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Prevalance of HIV in Children with Severe Acute Malnutrition Admitted in Children Hospital PIMS

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ABSTRACT

Background: Malnutrition contributes to about half of the mortality in children. HIV infection in children suffering from severe acute malnutrition (SAM) is a major health concern, especially in areas where both illnesses are prevalent. HIV and malnutrition have a synergistic effect on the immune system and general health, increasing risk of death and major complications. Our study focuses on finding prevalence of HIV infection in children admitted with severe acute malnutrition in a tertiary care hospital in Pakistan. **Methodology:** After taking informed consent from parents/guardians 140 children aged 6month to 5 years admitted with SAM were enrolled. After counselling of parents regarding HIV testing and written consent patients were tested for HIV via rapid HIV antibody test. If a child was found to be positive for HIV their parents were tested for HIV and the child registered in HIV center for management. The demographic data, HIV test results and anthropometric measurements of patients were entered in a preformed performa and data analyzed using SPSS 27. **Results:** In our study, 6 patients (4.3%) out of the 140 children admitted with severe acute malnutrition, had HIV. All SAM patients with HIV had a vertical HIV transmission pathway. Compared to the overall HIV incidence in Pakistan, the prevalence of HIV among children with SAM is significantly higher. **Conclusion:** Children who suffer from severe acute malnutrition are far more likely to be HIV-positive, this necessitates routine HIV screening.

INTRODUCTION

Malnutrition is still a significant public health concern in undeveloped and developing nations. It is more common in the pediatric population. It's responsible for half of the world's child mortality rate. Even with Pakistan's social and economic progress, the country still has a high rate of malnutrition.[1] Stunting affected an estimated 149 million (21.9%) children under the age of five in 2018, while wasting affected 49 million (7.3%) in the same age group. Globally, undernutrition was linked to approximately 45% of all under 5 deaths among children.[2]

Four out of ten children under five are stunted, 17.7% have wasting, and nearly one in three are underweight (28.9%); according to Pakistan's 2018 National Nutrition Survey. Low birth weight, inadequate and exclusive breastfeeding, inappropriate supplemental feeding, maternal education, inadequate nutrition knowledge/micronutrient intake, food insecurity, parity, birth spacing, vaccination, infectious diseases, household socioeconomic status and poor sanitation are some of the factors that contribute to malnutrition.[1]

The World Health Organization (WHO) defines severe acute malnutrition (SAM) as having a weight-for-height z-score of less than -3, a mid-upper arm circumference (MUAC) of less than 11.5 cm in children between the ages of 6 months and 5 years, or bilateral pitting edema.[3]

HIV is a pandemic that continues to grow in developing countries. It is becoming a public health challenge especially in resource poor settings where the disease is stigmatized. According to UNICEF out of the estimated 39.9 million people infected with HIV in 2023, 1.4million were children aged 0-14.[4,5] Everyday 120 000 children became newly infected with HIV and

approximately 76 000 children died from AIDS related factors. In 2019, an estimated 1.9 million HIV cases among children 0-19 years were reported from eastern and southern Africa; and 120000 from south Asia.[6] In Larkana, Pakistan, an HIV screening camp for all ages was set up in April 2019 due to an abnormally high number of pediatric HIV cases found. In Larkana district, this was the fourth reported outbreak of HIV since 2003. The region is also known for its famine and droughts and a high prevalence of malnutrition. The overall HIV prevalence in a study conducted on the outbreak was 3%, with 7% of children aged 0–2 and 6% aged 3–5 years.[7]

In regions with high HIV prevalence, HIV infection in children having severe malnutrition is a critical issue. Children under five with SAM having HIV face up to three times higher mortality rates during treatment for SAM compared to HIV-negative children. This is likely due to complications like persistent diarrhea, opportunistic infections, and weakened immune systems. The challenges of managing HIV are also increased due to SAM, due to poorer responses to antiretroviral therapy (ART) and increased rates of immune reconstitution inflammatory syndrome (IRIS) after ART initiation.[8,9]

It is thought that HIV infection and malnutrition are linked in a vicious cycle that results in immunosuppression. When both disorders coexist, their effects on mortality are synergistic.[10] It can be clinically challenging to differentiate malnutrition from AIDS because of their comparable presentation. The World Health Organization (WHO) actually considers severe unexplained wasting, stunting, and severe malnutrition that does not respond to standard medication as stage 4 AIDS conditions.[11]

Little work has been done on HIV in pediatric population in Pakistan. HIV screening of children having severe acute malnutrition will help us determine the disease burden and determine how common the coexistence of the two conditions is.

