

Frequency of Measles and Its Complications in Malnourished Children

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ABSTRACT

Objective: To determine the frequency of measles and its complications in malnourished children visiting a tertiary care hospital Larkana

Introduction: Measles, a highly contagious viral infection, remains a major global health issue, especially in low-income countries with poor healthcare systems. Despite the availability of a low-cost vaccine, measles causes significant morbidity and mortality, particularly in malnourished children. Complications include severe CNS infections and secondary issues like diarrhea and pneumonia.

Methodology: The Paediatric Medicine Department at Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkana conducted a six-month descriptive cross-sectional research which was conducted from January to June 2021. The research focused on children aged 6 months to 14 years who presented with measles. The patients were

assessed for measles and related complications i.e. pneumonia, gastroenteritis, and encephalitis. The data was gathered using a standardized form and analyzed using the SPSS software, specifically version 26.0.

Results: A total of 142 children were enrolled in the study, with a mean age of 3.57 ± 2.62 years. The majority of the participants were male (54.2%), compared to 45.8% female. Measles was observed in 59.2% of children. Among the complications associated with measles, 26.2% of the children developed pneumonia, 8.3% experienced otitis media, 19% suffered from gastroenteritis, 16.7% presented with conjunctivitis, and 3.6% were diagnosed with encephalitis.

Conclusion: It is to be concluded that pneumonia emerged as the most common complication of measles, followed by conjunctivitis and gastroenteritis. These complications emphasize the need for vaccination and early intervention. Further research is crucial to understand contributing factors and improve public health strategies in pediatric care.

Keywords: Complications, Malnourished, Measles, Vaccination

INTRODUCTION

Measles, an exceedingly contagious viral infection induced by the measles virus, continues to pose a significant threat to the health of children worldwide. Measles is prevalent worldwide, and outbreaks often occur mostly during the spring and winter seasons¹. Despite the presence of a low-cost vaccination, it remains a significant global health issue and continues to be a top cause of death in children².

The occurrence of the condition in youngsters ranges from 58% during epidemics to 10-15% during periods of endemicity. In 2010, the total number of fatalities worldwide amounted to 139,300, with over 95% occurring in low-income nations that had inadequate healthcare systems. Measles is far more severe in malnourished children, with a fatality rate up to 400 times greater compared to well-nourished children who get measles³.

The widespread presence of confirmed measles infections in Pakistan rose from 24.6 per million cases during the period from 2000 to 2009 to 80.4 per million cases between 2010 and 2018. Roughly 30-40% of individuals diagnosed with measles encounter specific problems⁴.

Measles infection may lead to many consequences, such as diarrhoea, otitis media, pneumonia, CNS infections and sequelae, blindness, and hearing impairments. The frequency of morbidity and mortality associated with measles is more severe in impoverished countries as a result of factors such as hunger, large populations, limited access to healthcare, and inadequate vaccine coverage⁵⁻⁶. The measles virus affects the central nervous system (CNS) both during the active phase of infection and after the sickness has entered a dormant state. The central nervous system (CNS) complications after measles infection include primary measles encephalitis, subacute sclerosing panencephalitis, measles inclusion body encephalitis, and acute post-infectious measles encephalomyelitis⁷. Approximately 40 million cases of measles are recorded annually on a global scale, resulting in 7.77×10^5 deaths per year. Pakistan is responsible for 66% of these fatalities. In 2008, over 164,000 fatalities were recorded due to measles, mostly in South Asian and African countries with inadequate healthcare systems⁸.

Measles may have severe consequences in a population with hunger, nevertheless, malnutrition is regarded a potential obstacle to measles immunisation, at least in theory⁹. Undernourished children are more vulnerable to severe symptoms of measles and are more likely to have serious consequences from the disease compared to children who are well-nourished. Early-onset acute measles infection is associated with significant morbidity and increased mortality¹⁰.

In light of these considerations, the current study was conducted among children admitted to the pediatric ward of a tertiary care teaching hospital who were diagnosed with malnutrition. This cohort was further evaluated for measles to enable the implementation of timely and effective interventions, aiming to prevent life-threatening complications and curb the further spread of the infection.

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METHODOLOGY

The Paediatric Medicine Department at SMBBMU, Larkana, conducted this descriptive cross-sectional from January to June 2021. The study recruited a total of 142 children using a non-probability consecutive sampling approach.

The sample size was determined using the W.H.O. sample size calculator, based on a reported frequency of gastroenteritis (38.2%) in malnourished children³, with a margin of error (d) set at 8% and a 95% confidence level. This calculation resulted in an estimated sample size of 142.

The study included malnourished children of either gender, aged 6 months to 14 years. Exclusion criteria were children with congenital heart disease, endocrinal and metabolic disorders (such as diabetes mellitus and hypo/hyperthyroidism), and those with conditions like chickenpox or herpes zoster. Additionally, children who had received antiviral therapy within 48 hours prior to enrollment, or were on immunosuppressive drugs, steroids, or hormonal therapy, were excluded.

