PROCEDURE

Exchange transfusion

Exchange transfusion removes blood in stages and replaces it with compatible donor blood or red cells.

PURPOSE
Remove harmful substances or abnormal red blood cells

PROCEDURE TYPE
Therapeutic - bedside or minimally invasive blood exchange

WHERE IT IS DONE
At the bedside or in an apheresis unit

ANAESTHESIA
None or local anaesthetic for vascular access

HOW LONG IT TAKES
Usually two to four hours

PREPARATION
Blood tests, crossmatching, and possible fasting for sedation

RECOVERY
Close monitoring, often overnight; no driving after sedation

MAIN RISKS
Transfusion reactions, electrolyte changes, bleeding, infection

RESULTS
Immediate blood results, followed by repeat testing

Overview

An exchange transfusion removes small amounts of your blood and replaces them with compatible donor blood or donor red blood cells. The process is repeated until the planned amount has been exchanged.

The procedure can remove substances carried in the blood, such as bilirubin, or lower the proportion of abnormal red blood cells. Bilirubin is a yellow waste product that can build up when red blood cells break down.

Exchange transfusion is not the same as a standard transfusion. A standard transfusion adds blood without removing a similar amount. During an exchange, the team carefully balances removal and replacement to keep blood volume stable.

Newborns may have a manual exchange through an umbilical catheter. Older children and adults, particularly people with sickle cell disease, may have an automated red-cell exchange using an apheresis machine.

Why the procedure is performed

In newborns, exchange transfusion may be used for dangerously high bilirubin that has not fallen enough with intensive phototherapy. Phototherapy uses special light to help the body clear bilirubin. Exchange transfusion may also remove antibodies that are continuing to destroy the baby's red blood cells.

In sickle cell disease, exchange transfusion lowers the percentage of red blood cells containing haemoglobin S, the type of haemoglobin responsible for sickling. It may be considered for serious complications such as an acute stroke or some severe episodes of acute chest syndrome.

Some people receive planned, repeated red-cell exchanges to prevent specific sickle cell complications. This approach can limit iron build-up compared with repeated simple transfusions.

The exact goal is set before the procedure. It may involve lowering bilirubin, reducing haemoglobin S, correcting severe anaemia, or removing antibody-coated red blood cells.

Who should and should not have it

Exchange transfusion is considered when the expected benefit is greater than the risks of donor blood and vascular access. The decision is based on your condition, blood results, response to other treatment, and how quickly treatment is needed.

For a newborn, factors include age in hours, gestational age, bilirubin level, signs of red blood cell breakdown, and risk of bilirubin affecting the brain. For sickle cell disease, the type and severity of the complication help determine whether exchange or simple transfusion is more suitable.

It may be avoided or delayed when:

A previous transfusion reaction or blood-group antibody does not always rule out exchange transfusion. It may require specially matched blood, additional monitoring, or changes to how the transfusion is given.

- A less invasive treatment is lowering bilirubin safely

- A simple transfusion can meet the treatment goal
- Safe vascular access cannot yet be established
- Compatible donor blood is not ready and treatment is not immediately urgent
- An unstable medical problem needs to be addressed first

How to prepare

Your treating facility's own instructions take priority because preparation differs between newborn exchange transfusion and automated red-cell exchange.

Blood tests usually confirm your blood group, blood count, treatment target, and compatibility with donor blood. Tests may also measure bilirubin, haemoglobin S, calcium, electrolytes, and blood clotting.

Tell the team about previous transfusion reactions, known blood-group antibodies, allergies, heart or kidney problems, pregnancy, and all medicines or supplements. Do not stop a blood thinner like warfarin or apixaban unless the treating team specifically tells you to.

Fasting is not usually needed when no sedation is planned. You may need to stop eating and drinking if sedation or a procedure to place a central line is expected.

The team will plan vascular access. This may be an umbilical catheter for a newborn, two intravenous lines, or a central venous catheter placed into a large vein.

What happens during the procedure

You or your baby will be connected to monitors that track heart rate, breathing, blood pressure, temperature, and oxygen level. Staff also check the intravenous or catheter sites.

During a manual exchange, small amounts of blood are withdrawn and replaced with warmed donor blood. This is repeated slowly while keeping the blood volume as steady as possible.

During automated red-cell exchange, blood passes through an apheresis machine. The machine separates and removes red blood cells, then returns the remaining blood components with donor red blood cells. Citrate is used to stop blood from clotting in the machine.

Most exchanges do not require general anaesthesia. Local anaesthetic may be used when placing a line. You may notice pressure at the access site or tingling around the mouth or fingers if citrate temporarily lowers calcium.

Blood samples may be taken during and immediately after the exchange. The procedure

commonly takes two to four hours, although access placement and observation add time to the visit.

