



*SNBTS Clinical Directorate
Edinburgh & South East Scotland
Blood Transfusion Centre*

Laboratory Handbook

2007 edition

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TELEPHONE NUMBERS

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Laboratory Manager	Mr M Maginnis	27518
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Duty Registrar		#6466

Red Cell Immunohaematology

Consultant Haematologist	Dr L Manson	27522
RIE Blood Bank	Mrs C MacFarlane	27501/2
Reference Immunohaematology	Mr R Steven	27509
Antenatal Services		27501/2
Cell Separator Unit	Sr A Stewart	23609

Tissue Typing, Platelet Immunohaematology and Clinical Immunology

Consultant Immunologist	Dr P L Yap	27521
Consultant Haematologist	Dr L Manson	27522
Tissue Typing and Platelet Immunohaematology	Ms K Stewart	27528
Clinical Immunology	Mrs J Sawers	27525/9
Tissue Bank	Dr G Galea	65756

HOURS OF OPENING

RIE Blood Bank

Open 24 hours for pre transfusion testing, issue of blood & blood products, and transfusion reaction investigations

All other laboratories

Monday - Thursday	0830 - 1700
Friday	0830 - 1630

(Last receipt for HLA typing is 1700 on Thursday)

“HIGH RISK” SPECIMENS

Any specimen from a patient who has (or is suspected to have) a hazardous infection must be labelled with a 'Risk of Infection' label on both the request form and sample tube. The sample should first be sealed in a separate bag before being placed in a double compartment bag. The request form must NOT be sealed in the bag with the specimen.

Hazardous infections include HIV, Hepatitis B and Hepatitis C.

NO sample should be taken from a patient suffering from a viral haemorrhagic fever (Lassa, Marburg or Ebola) until a consultant Medical Microbiologist has been informed.

REQUIREMENTS FOR LABELLING SPECIMENS & REQUEST FORMS

Inaccurate or incomplete laboratory requests cause risks. This is a clinical governance issue. **The laboratory will not accept requests that do not have the minimum information as described below.** Incorrectly or incompletely labelled samples will be destroyed or returned for amendment

Request forms

Mandatory patient demographics

- Forename(s) and surname
- Date of birth
- Sex
- Hospital number or A&E number or CHI number. If this is not available the patients' home address or post code should be used.

Other important information that should be provided on the request form

- Location
- Name & signature of requesting clinician
- Name of person taking sample
- Products required and when these are required

Sample containers

Samples must be labelled with at least:

- Forename & surname
- Date of birth
- Hospital number or A&E number or CHI number
- Date of sample withdrawal
- Signature

These must be completed legibly **by hand**

COMPLAINTS, ENQUIRIES AND AUDIT OF SERVICE

Edinburgh and South East Scotland Blood Transfusion Service (SEBTS) Clinical Directorate provides a wide range of services, products and clinical advice to clinicians, laboratory staff and patients.

We aim to provide the **right blood** for the **right patient** at the **right time**.

We endeavour to produce a high quality service at all times. SEBTS has been awarded the Manufacturers Special Licence by the MHRA and our laboratory services hold the certificate of accreditation awarded by the Clinical Pathology Accreditation (UK) Ltd.

We are constantly trying to improve the service and would be happy to receive your comments and suggestions.

If you are dissatisfied with any aspect of our service and are unhappy with the response that your initial comments receive, we would encourage you to pass on your concerns in writing to the Clinical Director, Dr M Turner, who will ensure that they are dealt with promptly and thoroughly.

Clear communication with the laboratory is essential.

The majority of serious hazards related to transfusion relate to transfusion of the wrong blood. These hazards are preventable. Please check the patient identity in accordance with Division guidelines before taking samples for transfusion and when administering blood products.

For further information on blood transfusion please refer to the 'Handbook of Transfusion Medicine' (TSO 2007) and the 'Blood and Blood Components Manual' from your Division.

