



A DESCRIPTIVE STUDY OF RECURRENT PNEUMONIA IN CHILDREN

Dr.S.Balamurugan	Assistant professor of pediatrics, institute of child health, Egmore, Chennai,600028
Dr.P.Ramkumar	Senior assistant professors of pediatrics institute of child health, Egmore, Chennai,600028
Dr.V.SureshKumar	Senior assistant professors of pediatrics, institute of child health, Egmore, Chennai,600028

KEYWORDS :

INTRODUCTION:

Pneumonia accounts for a significant morbidity in children. Approximately 150 million new cases of pneumonia occur annually among children younger than 5 years worldwide, accounting for approximately 10- 20 million hospitalizations. Of which, a subgroup suffer from recurrent pneumonia. Pneumonia in children usually recurs due to an underlying health problem. There may be some underlying illness predisposing them to such pneumonia recurrences. This study evaluates those underlying illnesses.

The WHO estimated the median global incidence of clinical pneumonia to be 0.28 episodes per child-year. This equates to an annual incidence of 150 million new cases, of which 11-20 million (7-13%) are severe enough to require hospital admission. Ninety-five percent of all episodes of clinical pneumonia in young children worldwide occur in developing countries.

Although the diagnosis is usually made on the basis of radiographic findings in developed countries, the World Health Organization (WHO) has defined pneumonia solely on the basis of clinical findings obtained by visual inspection and timing of the respiratory rate. It is important for the physician to understand that the typical causes and presentations of pneumonia in infants and children are variable, depending upon the child's age and underlying medical condition.

PATHOPHYSIOLOGY OF PNEUMONIA

Pneumonia results from inflammation of the alveolar space and may compromise air exchange. While often complicating other lower respiratory infections such as bronchiolitis or laryngotracheobronchitis, pneumonia may also occur via hematogenous spread or aspiration. Most commonly, this inflammation is the result of invasion by bacteria, viruses, or fungi, but it can occur as a result of chemical injury or may follow direct lung injury (e.g., near drowning).

Not all pneumonia is caused by infectious agents. Children who have severe gastro esophageal reflux may develop chemical pneumonitis secondary to recurrent aspiration. Children with impaired swallowing, gastrointestinal motility, or a gastrostomy tube may be prone to aspiration pneumonia.

RECURRENT PNEUMONIA

Recurrent pneumonia is 2 episodes of pneumonia within the same year or 3 or more episodes in lifetime, with complete resolution of clinical and radiological findings between acute episodes.

Those with clinical evidence or suspicion of recurrent or persistent pneumonia, or who are immunocompromised should have repeat films done at least 2-3 weeks after commencement of treatment.

Specific Risk Factors for Recurrent Pneumonia in Children

- Abnormalities in muscle coordination of the mouth and throat
- Asthma
- Genetic disorders like Kartagener syndrome...
- Cystic fibrosis
- Bronchopulmonary dysplasia and other chronic lung diseases
- Prematurity, especially during the first 6 - 12 months of life
- Sickle cell disease
- Gastro esophageal reflux disorder (GERD)
- Impaired immune system
- Inborn lung or heart defect

REVIEW OF LITERATURE

1. Owayed and colleagues performed a retrospective study to determine the frequency of underlying illnesses in children hospitalized with recurrent pneumonia.

The authors reviewed the charts for a 10-year period of all patients younger than 18 years who were admitted with recurrent pneumonia. Using a standard data extraction form, information was abstracted from the charts regarding patients' profile, results of the diagnostic evaluations that included computed tomography of the chest, sweat chloride test, echocardiography, barium swallow, laryngoscopy, bronchoscopy, esophageal pH manometry, quantitative serum immunoglobulin and tests for HIV.

Of the 2,952 charts reviewed, 238 children met the definition for recurrent pneumonia. Approximately 60 percent were males, and the mean age at diagnosis was 3.7 years. An underlying illness was diagnosed in 220 of these children. Aspiration syndrome was diagnosed as the cause of pneumonia in 114 children, congenital heart disease in 22, asthma in 19 children, congenital anomalies of the airway or lung in 18, gastro esophageal reflux in 13, sickle cell anemia in 10, Dysgammaglobulinemia in 5, HIV in 5, autoimmune pancytopenia in 1 and immune disorder in 1.

