Hydrops Fetalis

Hydrops fetalis comes from a Greek term meaning the pathological accumulation of fluid in the fetal soft tissues and body cavities. It is a severe, life-threatening pathology in a fetus and newborn that is characterized by severe edema. The mortality rate for this condition ranges from 60%–90%. There are two different types of hydrops: immune and nonimmune.

Immune Hydrops Fetalis

Immune hydrops fetalis (IHF) occurs when the mother's immune system sees the infant's red blood cells as dangerous and destroys them, known as *alloimmunization*. RhoGAM®, or Rho (D) immunoglobin, is given to Rh-negative mothers after they give birth to an Rh-positive baby. It is then given prophylactically to all Rh-negative mothers (and sometimes to other mothers) during each subsequent pregnancy at 26 to 28 weeks gestation.

Pathophysiology of IHF

As the mother's antibodies attack the fetal red blood cells, they begin to break down and are destroyed, leading to fetal anemia. As the fetal anemia continues, the baby's organs try to compensate for the anemia and begin to fail. The fetal heart weakens, leading to progressive heart failure with decreased pump efficiency. This leads to progressive pressure differential between the heart and body, resulting in third-spacing of fluid in the skin, heart, and lungs.

Nonimmune Hydrops Fetalis

Nonimmune hydrops fetalis (NIHF) accounts for approximately 90% of all cases. It occurs in one in 1,700 to 3,000 pregnancies. Unfortunately, in 85% of cases causation cannot be determined. Overall, 60% of the cases of NIHF are diagnosed prenatally (Bellini et al AV channel, 2015).

Pathophysiology of NIHF

The pathophysiology of NIHF often is the same as IHF in that severe chronic fetal anemia causes the neonate's organ systems (especially the heart) to fail. This leads to a pressure differential between the heart and body, resulting in third-spacing of fluid in the skin, heart, and lungs. Although IHF has a causative factor of alloimmunization, the cause of NIHF can be fetal cardiac dysrhythmias or twin-to-twin transfusion. Several factors have been associated with NIHF but no reasons have been found that can directly be linked to causation.

While each fetus/neonate will experience symptoms differently, some common factors may be seen both prenatally and after birth. Prenatal ultrasound diagnosis is determined by

- two or more abnormal fluid collections in the fetus
- ascities
- pleural and/or pericardial effusion
- generalized skin edema greater than 5 mm that may include polyhydramnios and placental thickening.

Postnatal symptoms include

- respiratory distress or failure requiring intubation at birth
- pallor with decreased perfusion
- severe edema overall, especially in the abdominal area
- hepatosplenomegaly and coagulopathies
- pleural effusion, may be unilateral or bilateral, requiring emergent evacuation in the delivery room
- pericardial effusion
- hypotension
- decreased urine output
- increased capillary permeability
- increased hydrostatic pressure caused by the volume overload from heart pump failure
- decreased colloid osmotic pressure
- lymphatic dysfunction.

Organ system dysfunction that is responsible for NIHF includes the following:

Cardiac

- Hypotension due to intravascular depletion
- Cardiovascular malformations such as atrioventicular canal or hypoplastic left heart

- Arrhythmias: either tachy or brady
  - Tachy-arrhythmias include paroxysmal supraventricular tachycardia, atrial flutter, or premature atrial contractions.
  - Brady-arrhythmias can be caused by conduction disorders and maternal autoimmune diseases such as systemic lupus erythematosus.

Pulmonary

Airway and pleural lesions such as

- laryngeal atresia
- tracheal atresia
- congenital cystic adenomatoid malformation
- bronchopulmonary sequestration
- diaphragmatic hernia
- bronchial cysts.

Hypoplastic lungs also can develop depending on the amount of ascites and edema that is present. These two types of edema will determine the space available in the thoracic cavity for the lungs to grow.

Urinary

Edema is caused by the above mentioned pathophysiologies, which can cause hydropnephrosis due to severe hypoproteinemia (consistent with prune belly syndrome presentation).

GastroIntestinal

Edema is due to liver tumors or hemangiomas, meconium peritonitis, or intestinal obstruction.

Neurological

Any condition that affects fetal breathing and limb movement leading to reduced lymphatic return, as seen in conditions such as anencephaly.

Infectious Disease

Parvovirus B19, cytomegalovirus, syphilis, and listeria moncytogenes also were found to be causal in HINF due to mechanisms causing severe anemia (An, Wang, Zhuang, & Yan, 2015). In an update of the original systematic review performed by Bellini and his colleagues, the causes of NIHF could be divided into 14 classification groups: cardiovascular, hematologic, chromosomal, syndromic, lymphatic dysplasia, inborn errors of metabolism, infections, thoracic malformations, urinary tract malformations, extra thoracic tumors, placental twin-to-twin transfusion, gastrointestinal issues, miscellaneous, and idiopathic causes (Bellini et al., 2015). It is interesting to note that the number one pathology according to this review was cardiovascular (20.1%). However, idiopathic causes came in second at 19.8% (Bellini et al., 2015). In another study by Turgal and colleagues, it was determined that if NIHF occurs before 24 weeks gestation, it is related to aneuploidy, whereas cardiac, pulmonary, and infectious causes accounted for the majority of cases after 24 weeks (Turgal, Ozyuncu, Boyraz, & Beksac, 2015).

