

**BLOOD TRANSFUSION AS A METHOD FOR PREVENTING
NEONATAL MORTALITY**

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Abstract

Neonatal mortality remains a major challenge in modern obstetrics and neonatology. Severe fetal anemia—resulting from Rhesus isoimmunization, intrauterine infections, fetomaternal hemorrhage, and various hereditary disorders—is one of the causes of adverse perinatal outcomes. Intrauterine blood transfusion is an effective treatment for fetal anemia that significantly reduces the risk of intrauterine death, preterm birth, and neonatal mortality.

Keywords: blood transfusion, fetus, intrauterine transfusion, neonatal mortality, fetal anemia, Rhesus incompatibility, perinatal medicine.

Despite significant progress in perinatal medicine, neonatal mortality remains a major cause of newborn loss. Conditions associated with severe fetal anemia play a significant role in this mortality. Without timely treatment, the anemia leads to chronic hypoxia, heart failure, fetal hydrops, and intrauterine death.

The introduction of intrauterine blood transfusion has been one of the most significant achievements in fetal medicine. This procedure has made it possible to effectively treat severe fetal anemia before birth, substantially improving perinatal outcomes.

Causes of fetal anemia

The most common causes of severe anemia are:

- Rhesus and other forms of red blood cell alloimmunization;
- parvovirus B19 infection;
- massive fetomaternal hemorrhage;
- twin-to-twin transfusion syndrome;
- hereditary hemolytic disorders.

Severe anemia is accompanied by a reduction in the oxygen-carrying capacity of the blood and the development of tissue hypoxia and heart failure, which significantly increases the risk of perinatal and neonatal mortality (Table 1).

Table 1. Main causes of severe fetal anemia

Cause	Mechanism of development	Possible consequences
Rhesus alloimmunization	Destruction of fetal red blood cells by maternal antibodies	Severe anemia, hydrops fetalis, intrauterine death
Other red blood cell alloantibodies (Kell, Duffy, Kidd, etc.)	Hemolysis or suppression of erythropoiesis	Anemia of varying severity
Parvovirus B19 infection	Suppression of erythropoiesis	Severe anemia, heart failure
Fetomaternal hemorrhage	Fetal blood loss	Acute anemia, hypoxia
Feto-fetal transfusion syndrome	Uneven redistribution of blood between twins	Donor-twin anemia

Nature of the blood transfusion procedure

Intrauterine blood transfusion involves the transfusion of compatible donor red blood cell concentrate directly to the fetus via the umbilical vein under ultrasound guidance.

The primary objectives of the procedure are:

- restoration of hemoglobin levels;
- elimination of hypoxia;
- prevention of fetal hydrops;
- prolongation of pregnancy until the optimal time for delivery;
- reduction of the risk of intrauterine and neonatal death.

If necessary, the procedure is repeated every 2–4 weeks until delivery.



The role of blood transfusion in the prevention of neonatal mortality

Modern studies demonstrate that timely intrauterine blood transfusion significantly improves pregnancy outcomes.

Key advantages of the method:

- prevention of severe anemia progression;
- reduction in the severity of chronic fetal hypoxia;
- reduction in the incidence of fetal hydrops;
- reduction in the risk of preterm birth;
- increased neonatal survival;
- reduction in the incidence of severe neurological complications.

In specialized perinatal centers, fetal survival following intrauterine blood transfusion exceeds 90%, and reaches 95% or higher in the absence of severe hydrops.

Potential complications

Despite its high efficacy, the procedure remains an invasive intervention and may be associated with complications (Table 2).

Table 2. Complications of intrauterine blood transfusion

Complication	Incidence rate	Prevention
Fetal bradycardia	Not often	Continuous ultrasonic monitoring
Umbilical cord bleeding	Rarely	Precise puncture technique
Premature rupture of membranes	Rarely	Minimization of the number of invasive interventions
Преждевременные роды	Not often	Postoperative monitoring
Intrauterine fetal death	Very rarely in specialized centers	Performance of the procedure by an experienced multidisciplinary team

The risk of complications is significantly reduced when the procedure is performed by experienced specialists in specialized centers.

Advances in ultrasound diagnostics and fetal middle cerebral artery Doppler assessment, improvements in blood component preparation technologies, and enhanced specialist training have made intrauterine blood transfusion a



highly effective treatment method. It is currently the standard of care for severe fetal immune anemia.

Conclusions

Intrauterine blood transfusion is one of the most effective methods for preventing neonatal mortality associated with severe fetal anemia. Timely diagnosis, appropriate patient selection, and performance of the procedure in specialized facilities make it possible to significantly increase fetal survival, reduce the incidence of severe complications, and improve long-term outcomes for newborns.

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E- Global Congress

Hosted online from Dubai, U. A. E., E - Conference.

Date: 30th June 2026

Website: <https://eglobalcongress.com/index.php/egc>

ISSN (E): 2836-3612

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