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ORIGINAL ARTICLE

ASSOCIATION BETWEEN BREASTFEEDING AND CLINICAL OUTCOMES OF INFANTS WITH VERY SEVERE PNEUMONIA

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The authors declare that the data presented are original material and has not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by all authors, and all authors have met the requirements for authorship.

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ABSTRACT

Objective: To determine the association of breastfeeding with the clinical outcomes of infants with very severe pneumonia`.

Methods: This retrospective study included intubated, full-term infants between one to six months of age admitted for very severe pneumonia at the critical care units of the National Children's Hospital from 2005 to-2015. The 52 subjects per type of feeding (exclusively breastfed and non-exclusively breastfed) were selected using simple random sampling. We examined the association between the type of feeding with the length of ICU stay, ventilator days, health-care-associated infection (HAI) and mortality.

Results: A total of 104 infants were included in the study. The exclusively breastfed (EBF) infants stayed for a shorter amount of time in the ICU than the non-exclusively breastfed (NEBF) infants (p-value = 0.0067). The EBF infants had shorter intubation period and mechanical ventilation use (p value=0.001), and less HAI (p-value = 0.015). There were more infants with very severe pneumonia who died from the NEBF group but no significant association (p-value = 0.076) was found between mortality and the type of feeding.

Conclusion: Exclusively breastfed infants who were admitted for very severe pneumonia at the critical care areas showed better outcomes in terms of shorter ICU stay and ventilator use, and lower incidence of HAI as compared to the NEBF infants. However, data showed no significant association between mortality and type of feeding.

KEYWORDS:
Breastfeeding, very severe pneumonia,

INTRODUCTION

Breastfeeding and human milk are considered the normative standards for infant feeding and nutrition according to the American Academy of Paediatrics (AAP).[1-2] Breastfeeding also improves the infant and maternal health outcomes in both industrialized and developing world.[3] In the 2017 WHO fact sheet on infant and young child feeding, it was mentioned that over 820,000 of children under 5 years old could be saved yearly if all children 0-23 months were optimally breastfed.[4] Meanwhile, the 2012 Pneumonia and Diarrhea Report conducted by UNICEF stated that young infants who are not exclusively breastfed are at a greater risk of dying due to these two diseases. Infants who are not breastfed are 2 times more likely to have pneumonia and 15 times more likely to die from it than are exclusively breastfed children.[5]

Community-acquired pneumonia is a potentially serious infection in children that often results to hospitalization, and if severe, will require ICU admission.[6] Studies have shown that breastfeeding is a key intervention for reducing pneumonia morbidity and mortality during the first 23 months of life.[7] Meanwhile, non-breastfeeding or early cessation of breastfeeding increases the risk of acute lower respiratory tract infections and frequent hospitalization.[8-9] It also increases the incidence of hypoxemia and mortality in infants who have both pneumonia and diarrhea.[11-12]

Studies on breastfeeding in the Philippines are either on the practices and determinants of breastfeeding or factors affecting breastfeeding. Although there are local studies that show breastfeeding decreases morbidity and mortality of children from diarrheal and respiratory diseases[12], there is no study yet that shows the association of breastfeeding with that of the outcome of infant patients admitted for very severe pneumonia in critical care units of a hospital. This study aimed to determine whether breastfeeding has an association with improved health outcomes in infants, 1-6 months old, with very severe pneumonia.

Objective: This study aims to determine the association of breastfeeding with the clinical outcomes of infants with very severe pneumonia admitted at the Pediatric Intensive Care and Pulmonary Critical Care units from 2005 – 2015.

METHODS

This retrospective cohort analytical study determined the association of breastfeeding with the clinical outcomes of infant patients with very severe pneumonia in critical care units of a hospital. The baseline characteristics of exclusively breastfed and non-exclusively breastfed infants were compared according to gender, age, weight on admission, nutritional status, and baseline chest x-ray result. The clinical outcomes of infants in terms of length of ICU stay, mechanical ventilator days, the incidence of HAI and mortality were determined.

Study subjects were full-term infants, 1 – 6 months old admitted for very severe pneumonia in the Pediatric intensive care (PICU) and Pulmonary Critical care units (PCCU) of the National Children's Hospital from 2005 - 2015.

Inclusion criteria: Intubated term infants, 1-6 months old diagnosed with very severe pneumonia either directly admitted at the PICU/PCCU or admitted at the ward and transferred to any of the critical care units in less than 24 hours.

