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Identification of the Congenital Heart Disease among Children with Recurrent Respiratory Infection

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ABSTRACT

Congenital Heart Disease CHD is the most common congenital problem accounting for nearly 25% of all congenital malformations and is the most common type of heart disease among children. Most of the cases are asymptomatic and discovered during routine checkup. As it is the most common major birth defect, put a significant economic burden and psychological impact on the affected families and treatment is expensive, it is very important to find out its pattern among children. In Bangladesh the pattern of CHD is not well documented and there is still lack of awareness regarding health problems and lack of diagnostic facilities which make the detection of CHD difficult. Therefore, early detection and proper intervention is most important. However the study has conducted to know the present status of CHD among children, to compare with different ages of under 5 children indicating CHD in Bangladesh, to develop a control model recovery system linking with recommendations on the study of recurrent LRTI related to CHD. This is a prospective observational study. The study was conducted in the department of Paediatrics, Dhaka Medical College Hospital, and Sir Solimullah Medical college Hospital, Bangladesh. Children in both outdoor and indoor admitted in the department of Paediatrics. Purposive sampling technique has applied. Total 200 samples have been collected between 2 months to 5 years of age. The Primary has collected on the basis of field observation, interviews, questionnaire, key informant interviews, feedback meeting and relevant networking, negotiation, communication and interpersonal communication. Secondary Data will be carried out on the following in the libraryBooks, Thesis, project paper and review paper prepared on the related field, Scientific journals, Magazines, Different university studies, Government documents and the publications and also related sources available websites. Collected data analysis was done by using Computer Program Statistical package for the Social Sciences (SPSS) version 26. Tables, graphs were made by using SPSS, MS Excel 2016 and R Programming version 3.5. From the result it was found that the case of children with RLRI; congenital heart disease is an important cause behind it. The percentage of presence of CHD is near about one third of total sample collected for the study. So there is a great opportunity for diagnosis of CHD in children with RRI. For this reason, each and every child with RLRI should be investigated appropriately to search any CHD present or not. Newborn CHD screening was an efficient method to prevent delayed diagnosis of CHD, and due to these efforts, this kind of screening has been routinely implemented in many areas of different country (Oster, M.E et *al.* 2016). Parents counseling is very necessary to understand the evaluation of this condition. Through suitable management of CHD, RLRI can be prevented more. By this, we can reduce the Infant and childhood mortality in our country and correlate the existing national policy in link with Sustainable Development Goals 2030. For this purpose, the research recommends for future research trajectory. So, it should be remembered that every child with RLRI will verify correctly to search for any CHD present or not. Every Necessary investigation facilities should arranged to diagnosis the CHD. All health care professionals should properly train up about identification of CHD. Follow-up and counseling have to be established for every patient with CHD.

Key words: *Congenital Heart Disease, Children, Recurrent Respiratory Infection, Anaemia, Hepatomegaly, Nutrition.*

INTRODUCTION

Congenital Heart Disease (CHD) is one of the most common types of birth defect in children. It is a difficulty with the structure of the heart and present at birth. The defects involve the valves, the walls of the heart and also the arteries and veins near the heart. They can interrupt the usual flow of blood through the heart. So, the blood flow become slowly down, and passes into wrong direction or wrong place, or be blocked totally. Many CHDs are remaining undiagnosed and comes with complication due to lack of routine neonatal checkup and proper diagnostic facilities. On the other hand, RTI is one of the major causes of child mortality in the world and RRTI is also common. CHD is one of the important cause of RRTI. The incidence of CHD is about 0.8% to nearly 1% among newborns (Sunnegardh, 2000) (Olney, 2015). The actual cause of a CHD is unknown (Causes Congenital Heart Defects, 2015). Risk factors consist of certain infections during pregnancy like rubella, use of certain medications or drugs such as alcohol or tobacco, parents being closely related, or very poor nutritional status or obesity in the mother (Mendis,

2011)(Dean, 2014). Having a parent with a CHD is also a risk factor (Milunsky, 2011). A number of genetic predispositions are associated with heart defects, such as Turner syndrome, Down syndrome, Marfan syndrome etc (Mendis, 2011). Congenital heart defects are classified into two main groups: cyanotic and acyanotic heart defects, depending on whether the child has the potential to turn bluish in color (Mendis, 2011). The defects may engage the interior walls of the heart, the heart valves, or the large blood vessels that lead to and from the heart. (What are Congenital Heart Defects, 2015?). RRTI is the common manifestation of these CHDs. So early identification of CHD could be possible by thoroughly examination of every RRTI and can be managed properly

OBJECTIVE OF THE STUDY

The Specific Objectives of the study are as follows:

1. To know the present status of CHD among children
2. To compare with different ages of under 5 children indicating CHD in Bangladesh.
3. To develop a control model recovery system linking with recommendations on the study of recurrent LRTI related to CHD.

DEFINITION OF KEY TERMS

1. Respiratory tract infection

Respiratory tract infections (RTIs) are infectious diseases affecting the respiratory tract. It's more or less impossible to avoid viruses and bacteria, but some risk factors increase the chances of developing acute respiratory infection (ARI). ARI accounts for up to 50% of visits of children to health facilities in worldwide (West T, 1999). ARI is common among children of under-five years. ARIs are the principal cause of mortality in children under five years of age globally. Most of these deaths are due to pneumonia and bronchiolitis (Williams, B.G). In the majority cases these are caused or precipitated by viruses. The most recent median global estimate of the frequency of pneumonia among children under 5 year is 0.28 episodes per child year (e/cy) with a 25% to 75% interquartile range of 0.21-0.71 e/cy (Rudan,I. 2004). This equates to around 150.7 million fresh cases of pneumonia every year. Child and maternal age, residence and maternal hand hygiene plays significant rule to cause an acute respiratory infection (Dagne, H, 2022). Threatening factors for ARIs in the public settings are not fully understood, especially in low-income countries (Vidal, K, 2022). Season is the main danger factor especially incidence rate high in rainy monsoon season and cool dry winter in comparison to hot dry summer in the first 2 years of life. On the other hand, young maternal age and low birth weight are associated with higher ARI incidence during the first 6 months of life (Vidal, K, 2022). The immune systems of children are more vulnerable to being affected by viruses (Deborah, 2019). Children are particularly at risk because of their regular contact with other kids who could be virus carriers. They sometimes don't wash their hands routinely. They are also much likely to rub their eyes and introduce their fingers in their mouths, resulting in the extend of viruses (Deborah, 2019).

ARI is manifested by cough and short rapid breathing which may be linked with death especially when there are other co-morbidities (Dagne, H, 2022). An infection of this type generally is further classified as an upper respiratory tract infection (URTI) or a lower respiratory tract infection (LRTI). The occurrence rates of URTI are higher during the monsoon and pre-winter periods, and LRTI at the end of the monsoon and during the pre-winter periods. Sociodemographic variables are not related with the frequency of upper respiratory infection (URI) or lower respiratory infection (LRI) (Zaman, K, 1997). Common symptoms of RTI include cough, sneezing, stuffy or runny nose, sore throat breathing difficulties, chest tightness, wheezing, fever etc. (2019, Respiratory tract infections, Slainecar) LRTIs are chief cause of morbidity and mortality globally (Murray, C. J. L., 2013). LRTI is a wide terminology encompassing different clinical manifestations and etiologies, which may differ according to, for example, age and season among others (Khan, S., Singh, P, 2014). Lower respiratory infections, such as pneumonia, tend to be far more serious than upper respiratory infections, such as the common cold. The upper respiratory tract is measured the airway above the glottis or vocal cords. This part of the tract includes the nose, sinuses, pharynx and larynx. Common infections of the upper respiratory tract (URT) consist of sinusitis, otitis media, tonsillitis, pharyngitis, laryngitis, certain influenza types, and the common cold (Eccles., 2007). Symptoms of URI can include running nose, nasal congestion, sneezing, cough, sore throat, headache, low-grade fever etc.

The LRT consists of the trachea, bronchial tubes, bronchioles, and the lungs. LRIs are usually more severe than URIs. LRIs are the principal cause of death among all infectious diseases (Robert. 2004). The two most common LRIs are pneumonia and Bronchiolitis (Antibiotic. 2006). LRTI occurs more frequently caused by viruses, bacteria, fungi and others (Khan et al., 2020b). There are so many underlying factors for recurrent LRTI like severe protein energy malnutrition, congenital and acquired immune deficiency states etc (Khan et al., 2020c). Organisms enter the distal airway by inhalation, aspiration or through hematogenous way. The pathogen multiplies in or on the epithelium, resulting inflammation, enhanced mucus secretion, and reduced mucociliary function; other lung functions may also be affected. In severe bronchiolitis, inflammation and necrosis of the epithelium may obstruct small airways leading to airway obstruction (Purushothama, 1996). Clinical manifestation of LRIs differs and depends on the severity of the infection. Mild infections can have symptoms similar to the common cold, including dry cough, runny nose, low

grade fever, mild sore throat, dull headache but in severe infections, severe cough, fever, difficulty breathing, blue tint to the skin, fast breathing, chest pain, wheezing may present (Alana, B. 2019).

In general, viruses are responsible for a great proportion of LRTIs but antibiotics are often unreasonably prescribed for their treatment without any laboratory testing and can develop to the emergence of antimicrobial resistance (Ren, L, 2012. Pavia, A, 2011). Influenza affects both the upper and lower respiratory tracts (Van Riel, 2006). The respiratory rate is a important clinical sign for diagnosing acute LRI in children who have coughing and fast breathing associated with lower chest wall indrawing indicates more severe disease (Mulholland and others 1992; Shann, Hart, and Thomas 1984). Both bacteria and viruses are responsible for pneumonia. The variation between bacterial and viral infections is easy. Bacterial infections are caused by bacteria, while viral infections are caused by viruses. Many ailments and illnesses have similar symptoms whether they are viral or bacterial—the largest difference between these two types of infections is that bacterial infections can be treated with antibiotics, while viral infections cannot (Bacterial Respiratory Tract Infection)

A bacterial respiratory tract infection is an infection of the throat, sinuses, airway, or lungs. Bacterial infections may grow after having a viral illness like a cold or the flu. Symptoms tend to restrict to one particular area (Bacterial Respiratory Tract Infection). Respiratory bacterial infections can affect two respiratory tract of your body: the upper and the lower. The common organisms for Bacterial pneumonia are *Streptococcus pneumonia* (pneumococcus), *Haemophilus influenzae,* mostly type b (Hib), and occasionally by *Staphylococcus aureus* or other streptococci. *Mycoplasma pneumoniae* and *Chlamydia pneumoniae,* cause atypical pneumonia. The load of LRIs caused by Hib or *S. pneumoniae* is hard to determine because current techniques to establish bacterial etiology lack sensitivity and specificity. Bacterial cultures of lung aspirate specimens are often measured the gold standard, but they are not practical for field application (Vuori-Holopainen and Peltola's; 2001) review of several studies indicates that *S. pneumoniae* and Hib account for 13 to 34 percent and 1.4 to 42.0 percent of bacterial pneumonia, respectively, whereas other studies (Adegbola and others; 1994), Shann, Gratten, and others ;1984), suggest that Hib accounts for 5 to 11 percent of pneumonia cases (Wall and others; 1986)

