

## Assessment of Serum Calcium Levels in Infants with Acute Bronchiolitis at a Tertiary Centre

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Received: 20-11-2023 / Revised: 13-12-2023 / Accepted: 17-01-2023

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Conflict of interest: Nil

### Abstract:

**Background:** A frequent viral lower respiratory tract ailment that affects newborns and causes a major global health burden is bronchiolitis. The present study was conducted to assess serum calcium levels in infants with acute bronchiolitis.

**Materials and Methods:** 120 infants with a diagnosis of acute bronchiolitis were put in group I and healthy controls in group II. 5 ml of venous blood samples were taken to measure total serum calcium, phosphorus, and ALP.

**Results:** The present retrospective observational study included 120 infants, 60 cases, and 60 controls. Out of 120 patients, males were 62 and females were 58, but the gender difference was not statistically significant (p-value=0.64). The mean calcium level in group I was 8.1 mg/dL, and in group II it was 9.4 mg/dL. The mean phosphorus level was 5.4 mg/dL in group I and 5.9 mg/dL in group II. The mean alkaline phosphatase level in group I was 372.4 U/L, and in group II it was 346.8 U/L. The difference was non-significant (P> 0.05). In group I, rickets were present in 10 subjects, and in group II, in 4 subjects. The difference was significant (P< 0.05).

**Conclusion:** The results imply that there may be a link between low serum calcium levels and acute bronchiolitis. The study also discovered that these patients have a higher prevalence of rickets, underscoring the significance of appropriate sun exposure and sufficient supplementation.

**Keywords:** Acute Bronchiolitis, Calcium, Vitamin D.

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### Introduction

A frequent viral lower respiratory tract ailment that affects newborns and causes a major global health burden is bronchiolitis. The most well-established cause of bronchiolitis is the respiratory syncytial virus (RSV), which causes a significant numbers of hospital admissions for children under five each year [1]. Among affluent nations such as the USA, bronchiolitis is the most common reason for hospital admissions among newborns during the first year of life. Unfortunately, there is a dearth of data from underdeveloped nations, most likely as a result of inadequate infection control, overcrowding, poor hygiene, and poverty [2]. Usually starting in late October, RSV bronchiolitis peaks in the winter and early spring. There are a number of hypothesized risk factors for often occurring bronchiolitis in infancy, such as being premature, being among smokers, living in congested housing without enough sunshine exposure, and being in an urban setting. There have been theories put forth on the mechanisms causing ciliary dysfunction, including being inside, crowded conditions, humid environments, and breathing in chilly mist [3].

Infants who require admission to an intensive care unit due to severe bronchiolitis have been directly related to vitamin D deficiency. One way to prevent severe bronchiolitis is to test vitamin D levels before the bronchiolitis season and provide the necessary supplements. Additionally, the presence of vitamin D in nasopharyngeal secretions has been linked to an increased risk of positive pressure ventilation in children [4]. The regulation of calcium and phosphate homeostasis is intricate, with major hormonal fluctuations influencing the majority of this regulation outside of cells. Serum calcium levels are maintained or restored in part by parathyroid hormone [5]. For the cellular functioning, metabolic and communication pathways, immune system functions, and survival, calcium is essential. Low serum calcium has been associated with higher mortality and complications, making it a prognostic factor for the severity of viral diseases [6].

**Aims and Objectives:** The present study was conducted to assess serum calcium levels in infants with acute bronchiolitis.

## Materials & Methods

The present retrospective observational study included 120 infants admitted to the paediatric emergency department with a diagnosis of acute bronchiolitis, presenting with the first episode of wheeze based on American Academy of Paediatrics (AAP) criteria for both genders. The study was conducted at the Department of Paediatrics, Madhubani Medical College, Madhubani, Bihar. Parents gave their written consent to participate in the study. The study was conducted from July 2021 to February 2022.

Keeping power (1-beta error) at 80% and confidence interval (1-alpha error) at 95%, the minimum sample size required was 60 patients; therefore, we included 120 (more than the minimum required number of cases) patients in the present study.

