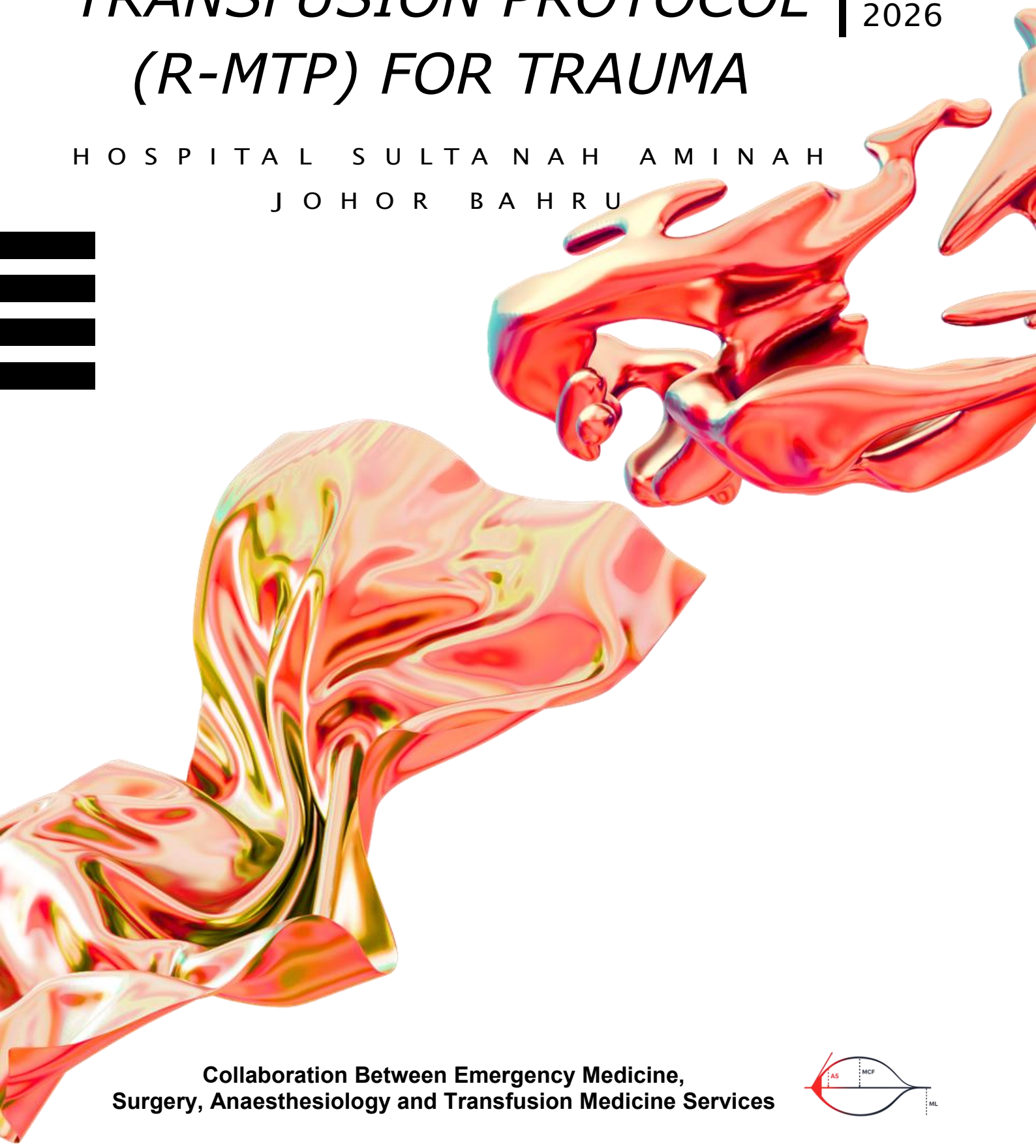
A tre

ROTEM-GUIDED MASSIVE TRANSFUSION PROTOCOL (R-MTP) FOR TRAUMA

MAY 2026

HOSPITAL SULTANAH AMINAH
JOHOR BAHRU



Collaboration Between Emergency Medicine, Surgery, Anaesthesiology and Transfusion Medicine Services

