

Recurrent Pneumonia in Children Attending Mukalla City Hospital –Yemen

Saleh Awad Bahwal*

Mazin Ahmed Jawass**

Hanan Saeed Bin Gouth**

Abstract

Recurrent pneumonia in children continues to be a major problem for the pediatricians. The aim of our study was to determine the prevalence and predisposing causes of recurrent pneumonia (RP) in children. This is a prospective hospital-based study. Children between 2 months and 15 years old who had a history of pneumonia were investigated in order to determine the prevalence and predisposing causes of recurrent pneumonia in children at Mukalla city hospital, Mukalla, Yemen in between January 2014 and December 2016. The result revealed that out of 920 children hospitalized for pneumonia, 80 (8.7%) met the study criteria for RP. Their age ranged from 2 months to 15 years (mean age of 5.3 ± 3.8 years) with male preponderance 51 (63.8%) and 29 (36.2%) female with (M:F ratio 1.76:1). Underlying illness was identified in (77.5%) of our patients and no predisposing factors could be identified in the remaining (22.5%). The most common causes for RP were aspiration syndromes (20%), bronchial asthma (16.2%), congenital heart disease (CHD) (13.8%), pulmonary tuberculosis (TB) (8.8%), immune deficiency disorders (6.2%), and nutritional rickets (5%). We concluded that approximately 1 in 12 children with pneumonia in our hospital had RP. New strategies and guidelines are required for early diagnosis of underlying causes of recurrent pneumonia in children.

Key words: Recurrent pneumonia, aspiration syndromes, asthma, congenital heart disease.

Introduction:

Pneumonia, is defined as inflammation of the lung parenchyma, is the leading cause of death globally among children younger than age 5 years, accounting for an estimated 1.2 million (18%) deaths annually. The number of childhood-related deaths from pneumonia \approx 2,000 fold higher, in developing than in developed countries [13].

A subgroup of children with pneumonia develop recurrent or persistent pneumonia that is one of the most significant reasons for referral to pediatricians and is still a major challenging disease [25]. Recurrent pneumonia (RP) is defined as 2 or more episodes in a single year or 3 or more episodes ever, with radiographic clearing between occurrences [13]. RP was determined in 6.4–9% of children with pneumonia [6,15,17]. RP usually occurs due to an underlying disorder that negatively affects local or systemic defense mechanisms and the underlying cause is identified in 80-90% [21]. The factors associated with recurrent pneumonia in developed countries include asthma, immunodeficiency (e.g. human

immunodeficiency virus infection, immunoglobulin deficiency), pulmonary anomalies, and foreign body aspiration [8,11]. There are only a few studies of recurrent pneumonia in the developing countries [1,2,23]. This study aimed to determine the prevalence and predisposing causes of RP in children.

Patients and methods:

This is a prospective hospital-based study. Children between 2 months and 15 years old who had a history of pneumonia were investigated in order to determine the prevalence and predisposing causes of RP in children at Mukalla city hospital, Mukalla, Yemen in between January 2014 and December 2016.

This hospital is the referral pediatric hospital serves 3 Governorates (Hadhrumaut, Al-Mahra, and Shabwa) with a total of approximately 1000 children attending the Mukalla city hospital per month. Diagnosis of pneumonia was based on cough, chest wall in-drawing and/or difficult breathing and tachypnea (respiratory rate \geq 50 cycles /minute in infants 3 to 12 months old; \geq 40 /min in children 12 to 60 months old; \geq 30/min in children older than 60 months), fever and lobar or bronchopneumonic infiltration demonstrated by x-ray (16). Recurrent pneumonia is defined as 2 or more episodes in a single year or 3 or more episodes ever, with radiographic clearing between occurrences [13]. Standardized questionnaires were obtained on

* Assistant Professor of Pediatrics Department of Pediatrics, College of Medicine and Health Sciences, Hadhrumout University, Republic of Yemen.,

** Associate Professor of Pediatrics Department of Pediatrics, College of Medicine and Health Sciences, Hadhrumout University, Republic of Yemen. Received on 4/12/2017 and Accepted for Publication on 8/1/2018

patients' demographic characteristics, including sex and age of the child, clinical findings. Confirmation of underlying disorders were based on standardized laboratory tests including complete blood counts, quantitative immunoglobulin's, x-ray and/or computerized tomography of the chest, rigid bronchoscopy(done at Al-Thawra Hospital, Sana'a), echocardiography, barium swallow and mantoux test.

