Incidence of childhood pneumonia in patients in a hospital of Dhaka city, Bangladesh

A Dissertation Submitted to the Department of Pharmacy, East West University, Dhaka, Bangladeshin the partial fulfillment of the requirements for the Degree of Bachelor of Pharmacy.

Submitted by

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Declaration by the Research Candidate

I, Anjuman Ara Ankhi, ID: 2012-3-70-040, hereby declare that the dissertation entitled--- "Study on Incidence/ Prevalence of child hood pneumonia patients in a hospital of Dhaka city" submitted by me, has been carried out under the joint supervision and guidance of Dr. Sufia Islam, Professor to the Department of Pharmacy, East West University in partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy. It is further declared that the research work presented here is original, has not been submitted anywhere else for any degree or diploma.

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Certificate by the Supervisor

This is to certify that the thesis entitled "Study on Incidence/ Prevalence of child hood pneumonia patients in a hospital of Dhaka city" submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a bona fide record of original and genuine research work carried out by Anjuman Ara Ankhi, ID: 2012-3-70-040 in 2017 of her research in the National Medical College Dhaka, under the supervision and guidance of me.

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Certificate by the Chairperson

This is to certify that the thesis entitled "Study on Incidence / Prevalence of child hood pneumonia patients in a hospital of Dhaka city e" submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a bona fide record of original and genuine research work carried out by Anjuman Ara Ankhi, ID: 2012-3-70-040 in 2017 of her research in the National Medical College Dhaka.

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Dedication

To

My Beloved

Parents, Research Supervisors &

All EWUians.

Contents

Abstract

Pneumonia is a form of acute respiratory infection that affects the lungs. Pneumonia is still a single leading cause of child death, killing 1 child every 35 seconds. It accounts for almost one million deaths every year. Pneumonia is the leading cause of childhood death in Bangladesh. The objective of this study is to observe the comorbidity and clinical symptoms of childhood pneumonia in patients in a hospital in Dhaka city, Bangladesh. A total of 72 patients were enrolled in this study. Among them 22 patients suffered from childhood pneumonia in the pediatric department of the hospital. Two Newborn (>28 days-23 months), 11 infants (>28 days-23 months) and 9 children (2-11 year) were included in this study.A questionnaire was developed and some selected questions were asked to the patients. The clinical documents of all 22 patients were collected. Information on patients of pneumococcal condition, respiratory symptoms and signs, co-morbidity, antibiotic and hospitalization, and data on recovery were obtained. The present study shows that people in Bangladesh are still not aware about pneumonia and its risk factor, causes, symptom and treatment. Among 22 patients about 55% children are male and 45% are female. Twelve patients had Community-Acquired Pneumonia.The study revealed that among 22 patients the comorbidity of severe pneumonia and diarrhea was found in 55% patients. Nine patients (41%) had the comorbidity of dysentery with pneumonia. Seven (32%), 1 (5%) and 3 (14%) patients suffered from persistent diarrhea, malaria and influenza respectively along with pneumonia. Fever, shaking chill, cough and fast breathing problem were the common signs and symptoms of pneumonia.Childhood pneumonia in Dhaka city is associated with comorbidities. Common signs and symptoms of pneumonia can be useful for developing strategies for treating the disease immediately.

Chapter 1

Introduction and Literature review

1.1 Introduction:

Pneumonia is a form of acute respiratory infection that affects the lungs. The lungs are made up of small sacs called alveoli, which fill with air when a healthy person breathes. When an individual has pneumonia, the alveoli are filled with pus and fluid, which makes breathing painful and limits oxygen intake.(WHO, 2016)

Pneumonia is the single largest infectious cause of death in children worldwide. Pneumonia killed 920 136 children under the age of 5 in 2015, accounting for 16% of all deaths of children under five years old. Pneumonia affects children and families everywhere, but is most prevalent in South Asia and sub-Saharan Africa. Children can be protected from pneumonia, it can be prevented with simple interventions, and treated with low-cost, low-tech medication and care. (WHO, 2016)

Pneumonia is still a single leading cause of child death, killing 1 child every 35 seconds Pneumonia accounts for almost one million deaths every year, 922,000 in 2015 which is 16% of total deaths among children under-five years of age, 5% of which are neonatal. This makes it the single most common cause of child deaths worldwide. Despite having made some progress, a 51% decrease in pneumonia from 2000 to 2015, it is nowhere near the greater than 86% decrease in mortality from malaria-related under five mortality in the same time frame. There is still a significant road ahead to make a marked reduction in the preventable, treatable deaths due to pneumonia. Pneumonia is the leading infectious disease killer of children worldwide; killing 2,500 children each day - more children than malaria, TB, measles, and AIDS combined. Despite causing 16% of all child deaths, pneumonia receives little attention and a tiny fraction of global public health investment - less than 2% of total global development funding for health. Despite the existence of effective tools to prevent, diagnose and treat pneumonia, most of the countries struggling with high rates of pneumonia-related deaths allocate a tiny portion of their health budgets to fighting child pneumonia. Mortality due to childhood pneumonia is strongly linked to poverty-related factors such as under nutrition, lack of safe water and sanitation, indoor air pollution and inadequate access to health care. Acute lower respiratory infections (ALRI),

