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# Study of serum prolactin levels in seizures List of authors in order

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**ABSTRACT**

**Introduction**: Seizures have profound hormonal manifestation, and serum prolactin changes have been used to distinguish generalized tonic-clonic seizures from other causes of brief stereotyped disturbances of cerebral function. Serum prolactin rises rapidly after spontaneously occurring generalized seizure reaching a peak between fifteen and twenty-five minutes after the seizure and reverting to normal in about two hours. In generalized tonic clonic seizures there is a release of a specific prolactin regulator into the hypophyseal portal system. In complex partial seizures, seizure spread originates from medial temporal structures, such as amygdale and the hippocampus, to the hypothalamic nuclei leading not only to the alteration of consciousness but also to change in the anterior pituitary hormone output.

**Materials and Methods**: 102 patients of either sex, age range being 6 months to 12 years, enrolled into 4 groups, **Group I** consisted of 32 children included generalized tonic clonic seizure (GTCS), simple partial seizures (CPS), and complex partial seizure (CPS). **Group II** included 24 patients with typical febrile seizures. **Group III** included 28 patients with conditions mimicking seizures i.e. syncope, breath holding spells, pseudo-seizures. **Group IV** consisted of 18 children admitted for reasons other than fever or seizures and without significant illness. Prolactin assay was quantitatively done. The normal range of prolactin is 20-23 ng/ml.

**Results:** It was observed that serum prolactin was significantly high only in Group I. Maximum prolactin in Group I was 40.12 ng/ml and minimum was 8.18 ng/ml. Mean prolactin for Group I was 26.29 ng/ml. For Group II, maximum prolactin level was 19 ng/ml and minimum prolactin was 4.65. Mean prolactin for Group II was 11.57. For Group III, maximum prolactin was 17.68 ng/ml and minimum prolactin was 1.49 with a mean of 8.84 ng/ml. In Group IV, maximum prolactin level was 19.19ng/ml and minimum prolactin level was 2.04, mean prolactin for Group IV was 10.92.

**Conclusion:** Our study showed that prolactin level was significantly higher only within group I. In group I, mean prolactin level was higher in GTCS and CPS as compared to SPS . For group II, III, IV it was within normal range.

**Keywords:** Seizures, Prolactin levels

## INTRODUCTION

A seizure or convulsion is a paroxysmal, time limited change in motor activity and/or behavior that results from abnormal electrical activity in the brain. Epilepsy describes a condition in which a person has recurrent seizures due to chronic underlying process.

Seizures are common in the pediatric age group and occur in approximately 10% of children [1].Jeavon's et al demonstrated that 20% of patients being treated as epileptics were not actually so in a reputed epilepsy clinic in England [2].

An elaborate history and accurate description are necessary for making correct diagnosis of seizures. The repertoire of seizure is so extensive that even physicians find it difficult to distinguish between seizures and similar conditions [3]. Patients with non-epileptic or pseudo-seizures present a difficult problem in differential diagnosis.

Seizures have profound hormonal manifestation, and serum prolactin changes have been used to distinguish generalized tonic-clonic seizures from other causes of brief stereotyped disturbances of cerebral function [4,5,6,7]. Serum prolactin rises rapidly after spontaneously occurring generalized seizure and after electroconvulsive therapy [8], reaching a peak between fifteen and twenty-five minutes after the seizure [4] and reverting to normal in about two hours [5].

**Physiology of Prolactin Secretion**

Prolactin, also known as luteotrophic hormone, is a polypeptide of approximately 200 aminoacids, molecular weight 23,000, secreted by anterior pituitary. It is synthesized and secreted by lactotrophe cells, tuberoinfundibular dopamine neurons in arcuate nucleus in the adenohypophysis [9]. Studies suggest the possibility of a correlation between the degree of prolactin elevation and extent of epileptic activity [10].