METHODS

After taking proper approval from the ethical review board of our institute, we carried out a Cross-sectional prospective study in Children Hospital, Pakistan Institute of Medical Sciences, Islamabad over a period of 2 years from May, 2022 to April, 2024. Total 140 Children aged between 6months to 5 years admitted with SAM were enrolled in our study after written consent from parents/guardians. If parents refused HIV testing of child and children already diagnosed with HIV were excluded. We used non-probability consecutive sampling for enrollment of patient.

Sample size of 140 was calculated by using WHO calculator, with 95% confidence level and anticipated population proportion is 0.216, absolute precision is 7%.[12]

Patients were diagnosed with Severe acute malnutrition according to World Health Organization (WHO).[3] The admitting physician used a beam weighing scale to measure the patients' weight, a stadiometer or infantometer to measure their height or length, a measuring tape to measure their head circumference, and a Shakirs strip to measure their mid-arm circumference.

All hospitalized children received counseling in accordance with the malnourished children's unit management protocol. A trained laboratory scientist obtained the patients' blood samples and used two quick HIV antibody tests (Determine and Uni-gold) to check for HIV infection. When a child was found to be HIV positive, parents were counselled, HIV testing of parents done and child was registered in the HIV center of the institute for further management.

Each patient enrolled in our study underwent a physical examination and a history of presenting illness, with particular attention paid to the existence of skin diseases, hepatomegaly, splenomegaly, diarrhea, pneumonia, oral thrush, pedal edema, fever, and lymphadenopathy. All pertinent laboratory, sociodemographic, and clinical data were entered in a performa created for our study. The data was then entered and analyzed using SPSS version 27.

RESULTS

The results of our study indicate that out of 140 children admitted with severe acute malnutrition 6 patients were HIV positive which shows a frequency of 4.3% (figure 1). The mode of HIV transmission in all SAM patients who were HIV positive was vertical, mothers were also found to be HIV positive. SAM patients who were HIV-positive tend to be older with mean age of 27.33 months ± 14.18 vs 17.53 months ± 11.47 for HIV Negative patients. No difference was found in weight-for-height Z scores between the two groups, weight-for-Height Z score for HIV Positive patients was -4.49 ± 0.78 as compared to HIV Negative -4.15 ± 0.79. All patients who were HIV positive and majority of HIV negative patients (112 patients) had Mid-Upper Arm Circumference (MUAC) < 11.5 cm. Only 22 HIV negative SAM patients had MUAC > 11.5 cm which shows that MUAC measurements between HIV positive and HIV negative patients were comparable. As weight-for-height Z scores or MUAC of both HIV positive and HIV negative patients were comparable, this indicates that both groups were similarly affected by malnutrition relative to their body proportions. (Table 1)

Half of SAM patients who were HIV positive were male and half female. Of the HIV negative SAM patients 44.7% male and 55.3% female. Majority of patients with SAM belonged to middle socio-economic status. The gender, socio-economic status, and area of residence

distribution did not differ significantly between HIV-positive SAM patients and HIV-negative SAM patients.

Table 3 compares the signs and symptoms observed in HIV-positive and HIV-negative patients having severe acute malnutrition (SAM). Overall, the clinical presentations were largely comparable. Both HIV positive and HIV negative patients commonly presented with fever, diarrhea, cough, lethargy, pallor, and oral thrush, though frequencies were slightly higher in HIV-negative patients. The most common presenting symptom in both HIV-positive SAM (66.7%) and HIV-negative SAM (87.3%) patients was fever. Splenomegaly occurred less frequently in both groups. Hepatomegaly was observed in 66.7% of HIV-positive SAM patients and 47% of HIV-negative SAM patients. SAM with edema was more frequent in those having HIV (66.7%) as compared to HIV-negative SAM patients (48.5%). Over all the clinical presentation of HIV-positive SAM patients and HIV-negative SAM patients were comparable. Both groups exhibit overlapping clinical presentations, reflecting the severe impact of malnutrition on general health.

