—Case Reports—

A Case Report of Complete Chorioamniotic Membrane Separation

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Abstract

We describe a patient with complete chorioamniotic membrane separation (CMS). During embryologic development, the chorionic and amniotic membranes each arise from their own germ layers and form a celomic cavity in the first trimester of pregnancy. By the early second trimester, the cavity has shrunk and the membranes become conjugated. However, the membranes may separate spontaneously or because of an invasive intrauterine procedure. This pathologic condition is referred to as CMS. Extensive CMS can lead to miscarriage, fetal death, neonatal death, amniotic band syndrome, umbilical cord complications, and preterm delivery. In this case, CMS was detected in the 29th week of pregnancy with a routine ultrasonographic examination in the absence of a distinct non-reassuring fetal status or an abnormality of the intrauterine environment. The patient had undergone amniocentesis at 16 weeks of pregnancy for chromosomal analysis. Ultrasonography showed a floating membranous structure in almost every view of the intra-amniotic cavity. Thus, complete CMS was believed to have occurred. Therefore, precautionary checkups and examinations were periodically performed. Childbirth took place uneventfully by means of elective cesarean section in the 37th week of pregnancy. Because pathological examination showed complete CMS, the validity of the prenatal diagnosis was confirmed.
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Key words: chorioamniotic membrane separation, prenatal ultrasonography, ultrasonic diagnosis, prenatal diagnosis, amniocentesis

Introduction

Both the chorionic and the amniotic membranes originate in a fertilized egg. Each arises from its own germ layer in the early stages of pregnancy. Thus, in the first trimester, the membranes are physiologically separate and line a fluid-filled extraembryonic celomic cavity. By 13 to 14 weeks of gestation, the cavity is reduced to a virtual cavity by close approximation of the amniotic and chorionic membranes[1]. As a result of mutual conjugation during this period, the 2 membranes join to become a single-layer membrane, that is, an egg membrane. The egg membrane surrounds and encloses the fetus and forms the embryonic environment[2]. The presence of 2 separate membranes is called chorioamniotic membrane separation (CMS). CMS

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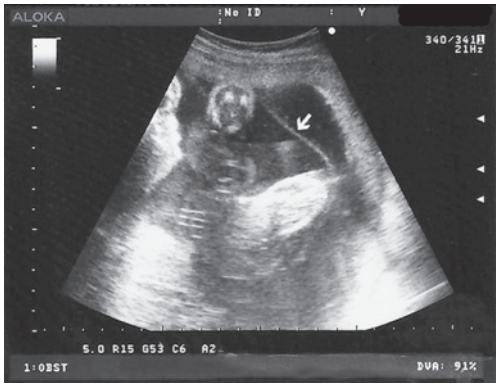

Fig. 1 At a regular checkup at 29 weeks and 1 day of gestation, a diaphragmatic structure **(arrow)** was detected in the uterine cavity on an ultrasonographic image.

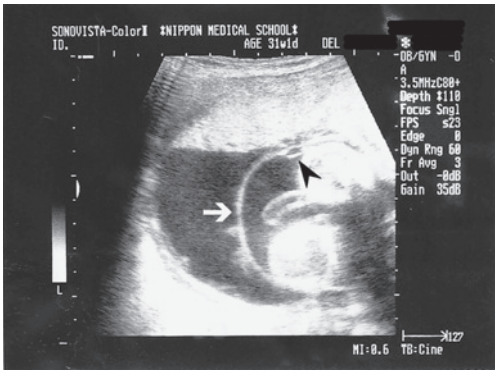

Fig. 2 At 31 weeks and 1 day, a further detailed ultrasonographic examination was performed. A complete floating membranous structure was detected in the amniotic cavity **(arrow)**. The area of detachment of the amniotic membrane extended to where the umbilical cord was inserted into the placenta **(arrowhead)**.

may occur spontaneously or as a complication of invasive intrauterine procedures, including amniocentesis, fetal blood sampling, and fetal surgery[3–8]. In complete CMS, both membranes are completely separated from each other, except where the umbilical cord inserts into the placenta. Extensive CMS can lead to miscarriage, fetal death, neonatal death, amniotic band syndrome, umbilical cord complications, premature rupture of membrane, and preterm delivery[1]. The incidence of complete CMS is extremely low, and some cases are revealed only after a fetus has died[9]. In the present report, we describe an asymptomatic case of complete CMS that was detected with ultrasonographic examination during a regular pregnancy checkup; the fetus was safely delivered after careful follow-up examinations.

