International Journal of Research in Medical Sciences
Shukla O et al. Int J Res Med Sci. 2017 Mar;5(3):1078-1083
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20170665

Original Research Article

Clinical and microbiological profile of pneumonia in severe acute malnourished children

Omprakash Shukla[1], Reema Dave[1], Rajkumar Prakashbhai Doshi[2]*

[1]Department of Paediatrics, Medical College Baroda and Sir Sayajirao Gaikwad General Hospital Gujarat, India
[2]Department of Medicine, NorthShore University Hospital, New York, United States

Received: 06 January 2017
Revised: 09 January 2017
Accepted: 06 February 2017

***Correspondence:**
Dr. Rajkumar Prakashbhai Doshi,
E-mail: raj20490@gmail.com

ABSTRACT

Background: It is estimated that 57 million children are underweight (moderate and severe) in India. More than 50% of deaths in 0-4 years are associated with malnutrition. Pneumonia is common in malnourished children and is frequently associated with fatal outcome, especially in children younger than 24 months of age. The aim and objectives was to evaluate the clinical and microbiological profile of pneumonia in severe acute malnourished children.
Methods: A cross sectional study was carried out on 60 severe acute malnourished children admitted at Department of Pediatrics, SSG Hospital Vadodara.
Results: Most of the admitted children belonged to rural and tribal areas (81.7%). Children in the age group of 1-3 years were more prone to develop very severe pneumonia (51.7%). Blood culture yield was 80%. Most common isolate was *Staphylococcal Aureus* which was isolated in 16.6% of the patients.
Conclusions: We concluded at the end of the study that malnourished children were prone to develop more severe pneumonia, required aggressive antibiotic usage as the causative organisms were strikingly different as compared to well-nourished children and needed a longer hospital stay.

Keywords: Lower respiratory tract infection, Malnutrition, Pneumonia, Pediatric

INTRODUCTION

Children who are malnourished have higher incidence and severity of infections due to deterioration of immune function, limited production and/or diminished functional capacity of all cellular components of the immune system.[1] Hence, the risk of fatal outcome is high when children with pneumonia have co-morbidity of severe acute malnutrition, increasing the fatality 15 times compared to those who do not have severe acute malnutrition. Also, the bacterial pathogens causing pneumonia in severe acute malnourished children are different than the ones in well-nourished children therefore the former require aggressive and specialized care.[2]

We at Sir Sayajirao Gaikwad Hospital, Vadodara receive several such patients. We enrolled all the children who met our inclusion criteria, sent laboratory investigations and treated them with parenteral antibiotics to study and identify the clinical and microbiological profile of pneumonia in these children.

Early recognition of malnutrition, respiratory difficulty and prompt treatment with culture sensitive antibiotics may prove very useful in reducing the morbidity and the

mortality of pneumonia related deaths in children with severe acute malnutrition. This study was a small step towards achieving this goal.

METHODS

Study design

An observational study was conducted in the Department of Pediatrics, Medical College & S.S.G. Hospital, Vadodara over a period of 9 months (March 2015-November 2015). A total number of 60 patients in the age group 6 months to 59 months with severe acute malnutrition (SAM) were included in this study who had presented with clinical features of mainly lower respiratory tract infection. Detailed history of the illness and examination was conducted according to a questionnaire prepared for the purpose of study. The children who met the inclusion criteria were included in the study.

Inclusion criteria

- Patients in age group from 6 to 59 months with severe acute malnourishment having symptoms of pneumonia clinically admitted in Department of Pediatrics, SSGH, Vadodara.
- Pneumonia Identified on routine chest X-ray.

Exclusion criteria

- Children below 6 months and above 59 months.
- Wheezing was an exclusion criterion, in infants as it is more likely a sign of bronchiolitis, wheezy bronchitis/asthma exacerbation rather than pneumonia.[4]
- Parents/guardians not willing to enroll the child.