particularly pneumonia, are the leading and largest single cause of mortality among <5-year-old children in developing countries The problem is responsible for 18% of the annual 7.6 million deaths in this age group Moreover, 95% of all these pneumonic deaths occur in the developing countries Among the under-5 children who die in Bangladesh each year, 14% are due to pneumonia. (UNICEF, 2017).

In developing countries including Bangladesh, mothers or primary caretakers of pneumonic children had inadequate knowledge about pneumonia. Most of them could not recognize whether their child had pneumonia or not. When the mothers detected that their child either was not breathing properly or had high fever or convulsion or was unable to take or stopped taking or was reluctant to receive the feed, they brought their child to the health facility. Majority of them did not have prior knowledge about the clinical features of pneumonia. Those mothers who had knowledge about clinical features especially early danger signs of pneumonia, they even could not identify properly that their children were suffering from pneumonia. They brought their child to the hospital when the child developed late danger signs with severe form of the disease or associated complications. It is very important that rural mothers should have appropriate knowledge about the clinical features of pneumonia, because delays in detecting clinical signs including danger are the major obstacles to preventing deaths due to childhood pneumonia. It has been observed that mothers were unable to detect the severity of the illness of their child and brought the matter to the attention of adult family members or household head in order to get permission to take the child outside of home for treatment. A study in recent past in western Kenya reported that comorbidities, spread from upper respiratory tract and delay in seeking treatment, were the common identified causes of severe pneumonia on presentation to health facilities.(WHO, 2016)

1.2Types of Pneumonia

A factor that has to be taken into consideration is the main agent that causes the infection. These are just some of the main groups of pneumonia based on what ignites the disease:

Bacterial pneumonia: commonly caused by bacteria strains such as *Streptococcus pneumoniae, Chlamydophila pneumonia* or *Legionella pneumophila*. Bacterial pneumonia cases can be mild or severe, depending on the strength of the bacteria strain and how long until the disease is diagnosed and treated.(Ladhani et.al, 2013)

Viral pneumonia: triggered by viruses such as influenza, chickenpox, adenoviruses or respiratory syncytial virus. One can catch viral pneumonia via coughing, sneezing or touching an object that was contaminated by an infected person.

Mycoplasma pneumonia: generated by Mycoplasma pneumonia, an "atypical bacterium" that's considered to be one of the smallest agents that affect humans. This is why this type of pneumonia is also called atypical or walking pneumonia.

Aspiration pneumonia: infections or inhalation of food, liquid, gases or dust lead to this type of pneumonia.

Fungal pneumonia: produced by various endemic or opportunistic fungi. This causes fungal infections, such as histoplasmosis, coccidioidomycosis, and blastomycosis that occur after inhaling spores or conidia or reactivating a latent infection. It has to be noted that fungal pneumonia cases are quite difficult to diagnose.

("Pneumonia," Johns Hopkins Medicine, October 2015)

Types of Pneumonia According to Where the Infection Was Acquired

Another way to classify a pneumonia case is to know where you got infected with the pneumonia-causing bacteria, virus or germ. There are three types of pneumonia that are determined by the place where you acquired the disease:

• Community-acquired pneumonia (CAP): happens after acquiring a common viral infection, such as the flu. Patients who have CAP got the disease outside of hospitals or other health care settings, such as at school or at work,and are consequently infected with germs that are found in the mouth, nose or throat while they are sleeping. Community-acquired pneumonia is the most common type of pneumonia, with majority of the cases occurring during winter. According to the National Heart, Lung, and Blood Institute, around 4 million Americans are affected every year, with 1 out of 5 people with CAP requiring hospitalization. (Ruiz,et.al,1999)

• Hospital-acquired pneumonia (HAP): occurs when people are infected when they're admitted to a hospital for another illness. HAP tends to be more dangerous compared to community-acquired pneumonia because you're already sick when you're infected with HAP. Your risk for HAP even rises when you already use a ventilator. Plus, hospitals are usually hotbeds for antibiotic-resistant germs. ("Types of Pneumonia," 2011)

1.3 Signs and symptoms

Pneumonia can occur at any age, although it is more common in younger children. Pneumonia accounts for 13% of all infectious illnesses in infants younger than 2 years.

Newborns with pneumonia commonly present with poor feeding and irritability, as well as tachypnea, retractions, grunting, and hypoxemia. Infections with group B Streptococcus, Listeria monocytogenes, or gram-negative rods (e.g., Escherichia coli,*Klebsiella pneumonia*) are common causes of bacterial pneumonia. Group B streptococci infections are most often transmitted to the fetus in utero. The most commonly isolated virus is respiratory syncytial virus (RSV).