Case Report

A 40-year-old gravida 2, para 1 woman presented for prenatal care. The pregnancy had so far been normal, and she had no history of treatment for infertility. The first outpatient examination was performed at the 7th week of gestation, and at that time the pregnancy was progressing well. Subsequent outpatient checkups were administered periodically, and ultrasonographic examinations were routinely performed at each checkup. No problems were found. Owing to the woman's age, amniocentesis was performed at 16 weeks and 0 days of gestation. The procedure was safely performed. Although the placenta was attached to the anterior wall of the uterus, amniocentesis could be performed with a single puncture, thus avoiding transplacental puncture. Consequently, the entire procedure was performed quickly and efficiently with a 23-gauge needle.

After amniocentesis, regular checkups were performed every 4 weeks. At a checkup at 29 weeks and 1 day of gestation, a diaphragmatic structure was detected in the uterine cavity on ultrasonography **(Fig. 1)**. Two weeks later, at 31 weeks and 1 day, a detailed ultrasonographic examination revealed a complete floating membranous structure in the amniotic cavity **(Fig. 2)**. Therefore, CMS was diagnosed. The examination showed the detachment of the amniotic membrane extended to where the umbilical cord was inserted into the placenta. Obvious abnormalities of the umbilical cord or fetal head, neck, extremities, or trunk were not detected. In addition, amniotic fluid volume was estimated to be within the normal range, and fetal growth was estimated to be adequate for the gestational age.

Although the membranous floating structure was detected throughout the uterine cavity, there was no evidence of band formation, which would suggest amniotic band syndrome. However, because poor

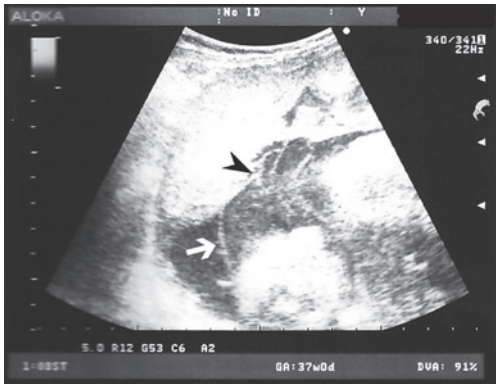

Fig. 3 The membranous floating structure was detected throughout the uterine cavity, and the lesion of the detached amniotic membrane extended to where the umbilical cord was inserted into the placenta. Careful ultrasonographic examination had been performed throughout the pregnancy.
Arrow: separated amniotic membrane.
Arrowhead: insertion of the umbilical cord into the placenta.

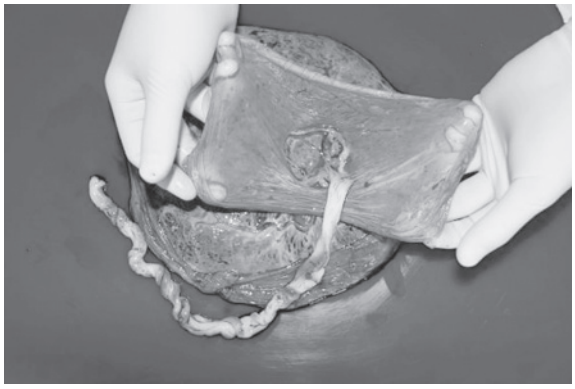

Fig. 4 The amniotic membrane was separated from the chorionic membrane all around the placenta and was only attached at the insertion of the umbilical cord on the placental disc.

clinical outcomes have been reported in similar cases, careful outpatient examinations were performed weekly throughout the pregnancy **(Fig. 3)**. At 37 weeks and 4 days of gestation, elective cesarean section was performed, after informed consent had been obtained. Because sufficient analgesia had been obtained after subarachnoid block, an abdominal cesarean section was performed in the usual manner. The surgical procedure took 48 minutes and was performed smoothly, and a male neonate weighing 3,138 grams and 49 cm long was delivered uneventfully. The Apgar scores were 9 and 10 points at 1 and 5 minutes after birth, respectively. The arterial pH of the umbilical cord blood was 7.376. Separation of the placenta from the uterine wall was attempted following the delivery, and the afterbirth was normal.

