Pentalogy of Cantrell or Cantrell Syndrome: One in a million disease

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ABSTRACT

Introduction: Pentalogy of Cantrell (PS) or Cantrell Syndrome (CS), first described by Cantrell in 1958, is a rare congenital anomaly characterized by a defect in the lower sternum, anterior abdominal wall defect, defect in the anterior diaphragm, ectopia cordis and congenital heart disease. **Case Report:** A 12 hours female neonate born to full term primigravida was referred to us with her heart lying outside the chest and an omphalocele as well. The baby had complete thoracic ectopia cordis, midline anterior thoraco-abdominal wall defect through with liver was protruding, which was covered by a membrane. Sternum lower to ectopia cordis was not palpable. Echocardiography showed ASD, VSD, pulmonary and infundibular stenosis. The child was referred to a pediatric cardiac surgeon but died after 36 hours of life. **Discussion:** Pentalogy of Cantrell (PC) is a rare congenital malformation with considerable variation in expression. Aetiology is unknown but defective development of lateral mesoderm with poor differentiation, proliferation and migration during 14-18 days of embryonic life is suggested to be responsible for this anomaly. Other organ system involvement like cleft lip, cleft palate, craniorachischisis, gall bladder agenesis, renal agenesis, adrenal hypoplasia, bladder exstrophy, undescended testes, inguinal hernia, polysplenia, club feet, absent tibia, absent radius and hypodactyly have also been reported in the literature. Three types of PC has been described, Class I in which all the five defects are present. Class II has four defects with intracardiac and abdominal defects as essential components. Class III is incomplete disease expression having a combination of various defects with sternal defect as an essential component. Early diagnosis with antenatal ultrasound is possible. Ectopia cordis can be partial or complete, and its location may be cervical, thoracic, thoracoabdominal and abdominal. Management of PC is challenging and multidisciplinary. Aim of management is to have a complete survey of other congenital anomalies and closure of defects as early as possible. Overall prognosis is not good. Prognosis depends on the type of PC, the position of ectopia cordis and intracardiac defects. **Conclusion:** Pentalogy of Cantrell is a rare condition with high morbidity and mortality. Antenatal ultrasound is helpful in early diagnosis. The child must be delivered in a tertiary care hospital where all the facilities are available. Early intervention to cover the exposed organs is necessary to avoid organ injury.

KEYWORDS Pentology of Cantrell, Cantrell syndrome, Ectopia Cordis, Naked heart, Omphalocele, Sternal defect, pericardial defect, cardiac defects, cephalic fold defect, diaphragmatic defect, Atrial septal defect, ventricular septal defect, pulmonary valve stenosis, infundibular pulmonary stenosis.

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Introduction

Pentalogy of Cantrell (PC) or Cantrell Syndrome (CS) is a very rare congenital anomaly, first described in the literature by Cantrell in 1958. This rare syndrome has five components, thus giving it a name pentalogy. These include: i)lower sternal defect, ii) defect in the anterior diaphragm, iii) defect in the anterior abdominal wall, iv) ectopia cordis and v) congenital heart disease.[1]

Ectopia cordis is a condition in which the heart is naked and found at an abnormal position lying completely or partially outside the chest cavity. It is rare and constitutes 0.1% of all the congenital heart anomalies.[2] We are reporting a rare case of 12 hours of life female child born to a full term primigravida via Caesarean section. The child had complete ectopia cordis with cardiac defects such as ASD, VSD and Pulmonary valvular and infundibular stenosis. The child had midline anterior abdominal wall defect (Omphalocele).

Case Report

Twelve hours old female neonate presented to A&E department of The Children's Hospital, Pakistan Institute Of Medical Sciences (PIMS) Islamabad with complaints of visible heart, beating outside the chest wall and a large swelling on the abdomen. The child was born via caesarean section to a primigravida at full term. There was no family history of congenital anomalies. No record of antenatal visits and antenatal scans was available. On examination child was weighing 2.5kg, vitally stable, pink in room air, heart rate of 152 per minutes and a respiratory rate of 45 per minute. There was a lower sternal defect with complete ectopia cordis (Figure 1&2) and a midline anterior thoracoabdominal wall defect (Figure 1&2) through which abdominal contents covered by a membrane were protruding (Omphalocele).

