 50 cases, 40% male and 38% female children had generalized seizures, 6% male and 4% female children had focal seizures,4% male and 6% female children had tonic seizures and 2% female children had atonic seizures.
It was observed that only 6% males and 2% females had family history of seizures.

Table 2 : Distribution of Antiepileptic drug in cases

Antiepileptic Drug	Cases
Phenobarbitone	6(12%)
Phenytoin	21(42%)
Valproate	10(20%)
Levetiracetam	3(6%)
Phenobarbitone+levetiracetam	7(14%)
Phenytoin+valproate	3(6%)
Total	50(50%)

Among 50 cases,42% were on phenytoin 12% children were on phenobarbitone, 20% were on valproate, 6% were on levetiracetam.14% children were on combination phenobarbitone and levetiracetam therapy,6% were on phenytoin and valproate therapy.

Table 3 : Mean distribution of LDL between 0, 1 months and 3 months

Lipid Profile	Drug	N	Mean±SD		
			0 visit	1 Month	3 Month
LDL	Phenobarbitone	6	124.1667±1.16	136±4.147	136.17±2.31
	Phenytoin	21	124.1905±1.07	135.48±2.96	134.62±6.5
	Valproate	10	125.2±1.68	135.2±2.53	135.5±4.42
	Leviteracetam	3	124.3333±1.15	137.67±1.15	138±5.19
	Phenobarbitone +leviteracetam	7	125.1429±1.57	134.57±3.259	133.71±3.72
	phenytoin+valproate	3	125.6667±2.08	136.33±1.15	134.33±1.52
	Total	50	124.62±1.39	135.54±2.90	135.04±5.03
	P-value		0.211	<0.001**	<0.001**

There was highly significant difference in values of LDL after 3rd visit of the patients. Highest mean LDL values were observed phenobarbitone, levetiracetammonotherapy and in combination phenytoin and valproate therapy.

Table 4 : Mean distribution of HDL between 0, 1 months and 3 months

Lipid Profile	Drug	N	Mean±SD		
			0 visit	1 Month	3 Month
HDL	Phenobarbitone	6	46.1667±7.30	30.17±1.32	33.12±4.95
	Phenytoin	21	46.6667±7.30	31.52±2.33	28.57±2.61
	Valproate	10	52.1±6.8	33.8±2.098	27.8±2.7
	Leviteracetam	3	42.6667±9.81	32.67±5.132	31.33±5.033
	phenobarbitone+leviteracetam	7	43.1429±7.64	30.29±1.254	32.13±2.54
	phenytoin+ valproate	3	523.6±0	31.67±1.155	34.23±2.082
	Total	50	47.28±7.61	31.72±2.466	28.3±3.196
	P-value		0.119	0.021*	<0.001**

After 3rd visit significant changes in HDL was observed in phenytoin and valproate drugs with mean 28.57 and 27.8 mg/dl respectively. P value was <0.001

Table 5 : Mean distribution of Total Cholesterol between 0, 1 months and 3 months

Lipid Profile	Drug	N	Mean±SD		
			0 visit	1 Month	3 Month
Total Cholesterol	Phenobarbitone	6	199.8±30.0	256.43±5.46	253.21±5.32
	Phenytoin	21	193.09±22.85	262.95±3.15	263.1±7.71
	Valproate	10	203.1±32.0	261.1±4.06	260.7±6.84
	Leviteracetam	3	193.3333±34.5	251.23±1.155	258.3±4.35
	Phenobarbitone +leviteracetam	7	208.42±29.07	249.3±4.923	259±6.42
	phenytoin+valproate	3	190.33±9.87	248.23±5.29	251.4±12.74
	Total	50	197.9±26.24	253.1±3.89	25524±6.78
	P-value		0.78	<0.001**	<0.001**

Highly significant difference was observed in total cholesterol after 2nd and 3rd visit among epileptic drugs with maximum in phenytoin and valproate drugs. Mean values were 262.95 and 263.1 respectively and P value was <0.0001.