2. Another study was conducted by Ankara University Medical School, Department of Pediatrics, Ankara, Turkey. The aim of this study was to determine the relative frequency of underlying illnesses for recurrent pneumonia in children. Retrospectively analyzed from January 1997 to October 2002. Out of 788 children hospitalized for pneumonia, 9% met the criteria for recurrent pneumonia. An underlying illness was demonstrated in 85%. Underlying diseases were bronchial asthma (32%), gastro esophageal reflux (15%), immune disorders (10%), congenital heart defects (9%), anomalies of the chest and lung (6%), bronchopulmonary dysplasia (4%), cystic fibrosis (3%), tuberculosis (3%) and aspiration syndrome (3%). In conclusion, approximately one-tenth of hospitalized children with pneumonia in our hospital had recurrent pneumonia.

3. Another study to identify underlying causes of recurrent pneumonia in children in a general hospital of Netherland in Western Europe(26) by analyzing retrospectively medical records of

all children with recurrent pneumonia over a seven year period.

62 children were included. The most common underlying causes of recurrent pneumonia were psychomotor retardation or congenital abnormalities with reflux or aspiration in 16 (25.8%), immunodeficiency in 10 (16.1%), lung disease (bronchiectasis, airway stenosis, middle lobe syndrome) in 10 (16.1%), and other causes (congenital heart disease, immunosuppression and ectodermal dysplasia) in 7 patients (11.2%).

OBJECTIVE OF THE STUDY:

- To study the incidence of recurrent pneumonia in children
- To study the underlying predisposing factors of recurrent pneumonia in children admitted in a tertiary care children hospital in a developing country.

STUDY JUSTIFICATION

- The children with recurrent pneumonia require detailed investigation work up. Unfortunately many specialized procedures are not available in many hospitals but being an apex referral hospital such problematic cases are frequently find the place at ICH&HC.
- No study is available on recurrent pneumonia at our hospital previously
- So we are in a position to evaluate incidence and predisposing causes in our hospital.
- Thereby we can educate the parents to prevent further recurrence and the admission rate can be reduced.

METHODOLOGY:

- **STUDY DESIGN** : Cross sectional study.
- **PLACE** : Institute of Child Health and Hospital for Children, Egmore, Chennai 600 008
- **STUDY POPULATION** : Children less than 12 years of age having recurrent pneumonia.
- **PERIOD OF STUDY** : 2Years from September 2013- august 2015
- **INCLUSION CRITERIA** : Children less than 12 years of age, admitted for documented pneumonia of 2 or more episodes in one year, 3 or more episodes in lifetime with radiological clearance between the episodes.
- **EXCLUSION CRITERIA**: Persistent pneumonia cases are excluded.

MANEUVER:

- Eligible children with defined criteria are registered for study.
- Using a standard data extraction form information is extracted from the charts regarding patient's age, sex, body weight, height and age at which an underlying illness is diagnosed.
- Diagnostic evaluation that is included are:
- Clinical clues to diagnosis -
 - The association of respiratory symptoms with feeding in those with gastro esophageal reflux.
 - Recurrent infections at other locations and failure to thrive in the cases of immune disorder.
 - History of contact with TB patients
 - Recurrences involving the same location in those with underlying pulmonary pathology.
 - Detailed clinical history relevant to asthma.
 - Personal History and family history of atopy or asthma, triggers, seasonal & diurnal variations.
- **INVESTIGATIONS:**
 - Basic investigations
 - Monteux Test
 - Chest X rays
 - Resting Gastric Juice for AFB

- Testing for HIV infection.
- The following investigations are carried out in relevant to clinical features.
 - Computed Tomography of Chest.
 - Immunoglobulin Assay
 - Barium Swallow to document Gastroesophageal reflux.
 - Flexible Fiberoptic Bronchoscope.
 - Echocardiogram to detect cardiac anomalies causing pneumonia.
- Sweat chloride test

