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Case Report

Pentalogy of Cantrell with ectopia cordis: A rare case with review of literature

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ABSTRACT

Pentalogy of Cantrell (PC) is a rare congenital syndrome comprising five characteristic abnormalities that include midline anterior abdominal wall defect, sternal defect, diaphragmatic defect, defect in apical pericardium, and structural heart defect. The exact etiology of this syndrome is still unknown. However, many causative factors and association with other syndromes/aneuploidies (trisomy 18/trisomy 13) have been described in literature. Prognosis is often poor in cases with complete ectopia cordis with large defect. The postnatal surgical correction demands expert care in good resource settings. We are describing a rare case of severe form of PC with complete ectopia cordis and omphalocele, detected at 32 weeks of gestation. The patient had vaginal delivery of live female baby but unfortunately, the baby succumbed on day 2 of life. We are reporting this rare and fatal case to make health-care professionals more aware about importance of timely detection of such anomalies by anomaly scan in the second trimester before the period of viability so that the parents can make informed choice about termination of pregnancy in such lethal cases. Furthermore, the corrective surgeries can be planned beforehand with multidisciplinary approach in cases where affordability is not an issue for parents.

Keywords: Pentalogy of Cantrell, Ectopia cordis, Sternal defect, Diaphragmatic defect, Omphalocele

INTRODUCTION

Pentalogy of Cantrell (PC) is a rare congenital anomaly which was first described by Cantrell *et al.* in 1958 consisting of anterior abdominal wall defect, distal sternal defect, diaphragmatic defect, pericardial defect, and structural heart defect.[1] The incidence is about 1 in 65,000–200,000 live births.[2] Ectopia cordis, which is defined as complete or partial displacement of heart outside the thoracic cavity, is a typical manifestation of PC. The etiology of PC is considered as multifactorial, though the exact cause is unknown, and its prognosis depends on the extent of severity of lesion. Early diagnosis of such lesions in antenatal period can decrease perinatal morbidity and mortality.

We are describing a rare case of severe form of PC with ectopia cordis and omphalocele, which was detected at 32 weeks of gestation. The baby was delivered vaginally but could not survive beyond 48 h of life. We are reporting this case with the aim to make healthcare professionals more aware about importance of early detection of such anomalies (even before the period of viability) so that further management can be planned accordingly to reduce perinatal morbidity and mortality. Furthermore, explaining about disease itself and its prognosis helps parents to make informed choice and allay anxiety.

CASE REPORT

A 21-year-old lady with diagnosis of G3A2 with 32 weeks gestation presented to our outpatient department after being referred in view of her latest ultrasound showing ectopia cordis in baby. She had a negative history for similar anomaly in family/exposure to radiation or any drug in this pregnancy/infection in the first trimester or consanguinity. This pregnancy was spontaneous conception with the first two trimesters being uneventful. The patient had ultrasonography done at 11 weeks period of gestation but ectopia cordis was not detected on this scan. She did not have any anomaly scan in the second trimester and got her next ultrasound done at 32 weeks period of gestation which showed thoracic ectopia cordis [Figure 1]. All the antenatal routine investigations were within normal limits. Her previous two pregnancies were spontaneous abortions at 2 months of amenorrhea. When the patient presented

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to us, we explained about the fetal prognosis, need for fetal echocardiography, and management in postnatal period including multistage repair (which we planned for the baby). Unfortunately, the mother denied further investigations and postnatal surgical management because of non-affordability. She wished to continue pregnancy and wanted vaginal birth for this baby. She was kept on regular follow up. At 39 weeks period of gestation, she came in active labor in emergency and delivered a live female baby with birth weight 2.4 kg. The baby did not cry immediately after birth and had low Apgar score at 0 and 1 min. The newborn was resuscitated and was intubated. On examination, the baby had anterior chest wall defect along with sternal defect as body of sternum and xiphoid process of sternum were absent. Her heart was lying completely outside the thoracic cavity. The baby also had defects in the diaphragm and omphalocele with part of liver herniating outside the abdominal cavity [Figure 2]. She was admitted in neonatal ICU. No other associated congenital anomaly was seen. 2D echocardiography was done on day 1 and showed AV canal defect, ventricular septal defect, and ostium primum ASD. However, because of limited echocardiographic examination, we could not see whether the apical pericardium was absent or present.