Table 6 : Mean distribution of VLDL between 0, 1 months and 3 months

Lipid Profile	Drug	N	Mean±SD		
			0 visit	1 Month	3 Month
VLDL	Phenobarbitone	6	21.5±5.6	36.83±6.94	31.12±6.94
	Phenytoin	21	20.66±4.37	36.48±6.623	36.48±6.623
	Valproate	10	21.6±3.83	35.6±6.72	35.6±6.72
	Leviteracetam	3	15±2.64	36.67±7.50	29.3±7.50
	phenobarbitone+leviteracetam	7	19.2857±4.15	33.57±6.47	32.1±6.47
	phenytoin+valproate	3	20.334.041	35±9.64	28.3±9.64
	Total	50	20.4±4.39	35.86±6.59	32.68±6.59
	P-value		0.294	<0.001**	<0.001**

VLDL was increased in 2nd and 3rd visit and found statistically significant for antiepileptic drug Phenytoin and Valproate with mean 36.48 and35.6mg/dl respectively. VLDL were increased in 2nd visit in Levetirectam and phenobarbitone treated patients with mean 36.67 and 36.83 respectively. P value was <0.001.

Mean distribution of Sodium between 0, 1 months and 3 months and Hyponatremia was observed in 2nd and 3rd visit in children taking phenytoin and valproate drugs with mean 121.2 and 124.5 respectively. P value was <0.001.

Mean distribution of Potassium was observed between 0, 1 months and 3 months. Mean Serum potassium levels (4.47±0.39) showed no change in all 3 visits among this antiepileptic drugs. P value was insignificant.

Table 7 : Mean distribution of Calcium between 0, 1 months and 3 months

Lipid Profile	Drug	N	Mean±SD		
			0 visit	1 Month	3 Month
Calcium	Phenobarbitone	6	10.1667±0.75	11±1.67	9.67±1.50
	Phenytoin	21	10±0.63	8.63±2.17	8.881±1.80
	Valproate	10	10.2±0.78	8.45±2.31	8.63±1.41
	Leviteracetam	3	10.3333±0.57	8.9±2	9±2.64
	phenobarbitone+leviteracetam	7	10.1429±0.89	10.12±3.4	10.29±1.49
	phenytoin+valproate	3	10±1	10.45±1	10.33±3.51
	Total	50	10.1±0.70	9.59±2.274	9.46±1.82
	P-value		0.961	<0.001	<0.001

****p-value<0.05, highly significant at 5% level of significance**

It was observed that hypocalcemia was noted in children taking phenytoin and valproate drugs with mean 8.63, 8.45 mg/dl and 8.881, 8.63mg/dl in 2nd visit and 3rd visit respectively.

Mean distribution of Lipid levels between 0, 1 months and 3 months in male gender. Increase in TC, LDL, VLDL levels were seen in both groups with mean value 134.69,261.31,37.86 and 135.14,258.91,36.41 respectively. HDL levels were decreased with mean 28.45 and29.45 respectively in both groups. P value is insignificant.

Mean distribution of Lipid levels was observed between 0, 1 months and 3 months in female children. LDL,HDL, TC were equal in both groups with mean values 135.52,28.1,262.76 and 134.68,29.82,263 respectively. P value is significant (0.003)with VLDL levels 41.05mg/dl in female cases. We have found no significant difference in lipid profile in three visits, among male as well as female children.

Mean distribution of serum electrolytes was observed between 0 1 3 months in male children .Serum sodium ,potassium , calcium levels measured were 138.693,4.541,10.45mg/dl and 138.1,4.523,9.91mg/dl respectively and no correlation was seen in both groups. P value was insignificant.

Mean distribution of serum electrolytes was observed between 0 1 3 months in female children. Serum sodium, potassium, calcium levels measured were137.076, 4.319, 10.57 and 137.871, 4.443, 9.39 respectively in both groups. Low calcium levels were seen in healthy female children and P value was 0.037.

Low VLDL levels were observed in children of age 1-3 years after 3rd visit with p value 0.004.No change in other lipid parameters was observed in both cases and controls.

Sodium levels were decreased in children of age 1-3 years but p value was not significant. No significant difference in serum electrolytes was seen in both cases and controls.

Total cholesterol levels were increased after 3rd month but p value was not significant. No changes in lipid profile was observed in both cases an controls in children of age group 3-6 years.

Mean distribution of Serum Electrolyte was observed between 0 1 3 months in 3 - 6 Years children. No significant difference was observed in serum electrolytes measured in 3 visits in both cases and controls.

Mean distribution of Lipid Profile was observed between 0 1 3 months in 6 - 9 years children .No significant changes in lipid profile was seen when measured in 3 visits in both cases and control groups.