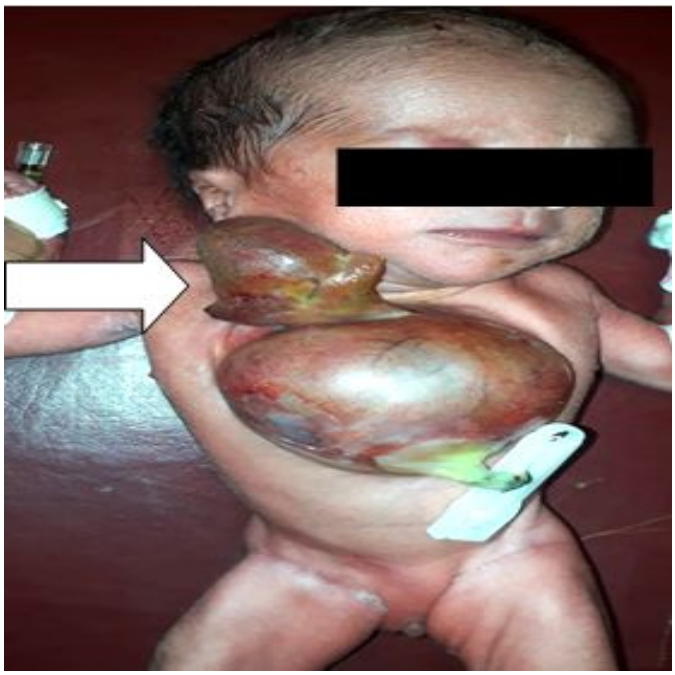

Figure 1. Complete thoracic ectopia cordis (white arrow).

External genitalia and limbs were normal. Investigations revealed WBC 8.7x10/mm3, Hb 14 g/dL, hematocrit 35% and platelet count of 400x10/mm3. Urea, creatinine, serum bilirubin, ALT, alkaline phosphatase, serum albumin and serum electrolytes were within normal limits. Ultrasound abdomen and pelvis was done, which showed large anterior abdominal wall defect through which the liver was protruding. The renal system was normal. Chest X-ray and babygram were normal as well. Due to non-availability of pediatric cardiologist and pediatric cardiac surgeon at our hospital, the child was referred to Armed Forces Institute Of Cardiology and National Institute of Heart Diseases (AFIC & NIHD) Rawalpindi. Neonate was admitted in the Neonatal intensive care unit in AFIC & NIHD. Echocardiography showed Atrial septal defect (ASD), large subaortic Ventricular septal defect (VSD) and pulmonary valvular and infundibular stenosis. The child was initially managed with intravenous antibiotics and fluids, but the neonate could not survive beyond 36 hours of life.

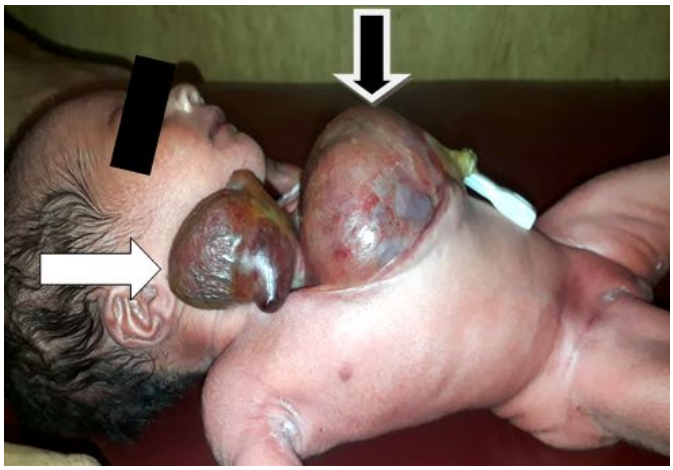

Figure 2. Beating heart (white arrow) with anterior thoracoabdominal wall defect (omphalocele) black arrow.