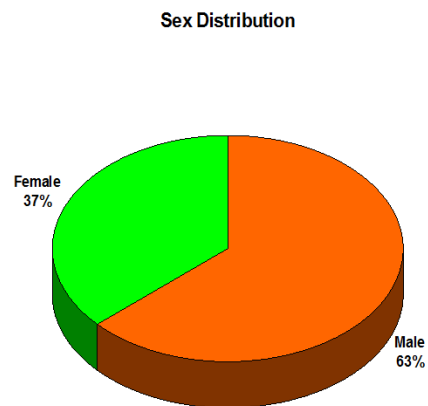
CONSENT: Institutional consent was obtained from the parents after explaining the nature of study.

OBSERVATIONS

The total no of children hospitalized for pneumonia during the study period was 670. Fifty two children among them were identified to have recurrent pneumonia and were included in the study. Detailed works up with the available and necessary investigations are carried out.

Males outnumbered females with a ratio of 1.7:1. Thirty three (63.5%) of the total number of children were male and nineteen (36.5%) were female.

Fig . Sex distribution of study population.

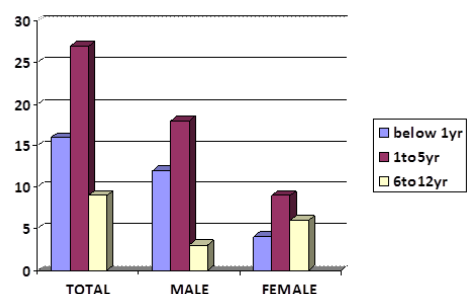


In our study, 82.6% of all patients were in the under five age group with more than 30% of total presenting in the very first year of life. Only nine (17%) of total no of children were in the 6 to 12 years of age group. (Fig 1, Fig 2)

Age and sex incidence of recurrent pneumonia.

	Total(52) n(%)	Male(33) n(%)	Female (19) n(%)
<1 yr	16(31.2)	12(36.3)	4(21)
1-5 yr	27(51.5)	18(54.5)	9(47.3)
6-12 yr	9(17.3)	3(9)	6(31.5)

Fig. 2. Bar Diagram comparing the different age group and sex in the study population.



Males outnumbered females by 300% in the <1 year age group and by 200% in the 1-5 year age group and by 300% in the 6-12 year age group.(fig 2)

Protein energy malnutrition was found to be a common accompaniment with recurrent pneumonia . Seventeen (33%) of children had normal nutritional status with regard to their weight for age according to Indian academy of paediatrics classification of protein energy malnutrition, while 15(29.4%) had grade1 PEM, 13(25.5%) had grade 2 PEM and 3(5.9%) had grade 3 PEM. Three (5.9%) children were found to have grade 4 PEM.

Cough was the universal complaint for all children. Breathlessness (86.5%) and fever (71.2%) were the next major complaint in 45(86.5%) and 37(71.2%) of the children respectively. History of aspiration (51.9%), wheezing (40.4%) and failure to thrive (53.8%) were the next major complaint of the studied children. Loss of appetite, loss of weight, seizures, recurrent infections at other locations of the body, haemoptysis were present in a lesser population of the children.

Contact history with tuberculosis patients and past history of tuberculosis were present in 3(5.8%) and 6(11.5%) of children respectively. BCG scar was present 49(94%) of children and absent in 3(5.8%) children.

Detailed history relevant for asthma was present in 13(25%) of children. History of bad child rearing practice, like, using irritant fumes, nose blowing, oil instillation and native medication were present in 12(23.2%) children.

TABLE 4 Clinical features in the studied population.

