Kartagener Syndrome: An Unusual Cause of Respiratory Distress in The Newborn

R.O. Ugwu MBBS, FWACP, **A.U. Eneh** MBBS, FWACP, **B.E. Otaigbe** MBBS, FWACP
Department of Paediatrics, University of Port Harcourt Teaching Hospital , Port Harcourt, Nigeria

ABSTRACT

Background: *Kartagener Syndrome (KS) a rare genetic disorder belongs to a group of disorders referred to as primary ciliary dyskinesia (PCD) where the cilia covering the respiratory epithelium is either immotile or beat in an uncoordinated fashion. It is characterized by a triad of dextrocardia (with or without situs inversus), chronic sinusitis and bronchiectasis as a result of poor mucociliary clearance of mucus and bacteria. This may lead to respiratory distress in the newborn period.*

Method: *This is a case report of a 14-day old male who presented with respiratory distress (which was noticed soon after birth) and features suggestive of KS.*

Conclusion: *KS should be suspected in neonates presenting with respiratory distress, pneumonia and no risk factors for infection.*

KEWORDS: Respiratory distress; Kartargener Syndrome; Newborn.

Paper accepted for publication 10th August 2006.

INTRODUCTION

Respiratory distress in the newborn is usually a non specific sign to a serious neonatal illness and usually manifests with tachypnoea, flaring alae nasi, intercostal recession, subcostal recession, expiratory grunting, and cyanosis[1]. Its origin may not necessarily be of primary lung disease, but may emanate from cardiac, hematologic, infectious, anatomic and metabolic disorders which directly or indirectly involve the lungs[1]. Common causes of respiratory distress in the newborn include bacterial or viral sepsis causing pneumonia, severe anaemia, birth asphyxia, Transient tachypnoea of the newborn, pneumothorax, cyanotic congenital heart disease, heart failure, polycythemia and congenital anomalies (congenital lobar emphysema, diaphragmatic hernia, pulmonary hypoplasia). Others include Respiratory Distress Syndrome which is commoner in preterms, meconium aspiration syndrome and persistent pulmonary hypertension of the newborn, which are commoner in the term infant.

Kartagener Syndrome (KS) is a rare genetic birth defect inherited in an autosomal recessive pattern and characterized by dextrocardia (with or without situs inversus), chronic sinusitis, recurrent pneumonia, bronchiectasis and infertility in adult life[2]. We present a 14-day old male who presented with subcostal recession and features suggestive of KS.

CASE REPORT

Baby FG, a male, presented to the Consultant Paediatric Clinic of University of Port Harcourt Teaching Hospital (UPTH) on the 14th day of life with a history of fast breathing, which was noticed soon after birth. The fast breathing did not interfere with sucking nor was there a history of change in body colour. He had been admitted into Special Care Baby Unit (SCBU) of the University of Port Harcourt Teaching Hospital on the 2nd day of life for fast breathing and was managed for congenital pneumonia with intravenous ceftriazone and gentamicin, and was discharged after seven days. The full blood count and the blood culture done then were both normal. Although a chest radiograph was requested for, it was however not done due to financial constraints.

The pregnancy was booked and supervised in a private hospital in Port Harcourt and was essentially uneventful and carried to term. There was no history of prolonged rupture of membrane or peripartum pyrexia. The labour lasted for 8 hours, delivery was by spontaneous vertex in the same hospital and he cried immediately after delivery. The birth weight was 3.9kg. He is the 5th child in a family of 5 children with 4 alive in a monogamous setting. The 2nd child died at 11 months from complications of diarrhea. The other siblings are alive and healthy. The mother is a 25 year old trader in clothing material whilst the father is a 32 year old sailor.

On examination he was noted to be in obvious respiratory distress with subcostal and intercostal recessions. The respiratory rate was 68cycles/minute with few bilateral crepitations. The heart rate was 140beats/minute with the apex beat maximally felt on the 4th right intercostal space. There were occasional missed beats otherwise the heart sounds were normal with no murmur. The other systems were normal. A diagnosis of recurrent bronchopneumonia with dextrocardia possibly Kartagener's Syndrome was made and he was re-admitted.