Mean distribution of Serum Electrolyte was observed between 0 1 3 months in 6 - 9 years children .No alterations in Serum sodium ,potassium and calcium levels were seen in 3 visits among both groups.

Mean distribution of Lipid Profile was observed among 0, 1, 3 months in > 9 Years children .No changes in Lipid levels were seen when measured in 3 visits in both cases and controls.

Mean distribution of Serum Electrolyte among 0, 1, 3 months in age > 9 Years No change in serum sodium , potassium and calcium levels were seen in children more than 9 years age. P value is insignificant.

V. DISCUSSION

In the present study, serum lipid profile which includes the total cholesterol, LDL-C, VLDL-C, HDL-C levels along with serum electrolytes were compared in the children who were taking antiepileptic monotherapy and combination therapy for at least one year duration with that of the normal children.

Study population included 50 consecutive patients on antiepileptic therapy as cases and 50 healthy children as controls. Among 50 cases, 29(58%) were males and remaining 21(42%) were females and out of 50 controls, 22(44%) were males and 28(56%) were females. Out of total 100 ,51 % were males while the remaining 49% were females. This closely resembled study done by **Grossoet al**[2]. In a study conducted by **Amudhan et al**[i]concluded that the prevalence of epilepsy is more in males than in females in India. **Attilakos A et al**[3]in their study reported out of 39, 21(53.8%) were males and 18(46%) were females.

In the present study majority of children taking antiepileptic drugs were belonging to age group 3-6 years 38% followed by 30% in 1-3 years of age, 24% in 6-9 years of age and least of 8% children are in group of more than 9years of age.

Majority 30(60%) children father completed secondary education followed by 10% of completed primary education and least 2% fathers were graduates as observed in this study. As also reported by **Briggs et al**[4] and **Shaju et al**[5].

It is observed that majority of children fathers included in this study were farmers 28%, followed by 22% children father working in private sector and least prevalence of 2% working in government sector. Among 50 controls, majority children (32%) fathers were working in private sector followed by 30 % of farmers. On the other hand, majority of children mothers were housewives (84%) as study also conducted by **Mini S et al**[6].

Majority 39(78%) children participated in this study had generalized tonic clonic seizures followed by 10% of focal seizures and clonic seizures and least of 2% atonic seizures as also reported by **Somez et al**[7] and **Deewan et al**[8].

Among 50 cases, included in the study majority of children 92% had no family history of seizures and remaining 8% had family history of seizures as also reported by **Ahmed et al**[9].

Majority of children 42% included in this study were taking phenytoin followed by 20% children taking valproate, 12 % children taking phenobabitone and 6% children taking levetiracetam. Simultaneously children taking two drugs were also included to study the effect of combination drugs. It was observed that 14% children were on combination phenobarbitone and levetiracetam therapy and 6% of children were on combination phenytoin and valproate therapy as also reported by **Mugloo et al**[10]**, Vishal et al**[11]**, Coppola G et al**[12]and **Kumar P et al**[13].

In this study, it was observed that majority of children 64% epilepsy for 1-2 years duration followed by 2-3years duration in 26% and 3-5 years duration in 10% as also reported by **Nagabhushan et al**[14]and **Shetty J et al**[15].

In this study it was observed whether any correlation exists between lipid profile of male and female children on usage of different antiepileptic drugs. Statistically significant high TC more than 250mg/dl was observed in 42% males taking antiepileptic drugs and 62% healthy male children with a P value less than 0.01.On the other hand, low HDL levels falling in the range 30-60mg/dl were observed in 56% male children taking antiepileptic drugs as also reported by **H.S. Sidhu et alError! Bookmark not defined..** This results were contrary to the study done by **Mugloo et al** and **Dewan et al**.

In the present study 1-3 years children taking antiepileptic drugs had high total cholesterol and LDL levels.12(33.3%) children showed LDL levels more than 130m g/dl and 18(47.4%) children showed TC levels more than 200mg/dl as also reported by **Mujgan F et al**[17]**.**

Increase in LDL and TC levels is observed in 1-3 years healthy children.TC levels more than 250mg/dl were observed in 66.7% children followed by more than 130mg/dl LDL levels in 39.5 % children.2(100%) children of 3-6 years age showed VLDL levels more than 30mg/dl. 1(100%) more than 9 years children had HDL levels more than 60mg/dl as also reported by **Mugloo et al** and **Castro-Gago et al**[18]study reported TC 172mg/dl, VLDL 13.8 mg/dl and HDL 55.8 mg/dl in more than 9 years age healthy children.

