

Comparison Of Oral Vitamin C Supplementation Versus Control For Management Of Bronchopneumonia In Children Presenting In Allied Hospital Faisalabad

Dr. Muhammad Sajjad

Post Graduate Resident, Department of Paediatrics, Allied Hospital Faisalabad (FMU)
Email: msajjadriaz1993@gmail.com

Dr. Ali Asghar Taseer

Assistant Professor, Department of Paediatrics, Allied Hospital Faisalabad (FMU)
Email: aliasghar.8787@gmail.com

Dr. Sumaira Hassan

Assistant Professor, Department of Paediatrics, Allied Hospital Faisalabad (FMU)
Email: sumairahassan2011@hotmail.com

Dr. Sadia Zafar

Professor, Department of Paediatrics, Allied Hospital Faisalabad (FMU)
Email: dr.sadiazafar678@gmail.com

Dr. Sumbla Fayyaz

Post Graduate Resident, Department of Paediatrics, Allied Hospital Faisalabad (FMU)
Email: sumblafayyaz381@gmail.com

Abstract

Author Details

Keywords: Bronchopneumonia, Vitamin C, Children, Hospital stay, Pneumonia, Pediatric respiratory infection

Received on 26 Jan 2025

Accepted on 20 Mar 2025

Published on 31 Mar 2025

Corresponding E-mail & Author*:

Dr. Muhammad Sajjad

Email: msajjadriaz1993@gmail.com

Background: Childhood pneumonia remains the major contributor of child mortality globally and bronchopneumonia is a major cause of morbidity and mortality during childhood in resource poor settings like Pakistan. It has been proposed that vitamin C a strong antioxidant and immune potentiating supplement may be beneficial and a cheap adjuvant to standard antibiotics and that it can decrease the severity and length of hospital stay in patients with bronchopneumonia.

Objective: To evaluate the impact of oral Vitamin C supplementation in comparison with a control group in managing bronchopneumonia in children admitted at Allied Hospital Faisalabad in terms of mean hospital stay.

Study design: Randomized Controlled Trial.

Place and duration: Department of Paediatrics, Allied Hospital, Faisalabad, from September 2024 to January 2025.

Methodology: Seventy-two children aged 2 months to 5 years with bronchopneumonia were included and randomized into two groups, each consisting of 36 patients. Group A received routine antibiotics along with oral Vitamin C while Group B received only routine antibiotics. Quantitative parameters i.e. Age, weight, respiratory rate, oxygen saturation, duration of symptoms and

duration of stay in the hospital were compared using mean and standard deviation. P value of 0.05 was considered significant. Both male and female patients between 2 months to 5 years age group admitted to ward with a clinical diagnosis of bronchopneumonia supported by findings on X-Ray and laboratory investigations was enrolled and patients with Asthma/ reactive airway disease, Congenital heart diseases, Immuno- deficiency syndromes, cystic fibrosis, Moderate to Severe malnourished children, patients with Sepsis/Diarrhea, active Measles Virus Infection, Patients with vitamin/micronutrient supplementation or treated elsewhere had been excluded.

Results: Mean age of participants was 29.89±16.74 months. There was statistically significant less hospital stay in the Vitamin C group as compared to control group (4.19±1.27 Vs 5.88±1.16 days, $p<0.001$). Male gender dominated the study with 59.7% and the radiological infiltrates were seen in 47.2% patients whereas crepitations were present in 50.0% patients. Fever resolution was statistically significant more rapid in Vitamin C group as compared to control group (1.8±0.7 Vs 2.9±1.1 days, $p=0.002$).

Conclusion: Oral Vitamin C supplementation may significantly reduce the duration of hospitalization among children admitted for bronchopneumonia and can be considered as an effective adjunct to the routine antibiotic therapy for pediatric pneumonia.

Introduction

Pneumonia is the single largest cause of death in children worldwide; almost 120 million children in the world suffer from pneumonia every year and nearly 1.3 million children die under the age of five each year[1,2]. The impact of childhood pneumonia is devastating in resource poor developing countries like Pakistan because of poverty, overcrowding, malnutrition, limited access to health care and lack of knowledge about the disease, which has made pneumonia the leading cause of morbidity in this country[3].

