

# The Corpus Callosum Agenesis, Antenatal Diagnosis: A Case Report, 2018, Kingdom of Saudi Arabia, Eastern Region, Alahsa

Latifa Buhmail, Malak Alali

**Abstract:** ***Background:** Corpus callosum agenesis is a congenital abnormality that can be partial or complete. It is reported to have an incidence of about 1:4000 live births. This case of corpus callosum is reported as the third incidence on the family. It was detected antenatally by the sonographic study. **Case presentation:** A 33-year-old married female gravida3 para2 living0, referred to perinatology clinic at 12 weeks and two days of gestation due to a history of congenital anomalies. In 22 weeks plus two days of gestation the ultrasound revealed typical signs of corpus callosum agenesis: dangling choroid plexus, teardrop sign (highly suggestive of agenesis of corpus callosum), and absent cerebellar vermis. The outcome of this pregnancy is a preterm baby girl with congenital anomalies and dysmorphic features; cranial ultrasound showed complete absences of the corpus callosum. **Conclusions:** The baby girl is admitted to maternity and children hospital under observation and for further intervention seeking for symptomatic relief. The case is reported to cytogenetic center at Dammam for further genetic analysis. We are reporting this case in the literature to raise any association since it is the third incidence of congenital anomaly in the same family since there is no previous incidence has been reported in Kingdom of Saudi Arabia.*

**Keywords:** Agenesis of corpus callosum, antenatal diagnosis, Perinatology

## 1. Background

Corpus callosum is a vital commissure, which connects the non-olfactory areas of the right and left hemispheres. It is developed from the telencephalon. It is essential for learning, discrimination, sensory experience, memory, and synchronicity of sleep. A disruption of brain cell migration causes the partial or complete absence of corpus callosum during fetal development. The agenesis of the corpus callosum was first recognized and documented in 1887 by John Langdon Down, a British physician best known for his description of the common genetic disorder that is now called Down syndrome. [1] *Nowadays*, It is more easily detected via ultrasound, and MRI screening. Despite the limitations of early diagnosis, the value of antenatal diagnosis is two-fold. A case of antenatal detection of corpus callosum agenesis is described here.

## 2. Case Presentation

A 33-year-old Saudi married woman, who is gravida3 para2 living0 with gestational age of 12 weeks and two days, was referred to fetomaternal medicine unit at maternity and children hospital at Alahsa due to a history of previous two babies with congenital anomalies. Her first baby was an intrauterine fetal demise at 31 weeks plus six days of gestation after a spontaneous rupture of membrane suspected to be due to congenital anomalies, the second baby is delivered spontaneously vaginally but died at nine months of age due to congenital anomalies as well, suspected to be an agenesis of corpus callosum. The patient and her husband have healthy karyotyping. Although they are second-degree relatives, there is no family history of congenital anomalies.

The ultrasound of the appointment at 12 weeks and two days of gestation showed a single viable fetus with a CRL measuring 63 mm, which corresponds to 12 weeks and five days of gestation. The NT measures 1.8 mm, nasal bone

present. Normal tricuspid and ductal flow, heart rate of 170 beats/minute with normal basic anatomy.

While the ultrasonography of the perinatology visit at 18 weeks and two days of gestation revealed; a single active fetus, cephalic presentation, low anterior placenta, average liquor, with normal growth velocity. In addition to, a dangling choroid plexus, teardrop sign, absent cerebellar vermis, and mild bilateral dilation of the renal pelvis.

The next visit at 22 weeks and two days of gestation supported the abnormal sonographic findings of the previous one; including single active fetus, cephalic presentation, anterior placenta, average liquor, and normal growth velocity. In addition to, a dangling choroid plexus (Figure 1), teardrop sign (Figure 2) (highly suggestive of agenesis of corpus callosum), and absent cerebellar vermis (Figure 3). The right renal pelvis measures 5.8 mm and the left 4.8 mm., and the right ulna appeared short in length (Figure 4).

The outcome of this pregnancy with a normal spontaneous vaginal delivery at 32-week of gestation is a baby girl weighs 1.335 kg. Apgar score 4/10, 6/10, 8/10 at 1, 5, 10 minutes respectively. Clinical examinations revealed congenital anomalies and dysmorphic features: (1) complete absence of corpus callosum; (2) bilateral choanal atresia; (3) moderate to large patent ductus arteriosus; (4) imperforated hymen which bluded by a vaginal cyst; (5) upturn nose; (6) low-set ears; (7) micrognathia; (8) short right forearm; and (9) overlapping of toes. The cranial ultrasound confirmed the antenatal findings of complete agenesis of corpus callosum. The abdominal ultrasound showed moderate enlargement of the right kidney, no other abnormalities detected. The baby underwent taranspalatal repair to relieve the choanal atresia but complicated by septicemia, the baby treated and kept under ventilation with a plan of weaning from it according to the baby's lung response. The case was reported for a cryptogenic center at Dammam for further differentiation of the syndrome/syndromes associated with

the agenesis of corpus callosum and for future management considering the history of congenital anomalies of the two previous pregnancies.



**Figure 1:** This axial view of the brain of the fetus at 22weeks+2days was obtained with abdominal sonography using Voluson E10 demonstrates dangling choroid plexus.



**Figure 2:** This axial view of the brain of the fetus at 22weeks+2days was obtained with abdominal sonography using Voluson E10 shows Tear-drop sign.



**Figure 3:** This axial view of the brain of the fetus at 22weeks+2days was obtained with abdominal sonography using Voluson E10 reveals absent cerebellar vermis.