Cough is the most common symptom of pneumonia in infants, along with tachypnea, retractions, and hypoxemia. These may be accompanied by congestion, fever, irritability, and decreased feeding. Streptococcus pneumonia is by far the most common bacterial pathogen in infants aged 1-3 months.

Adolescents experience similar symptoms to younger children. They may have other constitutional symptoms, such as headache, chest pain, and vague abdominal pain. Vomiting, diarrhea, pharyngitis, are also common in this age group. *Mycoplasma pneumonia* is the most frequent cause of pneumonia among older children and adolescents. (Nicholas John Bennett, Mar 14, 2017)

Overall, pneumonia symptoms vary according to age, but there are a number of clues that can help you recognize when your child has more than a bad cold.

1.4 Diagnosis

The signs and symptoms of pneumonia are often nonspecific and widely vary based on the patient's age and the infectious organisms involved.

Several studies have discussed the criteria for a diagnosis of pneumonia. In a study of pediatric administrative billing codes, diagnostic codes were considered accurate for identifying pediatric community-acquired pneumonia hospitalizations, although the sensitivity ranged from 60% to 99%. Pneumonia is often assumed to be coded as all-cause pneumonia (J12.0–J18.9) or as bacterial pneumonia (J13.0–J18.9). However, it is well recognized that it is difficult to clinically distinguish between bacterial and nonbacterial pneumonia. It is reasonable to assume that new microbiological methods leading to the identification of probable etiological agents in an increasing number of patients will affect the choice of discharge diagnoses. (Williams DJ, 2013)

Observing the child's respiratory effort during a physical exam is an important first step in diagnosing pneumonia. The World Health Organization (WHO) respiratory rate thresholds for identifying children with pneumonia are as follows:

- Children younger than 2 months: Greater than or equal to 60 breaths/min
- Children aged 2-11 months: Greater than or equal to 50 breaths/min
- Children aged 12-59 months: Greater than or equal to 40 breaths/min

Assessment of oxygen saturation by pulse oximetry should be performed early in the evaluation when respiratory symptoms are present. Cyanosis may be present in severe cases. Capnography may be useful in the evaluation of children with potential respiratory compromise. (Boggs W, December 10, 2012)

Other diagnostic tests may include the following:

- Auscultation by stethoscope
- Cultures
- Serology
- Complete blood cell count (CBC)
- Chest radiography
- Ultrasonography

New data show that point-of-care ultrasonography accurately diagnoses most cases of pneumonia in children and young adults. Ultrasonography may eventually replace x-rays for diagnosis. (MBBCh, 2017)

1.5: Treatment and prescribed drugs:

A study shows that the guidelines for treatment duration in particular are based upon limited (and often weak) evidence, resulting in national and international guidelines recommending treatment courses for uncomplicated pneumonia ranging from 3 to 10 days. The advantages of short-course therapy include a lower risk of developing antibiotic resistance, improved adherence, fewer adverse drug effects, and reduced costs. The risks include treatment failure, leading to increased short- or long-term morbidity, or even death. The initial challenge is how to distinguish between bacterial and non-bacterial causes of pneumonia and then to undertake adequately powered randomised-controlled trials of varying antibiotic treatment durations in children who are most likely to have bacterial pneumonia. (Grimwood et al., 2016)

Drug therapy for pneumonia is tailored to the situation. Because the etiologic agents vary, drug choice is affected by the patient's age, exposure history, likelihood of resistance (e.g., pneumococcus), and clinical presentation. Beta-lactam antibiotics (e.g., amoxicillin, cefuroxime, cefdinir) are preferred for outpatient management. Macrolide antibiotics (e.g., azithromycin, clarithromycin) are useful in most school-aged children to cover the atypical organisms and pneumococcus. Local variations in resistance require different approaches to therapy, including cases caused by pneumococcus. (Nieddu et al., 2010)

Doctors use antibiotics (mostly penicillins, macrolides, cephalosporin and fluroquinolones) to treat pneumonia caused by bacteria. There are many types of antibiotics.They do not use tetracyclines for children younger than age 8. These medicines can discolor a child's teeth. (Stuckey-Schrock et al, 2015)

Doctors use vancomycin to treat people who are in the hospital for severe infections that do not respond to other antibiotics. Here some highly used antibiotic for pneumonia treatment are given below:

Drug Class	Generic Name
Penicillins	• ampicillin • piperacillin • ticarcillin with clavulanate • amoxicillin • amoxicillin with clavulanate
Fluoroquinolones	• gemifloxacin • levofloxacin • moxifloxacin
Vancomycin	• vancomycin
Macrolides	• azithromycin • clarithromycin • erythromycin
Tetracyclines	• doxycycline
Cephalosporins	• cefaclor • cefadroxil • cefuroxime • cephalexin