The Chest Radiograph (Fig. 1) revealed a fairly homogenous opacity in the left upper lung zone with patchy opacities in both the right and left lung bases,

Correspondence to: **Dr. R.O. Ugwu**
E-mail - rossaire2003@yahoo.com

flattening of the hemidiaphragm, hyperinflation, atelectasis and evidence of bronchiectasis (ring shadows at the lung bases). The mediastinum was significantly deviated to the right with a right-sided cardiac shadow. The hepatic and fundal gas shadows were normal in position. Electrocardigraphy (ECG) showed right axis deviation with atrial extrasystole and moderate tachycardia. The 2-D ECHO (Fig. 2) revealed dextrorotation of the heart, with non-dilated cardiac chambers, intact interventricular septum, and visible tricuspid and bicuspid valvular activities. The abdominal ultrasound showed that all the visceral structures were noted within their anatomic sites.

He was placed on intravenous ceftazidime and was reviewed by the Paediatric Cardiologist. On the 3rd day of admission, he developed features of cardiac failure with a heart rate of 170beats/minute, gallop rhythm and a tender hepatomegaly of 4cm. The respiratory rate also increased to 72cycles/mimute. He was commenced on intravenous digoxin (0.03mg/kg as total digitalizing dose(TDD); half of which was given as stat dose and then a quarter of the TDD was given 8 and 16 hours after the stat dose, and then maintained on one-eight of the TDD). After 48hours, the heart rate came down to 120 -130beats/minute, the occasional missed beats disappeared, and the liver size receded to 2cm. Although he still had mild subcostal recession and the respiratory rate was between 60 and 66cycles per minute, he remained stable. He was discharged on the 10th day of readmission after parents have been counseled to bring child immediately to the hospital if he develops fever or any symptoms of respiratory tract infection. He is still being followed up, and so far, has remained stable and gaining weight adequately.

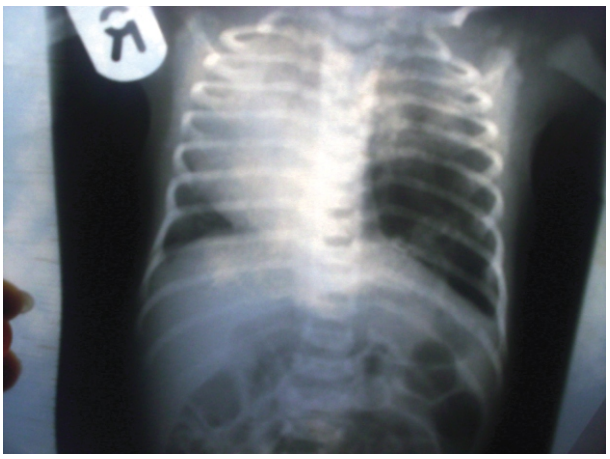

Fig. 1. Chest Radiograph Showing Dextrocardia, Left Upper Lobe Consolidation and Bronchiectatic Changes At The Lung Bases

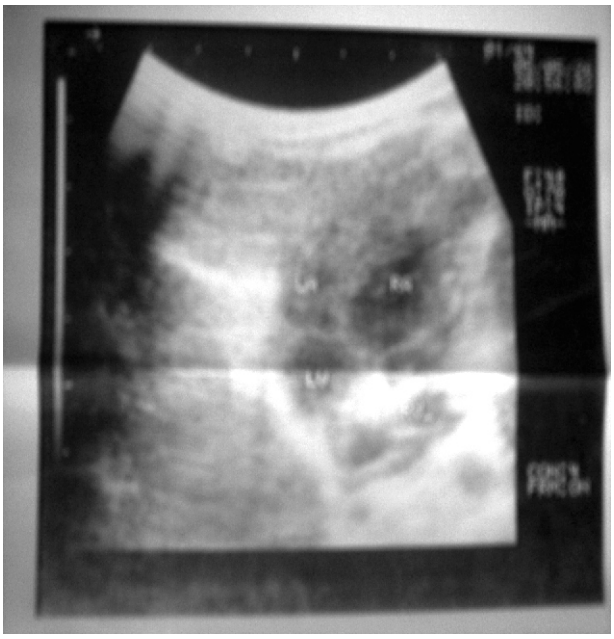

Fig. 2. 2-D Echocardiography Showing the Left Chambers to the Right of the Chest Wall