Complications of ARI are extremely severe and can effect in permanent damage and even death such as respiratory arrest, respiratory failure, congestive heart failure etc. ((Deborah, 2019). Maximum causes of an ARI aren't treatable. Therefore, prevention is the best technique to ward off dangerous respiratory infections (Deborah, 2019). A Physician will usually identify a lower respiratory infection during an exam and after discussing the symptoms a children has and how long they have been present. During the exam, the doctor will listen to the child's chest and breathing by a stethoscope. The doctor may order tests to help to make a diagnosis the problem, such as: pulse oximetry to find oxygen saturation is in the blood, chest X-rays to prove for pneumonia, blood tests to check for organisms, mucus samples to look for bacteria and viruses (Alana, B. (2019)

2. Recurrent respiratory infections

There are many children suffering from RRI but the greater parts of them do not suffer from dangerous lung or extra pulmonary disease. The challenge for clinicians is to differentiate the recurrent RTIs with self-limiting or minor problems from those with underlying disease (Patria, M.F, 2011). The child with RRI presents a difficult diagnostic challenge. RRIs are a very common medical condition in children; in reality about 25% of children less than 1 year and 6% of children during the first 6 years of life have RRIs (Chiappini, 2021). In majority cases, infections happen with mild clinical manifestations and the incidence of episodes tends to decrease over time with a complete recovery by 12 years of age. Moreover, RRIs extensively decrease child and family quality of life and lead to important medical and social costs (Chiappini, 2021) In case of otitis media; a reference standard for incidence is three episodes within 6 months or four episodes within 12 months. Roy (Roy, E (2007). Every definition of RRI is arbitrary and too generic and limiting. Rather than defining if a child has repeated infections with an objective numeric assessment, it is better to know (AlKhater, S.A., 2009). If the child normally feels good, if there are conditions that could be diagnosed and treated as a true disease, if the findings on the history and clinical examination are suggestive of an immunodeficiency. It is obvious, that only a little appropriate tests are enough helpful to discriminate between a "well-being" child and a patient with immune dysfunction (Don, M, et. All. 2007). It has been proposed that to identify RRI at least one of the following criteria has to be present ≥ 6 respiratory infections per annum, ≥ 1 respiratory infections per month involving the upper airways from September to April, ≥ 3 respiratory infections per annum involving the lower airways (Ameli, F *et al*· (2020).

It is essential to discriminate between those with simply-managed cause for their symptoms such as recurrent viral infections or asthma, from the children with more severe original pathology such as bronchiectasis or immune dysfunction. Various disorders present this way, including cystic fibrosis, multiple immunodeficiency syndromes, congenital anomalies of respiratory tract, but in some children lung damage could follow a single severe pneumonia or can be the result of the inhalation of food or foreign body (Couriel, 2002). According to the epidemiological studies it was measured that around 6% of the children younger than 6 years of age present RRI. In developed countries, up to 25% of children aged < 1 year and 18% of children aged 1-4 years experience RRI (Bellanti, 1997). The actual job for

the paediatricians is to distinguish the normal children with high respiratory infections frequency related to an augmented exposure to environmental risk factors from the children affected by other underlying pathological conditions predisposing to infectious respiratory diseases (De, M., Balloti, S.2007). Typically, the children with RRI are not affected by severe alterations and RRI represent effectively the consequence of a better exposure to infectious agents due to environmental factors during the first years of life (Arden et al., 2006).

Upper respiratory infections (URI) are frequent but are unlikely to show an underlying medical condition when they occur in isolation (Thomas, 2021). When evaluating the patients with recurrent infections, it is rational to use acronym SPUR (severe, persistent, unusual, and recurrent) to quick appropriate investigations for underlying causes. Children with RRI have the course of the airway infections (feature, severity and duration) parallel to those presented by children with "normal" incidence of respiratory infections. The occurrence of RI (Respiratory infection) in children with RRI shows classic seasonality with the highest rate during autumn and winter (Arden et al., 2006). Usually, these children are not affected by the recurrent infections of the other systems (Central nervous system, gastrointestinal tract, uro-genital tract or skin). Even as most children with recurrent infection have a normal immunity, it is important to identify the child with an underlying primary immunodeficiency and explore and treat correctly and not over-investigate normal children (Slatter & Gennery, 2008).

RRI are a regular problem mainly in preschool age, typically due to the presence of unfavorable environmental conditions, such as the immaturity and inexperience of the immune system (Simon, 2015). In infancy and early childhood the immune system encounters antigens for the first time, increasing immune responses and acquiring memory. Young children mix with other children in families are exposed to many organisms and therefore there are more susceptible to infection and recurrent infections are common (Slatter & Gennery, 2008). Most of the children are simply having the frequent viral upper respiratory tract infections that are a normal part of growing up. In others, the symptoms are the first manifestations of asthma. If there is a history of constant or recurrent pneumonia with or without chronic sputum production, it is representing more severe pathology (Couriel, 2002). RRI primarily occur as a viral respiratory tract infection, but bacterial growth is established in 60% of patients with symptoms of an upper respiratory tract infection of at least 10 days duration (Elliott, 2008).The children with prolonged or repeated respiratory illnesses most often have a series of infections rather than constant infection with one virus strain (Jartti, 2008). A few children experience significant morbidity due to RRI and get repeated courses of antibacterial that are not efficient against viral infectious agents and can increase bacterial resistance (Bousquet & Fiocchi, 2006). Eight or more respiratory infections per year in children under the age of 3, and six or more in children older than age 3 **(**Eldridge, L 2020). RRI are so common, with 10% to 15% of children experiencing these infections (Schaad, 2016)RRI are unusual in the first six months of life, as antibodies from the mother are still present. After 6 months of age children still have a relative immune deficiency until their immune systems grown-up at the age of 5 or 6 years old. In developed countries, recurrent respiratory infections are a chief cause of hospitalization, responsible for 8% to 18% of hospitalizations in the UK (de Benedicts, 2018). In developing countries, the scenario is grim. Recurrent respiratory tract infections are thought to result in 2 million deaths annually (Schaad, 2016)

3. Congenital Heart Disease

CHD are the most common birth defect and the leading cause of birth defect-related deaths (Mendis, 2011); Vos, T, 2015). CHD, a common cause of congenital malformations, represents a main worldwide health problem. (Linde, D.V.D. *et al*, 2011); Dolk, H. 2011) CHD is one of the principal causes of death in full term babies and small children (Chowdhury, H.R. et al. 2010). In developed countries, these heart defects can be identified before birth, allowing parents the opportunity to terminate the pregnancy or to prepare for special care of their child at birth. Because these children now live longer due to advances in medical care. A probable 2,95,000 newborns die within 28 days of birth each year, worldwide, due to congenital anomalies. Congenital anomalies can contribute to long-term disability, which may have important impacts on individuals, families, health-care systems, and societies. The most frequent, severe congenital anomalies are heart defects, neural tube defects and Down syndrome. Although congenital anomalies may be the outcome of one or more genetic, infectious, nutritional or environmental factors, it is often hard to identify the accurate causes.

A CHD, also known as a defect in the structure of the heart or great vessels that is present at birth (National Heart, 2015) .The incidence of CHD is about 0.8% to nearly 1% among newborns (Wu, W, 2020). Repairing a heart defect early in life can avoid the development of its inoperable outcome -- Eisenmenger syndrome. Two in every 100 child cardiac patients had developed Eisenmenger syndrome, and age is the most significant risk factor for developing Eisenmenger syndrome in children with CHD (Fangqi, G. 2020). Defects range in severity from easy, such as "holes" between the chambers of the heart, to very severe malformations, such as complete absence of one or more chambers or valves. CHD now can be detected during fetal development; fetal study done with sonography have shown that CHDs are more common in the fetus than after birth and that the disease prospects are more severe in the fetal stage than in live births. Search of spontaneous abortion fetuses have shown severe CHD, often in relationship with chromosome disorders (**Dugas, 2021)**

Clinical features depend on the specific type of defect (Mendis, 2011). Symptoms can differ from none to severe (National Heart, 2015). The common symptoms may include rapid breathing, bluish skin (cyanosis), poor weight gain, and feeling tired (Signs and Symptoms of Congenital Heart Defects, 2015). A general complication of CHD is heart failure (Signs and Symptoms of Congenital Heart Defects, 2015). Critical congenital heart disease (CCHD) represents a group of heart defects that cause serious, life-threatening symptoms and requires intervention within the first days or first year of life. (Khalil, M *et all*. 2019). CCHD is often treatable if identified early. It can include abnormalities in the rhythm of the heart, as well as a wide array of structural heart problems. These problems can range from mild (never requiring cardiac surgery), to severe (requiring multiple different stages of open heart surgeries). CCHD can engage abnormal or absent chambers, holes in the heart, abnormal connections in the heart, and abnormalities in the activity or squeeze of the heart. Most congenital heart conditions involve patients from childhood through adulthood. (Khalil, M *et al*. 2019). Some babies with CCHD can look and act like healthy at first, but within few hours or days after birth they can have serious complications. Pulse oximetry newborn screening is a non-invasive test that determine how much oxygen is in the blood and can help to identify babies that may be affected with CCHD before they leave the newborn nursery. If diagnosed early, infants affected with CCHD can often be treated and lead longer, healthier lives (Chamsi-Pasha, M.A., Chamsi-Pasha, H. 2016). CHD, grouped by structural and functional type: Due to the large variation of congenital heart defects, any classification and sub grouping of these defects will be incomplete. Some defects may be measured simple and rather innocent, yet most of them are life threatening either immediately after birth or at a later age if left untreated. Below is aoutline of different types of defects, grouped by structural and function type (Sunnegardh, 2000).