Data collection was conducted through a standardized questionnaire specifically designed for this study. The mid-upper arm circumference (MUAC) of each child was measured at the midpoint between the acromion and olecranon, ensuring the arm was relaxed and hanging naturally. The tape measure was applied snugly but not too tightly, and the measurement was recorded.

Patient data were collected for age, weight, height, and BMI. Frequencies and percentages were calculated for variables such as gender, vaccination status, anemia, fever, and leukocytosis. All patients were assessed for the presence of measles and its complications, including pneumonia, gastroenteritis, and encephalitis.

Statistical analysis was performed using SPSS version 26.0. The Chi-Square or Fisher's Exact test was applied, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

Table I summarizes the demographic characteristics of the study participants, comprising 142 children. The mean age of the participants was 3.57 ± 2.62 years. Age distribution showed that 28.2% were under 2 years old, 54.9% were between 2 and 5 years old, and 16.9% were over 5 years old. The average hospital stay was 3.84 ± 2.25 days, with 30.3% of participants hospitalized for less than 3 days, 57.0% for 3 to 7 days, and 12.7% for more than 7 days. Gender distribution revealed 54.2% males and 45.8% females. Regarding vaccination status, 47.2% of participants were vaccinated. Nutritional status showed that 20.4% were well-nourished, 46.5% were malnourished, and 33.1% were severely malnourished. Additionally, 64.8% of participants had a history of contact with measles, and 59.2% had contracted measles, while 40.8% had not. Complications from measles were observed in 43.6% of the cases (n=62), whereas 56.4% (n=22) did not experience any complications.

Table II details the complications of measles observed among the cohort of 84 children. Pneumonia was the most common complication, affecting 26.2% (n=22) of the children. Otitis media was present in 8.3% (n=7) of cases, gastroenteritis in 19.0% (n=16), and conjunctivitis in 16.7% (n=14). Encephalitis was the least frequent complication, occurring in 3.6% (n=3) of the cases.

Table III presents the gender distribution of measles complications among the 84 children. Pneumonia was experienced by 59.1% of males and 40.9% of females, with no

significant gender difference ($p = 0.962$). Otitis media affected 57.1% of males and 42.9% of females, also showing no significant gender difference ($p = 0.596$). Gastroenteritis affected an equal proportion of males and females (50% each), with no significant gender difference ($p = 0.388$). However, conjunctivitis was significantly more common in females (64.3%) than in males (35.7%), with a statistically significant difference ($p = 0.047$). Encephalitis occurred in 33.3% of males and 66.7% of females, with no significant gender difference ($p = 0.357$).

Table I: Demographic Characteristics of Study Participants (n=142)	
Variable	n (%)
Age (Mean \pm SD) = 3.57 ± 2.62	
<2 years	40 (28.2)
2-5 years	78 (54.9)
>5 years	24 (16.9)
Hospital Stay (Mean \pm SD) = 3.84 ± 2.25	
<3 days	43 (30.3)
3-7 days	81 (57.0)
>7 days	18 (12.7)
Gender	
Male	77 (54.2)
Female	65 (45.8)
Vaccination Status	
Vaccinated	67 (47.2)
Non-Vaccinated	75 (52.8)
Nutritional Status	
Well nourished	29 (20.4)
Malnourished	66 (46.5)
Sever Malnourished	47 (33.1)
History of Contact	
Yes	92 (64.8)
No	50 (35.2)
Measles	
Yes	84 (59.2)
No	58 (40.8)
Frequency of Measles-Related Complications	
Yes	62 (43.6)
No	22 (56.4)

Table II: Measles Complications in Children (n=84)			
Variables		Frequency n (%)	
Pneumonia	Yes	22	26.2%
	No	62	73.8%
Otitis media	Yes	7	8.3%
	No	77	91.7%
Gastroenteritis	Yes	16	19.0%
	No	68	81.0%
Conjunctivitis	Yes	14	16.7%
	No	70	83.3%
Encephalitis	Yes	3	3.6%
	No	81	96.4%

Table III: Gender Distribution with Complications of Measles (n=84)					
Variables, n (%)		Gender		95% C.I	P-Value
		Male, n (%)	Female, n (%)		
Pneumonia	Yes	13 (59.1%)	9 (40.9%)	(0.363-----2.626)	0.962
	No	37 (59.7%)	25 (40.3%)		
Otitis media	Yes	4 (57.1%)	3 (42.9%)	(0.188-----4.296)	0.596
	No	46 (59.7%)	31 (40.3%)		
Gastroenteritis	Yes	8 (50.0%)	8 (50.0%)	(0.207-----1.851)	0.388
	No	42 (61.8%)	26 (38.2%)		
Conjunctivitis	Yes	5 (35.7%)	9 (64.3%)	(0.093-----1.022)	0.047*
	No	45 (64.3%)	25 (35.7%)		
Encephalitis	Yes	1 (33.3%)	2 (66.7%)	(0.028-----3.752)	0.357
	No	49 (60.5%)	32 (39.5%)		

*p-value of ≤ 0.05 considered statistically significant.