In generalized tonic clonic seizures there is presumed spread of electrical activity from the ventromedial hypothalamus, leading to release of a specific prolactin regulator into the hypophyseal portal system. This could either by a direct stimulator of prolactin release or an inhibitor of prolactin-inhibiting factor[11,12]. The increase in prolactin level is due to abnormal electrical activity within areas of the central nervous system that regulate anterior pituitary hormone release.

In complex partial seizures, the elevated levels of prolactin are seen immediately. Those cases of complex partial seizure not exhibiting a rise in prolactin probably originate in the frontal and supplementary motor cortex without involving the limbic system. Sperling [13] found that only high frequency (> 10 Hz), unilateral or bilateral limbic discharges, persisting for more than 20 seconds, spread to subcortical areas. These presumably triggered the ventromedial hypothalamus. Discharges, which were of variable or lower frequency, of shorter duration or did not involve the limbic regions, did not propagate to these areas [13].

In simple partial seizures, the decreased intensity and spatial involvement

probably account for the decreased occurrence of prolactin increase. Patients with myoclonic or akinetic seizures did not demonstrate hyper-prolactinemia. These seizures are brief and may provide an inadequate stimulus to interfere with anterior pituitary function. Pritchard et al [7] suggested that patients with interictal mesiobasal temporal lobe discharges had higher interictal serum prolactin levels. Mesial and lateral temporal seizure originations produced the same magnitude of postictal hyperprolactinemia. It is not likely that the increased prolactin levels after complex partial seizures with increasing motor behavior are due to physical activity, because maximal physical activity occurs with grand mal seizures and does not further increase prolactin values. This graded prolactin response suggests that post-ictal hyperprolactinemia is a specific response to seizures and is not due to stress.

In typical febrile seizures, sub-clinical electrical activity does not exist since the after discharges are less intense and transient to project to the ventromedial hypothalamus [14] whereas conditions mimicking seizures completely lack electrical discharges. This accounts for the lack of prolactin elevation.

**AIMS AND OBJECTIVES**

1. To determine whether prolactin levels could be used as a single exposure biochemical marker to differentiate between various types of epileptic seizures, febrile convulsions and seizure like events in children.
2. Correlation of the prolactin levels with the post-ictal duration in Group I.
3. Using prolactin level as a cheaper and easily accessible alternative to expensive, sophisticated and time-consuming investigations like 24-hour video monitoring, ambulatory EEG.
4. To assess whether prolactin level can increase the diagnostic accuracy before starting treatment and thereby avoiding the unnecessary adverse effects of anti-convulsant drugs, duration of expenses of therapy and social implication.
5. To determine whether prolactin level can increase the diagnostic accuracy in those patients where EEG findings may be normal, non-pathognomic or inconclusive.

**MATERIAL AND METHODS**

**Set up**

The study was conducted over a period of two years from June 2014 to June 2016 in the Department of Pediatrics, Sher-i-Kashmir Institute of Medical Sciences, Soura Srinagar, a tertiary centre for sick children. There is very little data available on the study of prolactin in seizure disorders from India [10].



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**Sample size**

One hundred and two (102) patients with required criteria for the study were selected. Blood samples were collected and proalctin assay was done at the department of Immunology, SKIMS.

**Subjects**

The study was a prospective one, involving 102 patients of either sex, age range being 6 months to 12 years. The patients were enrolled into four groups after a detailed history and examination and a proper consent.

**Group I** consisted of 32 children of either sex and included generalized tonic clonic seizure (GTCS), simple partial seizures (CPS), and complex partial seizure (CPS).

**Group II** included 24 patients with typical febrile seizures.

**Group III** included 28 patients with conditions mimicking seizures i.e. syncope, breath holding spells, pseudoseizures.

