A Pathologists' Assistant's Critical Role in the Proper Diagnosis of Gastroschisis and Trisomy 18

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Abstract:

Although gastroschisis is a frequently studied abdominal wall defect, it continues to be researched as many believe the condition has an environmental component. Unlike omphalocele, a similar abdominal wall defect, the organs are not covered by a protective sac. Thus, the severity of gastroschisis depends on the number of protruding organs as well as the duration they are exposed for. In this particular case, a woman from Brazil presented to a hospital in Pennsylvania for a follow-up on the condition of her fetus. Through techniques such as gross and microscopic dissection, as well as microarray testing, her fetus was discovered to have gastroschisis and trisomy 18.

Background:

Gastroschisis is a rare type of abdominal wall defect that occurs during gestation. The term originates from the Greek word *laproschisis*, which means bellycleft.[1] In this condition, the abdominal muscles do not form properly, creating a hole adjacent to the umbilicus. Further, the baby's intestines and other organs may protrude outside of the body and come into contact with amniotic fluid. Over time, the abnormal contact can lead to irritation and damage. Since its discovery, gastroschisis has been linked with young maternal age. While the exact cause is unknown, some theories include genetics or a combination of environmental factors. Through early screenings and other tests, gastroschisis can be diagnosed during pregnancy or after birth. Yet, one of the most concerning aspects of the condition is its increasing worldwide incidence.

This case involves a 40-year-old woman G1, PO, who presented to the hospital at 32 weeks and 5 days gestation. She had previously received prenatal care in Brazil where she was told that her fetus had congenital anomalies not compatible with life outside of the womb. Thus, the patient had been planning on having a palliative labor and delivery. However, upon presentation to the hospital in Pennsylvania, the patient was found to have no fetal heart tones. She also denied having any loss of fluid or fetal movements. The patient's pertinent previous medical history included a lumpectomy for benign lesions. Some risk factors for gastroschisis included the patient's advanced age at the estimated due date and her father's diagnosis of heart disease.

Incidence:

Many studies have been performed in order to evaluate the prevalence of gastroschisis on a state or national level. For instance, in Texas, researchers discovered an incidence of 5.13 cases per 10,000 births.[1] The most comprehensive study of gastroschisis to date took place in two parts within the United States from 1995 to 2005, and 2006 to 2012. Performed by Jones et al[7], births in 14 states, the equivalent of 29 percent of all births within the United States, were evaluated in order to assess the prevalence of gastroschisis. Researchers discovered that the incidence of gastroschisis increased by thirty percent between the two time periods, from 4,369 cases per 12,014,244 births to 4,497 cases per 9,264,540 births.[2] However, as more studies were performed throughout the world, an apparent discrepancy in incidence was discovered. This led researchers to believe that gastroschisis has strong environmental causes, due to the stark contrast in frequency between countries. Interestingly, in addition to regional disparities, incidence also appears to vary in accordance with race. In a multi-state study by Abbey M. Jones et al., gastroschisis was present at much higher rates in non-Hispanic black mothers compared to non-Hispanic white mothers.[2] This same population also had the greatest increase in prevalence from 1995 to 2012, with a growth of 263%.[2]

However, there has been controversy over the misdiagnosis and reporting of the prevalence of gastroschisis. Depending on the location, gastroschisis with Trisomy 18 may only be recorded as Trisomy 18, and therefore not included in the gastroschisis count.[3] It follows that areas recording both anomalies would have higher recorded rates of gastroschisis, than those accounting only for the chromosomal abnormality. Thus, it is imperative that gastroschisis be recorded separately from other abdominal wall defects and chromosomal aberrations in order to have a more accurate representation of its incidence.

Methodology:

A bedside ultrasound was performed and intrauterine fetal demise was confirmed. Before discharging the patient, plans for an autopsy and chromosome analysis with micro-array testing were made.

Results:

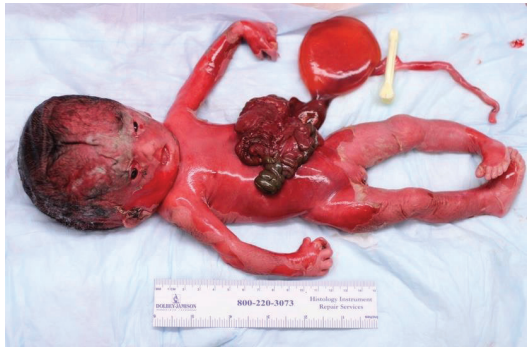


Figure 1. Photograph of a fetus at approximately 29 weeks. The small bowel and liver protrude through a defect in the abdominal wall.