TABLE OF CONTENTS

UPDATING THE PROTOCOL

This protocol was updated in 2026 and will undergo review at a minimum interval of three years (next scheduled review: 2029), or earlier should significant new evidence, national policies, or clinical practice changes emerge. When the protocol is due for revision, the Chairman of the protocol and representatives from the relevant specialty committees will be notified. A multidisciplinary review meeting will then be convened to evaluate the scope of revisions required, after which the protocol will be updated accordingly.

LIST OF COMMITTEES

Mr Yuzaidi Bin Mohamad
Head of Department, Department of General Surgery

Dr Ahmad Abdulbasitz Bin Ahmad Fatan
Head of Department, Emergency and Trauma Department

Dr Mohamad Mizan Bin Gusari
Head of Department, Department of Transfusion Medicine

Dr Mohd Hilmi Bin Senin @ Nordin
Transfusion Medicine Specialist

Dr Nuraini Sham
Transfusion Medicine Specialist

Dr Zulaili Binti Asri
Emergency and Trauma Physician

Dr Ong Su Ping
Anaesthesiologist

Dr Nurul Nadiah Sani
Medical Officer, Transfusion Medicine Department

LIST OF REVIEWERS

Mr Rizal Imran Bin Alwi
Senior Consultant Trauma Surgeon

Dr Mohd Amin Bin Mohidin
Consultant Emergency and Trauma Physician

Dr Omar Bin Sulaiman
Head of Department and Senior Consultant Anaesthesiology and Intensive Care

TITLE

ROTEM-Guided Massive Transfusion Protocol (R-MTP) For Trauma, Hospital Sultanah Aminah Johor Bahru

1.0 Introduction

Trauma is the leading cause of death worldwide among individuals under 40 years of age and accounts for approximately 10% of all deaths globally. In Malaysia, transport accidents have consistently ranked as the fourth leading cause of death from 2023 to 2025. In 2025, approximately 20% of these fatalities involved young Malaysians aged 15 to 40 years. The economic burden of injury is substantial, with losses estimated at RM 25 billion annually based on the Value of Statistical Life (1). Nearly half of trauma-related deaths within the first 48 hours are attributable to uncontrolled haemorrhage (2). Trauma- induced coagulopathy is present in approximately 25% of patients upon arrival to the trauma bay and is associated with increased transfusion requirements, morbidity, and mortality. In approximately 3–6% of trauma cases, exsanguinating haemorrhage necessitates massive transfusion.

Early and coordinated haemostatic resuscitation is critical in the management of severe traumatic haemorrhage. Massive Transfusion Protocols (MTP) have been shown to improve patient outcomes when activated promptly, allowing rapid and balanced administration of blood components in response to ongoing bleeding (3). Blood and blood products are typically transfused in the Emergency and Trauma Department (ETD) or Operation Theatre (OT) in life- threatening situations where rapid restoration of circulating volume, oxygen delivery, and haemostatic competence is essential. Effective MTP activation therefore requires a reliable mechanism to identify patients at risk of massive haemorrhage early in the course of resuscitation.

At Hospital Sultanah Aminah Johor Bahru (HSAJB), a clinical pathway was developed to ensure timely activation of the protocol, rapid and safe delivery of blood components, and effective coordination between clinical teams and the transfusion service. The Massive Transfusion Protocol for exsanguinating trauma was first implemented in HSAJB in 2016. Since its introduction, periodic audits, clinical feedback, and multidisciplinary discussions have been conducted to evaluate and refine the protocol. In 2020, the Massive Transfusion Protocol (MTP) was revised, with the activation criteria changed from the Assessment of Blood Consumption (ABC) score to the Trauma Associated Severe

Haemorrhage (TASH) score. This change was made because the ABC score was associated with a lower activation threshold, leading to frequent and unnecessary utilisation of blood components. The TASH score was adopted as it provides a more detailed and stringent assessment, aligning better with the expectation that most major trauma cases requiring MTP activation will need admission to the operating theatre or intensive care unit.