**Group IV** consisted of 18 children admitted for reasons other than fever or seizures and without significant illness.

**METHODS**

- 3ml of blood was collected by venipuncture at admission in those patients in whom seizure had occurred within two hours. The exact interval of seizure was noted.
- In group I, two venous blood samples were collected within two hours of the seizure episode.
- In group IV, blood sample was collected preferably between 9am and 12 noon.
- Blood was collected in plain tubes54 and serum was obtained by centrifugation. Serum was stored at 2-8$^0$C.
- Prolactin assay was quantitatively done at the Department of Immunology, SKIMS Srinagar by "Beckman Coulter UNICEL DXI 800".
- The normal range of prolactin is 20-23 ng/ml[10] .

**Exclusion Criteria**

Following patients were excluded from the study:

- Patients with any metabolic disturbance.
- Patients with any infective central nervous system pathology.
- Patients with developmental, structural or neurological abnormality.
- Patients on drugs known to alter prolactin levels.

**Principle X Procedure of Prolactin assay**

The prolactin assay is simultaneous one-step immunoenzymatic "Sandwich" assay.

**OBSERVATIONS AND RESULTS**

**Table – 1**

**Age (in years) and gender distribution of studied subjects**

| Sex | N | Mean Age (Years) | SD | St. Error Mean | P value |
|---|---|---|---|---|---|
| Female | 42 | 3.536 | 3.2878 | 0.5073 | 0.403 NS |
| Male | 60 | 4.133 | 3.6982 | 0.4774 | |

In our study we registered 102 patients. Among them males were 60 (58.82%) and females were 42 (41.11%). Mean age for males was 4.13 years and mean age for females was 3.53 years. p-value of the age and gender wise distribution was 0.403 which is non-significant.



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**Table – 2**

**Gender distribution of studied subjects across four groups**

| Group | Male | | Female | | P value |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| Group I | 20 | 60.6 | 12 | 39.4 | 0.548 NS |
| Group II | 16 | 69.6 | 8 | 30.4 | |
| Group III | 14 | 50.0 | 14 | 50.0 | |
| Group IV | 10 | 55.6 | 8 | 44.4 | |

No = Number; % = Percentage; NS = Non-significant

In our study there were 20 males and 12 females in group I; 16 males and 8 females in group II; 14 males and 14 females in group III; and 10 males and 8 females in group IV (p value = 0.548) which is non-significant.

**Table – 3**

**Age distribution in various groups of study**

| Age (Years) | GROUP | | | | | | | | P value |
|---|---|---|---|---|---|---|---|---|---|
| | I | | II | | III | | IV | | |
| | No. | % | No. | % | No. | % | No. | % | |
| < 2 | 10 | 27 | 10 | 27.0 | 9 | 24.3 | 8 | 21.6 | 0.186 |
| 2 to 3 | 12 | 46.2 | 9 | 34.6 | 2 | 7.7 | 3 | 11.5 | |
| 4 to 5 | 3 | 25.0 | 3 | 25.0 | 4 | 33.33 | 2 | 16.7 | |
| 6 to 7 | 1 | 14.3 | 2 | 14.3 | 3 | 42.9 | 2 | 28.6 | |
| 8 to 9 | 2 | 28.6 | 0 | 0.0 | 4 | 57.1 | 1 | 14.3 | |
| 10 to 12 | 4 | 38.5 | 0 | 0.0 | 6 | 46.2 | 2 | 15.4 | |
| **Total** | **32** | **32.4** | **24** | **22.5** | **28** | **27.5** | **18** | **17.6** | |

No. = Number; % = Percentage



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**Table – 4**

**Diagnosis in studied subjects**

| Group | Diagnosis | No. | % | P value |
|---|---|---|---|---|
| Group I | GTCS | 17 | 16.5 | 0.0001 Significant |
| | SPS | 10 | 9.8 | |
| | CPS | 5 | 4.9 | |
| | Total | 32 | 31.3 | |
| Group II | Febrile seizure | 24 | 23.5 | |
| Group III | BHS | 7 | 6.8 | |
| | Syncope | 15 | 14.7 | |
| | Pseudoseizure | 6 | 5.8 | |
| | Total | 28 | 27.45 | |
| Group IV | Control | 18 | 17.6 | |