(Antibiotics of pneumonia, 2017)

1.6: Risk factor of childhood pneumonia:

Determining the cause of pneumonia in children is often difficult. Sputum from the lower respiratory tract can rarely be obtained from children. As with adults, culturing the upper respiratory tract is of little value, as the normal flora in this area may not be responsible for the pneumonia. Several investigations have explored the microbial etiology of CAP.(Cevey-Macherel M2009) These studies vary considerably in their etiologic findings. The use of different evaluative laboratory tests between studies poses a challenge in comparing the causes of pneumonia. Despite these variations, it is widely accepted that the most prominent pathogens responsible for CAP in children are viral and bacterial in nature. (Bradley JS,2011) It is important to note that children often present with combined infections of multiple viruses, bacteria, or both. (Tsolia MN, 2004)

A surveillance system was developed in six public sector primary care clinics and in a regional referral hospital, to detect childhood pneumonia cases. The study shows that, from June 2012 until September 2013, the surveillance system detected 306 pneumonia episodes in children under 1 year of age, an incidence of 0.20 episodes/child-year (e/cy) (95% CI 0.17 to 0.22 e/cy). The incidence in the cohort study from the same period was 0.27 e/cy (95% CI 0.23 to 0.32 e/cy). Pneumonia incidence in the surveillance system was almost 30% lower than in the birth cohort; incidence rate ratio 0.72 (95% CI 0.58 to 0.89). In the surveillance system, 18% were severe pneumonia cases, compared to 23% in the birth cohort, rate ratio 0.81 (95% CI 0.55 to 1.18). (David M le Roux et al, 2015)

Estimating the incidence of pneumonia in LMICs can be challenging, with widely varying estimates. Many studies report incidence of hospitalization or of radiologically confirmed pneumonia, and do not quantify ambulatory events or events without radiological confirmation. Some studies have reported population-level incidence estimates using WHO clinical case definitions in children aged under-1 and under-5 years (under-5), but the incidence estimates are

highly variable, reflecting large regional variations in pneumonia incidence. Most population-level estimates of pneumonia incidence are extrapolated from national under-5 mortality estimates, prevalence of known pneumonia risk factors and likely proportion of deaths due to pneumonia. From the estimated number of pneumonia deaths, the number of severe pneumonia admissions and ambulatory pneumonia cases can be back calculated. A recent modelled estimate of pneumonia incidence for children younger than 5 years of age in South Africa was 0·14 episodes/child-year.However, reliance on modelled estimates of pneumonia incidence can be problematic as the pneumonia incidence models do not necessarily account for local high-prevalence risk factors (such as HIV infection) or changes to healthcare (such as introduction of 13-valent pneumococcal conjugate vaccine, PCV13). (Roux et. al,2015)

1.7 Literature Review:

1.7.1 Risk factors and Comorbidity of Childhood pneumonia:

A study conducted in Dhaka suggested that 22% of childhood deaths occurred from respiratory infection. Approximately 14–20% of children aged <2 years with respiratory infection in Bangladesh never seek any health care services. As a densely populated country, malnutrition, overcrowding and lack of health care facilities further contribute to increased mortality of the young children (NusratHomaira, 2012).

Study conducted by Chisti et al. identified risk factors of pneumonia in under 5 years children in order to improve the case management strategies. The article highlighted that severe underweight, hypoxaemia an. d severe sepsis are the independent risk factors for death in children with pneumonia (Chisti et al. 2011).

WHO defined in 2010, an estimated 120 million episodes of pneumonia in children younger than 5 years old in 2010. Among them 14 million cases progressed to severe pneumonia. It was estimated that 1.3 million children died from pneumonia. The major risk factor for child mortality with pneumonia is hypoxaemia. It has been shown from a study that children who received oxygen from Bubble continuous positive airway pressure had lower rates of death (Chisti et al. 2015).

It has been shown from a study that from a total of 401 children less than 5 years of age,the case-fatality rate (CFR) was 14% in childrenwho suffered for pneumonia and diarrhoea. The CFR was 14% in malnourished children with shigellosis and acute lower respiratory tract infection (ALRI) (Rahman M, 1990).