Data such as name, age, gender, etc. was recorded. Clinical features such as coryza, fever, tachypnoea, tachycardia, paroxysmal wheezy cough, irritability, etc. were recorded. Patients were put in group I, and healthy controls were in group II. 5 ml of venous blood samples were taken to measure total serum calcium, phosphorus, and ALP.

**Inclusion criteria:** Infants younger than one year old who had acute bronchiolitis were included as cases. Controls were defined as patients in the same age group with acute febrile illness (fever  $>38.5^{\circ}\text{C}$ ,

duration  $>24$  hours) but without respiratory symptoms.

**Exclusion criteria:** Children with chronic disorders that could influence the severity and course of bronchiolitis were excluded from the study.

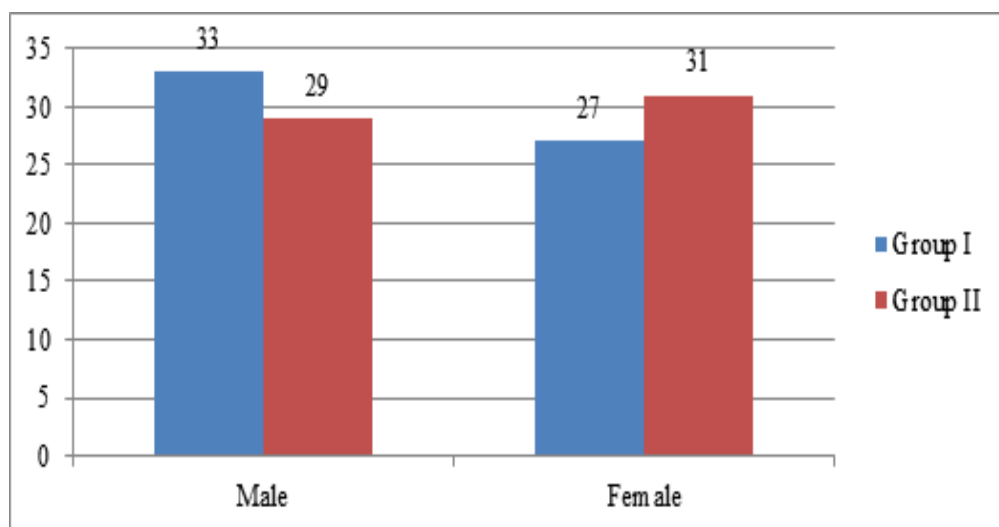
**Statistical analysis:** The data thus obtained were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) software version 22.0. Continuous variables such as age, weight, length, total calcium, phosphorus, and albumin were compared using the Student's t-test. The continuous non-parametric variable, ALP, was compared using the Kruskal-Wallis test due to the wide variation in values. The nominal variable, gender, was compared using the Chi-square test. A P value  $< 0.05$  was considered significant.

## Results

The present retrospective observational study included 120 infants, 60 cases, and 60 controls. Out of 120 patients, males were 62 and females were 58, but the gender difference was not statistically significant (p-value=0.64). Variables such as length and weight were analysed, and no significant difference was found among the study groups [Table I]. The mean age of patients in group I was  $4.96 \pm 2.60$  months, whereas in group II it was  $5.40 \pm 3.85$  months, respectively, which was statistically significant (p-value = 0.001).

**Table 1: Demographic characteristics of study cases (Group I) and controls (Group II)**

Characteristics	Group I (n=60) [Mean $\pm$ SD]	Group II (n=60) [Mean $\pm$ SD]	P Value
Age (months)	4.96 $\pm$ 2.60	5.40 $\pm$ 3.85	0.001
Gender			
Male	33 (55%)	29 (48.33%)	0.64
Female	27 (45%)	31 (51.67%)	
Weight (in Kg)	5.40 $\pm$ 1.25	5.68 $\pm$ 1.75	0.80
Length (in cm)	58.74 $\pm$ 5.63	59.82 $\pm$ 6.25	0.21



**Figure 1: Gender wise distribution of study cases and control group**

**Table 2: Comparison of biochemical parameters between Group I and Group II**

Parameters	Group I(n=60)	Group II(n=60)	P value
Calcium (mg/dL)	8.1 ± 1.72	9.4±1.53	0.04
Phosphorus (mg/dL)	5.4± 1.82	5.9± 1.42	0.81
Alkaline phosphatase (U/L)	372.4± 254.62	346.8± 245.25	0.94

Table 2 shows that the mean calcium level in group I was 8.1 mg/dL and in group II was 9.4 mg/dL. The mean phosphorus level was 5.4 mg/dL in group I and 5.9 mg/dL in group II. The mean alkaline phosphatase level in group I was 372.4 U/L, and in group II it was 346.8 U/L. The difference was non-significant (P> 0.05).