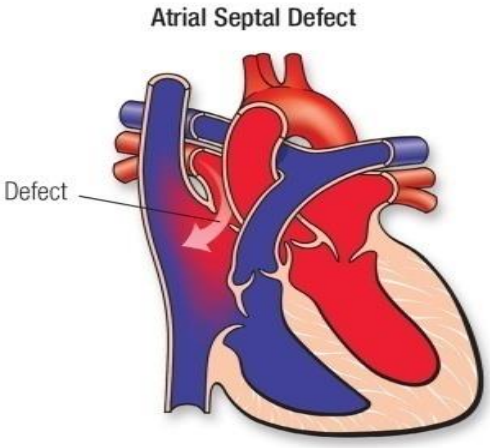


Figure-1: Atrial Septal Defect

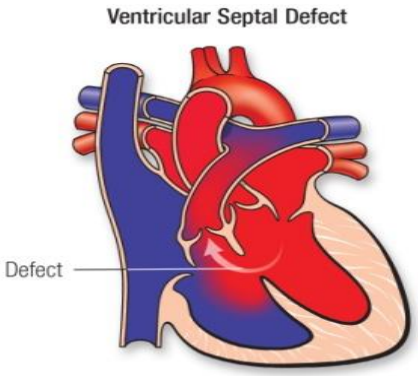


Figure- 2: Ventricular Septal Defect

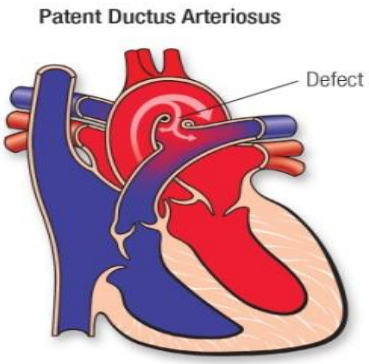


Figure- 3: Patent Ductus Arteriosus

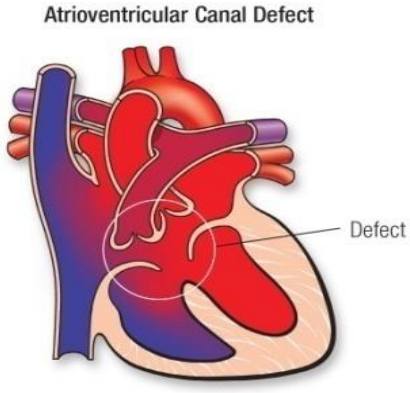


Figure-4: Atrioventricular Canal Defect

Systemic to pulmonary shunt defects or left to right shunt defects; include ventricular septal defects (VSD), atrial septal defects (ASD), persistent ductus arteriosus (PDA) and atrioventricular septal defects (AVSD) as the more common ones. Provided the pulmonary vascular resistance is lower than the systemic vascular resistance the shunt across the defect will be left to right, and the pulmonary blood flow is enhanced in these patients. In patients with VSD, PDA and complete AVSD left ventricular failure may develop if the shunt is large, while in patients with ASD the right ventricle will dilate rendering a poor right ventricular function later in life. Valvular stenosis occurs both on the right side of the heart, pulmonary valve stenosis, and on the left side, valvular aortic stenosis. As with some of the shunt lesions discussed above, they might be mild without causing any symptoms for several years. They may however also be severe and life threatening directly after birth. In these latter cases either the pulmonary (critical pulmonary stenosis) or the systemic circulation (critical aortic stenosis) is duct dependent. This may also be the case in some patients with coarctation of the aorta and in all patients who suffer the unusual defect of interrupted aortic arch.

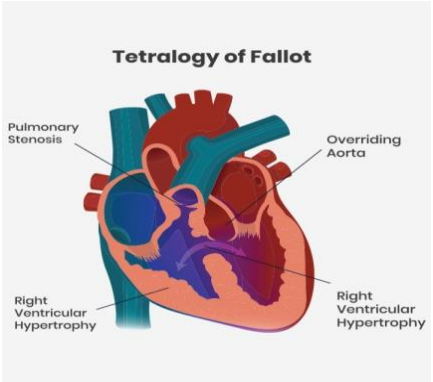


Figure-5: Tetralogy of Fallot

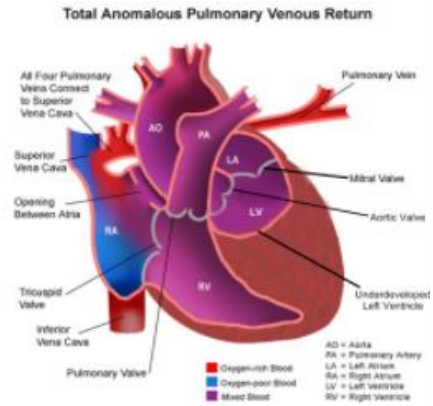


Figure- 6: Total Anomalous Pulmonary Venous Return (TAPVR)

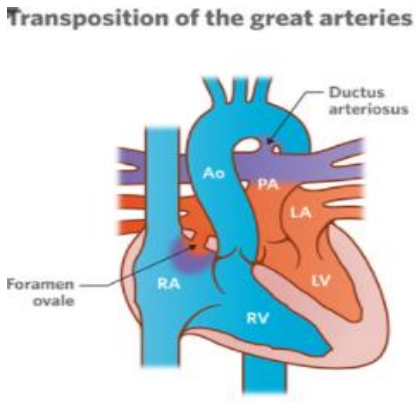


Figure-7: Transposition of the great arteries

Tetralogy of Fallot (TOF) and transposition of the great arteries (TGA) are more common cyanotic heart defects.

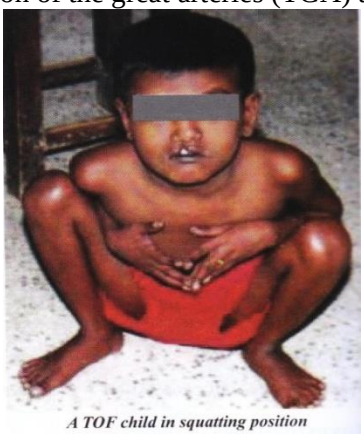


Figure-8: A child with TOF in squatting position

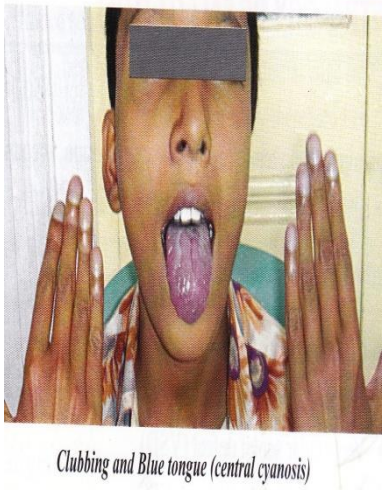


Figure-9: A TOF patient showing Clubbing and Cyanosis

Some patients with TOF may have a duct dependent pulmonary circulation or be severely cyanotic shortly after birth, while others may be circulatory stable for many months or even years after birth. Patients with isolated TGA usually present shortly after birth with intense cyanosis and may die within hours or days if left become untreated. However patients with these lesions have an excellent long-standing survival and outcome after surgical correction.

Truncus arteriosus, total anomalous pulmonary venous return are other cyanotic CHD.The most common combined defects in this category are hypoplastic left heart syndrome, double inlet left ventricle and tricuspid atresia. They all comprise complex entities where one has to surgically control and balance the pulmonary blood flow within the first weeks after birth, followed by surgical correction. Other heart diseases in children-Cardiomyopathy may be classified as dilated or hypertrophic (Lee, 2017). In both types the etiology may be genetic or unknown (Lipshultz, 2019). In case of dilated cardiomyopathy mainly the systolic function of the heart is affected, while in the patients with hypertrophic cardiomyopathy this concerns mainly the diastolic function of the heart. These diseases may affect children under the age of one year who may need lifetime pharmacological treatment and in many cases even heart transplantation (Cox, 2006). Pulmonary hypertension in small children is usually a common complication of congenital heart defects, and has to be dealed with as early as possible in order to prevent a chronic state of pulmonary vascular disease (Simonneau, 2013). For example patients with large VSDs, complete atrioventricular septal defects

have to be corrected early, i.e. within months, in order to prevent pulmonary obstructive vascular disease (Lammers, 2016). Idiopathic pulmonary hypertension is rarely seen in children below the age of one year.

Some small defects do not need treatment (What are Congenital Heart Defects, 2015). Others may be efficiently treated with catheter based procedures or heart surgery. Sometimes a number of operations may be needed (How Are Congenital Heart Defects, 2015) or a heart transplant may be required (How Are Congenital Heart Defects, 2015). With appropriate treatment, outcomes are generally good, even with complex problems (What are Congenital Heart Defects, 2015). It has been recommended that research should examine what particular needs these children have and what interventions are needed to progress the children's opportunities so they can develop to their full potential and live long and healthy lives (Castro, 2016)

METHODS AND MATERIALS

1. **Study design:** This is a prospective observational study.
2. **Study place:** In the department of Paediatrics, Dhaka Medical College Hospital, and Sir Solimullah Medical college Hospital, Bangladesh.
3. **Study population:** Children in both outdoor and indoor admitted in the department of Paediatrics.
4. **Study duration:** Over a period of 2 years
5. **Sampling method:** Purposive sampling technique has applied.
6. **Sample size:** Total 200 samples have been collected between 2 months to 5 years of age.
7. **Tools for data collection:** Questionnaire was used for data collection.
8. **Method of data collection:** The Primary has collected on the basis of field observation, interviews, questionnaire, key informant interviews, feedback meeting and relevant networking, negotiation, communication and interpersonal communication. Secondary Data will be carried out on the following in the library, (i) Books written by foreign writers as well as by homeland professors and researchers, (ii) Thesis, project paper and review paper prepared on the related field, (iv) Scientific journals, (v) Magazines, (vi) Different university studies, (vii) Personal communication with researcher, (viii) Government documents and the publications and also related sources available websites.
9. **Data compilation:** All general information regarding RTI and CHD, its history, clinical examination, investigation, diagnosis, were compiled according to research objective.
10. **Data analysis:** Collected data analyzed by using Computer Program Statistical Package for the Social Sciences (SPSS) version 26. Tables, graphs were made by using SPSS, MS Excel 2016 and R Programming version 3.5.

RESULTS

1. Age incidence

From the study at NEMCH, the incidence of the disease is more within one year and secondly between 1 to 2 year and low in between 3 to 4 year of age which are shown in Figure 12.

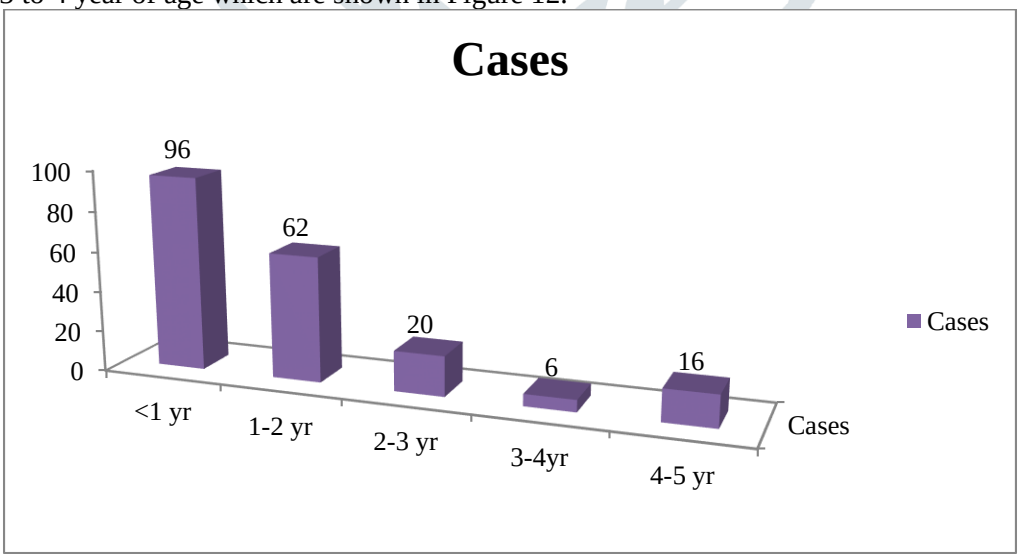


Figure: 12. Incidence of disease in different years of age at Department of Paediatrics of NEMCH

2. Sex differentiations

From the patient record of NEMCH, the total numbers of male children are 126 and female children are 74 in number at the Department of Paediatrics from 1st October, 2019 to 1st October, 2021. So, the disease happening, males are more predominant than females, which as shown in Figure 13.