**Figure 4:** This is at a 22weeks+2days of gestation was obtained with abdominal sonography using Voluson E10 shows short ulna of the right forearm

### 3. Discussion

The corpus callosum is considered the largest white matter connection, which consist of 190 million axons functioning to connect the left and right hemispheres of the brain. [2] This connection allows the incorporation of complex sensory and motor information from both sides of the body and influence higher cognition related to language, social interaction, executive functioning, and language. [3] The corpus callosum develops between 6 and 20 weeks of gestation through a complex process of multiple cellular and molecular incidents includes neocortical commissural axon fasciculation and reflects the inter-hemispheric circuitry and successive steps of synaptogenesis. Any perinatal disruption of these incidents can result in agenesis of corpus callosum. In agenesis of corpus callosum, commissural fibers do not cross the midline instead thick bundles of intersecting fibers called Probst bundles which lie along the supermedial aspect of the lateral ventricles and the third ventricle may sometimes be shifted upward. In the majority of cases, there is a stable, non-progressive dilatation of the caudal portion of lateral ventricles.

Agenesis of the corpus callosum is one of the most common brain malformations that observed in 0.3%–0.7% of individuals undergoing brain imaging studies. [4 – 9]According to WHO-Center for Arab Genomic Studies; recent epidemiology of agenesis of corpus callosum documented in 2006; Alorainy reviewed and analyzed the MRI studies on 808 pediatric patients (aged three days to 15 years) over 3 years . Among 114 cases of congenital cerebral malformations were detected in 86 of these patients via MRI. Three patients were identified with Joubert Syndrome. Corpus callosum dysgenesis, that diagnosed in 22 patients, accounted as of the most common malformations. Among patients with this condition, the entire corpus callosum was absent in 10 patients. In nine, corpus callosum was partially affected, while in one patient there was global hypoplasia of the corpus callosum with no signs of agenesis, while in two patients; part of the body of the corpus callosum was not developed.

Corpus callosum malformations may be found to be dysplastic, partially, or completely absent. Besides, the corpus callosum agenesis can be isolated or associated with

other syndromes as Aicardisndrome, orofacial digital, Anderman, or Shapiro. However, the prognosis of corpus callosum agenesis is similar regardless of whether it is partially or completely absent. In 70% of cases, they have normal neurological development. [10-14] In our case the agenesis of corpus callosum is complete and associated with syndromic features but still under diagnosis. In fact, the prognosis found to be much poorer where additional brain or other morphological anomalies are present; which may lead to fetal death in utero, neonatal death, developmental delay, intellectual disability, and seizures. [9, 11 – 16] Therefore, we raised a suspicion of corpus callosum agenesis with first pregnancy that results in the intrauterine fetal death.

Since 1980s prenatal diagnosis of corpus callosum agenesis is detected prenatally from the mid-trimester onwards by expert ultrasonography. By using two-dimensional ultrasound, suggestive findings have been categorized as either directly such as complete absence of the corpus callosum in the midsagittal plane or indirectly such as absent cavumseptipellucidi, an abnormal course of the pericallosal artery, and teardrop configuration of the lateral ventricles with possible ventriculomegaly in the axial view of the fetal head. Antenatal diagnosis is established upon the non-visualization of the corpus callosum at transfontanellar ultrasound in either the sagittal or the coronal plane. [17 – 20] In this case during the second trimester-follow-up visit; the sonographic findings in the axial view revealed: a dangling choroid plexus, teardrop sign, and absent cerebellar vermis. Furthermore, More subtle findings, such as hypoplasia and partial agenesis of the corpus callosum, may be identified antenatally. [16, 21 – 23] In such cases the ultrasound-based diagnosis is challenging because of the presence of corpus callosum although it has an atypical appearance, the axial view of the fetal head is often unremarkable. In cases of callosal hypoplasia or partial agenesis, ultrasound diagnosis is determined by, respectively, on the demonstration of a reduced thickness of the corpus callosum or a decreased thickness and abnormal shape, in the median view. Normative charts for fetal corpus callosal biometry have been established and are of critical importance in assisting the sonographer during the subjective assessment to confirm either corpus callosum integrity or its underdevelopment. [24 – 25] After delivery of the baby, the cranial ultrasound confirmed the antenatal diagnosis of the complete agenesis of corpus callosum.

#### 4. Conclusions

The Agenesis of the corpus callosum can be diagnosed antenatally using imaging studies and can be running in the siblings of the same family. Waiting for the cytogenetic center report to diagnose the syndrome and to detect the chromosomal abnormalities between the three cases.

#### List of abbreviations

CRL: Crown-rump length

NT: Nuchal translucency

WHO: world health organization.

#### 5. Declarations

##### Acknowledgments

The authors express their sincere gratitude to **Dr.Nihad Ahmad Al-Kishi** (Feto-maternal medicine consultant at Maternal and Children Hospital At dAlhsa) for her guidance, help and advise during the development of this manuscript. Also, we are grateful to the patient's parents who participated in the study.

##### Funding

No sources of funding to declare, either from the public, private or not-for-profit sectors.

##### Competing interests

The authors declare that they have no competing interests

##### Authors' contributions

BL analyzed and interpreted the patient data, interviewed the patients' parents, did multiple visits to the hospital following the patient's condition progress, and drafted the case report. AM revised and edited the article in each step of the manuscript. All authors read and approved the final manuscript.

##### Ethics approval and consent to participate

Ethical approval was sought and obtained from the Maternal and Children Hospital, Alahsa before the commencement of reporting the case. Written informed consent/permission was also obtained from the mother for her Newborn baby to report the case.

##### Publisher's Note

The Agenesis of the corpus callosum can be diagnosed antenatally using imaging studies and can be running in the siblings of the same family. Waiting for the cytogenetic center report to detect the chromosomal abnormalities between the three cases.

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