Tests used in pregnancy to detect and manage blood group antibody problems

- **ABO and D grouping**
- **Antibody screen:** Detects unexpected blood group anti–bodies (antibodies other than anti-A and anti-B)

Check ABO/D group and antibody screen at the start of pregnancy and repeat in all women at 28 weeks, and in D negative women again at 34 weeks if not receiving antenatal RhD Immunoglobulin prophylaxis.

- **Antibody specificity:** The blood group target of an antibody.
- **Antibody titre:** An estimate of the amount of antibody. Some antibodies are more likely to reach higher titres, e.g. anti-D. Higher titres cause more severe haemolysis.
- **Anti-A and anti-B titres are NOT** measured as they do not provide useful information about risk of haemolysis.

Serial titre measurements are needed and may be required monthly in the second trimester, fortnightly in the third trimester, but more often after an increase in titre has occurred.

Blood group antibodies may cause haemolysis

Maternal IgG antibodies are able to cross the placenta. If an IgG blood group antibody is present in the mother the antibody may react with paternal blood groups on fetal red cells. Red cells coated with moderate or large amounts of antibodies are destroyed faster than normal – this is called haemolysis.

Rapid haemolysis will cause anaemia. A high titre maternal antibody will usually cause more severe anaemia and in very severe cases, will cause fetal death. Intrauterine transfusion of red cells and, exchange transfusion or top-up transfusions in the first 3-4 weeks after birth may be needed.

Moderate titre antibodies cause neonatal anaemia and are a cause of high bilirubin levels after birth. Low titre antibodies typically do not cause significant haemolysis. An antibody titre may be boosted if fetal cells cross the placenta during pregnancy.

Antibodies vary in the risk for causing haemolysis. The table below provides a guide, but remember, the risks for anaemia from any antibody will vary in different pregnancies.

Refer to a Maternal Fetal Medicine Specialist / Obstetrician if any of the following is present			
Antibody	**Anti-D, Anti-CD or anti-c**	**Anti-K**	**Most other antibodies**
Referral Titre	≥16	Any titre	≥32

Previous fetal history of HDFN must always be assessed as a guide for severity of haemolysis in subsequent pregnancies.

Antibody titres are used by an Obstetrician / Maternal Fetal Medicine Specialist to decide when ultrasound assessment of fetal liver length and middle cerebral artery blood velocity are indicated.

Bilirubin is produced during clearance of haemoglobin from red blood cells. The newborn liver is not able to clear bilirubin efficiently in the first few days after birth. High levels of bilirubin may cause irreversible brain damage called kernicterus. Phototherapy with blue lights, and rarely exchange transfusion, are needed to clear excess bilirubin. High dose IV Immunoglobulin may be used to reduce the rate of haemolysis and bilirubin production.

Tests on cord blood samples from neonates who may have haemolytic disease of the fetus and newborn (HDFN)

- If a mother has a clinically significant blood group antibody (not anti-A or anti-B), **send cord blood samples for: full blood count, bilirubin, and Baby's group, DAT and any other relevant blood group tests.**
- The **direct antiglobulin test (DAT)** detects antibodies and complement on red cells (done on blood grouping sample).
- **Crossmatching red cells for neonatal transfusion:** A maternal blood sample is normally used as it provides best access to any maternal antibody causing haemolysis.

Testing for Fetal Red Cells in Maternal Blood

The **Kleihauer test** is carried out on D-negative women after childbirth, or any potentially sensitizing event after 20 weeks gestation. The test detects fetal red cells and is used if an infant is D-positive or the D group is unknown (unborn fetus or miscarriage). It will detect a large fetomaternal bleed for which additional Anti-D is needed. **A negative Kleihauer test does not mean Anti-D is not needed as the test will not detect traces of fetal cells.**

The standard dose of Anti-D injection is 625IU and will clear up to 6 mL of D-positive red cells from maternal blood.

Further Sources of Advice or Information

- **Anti-D Information Leaflet** for use when obtaining informed consent to receive Anti-D treatment
- Transfusion Medicine Specialists: contact local Blood Bank for contact details
- Transfusion Nurse Specialists: Blood Banks, Main Centres
- NZBS Transfusion Medicine Handbook: on DHB intranet or NZBS website www.nzblood.co.nz/clinical-information/

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NZBLOOD

Blood Group Antibodies & Haemolytic Disease of the Fetus and Newborn

INFORMATION

A basic guide for Lead Maternity Providers

This leaflet provides information about:

- **Blood groups and blood group antibodies**
- **Why blood group antibodies are important in pregnancy and for blood transfusion**
- **The team approach needed for pregnancies complicated by blood group antibodies**
- **How to get more information**

What are Blood Groups?