Pneumonia was diagnosed by the presence of cough or difficult breathing and fast breathing. Severe pneumonia was diagnosed by lower chest wall in drawing and very severe pneumonia was diagnosed by danger signs such as refusal to feed, cyanosis, lethargy and convulsions.

Within half an hour of arrival to pediatric emergency, a standardized history including symptoms, past history, family & immunization history with demographic data - age and sex, a physical examination including anthropometry and presence or absence of various clinical symptoms and signs namely tachypnea, respiratory distress, central cyanosis, nasal flaring, inability to feed and auscultatory signs like wheeze, rhonchi & crepitations was recorded.

Blood culture was collected with proper aseptic & antiseptic precautions before starting antibiotic therapy. All patients were started on humidified oxygen, par enteral first line antibiotics and intra gastric feeds (except 7 patients who were received with shock in whom SAM with shock protocol guidelines were followed for intravenous fluids and inotropes). The clinical assessment was done daily for signs of improvement. Antibiotics were changed, if required per clinical response & blood culture report.

Once the patients were stabilized they were weaned off from oxygen therapy and micronutrient supplementation was started. Discharge was given when they met discharge criteria per NRC guideline.

RESULTS

The present study was carried out in the Department of Pediatrics, Medical College and S.S.G. Hospital, Baroda from March 2015 to November 2015 over a period of 9 months. Total 60 patients were enrolled in the study.

In our study, 36.7% of the patients presented during infancy, 45% presented between 1 year to 3 years of age (toddler age group) and 18.3% presented between 3 years to 5years (preschool age group). The most common sign was tachypnea, present in 93% of the patients followed by respiratory distress (83%) and hypoxia (58%), fever (>38.5°C) (18%) and cyanosis (8%). All patients presented with anemia. 58% of the patients had severe anemia. Moderate anemia was noted in 40% and mild anemia in 2%. Nutritional and socio-economic factors were responsible for anemia in present study. Hypoxia was more common in very severe pneumonia (69%). There was a significant association of Spo_2 at admission with the severity of pneumonia. Hence $Sp0_2$ monitoring is useful in diagnosing very severe pneumonia and severe pneumonia. In clinical signs, the clinical predictors of severe pneumonia were respiratory distress (chest in drawing and nasal flaring) and cyanosis. There is a significant association between breathing difficulty / chest in drawing, refusal to feed, cyanosis and hypoxia with severity of pneumonia. Cough (dry/wet) was the predominant symptom found in 98% of patients, followed by fast breathing (95%) and fever (90%).

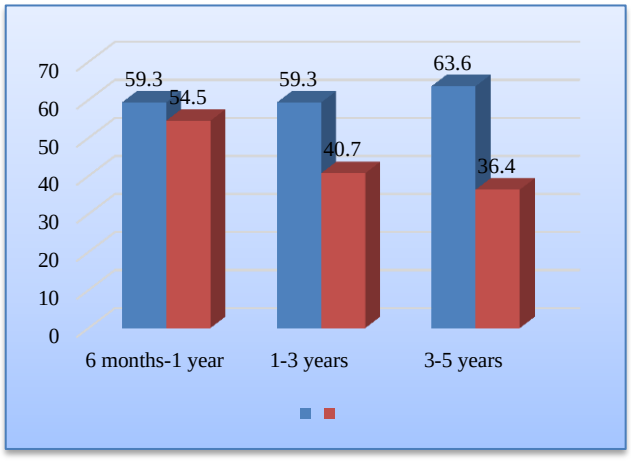

Figure 1: Comparison of number of males and females according to age on admission.