A case-control study shows the risk factors for childhood pneumonia in a children's hospital in Calcutta. Cases were 127 children aged 2-35 months of either sex admitted with pneumonia and controls were 135 children attending their immunization clinic.). Nearly 80% of people in India use such smoke producing fuel and the population attributable risk would be very high. This finding has important health policy implications. Furthermore, history of asthma is a useful prognostic indicator for early action for prevention of severe pneumonia. (Mahalanabis D, Aug, 2002)

A retrospective medical record review performed for a 10-year period from January 1987 through December 1997 at The Hospital for Sick Children in Toronto, Ontario, a tertiary care pediatric hospital.Of 2952 children hospitalized with pneumonia, 238 (8%) met criteria for recurrent pneumonia. An underlying illness diagnosis was identified in 220 (92%). Of these, the underlying illness was diagnosed prior to pneumonia in 178 (81%), with the first episode in 25 (11%), and during recurrence in 17 (8%). Underlying illnesses included oropharyngeal in coordination with aspiration syndrome (114 cases [48%]), immune disorder (24 [10%]), congenital cardiac defects (22 [9%]), asthma (19 [8%]), pulmonary anomalies (18 [8%]), gastroesophageal reflux (13 [5%]), and sickle cell anemia (10 [4%]). (Abdullah F, 2000)

1.7.2 Signs and Symptoms:

A survey shows the current landscape of recent pneumonia etiology studies in children under 5 years of age in the developed and developing world, as ascertained by a literature review of relevant studies with data since the year 2000 and a survey of researchers in the field of childhood pneumonia. A literature review identified 88 studies with child pneumonia etiology results. However, the landscape analysis also reveals a multiplicity of case definitions, levels of clinician involvement, facility types, specimen collection, and laboratory techniques. It reinforces the need for the standardization of methods and analyses for present and future pneumonia etiology studies of childhood pneumonia. (Gilani, 01 April 2012)

A study on etiology childhood pneumonia was performed in 4232 cases of hospitalized patients.World Health Organization (WHO)-defined severe and very severe pneumonia from 9 sites in 7 countries (Bangladesh, the Gambia, Kenya, Mali, South Africa, Thailand, and Zambia). Chest radiographs (CXRs) are frequently used to assess pneumonia cases**.** Chest radiographswere interpretable in 3587 (85%) cases, of which 1935 (54%) were abnormal (site range, 35%-64%). Cases with abnormal Chest radiographs were more likely than those with normal Chest radiographs to have hypoxemia (45% v/s 26%), crackles (69% v/s 62%), tachypnea (85% v/s 80%), or fever (20% v/s 16%) and less likely to have wheeze (30% vs 38%; all $P < .05$). (Fancourt N,2017)

Acute respiratory infection (ARI) is the most frequent illness globally and a leading cause of death in developing countries mainly due to pneumonia in children under 5. Globally 4 million children under 5 (31% of all causes of mortality) die from acute lower respiratory infection (ALRI) Of the ALRI associated deaths, half a million are associated with measles and quarter of a million respectively are associated with pertussis and perinatal causes. The mortality due to pneumonia is 10–50 times higher in the developing world and is therefore amenable to substantial improvement. (Mahalanabis D, Aug, 2002)

Risk factors for fatal pneumonia include poor socioeconomic status, incomplete immunization schemes, malnutrition, late care seeking and inadequate treatment. Yet cheap and effective tools exist for pneumonia prevention and care. Generally, the recommendations focus on improvement in vaccine coverage for measles, Haemophilus influenza type B and pertussis, community education, improved nutrition, training of health providers in diagnostic and treatment algorithms, use of effective antibiotics, and timely referral of severely ill cases. However, in 2004, only 29% of Ugandan children with symptoms suggestive of pneumonia were reported to have used first-line or second-line antibiotics during illness. (Karin Källander, May. 2008)

Chapter 2

Objective of the Study

2.1 Research Objective:

Pneumonia is the leading cause of childhood mortality and a major contributor to childhood morbidity. The objective of this study is to observe the comorbidity and clinical symptoms of childhood pneumonia in patients in a certain hospital in Dhaka city.

Chapter 3

Methodology

3.1. Research Methodology

We conducted a study on incidence of childhood pneumonia in National Medical college hospital from January 2017through April 2017.Among 72 patients about 22 patients who were suffering from childhood pneumonia in the pediatric department of the hospital were enrolled in this study.

A questionnaire was developed andsome selected questions were asked to the patients. The questions were about the age, sex, economic condition, suffering period, knowledge, risk factors, signs and symptoms, comorbidity, prescribed drugs (Annexure). This study provides a preliminary quantification of comorbidity using one set of data from a specific population.

We also collected the clinical documents of all twenty two patients. Here we observed the diagnostic information of the patients.Information on patient's pneumococcal condition, respiratory symptoms and signs, co-morbidity, antibiotic and hospitalization, and recovery were obtained. Data from the Inpatient Sample, were analyzed with an interrupted time-series analysis that used pneumonia admission rates and comorbidity as the main outcomes.

Study Type: Retrospective study.

Duration of study: 4 months.