Ethical consent:

Verbal consents were taken from the parents and caregivers of children in the study.

Statistical methods:

The data were processed and analyzed by Statistical Package for Social Sciences (SPSS) software (version 17). Statistics such as frequency, mean and standard deviation were used.

Results:

From January 2014 to December 2016, a total of 920 patients were admitted to the hospital with the diagnosis of pneumonia; 80 (8.7%) of them met the definition for recurrent pneumonia.

Table (1): Distribution of patients with recurrent pneumonia according to age and sex (n=80)

Age groups in years	Sex		Total	Ratio (M:F)
	Male %	Female %		
0.2*-5	36 (45%)	14 (17.5%)	50 (62.5%)	2.57:1
6-10	9 (11.3%)	11 (13.7%)	20 (25%)	0.82:1
11-15	6 (7.5%)	4 (5%)	10 (12.5%)	1.50:1
Total	51(63.8%)	29(36.2%)	80 (100%)	1.76:1

***Two months**

Table 1 shows distribution of patients with recurrent pneumonia according to age and sex. They were 51 (63.8%) males and 29 (36.2%) females. Maximum number of 50 (62.5%)

patients was in the two months – 5 years age group, followed by 20(25%) patients in the 6-10 years age group and 10(12.5%) patients in the 11-15 years age group.

Table (2): Clinical profile among children with recurrent pneumonia (n=80)

Clinical parameter	No	(%)
Cough	80	(100%)
Respiratory distress	80	(100%)
Fever	76	(95%)
Pallor	38	(47.5%)
Global developmental delayed	36	(45%)
Underweight	24	(30%)
Wheezing	22	(27.5%)
Cyanosis	14	(17.5%)
Lymphadenopathy	10	(12.5%)
Atopy/allergy	9	(11.3%)
Hepatomegaly	7	(8.7%)
Splenomegaly	6	(7.5%)
Otitis media	5	(6.2%)
Rickets	4	(5%)
Digital clubbing	3	(3.7%)

Table 2, shows the clinical data among patients with recurrent pneumonia. The presenting symptoms included cough(100%), respiratory distress (100%) , fever (95%) , pallor (47.5%), global developmental

delayed (45%) , underweight (30%) , wheezing (27.5%) , cyanosis (17.5%) , lymphadenopathy (12.5%) , Atopy/allergy (11.3%) , hepatomegaly (8.7%) , splenomegaly (7.5%) , otitis media (6.2%), rickets (5%) and digital clubbing (3.7%).

Table (3): Underlying illness in children with recurrent pneumonia (n=80)

Underlying illness	Recurrent Pneumonia	
	No	%
Aspiration syndrome:	16	20%
GERD*	9	
FB aspiration**	5	
Oesophageal stricture(corrosive)	1	
Oesophageal stricture (postoperative tracheoesophageal fistula)	1	
Bronchial asthma	13	16.2%
Congenital heart disease:	11	13.8%
VSD***	5	
PDA****	3	
ASD*****	2	
Complex congenital heart defects	1	
Pulmonary TB*****	7	8.8%
Immune deficiency:	5	6.2%
Ataxia telangiectasia	2	
Selective IgA deficiency	2	
Common variable immunodeficiency syndrome	1	
Nutritional rickets	4	5%
Anomalies of respiratory tract:	3	3.8%
Congenital lobar emphysema	2	
Congenital cystic adenomatoid malformation	1	
Sickle cell anemia	2	2.5%
Bronchiectasis	1	1.2%
Unknown cause	18	22.5%

GERD* = Gastroesophageal reflux disease; FB aspiration** = Foreign body aspiration; VSD*** = Ventricular septal defect; PDA**** = Patent Ductus Arteriosus; ASD***** = Atrial Septal Defect; Pulmonary TB***** = Pulmonary tuberculosis.