		N	%
Cough	Yes	52	100.0
	Total	52	100.0
Breathing difficulty	Yes	45	86.5
	No	7	13.5
Total		52	100.0
Fever	Yes	37	71.2
	No	15	28.8
Total		52	100.0
Loss of appetite	Yes	8	15.4
	No	44	84.6
Total		52	100.0
Loss of weight	Yes	14	26.9
	No	38	73.1
Total		52	100.0
Haemoptysis	Yes	1	1.9
	No	51	98.1
Total		52	100.0
History of aspiration	Yes	27	51.9
	No	25	48.1
Total		52	100.0
History of wheezing	Yes	21	40.4
	No	31	59.6
Total		52	100.0
History of recurrent infections at other locations of body	Yes	3	5.8
	No	49	94.2
Total		52	100.0
History of failure to thrive	Yes	28	53.8
	No	24	46.2
Total		52	100.0
History of contact with TB patients	Yes	3	5.8
	No	49	94.2
Total		52	100.0
History of seizures	Yes	9	17.3

	No	43	82.7
Total		52	100.0
Past history of TB	Yes	6	11.5
	No	46	88.5
Total		52	100.0
BCG scar	Yes	49	94.2
	No	3	5.8
Total		52	100.0

After detailed etiological work up, congenital airway anomaly was found as the underlying abnormality in 21(40%) children, oropharyngeal incoordination in 12(23.1%) children, asthma in 7(13.4%) children, gastro esophageal reflux disease in 4(7.6%) children and other causes in about 6 children. The underlying cause could not be detected in two cases.

The congenital airway anomaly included tracheomalacia of varied severity, laryngomalacia, bronchial airway anomaly, tracheal bronchus and lung aplasia. It was evaluated by using flexible fibroptic bronchoscopy. Congenital airway anomalies was more commonly present 12(44.4%) of 1-5 years of age of children. Among the twenty one congenital airway anomaly affected children, 15 were boys and 6 were girls. Among 16 infants, congenital airway anomaly accounted for seven cases (43%) and oropharyngeal incoordination accounted for five cases (33.3%).

Of the twelve oropharyngeal in coordinated children seven were boys and five were girls. Among the seven asthma affected children five were boys and two were girls. Congenital heart diseases, trachea oesophageal fistula, gastro oesophageal reflux disease accounted for one case each. The cause could not be found out with the available investigations in one child.

Among the twenty seven children from 1 to 5 years the most common underlying pathology was again congenital airway anomaly which was present in twelve children (44.4%). The next common illness detected was asthma in six (22.2%) children followed by oropharyngeal incoordination (14.8%). Three of them had gastro oesophageal reflex disorder and one had acquired airway anomaly due to healed endobronchial tuberculosis. The cause could not be identified in one child.

In above 5 years age group among 9 affected children 2 had congenital airway anomaly like right lung upper lobe aplasia, left bronchial stenosis in one child and segmental tracheomalacia middle 1/3 more in the right side. Two children had oropharyngeal incoordination. Two children had HIV infection. One child had SMA. One child had asthma. One had GERD. One had cerebral palsy. One child had seizures.(Table 5 & 6).

TABLE 5

Underlying illness associated with recurrent pneumonia in studied population

Underlying illness	No. of Cases	%
Congenital airway anomaly	21	40.3
Oropharyngeal incoordination	12	23.0
Asthma	7	13.4
GERD	4	7.6
HIV infection	2	3.8
Healed EBTB with acquired airway anomaly	1	1.9
Congenital Heart disease with Marfan syndrome	1	1.9
TEF	1	1.9
Rickets with congenital Heart disease	1	1.9
Cause undetected	2	3.8
Total	52	100

TABLE 6 Underlying illness of recurrent pneumonia by age group

Underlying illness	Total (52) n (%)	0-12 months (16) n (%)	1-5 years (27) n (%)	6-12 years (9) n (%)
Congenital airway anomaly	21(40.3)	7 (43.8)	12 (44.4)	2 (22.2)
Oropharyngeal incoordination	12(23.0)	5(31.3)	4 (14.8)	3 (33.3)
Asthma	7(13.4)		6(22.2)	1 (11.1)
GERD	4(7.6)	1(6.3)	3(11.1)	
HIV infection	2(3.8)			2 (22.2)
Healed EBTB with acquired airway anomaly	1(1.9)		1 (3.7)	
Congenital Heart disease with Marfan syndrome	1(1.9)			1(11.1)
TEF	1(1.9)	1(6.3)		
Rickets with congenial Heart disease	1(1.9)	1(6.3)		
Cause not known	2(3.8)	1 (6.3)	1 (3.7)	

Basic investigations were done in all children with recurrent pneumonia. Thirty eight children (73.1%) had anaemia. One child had anaemia with UTI. Three children had UTI and sepsis. Montex test was done in all children. Fifty children (96.2%) found to be negative and 2 (3.8%) was positive.