Sample size: 22

Chapter 4

Result

4.1: General clinical information pneumonia in children

Table1: General clinical information of pneumonia in children (Approximately 4 months study)

Gender		Number(n=22)	%	Total (n=22)
	Male	12	54.54%	22
	Female	10	45.45%	

Age groups		
Newborn infants (0-28 days)	Infant and toddlers (>28 days-23 months)	Children (2-11years)
2	11	9

Disease Time length information (suffering period)									
Before admission in hospital	1day	2days	3days	4days	5days	6days	7days	8days	>8days
	-	4	4	3	4	-	1	2	4
After admission in hospital	3	3	4	1	3	3	2	2	1

Types of Pneumonia that attacked to the patients	
Types	**No. of patients**
Community-Acquired Pneumonia	18
Hospital-Acquired Pneumonia	4

Table 1 shows the General clinical information of pneumonia in children. Among 22 patients about 54.54% children are male and 45.45% are female.

From the study three age group of the patients were included in our study. They were newborn infants (0-28 days) (n=2), infant and toddlers (>28 days-23 months) (n=11) and children (2-11 years) (n=9).

According to the suffering period 4 patients suffered 8 days or longer before admission. However, suffering period has been reduced to the patients after admission. Only 1 patient suffered more than 1 day after admission. Two types of pneumonia attacks were found in these patients and they were community-Acquired Pneumonia and Hospital Acquired Pneumonia.

4.2 Diagnosis information

Table 2: Diagnosis information of patients:

Patients no.	Age	Heart rate(breath ppm)	Renal rate (breath ppm)	Sputum and Blood culture	Bladder condition	Average body temperature(in degree)	Urinary habit	Sensory function	Chest x ray
1	8m	130	36	D	normal	98	normal	normal	AD
2	12d	138	34	D	normal	99	normal	normal	Not done
3	5d	137	33	D	normal	99	normal	normal	AD
4	4m	138	38	D	normal	99	normal	normal	AD
5	14m	136	41	D	normal	102	AD	normal	Not done
6	5m	130	36	D	Normal	98	normal	Good	AD
7	2m	129	31	D	normal	100	AD	normal	AD
8	8m	120	22	D	normal	99	AD	normal	AD
9	6m	135	40	D	normal	101	AD	normal	AD
10	9m	138	37	D	normal	98	normal	good	AD
11	8m	130	38	D	normal	101	AD	normal	Not done
12	1m	139	35	D	normal	99	Normal	good	Not done
13	6m	138	26	D	normal	100	AD	good	AD
14	10y	122	30	D	-	101	normal	normal	NAD
15	8y	140	35	D	normal	98	normal	good	AD
16	3y	130	36	D	normal	98	normal	good	Not done
17	2y	132	36	D	-	99	AD	-	AD
18	5y	137	38	D	normal	98	normal	normal	Not done
19	3y	131	29	D	normal	101	AD	Normal	Not done
20	9y	128	34	D	Normal	102	AD	good	AD
21	8y	122	33	D	Normal	98	normal	good	NAD
22	4y	130	37	D	-	98	normal	normal	NAD

Table 2 shows the diagnosis characteristics of the patients of the different age group in total. The figures represents D= Detected, NAD= No abnormality detected, AD=abnormality detected. Here is the test results of different segment which assured the patients' disease condition. From this data it shows the bladder condition and the sensory function were normal in patients suffering from pneumonia.

From Chest X-ray abnormality has been detected in most pneumonia patients. Pneumonia was detected by sputum and blood culture.

Prescribed Drugs: Amoxicillin and azithromycin was prescribed in most of the patients.

4.3: Comorbidity in pneumonia patients:

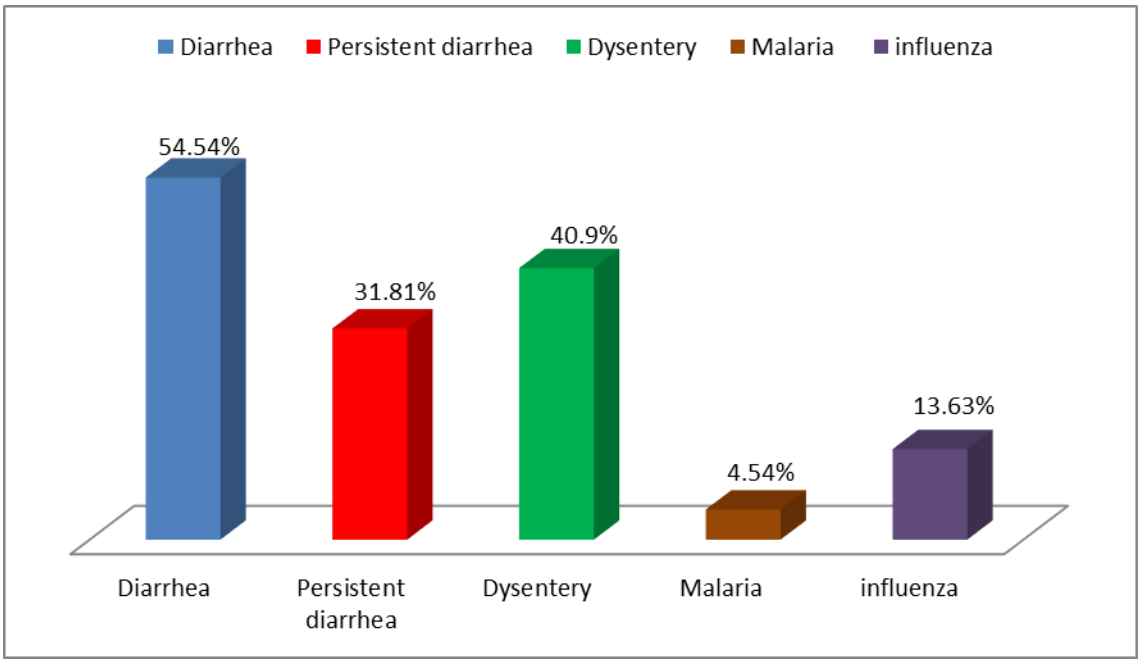

Figure: % comorbidity in pneumonia patients

The figure illustrates comorbidity of pneumonia in different ratio. From the diagram it shows there are 54.54% pneumonia patients also have diarrhea. About 32% patients have persistent diarrhoea. About 41%, 5% and 14% patients have comorbidity of dysentery, malaria and influenza respectively.

4.4: Signs and symptoms

Table 4: Signs and symptoms associated with childhood pneumonia.

symptoms	**No. of patient**	**%**
fever	22	14.57
Chest crump/ pain	19	12.58
Shaking chill	22	14.57
Loos appetite/poor feeding	17	11.26
Very fast breathing, heard breathing, wheezing sound	18	11.92
cough	22	14.57
Abdominal pain	15	9.93
vomiting	16	10.6

Table 4 shows the signs and symptoms of pneumonia patients.

About 15% (approx.) patients have fever, shaking chill and cough. Chest pain was observed in 13% patients. Fast breathing problems was observed in 18 patients (12%).

Vomiting and abdominal pain were found in 11% and 10% patients respectively. Loss of appetite was observed in 17 patients (11%).

4.5: Knowledge of parents of patients suffering from pneumonia

Table 5:

	Yes	**No**
Knowledge of Patients' parents/ caretaker about pneumonia (signs, symptoms, causes, treatment)	**9 (41%)**	**13 (59%)**

Table 5 represents the number of parents / caretaker have knowledge about the disease. Only 41% parents/caregivers have the knowledge of pneumonia.

Chapter 5

Discussion and conclusion

Discussion and conclusion:

Our study has demonstrated on significant co-occurrence of illness of childhood pneumonia. Certain disease combinations, particularly those involving pneumonia and diarrhea, were more likely to be observed than others, and increasing severity of disease was associated with greater comorbidity. In our study, Among 22 patients about 54.54% children are male and 45.45% are female. Two Newborn (>28 days-23 months), 11 infants (>28 days-23 months) and 9 children (2-11 year) are included in this study. Here, the suffering period of the patients before admission in hospital in most cases more than 8 days and after admission in hospital it is 3days for most of the patients. For the purpose of treatment in most of the cases amoxicillin was used as the prescribed drug.

The evidence of comorbidity, suggests the need for further research in this area, especially with regard to possible synergistic effects of comorbidity on child mortality. (Fenn .et .al, 2005).

It has been shown from a study that, in developing countries, mortality in children with very severe pneumonia is high, even with the provision of appropriate antibiotics, standard oxygen therapy, and other supportive care. It was an open, random, controlled trial took place in Dhaka Hospital of the International Centre for Diarrheal Disease Research, Bangladesh. They randomly assigned children younger than 5 years with severe pneumonia and hypoxemia and randomly allocated 79 (35%) children to receive oxygen therapy by bubble continuous positive airway pressure (CPAP), 67 (30%) to low-flow oxygen therapy, and 79 (35%) to high-flow oxygen therapy. Treatment failed for 31 (14%) children, of whom five (6%) had received bubble CPAP, 16 (24%) had received low-flow oxygen therapy, and ten (13%) had received high-flow oxygen therapy. The result of the study shows that, Oxygen therapy delivered by bubble CPAP improved outcomes in Bangladeshi children with very severe pneumonia and hypoxemia compared with standard low-flow oxygen therapy. (Chisti,et .al, August 19, 2015)

Another study were performed on up-to-date information on the causes of child deaths is crucial to guide global efforts to improve child survival and estimates for 2008 of the major causes of death in children younger than 5 years. They used multi-cause proportionate mortality models to

estimate deaths in neonates aged 0–27 days and children aged 1–59 months, and selected single-cause disease models and analysis of vital registration data when available to estimate causes of child deaths. Findings Of the estimated 8•795 million deaths in children younger than 5 years worldwide in 2008, infectious diseases caused 68% (5•970 million), with the largest percentages due to pneumonia 18%, 1•575 million, uncertainty range [UR] 1•046 million–1•874 million). 49% (4•294 million) of child deaths occurred in five countries: India, Nigeria, Democratic Republic of the Congo, Pakistan, and China. These country-specific estimates of the major causes of child deaths should help to focus national programs and donor assistance.(Robert E Black et .al,2010)