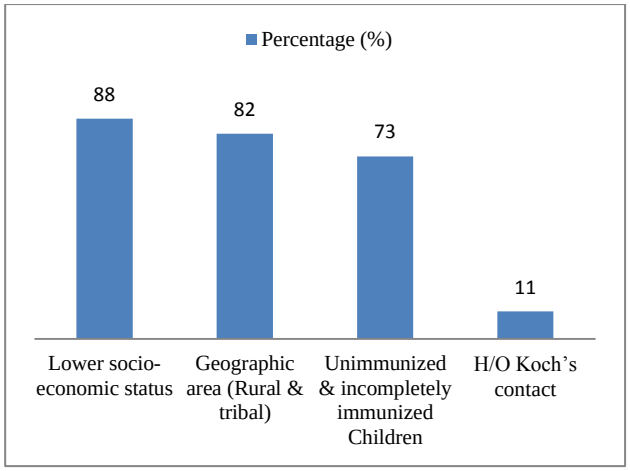

Figure 2: Distribution according to risk factors other than malnutrition.

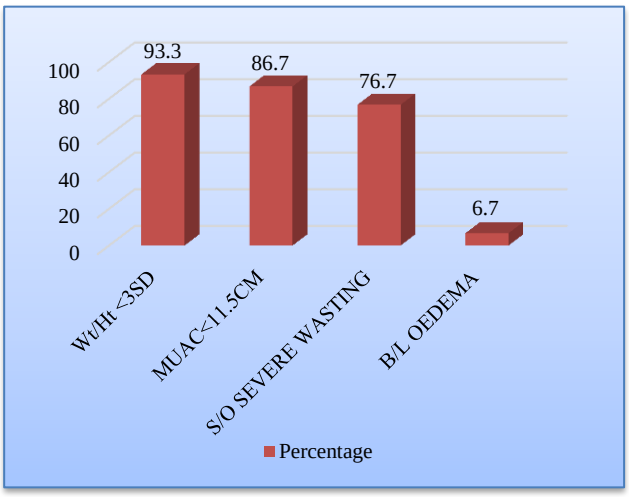

Figure 3: Distribution according to SAM criteria fulfilled (WHO guidelines).

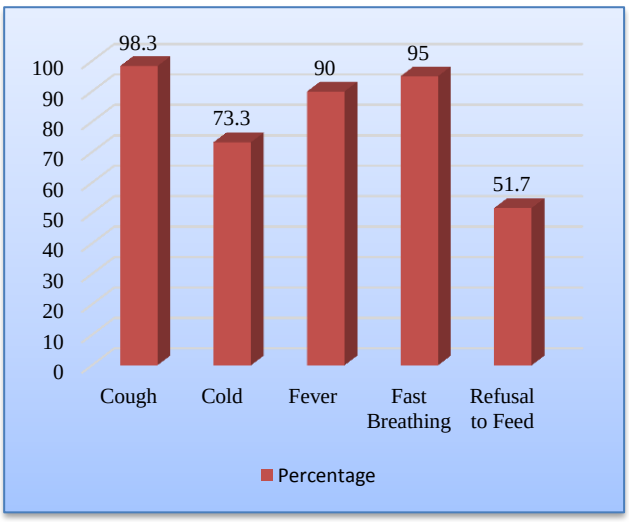

Figure 4: Mode of presentation (symptoms).

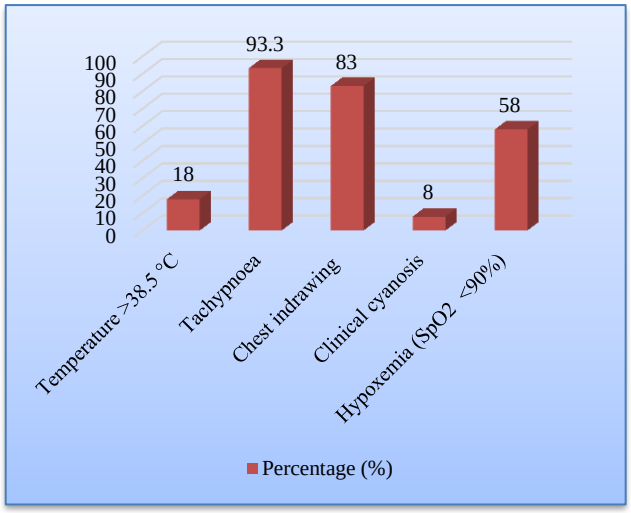

Figure 5: Mode of presentation (signs).

