CONDITION

ABO incompatibility

Learn how ABO blood type incompatibility can affect blood transfusions and newborns, including symptoms, testing, treatment, and when urgent care is needed.

WHAT IT IS
Immune destruction of incompatible red blood cells

BODY SYSTEM
Blood and immune system

MAIN SYMPTOMS
Jaundice, pale skin, shortness of breath, dark or red urine

WHAT CAUSES IT
Immune reaction to incompatible blood markers

HOW IT IS DIAGNOSED
ABO blood typing, compatibility testing, direct antiglobulin test

MAIN TREATMENT
Supportive care, phototherapy, compatible transfusion

CAN IT BE CURED?
Sometimes - outcome depends on reaction severity

IS IT AN EMERGENCY?
Sometimes - breathing trouble or seizure-like movements

LONG-TERM OUTLOOK
Usually full recovery, but severe cases can cause permanent injury

Overview

ABO incompatibility occurs when blood is exposed to A or B blood group markers that the immune system recognizes as foreign. The immune system may attack the unfamiliar red blood cells, causing hemolysis , which means red blood cells break down faster than normal.

The four main ABO blood types are:

ABO incompatibility matters mainly during blood transfusions and pregnancy.

An ABO-incompatible red blood cell transfusion can cause a serious, potentially life-threatening reaction. Blood banks use identification, blood typing, compatibility testing, and bedside checks to prevent this. Plasma and platelet transfusions also require compatibility considerations because plasma may contain antibodies.

During pregnancy, maternal antibodies may cross the placenta and destroy some fetal red blood cells. The most common clinically important pattern is a type O mother carrying a fetus with type A or B blood. This is called ABO hemolytic disease of the fetus and newborn .

Newborn ABO disease is usually less severe than Rh disease, but it can cause jaundice or anemia. Unlike Rh disease, it can affect a first pregnancy.

- Type A: A markers on red blood cells and anti-B antibodies in plasma
- Type B: B markers and anti-A antibodies
- Type AB: both markers and usually neither antibody
- Type O: neither marker and usually both anti-A and anti-B antibodies

Symptoms

ABO incompatibility does not always cause symptoms. Problems occur when enough red blood cells are destroyed.

Symptoms in a newborn

The most common sign is jaundice , a yellow color of the skin or whites of the eyes caused by bilirubin buildup. Bilirubin is produced when red blood cells break down.

Jaundice from hemolysis may appear within the first 24 hours after birth or increase faster than expected. Visual inspection cannot measure bilirubin accurately, so a baby who appears jaundiced may need a skin or blood test.

Other possible signs include:

Contact the baby's clinician promptly if jaundice appears, especially during the first day or if it is worsening. Seek urgent medical care if the baby is difficult to wake, will not feed, has breathing trouble, becomes unusually limp or stiff, develops a high-pitched cry, or has seizure-like movements.

Symptoms during a transfusion

An acute ABO-incompatible transfusion reaction may begin during or shortly after a transfusion. Symptoms can include:

Signs may be less obvious in someone who is unconscious, sedated, or under anesthesia. Unexpected bleeding, dark urine, or a blood pressure change may be the first clue.

Report any new symptom during a transfusion immediately. The clinical team should stop the transfusion while investigating the cause. A suspected severe reaction is an emergency.

- Pale skin
- Sleepiness or difficulty waking for feeds
- Poor feeding
- Fewer wet or dirty diapers than expected
- Fast heart rate or rapid breathing
- An enlarged liver or spleen in more significant cases
- Fever, chills, or flushing
- Pain or burning near the intravenous line
- Back, side, chest, or abdominal pain
- Shortness of breath
- Nausea or vomiting
- Rapid heartbeat
- Dizziness or low blood pressure
- Dark or red urine
- Unusual bleeding

Causes and risk factors

ABO antibodies are a normal part of the immune system. A reaction occurs when they bind to incompatible red blood cells and trigger their destruction.

In transfusions, ABO incompatibility is most often related to an identification, labeling, collection, or administration error. Hospitals reduce this risk through wristband checks, specimen labeling, blood typing, antibody screening, compatibility testing, and bedside verification.

Compatibility rules vary by blood component. Red blood cells carry ABO markers, while plasma contains antibodies. Platelet products may contain donor plasma, so blood banks consider several factors when choosing them.

During pregnancy, IgG antibodies can cross the placenta. People with type O blood are more likely than those with type A or B blood to have IgG anti-A or anti-B antibodies. However, a blood type difference alone does not mean the baby will become ill. Many incompatible pregnancies do not cause significant hemolysis, and severity can differ between pregnancies.

ABO incompatibility differs from Rh incompatibility. Rh immune globulin can prevent Rh

sensitization, but it does not prevent ABO incompatibility.