In 2023, the multidisciplinary committee integrated the use of walkie talkie to enhance communications between clinical coordinator, blood bank coordinator and runner.

The European Guideline on the Management of Major Bleeding and Coagulopathy following Trauma (2023) recommends the use of viscoelastic point-of-care testing such as ROTEM or TEG to guide haemostatic therapy in bleeding trauma patients. Viscoelastic Assay provides rapid, real-time assessment of the coagulation process, including clot initiation, clot formation, clot strength and fibrinolysis, allowing early identification of specific coagulation abnormalities. Viscoelastic assay-guided haemostatic resuscitation enables targeted administration of blood components such as cryoprecipitate (fibrinogen replacement), platelets and plasma (coagulation factor replacement). Studies have shown that this approach improves the precision of transfusion therapy, reduces unnecessary blood product use and wastage, and is associated with reduced transfusion requirements, shorter intensive care unit and hospital length of stay, lower overall treatment costs, and potential reductions in morbidity and mortality among severely bleeding trauma patients (4).

In 2024, the Ministry of Health (MOH) Malaysia published a Consensus Statement on Patient Blood Management (PBM), recommending the adoption of a Targeted Massive Transfusion Protocol (T-MTP) for patients with traumatic massive haemorrhage (5). T-MTP is a guided transfusion strategy that integrates objective clinical assessment with adjunct Point-of-Care Testing (POCT), including Full Blood Count (FBC), blood gas analysis, International Normalised Ratio (INR), fibrinogen levels, and viscoelastic assays (TEG or ROTEM).

In alignment with this recommendation, the current protocol adopts a ROTEM-guided Massive Transfusion Protocol (R-MTP), whereby initial empirical transfusion (Box 1a) is followed by targeted haemostatic therapy guided by ROTEM findings. This approach supports timely, goal-directed resuscitation tailored to the patient’s dynamic coagulation status, reducing unnecessary transfusions, minimising complications, and optimising clinical outcomes.

At Hospital Sultanah Aminah Johor Bahru (HSAJB), Rotational Thromboelastometry (ROTEM) was implemented in the Transfusion Medicine Laboratory in December 2025, enabling rapid viscoelastic testing to support haemostatic resuscitation. The updated Massive Transfusion Protocol (MTP) incorporates this capability to enhance clinical decision-making, optimise blood component utilisation, and improve outcomes in patients with severe traumatic haemorrhage.

1.1 Definition

1.1.1 Massive Bleeding

- Massive bleeding is defined as:
  - blood loss of 150 mL/min, OR
  - 50% blood volume within 3 hours, OR
  - loss of total blood volume in 24 hours (6).

1.1.2 Massive Blood Transfusion

- Massive transfusion is defined as:
  - infusion of >10 units of red cell within 24 hours or a transfusion of blood and blood components equivalent to or more to the patient's total blood volume if less than 24 hours, Or
  - replacement of 50% or more of the estimated blood volume within 3 hours, Or.
  - transfusion of > 4 RBC units in 1 hour with anticipation of continued need for blood product support
- In children - massive transfusion is defined as the requirement of packed red cells >40 mL/kg in the first 4 hours or >80 mL/kg in the first 24 hours (6).

1.1.3 Massive Transfusion Protocol (MTP)

A structured clinical pathway for the rapid and coordinated delivery of blood components in patients with severe bleeding.

1.1.4 Targeted Haemostatic Therapy

Administration of specific blood components based on identified coagulation abnormalities

rather than fixed ratios.

1.1.5 ROTEM (Viscoelastic Testing)

A point-of-care test that provides real-time assessment of clot formation and stability to support transfusion decision-making.

1.1.6 Trauma-Induced Coagulopathy (TIC)

An early coagulopathy occurring after trauma, characterised by impaired clot formation and increased bleeding tendency.