**Table 3: Effect of sun exposure on biochemical parameters in the control group (Group II)**

Parameters	Sun-exposure in Group II (n=60)		P Value
	Present (n=19)	Not present (n=41)	
Calcium (mg/dL)	9.48±1.50	8.92±1.61	0.002
Phosphorus (mg/dL)	5.23±1.29	5.86±1.32	0.01
Alkaline phosphatase (U/L)	342.61±231.64	362.96±258.43	0.42

The association of sun exposure with these biochemical parameters within the control group showed that calcium levels were low and phosphorus levels were high in the non-exposed group (sunlight exposure

for 40 minutes without cover), which was statistically significant. However, there was no statistically significant difference in ALP levels among the exposed and non-exposure groups [Table 3].

**Table 4: Effect of sun exposure on biochemical parameters in cases (Group I)**

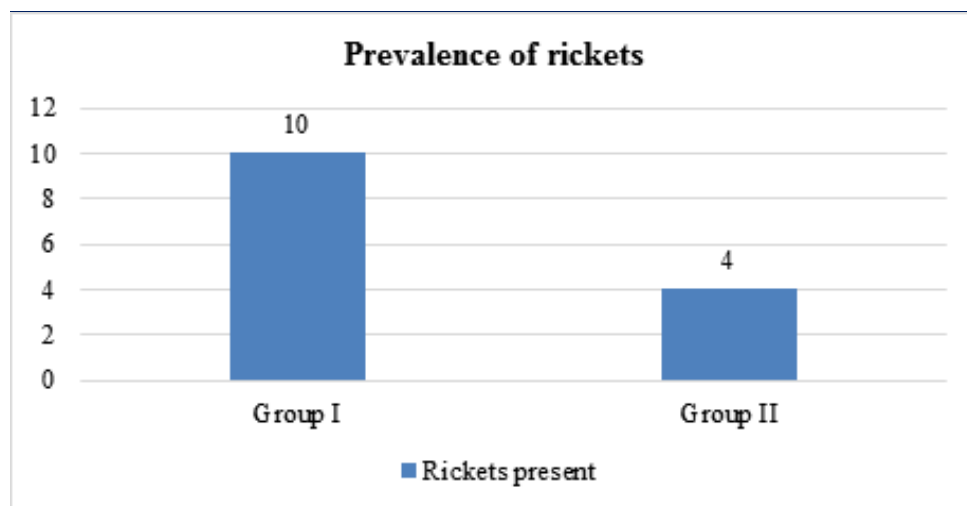
Parameters	Sun-exposure in Group I(n=60)		P Value
	Present (n=15)	Not present (n=45)	
Calcium (mg/dL)	8.58±1.62	8.62±1.43	0.62
Phosphorus (mg/dL)	5.28±1.38	5.42±1.26	0.40
Alkaline phosphatase (U/L)	361.65±252.41	373.49±254.25	0.85

The association of sunlight exposure with calcium levels within the cases showed that no statistically significant difference in total serum calcium, phosphorus, and alkaline phosphatase levels between the exposed and non-exposed groups [Table 4].

**Table 5: Prevalence of rickets**

Groups	Rickets present	P value
Group I	10	0.01
Group II	4	

Table 5, figure I, shows that in group I, rickets were present in 10 (8.33%) and in group II in 4 (3.33%) subjects. The difference was significant (P< 0.05).



**Figure 2: Prevalence of rickets**

**Discussion**

Acute bronchiolitis is a respiratory condition that primarily affects infants and young children. It is characterized by inflammation and swelling of the

small airways in the lungs, known as bronchioles. The most common cause of acute bronchiolitis is a

viral infection, with respiratory syncytial virus (RSV) being the predominant culprit [7].