A retrospective study by Handy et al concluded that, antibiotic choice for children with community-acquired pneumonia (CAP) varied widely across practices for reasons other than the microbiologic etiology. The study found that 40.7% of the 10,414 children in the study (4239) received amoxicillin, however, 42.5% (4430) received macrolides, and 16.8% (1745) received broad-spectrum antibiotics. Another study by Williams et al found that there was an improvement at children's hospitals in the use of penicillin to treat pneumonia after the publication of the 2011 Pediatric Infectious Diseases Society/Infectious Diseases Society of America pneumonia guideline. Before the guideline was published <10% of children's hospitals prescribed penicillin to treat pneumonia vs. 27.6% after publication. (Nicholas John Bennett, Mar 14, 2017)

In our present study, among 22 patients the comorbidity ranged from 54.54% for severe pneumonia + diarrhea with severe dehydration to 40.9% for dysentery + pneumonia. Adjusting for all other shared risk factors, the comorbidity ranged 31.81% for severe persistent diarrhea in pneumonia patients. Fever, shaking chill, cough and fast breathing problem is the highest common signs of pneumonia.

Mohammod J Chisti mentioned on his another study that all children under 5 years of age admitted to the Special Care Ward, Dhaka Hospital of the International Centre for Diarrheal

Disease Research (ICDDR,B) from 1 September to 31 December 2007 were considered for enrollment if they also had diarrhea. Of the 258 children with diarrhea enrolled, those with (n=5198) or without (n=560) WHO-defined pneumonia constituted the pneumonia and comparison groups, respectively. Among the 198 children with pneumonia, children who survived (n=5174) were compared with those who died in hospital (n=524). (CHISTI et.al, June 2011)

In a study some researchers followed up with 259 patients who were admitted to the hospital with CAP between 2008 and 2011 and collected demographic data, as well as information about pre-existing comorbidities, vaccinations, and laboratory test results within 48 hours of patients being admitted to the hospital. The study shows that 79 (30.5%) of the 259 patients died within 1804 days of discharge. According the the researchers "The main underlying causes of death during the follow-up period among the 79 non-survivors were COPD (23%), vascular diseases (23%) and malignancy (16%), while only 5% (4 cases) died because of recurrent pneumonia,". (Holter JC, 2016)

The study revealed that among 22 patients the comorbidity of severe pneumonia and diarrhea was found in 55% patients. Nine patients (41%) had the comorbidity of dysentery with pneumonia. Seven (32%), 1 (5%) and 3 (14%) patients suffered from persistent diarrhea, malaria and influenza respectively along with pneumonia. Fever, shaking chill, cough and fast breathing problem were the common signs and symptoms of pneumonia. Childhood pneumonia in Dhaka city is associated with comorbidities. Common signs and symptoms of pneumonia can be useful for developing strategies for treating the disease immediately. In this study, as our sample size is too short we got no deathreports that occurred by childhood pneumonia. It is very important that the mothers and family members should have the appropriate knowledge about the clinical features of pneumonia. Immediate detection of clinical signs and starting appropriate treatment can prevent the deaths due to childhood pneumonia. From the perspective of Bangladesh, people are still not aware about pneumonia and its risk factor, causes, symptom and treatment, that signified by the study.

Chapter: 6

Annexure-1

Incidence of Childhood Pneumonia

Patient in a hospital of Dhaka city, Bangladesh

1. Name (if interested):_____
2. Sex: □ Male □ Female
3. Age: _____
4. Net household income (BDT) : ☐< Tk 5000 ☐ Tk 5000-10,000 ☐ Tk 10,000-50,000 ☐>Tk 50,000
5. Symptoms of pneumonia:

Symptoms of pneumonia	Yes	No	Don't know
Fever			
shaking chills			
Cough			
stuffy nose			
very fast breathing, breathing with grunting or wheezing sounds, working hard to breathe			
Vomiting			
chest pain			
abdominal pain, which often happens because a child is coughing and working hard to breathe			
loss of appetite or poor feeding			
bluish or gray color of the lips and fingernails			

6. Suffering time period: _____
7. Hospital admission time period: _____

8. Prescribed drugs:

_____

_____

9. Do you knowPneumococcal disease is caused by bacteria that can spread from person to person through close contact: □ Yes □ No
10. The child's condition was classified as pneumonia:
    - Community-acquired pneumonia (CAP) □
    - Hospital-acquired pneumonia □

11. Hart Rate_____

12. Renal rate_____

13. Comorbidity_____

_____

14. Other information:

Chapter 8

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