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure; CPS = Complex partial seizures; BHS = Breath holding spells

- Group I contained total of 32 patients (31.3%) and included GTCS- 17 (16.5%), SPS-10 (9.8%), CPS-5 (4.9%).
- Group II included 24 patients (23.5%) with febrile convulsions.
- Group III included conditions mimicking seizures that is breath- holding spells - 7 patients (6.8%), syncope 15 patients (14.7%), pseudoseizure 6 patients.
- Group IV included 18 patients (17.6%) which were taken as control.

**Table – 5**

**Serum prolactin level (ng/ml) of the first sample in studied subjects**

| Group | N | Mean | SD | Std. Error | Minimum Prolactin | Maximum Prolactin | P value |
|---|---|---|---|---|---|---|---|
| I | 32 | 26.2930 | 8.36981 | 1.4570 | 8.18 | 40.12 | 0.0001 (S) |
| II | 24 | 11.5723 | 4.22743 | 0.881 | 4.65 | 19.00 | |
| III | 28 | 8.8403 | 3.93205 | 0.743 | 1.49 | 17.68 | |
| IV | 18 | 10.929 | 4.7768 | 1.19422 | 2.04 | 19.19 | |



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Total** | **102** | **15.56** | **9.6238** | **0.9623** | **1.49** | **40.12** | |

N=Number; SD = Standard deviation; Std. = Standard

It was observed that serum prolactin was significantly high only in Group I. Maximum prolactin in Group I was 40.12 ng/ml and minimum was 8.18 ng/ml. Mean prolactin for Group I was 26.29.

For Group II, maximum prolactin level was 19 ng/ml and minimum prolactin was 4.65. Mean prolactin for Group II was 11.57.

For Group III, maximum prolactin was 17.68 ng/ml and minimum prolactin was 1.49 ng/ml with a mean prolactin of 8.84 ng/ml.

In Group IV, maximum prolactin level was 19.19ng/ml and minimum prolactin level was 2.04, mean prolactin for Group IV was 10.92 with a p value of 0.0001, which is significant.

**Table – 6**

**Comparison of serum prolactin (ng/ml) for Group I of the study**

| **Blood sample** | **Mean** | **SD** | **SE** | **P value** |
|---|---|---|---|---|
| 1st sample | 26.732 | 8.108 | 1.433 | 0.0001 Significant |
| 2nd sample | 8.0445 | 3.672 | 0.649 | |

In Group I mean prolactin level of the first sample was 26.732. For second sample mean prolactin level was 8.0445. So serum prolactin level of first sample was significantly raised than the second sample with a p value of 0.0001 which is significant.

**Table – 7a**

**Serum prolactin level (ng/ml) in Group I subjects as per final diagnosis in first sample**

| **Diagnosis** | **N** | **Mean** | **SD** | **Std. Error** | **Minimum Prolactin** | **Maximum Prolactin** | **P value** |
|---|---|---|---|---|---|---|---|
| GTCS | 17 | 31.933 | 4.1028 | 0.995 | 25.73 | 40.12 | 0.0001 |
| SPS | 10 | 19.164 | 5.7932 | 1.831 | 8.18 | 24.89 | |
| CPS | 5 | 24.180 | 10.0241 | 4.481 | 9.98 | 36.83 | |
| **Total** | **32** | **26.293** | **8.369** | **1.4570** | **8.18** | **40.12** | |

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure; CPS = Complex partial seizures; N=Number; SD = Standard deviation; Std. = Standard

In Group I, the maximum prolactin level for the first sample was higher in generalized tonic clonic seizures (40.12 ng/ml) and complex partial seizure (36.83 ng/ml) as compared to simple partial seizures (24.89 ng/ml). The minimum level of prolactin of first sample for GTCS, SPS, CPS were 25.73, 8.18, 9.98 respectively. The mean prolactin of first blood sample for GTCS, SPS and CPS were 31.93, 19.16, 24.18 respectively with a p value of 0.0001 which is significant.