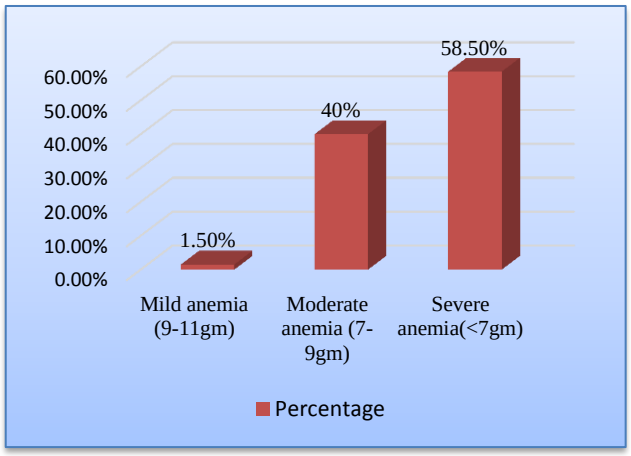

Figure 6: Distribution according to anemia status of the patients.

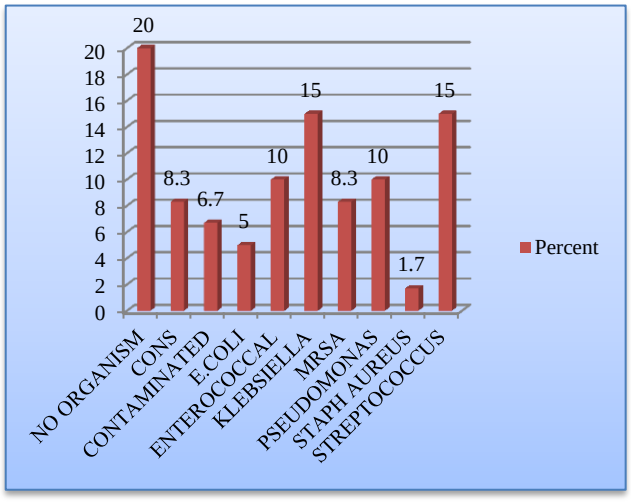

Figure 7: Blood culture and sensitivity pattern of the patients enrolled in our study.

DISCUSSION

A study conducted by Arpitha G, Rehman MA, Department of Pediatrics, Mamata Medical College, Khammam, Telangana, India in the year 2014 showed that 24% of children were infants, 66% belonged to the age group of 1-3 years and only 10% were between 3-5 years.[5]

According to a study conducted by Elsayh KI, Sayed DM at the Department of Pediatrics, Assiut University, Egypt in 2013, the mean age of malnourished children was 14.39±6.89 months.[6]

Our study showed that 45% of cases were male and 55% cases were females attaining Male to Female ratio of 0.8:1.

According to a study conducted by Elsayh KI, Sayed DM at the Department of Pediatrics, Assiut University, Egypt in 2013, the male to female ratio was 0.8:1 which was comparable to our study.[6] However, a study conducted by Arpitha G at Department of Pediatrics, Telangana, India showed a male preponderance with a sex ratio of 1.05:1.[5]

Table 1: Incidence of common symptoms in other studies.[2]

Symptoms	Arpitha G, Rehman MA, et al[5]	Present Study
Place & Year	Mamta medical college Telangana 2014	Medical College, Baroda-2015
Cough	95%	98%
Fast breathing	90%	95%
Fever	72%	90%
Inability to feed	15%	52%

Study of other risk factors in the study apart from malnutrition

Our present study showed high incidence of pneumonia in lower socio-economic class, rural area, and unimmunized children. History of Koch's contact was present only in 11% of cases.