DIAGNOSTIC SERVICES

Table of tests, normal values, and specifications for sample collection

The following pages give detailed information on the tests available. Contact the Department if you require further information

Codes for specimen containers

(Where label colours are given, this refers to Monovette tubes)

A	EDTA, 4.5mls (Blue label)
O	lithium heparin, 5.5 mls (Orange label)
W	plain serum 7 - 10mls (White label)
P	potassium EDTA, 2.5mls (Pink label)

RED CELL IMMUNOHAEMATOLOGY

TEST	Reference value	Tube type	Important notes
Group and Antibody screen +/- crossmatch		A	<p>Pre-op samples can only be used for crossmatching for a maximum of 7 days after being drawn, unless the patient is eligible for electronic blood issue, when the sample may be valid for longer. Refer to local unit policy for guidance or contact Blood Bank to determine if a repeat sample is required.</p> <p>Where there is no medical indication for this test to be performed eg for travellers, SEBTS will invoice the requesting medical practitioner for the costs (currently £19) In this circumstance, please allow at least 1 week to process the sample and issue a report bearing the patient's details and blood group.</p>

Extended blood grouping		A	Used for patients with antibodies or chronic transfusion requirements
Direct antiglobulin test (Coombs test)		A	Used if autoimmune haemolytic anaemia is suspected
AIHA or cold antibody screen		A W	ABO, RhD, DAT & antibody screen for both auto & allo antibodies
Transfusion reaction		A W packs	Refer to appendix on management & investigation of a transfusion reaction.
Antenatal group & screen		A	Please complete request form fully with EDD, previous pregnancies, known antibodies, transfusions and history of haemolytic disease of the newborn
Antenatal antibody follow up		2 x A	
Kleihauer		A P	Only available during normal working hours
Baby group & direct antiglobulin test (Coombs test)		A	Cord blood sample is acceptable. Clearly label as baby sample, but include maternal details on request form. Heavily blood stained tubes may be discarded.
Paternal group		A	Please include partner's details

RED CELL IMMUNOHAEMATOLOGY

Group & Screen

This determines the patient's ABO and Rh(D) group and tests for the presence of atypical red cell antibodies. Takes 40 minutes to complete. Samples are stored for 7 days. If a compatibility test is subsequently required, blood can be available within 10 - 15 minutes.

Compatibility Test

This consists of a G & S and selection of compatible units of red cells. Where no antibodies are identified blood can be released rapidly by electronic issue or using a rapid compatibility test (immediate spin).

To permit electronic issue the following criteria must apply:

- Historical record of patient's group available
- No atypical red cell antibodies
- Sample suitable for automated testing (4.5ml EDTA)
- No history of solid organ or bone marrow transplant

In the presence of red cell antibodies a more lengthy compatibility procedure using the indirect antiglobulin test is required. Identification of compatible blood for patients with antibodies can be a difficult and time consuming procedure.

Blood transfusion can stimulate new antibody production so it is important to ensure the sample is taken within the appropriate time period if a patient is previously transfused:

Patient transfused within	Sample to be taken up to
3 - 14 days	24hr before transfusion
14 - 28 days	72 hr before transfusion
28 days to 3 months	7 days before transfusion

Identification of Red Cell Antibodies

If red cell antibodies are detected these will be identified where possible and appropriate units of blood selected. A further sample may be requested and you may be notified that provision of blood will be delayed.

Provision of Blood Which is Not Fully Compatible With the Patient

In certain circumstances it may not be possible to find blood which is serologically compatible with the patient's serum. We will always try to select the units which we feel are safest for the patient in this instance. The doctor prescribing the blood will be notified of any concerns and advised if any special precautions are required.

Issue of Blood of a Different ABO/Rhesus Group

Occasionally blood may be issued which is not the same group as the patient. This may be because of a shortage of suitable blood of the patient's group eg during a large volume transfusion, or a patient with a rare blood group. The blood issued will always be ABO and Rh(D) compatible.

Compatibility Testing of Patients for Surgical Procedures

Many hospitals use a maximum surgical blood ordering schedule (MSBOS) for patients undergoing surgery. This is a locally agreed tariff for blood ordering. It is designed to reduce blood wastage and unnecessary testing of blood for procedures where the likelihood of transfusion is small. For all operations requiring a G & S compatible blood can be made available rapidly if required. In exceptional circumstances adaptations may be required eg if a patient has a bleeding tendency.

Special Requirements - Irradiated or CMV Negative Products

We can supply blood and blood products to meet a variety of special needs. It is the responsibility of the requesting doctor to identify these needs. Please discuss with the duty doctor if you are unsure. If a patient has special needs an entry will be made in their computer records and will normally be recalled when any future request is received.

REFERENCE RED CELL IMMUNOHAEMATOLOGY

This laboratory offers a comprehensive reference service for the investigation and confirmation of red cell antibodies, investigation of autoimmune haemolytic anemia and possible transfusion reactions.