DISCUSSION

The combination of situs inversus, chronic sinusitis and bronchiectasis was first described by Siewert in 1904, although it was Manes Kartagener who first recognized this clinical triad as a distinct congenital syndrome in 1933[3]. KS is a part of a large group of disorders called Primary Ciliary Dyskinesia (PCD) where the ciliated epithelial covering of the respiratory tract were immotile[4,5]. It is estimated to occur between 1:10, 0006 to 1:32, 0003 live births and both males and females are equally affected. The respiratory epithelium show an absence of dynein arms which are structures that form temporary cross bridges between adjacent ciliary filaments and are believed to be responsible for generating movement in cilia[2,3, 7-9]. In some cases, no structural abnormality of cilia is detectable, even though the cilia exhibit an uncoordinated and inefficient movement pattern and the clinical syndrome is typical[4,10,11,12]. It has been postulated that normal visceral asymmetry is determined by movement of embryonic cilia which cause the normal embryo to bend into a right-handed helical twist, shifting the heart to the left[2,7,13]. This random lateralization explains the presence of dextrocardia and situs inversus in 50% of cases with abnormal ciliary function. The presence of dextrocardia defines KS in these children with primary ciliary dyskinesia[3]. Absence of dextrocardia or situs inversus however does not exclude KS[3,13].

Because the respiratory tract cilia fail to beat normally, secretions accumulate in the airways and bacterial infections occur. Presence of bronchiectasis and atelectasis suggests chronic lung infection which in this neonate could only have occurred in utero secondary to mucus plugs during pregnanacy. Several authors have similarly described neonates with respiratory distress, situs inversus and radiological evidence of bronchiectasis, and suggested that immotile cilia syndrome should be highly suspected in neonates with respiratory distress[14-17]. Valerius *et al* [18] suggested that the chronic lung infection might also be due to defective motility of the polymorphonuclear leucocytes even though the bactericidal activity is normal. The clinical manifestations of chronic sinusitis and bronchiectasis are more severe during the first decade of life but remit by the end of adolescence.

Extrinsic factors like a right pulmonary atresia, fibrosis, hypoplasia of the right lung, or a left pleural effusion, and tension pneumothorax might displace the heart to the right, but in these cases, the apex will still be maximal to the left or in the midline, whereas in true dextrocardia (as in our patient), the apical impulse is maximal on the right. Dextrocardia can occur as an isolated event with the abdominal organs in their normal anatomic position (situs solitus) as seen in our patient or it can occur with situs inversus with the abdominal organs reversed in their position. Isolated dextrocardia is rare and in 90% of cases is associated with other congenital heart defects, [19] however, the Echocardiography findings in our patient showed that apart from the malpositioning of the heart, there were no other intracardiac abnormalities.

Features seen on plain chest radiograph include hyperinflation, atelectasis and bronchiectasis which typically occurs in the lower lobes unlike in patients with cystic fibrosis where the bronchiectasis is predominantly in the upper lobes[3,14], as well as dextrocardia with or without situs inversus. Histologic diagnosis can be made by examination of mucosal (tracheal or nasal) biopsy for ciliary function and ultrastructure using a light microscopy. Electron microscopy however in conjunction with light microscopy provides a higher degree of accuracy when examining for ciliary movement[3,7]. High resolution CT scan on the other hand is more sensitive in documenting early and subtle abnormalities within the airways and pulmonary parenchyma which may not be detected by routine chest X-ray. Electron microscopy and CT scan are not available in our centre.

Treatment is usually with antibiotics but bronchodilators, aggressive pulmonary toilet and mucolytics may also be required when obstructive lung disease ensues. Mortality and morbidity usually stems from the chronic upper and lower respiratory infections. In addition to the triad of dextrocardia, chronic sinusitis and bronchiectasis, patients with KS may have nasal polyps, impaired sense of smell, chronic otitis media and hearing loss.[20] Males demonstrate infertility, secondary to immotile spermatozoa whereas the females may have reduced fertility[3,21]. Diagnosis of PCD and thus of KS is difficult in newborns. In those patients with situs inversus, the typical radiological appearance makes early diagnosis possible; however, in those patients with immotile-cilia syndrome and normal visceral situs, a high index of suspicion and early electron microscopic examination of respiratory tract cilia will be necessary for early diagnosis and therapy to prevent irreversible bronchiectasis and lung destruction.