The condition often begins with symptoms similar to those of a common cold, such as a runny or stuffy nose, cough, and mild fever. As the illness progresses, the inflammation of the bronchioles leads to increased mucus production and difficulty breathing [8]. This can result in wheezing and a persistent cough. Acute bronchiolitis is most common in infants under the age of 2, and the severity of the illness tends to decrease with age. There is often a seasonal pattern to the occurrence of acute bronchiolitis, with a higher incidence during the fall and winter months [9]. In severe cases, bronchiolitis can lead to respiratory distress, which may require hospitalization. Infants with underlying health conditions or premature babies are at a higher risk of developing severe complications [10].

The present study was conducted to assess serum calcium levels in infants with acute bronchiolitis.

We found that out of 120 patients, males were 62 (51.67%) and females were 58 (48.33%). In the control group, there were 29 (24.17%) males and 31 (25.73%) females, while in the cases; there were 33 (27.5%) males and 27 (22.5%) females. The mean age of cases was  $4.96 \pm 2.60$  months, and controls were  $5.40 \pm 3.85$  months, respectively.

Gupta et al. [11] included 223 patients in both the case and control groups. In the control group, there were 76.58% males and 23.42% females, while in the cases; there were 81.53% males and 18.47% females. The mean age of cases was  $5.78 \pm 3.45$  months, and controls were  $4.77 \pm 2.83$  months, with a mean difference of 1.01. The mean calcium levels were  $9.00 \pm 1.43$  mg/dL and  $8.71 \pm 1.51$  mg/dL in controls and cases, respectively, with a mean difference of 0.29, which was statistically significant. There was no significant difference in phosphorus and ALP levels between the two groups.

We found that the mean calcium level in group I was 8.1 mg/dL and in group II was 9.4 mg/dL. The mean phosphorus level was 5.4 mg/dL in group I and 5.9 mg/dL in group II. The mean alkaline phosphatase level in group I was 372.4 U/L, and in group II it was 346.8 U/L. In group I, rickets were present in 10 subjects, and in group II, in 4 subjects.

In their study, Golan-Tripto et al. [12] recruited one hundred twenty-seven patients aged < 24 months; 80 were diagnosed with acute bronchiolitis and 47 with non-respiratory febrile illnesses. Both groups had similar demographics aside from age (median [IQR] 5 vs. 9 months) in the bronchiolitis group compared to the control group ( $p = 0.002$ ). Serum 25(OH) vitamin D levels were significantly lower in the bronchiolitis group; median [IQR] 28 [18–52] vs. 50 [25–79] nmol/L, respectively ( $p = 0.005$ ). Deficient vitamin D levels (< 50 nmol/L) were found more

frequently in the bronchiolitis group than controls (73% vs. 51%,  $p = 0.028$ ). Multivariate logistic regression showed vitamin D deficiency was more probable in bronchiolitis patients; OR [95% CI]: 3.139 [1.369–7.195]. No correlation was found between serum vitamin D levels and bronchiolitis severity, which was assessed via the Modified Tal Score and by length of hospital stay.

The present study also showed that rickets were present in 8.33% of cases, compared to 3.33% in controls. In a previous study, the incidence of rickets in infants with wheezy bronchitis was 24%. Other studies have reported a high prevalence of vitamin D deficiency and rickets in cases of bronchiolitis [12].

**Limitations of the study:** The limitation of the study is the small sample size.

### Conclusion

The authors found that there may be a link between low serum calcium levels and acute bronchiolitis. The study also discovered that these patients have a higher prevalence of rickets, underscoring the significance of appropriate sun exposure and sufficient supplementation.

**Acknowledgment:** The authors would like to acknowledge the entire faculty and residents of the Department of Paediatrics, Madhubani Medical College, Madhubani, Bihar, India, for their valuable support, time to time suggestion in undertaking present study. Special thanks to Dr. Rajiv Kr Jha, Associate Professor, Head of Department, Department of Paediatrics, Madhubani Medical College Madhubani, Bihar, India, for their valuable suggestions during the study.

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