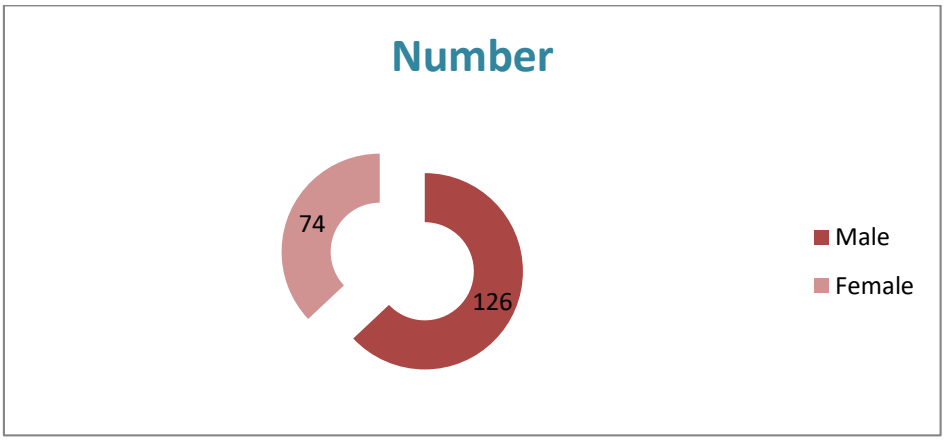


Figure: 13. Sex variation status of multiple Patients at Department of Paediatrics of NEMCH

3. Presence of Fast Breathing in patients

The majority of children present with fast breathing. It is the cardinal and primary sign of pneumonia. But some children may stand in preliminary stat before pneumonia where fast breathing remains absent which are shown in Figure: 14 below.

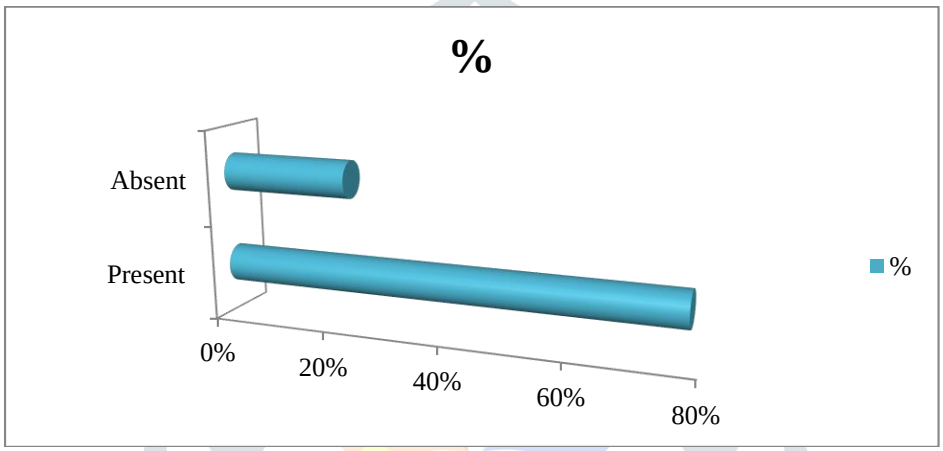


Figure: 14. Rate of patients with fast breathing

4. Patients with Tachycardia There are many patients represent with increased heartbeat called tachycardia according to age variable in number. In common, heart beat in case of newborn : >160, in case of infant : >150, in case of Toddler : >120, in case of 3-5yrs : >110 is called Tachycardia. Figure: 15 show different children with presence of tachycardia.

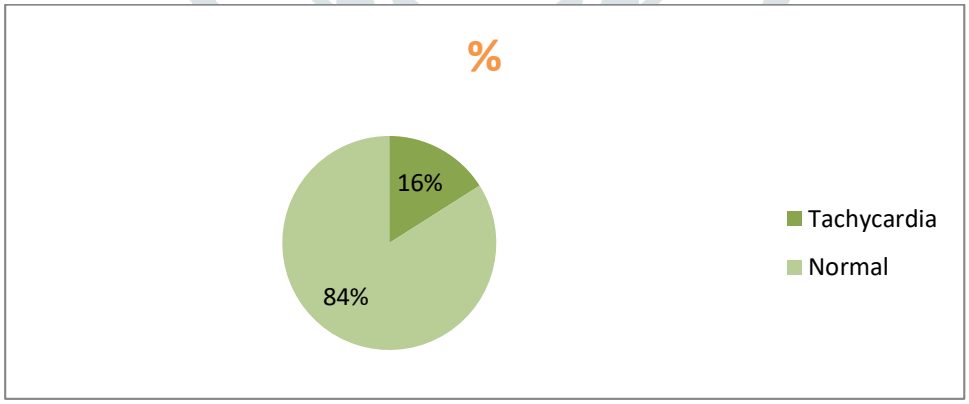


Figure: 15. Different patient with tachycardia

5. Condition of heart sound in children:

There are different areas for measurement of heart sound clinically which are shown below.

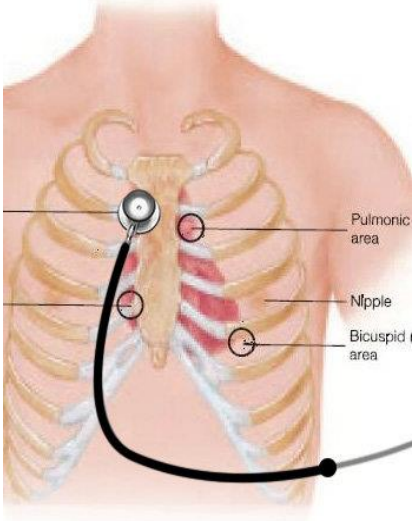


Figure: 16. Measurement of heart sound by stethoscope

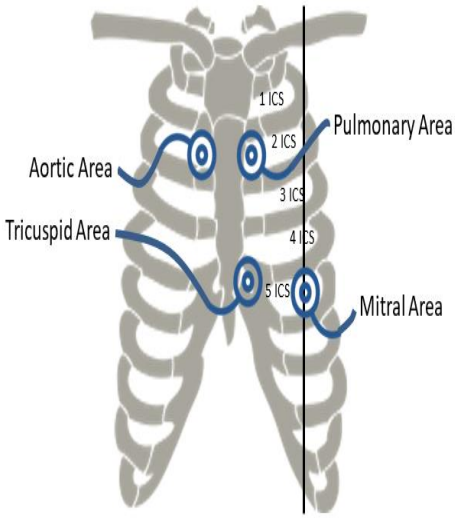


Figure: 17. Areas on the precordium for auscultation of heart

Above figure showing auscultation of different sites of heart to see the normal and abnormal heart sound clinically. From the study, it has been shown that the rate of abnormal heart sounds of those children is very minimal which is only 8%; otherwise the rate of normal heart sound is 92%. The added sound present in the heart is 42% and absent in 58% cases which as shown in Figure: 18.

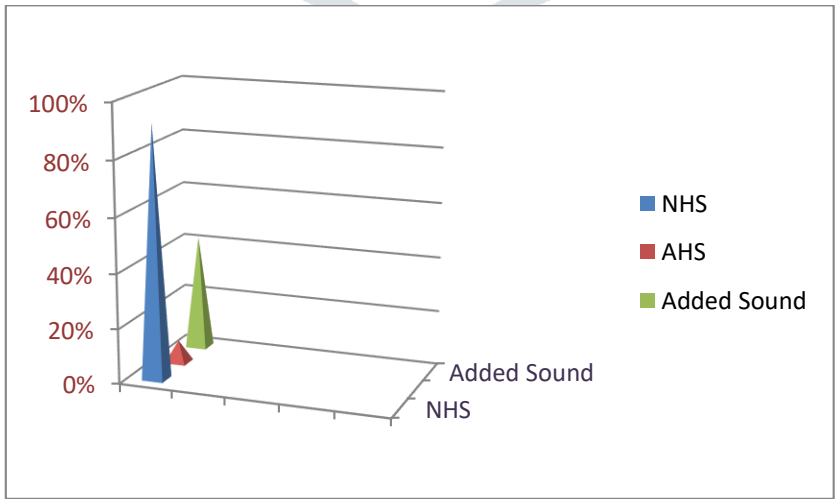


Figure: 18. The percentage of normal, abnormal and added sound in the heart

6. Increased body temperature

Fever is a common manifestation incase of children with ARI. Figure: 19 shows comparison between raised and normal temperature of the above mentioned cases.

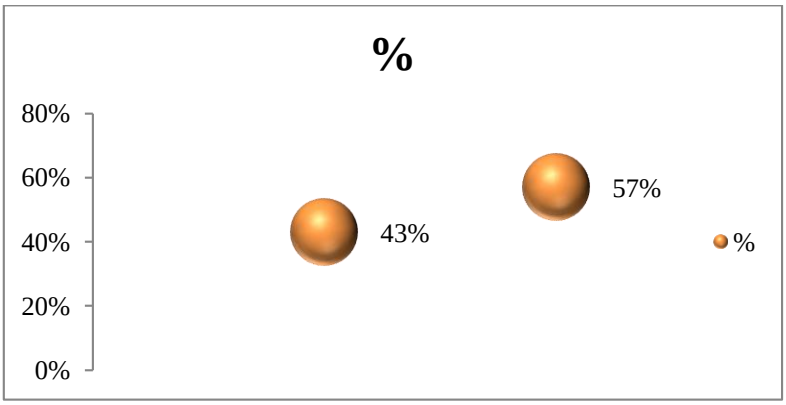


Figure: 19. Comparison between increased and normal temperature of the children

7. Existence of Cyanosis

There are many children present with cyanosis indicates severe respiratory distress. Some may present with heart failure and also it is the presentation of congenital cyanotic heart diseases. Following figure shows percentage of both cyanotic and acyanotic heart diseases.