1.1.7 Safe O Blood

Uncrossmatched group O **positive** red cells issued for emergency transfusion when patient's blood group is unknown or crossmatch is not yet available.

1.1.8 ROTEM-Guided MTP (R-MTP)

A massive transfusion approach that incorporates viscoelastic testing to guide targeted blood component therapy.

1.1.9 Empirical MTP (E-MTP)

A transfusion approach based on predefined ratios of blood components without guidance from viscoelastic testing.

1.1.10 MTP Activation

The formal initiation of the Massive Transfusion Protocol for a patient identified as requiring urgent blood component support.

1.1.11 MTP Termination (Stand-down)

The formal discontinuation of the Massive Transfusion Protocol when ongoing massive bleeding is no longer present.

1.1.12 MTP Cycle

One complete sequence of blood and blood component supply during MTP.

1.1.13 MTP Box

A predefined package of blood components issued as part of each MTP cycle, consisting of an initial empiric component (Box A) and a subsequent component that may be guided by clinical or laboratory assessment (Box B).

1.1.14 Box A (Initial / Non-ROTEM Phase)

The first component of an MTP cycle consisting of predefined blood components issued rapidly to support immediate resuscitation, without reliance on ROTEM results.

1.1.15 Box B (ROTEM-Guided Phase)

The second component of an MTP cycle in which blood components are adjusted based on ROTEM findings or laboratory assessment.

1.1.16 Hybrid MTP Approach

A transfusion strategy in which initial resuscitation is performed using predefined blood components, followed by targeted therapy guided by ROTEM or laboratory results for the first cycle.

1.1.17 Turnaround Time (TAT)

The time interval from receipt of samples from MTP Kit (activation or continuation kit) at the Blood Bank counter to the release of the respective MTP Box for clinical use.

1.1.18 MTP Continuation

The process of proceeding to the next MTP cycle based on ongoing clinical need for blood component support.

1.1.19 MTP Clinical Coordinator

The designated clinician responsible for coordinating MTP activation, communication, and blood component utilisation at the clinical site.

1.1.20 Blood Bank Coordinator

The designated personnel responsible for coordinating blood component preparation, release, and communication from the Blood Bank.

1.1.21 Runner

The assigned personnel responsible for collecting and transporting MTP boxes between the Blood Bank and clinical area.

1.1.22 Closed-Loop Communication

A communication method in which information is clearly transmitted, acknowledged, and confirmed between sender and receiver.

1.1.23 Single-Line Communication

A structured communication approach where all information between clinical and Blood Bank teams is channelled through designated coordinators.

1.1.24 Positive Patient Identification

A verification process ensuring correct patient identity before transfusion using at least two or more unique identifiers.

1.2 Rationale Of MTP

Protocolized transfusion strategies for traumatic haemorrhage have been shown to improve clinical outcomes when initiated early during resuscitation (2). Early recognition and coordinated management of exsanguinating haemorrhage are critical to prevent the progression of trauma-induced coagulopathy, shock, and organ failure.

Key factors associated with improved outcomes in patients with severe haemorrhage include:

1. Early identification of patients at risk of massive haemorrhage
2. Rapid control of the source of bleeding
3. Prompt resuscitation of haemorrhagic shock
4. Early initiation of **appropriate** blood component therapy
5. Early implementation of definitive critical care measures

Severe or exsanguinating haemorrhage may occur in several clinical scenarios, including:

1. Severe intra-abdominal injury (intraperitoneal or retroperitoneal bleeding)
2. Complex pelvic fractures
3. Major long bone fractures

4. Severe maxillofacial injuries
5. Penetrating thoracic trauma or high-energy blunt torso injuries
6. Massive bleeding from multiple anatomical site

1.3 Objectives Of MTP Committee

To develop a commonly agreed pathway for Massive Transfusion Protocol for Trauma that will ensure the following:

1. Accurately identify patients that will need massive transfusions,
2. Ensure efficient activation of the protocol,
3. Ensure safe, **indicated** and rapid delivery of blood products,
4. Coordinate communications to ensure most effective use of available resources, and
5. Prepare a mechanism for audit and review of the protocol.