Antibody Identification

Following antibody identification

- suitable red cell units can be selected if required
- antibody notification cards are issued to patients
- a permanent computer record is generated which will be automatically recalled if further requests are received.

Investigation of Transfusion Reactions

Please refer to appendix 1

ANTENATAL IMMUNOHAEMATOLOGY

Blood Group & Antibody Screen

Essential for all pregnant women at booking or those undergoing termination of pregnancy or spontaneous miscarriage. Women with antibodies are issued with an antibody notification card.

Antibody Update

Antenatal patients with red cell antibodies require regular monitoring of the antibody titre. Appropriate timing of the follow-up samples will be given on the report form. (see suggested schemata on page 20).

Paternal Samples

The lab requests these when a clinically significant antibody has been detected in the maternal sample. This investigation indicates whether or not the fetus is likely to be at risk from the maternal antibody.

Cord Blood or Neonatal Samples

Cord samples should be sent from an infant of a mother who is Rh(D) negative or has red cell antibodies. An ABO and Rh group and DAT will be performed to determine if the infant is at risk of anaemia or jaundice. Alternatively a small (0.5ml) neonatal sample should be sent.

Kleihauer Test

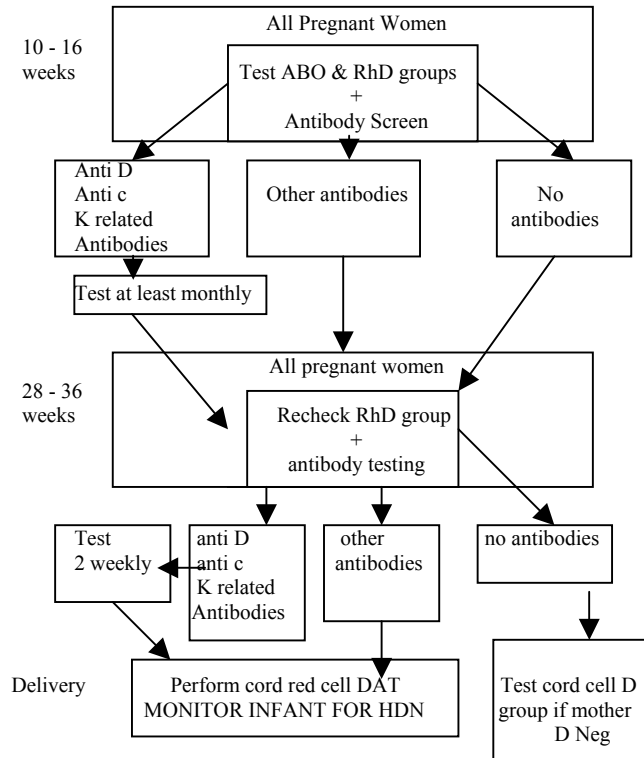
This determines the volume of foetal cells in the maternal circulation. It should be performed after any potentially traumatic procedure (including delivery) after 20 weeks' gestation in a Rh(D) negative woman. Large fetomaternal

bleeds (>4mls foetal red cells) may indicate a requirement for larger doses of anti-D immunoglobulin.

This test may also reveal a large fetomaternal bleed in the event of an unexpected intrauterine death or anaemia in a newborn infant.

False positive results may be obtained in conditions resulting in a raised maternal HbF level eg thalassaemia.

Suggested Scheme for Antenatal Serology Testing
(adapted from BSCH guidelines on blood grouping & red cell antibody screening in pregnancy 1996)



Rhesus Programme

Rh(D) negative women detected at booking require prophylactic anti-D immunoglobulin for all sensitising events in pregnancy and at delivery. Routine antenatal prophylaxis at 28 and 34 weeks has been introduced throughout the region . However, if a woman has already developed anti-D, prophylactic anti-D immunoglobulin will be of no benefit.

Indications & Doses for Anti-D Prophylaxis

Routine prophylaxis at 28 and 34 weeks

Sensitising events:-

- Hydatidiform mole
- Ectopic pregnancy
- Abortion or threatened abortion after 12 weeks
- Abortion or threatened abortion at any gestation where instrumentation required
- Threatened abortion with ongoing pregnancy before 12 weeks if heavy bleeding or abdominal pain
- Chorionic villus sampling
- Amniocentesis or cordocentesis
- External version or abdominal trauma
- Antepartum haemorrhage
- Delivery

Anti-D is given within 72 hours of a sensitising event.