Diagnosis

Diagnosis depends on whether the concern involves a newborn or a transfusion.

Testing a newborn

Clinicians assess the baby's age in hours, gestational age, bilirubin level and rate of increase, feeding, weight change, examination findings, and other risks. Testing may include:

The direct antiglobulin test checks for antibodies attached to the baby's red blood cells. A positive result supports immune hemolysis but does not show its severity. Some affected babies have a weak or negative result, so bilirubin levels, anemia, and the baby's condition remain important.

Clinicians may check for other causes of jaundice or anemia, including birth-related bruising, infection, inadequate feeding, G6PD deficiency, or inherited red blood cell disorders.

Investigating a transfusion reaction

If a reaction is suspected, the team stops the transfusion and checks the patient's identity, blood unit label, and records. The blood bank may repeat blood typing and compatibility tests.

Blood and urine tests may assess hemolysis, bilirubin changes, kidney injury, and abnormal clotting. A direct antiglobulin test may be performed, and the blood bag and tubing are usually returned to the blood bank according to local procedures.

Allergic reactions, bacterial contamination, fluid overload, and transfusion-related lung injury can cause similar symptoms. Rapid evaluation helps determine the cause and treatment.

- Maternal and newborn ABO and Rh blood types
- A skin or blood bilirubin measurement
- A complete blood count and hemoglobin level
- A reticulocyte count to measure new red blood cells
- A blood smear
- A direct antiglobulin test, also called a direct Coombs test

Treatment and management

Treatment depends on the setting, severity of hemolysis, and the patient's condition.

Management in newborns

Mild jaundice may require repeat bilirubin checks and feeding support. Effective feeding helps remove bilirubin through stool and urine. Families may be advised to feed frequently and obtain breastfeeding or formula-feeding support.

Phototherapy is the main treatment when bilirubin reaches an age-specific threshold. Blue light changes bilirubin into forms the body can remove. Decisions are based on the bilirubin level, age in hours, gestational age, and medical risk factors-not skin color alone.

If bilirubin approaches a dangerous level, the baby needs closer monitoring and intensive treatment. Intravenous immune globulin, or IVIG, may be considered for selected babies with antibody-related hemolysis whose bilirubin reaches an escalation-of-care threshold despite intensive phototherapy. Specialists must weigh its possible benefits and risks.

An exchange transfusion may be required if bilirubin becomes critically high or there are signs of nervous system involvement. Small amounts of the baby's blood are replaced with compatible donor blood in a neonatal intensive care setting.

Significant anemia may require a compatible red blood cell transfusion. Treatment is based on symptoms and test results, not the blood type difference alone.

Management of a transfusion reaction

The immediate steps are to stop the transfusion and notify the clinical team and blood bank. The unit should not be restarted unless the transfusion service completes its evaluation and specifically determines that doing so is safe.

Treatment may include intravenous fluids, breathing or blood pressure support, and close monitoring of urine output and kidney function. Severe reactions may require intensive care, medicines to support circulation, kidney replacement therapy, or treatment for abnormal clotting.

Do not try to manage a suspected transfusion reaction without medical help. Symptoms during or soon after a transfusion require immediate evaluation.

Complications

Most affected newborns recover without lasting problems when jaundice is recognized and treated promptly.

Anemia may worsen after discharge because antibody-coated red blood cells can continue breaking down. Severe anemia may affect feeding, growth, breathing, or circulation.

Extremely high bilirubin can enter brain tissue. Early nervous system effects are called acute

bilirubin encephalopathy. Permanent injury, called kernicterus, may cause hearing loss, movement problems, or other neurologic disability. These outcomes are uncommon with appropriate monitoring and treatment.

An acute incompatible transfusion can cause:

Because these complications can develop quickly, even apparently mild transfusion symptoms need prompt assessment.

- Low blood pressure and shock
- Acute kidney injury
- Widespread abnormal clotting and bleeding
- Heart or breathing problems
- Severe anemia

Follow up

A newborn's follow-up plan depends on the bilirubin result before discharge, age at discharge, gestational age, feeding, weight change, and other risks. Follow-up may include a bilirubin test, jaundice examination, feeding assessment, and weight check.

After phototherapy, bilirubin may need to be checked again because it can rebound. Babies with known or suspected hemolysis may need later blood counts to detect anemia. Keep all recommended appointments even if the baby looks well.

Seek prompt advice for worsening jaundice, poor feeding, unusual sleepiness, or fewer wet diapers. Breathing difficulty, inability to wake the baby, seizure-like activity, marked limpness, or unusual stiffness requires urgent or emergency care.

After a transfusion reaction, follow-up may include blood counts, kidney function tests, and review by the transfusion service. The reaction should be documented in the medical record. Tell clinicians about it before future transfusions, although standard testing and identity checks will still be required.

Sources

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