Patients who had major congenital abnormality or dysmorphic features likely to affect the life expectancy; major neurologic conditions; chronic respiratory disease (bronchopulmonary dysplasia); surgical (abdominal wall defects, short bowel syndrome) or medical (necrotizing enterocolitis) conditions

that need surgical intervention; and severe malnutrition were excluded.

Data that were collected from patients included the following: gender; age; gestational age at birth; maternal age; parity and illness during pregnancy; feeding history and duration of breastfeeding; weight upon admission; length and weight-for-length z-score; nutritional status upon admission; baseline chest radiography result; length of ICU stay; ventilation days; presence of healthcare-associated infection; and mortality. The treatment given for both groups were not taken into account. We assumed that patients were given standard regimen for very severe pneumonia.

Infants were grouped depending on their type of feeding, whether they are exclusively breastfed, or non-exclusively breastfed. Exclusive breastfeeding was defined in this study as no other food or drink, not even water, except breastmilk (including milk expressed or from a wet nurse) from birth up to day of discharge, even if patient is placed on NPO temporarily for medical indication/s, but allows the infant to receive ORS, drops, and syrups (vitamins, minerals, and medicines). Non-exclusive breastfeeding, on the other hand, was defined as either formula-feeding or mixed feeding.

The number of subjects to be included was computed using a 95% level of confidence and 80% power of the study. Fifty-two subjects per type of feeding—exclusively breastfed and non-exclusively breastfed, were enrolled in the study to detect a 20% reduction in infection. A similar ratio was used in the study of Patel, et al.[13]

Charts of 109 patients were reviewed. The subjects were grouped under two clusters: 54 subjects under exclusively breastfed, and 55 subjects under the non-exclusively breastfed. From each cluster, 52 patients were selected by simple random sampling using RAND function in Microsoft Excel.

Data analysis was based on the following tests: Mean and SD for age, admission weight, and length of ICU stay; Two-sample T-test with equal variances (for age, weight and length of ICU stay); and Fisher's exact test to examine the significance of association between two kinds of classification (for gender, nutritional status, duration of ventilator use, health-care-associated infection and mortality).

RESULTS

The infant's characteristics like gender, age, weight on admission, length, weight-for-length Z-score, and baseline chest radiography result were compared according to the type of feeding and shown in Table 1.

The mean age of exclusively-breastfed infants was 1 - 4 months old as compared to the mean age of the non-exclusively breastfed which was 1.5 – 5 months old. Using 5% significance, there was statistical significance between the ages of the two groups. The exclusively-breastfed group was younger (P-value = 0.037) than that of the non-exclusively breastfed group.

There was no significant difference (P value = 0.383) in the mean weights of both groups.

For nutritional status, 38 out of 52 (73%) exclusively breastfed infants and 39 out of 52 (75%) non-exclusively breastfed infants had normal nutritional status. There was noted more infants that were overweight in the exclusively breastfed group (10%) than that of the non-exclusively breastfed (6%), while there were less 'wasted' infants in the exclusively breastfed group (17%) than that of the non-exclusively breastfed (19%) group. However, the analysis showed that there was no significant difference (P value = 0.754) in the nutritional status of both groups.

Comparing the baseline chest x-ray, results showed that more infants in the non-exclusively breastfed group (27%) had complicated

pneumonia as compared to the exclusively breastfed infants (5.8%). Using a one-sided Fisher's exact test (P value=0.003), the exclusively breastfed group was found to have better x-ray results than the non-exclusively breastfed group.

Table 1. Comparison of Infants with Very Severe Pneumonia at NCH, 2005-2015 Baseline Characteristics According to Type of Feeding.

	EBF n = 52	NEBF n = 52	P value
Gender			
Female	28 *(53.8%)*	23 *(44.2%)*	0.327
Male	24 *(46.2%)*	29 *(55.8%)*	
Age (months)			
Mean±SD	2.461 (±1.540)	3.135 (±1.700)	0.037
Weight (kg)			
Mean±SD	4.877 (±1.187)	5.097 (±1.370)	0.383
Nutritional Status			
Normal	38 *(73%)*	39 *(75%)*	0.754
Overweight	5 *(10%)*	3 *(6%)*	
Wasted	9 *(17%)*	10 *(19%)*	
Baseline Chest X-ray Result			0.003
Uncomplicated Pneumonia	49 *(94.2%)*	38 *(73%)*	
Complicated Pneumonia	3 *(5.8%)*	14 *(27%)*	
Atelectasis	1	2	
Consolidation	2	6	
Effusion	0	4	
Pneumothorax	0	2	

Table 2 showed the comparison of infant's outcome according to the type of feeding. The mean length of ICU stay of exclusively breastfed infants was shorter or 5.654±2.930 days as compared with that of the non-exclusively breastfed group which was 8.143±6.503 days. There was a significant difference between the length of ICU stay of exclusively breastfed and non-exclusively breastfed infants (P-value =0.0067).