Table 3, shows underlying illness in children with recurrent pneumonia. Aspiration syndromes were found in 16 (20%) patients; 9 patients were secondary to GERD, while 5 patients had definite history of FB aspiration, one patient had oesophageal stricture(corrosive) and one patient oesophageal stricture (postoperative tracheoesophageal fistula).Thirteen patients (16.2%) had bronchial asthma. Congenital heart disease (CHD) was confirmed by echocardiography in 11 patients (13.8%).This included 5 patients with VSD, 3 with PDA, two with ASD and one with complex congenital heart

defects. Pulmonary TB was diagnosed in 7 (8.8%) patients. Five patients (6.2%) had immune deficiency disorders, two of them had ataxia telangiectasia, two had selective IgA deficiency and one patient with common variable immunodeficiency syndrome. Four patients 4(5%) had nutritional rickets. Three patients (3.8%) had congenital anomalies of the respiratory tract; 2 had congenital lobar emphysema, and 1 had congenital cystic adenomatoid malformation. Sickle cell anemia and bronchiectasis were diagnosed in 2 (2.5%), and 1 (1.2%) patients respectively.

Table (4): Underlying illnesses of recurrent pneumonia in this study, compared with results from previous studies

Study	Current study	Ali et al. (1)	Bolursaz et al. (2)	Capanoglu et al. (5)	Hoving et al. (12)	Ozdemir et al. (18)	Saad et al. (23)
Published year		2014	2017	2017	2013	2002	2013
Country	Yemen	Pakistan	Iran	Turkey	Netherlands	Turkey	Egypt
Number of cases	80(8.7%)	292(2.81%)	128(21.3%)	177(8.3%)	62(48.8%)	62(10.42%)	86(7%)
Aspiration syndromes	16(20%)	11(3.6%)	59 (51.75%)	55(31%)	16 (25.81%)	11 (17.74%)	13(15.12%)
Asthma	13(16.2%)	7(2.3%)	14(12.28%)	16(9.1%)	-	19 (30.64%)	11(9.7%)
Congenital heart disease	11(13.8%)	23(8%)	23 (20.17%)	44(24.9%)	3 (4.84%)	7 (11.29%)	9(10.4%)
Pulmonary TB	7(8.8%)	-	2 (1.57%)	-	-	-	10(11.6%)
Immune deficiency	5(6.2%)	1(0.3%)	9(7.9%)	7(4%)	10 (16.13%)	11 (17.75%)	6(7%)
Anomalies of respiratory tract	3(3.8%)	5(1.7%)	8 (7%)	16(9.1%)	10 (16.13%)	3 (4.84%)	4(4.7%)
Unknown cause	18(22.5%)	10(3%)	14(10.9%)	29(16.3%)	19(30.65%)	6(9.68%)	14(16.3%)

Discussion:

Pneumonia is an important cause of morbidity and mortality in children, especially those younger than 5 years of age in developing countries [16]. In our study 8.7% of admission to the hospital with a diagnosis of pneumonia met the definition of recurrent pneumonia. Similarly, 7%-10.42 % of patients with pneumonia met the criteria for recurrent pneumonia in previous studies [5,18,23]. The most common age group affected are patients less than 5 years constitute 50 (62.5%) of cases which correlates with the results of other studies [1,23]. It was found that recurrent pneumonia was more common in male 51(63.8%) children than female 29 (36.2%), with a male to female ratio of 1.76:1, similar finding occurs in others studies[1,5,18,23]. Patients with RP commonly present with cough, respiratory distress, and fever. Of the patients with RP, 100 % had cough, 100 % had respiratory distress and 95% with fever, which is in agreement with other studies[5,23].

We demonstrated an underlying illness for recurrent pneumonia in 77.5% of our patients and no predisposing factors could be identified in the remaining 22.5%. Unknown etiology of patients with recurrent pneumonia was found

3%-30.65% in previous studies [1,2,5,12,18,23]. We had observed that, the most frequent underlying cause for RP in children was aspiration syndromes 16(20%), followed by bronchial asthma 13(16.2%), congenital heart disease 11(13.8%), pulmonary TB 7(8.8%), and immune deficiency disorders 5(6.2%), nutritional rickets 4(5%), congenital anomalies of the respiratory tract 3(3.8%), sickle cell anemia 2(2.5%), and bronchiectasis 1(1.2%).