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**Table – 7b**

**Serum prolactin level (ng/ml) in Group I subjects as per final diagnosis in second sample**

| Diagnosis | N | Mean | SD | Std. Error | Minimum Prolactin | Maximum Prolactin | P value |
|---|---|---|---|---|---|---|---|
| GTCS | 17 | 9.279 | 4.169 | 1.0112 | 3.60 | 20.0 | 0.098 (NS) |
| SPS | 10 | 6.174 | 1.8320 | 0.578 | 2.46 | 8.19 | |
| CPS | 5 | 7.586 | 3.4591 | 1.547 | 2.64 | 11.65 | |
| **Total** | **32** | **8.0445** | **3.6723** | **0.649** | **2.46** | **20.0** | |

N=Number; SD = Standard deviation; Std. = Standard

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure;

CPS = Complex partial seizures; BHS = Breath holding spells

Maximum prolactin level of second sample for GTCS, CPS, SPS was 20.0 ng/ml, 11.65 ng/ml and 8.19 ng/ml respectively. Mean prolactin level for GTCS, CPS, SPS for second sample was 9.279, 7.58, 6.17 respectively with a p value 0.098 which is non-significant.

**Table – 8**

**Serum prolactin level (ng/ml) of the first sample across diagnosis in studied subjects**

| Diagnosis | Abnormal | | Normal | |
|---|---|---|---|---|
| | **No.** | **%** | **No.** | **%** |
| Control | 0 | 0.0 | 18 | 100.0 |
| BHS | 0 | 0.0 | 7 | 100.0 |
| Febrile convulsion | 0 | 0.0 | 24 | 100.0 |
| Pseudoseizure | 0 | 0.0 | 6 | 100.0 |
| Syncope | 0 | 0.0 | 15 | 100.0 |
| CPS | 4 | 80.0 | 1 | 20.0 |
| GTCS | 15 | 88.2 | 2 | 11.78 |
| SPS | 3 | 30.0 | 7 | 70.0 |

No=Number; SD = Standard deviation; Std. = Standard

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure; CPS = Complex partial seizures; BHS = Breath holding spells



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Our study showed that 88.2% GTCS (15), 60% CPS (3) and 30% SPS had elevated prolactin level. The sensitivity of elevated prolactin for GTCS (88.2%) which is higher as compared to 60% sensitivity in CPS and 30% sensitivity in SPS.

**Table – 9**

**Time of collection of first blood sample from the event (in minutes) in the studied subjects**

| Group | Min. | Max. | Mean | SD | SE | P value |
|---|---|---|---|---|---|---|
| I | 10 | 30 | 17.12 | 4.68 | 0.81 | 0.071 (NS) |
| II | 10 | 30 | 18.70 | 5.04 | 1.05 | |
| III | 5 | 30 | 20.71 | 7.54 | 1.42 | |
| IV | - | - | - | - | - | |

Min = Minimum; Max = Maximum; SD = Standard Deviation; SE = Standard Error

The mean time of collection of first blood sample from the event (in minutes) for Group I, Group II, Group III was 17.12 minutes, 18.70 minutes, 20.71 minutes respectively. The results were statistically not significant with a p value of < 0.071.

**Table – 10**

**Time of collection of first blood sample from Group I, Group II, Group III from the event in minutes with respect to Prolactin levels**

| Serum Prolactin Level | | ≤ 20 min. | > 20 min. | Total | P value |
|---|---|---|---|---|---|
| Raised | No. | 24 | 1 | 25 | 0.009 (NS) |
| | % | 36.92 | 5.26 | 2976 | |
| Normal | No. | 41 | 18 | 59 | |
| | % | 63.07 | 94.73 | 70.23 | |

No. = Number; min. = Minute

In Group I, Group II, Group III patients with raised serum prolactin levels, 24 (36.92%) patients sample was taken at a duration of ≤20 minutes from the event, while of those with normal prolactin level 41 (63.07%), blood samples were taken ≤20 minutes. So peak value of prolactin is attained of the blood sample is taken with 20 minutes and begins to drop beyond 20 minutes.