Similar trend of prevalence of most associated diseases like Ear infections, pneumonia, UTI, pulmonary TB, and severe anemia was found in HIV-positive SAM and HIV-negative SAM children. The most notable finding is the higher prevalence of sepsis in the HIV-negative SAM patients compared to the HIV-positive SAM patients. This suggests that SAM patients are at higher risk for sepsis but HIV infection does not predispose significantly to it.

Table 1

Showing Prevalence of HIV in Pediatric Patients Admitted with Severe acute Malnutrition.

Baseline Anthropometric measurements		HIV Positive Mean ± SD	HIV Negative Mean ± SD
Age (months)		27.33 ± 14.18	17.53 ± 11.47
Height (cm)		80.0 ± 7.07	66.78 ± 9.9
Weight (kg)		8.0 ± 1.5	5.4 ± 1.7
Weight for height z score		-4.49 ± 0.78	-4.15 ± 0.79
MUAC	<11.5	6	112
	>11.5	0	22

Figure 1

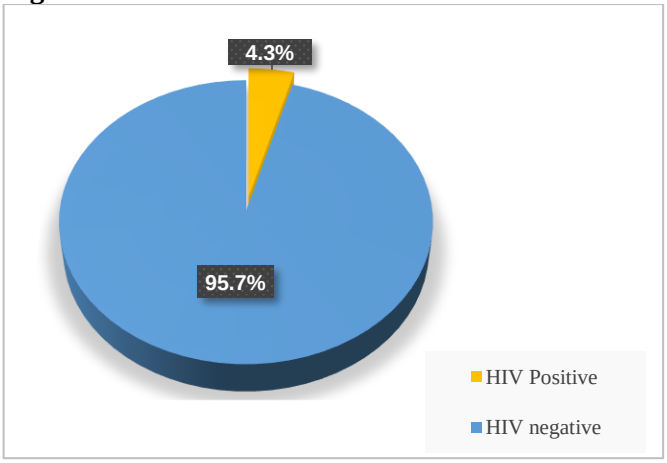

Table 2

Qualitative baseline characteristics of HIV positive SAM and HIV negative SAM patients.

Qualitative Baseline Characteristics		HIV Positive Frequency n=6	HIV Positive Percentage %	HIV Negative Frequency n=134	HIV Negative Percentage %
Gender	Male	3	50	60	44.7
	Female	3	50	74	55.3
Socio-Economic	High	1	16.7	25	18.7
	Middle	3	50	91	67.9
	Low	2	33.3	18	13.4
Area	Rural	3	50	65	48.5
	Urban	3	50	69	51.5

Figure 2

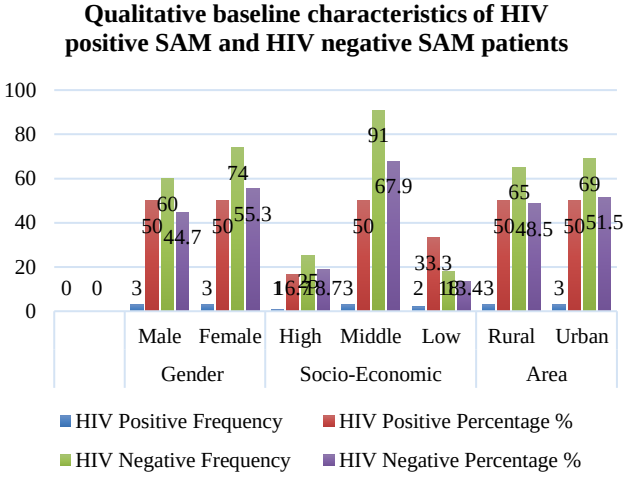

Table 3

Comparison of Signs and symptoms of HIV positive SAM and HIV negative SAM patients.