None of the exclusively breastfed infants was on a mechanical ventilator for more than 7 days, while 10 non-exclusively breastfed infants (19.2%) were on prolonged intubation. Based on this parameter, an association was established between the type of feeding and duration of ventilation (P value=0.001).

Of the 52 exclusively breastfed infants, only 1 had a healthcare-associated infection (HAI) (1.9%) as compared to the 8 (15.4%) infants from the non-exclusively breastfed group. This again showed that there was an association between HAI and type of feeding (P-value = 0.015).

Six (11.5%) infants died from the exclusively breastfed group while 13 (25%) died from the non-exclusively breastfed group. Despite a difference of 13% between the two groups, there was no significant association (P-value = 0.076) found between mortality and type of feeding at 5% significance.

Due to the significant difference in the baseline chest x-ray results between the two groups, a subgroup analysis was done to compare the outcome of infants whose chest x-ray only showed 'uncomplicated pneumonia' (Table 2b). A significant difference was still noted between the length of ICU stay of exclusively breastfed and non-exclusively breastfed infants (P-value =0.0162). The exclusively breastfed infants had a shorter duration of ICU stay than the non-exclusively breastfed infants. Also, NEBF group significantly stayed longer on the ventilator as compared to the EBF infants (P value=0.002). Data also showed that there was an association between HAI and type of feeding (P-value = 0.019). More infants from the NEBF group had HAI as compared to the EBF group. There was still no significant association (P-value = 0.352) between mortality and type of feeding at 5% significance.

Table 2. Comparison of Outcome According to Type of Feeding of Infants with Very Severe Pneumonia at National Children's Hospital, 2005-2015.

	EBF n = 52	NEBF n = 52	P value
Length of ICU Stay (days)			
Mean days ±SD	5.654 (±2.930)	8.143 (±6.503)	0.0067
Days on Ventilator			
> 7 days	0	10 *(19.2%)*	0.001
≤ 7 days	52 *(100%)*	42 *(80.8%)*	
Healthcare-associated infection (HAI)			
With HAI	1 *(1.9%)*	8 *(15.4%)*	0.015
Without HAI	51 *(98.1%)*	44 *(84.6%)*	
Mortality			
Died	6 *(11.5%)*	13 *(25%)*	0.076
Survived	46 *(88.5%)*	39 *(75%)*	

Table 2b. Comparison of Outcome According to Type of Feeding of Infants with Uncomplicated Pneumonia by Baseline Chest Xray at National Children's Hospital, 2005-2015.

	EBF n = 49	NEBF n = 38	P value
Length of ICU Stay (days)			
Mean days ±SD	5.65(±3.02)	7.93(±5.79)	0.0162
Days on Ventilator			
> 7 days	0	7 *(18.4%)*	0.002
≤ 7 days	49 *(100%)*	31 *(81.6%)*	
Healthcare-associated infection			
With HAI	1 *(2%)*	7 *(18.4%)*	0.019
Without HAI	48 *(98%)*	31 *(81.6%)*	
Mortality			
Died	5 *(10.2%)*	7 *(18.4%)*	0.352
Survived	44 *(89.8%)*	31 *(81.6%)*	

DISCUSSION

In this study, the association of breastfeeding with the outcome of infants 1-6 months old with very severe pneumonia admitted to a pediatric tertiary hospital from 2005-2015 was reported. Clinical outcomes namely: length of ICU stay, ventilation days, the incidence of healthcare-associated infections, and mortality rate, were compared between the

exclusively breastfed and non-exclusively breastfed groups.

The study by Patel and colleagues showed that low birth weight infants who were fed exclusively with human milk during their NICU stay were discharged earlier (11.7 days shorter) as compared to those infants who received exclusive formula milk.[14] A similar trend toward earlier improvement was seen in this research. This study showed that there was a significant difference between the lengths of ICU stay of EBF and NEBF infants. Data revealed that exclusively breastfed infants had approximately 2-5 days shorter stay in the Critical Care unit than the non-exclusively breastfed infants.