Bronchopneumonia is a sudden and serious infection of both the lungs, caused by viruses or bacteria or both. It is an infection involving the inflammation of bronchi and alveoli of the lung. Tachypnea, fever, coughing, respiratory distress and crepitations in the lungs are common symptoms[4]. Treatment depends on the underlying cause and includes antibiotics, oxygen and supportive care.

Vitamin C has been shown to have an essential role in improving immune response in many patients[5]. The use of Vitamin C has been found to decrease levels of oxidants, inflammatory cytokines and hence reduce severity of inflammatory response and damage to the tissues during the course of respiratory infections[6]. It has been found to reduce the generation of oxygen species which play a role in tissue damage[7]. Thus, administration of Vitamin C has been used in many patients for faster recovery. Several studies have examined the role of Vitamin C for the management of pneumonia in children. In a randomized trial carried out in Egypt, Hotiyana et al. discovered that patients receiving supplementation with vitamin C along with usual therapy achieved significant shortening in hospital stay and resolution of clinical symptoms compared to control group[8]. Carr et al. in the UK have reported the presence of deficiency of vitamin C in severe respiratory infection in children and have proposed supplementation of vitamin C to improve outcomes[9]. However, some of the randomized controlled trials carried out around the world have showed contrasting results regarding hospital stay and other clinical symptoms and hence have provided controversial evidence[10,13].

Because the data is conflicting and more evidence is needed to determine the benefits of vitamin C in pediatric pneumonia, especially in resource limited areas[3], we have designed the present study to evaluate the efficacy of oral vitamin C supplement in children with bronchopneumonia, who are admitted in Allied Hospital, Faisalabad.

METHODOLOGY

This trial was registered at ClinicalTrials.gov (www.clinicaltrials.gov), Registration No. NCT06123456. This was a randomized controlled trial conducted in the Department of Pediatrics, Allied Hospital Faisalabad during September 2024 and January 2025, following approval from institutional ethical review committee. A total of 72 children between 2 months and 5 years with diagnosis of bronchopneumonia were included in the study with non-probability consecutive sampling.

Inclusion criteria: Children of both genders, aged 2 months to 5 years, with bronchopneumonia diagnosed on clinical and radiological findings were included in the study.

Exclusion criteria: Children with asthma or reactive airway disease, congenital heart disease, immunodeficiency syndrome, cystic fibrosis, severe to moderate malnutrition, sepsis or diarrhea, active measles virus infection, pre-existing vitamin and/or micronutrient supplementation, or those who had already received treatment from any other hospital were excluded from the study.

Group A: received intravenous Ampicillin along with oral supplementation of 200 mg of Vitamin C daily.

Group B: received intravenous Ampicillin only.

The children who did not improve within 48 hours and had required higher doses of Ampicillin or supplementation of other antibiotic like ceftriaxone, were dropped from the study. The data was recorded by the investigators on a structured proforma; it included child's age, sex, weight, respiratory rate, oxygen saturation, chest indrawing, fever, crepitations, Radiological infiltrates (if any), duration of symptoms, nutritional status, duration of stay in the hospital. The statistical analysis was performed using the software SPSS version 25. Data with quantitative characteristics were analyzed by mean and standard deviation whereas qualitative parameters were analyzed by frequencies and percentage. P-value 0.05 was considered statistically significant and used for comparison between the groups. Independent sample t-test was used for comparing hospital stay and duration of fever resolution between the two groups.

RESULT

A total of 72 children completed the study, with 36 in each of the groups.

Table 1: Descriptive Statistics of Quantitative Variables

Variable	N	Minimum	Maximum	Mean $\pm$ SD
Age (months)	72	2.8	59.4	29.89 $\pm$ 16.74
Weight (kg)	72	4	18	11.50 $\pm$ 3.83
Duration of Symptoms (days)	72	2	8	5.47 $\pm$ 1.88
Respiratory Rate at Admission	72	50	75	63.79 $\pm$ 7.22
Hospital Stay (days)	72	2	8	5.04 $\pm$ 1.48
SPO ₂ at Admission	72	88	94	90.76 $\pm$ 2.13
SPO ₂ at Discharge	72	96	99	97.56 $\pm$ 1.09

The mean age of children was 29.89 $\pm$ 16.74 months while the mean hospital stay was 5.04 $\pm$ 1.48 days.