Macroscopic examination showed that the amniotic membrane was separated from the chorionic membrane all around the placenta and was only attached where the umbilical cord was inserted on the placental disc. On the basis of the macroscopic findings, complete CMS was diagnosed. The amniotic membrane was sustained on the insertion region of the umbilical cord by the barest of margins. Fortunately, the detached amniotic membrane had not twisted around the umbilical cord nor occluded it **(Fig. 4)**.

According to a subsequent histopathological examination, separation of the egg membrane between the amniotic and chorionic membranes was apparent, and the pathologic site was evident and extended to the insertion of the umbilical cord. Hemosiderin deposits were observed in the peripheral part of the insertion region of the umbilical cord, although neither chorioamnionitis nor any form of inflammatory cell infiltration was evident.

The subsequent course of surgical delivery and postnatal progression were excellent, and both the mother and neonate were discharged 9 days after delivery.

Discussion

A retrospective study by Levine et al.[9] has found that 7 cases of complete CMS were detected with ultrasonographic examination in 23,883 pregnant subjects with no history of uterine surgery. The rate of complete CMS was estimated to be 1 in 3,400 cases, or 0.029%. CMS can occur spontaneously or can be due to an invasive intrauterine procedure, such as amniocentesis, chorionic villus sampling, drainage of amniotic fluid, and fetal surgery[3-8]. Extensive CMS may, through various mechanisms, lead to miscarriage, fetal death, neonatal death, amniotic band syndrome, umbilical cord

complications, premature rupture of membrane and preterm delivery[1,10]. In the present report, we have described an asymptomatic case of complete CMS that was detected with ultrasonographic examination during a regular pregnancy checkup, and a healthy infant was delivered after careful follow-up examinations.

Levine et al. reviewed 25 cases of complete CMS reported in 13 articles. In this series, only 8 of 25 cases resulted in a term delivery[9]. Moreover, 1 case resulted in neonatal death because of a torn vessel during vaginal delivery, and another case resulted in emergency cesarean section because of non-reassuring fetal status due to cord compression by amniotic band syndrome. In 25 cases of CMS, 11 neonates were delivered prematurely. Of these 11 neonates, 1 died less than 24 hours after birth, and 2 were delivered via emergency cesarean section because of non-reassuring fetal status. In these 11 cases, 5 fetuses died in utero; 2 of them died with a band wrapped around the umbilical cord, and 1 died with a band around the arm. We believe that these 3 cases were affected by amniotic band syndrome. Amniocentesis had been performed before the diagnosis of complete CMS in 9 of the 25 cases. In total, some sort of invasive examination or intervention, such as amniocentesis or in utero surgery, had been performed in 14 cases.

The presence of CMS cannot be effectively determined without ultrasonography. Therefore, to predict and prevent such a potentially severe condition, detailed ultrasonographic examination should be performed. Specifically, similar to the way the development of the fetus, placenta, umbilical cord and intrauterine environment should be assessed with ultrasonography, so too should the development of the egg membrane be assessed at each maternity checkup, for the sake of early recognition and treatment of CMS.

In the present case, the patient underwent amniocentesis for chromosomal analysis during the 16th week of gestation. After the procedure, no evidence of CMS was found at 2 regular maternity checkups, although ultrasonographic examinations were performed each time. The CMS was finally discovered as a loose floating diaphragmatic object in the uterine cavity 13 weeks after amniocentesis. Subsequently, careful examination was performed each week. The mother was asked to note fetal movement daily to assess the general fetal status, which was verified at each checkup. For vigilant examination and follow-up, detailed ultrasonographic examinations were performed to assess fetal growth, the presence and frequency of fetal movements as fetal activity, amniotic fluid volume, the extent of the separated lesion, the presence of amniotic band formation, and any subsequent compression from twisting around the umbilical cord[11]. Simultaneously, fetal blood flow, such as middle cerebral arterial flow and umbilical blood flow, was determined with ultrasonography, in the usual manner for fetal assessment, to evaluate both fetal status and the presence of possible compression of the umbilical cord[12]. In addition, cardiotocography was performed to evaluate fetal well-being at each checkup. From the findings on ultrasonography and cardiotocography, the biophysical profile score was determined[13]. In our case, the fetal status, as indicated by a maximum score for the biophysical profile and other findings, was considered good. Thus, the mother was able to carry the fetus to full term.