Another study by Patel showed that breastfeeding very-low-birth-weight infants greatly reduced the risk for acquiring sepsis by almost 20%; it also significantly lowered associated NICU costs by decreasing the likelihood of ventilator use.[13] The study of Tiewsoh and colleagues showed that children who were hospitalized for severe community-acquired pneumonia and were not exclusively breastfed had abnormal baseline chest x-ray results. They were also most likely to require a change of antibiotics from the primary regimen and had prolonged hospital stay.[15] Similarly, this study showed that the baseline chest x-ray results of infants in the non-exclusively breastfed group presented with more complicated pneumonia (x-ray findings of effusion, atelectasis, air leak/pneumothorax, and consolidation). The infants under this group also were on a mechanical ventilator for more than 7 days. This study also demonstrated that there was a significant association between healthcare-associated infection and type of feeding. According to studies, tracheal intubation is the most important risk factor for ventilator-associated pneumonia, which is the most common infectious complication among patients admitted to the ICU.[16] Although this study did not mention the type of the healthcare-associated infection, prolonged intubation among the non-exclusively breastfed infants in this study might have contributed to the increased incidence of HAI and subsequent prolonged length of ICU stay.

The study of Chen and Rogan showed that breastfed babies were 21% less likely to die between ages 1 month and 1 year, and that ≥ 3 months of breastfeeding showed fewer odds for dying in the post-neonatal period as compared to the ever/never breastfed.[17] Meanwhile, the study of Lamberti and his colleagues revealed that the relative risk of pneumonia mortality among 0-5 months of age was higher among never breastfed and partially breastfed infants as compared to the exclusively breastfed infants.[7] Likewise, this study showed that there were fewer infants with very severe pneumonia who died from the exclusively breastfed group (12%) as compared to the non-exclusively breastfed group (25%). Despite a difference of 13%, there was no significant association between mortality and type of feeding at 5% significance. However, this study compared only two groups of infants based on the type of feeding (exclusively breastfed versus non-exclusively breastfed); and those infants who were never breastfed, partially breastfed, and breastfed for at least 3 months were all included under the non-exclusively breastfed group. Comparing the mortality between 3 groups (never breastfed, infants who had exclusive breastfeeding for at least 3 months, and infants who had 6 months of exclusive breastfeeding) might have given a more significant result.

Since this is a retrospective cohort study, the baseline characteristics between the two groups were found to be significantly different when it comes to the severity of pneumonia as shown in their chest x-ray results. Hence, the

effect of non-exclusive breastfeeding to the duration of ICU stay, ventilator days, and incidence of HAI cannot be attributed to non-exclusive breastfeeding alone, since this group significantly had more complicated pneumonia by baseline chest x-ray. To account for this, a subgroup analysis comparing the outcomes of infants whose baseline chest x-ray only showed 'uncomplicated pneumonia' was done. Data still showed that exclusively breastfed infants had better outcomes in terms of length of ICU stay (P-value =0.0162), ventilator use duration (P value=0.002), and HAI (P-value = 0.019) as compared to the non-exclusively breastfed infants. There was still no significant association (P-value = 0.352) between mortality and type of feeding at 5% significance. Meanwhile, comparing the outcomes of those infants whose chest x-ray only showed 'complicated pneumonia' was not possible due to their small sample sizes.

CONCLUSION AND RECOMMENDATION

Exclusively breastfed infants with very severe pneumonia admitted at the critical care areas had better outcomes as compared to the non-exclusively breastfed infants in terms of shorter ICU stay and ventilator use, and lower incidence of healthcare-associated infection. This is the first local study that showed the association of breastfeeding with the outcome of infants aged 1-6 months old with very severe pneumonia admitted to the critical care unit. This research also revealed that more infants who were non-exclusively breastfed died; however, there was no significant association between mortality and type of feeding. With such results, this can serve as a tool in educating the parents on benefits of exclusive breastfeeding and can be used to promote breastfeeding.