Analysis of the chest x rays of all the patients revealed that, single lobe involvement in 35(67.3%) was more than multiple lobe involvement in 17(32.7%) children. Lobar infiltrates of particular lobe was not indicative of any specific etiological diagnosis.

Table 7 Chest x ray lobe involvement

	N	%	
CXR lobe involvement	Single lobe	35	67.3%
	Multiple lobe	17	32.7%
Total	52	100.0%	

Resting gastric juice for AFB was negative in all children. HIV ELISA test was reactive in 2(3.8%) children and Non reactive in the remaining children. Barium swallow radiography studies were normal in 44(84.6%) children and showed finding suggestive of GERD in 7(13.5%) children.

Sweat chloride test was done in 26 children which was normal.

CT chest was done in 26 children. Among the 26 children who undergone CT chest 8 had normal findings, consolidation was found in 17 children and one had features suggestive of bronchiolitis obliterating organizing pneumonia (BOOP). One child showed features suggestive of right lung upper lobe aplasia which was confirmed with FFBS findings. One child showed features suggestive of right lower lobe consolidation with lung cyst. FFBS showed narrowing of right lower lobe bronchus which might be due to external compression of the lung cyst. One child had features suggestive of interstitial pneumonia, which is followed by a measles episode, which was resolved latter and followed by left lower lobe pneumonia. BAL for BACTEC TB culture analysis was taken from the child by FFBS and it was found to be negative.

Out of the 52 children who were recruited to the study FFBS was performed in 50 patients. Two patients with HIV infection had lobar pneumonia which resolved with antibiotics, and so, FFBS was not performed in them. Among the remaining 50 patients airway anomalies and cricopharyngeal incoordination were identified in 21 patients. The common abnormalities that were detected were,

- a) Tracheomalacia in eleven children(21.2%)
- b) Laryngomalacia nine children(17.3%)
- c) Bronchial airway anomaly in five children (9.6%)

Four children had mucous plug occluding the bronchial system which was removed.

A 9 month old girl who had recurrent pneumonia and respiratory symptom on feeding was investigated with barium swallow which fail to identify any abnormality. Later, on FFBS, the child was found to have TEF, underwent surgery for the same and improved well post operatively.

Another interesting anomaly diagnosed using FFBS was Pig's bronchus or Tracheal bronchus in 8 month old child, who presented with recurrent pneumonia.

Another interesting bronchial anomaly was noted in one child who was undergone FFBS and found to have the "all the bronchi originating simultaneously at left upper lobe bronchi level".

	N	%
FFBS	Normal	25 48.2
	Tracheomalacia	11 21.2
	Laryngomalacia	9 17.3
	Bronchial airway anomaly	5 9.6
	Mucous plug	4 7.7
	TEF	2 3.8
	Cricopharyngeal incoordination	2 3.8
	External compression	1 1.9
	Total	52

BAL was done for twenty seven patients. Among them AFB was negative in 26 patients. Among them two sample sent for BACTEC culture which was also found to have no growth. Bacterial culture and sensitivity was negative in 21 children positive in 2 children.

All the children recruited in the study underwent Echocardiogram, which was normal in 48 children and detected ventricular septal defect and mitral valve prolapsed in one child each.

Immunoglobulin assay done in sixteen children did not reveal any abnormality.

Sweat chloride assay done in twenty six children did not reveal any abnormality.

DISCUSSION

Recurrent pneumonia, though it is not a special entity, it is a manifestation of underlying disorder. The correct identification of the predisposing cause and its appropriate management is the corner stone in the management of these children. Recurrent pneumonias can be due to congenital malformations of upper or lower respiratory tract and cardiovascular system, recurrent aspiration, defects in the clearance of airway secretions, ciliary abnormalities and disorders of systemic or local immunity which may be congenital or acquired.