According to a study conducted by Rudan et al in 2008, malnutrition, lack of immunization, overcrowding, past history of measles infection, lower socio economic status are the risk factors for pneumonia.[7]

According to a study conducted by Savitha MR et al, Mysore, 2005, the risk factors for pneumonia were malnutrition (PEM III &IV - 21.15%), lower socioeconomic status (99.0%) and lack of immunization (21.15%) which is comparable to our study.[8]

A study conducted by Arpitha G in 2014 at Telangana also showed lower socioeconomic status and lack of exclusive breast feeding as an important risk factor for pneumonia in severe acute malnourished children. Most of the children with pneumonia belonged to class V of the modified Prasad classification.[5]

Out of the 60 patients admitted at SSG Hospital, Vadodara and enrolled in our study, only 4 (6.7%) patients presented with bilateral pedal edema and the rest 56 (93.3%) fulfilled weight/height<-3SD criteria. Mid upper arm circumference of less than 11.5 centimeters and signs of severe wasting were seen in 86.7% and 76.7% of children respectively.

Cough (dry/wet) was the predominant symptom found in 98% of patients, followed by fast breathing (95%), fever (90%). Less common symptoms were cold (73.3%) and inability to feed (51.7%).

The above-mentioned study conducted by Arpitha G, Rehman MA et al 2014 specifically undertook the study of pneumonia in malnourished children and their findings were similar to ours except for the mode of presentation as fever which was 66% in their study as against 90% in our study.[5]

The above table shows that tachypnea was the most common finding, present in 93% of pneumonias followed by distress (83%) and hypoxia (58%), fever (>38.5°C) (18%) and cyanosis (8%).

Hypoxemia was defined as an arterial oxygen saturation of <90% recorded by a portable pulse oximeter. Since many studies have demonstrated a low predictive value of clinical signs of hypoxemia, pulse oximetry is the optimal approach to determine the need for and response to oxygen therapy.[9] Early detection of hypoxemia by pulse oximetry and effective treatment of hypoxemia by oxygen therapy is an important component of in-patient management of pneumonia.

According to WHO, tachypnea may not be present in a child in whom pronounced retractions or any other signs of increased work of breathing are present.[10]

The patients were categorized into mild, moderate and severe anemia according to WHO classification. 58% of the patients had severe anemia. Moderate anemia was noted in 40% and mild anemia in 2%.

In a study conducted by Léon G. Blaise Savadogo et al in the year 2014 at Burkina Faso, 85.3% of included malnourished children had anemia (Hb≤11 g/dl) and 10.6% had severe anemia.[11]

According to WHO, Anemia is a frequent complication for the children with severe acute malnutrition.[12] Nutritional and socio-economic factors were responsible for anemia in the present study.

According to British thoracic guidelines blood cultures should be performed in all hospitalized children suspected of having bacterial pneumonia.[13]

In the present study, blood culture was sent in 60 patients and the culture yield was 80%. No organism was isolated in 20% of cases and 15% had positive culture for Klebsiella and Streptococcus each. Thus, Klebsiella and streptococcus are the prominent organisms in the present study, followed by Pseudomonas and Enterococcus (10%), MRSA (8.3%), CONS (8.3%), E. coli (5%) and Staphylococcus Aureus (1.1%). About 6% of the blood cultures came out to be contaminated.