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**Table – 11**

**EEG findings with respect to final diagnosis in group I**

| Diagnosis | EEG Findings | | | | P value |
|---|---|---|---|---|---|
| | Normal | % | Abnormal | % | |
| GTCS | 6 | 35.3 | 11 | 64.7 | 0.134 (NS) |
| SPS | 1 | 10.0 | 9 | 90.0 | |
| CPS | 0 | 0.0 | 5 | 100.0 | |
| Total | 7 | 21.9 | 25 | 78.1 | |

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure; CPS = Complex partial seizures; NS = Non-significant

In GTCS, 11 (64.7%) patients had abnormal EEG, while 6 (35.3%) patients had normal EEG. In CPS, 100% patients had abnormal EEG and in SPS, 9 (90%) patients had abnormal EEG. Thus 64.7% GTCS, 100% CPS and 90% SPS had abnormal EEG. The results were statistically not significant with a p value of 0.134.

**Table – 12**

**Serum prolactin levels (ng/ml) with respect to EEG of Group I of the studied subject**

| Serum Prolactin Level | | No. | Mean | SD | SE | P value |
|---|---|---|---|---|---|---|
| 1st sample | Abnormal | 25 | 26.49 | 7.82 | 1.56 | 0.757 |
| | Normal | 7 | 27.58 | 9.66 | 3.65 | |
| 2nd sample | Abnormal | 25 | 7.98 | 3.70 | 0.74 | 0.876 |
| | Normal | 7 | 8.24 | 3.83 | 1.44 | |

No. = Number; SD = Standard deviation; SE = Standard Error

In Group I with abnormal EEG, for the first sample, the maximum prolactin obtained was 40.10 ng/ml and mean prolactin was 26.49. The prolactin level of the first blood sample with normal EEG had a maximum value of 40.12 ng/ml with a mean of 27.58.

Second blood sample of patients with abnormal EEG had a mean of 7.98 and normal EEG had a mean of 8.24. The results were statistically non-significant with a p value of 0.757 and 0.876 respectively.



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**Table – 13**

**Correlation of diagnosis in abnormal EEG findings with serum prolactin levels (ng/ml)**

| Diagnosis | Normal Prolactin | | Abnormal Prolactin | | P value |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| GTCS | 0 | 0.0 | 11 | 100.0 | 0.044 (S) |
| SPS | 7 | 70.0 | 3 | 30.0 | |
| CPS | 1 | 20.0 | 4 | 80.0 | |

GTCS = Generalized tonic clonic seizure; SPS = Simple partial seizure; CPS = Complex partial seizures

In GTCS, 11 patients had abnormal EEG and all of them, 11 (100%) had abnormal prolactin. 4 (80%) patients of CPS had abnormal prolactin which was 5 (100%) had abnormal EEG. In SPS, 3 (30%) patients had abnormal prolactin while as 90% had abnormal EEG. Thus, pick up rate of serum prolactin and EEG is same for GTCS. For CPS, serum prolactin has almost similar pick up rate as EEG. In SPS, EEG has better pick up rate than serum prolactin estimation.

**Table – 14**

**Correlation of diagnosis with serum prolactin**

| Serum Prolactin | Diagnosis | |
|---|---|---|
| | Abnormal | Normal |
| Abnormal | 21 | 2 |
| Normal | 11 | 68 |

Sensitivity = 65.62%; Specificity = 97.14%

The sensitivity and specificity of elevated prolactin for epileptic seizures is 65.62% and 97.14% respectively.