Compared to previous studies on the causes of RP [1,2,5,12,18,23], our study shows some similarities and differences. We might have missed few underlying causes of recurrent pneumonia due to non- availability of some work up for some diseases like cystic fibrosis and for evaluating the swallowing mechanism. Aspiration syndromes accounted for 20 % of our patients. This is in agreement with other studies [2,5,12,23] who observed that aspiration disorders were the most frequent cause of recurrent pneumonia. Repeated aspiration of even small quantities of gastric, nasal, or oral contents can lead to recurrent bronchitis or bronchiolitis; recurrent pneumonia; atelectasis; wheezing; cough; apnea; and/or laryngospasm. Aspiration may impair pulmonary defenses,

predisposing the patient to secondary bacterial [7].

Bronchial asthma was diagnosed among 16.2% of our patients. Bronchial asthma is the important underlying illness for recurrent in children reported by a number of authors [1,2,5,18,23], accounting for 2.3%-30.64 % of cases.

In contrast to our study and previous studies; Brand et al. [3] and Hoving et al. [12] reported that asthma was not diagnosed as an underlying cause of recurrent pneumonia in their study. They believed that asthma is a rare cause of recurrent pneumonia in children, and if occurs this seems to be confined to very unusual and complicated cases of asthma [3,12].

Our results demonstrated that congenital heart diseases were identified in 13.8% of cases. This is in agreement with many reports [1,18,23]. In the acyanotic CHD because of a left to right shunting of blood, via a septal defect or the arterial duct, there is pulmonary over circulation and pulmonary oedema [20]. The pulmonary oedema leads to congestive heart failure and becomes a nidus of infection for the lower respiratory tract [24]. The patients with CHD with increased pulmonary blood flow thus presents with pneumonia and congestive cardiac failure (CCF) amongst other features. Thus pneumonia and CCF may be the first signs of an underlying CHD[17].

In the current study, pulmonary TB was diagnosed in 7(8.8%) patients. In previous reports on recurrent pneumonia, pulmonary TB was detected as a cause in 1.57% – 11.6% of the patients [2,23]. Remarkably, immune deficiency disorders were identified in 5 patients (6.3%) of our cohort, which is in agreement with other studies [2,23]. Children with defects in antibody production, phagocytic cells, or complement proteins have recurrent infections with encapsulated bacteria [4]. Our results demonstrated that nutritional rickets were identified in 5% of recurrent pneumonia. Our results are similar to those studies [1,23]. Vitamin D is involved in maintaining an adequate level of innate immunity, in particular, by increasing production of antimicrobial peptides (β -defensin, cathelicidin), acting on

lymphocytes, neutrophils, macrophages and epithelial cells of the respiratory tract[9]. Vitamin D also regulates phagocytosis dependent and antibody-dependent macrophages which protect from respiratory infections [22].

In the present study, 3 patients (3.8%) had congenital anomalies of the respiratory tract; (two patients had congenital lobar emphysema and one had congenital cystic adenomatoid malformation). Previous studies have reported congenital anomalies of the respiratory tract in 1.7% -16.13% of cases [1,2,5,12,23].

Repeated episodes of pneumonia are often the presenting feature of structural airway abnormalities (localized bronchial stenosis, bronchomalacia, tracheobronchus and bronchiectasis) or parenchymal lung lesions (Pulmonary sequestration, cystic adenomatoid malformation and bronchogenic cysts [19].

Our results showed that 2 patients (2.2%) had sickle cell anemia. Saad and his colleagues [23] reported (3.5%) of cases had sickle cell anemia. Children with sickle cell disease were 30-600 times more likely to develop invasive pneumococcal disease, including pneumonia, meningitis, and septicemia [10].

In the present study 1(1.2%) of children had bronchiectasis. Our results are similar to those studies [1,23].The common thread in the pathogenesis of bronchiectasis consists of difficulty clearing secretions and recurrent infections with a “vicious cycle” of infection and inflammation resulting in airway injury and remodeling [14].

The limitations of this study include we were not able to do all the necessary immunological investigations as a result of financial constraints and lack of facilities and due to non-availability of some work up for diagnosis some diseases like cystic fibrosis and for evaluating the swallowing mechanism.