Signs and symptoms	SAM with HIV positive Frequency n=6	SAM with HIV positive Percentage n=134	SAM with HIV negative Frequency n=6	SAM with HIV negative Percentage n=134
Fever	4	66.7	117	87.3
Diarrhea	4	66.7	55	41.0
Vomiting	2	33.3	54	40.3
Cough	4	66.7	44	32.8
Poor Feeding	3	50	87	64.9
Difficulty breathing	2	33.3	58	43.3
Lethargy	4	66.7	44	32.8
Pallor	5	83.3	116	86.6
Oral thrush	4	66.7	68	50.7
Edema	4	66.7	65	48.5
Rash	2	33.3	36	26.9
Dehydration	0	0	18	13.4
Lymphadenopathy	0	0	9	6.7
Hepatomegaly	4	66.7	63	47
Spleenomegaly	1	16.7	8	5.9

Figure 3

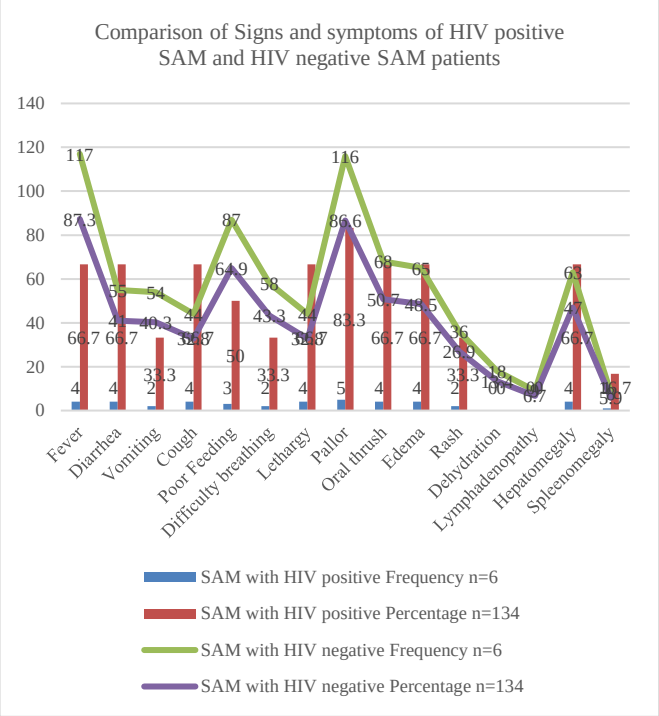

Table 4

SAM patients with associated diseases.

Associated diseases	SAM with HIV positive n=6		SAM with HIV negative n=134	
	Frequency	Percentage	Frequency	Percentage
Ear Infection	o	0	4	2.9
Pneumonia	2	33.3	49	36.6
UTI	0	0	14	10.4
Pulmonary TB	0	0	22	16.4
Severe anemia	2	33.3	54	40.3
Sepsis	1	16.7	104	77.6

DISCUSSION

To our knowledge, no similar study to find prevalence of HIV in pediatric population with severe acute malnutrition has been conducted in Pakistan. Studies regarding this topic are lacking even internationally. The results of our study show that 4.3% of children who suffer from severe acute malnutrition also have HIV. This compared to the incidence in general population in Pakistan is quite high, which was 0.2% in 2022.[13] There is no similar data regarding HIV prevalence in children in Pakistan to which we could compare the results of our study.