Recovery and what to expect afterward

Mild soreness or bruising can occur where a line was placed. Tell staff about increasing pain, swelling, burning, or numbness.

Eating and drinking can usually resume when you are fully alert and the team says it is safe. Feeding instructions for a newborn will reflect the baby's condition and the type of catheter used.

Activity may be limited for the rest of the day, especially if a central line was placed. Avoid strenuous activity until the access site is secure and you have received instructions about bathing and lifting.

Do not drive home if you received sedation. Even without sedation, arrange transport if your illness, weakness, or treatment could make driving unsafe.

Returning to work or school often depends more on the underlying condition than on the exchange itself. Some people can return the next day, while others remain in hospital for continued treatment.

Risks and possible complications

Exchange transfusion is closely monitored, but complications can occur. Important risks include:

In newborns, bilirubin can rise again after treatment because bilirubin continues moving from body tissues into the blood. Repeat testing is therefore important.

The team reduces risk by matching and testing donor blood, warming blood when appropriate, balancing fluid volumes, checking blood results, and monitoring throughout the exchange.

- Fever, hives, breathing problems, or other transfusion reactions
- Breakdown of donor red blood cells because of incompatibility
- Changes in calcium, potassium, glucose, temperature, or blood pressure
- Bleeding, infection, blockage, or a blood clot related to the catheter
- Low platelet levels or changes in blood clotting

- Too much or too little circulating fluid
- Infection transmitted through donor blood, despite screening and testing

Results and follow up

Initial results are usually available immediately after the procedure. Testing may show the new bilirubin level, haemoglobin level, percentage of haemoglobin S, platelet count, or electrolyte levels.

Further blood tests are often needed over the following hours. These check whether the treatment target was reached and whether bilirubin or abnormal red cells are increasing again.

Routine follow-up may include planned blood tests, review of the catheter site, and discussion of whether further transfusions or long-term treatment are needed.

Alternatives

The alternatives depend on why exchange transfusion has been proposed.

For newborn jaundice, intensive phototherapy is non-invasive and avoids donor blood, but it may not lower bilirubin quickly enough in a severe or rapidly worsening case. Intravenous immunoglobulin may be considered in selected babies with immune-related red blood cell breakdown, but it is not suitable for every baby and does not replace exchange transfusion when urgent bilirubin removal is needed.

For sickle cell disease, a simple transfusion is quicker and needs less complex equipment. However, it adds red blood cells without removing sickled cells, can increase blood thickness, and contributes more iron over repeated treatments.

Medicines that reduce future sickle cell complications can lower long-term risk, but they do not replace urgent transfusion for problems such as an acute stroke. Supportive treatments, including oxygen, fluids, antibiotics like amoxicillin or doxycycline , or pain relief, treat parts of an acute illness but may not reduce haemoglobin S enough.

Close monitoring without exchange avoids the procedure, but it does not actively remove bilirubin or abnormal red blood cells.

When to call your healthcare team

Contact the treating team promptly for fever, chills, a new rash, worsening pain, increasing

bruising, or redness and discharge at a catheter site. Also call about ongoing tingling, muscle cramps, unusual weakness, dark urine, or yellowing that is returning.

For a newborn, seek prompt assessment for worsening jaundice, poor feeding, unusual limpness, a high-pitched cry, or increasing sleepiness.

Seek emergency help for:

Mild access-site tenderness and planned repeat blood tests are usually part of routine recovery, but symptoms that are worsening should not wait for the next appointment.

- Trouble breathing, swelling of the face or throat, or severe chest pain
- Fainting, collapse, a seizure, or difficulty waking
- Sudden weakness, facial drooping, confusion, or trouble speaking
- Heavy bleeding that does not stop with firm pressure

Common questions

Will I be asleep?

Usually not. Exchange transfusion itself generally needs no anaesthesia. Local anaesthetic may be used for line placement, and sedation may be offered if a separate central-line procedure requires it.

Can I drive home?

Not after sedation. You may also need someone else to drive if you are weak, unwell, or have had a central line placed. Follow the facility's discharge instructions.

How painful is it?

The exchange should not be painful once vascular access is working. Needle or catheter placement can sting, and you may have mild soreness afterward. Tell staff immediately about burning, increasing pain, or swelling.

How long will it take?

The exchange commonly takes two to four hours. Preparation, line placement, blood testing, and observation can make the full visit longer.

When will I know if it worked?

The first blood results are usually available immediately afterward. Repeat tests over the next several hours show whether the result is stable or further treatment is needed.

Is donor blood safe?

Donor blood is tested for important infections and matched for compatibility. These steps make transfusion safer, although reactions and other complications cannot be eliminated completely.

Sources

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