CONCLUSION

KS should be suspected in term neonates with respiratory distress, pneumonia and no predisposing risk factors for infection. The radiological evidence of dextrocardia should also increase the index of suspicion. The absence of electron microscopy should however not deter the diagnosis.

REFERENCES

1. Kliegman RM. Foetal and Neonatal Medicine: Respiratory disorders. In: Behrman RE, Kliegman RM (eds). Nelson essentials of paediatrics, 4th ed. Philadelphia, WB Saunders, 2002; 212-222.
2. Rott HD. Kartagener's syndrome and the syndrome of immotile cilia. Hum Genet 1979; 46(3):249-261.
3. Bent J. Kartagener Syndrome. eMedicine, 2005 http://www.emedicine.com/med/topic1220.htm.
4. Rossman CM, Forrest JB, Lee RM. The dyskinetic cilia syndrome: Ciliary motility in immotile cilia syndrome. Chest 1980; 78(4): 580-582.
5. Rutland J, Cole P. Ciliary dyskinesia: (Letter). Lancet II 1980: 859.
6. Meeks M, Bush A. Primary cilia dyskinesia (PCD). Pediatr Pulmonol 2000;29:307316.
7. Milner AD, Greenough A. Malformations of the lower respiratory tract- The immotile cilia syndrome. In : Rennie JM, Robertson NRC (eds). Textbook of Neonatology 3rd Ed. Edinburgh, Churchill Livingstone 1999; 649-653.
8. Afzelius BA. A human syndrome caused by immobile cilia. Science 1976; 193: 317-319.
9. Neustein HB, Nickerson B, O'Neal M. Kartagener's syndrome with absence of inner dynein arms of respiratory cilia. Am Rev Resp Dis 1980; 122: 979-981.
10. Herzon FS, Murphy S. Normal ciliary ultrastructure in

children with Kartagener's syndrome. Ann Otol Rhinol Laryng 1980; 89: 81-83.
11. Schidlow DV, Katz SM. Immotile cilia syndrome. (Letter) New Engl J Med 1983;308: 595.
12. Schidlow DV, Katz SM, Turtz MG, Donner RM, Capasso S. Polysplenia and Kartagener syndromes in a sibship: association with abnormal respiratory cilia. J Pediat 1982;100: 401-403.
13. Eliason R, Mossberg B, Camner P, Afzelius BA. The immotile cilia syndrome: A congenital ciliary abnormality as an etiologic factor in chronic airway infections and male sterility. N Engl J Med 1977; 297(1): 1-6.
14. Morini F, Cozzi DA, Conforti A, Capocaccia P, Zicari AM, Tancredi G, Midulla F. An Infant with respiratory distress and failure to thrive. Eur Respir J 2002;20:500-503
15. Whitelaw A, Evans A, Corrin B. Immotile cilia syndrome: a new cause of neonatal respiratory distress. Arch Dis Child 1981; 56: 432-435
16. Pan Y, McCaskill CD, Thompson KH, Hicks J, Casey B, Shaffer LG, Craigen WJ. Paternal isodisomy of chromosome 7 associated with complete situs inversus and immotile cilia. (Letter) Am J Hum Genet 1998;62: 1551-1555.
17. Losa M, Ghelfi D, Hof E, Felix H, Fanconi S. Kartagener syndrome: an uncommon cause of neonatal respiratory distress?. Eur J Pediatr 1995;154:236238.
18. Valerius NH, Knudsen BB, Pedersen M. Defective neutrophil motility in patients with primary ciliary dyskinesia. Europ J Clin Invest 1983; 13: 489-494.
19. British Heart Foundation (BHF) Any Questions-Dextrocardia http://www.bhf.org.uk/questions/index.asp.
20. Wilhelm A. Situs Inversus. eMedicine 2003 http://www.emedicine.com/radio/topic639.htm.
21. Woodring AH, Royer JM, McDonagh D. Kartageners syndrome. JAMA 1982;247:2814-2816.