We believe the same type of assessment should be performed in other cases of CMS. Hence, a patient should be hospitalized whenever there is any concern about fetal morbidity. When any indication of exacerbation is noticed, immediate delivery could be considered despite the patient being in the preterm period. Especially when a pathological condition worsens because of an abnormal structure, emergency cesarean section should be performed to prevent deterioration of the fetal condition during vaginal delivery.

Whether to perform an elective cesarean section should be decided after informed consent has been obtained, which includes the sharing of information about possible fetal morbidity due to vaginal delivery, as well as the maternal and fetal risks involved in cesarean section. In our case, the patient chose elective cesarean section after being told of its risks and the possible necessity of emergency cesarean section after having first chosen vaginal

delivery. A prospective analysis by Levine et al.[9] showed that 388 patients who underwent amniocentesis were performed detailed ultrasonographic examinations for assessment of CMS. Furthermore, 25% of patients were found to have CMS, ranging from slight to complete, 2 weeks after the procedure. Three cases of CMS were complete, and the incidence was 0.7%. Of the 3 patients with complete CMS, 1 underwent premature delivery at 30 weeks, and another underwent emergency cesarean section because of fetal distress early in labor. The fetus showed severe recurrent variable decelerations and did not respond to the usual therapeutic maneuvers.

Levine et al. performed amniocentesis with 20- to 22-gauge needles, whereas, at our institution, finer needles of 23-gauge have been used. In fact, a 23-gauge needle was used, as usual, in the present case. Finer needles are considered less invasive than are larger-bore needles. Furthermore, at our institution, such a fine-bore needle has not led to insufficient extraction or any other procedural complications. A satisfactory outcome can be obtained by minimizing invasiveness, as long as 23-gauge needles are being used.

The rate of fetal loss related to amniocentesis is low, and the calculated value ought to be 0.02% to 0.5%[14]. Even if this value is low, the attention of the procedure should be reconfirmed as follows. The amniotic and chorionic membranes are not physiologically fused until the end of the first trimester of pregnancy. By 13 to 14 weeks of gestation, the membranes are conjugated to form the egg membrane. Meanwhile, the appropriate timing for amniocentesis is considered to be 15 to 16 weeks of pregnancy, because an adequate volume of amniotic fluid is considered to be present during this period. The egg membrane must be established, and sufficient time is required to decide on the maintenance of pregnancy from the results of chromosomal analysis.

Even if CMS happens infrequently around 16 weeks of gestation, some degree of CMS, such as incomplete conjugation or idiopathic separation, could be detected with ultrasonography. Therefore, conjugation of both membranes must be confirmed before amniocentesis. When an obvious separation is detected on ultrasonography, the procedure should be postponed. In our case, conjugation of the membranes was confirmed with ultrasonographic examination before amniocentesis. Therefore, amniocentesis was performed with a 23-gauge needle at 16 weeks of pregnancy.

The invasiveness and attendant risks of amniocentesis should be understood by the patient, and informed consent should be obtained. The patient should be told that the risk of CMS after amniocentesis is 25%. After amniocentesis, adequate, properly timed follow-up examinations should be performed. Slight CMS is unlikely to worsen and might even resolve spontaneously. However, when extensive CMS or amniotic band syndrome is discovered, careful examinations and follow-up are required.

In some cases, the possibility of a genetic or chromosomal disorder should be considered. Chen et al.[15] have reported on a patient with multiple pregnancies ending in stillbirth because of restrictive dermopathy. In this patient, complete CMS was evident with restrictive dermopathy in each pregnancy. Furthermore, the patient exhibited a specific gene mutation related to restrictive dermopathy. Another patient with recurrent fetal dermopathy and complete CMS has been reported[16]. Chen et al. have speculated that fetal restrictive dermopathy is somehow related to complete CMS. Decreased strength of the amniotic and chorionic membranes due to this genetic disorder may cause spontaneous CMS. As for chromosomal disorders, in a review of extensive CMS, a high frequency of trisomy 21 cases was found[1,10,17].

In summary, we have described an asymptomatic case of complete CMS that was detected with ultrasonography 13 weeks after amniocentesis was performed. A full-term neonate was safely delivered via elective cesarean section after careful follow-up. CMS may occur spontaneously, be related to genetic abnormalities and be a sequela of an invasive examination or other procedure. A slight degree of CMS might not be clinically significant, but extensive CMS may cause miscarriage, fetal death, neonatal death, amniotic band syndrome, umbilical

cord complications, premature rupture of membrane, or preterm delivery. Therefore, early recognition and treatment of CMS are important.

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