< 20 weeks: 250iu. Kleihauer test not indicated

>20 weeks: 500iu. Kleihauer test indicated and follow-up

Kleihauer essential to determine if further anti-D required.

All patients should have a pre-injection sample sent to ensure that they have not already developed anti-D antibodies.

The laboratory sends anti-D immunoglobulin to the ward or clinic from which the sample was received unless otherwise indicated.

Repeated Administration of Anti-D Immunoglobulin in the Antenatal Period

Further doses of anti-D will be required for each new sensitizing event. However, for patients with ongoing intermittent bleeding in the antenatal period, repeated doses are required only at approximately 6 weekly intervals. A further dose will be required at delivery of a Rh(D) positive infant.

Antenatal Prophylaxis

Routine antenatal administration of anti-D at 28 and 34 weeks is offered to all Rh(D) negative women who have not already developed anti-D. Before administering the anti-D at 28 weeks an EDTA sample is sent to check for the presence of anti-D antibodies. No further samples are required unless the mother has other red cell antibodies. The anti-D doses are generally administered in the community by the midwife or GP.

Anti-D Antibody Quantitation

When anti-D antibodies are detected this will be reported first as an antibody titration value and then quantitated in international units. The quantitation correlates better with the risk of intrauterine haemolysis.

Rhesus Grouping on Amniotic Fluid Samples

Samples of amniotic fluid can be referred to a reference centre for determination of foetal Rh(D) or (c) group using DNA based techniques. Please discuss with duty doctor.

NEONATAL TRANSFUSION

Samples

Neonates rarely make antibodies in response to blood transfusion but may have passively acquired red cell antibodies in their plasma from the mother.

At the time of the first request please send

- a maternal sample (4.5ml blue top EDTA) which will be screened for antibodies
- infant sample (0.5ml clotted) which will be used for ABO & RhD grouping and a DAT.

If no maternal sample is available a larger infant sample (1 - 1.5ml) is required.

A maternal sample is not required for subsequent requests and it may be possible to issue blood without further infant samples - please check with the laboratory.

Paedipacks

A paedipack system is available for top-up transfusion in neonates who are likely to require more than one transfusion in a four week period. The unit is divided into 5 aliquots of 50 - 60 mls, which are available for sequential transfusion in one infant. This reduces the neonate's exposure to donors.

Current evidence suggests that blood stored up to expiry should be satisfactory for routine top-up transfusions.

Exchange Transfusions

Blood for exchange should be fresh (<5 days old) and suspended in plasma rather than optimal additive solution. Please give the laboratory maximum notice for preparation for blood for exchanges.

T Activation/Necrotising Enterocolitis

Infants with NEC or a positive T activation screen should only receive low T titre plasma-containing blood products. Issue of these products requires discussion with the duty doctor.

PLATELET IMMUNOHAEMATOLOGY

This laboratory offers diagnostic services for the investigation of:

- Heparin induced thrombocytopenia
- Neonatal alloimmune thrombocytopenia
- Idiopathic thrombocytopenia
- Platelet refractoriness
- Post transfusion purpura

All of these investigations must be arranged through the duty doctor.

A platelet compatibility service is also available for patients with proven platelet refractoriness.

Please refer to specialist Histocompatibility and Platelet Immunohaematology Laboratory Handbook –

<http://www.scotblood.co.uk/docs/histo.doc>

CLINICAL IMMUNOLOGY

A comprehensive immunology service is provided by SEBTS. A list of available investigations is provided on pages 10-13. If the test you require is not shown, please contact the laboratory.

Dr Yap is available to provide clinical advice during normal working hours.

Please refer to specialist Immunology Services User Manual –

<http://www.scotblood.co.uk/docs/immunology.doc>

TISSUE TYPING

A 24 hour service is available for tissue typing for solid organ transplantation. The laboratory is contacted directly by the transplant coordinator.

Please refer to specialist Histocompatibility and Platelet
Immunohaematology Laboratory Handbook –
<http://www.scotblood.co.uk/docs/histo.doc>

CELL SEPARATOR UNIT

Therapeutic Apheresis

The unit provides a 24 hour service for therapeutic apheresis procedures. Most procedures are carried out in the clinical unit in CSU, RIE; in-patient apheresis is provided at the Royal Infirmary.