In neonatal ICU, the heart and herniated viscera were kept covered with wet dressing soaked in normal saline. Supportive care was given to the baby. The surgical correction was not attempted immediately as the general condition of baby was not good. Unfortunately, the baby succumbed on day 2 post-delivery.

DISCUSSION

As already discussed, PC consists of midline defect, intracardiac defect, and diaphragmatic defects. Cantrell *et al*. proposed that defect in the development of septum transversum and adjacent somatic and splanchnic mesoderm leads to defect in anterior diaphragm, inferior pericardium, and cardiac structures. Second, failure of primordial sternum to migrate and fuse leads to defect in anterior abdominal wall. According to him, the offending event must occur between the 14th and 18th days of life.[1] Till now, the original theory proposed by Cantrell holds true in terms of embryology and timing of likely event.

Till date, no discrete definitive genetic mutation has been identified for PC. Majority of cases are sporadic but certain other mutations have been seen in patients with PC suggesting role of such mutations in causing PC spectrum. These are:

1. Duplication of ALDH1A2 gene that encodes for an enzyme which is needed for Vitamin A metabolism into transretinoic acid which, in turn, plays a critical role in normal cardiac and diaphragm development
2. Mutation in the thoracoabdominal gene in Xq25-q26.1 zone plays a role in sternum defects, cardiac defects, and abdominal wall defects
3. PORCN mutation – This gene is X-linked and has been linked to Goltz-Gorlin syndrome. Few cases of concurrent Goltz-Gorlin syndrome in PC have been reported suggesting the presence of this mutation in cases of PC. This gene plays a role in Wnt ligand acetylation and any defect in Wnt/beta-catenin pathway may lead to midline defects.[3,4]

Association and causative factors

The exact cause of such pathology is still not known but association has been seen with trisomy 18 and trisomy 21.[5] We could not find any probable factor associated with this

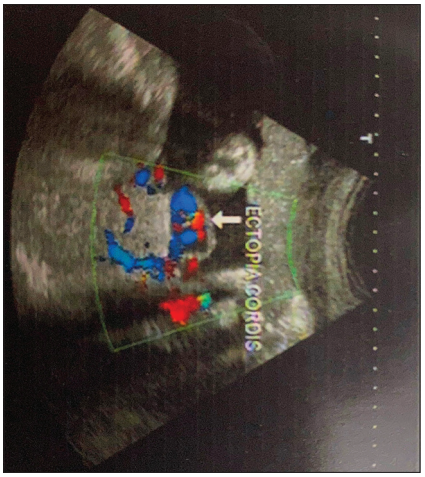

Figure 1: Antenatal ultrasound at 32 weeks. The antenatal ultrasound done at 32 weeks of gestation depicted thoracic ectopia cordis.

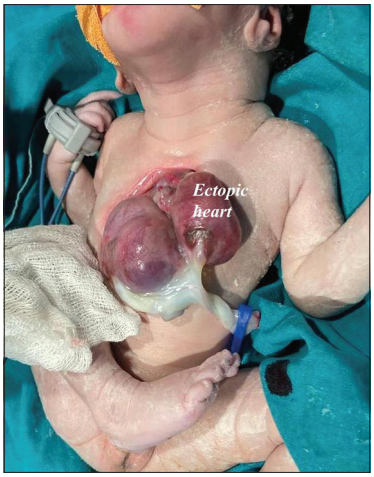

Figure 2: Clinical picture of the baby. The baby's heart was lying completely outside the thoracic cavity with defects in the diaphragm and omphalocele with part of liver herniating outside the abdominal cavity.

condition, though we agree that due to financial constraints, we could not send the fetal tissue for karyotyping.