## DISCUSSION

Seizures are common in pediatric age group and occur in approximately 10% of children. More than 1/3$^{rd}$ of the seizures are caused by epilepsy. The presentation of seizures is so extensive that it is very difficult to distinguish between seizures and similar condition even at expert hands.

Our study was conducted at Sher-i-Kashmir Institute of Medical Sciences Hospital – a tertiary care center for sick children from June 2014 to June 2016.

- 102 patients were selected for the study.
- These 102 patients were selected in 4 groups as per the set-up protocol and serum prolactin was estimated.
- Mean age for males was 4.13 years and for females it was 3.53 years (table 1).
- There were 20 males and 12 females in group I, 16 males and 8 females in group II, 14 males and 14 females in group III and group IV included 10 males and 8 females, with no significant difference in sex distribution.
- Group I contained total of 32 patients and included GTCS (17), SPS (10), CPS (5) patients (table 4).



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- In our study it was found that mean prolactin level was significantly raised only in group I. Further in group I, it was found that serum prolactin was higher in GTCS seizures and CPS as compared to SPS. This suggests the possibility of correlation between the degree of prolactin elevation and extent of epileptic activity.
- Our study showed that prolactin level was significantly higher only within group I. In group I, mean prolactin level was higher in GTCS and CPS as compared to SPS (table 7a). For group II, III, IV it was within normal range (table 8).
- Our study showed that serum prolactin was markedly elevated within group I only and highest prolactin attained (40.12 ng/ml) was at 10 minutes which was earliest time of presentation in a patient with GTCS (table 5). The second highest level of prolactin (40.10) was attained at 20 minutes postictally in one of the patients with GTCS. Normal levels of prolactin were observed in the above cases at 100 and 110 mts postically respectively.

The study, serum prolactin in seizures disorders conducted by Sharmila Banerjee et al [10] from the Department of Pediatrics at Safderjung Hospital, New Delhi in 2004 concluded that serum prolactin level was significantly elevated within group I only and highest and baseline levels were attained at 10 mts and 100 mts respectively within group I, mean prolactin values were 34.46 ng/ml in GTCS, 31.6 ng/ml in CPS and 14.20 ng/ml in SPS.

In our study 88.2% of GTCS, 60% of CPS and 30% of SPS patients had elevated levels of prolactin. Study conducted by Sharmila Banerjee et al [14] reported that 80% of GTCS, 60% of CPS and 20% of SPS patients had elevated levels of prolactin which is consistent with our study.

The highest percentage of elevated prolactin levels in GTCS and CPS in our study could be explained by a large sample size which was 32 as compared to 25 in the study conducted by Sharmila Banerjee et al [10].

We also found sensitivity and specificity of elevated prolactin level as an indicator of epileptic seizures is 65.62% and 97.14% respectively (Table 14). Study of Sharmila Banerjee et al[10] showed similar results with sensitivity of 64% and specificity of 98%.

The mean prolactin for group II, III, IV was 11.57, 8.84 and 10.92 respectively which is within normal limits (table 5).

It was found that none of the patients in our study with pseudo-seizure showed any rise in serum prolactin level which is again consistent with the study conducted by Yerby MS et al [15], Mehra SR et al [16] who studied levels of prolactin in seizure disorders and found that prolactin was raised in GTCS (68.83%) and partial seizures (11.11%). The peak levels were achieved in first 30 minutes and returned to baseline in one hour.

It was further showed in our study that there is a definite correlation between the post ictal prolactin level and post ictal duration in group I of the study. Raised prolactin level were attained within 10 minutes post ictally. Normal levels were observed in all cases with post ictal duration more than 100 minutes which is consistent with the study conducted by Sharmila Banerjee et al [10] and Wroe SJ et al [17].