Conclusion: Aspiration syndromes was the most common underlying illnesses for recurrent pneumonia in children. The results of this study would help the pediatricians identify and hence prevent and manage the most common etiologies of recurrent pneumonia in our location.

References:

- 1- Ali M, Saleem M, Babar MI, Sheikh A, Anwer J, Younus J, Niazi k.(2014), Causes of Recurrent Pneumonia Among Children. *JSZMC*, 5(2):591-596.
- 2- Bolursaz MR, Lotfian F, Ghaffaripour HA, Hassanzad M.(2017), Underlying Causes of Persistent and Recurrent Pneumonia in Children at a Pulmonary Referral Hospital in Tehran, Iran. *Arch Iran Med*, 20(5):266-269.
- 3- Brand PL, Hoving MF, de Groot EP.(2012), Evaluating the child with recurrent lower respiratory tract infections. *Paediatr Respir Rev*,13(3): 135-8.
- 4- Buckley RH.(2016), Evaluation of suspected immunodeficiency. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE (eds). *Nelson Textbook of Pediatrics* (20th ed). Philadelphia, PA: Elsevier Saunders, chapter 112, pp 999-1006.
- 5- Capanoglu M, Zorlu P, Sari E, Senel S.(2017), The Etiology of Recurrent Pneumonia with Onset During Infancy, and the Effect of Risk Factors on Age at First Episode and Episode Frequency. *Turkish Journal of Pediatric Disease*, DOI: 10.12956.
- 6- Ciftci E, Guneş M, Koksall Y, Ince E, Dogru U.(2003), Underlying causes of recurrent pneumonia in Turkish children in a university hospital. *J Trop Pediatr* ,49(4), 212-5.
- 7- Colombo JL.(2016), Chronic recurrent aspiration. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE (eds). *Nelson Textbook of Pediatrics* (20th ed). Philadelphia, PA: Elsevier Saunders, chapter 398, pp 2064-2067.
- 8- Couriel J. (2002), Assessment of the child with recurrent chest infections. *Br Med Bull* ,61, 115-32.
- 9- El Basha N, M. Mohsen M , Kamal M, Mehaney D.(2014), Association of vitamin D deficiency with severe pneumonia in hospitalized children under 5 years. *Comparative Clinical Pathology*, 23 (5), 1247-1251.
- 10- Halasa NB, Shankar SM, Talbot TR, Arbogast PG, Mitchel EF, Wang WC, Schaffner W, Craig AS, Griffin MR. (2007), Incidence of invasive pneumococcal disease among individuals with sickle cell disease before and after the introduction of the pneumococcal conjugate vaccine. *Clin Infect Dis*,44(11), 1428—33.
- 11- Heffelfinger JD, Davis TE, Gebrian B, Bordeau R, Schwartz B, Dowell SF. (2002), Evaluation of children with recurrent pneumonia diagnosed by World Health Organization criteria. *Pediatr Infect Dis*, 21(2), 108-12.
- 12- Hoving MF, Brand PL.(2013), Causes of recurrent pneumonia in children in a general hospital. *J Paediatr Child Health*, 49(3): E208 –12.
- 13- Kelly MS and Sandora TJ. (2016), Community acquired pneumonia. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE (eds). *Nelson Textbook of Pediatrics* (20th ed). Philadelphia, PA: Elsevier Saunders, chapter 400, pp 2088-2094.
- 14- Lakser OJ. (2016), Bronchiectasis. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE (eds). *Nelson Textbook of Pediatrics* (20th ed). Philadelphia, PA: Elsevier Saunders, chapter 112, pp 2094-2096.
- 15- Lodha R, Puranik M, Natchu UC, Kabra SK.(2002), Recurrent pneumonia in children: Clinical profile and underlying causes. *Acta Paediatr*, 91(11):1170-3.
- 16- McIntosh K.(2002), Community-acquired pneumonia in children. *N Eng J Med*, 346(6):429-37.
- 17- Owayed AF, Campbell DM, Wang EE.(2000), Underlying causes of recurrent pneumonia in children. *Arch Pediatr Adolesc Med*, 154:190-4.
- 18- Ozdemir O, Sari S, Bakirtas A, Zorlu P, Ertan U.(2010), Underlying diseases of recurrent pneumonia in Turkish children. *Turk J Med Sci*, 40 (1): 25-30.
- 19- Panitch HB.(2005), Evaluation of recurrent pneumonia. *Pediatr Infect Dis J*, 24(3),265–266.
- 20- Patel HT.(2004), Basic pathophysiology: left to right shunts. In: Koenig P, Hijazi ZM, Zimmerman F,(eds). *Essential Pediatric Cardiology*(1th ed). London: McGraw-Hill Medical Publishing, pp. 77–87.
- 21- Patria MF, Esposito S.(2013), Recurrent Lower Respiratory Tract Infections in Children: A Practical Approach to Diagnosis. *Ped Res Rev*,14, 53-60.
- 22- Raloff J. (2006), The antibiotic Vitamin, Deficiency in Vitamin D may predispose people to infection. *Science News*, 170(20): 312-317.
- 23- Saad k, Mohamed SA, Metwalley KA.(2013), Recurrent/Persistent Pneumonia among Children in Upper Egypt. *Mediterr J Hematol Infect Dis*, 5(1):e2013028.
- 24- Sadoh WE. Natural history of ventricular septal defect in Nigerian children. *South Afr J Child Hlth*. 2010;4:16–19.
- 25- Wald ER.(1993), Recurrent and non-resolving pneumonia in children. *Semin Respir Infect*, 8(1), 46 – 58.