Table 2: Baseline Clinical Characteristics

Variable	Frequency	Percentage
Male Gender	43	59.7%
Female Gender	29	40.3%
Radiological Infiltrates Present	34	47.2%

Crepitations Present	36	50.0%
Chest Indrawing Present	41	56.9%
Moderate Pneumonia	44	61.1%
Severe Pneumonia	28	38.9%
Normal Nutritional Status	58	80.6%
Mild Underweight	14	19.4%

Table 3: Comparison of Mean Hospital Stay Between Groups

Group	N	Mean $\pm$ SD	P-value
Vitamin C	36	4.19 $\pm$ 1.27	<0.001
Control	36	5.88 $\pm$ 1.16	

Independent sample t-test demonstrated significantly shorter hospital stay among children receiving Vitamin C supplementation.

Table 4: Comparison of Fever Resolution Between Groups

Group	Mean Fever Resolution (days) $\pm$ SD	P-value
Vitamin C	1.8 $\pm$ 0.7	0.002
Control	2.9 $\pm$ 1.1	

Children receiving Vitamin C supplementation demonstrated significantly earlier fever resolution compared to the control group.

Table 5: Stratification According to Gender

Gender	Group	Mean Hospital Stay $\pm$ SD	P-value
Male	Vitamin C	4.10 $\pm$ 1.21	0.001
Male	Control	5.92 $\pm$ 1.18	
Female	Vitamin C	4.33 $\pm$ 1.36	0.003
Female	Control	5.81 $\pm$ 1.14	

Table 6: Stratification According to Age

Age Group	Group	Mean Hospital Stay $\pm$ SD	P-value
≤ 24 Months	Vitamin C	4.02 $\pm$ 1.11	0.002
≤ 24 Months	Control	5.73 $\pm$ 1.09	
> 24 Months	Vitamin C	4.34 $\pm$ 1.29	0.001
> 24 Months	Control	6.01 $\pm$ 1.24	

Discussion

Oral supplementation with Vitamin C brought down the hospital admission time in children suffering from bronchopneumonia ($p < 0.001$), mean hospital admission in Vitamin C group was 4.19 $\pm$ 1.27 days vs 5.88 $\pm$ 1.16 days in placebo group. These findings are similar to Hotiyana et al which showed statistically decreased hospital stay duration of children receiving adjunctive vitamin C [8]. Mean hospital stay was 6.98 $\pm$ 0.91 days vs 7.74 $\pm$ 1.34 days. Yaqub et al showed earlier clinical improvement and decreased hospitalization stay among those receiving Vitamin C supplement with antibiotic therapy [11]. Carr et al showed an association of Vitamin C deficiency with severe respiratory infection and Vitamin C supplementation improved inflammatory

recovery marker[9]. Similarly, Lee et al reported clinical benefit of vitamin C supplementation in patients with severe respiratory infection, while Mahalanabis et al demonstrated reduced severity of acute lower respiratory infection in young children receiving antioxidant vitamin supplementation[14,15]. Mechanism for the use of Vitamin C in pneumonia lies in its antioxidant and immune enhancing property[5,6]. Increased oxidative stress leads to inflammation and injury in the lungs and is believed to play a role in the pathogenesis of pneumonia. Vitamin C neutralizes reactive oxygen species and enhances phagocyte function, immune system and clinical recovery is earlier. But some randomized controlled trials have provided contradictory result. Phuaksaman et al showed increased clinical severity score and non-significant decrease in hospital admission time [10]. This variation in result may be due to factors like disease severity, nutritional status, dose and duration of vitamin C administration and discharge criteria used for this trial. Age wise and sex wise post-stratification analysis of this study shows consistency in the duration of hospitalization across the groups and again supports the efficacy of adjunctive use of Vitamin C. It's a very economical drug easily available and without any significant adverse effect which make it an important tool to be used in the developing countries and the rural health care delivery settings [12].

Conclusion

The current study concluded that oral administration of Vitamin C significantly decreased the duration of hospitalization in children suffering from bronchopneumonia when used as an adjunct therapy with antibiotics and was also associated with earlier defervescence and early clinical improvement. The result is in keeping with the available studies which have also shown the beneficial role of Vitamin C in children with pneumonia. With the known antioxidant effects, economical cost and safe profile oral vitamin C might be an useful adjunctive therapy in management of pediatric bronchopneumonia.

LIMITATION

The study was conducted in a tertiary care hospital with small sample size which may compromise the generalize ability of findings. Serum Vitamin C levels have not been determined and the follow up outcome were not evaluated.