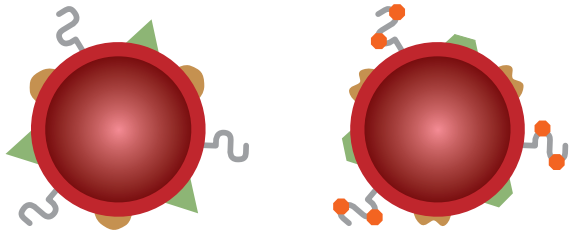
Blood groups are antigens on the surface of blood cells. Blood groups are inherited differences between people and are passed from parents to children.

Most blood groups occur on red cells but some special blood groups are also found on platelets and white blood cells.

Blood groups are important because individuals who do not have a particular blood group antigen may make an antibody against that blood group. Antibodies may cause rapid destruction of red blood cells. This is important when:

- A woman makes an antibody that could react with a blood group antigen in her fetus.
- Red cells are selected for transfusion.

Blood groups on red blood cells differ between people



Blood groups occur in families called **Blood Group Systems**. The two most important blood group systems are **ABO** and **Rh** (previously called Rhesus).

Important Blood Group Systems

Rh

The Rh blood group system has three pairs of blood groups: D or d, C or c and E or e. Rh D is shown in the table below.

Rh D group	Genes present	Frequency
D-positive	DD or Dd	85%
D-negative	dd	15%

Key points about Rh D are:

- D is a strong blood group factor and is common.
- D-negative is identified as 'd' but refers to ***absence*** of D.
- A D-negative woman who is exposed to D positive red cells during pregnancy may start making anti-D. Once started, anti-D production will continue for life. It cannot be stopped.
- If a D-negative woman gives birth to a D-positive infant the chance she will be immunised and make anti-D during or after the pregnancy is about 8%, unless treatment is given.

Rh blood group factors: C, c; and E, e are all weak factors. Women do not often make these antibodies during or after a pregnancy.

ABO

The four ABO blood groups are shown in the table below. Anti-A and, or anti-B are found in 97% of people.

ABO blood group (% pop.)	Genes present	ABO antibodies normally present in plasma
A (38%)	AA or AO	anti-B
B (11%)	BB or BO	anti-A
AB (3%)	AB	–
O (47%)	OO	anti-A & anti-B

Anti-A or anti-B are produced by everyone who does not have A or B. **Group O people make both anti-A and anti-B as they lack both B and A blood group antigens.** In contrast, group AB people cannot make anti-A or anti-B as both A and B antigens are present on their red cells.

Most anti-A and anti-B cannot cross the placenta but group O individuals usually have some IgG anti-A and anti-B that will cross the placenta. If a woman has a high level of IgG anti-A or anti-B this may affect her baby after birth and produce increased jaundice. A DAT on a baby after birth will detect any important antibody if jaundice is increased. Antenatal testing for anti-A and anti-B does not provide useful diagnostic information.

Blood Group Systems other than ABO

D, c and K may all induce very important antibodies.

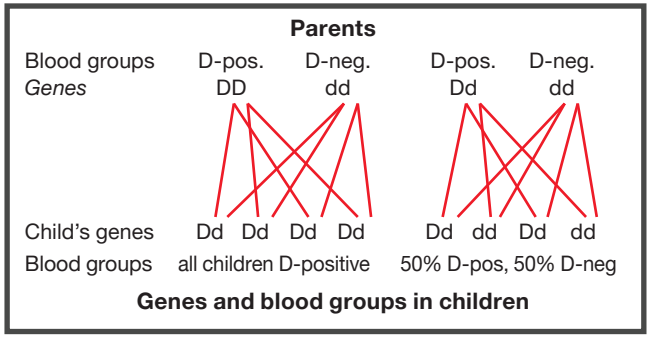
Name of System	Main blood group factors	Most common antibodies
Rh	C, c; D; E, e	Anti-D, Anti-CD, Anti-c, Anti-E
Kell	K (Kell), k (Cellano)	anti-K
Duffy	Fy(a), Fy(b)	anti-Fy(a), anti-Fy(b)
Kidd	Jk(a), Jk(b)	anti-Jk(a), anti-Jk(b)
Ss	S, s	Anti-S, anti-s
MN	M, N	anti-M (often not important)

- An antibody produced against a weak blood group factor may create an important clinical issue. Advice on any action needed can be obtained from NZBS Transfusion Medicine Specialists.
- If a D-negative woman has an antibody other than anti-D and if her baby is D-positive she will still need treatment with Anti-D Immunoglobulin.

Blood groups are inherited – they are passed from parents to children

Where a woman has an unexpected blood group antibody the Blood Bank will often request blood samples from both parents. The samples are used to determine the relevant blood groups and help estimate the risk of the fetus developing accelerated red cell destruction (haemolysis).

A D positive person: may be either DD (double dose of the D gene) or Dd (single dose of D and d). A person who is DD will only produce D-positive infants; a person who is Dd may produce D-positive or D-negative infants.



Genes and blood groups in children

Four combinations of genes are possible in the children born to each set of parents.