In all four studies originating from Nigeria (Diallo et al, Johnson et al, Fagbule 1993) *S. aureus* was a relatively common isolate, accounting for 14–30% of the cases.[14-16] In one of these studies *(Fagbule)* Klebsiella species were isolated in 39% of the cases, while these organisms were significantly less frequent in the other three studies from the same country (Diallo et al, Johnson et al).[14-17] However, similar findings were reported by studies from Ethiopia (Shimeles & Lulseged 1994) and South Africa (Berkowitz1983), in which Klebsiella species were identified as the causative agent in 18% and 11% of the cases, respectively.[17,18] *Escherichia coli* was another relatively common isolate in some studies. In one South African study (Berkowitz 1983) this organism accounted for 11% of the isolates.[18] However, the total number of isolates in this study was small, and solid conclusions could therefore not be made. Strikingly, *Streptococcus pneumoniae* was not isolated from any case in three studies including a total of 206 patients (Johnson et al; Fagbule, Shimeles & Lulseged) and only accounted for a small proportion of cases in a further four studies (Hughes et al, Morehead et al, Berkowitz, Johnson et al).[14,17-22] *Streptococcus pneumoniae* was a common isolate in only three reports, being responsible for 7–18% of the cases (Diallo et al, Friedl and Adegbola et al).[15,23,24] Similarly, only four of the eleven studies reported cases in whom Haemophilus influenza was identified as the causative agent (Hughes et al, Morehead et al, Friedland Adegbola et al).[20,22-24] Haemophilus influenza isolates were not typed in most studies.

Blood cultures may be helpful for inpatients with more severe, resistant, or other unusual forms of pneumonia. Their utility, however, is limited when antibiotics are administered prior to obtaining the specimen.[25]

CONCLUSION

The most common age group of presentation of pneumonia was from 1-3 years followed by 6months to 1 year and then 3 years - 5 years. The overall male to female ratio was 0.8: 1. The study shows that both malnutrition and pneumonia are more common in female children probability due to social and nutritional neglect of the girl child. 82% of patients were from lower socio-economic status. On logistic regression analysis, lower socio-economic class, rural area and unimmunized / partially immunized children remained as significant independent risk factors for pneumonia.

The present study showed that majority of the patients presented with very severe pneumonia (with chest in drawing with danger signs) (48%), followed by severe pneumonia (without danger signs) (35%) and pneumonia (with fast breathing) (17%). Hence, we can conclude that children with severe acute malnutrition have more chances of developing very severe pneumonia.

Klebsiella and Streptococcus are the prominent organisms in the present study, followed by *Pseudomonas* and *Enterococcus* (10%), MRSA (8.3%), CONS (8.3%), *E. coli* (5%) and *Staphylococcus Aureus* (1.1%). We concluded that the organism causing pneumonia in severe acute malnourished children differ from those in well-nourished children.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Guerrant, Richard L, Oriá RB, Moore SR, OB Oriá MO, Lima AAM. "Malnutrition as an enteric infectious disease with long-term effects on child development. Nutrition reviews.2008;66(9):487-505.
2. Leonor R, Cervantes E, Ortiz R. Malnutrition and gastrointestinal and respiratory infections in children: a public health problem. Int J Environmental Research and Public Health. 2011;8(4):1174-205.
3. Alcoba, Gabriel, Kerac M, Breysse S, Salpeteur C, Galetto-Lacour A, André Briend, Gervaix A. "Do children with uncomplicated severe acute malnutrition need antibiotics? A systematic review and meta-analysis." PLoS One. 2013;8(1):e53184.
4. Liu L, Johnson H, Cousens S, Perin J, Scott S, Lawn J, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. Lancet. 2012;379(9832):2151-61.
5. Arpitha G, Rehman MA, Ashwitha G. Effect of Severity of Malnutrition on Pneumonia in Childern Aged 2M-5Y at a Tertiary Care Center in Khammam, Andhra Pradesh: A Clinical Study. Scholars J Applied Medical Sciences. 2014;2(6E):3199-203.
6. Elsayh K, Douaa M, Asmaa M. Effects of pneumonia and malnutrition on the frequency of micronuclei in peripheral blood of pediatric patients. Epub. 2013;6(10):942-50.
7. Rudan I. Epidemiology and etiology of childhood pneumonia. Bulletin of the World Health Organization. 2008;86(5):408-16.