In our study all those patients who were included in group I were advised to undergo EEG brain. The follow up for EEG study revealed abnormal EEG in 64.7% GTCS, 100% of CPS and 90% of SPS (table 12). In GTCS, 11 patients had abnormal EEG and all of them had abnormal proalctin, 4 (80%) of patients of CPS had abnormal prolactin while as 5 (100%) had abnormal EEG. In SPS, 3 (30%) had abnormal prolactin, while as 90% had abnormal EEG.

In our study we observed that for GTCS the serum prolactin assay sensitivity is higher than sensitivity of EEG. For CPS, serum prolactin assay and sensitivity of EEG is almost similar and for SPS, sensitivity of EEG is higher than serum prolactin estimation. None of the studies we came across had studied the correlation of EEG with prolactin level in serum prolactin.

Our group II included 24 cases of febrile seizures, group III included syncope = 15 cases, BHS, 7 cases, pseudo-seizure, 6 cases which made a total of 28 cases (table 4). All cases in group II, group III had normal serum levels (table 8) which is consistent with Sharmila Banerjee et al [10] study. None among the control group IV had elevated prolactin levels (table 8). In typical febrile seizure, sub-clinical electrical activity does not exist since the after



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discharges are less intense and transient to project to ventro-medial hypothalamus [18]. Conditions mimicking seizures lack electrical discharges which accounts for lack of prolactin elevation.

The clinical usefulness of post-ictal prolactin estimation is restricted to positive diagnosis of epileptic seizures. A positive result is highly suggestive of GTCS and CPS having occurred. None elevated levels of serum prolactin were seen in 11.8% GTCS, 20% CPS and 70% SPS (table 8).

Serum prolactin estimation level be used exclusively for differentiating between subtypes of epileptic seizures. However, can be applied in case of diagnostic uncertainty between epileptic and non-epileptic events, before resorting to expensive investigation.

Our study shows that a marked post ictal prolactin elevation is a sensitive indication of recent epileptic seizure which is consistent with the study of Banerjeet et al [10], Wyllie et al [19] and Mehta et al [16].

## SUMMARY AND CONCLUSION

1. The study was conducted in the Department of Pediatrics, Sher-i-Kashmir Institute of Medical Sciences Hospital, a tertiary care hospital for sick children from June 2014 to June 2016.
2. 102 patients were selected in four groups for the study. It included 60 males and 42 females.
3. Prolactin level was significantly high only in group I. Maximum prolactin level that was obtained was 40.12 ng/ml at 10 minutes from the event which dipped to 8.47 ng/ml at 100 minutes from the event.
4. In our study 88.2% of GTCS, 60% of CPS and 30% of SPS had elevated levels of prolactin.
5. In group I, the mean prolactin was significantly higher in GTCS and complex partial seizures as compared to SPS.
6. The sensitivity and specificity of elevated prolactin n as an indicator of epileptic seizures was 65.62% and 97.14% respectively.
7. The serum prolactin level raised within 10 minutes from the event and returned to baseline within 100 mts from the event.
8. In case of group I, raised prolactin was attained 10 minutes post ictally. A progress decline in prolactin level was then found. normal levels of prolactin were observed in all cases with post ictal duration more than 100 minutes. Thus, a definite correlation was seen between post ictal prolactin level and post ictal duration in group I.
9. It was found in our study that for GTCS the serum prolactin assay sensitivity in higher than the sensitivity of EEG. For CPS the sensitivity of EEG and serum prolactin assay is almost similar and for SPS the sensitivity of EEG is higher than serum prolactin estimation.
10. Prolactin level estimation can be used to increase the diagnostic accuracy before starting treatment and thereby avoiding the unnecessary adverse effects of anticonvulsant drugs, duration and expense of therapy.
11. Serum prolactin estimation can be used as a cheaper and early accessible alternative to expensive and time-consuming investigation like ambulatory EEG.
12. Prolactin level estimation can be employed to increase the diagnostic accuracy in those patients where EEG findings may be normal or inconclusive.
13. A high prolactin level within 100 minutes of seizure is highly suggestive that GTCS or CPS has occurred.

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