Treatment

The treatment plan for hydrops is based on the following factors:

- the baby's overall health, gestational age, and extent of the disease
- the presumed cause of the hydrops
- parental wishes for treatment as related to the disease for their neonate.

Supportive measures require careful management of respiratory status and fluid and electrolyte status. Other measures may include pleural drainage, pain management, nutrition management, intravascular volume replacement, blood pressure support and immune support and correction of anemia. Chest tubes may need to be inserted to drain pleural effusions.

Prognosis

Overall prognosis for NIHF is related to gestation at diagnosis, presumed cause, and response to treatment. Morbidity ranges from 60%–90% (Ota, 2016).

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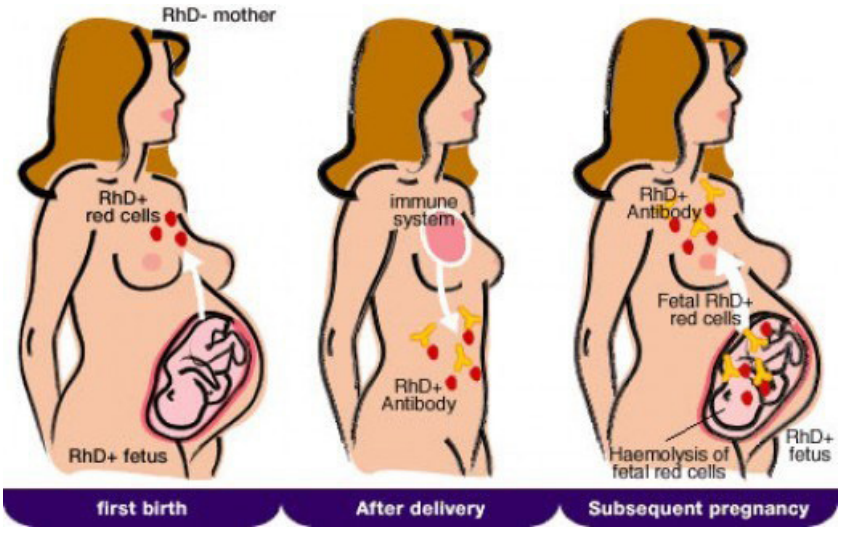
Hydrops Fetalis: Information for Parents

Your baby has been diagnosed with a condition referred to as *hydrops fetalis*—meaning the abnormal accumulation of fluid in the baby's soft tissues, organs, and cavities. There are two types of hydrops fetalis: immune and nonimmune. Neither of these conditions are related to something that the mother has done; said another way, there is nothing she could have done to prevent either of these conditions.



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Immune hydrops fetalis (IHF) results when the mother's immune system sees the baby's red blood cells as dangerous and starts to break them down. This is called alloimmunization. Alloimmunization occurs when a mother with a negative blood type is pregnant with a baby whose blood type is positive. The Rh antigen is an inherited protein found on the red blood cells. If the protein is present, then the person is Rh+. A negative blood type does not have the Rh antigen attached to it, so when the mom's blood and the baby's blood come in contact with each other, the mom's blood cells mount an immune response. An immune response happens when the cells of the body do not recognize the foreign cells (Rh antigen) and try to rid the body of any danger from the foreign cells. This is the same response that would happen if an infection was present. When the immune response is triggered, the mother's blood cells begin fighting the baby's blood cells and start making antibodies against them. It takes a very small amount of baby's blood (about a drop or two) to get into a mother's bloodstream to cause this antibody reaction. Usually during pregnancy a mother's blood and baby's blood do not mix. Mixing can occur if there is a leak in the placenta, which is very rare. Mixing can occur until birth.

Alloimmunization can occur with any pregnancy, not just your first. You might not be aware of the blood type issue the first time it happens, so after the baby is born, you will receive a shot called RhoGAM®. RhoGAM®, or Rho (D) immunoglobin, is given to Rh-negative mothers after they give birth to a Rh-positive baby. Then, it is given as a preventative to all Rh-negative mothers during each subsequent pregnancy between 26 and 28 weeks gestation. Before the invention of RhoGAM® in the 1960s, this condition occurred in 10% of all pregnancies. Today, it is a very rare occurrence.

Nonimmune hydrops fetalis (NIHF) accounts for about 90% of all nonalloimmunization cases. Unfortunately, in most cases, the cause for the hydrops is unknown. In the babies where a cause is found, it will typically be related to an issue with the baby's heart or genetic or chromosome problems that affect the baby. Overall, 60% of the cases of NIHF are diagnosed prenatally.