DISCUSSION

Measles remains a critical global health issue, particularly in regions with limited resources. The disease is infrequently seen in infants under 3-4 months and usually presents with mild symptoms for the first six months of life. However, it is notably prevalent among children aged 1-5 years in less developed areas. Despite the widespread availability of vaccines, measles continues to challenge healthcare systems worldwide, especially in low-income countries. Each year, about 40 million measles cases are reported, with Africa and Asia accounting for 70% of these instances. Measles leads to approximately 777,000 deaths annually in 11 countries, with Pakistan alone responsible for 66% of these fatalities¹¹.

Children who are malnourished experience more severe complications and prolonged hospital stays¹². A significant proportion of measles-related deaths in young children globally can be linked to being underweight for their age¹³.

This highly contagious viral disease can be effectively prevented through vaccination. The measles vaccine is given via subcutaneous injections at 9 and 15 months of age. Additionally, passive immunization with immunoglobulin can prevent the disease if administered within six days of exposure. Vaccination is also recommended for children aged 6-12 months who are at greater risk. The major reason for the ongoing burden of measles is inadequate vaccine coverage, including insufficient administration of the initial dose and a lack

of follow-up opportunities¹⁴. It is crucial to support strategies that maintain high levels of global immunity against measles through regular and supplementary vaccination campaigns to enhance coverage¹⁵.

Characterized by its rapid onset and brief duration, measles is a highly infectious viral condition¹⁶. Its prevalence among children ranges from 10-15% in endemic settings to 58% during outbreaks¹⁷. Worldwide, around 40 million cases are reported annually, with Africa and South Asia contributing to 70% of these cases. Out of the 777,000 measles-related deaths each year, 66% occur in 11 countries, including Pakistan¹⁸. In poorer nations, the case fatality rate is often between 1-5%¹⁹, representing about 50-60% of the estimated one million deaths from vaccine-preventable diseases in children¹⁸. The complications associated with measles are compounded by its ability to induce immunosuppression²⁰. Among children with measles, 5% develop pneumonia and 0.1% develop encephalitis. Of those with encephalitis, 15% may not survive, and 25-35% experience long-term neurological complications¹⁶. Additionally, children are at an increased risk of death within a year of infection due to impaired cellular immunity, and subacute sclerosing panencephalitis may result in death approximately 12 years after the initial measles infection²⁰.

In our study, measles was found in 59.2% of children. Studies reported its prevalence from 3%–34%²¹⁻²³. Our study noted complications of measles as 26.2% experienced pneumonia, 8.3% had otitis media, 19% suffered from gastroenteritis, 16.7% exhibited conjunctivitis, and 3.6% faced encephalitis. A different research found that the most common consequence seen in patients was pneumonia, affecting 53 individuals (48.2%). This was followed by encephalitis, which affected 16 patients (14.5%), and otitis media, which affected 4 patients (3.6%)²⁴. Ullah F, et al stated various complications like pneumonia (31.13%), gastroenteritis (19.33%), conjunctivitis (17.45%), otitis media (7.07%), and encephalitis (2.35%)²⁵. The study of Asghar RM, et al⁹ documented that 52 (43.3%) of patients had pneumonia, 53 (44.2%) had diarrhea and 26 (21.7%) had encephalitis.

The findings of our study align with previous research, reinforcing the significant burden of measles and its complications, particularly in malnourished pediatric populations. The high prevalence of pneumonia and other severe complications such as gastroenteritis, conjunctivitis, and encephalitis highlights the urgent need for vigilant monitoring, early diagnosis, and timely intervention. These measures are essential to reduce the morbidity and mortality associated with measles, especially in resource-limited settings where the disease remains a substantial public health challenge. Further studies are necessary to explore the underlying factors contributing to the variability in complication rates and to develop targeted strategies for mitigating the impact of measles in vulnerable populations.

CONCLUSION

It is to be concluded that pneumonia emerged as the most common complication of measles, followed by conjunctivitis and gastroenteritis. These complications emphasize the need for vaccination and early intervention. Further research is crucial to understand contributing factors and improve public health strategies in pediatric care.

Conflict of Interest: Authors declare that there is no conflict of interest.

Authors' Contributions: The successful completion of the research was the result of the collaborative efforts of all authors. **Rehman A;** led the study design and manuscript preparation. **Shaikh AS;** was responsible for data analysis and statistical evaluation. **Bhojwani SL;** managed patient recruitment and data collection. **Lal S;** worked on the discussion section, contributing to the interpretation of results. **Altat T;** provided feedback and contributed to the revision of the manuscript. Each author played a crucial role in advancing the study and its findings.

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