A study done in India showed that HIV prevalence among children with severe acute malnutrition was as high as 21.7%. This study recruited 175 malnourished children aged 1.5-12 years from a hospital setting over a period of 1.5 years and screened the children and their mothers for HIV infection after informed consent. The study also concluded that majority of patients with malnutrition who were HIV positive had vertical transmission (94.7% of cases).[14]

A Cross-sectional prospective study conducted at a nutritional rehabilitation unit in Ghana included children having severe acute malnutrition aged 3 months to 13 years and tested them for HIV. The study found HIV seroprevalence of 27.2% among children with severe acute malnutrition.[15] This is quite high compared to the HIV prevalence in general population, adults above 15 years, in Ghana which was 1.5% in 2023.[16] The study also showed a significantly higher mortality rates in HIV seropositive children of 37.8% (25/67) versus 10.1% in HIV seronegative patients with p value < 0.001.[15]

The burden of HIV infection in children under five who suffer from severe acute malnutrition was evaluated in a prospective study carried out in Nigeria. The research population had an extremely high HIV prevalence of 69.6%.[17] Nigeria ranks fourth in the world for HIV infection, and the high frequency of HIV among children under five with SAM in this study may be a reflection of the country's generally high HIV burden.[18]

A cross-sectional study conducted in 12 representative Nutrition Rehabilitation Units (NRUs) across Malawi, including both rural and urban settings. Over a two-week period, all children admitted to these NRUs, along with their caretakers, were offered HIV counseling and testing. HIV prevalence among children tested was 21.6% with considerable variation in HIV prevalence across the different Nutrition Rehabilitation Units, ranging from 2.0% to 50.0%.[12]

As seen from all these studies the HIV prevalence in children with malnutrition is much higher than in general population. The malnourished state predisposes to opportunistic and other infections. HIV infection in turn causes worsening of the malnourished state. HIV infection significantly weakens the immune system, increasing a child's vulnerability to a number of illnesses, particularly opportunistic infections that flourish in undernourished people.[19] HIV infection can harm the gut lining, which results in decreased absorption of nutrients. This weakens the immune system even more and makes malnutrition worse.[20] HIV infection raises the body's metabolic needs, which further depletes malnourished children's already meager nutritional store. HIV infection causes persistent inflammation, which can worsen malnutrition and lead to nutritional loss.[21]

Compared to children who only have SAM, children who have HIV with SAM are at a much higher risk of morbidity and mortality. Weakened immunity, poor nutrition, and elevated metabolic needs all contribute to this elevated risk.[15,19] Sub-Saharan Africa region is the most affected by this catastrophe, while the global impact varies greatly among regions. Particularly affected are those with high rates of malnutrition and high HIV prevalence.[6]

Complex treatment plans, such as antiretroviral therapy (ART) for HIV and therapeutic food for

malnutrition, are necessary to manage both HIV and SAM. Caregivers may find it difficult to follow complicated treatment plans, particularly in environments with limited resources. Access to high-quality healthcare services, such as diagnosis, treatment, and nutritional support, may be limited for many children in need of care.[22]

Improving the health and survival of these susceptible children requires integrated care strategies that target both HIV and malnutrition. This entails addressing underlying social/economic causes, providing nutritional support, diagnosing and treating both disorders promptly.[23]

For children having SAM, HIV infection dramatically increases the risk of morbidity and mortality. To tackle this intricate problem, a multifaceted strategy is needed, which consists of initiatives to prevent HIV (especially vertical/Mother to Child Transmission), enhancing these children's access to high-quality medical treatment, putting in place integrated care initiatives that take HIV-related factors and nutritional requirements into account.

According to WHO guidelines, HIV testing should be available to all groups visiting health care facility for TB, hepatitis, STI, children under five, immunization, malnourishment, and emergency care in any high prevalence region. For low prevalence settings it is recommended to test for HIV in adults, adolescents, or children who show up with symptoms or illnesses that can point to HIV infection, such as TB and STIs; Key populations and their partners; all pregnant women; children exposed to HIV; and babies and children exhibiting symptoms.[24] As pointed out by the results of our study that HIV prevalence in children with SAM is much higher even in low HIV prevalence country like Pakistan, so HIV testing should be routine in malnourished children.

CONCLUSION

HIV infection has much higher prevalence in children with severe acute malnutrition. HIV infection makes the symptoms worse and treatment difficult for SAM. This calls for routine screening of children with SAM for HIV infection.

Limitations

Our study was conducted at a single center and included a small sample size. It did not account for disease progression and mortality of patients. Larger, multicenter studies are required to address this.

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