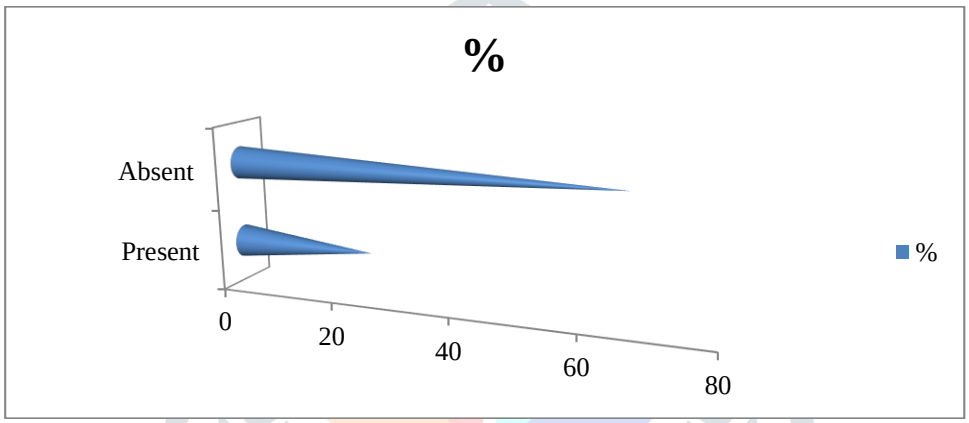


Fig: 20. Percentage of Presence of cyanosis in children

8. Percent saturation of oxygen (Spo2) in patient

Figure: 21. Showing measurement of Percent saturation of oxygen (Spo2) in different child

Hypoxemia is a major life-threatening complication of pneumonia in children. The existence of hypoxia is a predictor of radiological findings of pneumonia. From the evaluation, the oxygen saturation status of maximum patients stays in between the level of 90 to 94% which are shown in Figure: 22.

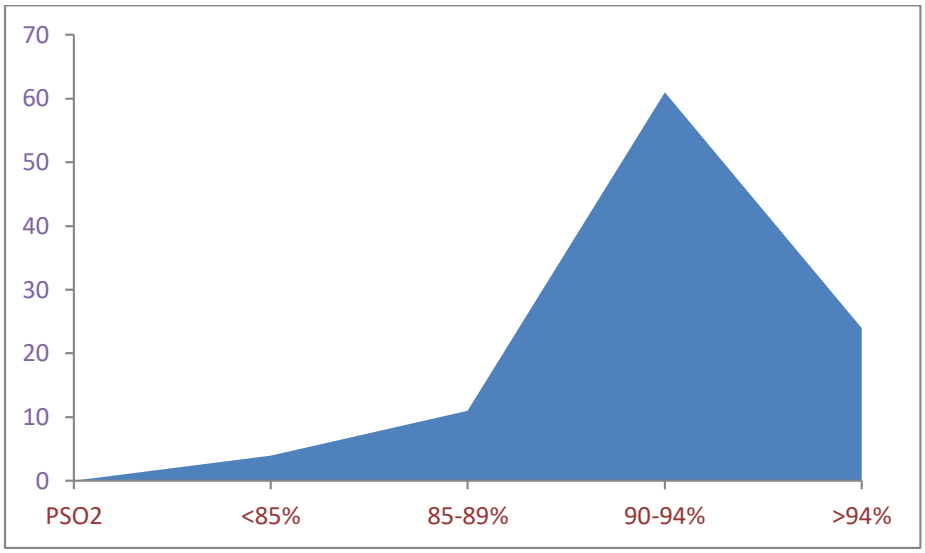


Figure: 22. Spo2 in different children admitted in Paediatric ward

9. Presentation of Anaemia in Patients:

Anaemia is a deficiency in the number or quality of red blood cells in our body. Red blood cells carry oxygen around our body using a particular protein called haemoglobin. Anaemia means that either the level of red blood cells or the level of haemoglobin is lesser than normal. About 1/3rd patients manifest as anemia which indicates chronicity of disease in both respiratory and cardiac system.

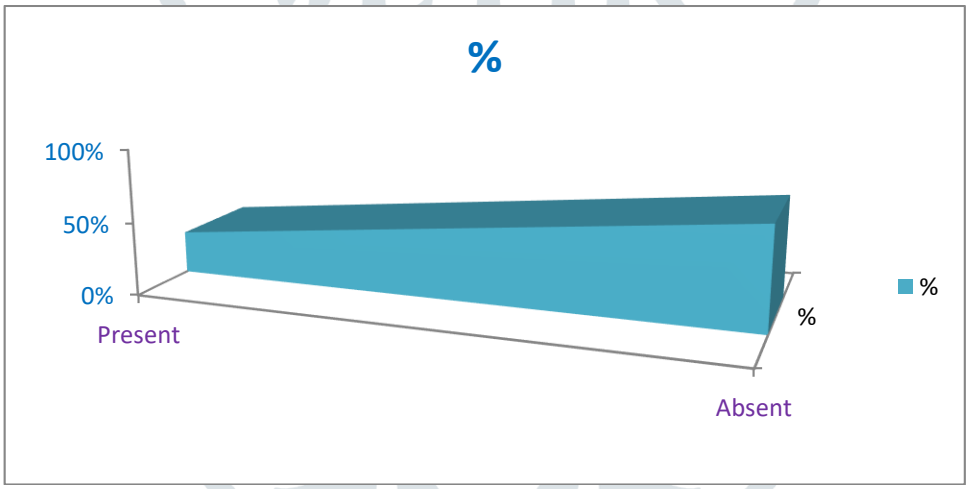


Figure: 23. Rate of Anaemia in study patients

10. Presence of hepatomegaly in patient

Hepatomegaly present in some cases of CHD in children with heart failure or long time problem. Following figure shows hepatomegaly present in 14.5% cases and absent in 85.5% cases.

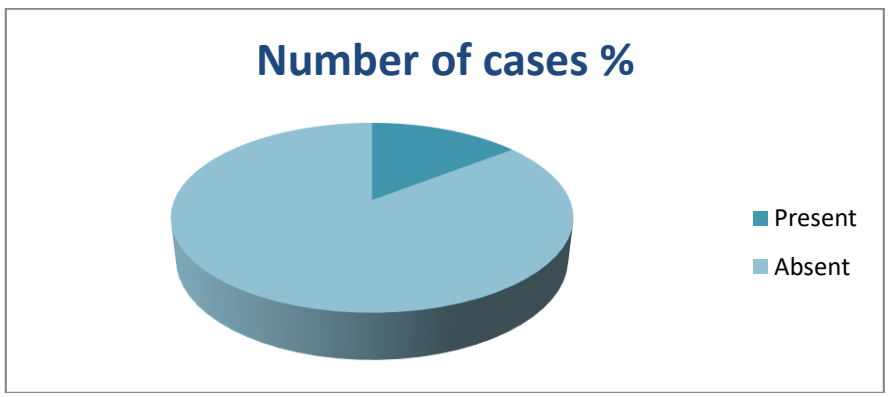


Figure: 24. Percentage oh hepatomegaly in all patients

11. Nutrional Status of the children:

Growth failure is a common presentation of CHD. RRTI is also a prime cause of delayed growth and development. So on weight measurement it has been shown that near about half of the cases are malnurished and out of them 3/4th cases are severely undernirished.