Discussion

Cantrell syndrome (CS) or Pentalogy of Cantrell (PC) is a rare condition occurring in 5.5 in 1 million live births [3]. The spectrum of the disease has great variations in severity ranging from incomplete to severe expression, with or without involving other organ systems. Involvement of other organ systems in CS reported in the literature include spina bifida, hydrocephalus, corpus callosum hypogenesis, vermian cerebellar hypoplasia, horseshoe kidney, anophthalmia and abnormal ears.[4] Other associations include cleft lip, cleft palate, craniorachischisis, gall bladder agenesis, renal agenesis, adrenal hypoplasia, bladder exstrophy, undescended testes, inguinal hernia, polysplenia, club feet, absent tibia, absent radius and hypodactyly.[5]

All the patient with CS does not have classical findings. Toyama classified CS into three types depending upon the severity of disease expression. Class I is a severe form in which all the five defects are present. Class II has four defects with intracardiac and abdominal defects as essential components. Class III is a milder form with incomplete disease expression having a combination of various defects with sternal defect as an essential component.[6]

Aetiology of this disease is still unknown. The various hypothesis has been proposed but defect information with incomplete differentiation and poor migration of lateral mesoderm during 14-18 days of embryonic life is the most accepted one

[7]. The ventral body wall development starts at 8th day of embryonic life. It starts with differentiation and proliferation of mesoderm, followed by its lateral migration. Initially, development of heart starts in cephalic location and reaches its definitive location in the chest cavity at about 16th to 17th day of embryonic life due to lateral folding and ventral flexing of the embryo. The fusion of walls in the midline is completed by the 9th week. Failure of midline fusion at this stage is responsible for the expression of various defects of CS.[8]

CS can be diagnosed in an antenatal period by using ultrasonography. Ectopia Cordis and large omphalocele can be seen easily in the first trimester with 2D ultrasound. However, small Omphalocele can be missed. Pleural and pericardial effusions are considered indirect markers for PC.3D scanning is better in visualising minor anatomical details and malformations as it has more significant contrast differentiation with adjacent organs. Fetal cardiac assessment should be done by echocardiography. Fetal MRI is a complimentary screening modality for anomalies.[7]

Ectopia cordis is a congenital malformation that occurs due to defect in the anterior chest and abdominal wall resulting in partial or complete protrusion of heart out of the chest cavity. It can occur alone or with other organs anomalies as in PC. Ectopia Cordis was first described in the literature by Hellar et al. in 1706. In an era of advanced neonatal cardiac surgery, complete ectopia cordis still poses a tremendous surgical challenge with a low survival rate.[8] Depending upon location, Ectopia Cordis can be cervical (3%), thoracic (60%), thoracoabdominal (7%) and abdominal (30%).[9]

Intracardiac defects are predominantly present in patients with ectopia cordis. Nearly 80% of patients with ectopia cordis have associated intracardiac anomalies. These include atrial septal defects (ASD), ventricular septal defect (VSD), left ventricular diverticulum, tetralogy of Fallot, double outlet right ventricle, tricuspid atresia, transposition of great vessels (TGA), single atrium, hypoplastic left heart syndrome, atrioventricular canal defects and pulmonary hypoplasia. [5, 6, 9, 10] Our patient has ASD, VSD, pulmonary valvular and infundibular stenosis. Apart from Omphalocele, other abdominal wall defects can also be seen in PC. These include diastasis recti, gastroschisis, umbilical hernia, epigastric hernia and combination of these.[2, 11]

Sternal defects include the short sternum, bifid sternum, absent xiphoid and defective lower part of the sternum. Differentials of midline defects should also be kept in minds such as body stalk anomaly and amniotic band syndrome.[11]

Management is challenging due to the complex nature of the disease and its association with various combinations of congenital anomalies. Treatment requires multidisciplinary team including a neonatologist, pediatric cardiologist, pediatric cardiac surgeon, pediatric plastic surgeon and skilled nursing staff. Management consists of a complete survey of other congenital anomalies and defects, assessment of intracardiac defects and early coverage of exposed viscera. Treatment of ectopia cordis is surgical and is divided into four steps i) coverage of heart by a soft tissue ii) reduction of heart into the thoracic cavity iii) treating intracardiac defects iv) chest wall reconstruction. [12]

Prognosis of this rare entity depends upon the location of ectopic heart, degree of intracardiac defects and complexity of associated congenital anomalies. [6] Prognosis is poor in patients having a complete form of CS with total ectopia cordis and having intracardiac defects.[13]

Conclusion

Pentalogy of Cantrell is a rare condition with high morbidity and mortality. Antenatal ultrasound is helpful in early diagnosis. The child must be delivered in a tertiary care hospital where all the facilities are available. Early intervention to cover the exposed organs is necessary to organ injury.

Competing Interests

The authors declare that there is no conflict of interest in this study.

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