The service is provided by specially trained nursing and medical staff and is equipped with resuscitation facilities and continuous ECG recording. Where clinically necessary, procedures can be performed at the patient's bedside or in other hospitals in the region. Patients with poor venous access require insertion of a central line (please discuss with staff).

The staff has extensive experience in plasmapheresis, stem cell harvesting, leukapheresis and isovolaemic red cell exchange in both adult and paediatric patients.

Venesection Service

An out-patient therapeutic venesection service is available for patients with polycythaemia or haemochromatosis. Regular monitoring of full blood count and biochemical parameters is performed.

Intravenous Infusions

A limited out-patient service for the administration of intravenous iron, immunoglobulin or red cell concentrate is available.

Referrals

All referrals must be made through the duty consultant or registrar. We require a brief summary of the clinical condition and any relevant drugs and an assessment of the patient's venous access.

BLOOD COMPONENTS AND PRODUCTS

This is a brief summary of the products available from SEBTS. More detailed information is available from the department. Blood products should only be administered where there is a clear indication and expectation of clinical benefit. The reasons for transfusion should be clearly documented in the medical notes. None of these products is guaranteed to be free from the risk of transmission of infectious diseases or other adverse events. All products are now leucodepleted at the time of manufacture.

Red Cell Products

- transfusion should be completed within 4 hours of removal from refrigeration
- must be stored in a designated validated blood fridge.

Red Cells , in Additive Solution

This is the major red cell component issued. Volume approx 300mls. Hct 0.55 - 0.65. Additive solution is added after the removal of virtually all the plasma - flow characteristics are like whole blood.

Red Cell Concentrate

Rarely used. Volume 260mls. Hct 0.55 - 0.75.

Whole Blood

Available only for exchange transfusion in neonates or large volume transfusions in children under 6 months of age. Laboratory must be given maximum notice of requests.

Plasma

- frozen within 6 hours of donation.
- Stored at below -30°C , takes at least 20 minutes to thaw before issue.
- Infuse as soon as possible after thawing & within 4 hours maximum.

Fresh Frozen Plasma

Standard dose approximately 15 mls/kg. Available in 300mls packs & 50ml paediatric packs
Methylene blue treated FFP (virally inactivated) is available for use in selected patient groups.

Cryoprecipitate

Rich source of fibrinogen, factor VIII & von Willebrand factor. Volume 100-250 mls/pool (5 donor units). Dose 5 - 10mls/kg (for adults a standard dose is 2 pools, equivalent to 10 single donor units).

Platelet Concentrates

- Stored at 22°C - do not refrigerate!
- Manufactured as apheresis units (from a single donor) or pooled units (derived from 4 whole blood donations)
- Transfusion must be completed within 60 minutes.

Volume approx 200 – 300 mls. One unit equals one adult dose and should increment platelet count by approximately $20 - 40 \times 10^9/l$ unless there is high consumption.

ORDERING BLOOD PRODUCTS

Requests for FFP and platelets should normally be discussed with the duty haematology/BTS registrar or consultant. Medical staff from selected units can order directly from Blood Bank according to the locally agreed protocol. All requests for cryoprecipitate must be discussed with BTS medical staff.

PLASMA DERIVATIVES

These products are prepared by fractionation of plasma from voluntary, non remunerated, non UK donors. All the products listed below are licensed by the MHRA.

Human Albumin Solution 4.5 / 5%

Available in 50, 100ml and 500ml bottles. Contains 45g – 50g/l protein, of which the majority is human albumin. Most commonly used for blood volume replacement, but expensive and not clearly superior to artificial colloids or crystalloids for this indication.

Human Albumin Solution 20%

Contains 200g/l protein, of which the majority is human albumin. Used in the short term management of diuretic resistant oedema and large volume paracentesis.

Immunoglobulin Preparations

Human Immunoglobulin for Intravenous Use

Lyophilised products: 6 or 12g vials with water for injection. Licensed to treat humoral immunodeficiency states, Kawasaki's disease and certain autoimmune conditions eg ITP. The use of immunoglobulin in other,

unlicensed, indications must be discussed with the duty doctor.

Administration rates are included in the product summary - infusion rates should not be exceeded due to the risk of renal failure.

Intravenous preparations with high titre antibody against CMV, tetanus or hepatitis B are also available from the department. Please discuss with the duty doctor if these are required.

Human Immunoglobulin for Intramuscular Use

Human normal immunoglobulin

Available by request from Supply Chain.