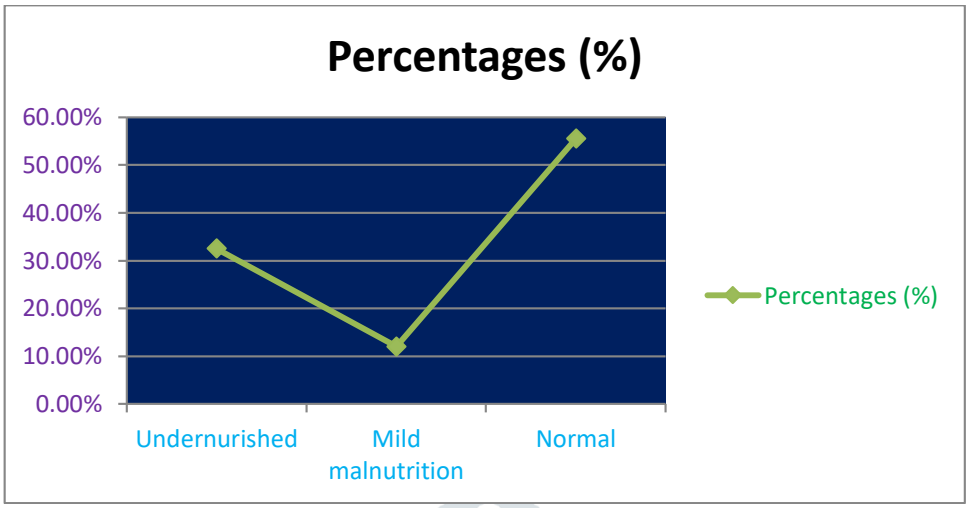


Figure: 25. Nutritional status of the study cases

12. Radiological features of chest

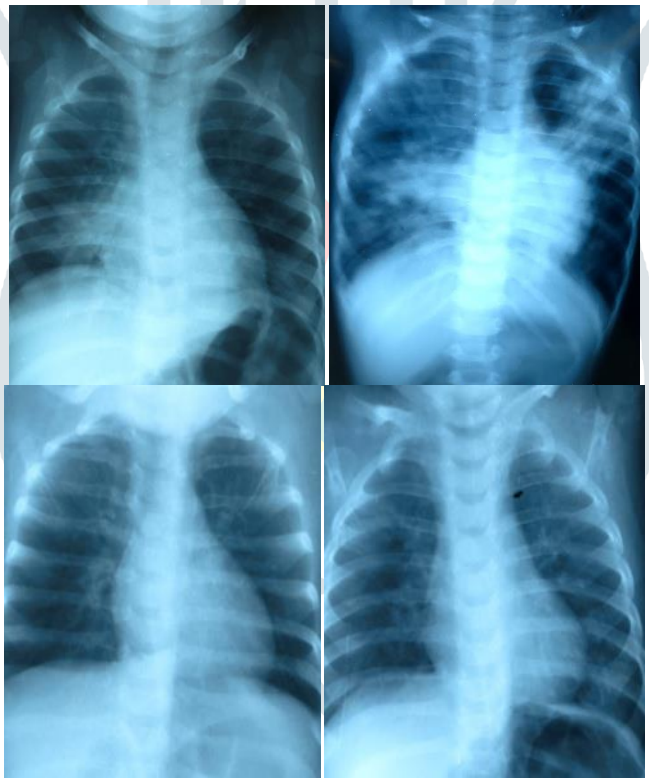
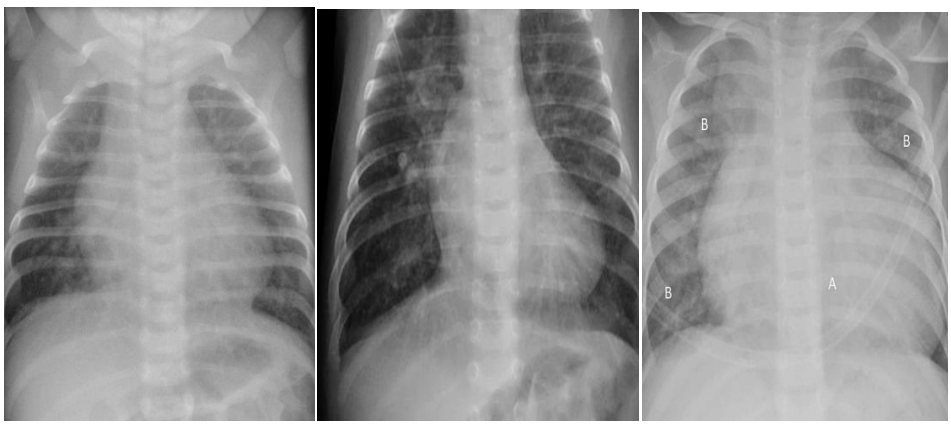
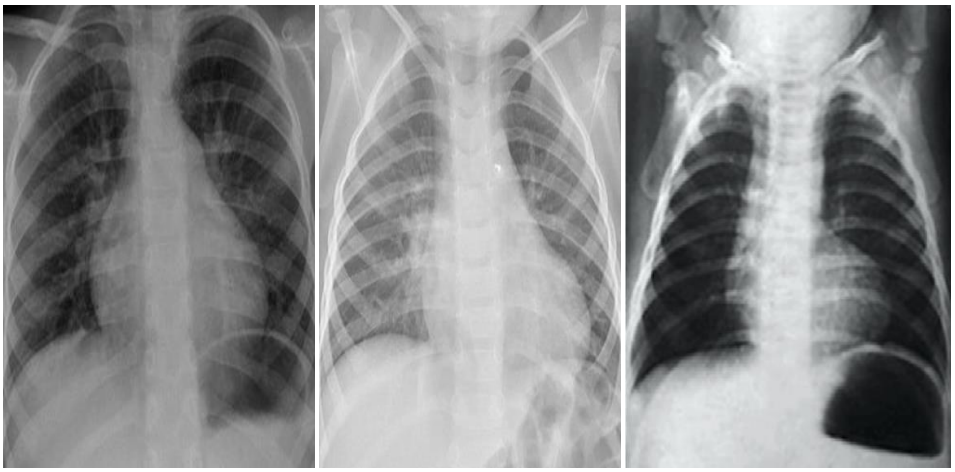


Figure: 26. Features of pneumonia in different child patients



VSD TGA TAPVR



ASD PDA TOF

Figure: 27. Figure showing different CHD in children

From estimation at NEMCH, out of the 200 patients, cardiomegaly was found in 31% of children and among them male was 20%, female was 11%.

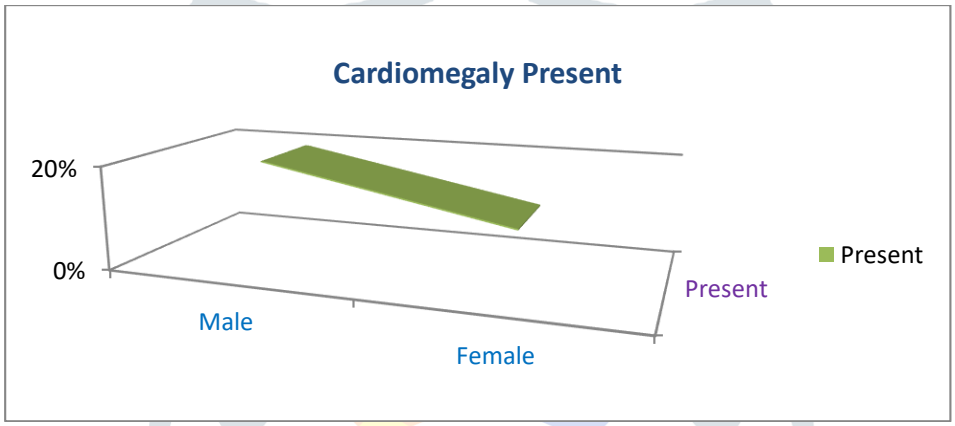
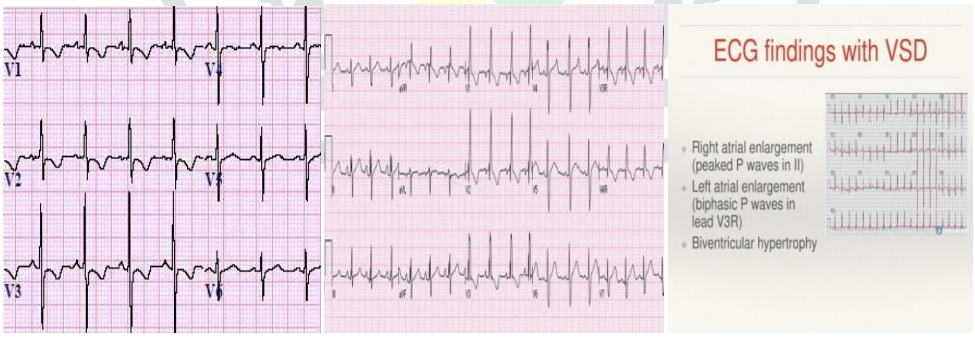


Figure 28. Presence of cardiomegaly in all Children

13. ECG findings



RVH **ASD** **VSD**

Figure 29: ECG changes in common CHDs

From inspection, ECG abnormalities were seen in 16% of children and among them Left Ventricular Hypertrophy (LVH) were 10%, Right Ventricular Hypertrophy (RVH) were 6%, which as shown in Figure 30.

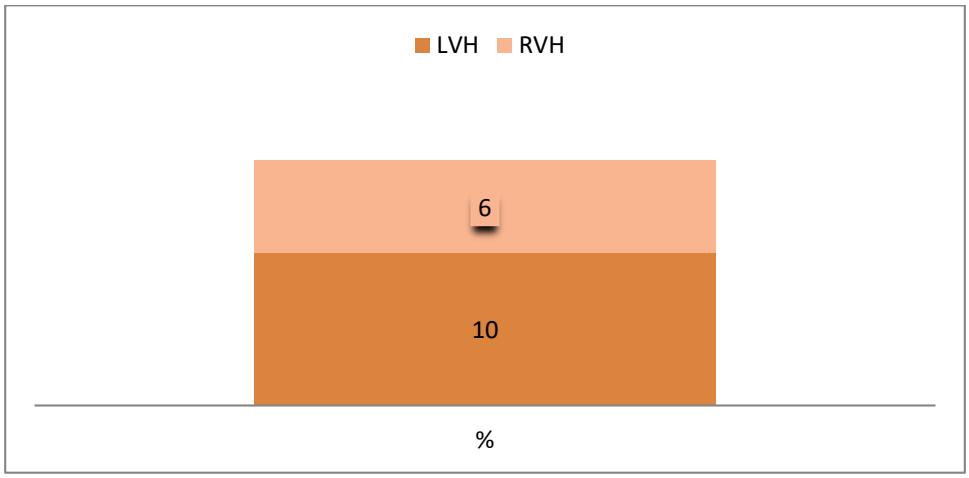
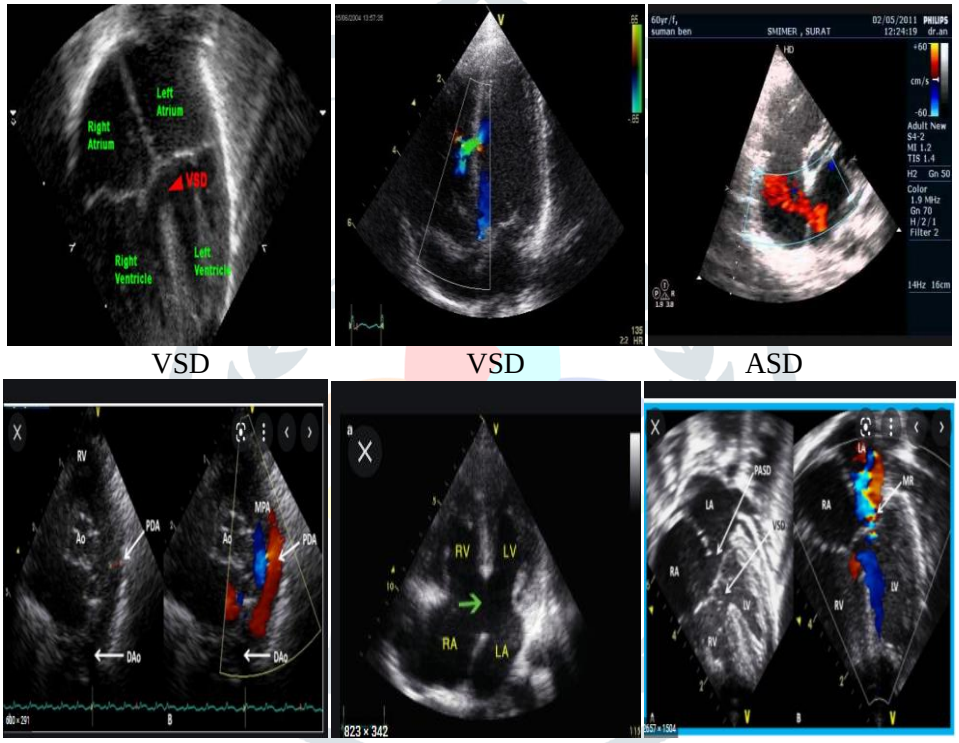


Figure 30: Rate of ECG abnormalities in study patients

14. CHD found in echocardiography



VSD VSD ASD

PDA AV Canal Defect TOF

Figure 31: Echo findings of children with CHDs

CHDs were found in 43% cases, diagnosed by echocardiography and were absent in 57% cases. In both cases there was male predominance than female, which as shown in Figure 32.

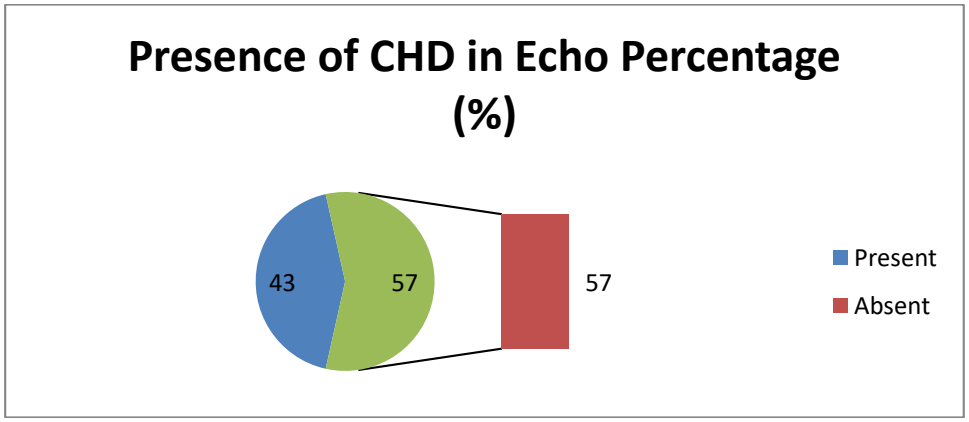


Figure 32: Percentage of presence and absence of CHD in echocardiography

From the study, the results were analyzed among children with the incidence of the disease being maximum below 2 years but minimum between 4 to 5 years. Males are more predominant than females in this study.