Gross description: The fetus was known to have brain and cardiac issues in addition to gastroschisis so consent for autopsy was given. According to the Pathologist' Assistant, upon external examination the body is that of a female fetus weighing 892.0 gm. The crown-rump length is 26.5 cm; the rump-heel, 16.0 cm. The right foot measures 5.2 cm. These measurements are consistent with a gestational age of 29 weeks.[4] The occipito-frontal circumference is 25.5 cm, that of the chest is 17.0 cm, and that of the abdomen is 14.5 cm. Rigor is not present. The ears are not low set. The nose has patent nares. The mouth has an intact palate. The umbilical cord measures 18.0 cm in length with an average diameter of 1.0 cm. A 6.0 cm segment of the cord is dilated/cystic, measuring up to 6.5 cm. The anus is patent containing meconium stool. The external genitalia are consistent with a female. The skin is disrupted and congested with marked slippage. There is a 3.0 cm defect in the abdominal wall through which protrudes the liver and bowel loops. Afterward, an autopsy was performed and every organ was examined. Notable findings include a maternal surface with disrupted cotyledons and a small tan/red area of discoloration.

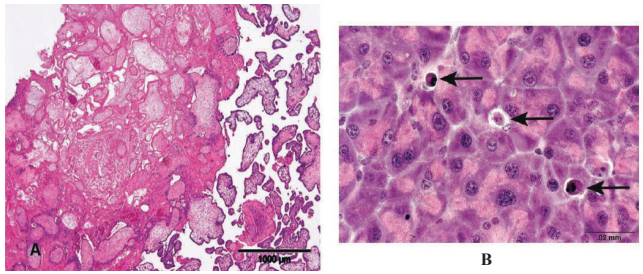


Figure 2. A. H&E photomicrograph of infarction in the placenta and spiral arteriolar thrombosis.[5] **B.** H&E photomicrograph of nuclear changes in exocrine pancreatic cells including pyknosis, karyolysis, and karyorrhexis.[6]

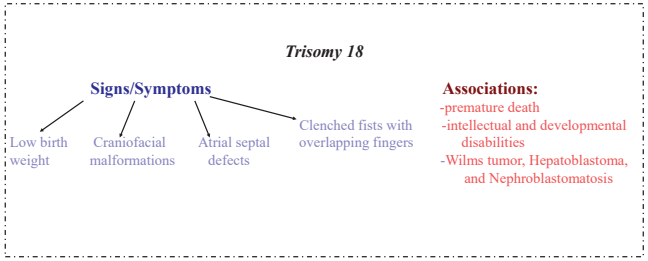
Microscopic description:
Normally, in suspected cases of gastroschisis, the key to the diagnosis is macroscopic findings – particularly an abdominal defect. However, if microscopic examination is to be performed, some important organs to investigate are those protruding from an abdominal defect as well as the placenta. In this particular case, the liver and intestine were exposed to the amniotic fluid. Thus, one would possibly expect to find reactive fibroblasts and signs of necrosis. Necrosis is typically recognized by changes to the nucleus, including swelling, pyknosis, and karyolysis.[7] Grossly, the placenta showed evidence of infarction on the maternal surface. By looking microscopically, one might be able to appreciate the vascular abnormalities associated with infarction, such as spiral arteriolar thrombosis. Although microscopic examination provides a closer look at affected portions of tissue, it is not always necessary for gastroschisis cases.

Discussion:

Another abdominal wall defect that has a similar appearance to gastroschisis is omphalocele. It is imperative to differentiate the two as the complications and treatment can vary. The most important distinction is the presence or absence of an outpouching of peritoneum, or a sac. Although gastroschisis may be associated with genetic aberrations, they are more frequently found in cases of omphalocele. Thus, the particular case involving the mother from Brazil is unique, as her fetus was found to have Trisomy 18 on microarray testing.

	Gastroschisis	Omphalocele
M:F	1:1	1.5:1
Location	Right of umbilicus	Central
Peritoneal sac	Absent	Present
Chromosomal abnormalities	Rare	Common
Intestinal atresia	10%	Rare
Size of defect	Small	Small or large
Treatment	Often primary	Often staged
Maternal age	Young	Advanced age

After microarray testing was performed, the fetus was found to have Trisomy 18 in addition to gastroschisis. Trisomy 18, also known as Edwards syndrome, is a common chromosomal abnormality characterized by having an extra copy of chromosome 18. The condition can be detected through chromosome analysis during pregnancy or by physical findings at birth.



Conclusion:

While the condition of the fetus could have been diagnosed in the OB/GYN department, gastroschisis and intrauterine fetal demise were only confirmed once the Pathologists' Assistant had completed the autopsy and gross description. Through a comprehensive external examination as well as a complete autopsy, several signs and symptoms pointed toward an abdominal wall defect. Further, microarray testing was paramount to discovering that the fetus had Trisomy 18. Otherwise, since gastroschisis is infrequently seen with chromosomal abnormalities, Trisomy 18 may not have been suspected or identified. Due to disparities in reporting gastroschisis and Trisomy 18 together, it is essential to find and correctly diagnose these cases in order to have a more accurate representation of its incidence. Thus, in cases such as this, it is essential to consult with a Pathologists' Assistant in order to give a family the most accurate picture possible.

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