الالتهاب الرئوي المتكرر في الأطفال المترددين على مستشفى مدينة المكلا - اليمن

صالح عوض بحول
مازن أحمد جواس
حنان سعيد بن غوث

الملخص

الالتهاب الرئوي المتكرر في الأطفال لا يزال مشكلة كبيرة لأطباء طب الأطفال وكان الهدف من هذه الدراسة المستقبلية تحديد انتشار وأسباب الالتهاب الرئوي المتكرر في الأطفال المترددين على مستشفى مدينة المكلا في الفترة ما بين يناير 2014 م وديسمبر 2016 م. تم معاينة وترقيد الحالات المصابة بالالتهاب الرئوي وتتراوح أعمارهم من شهرين إلى خمس عشرة سنة وتم أخذ التاريخ المرضي والفحص السريري لكل حالة مصابة بالالتهاب الرئوي المتكرر وتأكيد التشخيص بواسطة صورة الدم الكامل، التحليل المناعي الكمي، الأشعة السينية، التصوير المقطعي للصدر، منظار القصبات الهوائية، جهاز الإيكو للقلب، ابتلاع الباريوم واختبار مانتو. وقد تم جمع البيانات، وتم تحليلها إحصائياً باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية. تم معاينة وترقيد 920 حالة إصابة بالالتهاب الرئوي منها ثمانون حالة (8.7%) (إصابة بالتهاب رئوي متكرر. لوحظ بأن نسبة إصابة الذكور (63.8%) بالتهاب رئوي متكرر أعلى من الإناث) (36.2%) بمعدل (1:1.76). تم تحديد الأسباب في (77.5%) من الحالات بينما لم تعرف الأسباب في (22.5%) من الحالات، وكانت الأسباب الأكثر شيوعاً لالتهاب الرئة المتكرر هي: متلازمة الشفط (20%)، الربو القصبي (16.3%)، أمراض القلب الخلقية (13.8%)، السل الرئوي (8.8%)، نقص المناعة (6.2%)، الكساح الغذائي (5%)، تشوهات الجهاز التنفسي (3.8%) أما فقر الدم المنجلي وتوسع القصبات فهو يشكل (2.5%)، (1.2%) على التوالي. وخلصت الدراسة إلى أن حوالي 1 من بين كل 12 طفلاً مصاباً بالتهاب رئوي كان لديهم التهاب رئوي متكرر وهناك حاجة إلى استراتيجيات ومبادئ توجيهية جديدة للتشخيص المبكر للأسباب الكامنة وراء الالتهاب الرئوي المتكرر لدى الأطفال.

الكلمات المفتاحية: التهاب الرئة المتكرر، متلازمات الشفط، الربو، أمراض القلب الخلقية