In our study during the two years, among 670 cases of pneumonia, 52(7.8%) met criteria for recurrent pneumonia.

In our study, children presenting in the first year of their life, accounted for sixteen (30.2%) patients, while another 27(51.5%) presented between 1to5 years. Only nine (17.3%) of the children were above the 5 years to twelve years.

The etiological work up in our study revealed that congenital airway anomaly at various locations of airway and lung were the underlying abnormality in nearly 40.4 % (21 children) of 52 children. Next major underlying abnormalities were, oropharyngeal incoordination 12(23.1%) and Asthma 7(13.4%). GERD accounted for 4 cases (7.6%). HIV, TEF, Cerebral palsy, seizures, SMA, Rickets, congenital heart diseases, downs syndrome and BOOP were the other minor underlying abnormality in our study.

In below one year age group of sixteen children, congenital airway

anomaly accounted for 7 cases. Oropharyngeal incoordinations including neurological diseases (5 cases) were the second most common underlying abnormality. GERD was the next common cause occurring in 3 children. Other causes were SMA (1), Congenital diaphragmatic hernia (1), congenital heart disease (1), Rickets (1), TEF (2), tracheal bronchus (1).

Among eighteen children of 1 to 5 years age group congenital airway anomaly accounted for 12 (44.7%) as the predisposing illness. Six cases of Asthma was the second leading predisposing factor. Oropharyngeal incoordination was present in 4 children of 1 to 5 years group. GERD had presented in 3 cases. Healed EBTB, SMA, congenital heart disease and cerebral palsy were the cause in one case each.

In the above 5 years age group congenital airway anomaly (2 cases), oropharyngeal incoordination (3 cases), HIV (2 cases) were the underlying illness. SMA, Asthma, GERD, lung aplasia, BOOP were the underlying predisposing illness in one case each.

SUMMARY AND CONCLUSION

- Around 8% of 670 pneumonia cases (52 cases) admitted was met with recurrent pneumonia criteria.
- Recurrent pneumonia occurred predominantly in the under-five age group, 80% of the study population and around 30% presented in the first year of life.
- The male, female ratio is about 1.7: 1. It appears that male children (63%) were affected more frequent than their female counterparts (37%).
- The commonest underlying illness was congenital airway anomaly in 40% of recurrent pneumonia children. Congenital airway anomaly was the commonest underlying illness but more common in below 5 years age group and less common in 6-12 year age group.
- Oropharyngeal incoordination including various chronic neurological disorder including cerebral palsy, seizure disorder with developmental delay and SMA was the second commonest underlying illness (23%). It appears that children with neuro muscular problems develop recurrent pneumonia more frequently. Being a tertiary care centre, many of the neuro muscular disorder cases frequently referred to this institute.
- Bronchial asthma accounted for 13% of underlying illness. Bronchial asthma was not emerged as an underlying illness in below 1 year age group. It is major component in 1 to 5 years age group.
- GERD, HIV, congenital heart disease, TEF, Rickets, mucopolysaccharidosis were other important minor contributions to recurrent pneumonia.
- Cough was the universal symptom in all children. Other common symptom in these children, breathlessness (86.5%), fever (71.2%), history of aspiration (51.9%), wheezing (40.4%) and failure to thrive (53.8%) were the other major complaint points towards etiological factor.
- Protein energy malnutrition was found to be a common accompaniment with recurrent pneumonia, presented in 65.4% of children.
- Anemia was present in 73% of cases. Single lobe involvement in chest x ray was more common than the multiple lobe involvement. Left lower lobe is more frequently involved.
- FFBS was very useful identifying the airway anomalies in recurrent pneumonia in children in 55% of children.
- Detailed history relevant for Asthma was present in 25% of children. History of bad child rearing practice like, using irritant fumes, nose blowing, oil instillation, native medications, wrong feeding habits were present in 23% of children.