Case report: 1

A ten months old female baby weighing 7.5 kg got admitted to the Paediatric department in NEMCH, Sylhet, Bangladesh on 20 May, 2020. She has been suffering from fever, cough and respiratory distress for five days with difficulties in feeding. There was no history of convulsion, cyanosis, and unconsciousness. She was exclusively on breast feeding and proper weaning as well as immunized as per expanded program on immunization (EPI) schedule. She also had a history of repeated respiratory infection within the last 6 months and took medical treatment locally, but her condition could not improve properly. On examination, respiratory rate (RR) was 66 breaths/minute, heart rate was 160 beats/minute; with severe chest in drawing. Apex beat was lateral to mid clavicular line in 6th intercostal space. Heart sound was muffled, precordium was a little bulged and there was tender hepatosplenomegaly. Spo2 was 89%. On auscultation of the chest, breath sound was vesicular with prolonged expiration, crepitation and ronchi were present all-over the chest. Heart sound was normal with no added sound. The patient was clinically identified as Pneumonia with Heart Failure.

Chest X-ray showed cardiomegaly in Figure 33 and ECG showed left ventricular hypertrophy (LVH) in Figure 34. Echocardiography revealed global hypokinesia of the left ventricle (LV) with poor function. LV was massively dilated with ejection fraction (EF) - 37%, which as shown in Figure 35. CBC (Complete blood count) illustrates neutrophilic leukocytosis. So, with these above discussion, diagnosis was dilated cardiomyopathy with pneumonia with heart failure. The baby was treated with bed rest in propped up position, O_2 inhalation, nebulized with bronchodilator, intravenous Antibiotics such as Meropenum and Amikacin, Frusemide diuretics, Injection Digoxin, Anti-hypertensive drugs e.g. ACE inhibitors and other supportive managements including fluid and nutrition supplements in Paediatric Intensive Care Unit (PICU). Then slowly the patient was improved clinically with EF 46% and discharged after a week with continuance dose of oral Digoxin, Diuretics, ACE inhibitors and other associated supplementary drugs for better health and nutrition. With continuous 3 monthly follow up her EF raised up to 60% and 72% consequently with no other problems in other clinical examinations and other necessary investigations.

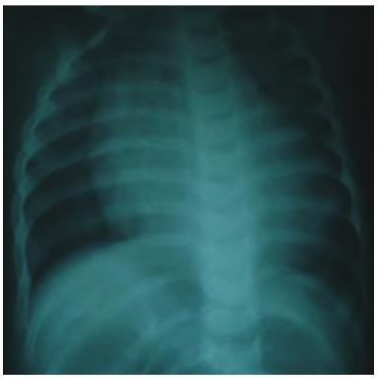


Figure 33: CXR of Patient showing cardiomegaly

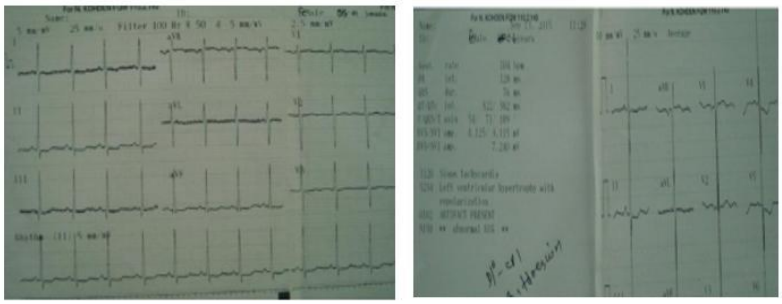


Figure 34: ECG showing normal sinus rhythm and LVH

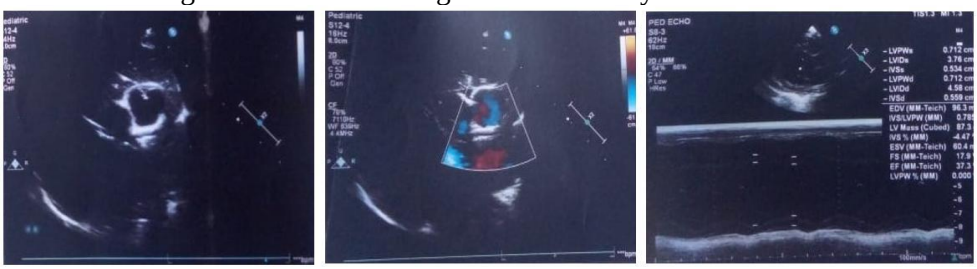


Figure 35: Echocardiography showing dilated LV and poor LV function

Case report: 2

An 8 months old male baby weighing 6 kg got admitted to the Paediatric department in NEMCH, Sylhet, Bangladesh on 16th march, 2021. She was suffering from high grade fever, cough and cold, breathing difficulties for three days. He has no history of convulsion and unconsciousness. She was immunized as per EPI schedule. He also had a history of frequent respiratory infection within the last 3 months and received medical treatment locally, but her condition was not improved adequately. On clinical examination, RR was 76 breaths/minute, heart rate was 140 beats/minute; with severe chest indrawing. Apical impulse was normal in position. Precordium was a little bulged and Spo2 was 88%. On auscultation of the chest, breath sound was vesicular with prolonged expiration, ronchi were present all-over the lung field. Heart sound was normal audible in all cardiac area; there was a pansystolic murmur over lower left sterna border. The patient was clinically identified as Pneumonia with CHD?

Chest X-ray showed bilateral patchy opacity in lungs in **Figure 1** and ECG showed LVH in **Figure 2**. Echocardiography revealed moderate size VSD with good ventricular function with Left ventricular ejection fraction (EF) - 67%, which as shown in **Figure 3**.

CBC demonstrates neutrophilic leukocytosis. So, with these above findings, diagnosis was dilated CHD (VSD) with pneumonia. The baby was managed with bed rest in head up position, O2 inhalation, nebulized with sulbutamol, Antibiotics only injection ceftriaxone, mild doses diuretics, antihistamin, antipyretics and other supportive treatments including fluid and nutrition supplements in Paediatric ward. Then gradually the patient was feeling better clinically and discharged after 7 days with continuance dose of oral diuretics, vitamins and minerals. With continuous 2 monthly follow up investigations such as CBC, chest X ray and Echocardiography and managements given, after 6 months his CHD (VSD) was closed with no other abnormalities.

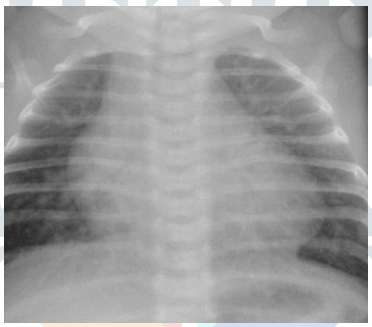


Figure 36: Chect X ray: Moderate VSD

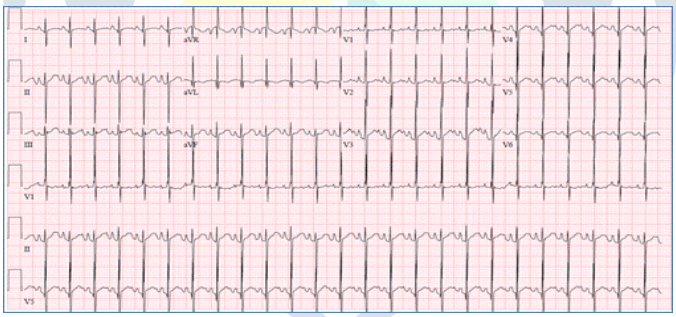


Figure 37: ECG of VSD

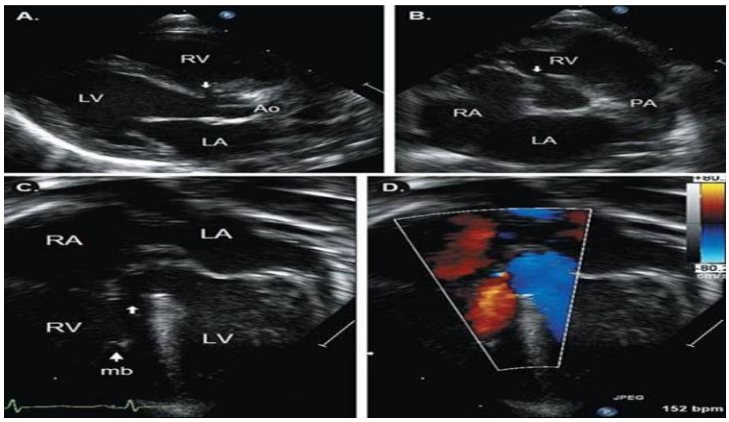


Figure 38: Echocardiography of VSD

DISCUSSION

The study demonstrated on patients' status with RRI at the Department of Paediatrics in Northeast Medical College Hospital over a period of 2 years. During this study, two hundred patients were calculated. Patients were enlisted in

view of their complaints, overall clinical findings & laboratory results. The end results were analyzed and found that, the frequency of the disease is highest in within one year and then between 1 to 2 years but lowest between 4 to 5 years. Males are much predominant than females. The greater part of children manifest with fast breathing which is about 78%. Near about 16% patients represent with increase heartbeat called tachycardia and the other remained normal. There are many patients present with fever which has also calculated as 43% cases and others were normothermic. 24% children presented with cyanosis which may indicate severe respiratory distress and also cyonoic CHD. On the other hand, about 1/3rd patients manifest with anaemia. Only 15% cases, existence of hepatomegaly found on examination. 32.5% children were undernutrition, 12% were mild malnutrition. The findings showing to the rate of abnormal heart sound of the children is very least amount which is only 8%, on the other hand comparatively the normal heart sound is 92%. The additional sound present in the heart is 32% and lacking in 68%. From the evaluation, the oxygen saturation status of maximum patients stays in between the level of 90 to 94%. Cardiomegaly was seen in 42% of cases and in 58% cases heart was normal in diameter on chest X -Ray. CHD was recognized in 36% of cases on echocardiography.

CHD was the underlying reason of an estimated 261247 deaths globally in 2017, a 34•5% decline from 1990 (Congenital Heart Disease Collaborators, 2020). When the quantity of deaths was 398580. Of all CHD deaths, 69% occurred in infants younger than 1 year. Condition closely related to CHD, Out of all, LRI (i.e., pneumonia), is the major cause of death in children worldwide. Infants with hemodynamically considerable CHD have a most important threat of ARI, recurrent pneumonia (70% of cases). The association of severity of ARI, specific infections and CHD requires multidisciplinary approach to prevent major cardiac and respiratory complications (Jat, N.K, 2022). So, the present study was conducted on children with RRTI presenting at a tertiary medical care, to identify the underlying CHD. CHDs are also one of the chief causes of infant mortality (Gilboa, S.M, 2010). In 90% of the CHD cases, there is no particular cause that can be attributed as multifactorial defects, and the most cases are asymptomatic and discovered during routine neonatal check-ups. Children with CHD are at risk for increased morbidity from viral LRTI because of anatomical lesions in heart than can worsen an already compromised respiratory status (Geskey, J.M, 2012).