NIHF results when a disease or complication during pregnancy causes the baby's blood cells to be continually broken down, which causes severe chronic anemia. Anemia means that there aren't enough red blood cells circulating in the body to carry oxygen. When this happens, the body tries to compensate by making the heart and other organs work harder to get the blood

through the body. However, it eventually tires out and extra fluid starts to build up in one or more of the following places: under the skin, in the lungs, and in the heart.

Symptoms of NIHF

While each baby's experience will differ, common symptoms seen at a prenatal ultrasound may include

- two or more abnormal areas of fluid collection in the fetus
- ascities, or swelling around the abdominal area
- fluid present in the lungs or around the heart
- generalized skin swelling of greater than 5 mm.

One symptom mothers may experience during pregnancy is a large amount of amniotic fluid. This is called polyhydramnios. Symptoms that can be seen after the baby is born include

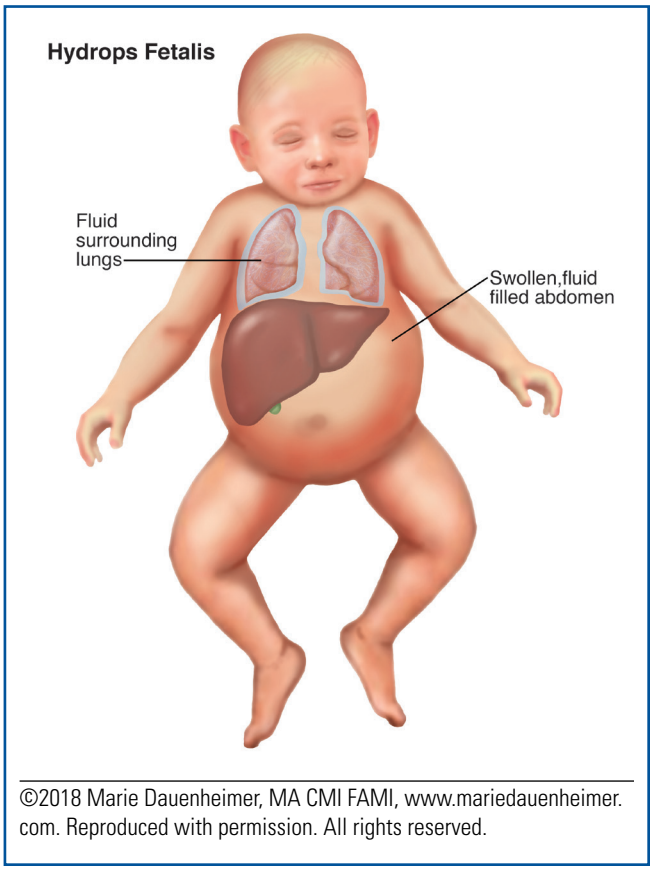
- difficulty breathing and needing some type of oxygen therapy
- pale coloring
- severe skin swelling overall, especially in the abdominal area
- an enlarged liver or spleen seen on ultrasound or X ray
- fluid collection in either one or both lungs as seen on ultrasound or X ray
- fluid collection in the sac around the heart as seen on ultrasound or X ray.

Treatment Options

There are many treatments for NIHF. The treatment your baby gets will depend on many different factors, including your baby's gestational age, your pregnancy history, severity of the condition, and how your baby tolerates different medications and procedures.

Treatments that might be used to help your baby include

- using supplemental oxygen to help with breathing. Oxygen can be delivered in many ways. It can be given by a cannula placed in the nose or by a mechanical breathing machine (ventilator) with a breathing tube.
- removal of the extra fluid from the spaces around the lungs, heart, or abdomen
  - Thoracentesis is removal of air or fluid from around the lungs.
  - Paracentesis is removal of fluid from the abdominal area.
  - Paracardiocentisis is removal of fluid from the sac around the heart.
- X rays and ultrasounds
- blood draws to check on the baby's chromosomes.



Surgery is usually not needed. However, surgical procedures such as thoracentesis, paracentesis, and paracardiocentis may be performed in the neonatal intensive care unit.

Long-Term Implications

The long-term outcome for babies born with NIHF varies. Of all the cases that are diagnosed during pregnancy, only about 20% will survive to delivery. Approximately half of these cases will die during the first month of life; however, research is showing that the outlook for babies who do survive is very optimistic.

In summary, NIHF is a very serious complication during pregnancy and immediately after birth. However, there are many treatment options that the neonatologist or nurse practitioner will discuss with you. It is important for you to keep notes of your discussion and write down any questions you have. The whole healthcare team wants you to understand the plan of care and to be involved in the decision-making process for your baby.

Resource

The American College of Obstetrics and Gynecology. Rh Factors: How it can affect your pregnancy. Retrieved from www.acog.org/Patients/FAQs/The-Rh-Factor-How-It-Can-Affect-Your-Pregnancy#what