Lipid parameters of different drugs were compared at first visit and after 1 and 3 months follow up. Statistically significant high LDL,TC,VLDL levels and low HDL levels were observed at the end of first and third month in children taking antiepileptic drugs with mean LDL levels 135.54 and 135.04, mean HDL levels 31.23 and 28.3, mean TC levels 262.64 and 261.92 and mean VLDL levels 35.86 and 36.2 the end of first and 3 months respectively. This results were similar to the study conducted by **Vishal et al**which concluded that statistically significant increase in TC , LDL, HDL levels were seen in children on antiepileptic treatment with mean TC levels 168 and 197, mean LDL levels 90 and 109 and mean HDL levels 52 and 63mg/dl at the end of 6 and 12 months follow. However, **Buyukgol et al**[19]study reported no significant difference in HDL levels when compared in cases and controls with a mean value 59.28mg/dl.

Low serum calcium levels were observed in cases when compared to controls in the present study as also reported **Nandiniet al**[20].

In the present study, serum sodium, calcium and potassium levels were observed at first visit, 1 month and at 3 month. Statistically significant low mean serum calcium and sodium levels were observed in cases when compared to controls. Mean serum sodium levels were 131.4 and 128.6, serum calcium levels were 8.12 and 8.62mg/dl at the end of 1 month and 3 month respectively in children receiving antiepileptic treatment. This results were similar to the study one by **Ahmed et al**.

Maximum number of cases were on phenytoin followed by valproate, phenobarbitone therapy. 7 cases were on phenobabrbitone and leviteracetam combination therapy.3 cases were on phenytoin and valproate combination treatment. On first visit, serum LDL were normal in all cases. After 1 month and 3 months, mean serum LDL levels were measured. Increased LDL levels were reported in all cases with mean values from135.5 to 137.6 mg/dl after 1 month and 134.3 to 138 mg/dl after 3months.Hence periodic screening of serum LDL levels should be done in all children these antiepileptic drugs. This results were contrary to the study conducted by **Demircioglu et alError! Bookmark not defined.**.

HDL levels were measure in 3 visits in 50 children taking monotherapy and combination therapy antiepileptic drugs. One first visit HDL levels were measured and were normal in all cases. No p value significance was seen. HDL levels were measured after 1 month and there was decrease in mean HDL levels. More decrease was observed in phenobarbitone and combination phenobarbitone and leviteracetam therapy with mean value 30.17mg/dl and 30.29mg/dl followed by decrease in children on phenytoin Mean HDL levels were 31.52mg/dl in phenytoin cases. After 3 months HDL levels were measured and more decrease in HDL levels were in phenytoin cases with mean value 28.75mg/dl followed by 32.13mg/dl in leviteracetam cases. P value was highly significant.

In this study, serum sodium, calcium and potassium levels were measured at 3 visits in female children. Serum calcium levels were normal in first visit in both groups .After 1 month of follow up Serum calcium levels were decreased to 9.62 and 8.96 in both cases and controls respectively. In 3rd visit significant decrease in calcium levels was observed in female children taking antiepileptic drugs .Serum calcium levels were normal in female child receiving phenytoin for more than 3 years.

VI. Conclusion

Total cholesterol was increase among phenytoin (262.95/dl) and valpropate group (263.1/dl. VLDL was increase in patient treated on Levetiracetam, Phenobarbitone, phenytoin and valproate. LDL were higher in phenobarbitone, Levetiracetam and combination therapy of phenytoin and valproate. HDL level was low in phenytoin and valproate drugs.

Hyponatremia was observed in children taking phenytoin and valproate drugs. Hypocalcemia was reported in phenytoin and valproate therapy. Potassium level was normal in all groups.

[1]. Amudhan S, Gururaj G, Satishchandra P. Epilepsy in India II: Impact, burden, and need for a multisectoral public health response. Annals of Indian Academy of Neurology. 2015 Oct;18(4):369.

[2]. Grosso S, Mostardini R, Piccini B, Balestri P. Body mass index and serum lipid changes during treatment with valproic acid in children with epilepsy. Annals of Pharmacotherapy. 2009 Jan;43(1):45-50.