Various possible causative agents include teratogenic drugs and external stimuli, maternal infections, and amniotic band syndrome which can tear yolk sac in early gestation and may lead to such anomaly.[6]

Spectrum of the disorder

Since the first description of PC, various different presentations, severity, and penetration in the disease spectrum have been reported. Anterior abdominal wall defect generally presents as an omphalocele in 63% of such cases. Sternal defects may range from complete absence of sternum to absence of xiphoid process only. Intracardiac defects are essential criteria to diagnose PC with ventricular septal defect being almost always present in all cases. Other associated lesions may consist of atrial septal defect, tetralogy of Fallot, Ebstein anomaly, or single atrium.[7] Toyama has classified PC into three classes: Class 1 – where all five defects are present, Class 2 – where four defects are present with intracardiac and ventral wall defects definitely present, and Class 3 – not all defects are seen but sternal defect is definitely seen.[8] The presence of ectopia cordis and omphalocele comes under the most severe form of PC. Depending on the location, ectopia cordis has been divided into four types – cervical, thoracic, abdominal, and thoracoabdominal.[9]

Other associated anomalies which can be seen in cases of PC are cleft lip, cleft palate, club foot, spina bifida, meningocele, meningomyelocele, hydrocephalus, and encephalocele. In our case, the baby had thoracoabdominal ectopia cordis, omphalocele, liver herniation, an absent lower 2/3rd sternum, diaphragmatic defect, and intracardiac defects. As we could not look for pericardium, our case comes under the most severe form of probable (Class 2) PC.

Prenatal diagnosis

PC can be diagnosed in the first trimester on 2D ultrasonography. Sepulveda *et al*. reported seven cases of PC which were diagnosed in the first trimester.[10] In cases where large defects are not seen, the presence of pericardial effusion may suggest possibility of PC. Further detailed anatomic evaluation can be done by 3D ultrasonography, MRI, and echocardiography (for intracardiac lesions). PC may be associated with aneuploidies, therefore, prenatal testing to rule out aneuploidies should be taken into consideration for better paternal counseling and formulate plan of further management.

Management in postnatal period

Detailed evaluation of all anomalies should be done. Thoracoabdominal computed tomography scan, X-ray chest, cardiac MRI, and echocardiography may be needed to diagnose additional defects. After birth, multidisciplinary approach should be used for both palliative care and definitive surgery. Early surgical repair has been associated with higher mortality rates.[6] Neonates should be given prophylactic antibiotics and covering of omphalocele by sterile dressing for epithelization of omphalocele sac. Surgical repair can be planned once neonate becomes stable. It can be multi-stage repair or single stage depending on the condition of the neonate. It involves correction of the following defects:

1. Repair of cardiac defects along with restoration of cardiac position – Cardiac defects are repaired first generally to avoid further cardiac insult during correction of abdominal wall defects. The type of surgery depends on type of defects, status of cardiopulmonary function, degree of abdominal wall defect, and general condition of neonate
2. Repair of abdominal wall defect – Low tension midline closure is the aim to prevent gut ischemia by mobilizing abdominal muscles
3. Correction of sternal defect – Optimal repairing of sternal defect should provide cardiac coverage but with no compression and also should not hinder chest wall expansion and growth. Direct approximation of two sternal halves can be attempted in small defect but large defect may need closure with flaps/grafts. Both single stage and multistage corrective surgeries have been described in literatures.[6]

Prognosis

Prognosis is generally poor especially in cases with ectopia cordis with large defects as less mediastinal space is available for repositioning the heart back and can cause significant hemodynamic compromise.

CONCLUSION

All patients should have detailed anomaly scan before the period of viability so that the prognosis can be explained in severe cases and decision regarding termination of pregnancy can be taken timely. The diagnosis of such anomalies in the third trimester significantly affects mental health of the parents as well. Our patient did not have any anomaly scan in the second trimester; therefore, this condition could be detected only in the third trimester (at 32 weeks of period of gestation). In severe cases, like ours, the prognosis is generally poor. Moreover, in mild cases, further planning and management can be planned through a multidisciplinary approach involving pediatricians, obstetricians, and pediatric surgeons in good resource settings.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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