Clinical presentations suggestive of HF in infants include tachypnea, tachycardia, feeding difficulty, diaphoresis (Jayaprasad, N.2016). Tiredness with feeding, sweating, and even feeding refusal are also common. Recognized HF presents with poor weight gain and in the longer term, failure in linear growth can also effect. Leg edema, Gallop rhythm, and hepatomegaly are also the features of HF in infants. Cardiomegaly on CXR is recommended by a cardiothoracic ratio of >60% in neonates and >55% in older children. Cardiomegaly is highly prognostic of ventricular dilation on echocardiography, with high specificity (Schultheiss, H-P, 2019). CCF was pointers to CHD complicating pneumonia in children. Similar clinical features has also been noticed by Memon Y et al. they reported infant feeding difficulties, restlessness, excessive sweating, tachypnoea, tachycardia and failure to thrive (FTT) are the usual clinical feature (Ley, N, 2011). While in case of children beyond 1 yrs exercise intolerance, fatigue, tachycardia, tachypnoea, poor appetite, wheezing, gallop rhythm, hepatomegaly, peripheral oedema, murmur and growth failure are the features. Malnutrition linked with FTT. The FTT is a major symptom of CHD because of low energy expenditure, insufficient food intake, and malabsorption or feeding difficulties.

Anaemia plays a exclusive role, considering the similarities in symptoms and the significance of oxygen carrying capacity in the manifestation of heart failure (Anand, I.S, 2018). The potential mechanisms connecting anaemia to CHF have not been characterized, but may be related to changes in ventricular loading conditions. Growth failure has also been seen to the most common problem in patients followed by congestive cardiac failure and pneumonia (Thomsen, R.W, 2008). Over the last 30 years there has been an increasing awareness about the significance of early transfer of newborn with cardiac disease to super specialized centers (Saxena, 2005). The majorities CHDs are remains asymptomatic and identified during regular neonatal checkup (Hussain, 2013). Because it is a well number of common among major congenital defect, put an important economic burden and emotional impact on affected families and treatment is costly, it is very significant to find out its pattern among children (Begum, 2012). In the modern countries pattern of CHD is well established, but has not been studied countrywide in Bangladesh as in other developed and neighboring countries (Islam, 2013). It is not a constant condition; changes occur all through patient's life end-of-life care (Queensland, 2018).With gradual advances in technology and education in Paediatric cardiology and pediatrics have developed long term benefit and promised better quality of life (Hussain, 2015).

Untreated CHD is an important cause of morbidity and mortality in children, therefore early detection and suitable intervention is most important (Hussain, M, 2010). As the frequency of CHD is rising in Bangladesh, the magnitude of the problem is gradually becoming alarming in the country (Islam, 2013). At present a good number of qualified pediatric cardiologists are not adequate (Fatema, N.N. 2013). The objective of this study was to monitor of all the children with recurrent RTI either admitted or not in order to recognize the congenital heart disease remain behind them. Early recognition of CHD is very essential for proper management purposes and so accurate medical examination and specialist echocardiography is considered a gold standard for the diagnosis of CHD (Amro, K., 2009).Three dimensional echocardiography is also compulsory for the identification and special cardiac centers have

to be established in our area in order to manage the patient effectively without delay that may affect the out- come of the disease (Haque, 2017). With the superior medication and management, children associated with CHD will live longer and lead a well life (Bertoletti, J, 2014). However, the special emphasis needs to provide for the children below 2 years to recover from birth-defect in heart.

Ideal examination of the hearts should be done in all newborn babies. All newborn babies have to be screening of CHD, including pulse oximetry screening and heart auscultation; can detect serious and major CHDs early in life with very high specificity and sensitivity (Jullien S. 2021). In rural areas, newborn CHD screening was not practiced in the past. So that if a training program could be arranged to educate rural obstetric and pediatric staff on proper CHD screening. It can improved knowledge and practice of CHD screening (Fangqi, G. 2020). Screening for critical congenital heart defects (CCHD) was added to the US Recommended Uniform Screening Panel in 2011. Within 4 years, 46 states and the District of Columbia had adopted it into their newborn screening program, leading to CCHD screening being nearly universal in the United States (Hom, L.A. 2016). This quick adoption happened while there were still questions about the usefulness of the recommended screening protocol and barriers to follow-up for infants with a positive screen. In response, the Centers for Disease Control and Prevention partnered with the American Academy of Pediatrics to convene an expert panel between January and September 2015 representing a broad array of primary care, neonatology, pediatric cardiology, nursing, midwifery, public health, and advocacy communities (Oster, M.E et al. 2013). The panel's goal was to review recent practices in newborn screening for CCHD and to recognize opportunities for improvement (Hom, L.A. 2016). In this article, we describe the experience of CCHD screening in the United States with tend to: (1) identifying the target lesions for CCHD screening; (2) optimizing the algorithm for screening; (3) determining state-level challenges to implementation and surveillance of CCHD; (4) educating all stakeholders; (5) performing screening using the proper equipment and in a cost-effective manner; and (6) implementing screening in special settings such as the NICU, out-of-hospital settings, and areas of high altitude. (Oster, M.E et al. 2013).

CONCLUSION

The study concludes the case of children with RLRI; congenital heart disease is an important cause behind it. The percentage of presence of CHD is near about one third of total sample collected for the study. So there is a great opportunity for diagnosis of CHD in children with RRI. For this reason, each and every child with RLRI should be investigated appropriately to search any CHD present or not. Newborn CHD screening was an efficient method to prevent delayed diagnosis of CHD, and due to these efforts, this kind of screening has been routinely implemented in many areas of different country (Oster, M.E et *al.* 2016). Parents counseling is very necessary to understand the evaluation of this condition. Through suitable management of CHD, RLRI can be prevented more. By this, we can reduce the Infant and childhood mortality in our country and correlate the existing national policy in link with Sustainable Development Goals 2030. For this purpose, the research recommends for future research trajectory. So, it should be remembered that every child with RLRI will verify correctly to search for any CHD present or not.

RECOMMENDATIONS

- Fetal echocardiography can be done in susceptible cases for early diagnosis and management purpose
- Each and every Newborn should be screened thoroughly after delivery
- All children with RRTI have to be proper examined
- Every Necessary investigation facilities should arranged to diagnosis the CHD
- All health care professionals should properly trained up about identification of CHD
- Follow-up and counseling have to be established for every patient with CHD
- Giving them extra facilities for diagnosis and treatment purpose.

REFERENCES

1. Adegbola, R. A., Falade, A. G., Sam, B. E., Aidoo, M., Baldeh, I., Hazlett, D. et al. (1994). the Etiology of Pneumonia in Malnourished and Well-Nourished Gambian Children. *Pediatric Infectious Disease Journal*. 13(11):975–82.
2. Ameli, F *et al*. (2020). Recurrent respiratory infections in children: a study in clinical practice, *Acta Biomed*. 91(4): e2020179.
3. Chowdhury, H.R. *et al*. (2010). Causes of Neonatal Deaths in a Rural Subdistrict of Bangladesh: Implications for Intervention, *J Health Popul Nutr*. 28(4): 375–382.
4. Couriel, J. (2002). Assessment of the child with recurrent chest infections, *British Medical Bulletin*. 61(1), 115–132.
5. Couriel, J. (2002). Assessment of the child with recurrent chest infections, *British Medical Bulletin*. 61(1), 115–132.
6. Khan, M.S., Miah, M.R., Hussain, T., Quaium, S.M.M.A., Rahman, A. (2020a). A Survey on Implementation of Integrated Management of Childhood Illness (IMCI) in Northeastern Part of Bangladesh. *American Journal of Medicine and Medical Sciences.* 10(9): 682-689.

7. Mendis, S., Puska, P., Norrving, B. (2011). World Health Organization Global Atlas on Cardiovascular Disease Prevention and Control (PDF), *World Health Organization in collaboration with the World Heart Federation and the World Stroke Organization*. pp. 3.
8. Mulholland, E. K., Simoes, E. A., Castales, M. O., McGrath, E. J., Manalac, E. M., Gove, S. (1992) Standardized Diagnosis of Pneumonia in Developing Countries, *Pediatric Infectious Disease Journal*.11:77–81.
9. Patria, M.F., Esposito, S. (2011). Recurrent Lower Respiratory Tract Infections in Children: A Practical Approach to Diagnosis. Paediatric Respiratory Reviews. 14(1):53-60.
10. Patria, M.F., Esposito, S. (2011). Recurrent Lower Respiratory Tract Infections in Children: A Practical Approach to Diagnosis. *Paediatric Respiratory Reviews.* 14(1):53-60.
11. Roy, E., Hasan, K.Z., Haque, F., Siddique, A.K.M., Sack, R.B. (2007). Acute Otitis Media during the First Two Years of Life in a Rural Community in Bangladesh: A Prospective Cohort Study, *J Health Popul Nutr*. 2007 Dec; 25(4): 414–421.
12. Schaad, UB., Esposito, S., Razi, CH. (2016). Diagnosis and management of recurrent respiratory tract infections in children: A practical guide. *Archives of Pediatric Infectious Disease*. 4(1):e31039.
13. Slatter, M. A., Gennery, A. R. (2008). Clinical immunology review series: an approach to the patient with recurrent infections in childhood, *Clin Exp Immunol.* 152(3):389-96.
14. Slatter, M. A., Gennery, A. R. (2008). Clinical immunology review series: an approach to the patient with recurrent infections in childhood, *Clin Exp Immunol.* 152(3):389-96.
15. Vidal, K., Sultana, S. *et al.* (2022). *Changing Epidemiology of Acute Respiratory Infections in Under-Two Children in Dhaka, Bangladesh.* Front Pediatr. 9:728382.
16. Vuori-Holopainen, E., Peltola, H. (2001) Reappraisal of Lung Tap: Review of an Old Method for Better Etiologic Diagnosis of Childhood Pneumonia, *Clinical Infectious Diseases Journal*. 32(5):715–26.
17. Wall, R. A., Corrah, P. T., Mabey, D. C., Greenwood; B. M. (1986). The Etiology of Lobar Pneumonia in the Gambia, *Bulletin of the World Health Organization*. 64(4):553–58.
18. Zaman, K., Baqui, A.H., Yunus, M et al. (1997). Acute respiratory infections in children: a community-based longitudinal study in rural Bangladesh, J Trop Pediatr. 43(3):133-7.