[3]. Attilakos A, Dinopoulos A, Tsirouda M, Paschalidou M, Prasouli A et al. Effect of levetiracetammonotherapy on lipid profiles and thyroid hormones in children with epilepsy: A prospective study. Epilepsy research. 2019 Sep 1;155:106162.

[4]. Frank-Briggs AI, Alikor EA. Knowledge and attitudes of parents toward children with epilepsy. Annals of African Medicine. 2011;10(3).

[5]. Shaju M, Vinayan KP, Abraham S. Knowledge, attitude and practice of parents regarding pediatric antiepileptic drug therapy. International Journal of Epilepsy. 2014 Dec;1(02):057-63.

[6]. Mini S. Case control study of developmental outcome of infants with in utero exposure to antiepileptic drugs.

[7]. MujganSonmez F, Demir E, Orem A, Yildirmis S, Orhan F et al. Effect of antiepileptic drugs on plasma lipids, lipoprotein (a), and liver enzymes. Journal of child neurology. 2006 Jan;21(1):70-4.

[8]. Dewan P, Aggarwal A, Faridi MM. Effect of phenytoin and valproic acid therapy on serum lipid levels and liver function tests.Indian Pediatrics. 2008 Oct 1;45(10):855.

[9]. Ali AA, Mohamed HE, Bayomy IM, Mostafa AI. Evaluation of vitamin D status in children with refractory epilepsy.

[10]. Mugloo MM, Akhtar R, Malik S. Assessment of serum lipid profile and liver function parameters in children with epilepsy on phenytoin or valproic acid monotherapy for 6 months and beyond. Astrocyte. 2017 Oct 1;3(4):180.

[11]. Prasad, Madhurima. (2018). A Hospital Based Comparative Study on Effect of Lipid Profile in Patients Treated with Older and Newer Anti Epileptic Drugs. Journal of Medical Science And clinical Research.6. 10.18535/jmscr/v6i10.73.

[12]. Coppola G, Fortunato D, Auricchio G, Mainolfi C, Operto FF et al. Bone mineral density in children, adolescents, and young adults with epilepsy. Epilepsia. 2009 Sep;50(9):2140-6.

[13]. Kumar P, Tyagi M, Kumar Tyagi Y, Kumar A, Kumar Rai Y. Effect of anticonvulsant drugs on lipid profile in epileptic patients. Journal of Neurology. 2004: 3 (1): 202. 2004;210.

[14]. Potharaju N. Seizures in cerebral palsy.Indian Journal of Cerebral Palsy. 2016;2(1).

[15]. Shetty J, Greene SA, Mesalles-Naranjo O, Kirkpatrick M. Adherence to antiepileptic drugs in children with epilepsy in a Scottish population cohort.Developmental Medicine & Child Neurology. 2016 May;58(5):469-74.
[16]. Sidhu HS, Srinivas R, Sadhotra A. Evaluate the effects of long-term valproic acid treatment on metabolic profiles in newly diagnosed or untreated female epileptic patients: A prospective study. Seizure. 2017 May 1;48:15-21.
[17]. MujganSonmez F, Demir E, Orem A, Yildirmis S, Orhan F et al. Effect of antiepileptic drugs on plasma lipids, lipoprotein (a), and liver enzymes. Journal of child neurology. 2006 Jan;21(1):70-4.
[18]. Castro-Gago M, Novo-Rodríguez MI, Blanco-Barca MO, Urisarri-Ruíz de Cortázar A, Rodríguez-García J et al. Evolution of serum lipids and lipoprotein (a) levels in epileptic children treated with carbamazepine, valproic acid, and phenobarbital. Journal of child neurology. 2006 Jan;21(1):48-53.
[19]. Büyükgöl H, Güneş M. The effects of antiepileptic medications on lipid profile, thyroid panel, and vitamin level. Cureus. 2020 Oct 17;12(10).
[20]. Nandhini Devi D. A Study to Assess Serum Calcium and Alkaline Phosphatase Levels in Patients on Antiepileptics in Government Vellore Medical College Hospital, Vellore (Doctoral dissertation, Christian Medical College, Vellore).
[21]. Demircioğlu S, Soylu A, Dirik E. Carbamazepine and valproic acid: effects on the serum lipids and liver functions in children. Pediatric neurology. 2000 Aug 1;23(2):142-6.