One limitation of this study is that the treatment given for both groups were not taken into account. Another important limitation of this study is its retrospective study design. The researchers recommend a prospective study design so as to get a detailed feeding history, which was a problem encountered when this research was conducted. Since this study compared only two groups of infants per type of feeding, namely exclusively breastfed versus non-exclusively breastfed infants, the researchers recommend another study that will separate the "non-exclusively breastfed" group further into "never breastfed", and "exclusively breastfed for 3 months". This might give a more significant result in the association of breastfeeding and mortality. Also, in doing a prospective study, weight gain can be included as an outcome since the infant's weight can be taken and plotted daily. Maternal and infant factors that were not included in this study, like maternal age, education, and smoking history, and the infant's gestational age and birth weight, can be taken into account as baseline characteristics.

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REFERENCES

1. Eidelman, A. I., & Schanler, R. J. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics. 2012; 129:3 e827-841.
2. Gartner, L., Morton, J., Lawrence, R., & et al. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics. 2005 Feb;115(2):496-506.
3. Ip S, Chung M, Raman G, Chew P, Magula N, DeVine D, Trikalinos T, Lau J. Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries. Evidence Report/Technology Assessment No. 153 (Prepared by Tufts-New England Medical Center Evidence-based Practice Center, under Contract No. 290-02-0022). AHRQ Publication No. 07-E007. Rockville, MD: Agency for Healthcare Research and Quality. April 2007.
4. July 2017. WHO fact sheet: Infant and young child feeding. Retrieved from http://www.who.int/mediacentre/factsheets/fs342/en/
5. June 2012. UNICEF Report 2012: Pneumonia and Diarrhoea: Tackling the deadliest diseases for the world's poorest children. Retrieved from https://www.unicef.org/publications/index_65491.html
6. Stuckey-Schrock, K., Hayes, B., & George, C. Community-Acquired Pneumonia in Children. American Family Physician 2012; 1:86(7): 661-661.
7. Lamberti, L., Zakarija-Grkovic, I., Fischer Walker, C., Theodoratou, E., Nair, H., Campbell, H., et al. Breastfeeding for reducing the risk of pneumonia morbidity and mortality in children under two: a systematic literature review and meta-analysis. Biomed Central Public Health 2013; 139Suppl 3): S18.
8. Chantry, C. J., Howard, C. R., & Auinger, P. Full Breastfeeding Duration and Associated Decrease in Respiratory Tract Infection in US Children. Pediatrics 2006; 117:425.
9. Cunningham, A., Jelliffe, D., & Jelliffe, E. Breastfeeding and health in the 1980s: a global epidemiologic review. Journal of Pediatrics 1991; 118 (5):659-66.
10. Cesar, J., Victora, C., Barros, F., Santos, I., & Flores, J. Impact of breastfeeding on admission for pneumonia during postneonatal period in Brazil: nested case-control study. British Medical Journal 1999; 318:1316-20.
11. Chisti, M., Salam, M., Smith, J., Ahmed, T., Ashraf, H., Bardhan, P., et al. Impact of Lack of Breast Feeding during Neonatal Age on the Development of Clinical Signs of Pneumonia and Hypoxemia in Young Infants with Diarrhea. PLos ONE 2011; 6(10): e25817
12. Yoon, P., Black, R., Moulton, L., & Becker, S. Effect of not breastfeeding on the risk of diarrheal and respiratory mortality in children under 2 years of age in Metro Cebu, the Philippines. American Journal of Epidemiology 1996; 143 (11): 1142-8.
13. Patel, A., Johnson, T., Engstrom, J., Fogg, L., Jegier, B., Bigger, H., & Meier, P. Impact of early human milk on sepsis and health-care costs in very low birth weight infants. J of Perinatology 2013; DOI: 10.1038/jp.2013.2
14. Patel, A., Engstrom, J., Goldman, J., Fogg, L., & Meier, P. Dose-response benefits of human milk in extremely low birth weight premature infants. Pediatric Academic Societies 2008; E-PAS2008:3777.1.
15. Tiewsoh, K., Lodha, R., Pandey, R., Broor, S., Kalaivani, M., & Kabra, S. Factors determining the outcome of children hospitalized with severe pneumonia. Biomed Central Pediatrics 2009; 9:15.
16. Vincent, J., Bihari, D., Suter, P., Bruining, H., White, J., Nicolas-Chanoin, M., et al. The prevalence of nosocomial infection in intensive care units in Europe. The Journal of American Medical Association. 1995; 274:639-644.
17. Chen, A., & Rogan, W. Breastfeeding and the risk of postnatal death in the United States. Pediatrics 2004; 113 (5): 435-439.