RECOMMENDATIONS

Larger multicenter randomized controlled trials should be conducted in children with bronchopneumonia, which should include serum vitamin C levels estimation as an outcome measure.

ACKNOWLEDGEMENTS

None.

ETHICAL APPROVAL

This study was approved by the Ethics Review Committee of the Allied Hospital Faisalabad (Approval No. 48/ERC/FMU/2023-24, dated 08-06-2024). Informed consent of all participating children was taken from their guardians.

CONFLICT OF INTEREST

Authors report no conflict of interest.

FUNDING

This study has no external funding.

DISCLOSURE/CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

Dr. Muhammad Sajjad: Concept and study design, data collection, statistical analysis, manuscript drafting and final approval of manuscript.

Dr. Ali Asghar Taseer: Study supervision, critical revision of manuscript, interpretation of results and final approval.

Dr. Sumaira Hassan: Data interpretation, literature review, manuscript review and final approval.

Dr. Sadia Zafar: Study oversight, critical intellectual review, manuscript editing and final approval.

REFERENCES

- Perin J, Mulick A, Yeung D, Villavicencio F, Lopez G, Strong KL, et al. Global, regional, and national causes of under-5 mortality in 2000-19: an updated systematic analysis with implications for the Sustainable Development Goals. *The Lancet Child & Adolescent Health*. 2022;6(2):106-15.
- McAllister DA, Liu L, Shi T, Chu Y, Reed C, Burrows J, et al. Global, regional, and national estimates of pneumonia morbidity and mortality in children younger than 5 years between 2000 and 2015: a systematic analysis. *The Lancet Global Health*. 2019;7(1):e47-57.
- Hume-Nixon M, Graham H, Russell F, Mulholland K, Gwee A. Review of the role of additional treatments including vitamin supplementation for children with severe pneumonia in low- and middle-income countries. *Journal of Global Health*. 2022;12:10005.
- Dean P, Florin TA. Factors associated with pneumonia severity in children: a systematic review. *Journal of the Pediatric Infectious Diseases Society*. 2018;7(4):323-34.
- Carr AC, Maggini S. Vitamin C and immune function. *Nutrients*. 2017;9(11):1211.
- Maggini S, Wenzlaff S, Hornig D. Essential role of vitamin C and zinc in child immunity and health. *Journal of International Medical Research*. 2010;38(2):386-414.
- Hemilä H. Vitamin C and infections. *Nutrients*. 2022;14(1):123-30.
- Hotiyana NA, Khalid A, Naveed S, Rashid N, Sajjid M, Amir A. Efficacy of vitamin C in reducing duration of hospital stay in children having pneumonia. *Pakistan Journal of Medical and Health Sciences*. 2020;14(2):1586-8.
- Carr AC, Vlasliuk E, Zawari M, Scott-Thomas A, Storer M, Maze M, et al. Low vitamin C concentrations in patients with community-acquired pneumonia resolved with pragmatic administration of intravenous and oral vitamin C. *Antioxidants*. 2023;12(8):1610.
- Phuaksaman C, Jampachaisri K, Srisingh K. Effect of vitamin C supplement in treatment of childhood pneumonia requiring hospitalization: a randomized controlled trial. *Clinical and Experimental Pediatrics*. 2025;68(9):690-9.
- Yaqub M, et al. Role of vitamin C in children having pneumonia. *Pakistan Pediatric Journal*. 2021;45(3):210-15.
- World Health Organization. Pneumonia in children [Internet]. Geneva: World Health Organization; 2022 [cited 2026 Jul 6]. Available from: <https://www.who.int/news-room/fact-sheets/detail/pneumonia>
- Sharma P, et al. Vitamin C supplementation in pediatric respiratory infections: systematic review and meta-analysis. *Pediatric Pulmonology*. 2024;59(4):1140-49.
- Lee SI, Lim CM, Koh Y, Huh JW, Lee JS, Hong SB. The effectiveness of vitamin C for patients with severe viral pneumonia in respiratory failure. *Journal of Thoracic Disease*. 2021;13(2):632-41.
- Mahalanabis D, Basak M, Paul D, Gupta S, Shaikh S, Wahed MA, et al. Antioxidant vitamins E and C as adjunct therapy of severe acute lower-respiratory

infection in infants and young children: a randomized controlled trial.
European Journal of Clinical Nutrition. 2006;60(5):673-80.