8. Savitha M, Nandeeshwara S, Pradeep Kumar M, Farhan-ul-haque, Raju C. Modifiable risk factors for acute lower respiratory tract infections. Indian J Pediatr. 2007;74(5):477-82.
9. Chisti M, Tebruegge M, La Vincente S, Graham S, Duke T. Pneumonia in severely malnourished children in developing countries - mortality risk, aetiology and validity of WHO clinical signs: a systematic review. Tropical Medicine & Int Health. 2009;14(10):1173-89.
10. Parker M. Integrated Management of Childhood Illness: A WHO/UNICEF Initiative. Supplement No. 1 to Volume 75 of the Bulletin of the World Health Organization. Pp. 128. (World Health Organization, Geneva, 1997.) US $18, ISBN 92-4-068750-5. J Biosoc Sci. 2000;32(3):421-32.
11. Savadogo L, Zoetaba I, Ilboudo B, Kinda M, Donnen P. Impact of Anemia on Mortality and Nutritional Recovery among Hospitalized Severely Malnourished Children in Burkina Faso. OJPed. 2014;04(01):115-20.
12. Cloete J. Management of severe acute malnutrition. S Afr Med J. 2015;105(7):605.
13. Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, Thomson A. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. Thorax. 2011;66(Suppl 2):1-23.
14. Johnson W, Aderele W, Gbadero D. Host Factors and Acute Lower Respiratory Infections in Pre-school Children. J Tropical Pediatrics. 1992;38(3):132-6.
15. Silverman M, Stratton D, Diallo A, Egler L. Diagnosis of acute bacterial pneumonia in Nigerian children. Value of needle aspiration of lung of countercurrent immunoelectrophoresis. Archives Disease in Childhood. 1977;52(12):925-31.
16. Fagbule D, Parakoyi D, Spiegel R. Acute Respiratory Infections in Nigerian Children: Prospective Cohort Study of Incidence and Case Management. J Tropical Pediatrics. 1994;40(5):279-84.
17. Naik SAS, AW, Saleem R. Demographic, clinical profile of severe acute malnutrition and our experience of nutrition rehabilitation centre at children hospital Srinagar Kashmir. Int J Contemporary Pediatrics. 2015;233-7.
18. Berman S. Epidemiology of Acute Respiratory Infections in Children of Developing Countries. Clinical Infectious Diseases. 1991;13(Supplement 6):S454-S62.
19. Johnson A, Osinusi K, Aderele W, Adeyemi-Doro F. Bacterial Aetiology of Acute Lower Respiratory Infections in Pre-School Nigerian Children and Comparative Predictive Features of Bacteraemic and Non-Bacteraemic Illnesses. J Tropical Pediatrics. 1993;39(2):97-106.
20. Hughes J, Sinha D, Cooper M, Shah K. Lung tap in childhood. Bacteria, Viruses and Mycoplasms in Acute Lower Respiratory Tract Infections. Pediatrics. 1978;3(4):210-4.
21. Fagbule D, Parakoyi D, Spiegel R. Acute Respiratory Infections in Nigerian Children: Prospective Cohort Study of Incidence and Case Management. J Tropical Pediatrics. 1994;40(5):279-84.
22. Morehead C, Morehead M, Allen D, Olson R. Bacterial Infections in Malnourished Children. J Tropical Pediatrics. 1974;20(3):141-7.
23. Babirekere-Iriso E, Musoke P, Kekitiinwa A. Bacteraemia in severely malnourished children in an HIV-endemic setting. Annals Tropical Paediatrics. 2006;26(4):319-28.
24. Adegbola R, Secka O, Lahai G, Lloyd-Evans N, Njie A, Usen S, et al. Elimination of Haemophilus influenzae type b (Hib) disease from The Gambia after the introduction of routine immunisation with a Hib conjugate vaccine: a prospective study. The Lancet. 2005;366(9480):144-50.
25. Kuppermann M, Goldberg J, Nease R, Washington A. Kuppermann et al. Respond. Am J Public Health. 1999;89(10):1592-3.

Cite this article as: Shukla O, Dave R, Doshi RK. Clinical and microbiological profile of pneumonia in severe acute malnourished children. Int J Res Med Sci 2017;5:1078-83.