Anti D immunoglobulin

Prophylaxis of Rh D immunization.

Tetanus immunoglobulin

Tetanus prophylaxis in non immune (or unknown status) individuals with 'at risk' wounds. Given with tetanus toxoid.

Hepatitis B immunoglobulin

Prophylaxis of hepatitis B in those thought to have been inoculated with blood or secretions containing HBsAg. Given with hepatitis B vaccine.

Varicella Zoster Immunoglobulin

Prophylaxis of varicella zoster infection in susceptible individuals exposed to varicella zoster.

Rabies immunoglobulin

Prophylaxis of rabies following exposure/suspected exposure in those not previously adequately immunised. Please discuss with the duty doctor if this is required.

Coagulation Factor Concentrates

OCTAPLEX

Concentrate rich in factors II, VII, IX and X. Indicated for the reversal of warfarin in life threatening haemorrhage or some congenital factor deficiencies. Please discuss with the duty doctor if this is required.

Factor VIII

Use of these products should be discussed with the Regional Haemophilia Centre.

MAXIMUM SURGICAL BLOOD ORDERING SCHEDULE

A maximum surgical blood ordering schedule (MSBOS) is designed to reduce blood wastage rates. It is a locally agreed tariff for ordering in elective surgery which has been agreed by the surgeons, anaesthetists and Blood Bank. An individual clinician can over-ride the MSBOS if deemed appropriate, however where an MSBOS has been agreed Blood Bank will prepare blood according to the given tariff unless a reason for deviation is expressly given. If patients have significant cardiac or respiratory disease, anticipated excessive blood loss or antibodies, they may need to be crossmatched. For a copy of the current MSBOS contact the blood bank.

MANAGEMENT OF TRANSFUSION REACTIONS

Reaction	features	cause	management
Acute haemolytic transfusion reaction	Dyspnoea fever, chest/back pain, hypotension haemoglobinuria	ABO incompatible transfusion	Stop blood. Give IV saline. Establish diuresis. Monitor U&E + coagulation. Send blood & new sample to BTS labs.
Anaphylaxis	Acute collapse, hypotension, dyspnoea	Reaction to plasma constituent eg IgA	Stop transfusion. Give O ₂ , iv antihistamines, nebulised salbutamol, iv adrenaline
Fever/rigors	Chills, fever, rigors	Antileucocyte antibodies or bacterial infection	Slow or stop transfusion. Paracetamol
Urticaria	Rash, itch	Antibodies to plasma protein	Slow transfusion. Oral or iv antihistamine
Infective shock	Acute collapse, hypotension, fever	Bacteria or endotoxin in component	Stop transfusion. Broad spectrum antibiotics. Maintain BP & O ₂
Non cardiogenic pulmonary oedema	Acute respiratory decompensation	Anti leucocyte antibodies	Stop transfusion. Intensive respiratory support. High dose steroids. Diuretics

LUHD MAJOR HAEMORRHAGE PROTOCOL

- ◆ Attending clinicians must telephone switchboard on 222, stating that there is a major haemorrhage; the name and location of the patient and contact telephone number (and individual if possible).

Switchboard will inform:

- Blood Bank on the emergency phone
 - Haematology laboratory
 - Haematology/BTS duty doctor
 - Porter to go to the clinical area (porter will remain until stood down by clinical team)
- ◆ Blood Bank should be rung directly to clarify;-
 - How urgent the need for blood is
 - Patient's minimum data set
 - The number and nature of blood components requested (a standard pack for an adult = 10 units RCC, 1 pool platelets & 4 units FFP)
 - The exact location of the patient
 - ◆ If required, emergency O negative stock is held in RIE & WGH blood banks, fridges in the A&E RIE, Labour Theatre RIE and RHSC. Use the nearest stock.
 - ◆ To speed up coagulation screen, fibrinogen will be done first. If $< 0.8\text{g/l}$ the clinical team will be informed immediately because the PTR and APTT will be prolonged and FFP and cryoprecipitate are likely to be required.
 - ◆ When the FBC and coag screen are available they will be phoned to the clinical team and to the Haem/BTS duty doctor. The Haem/BTS duty doctor will liaise with the attending clinicians with regard to the haematological results and further blood component requirements.

For further FBC/coagulation or blood components, the clinical team should liaise direct with the appropriate laboratories on the emergency numbers. There is no requirement to go through the Haem/BTS duty doctor, though he/she will be available as required.