1.4 Advantage Of Rotem-Guided Massive Transfusion Protocol (R-MTP)

1. Standardises the management of severe traumatic haemorrhage by providing a clear and coordinated protocol for clinical teams, the transfusion service, and laboratory personnel involved in patient care.
2. Facilitates rapid activation and delivery of haemostatic resuscitation by minimising delays in clinical decision-making, laboratory testing, blood component preparation, and transfusion.
3. Supports goal-directed haemostatic therapy through the integration of viscoelastic testing (ROTEM), enabling early detection of trauma-induced coagulopathy and targeted administration of blood components.
4. Optimises the utilisation of blood products by reducing unnecessary transfusion and blood component wastage through ROTEM-guided transfusion strategies.
5. Improves patient outcomes, including enhanced haemostatic control, reduced transfusion requirements, lower rates of organ failure and post-trauma complications, and potential improvements in survival.

1.5 Factors Contributing To Suboptimal MTP Implementation

Several operational factors may affect the timely and effective implementation of the Massive Transfusion Protocol (MTP). These issues may result in delayed transfusion, inefficient utilisation of blood components, and potential risks to patient safety.

1. Inappropriate MTP activation
   • Activation without proper clinical indication or incorrect/absent TASH score assessment.
   • Activation despite adequate blood components already reserved.
   • Activation WITHOUT two specialists from two different disciplines when the TASH score is below the activation threshold (TASH Score < 17).
2. Communication and coordination failures

   - Poor communication between the Emergency Department, surgical, anaesthesia, and the blood bank team due to unfamiliarity with the line of communication (phone vs walkie talkie) and the use of walkie-talkie communication itself during MTP activation.
   - Communication overload caused by multiple simultaneous communication channels (e.g., coordinator -> non coordinator, non-coordinator -> non-coordinator) particularly after office hours, leading to delays or missed updates during MTP management, apart from distraction.
   - Lack of clear handover of MTP status, coordinator, and runner responsibilities during patient transfer from ED to OT.
   - Delayed updates regarding continuation or stand-down of MTP from the clinical team (no update for more than one hour).

3. Delay in transfusion or patient transfer process
   • Blood components not transfused promptly despite its availability on the clinical site.
   • Delay in patient transfer to the Operation Theatre while awaiting blood component preparation.
4. Blood component utilisation and wastage
   • Incorrect expectations of MTP component packs.
   • Blood products issued but not transfused and subsequently returned.
5. Poor documentation and SOP non-compliance
   • Incomplete transfusion documentation (timing of starting and completing transfusion).

- Incorrect handling of laboratory samples, request forms, or blood bag barcodes.
- MTP Blood boxes not returned after MTP stand down.

These issues may lead to unnecessary activation of MTP, unnecessary escalation of panic and anxiety, delayed transfusion and wastage of blood resources, highlighting the importance of clear SINGLE LINE communication, strict adherence to protocol, and regular multidisciplinary training and debriefing.

2.0 ACTIVATION OF MTP FOR TRAUMA

Prediction tools to identify the need for massive transfusion rely on simple scoring systems such as the TASH Score (Trauma Associated Severe Haemorrhage Score) (Table 1). In certain clinical scenarios, a senior clinician's judgement may provide additional valuable input in determining the need to initiate MTP. Early and accurate assessment is essential, as unnecessary or non-judicious transfusion of blood components may expose patients to avoidable complications, including transfusion-related acute lung injury (TRALI), transfusion-associated circulatory overload (TACO), acute respiratory distress syndrome (ARDS), infection, multiple organ dysfunction syndrome (MODS), and sepsis (7).

2.1 TASH Score

1. The TASH Score (Trauma Associated Severe Haemorrhage Score) is used to predict the likelihood of massive transfusion based on clinical and laboratory parameters. It assists clinicians in identifying patients who may benefit from activation of the Massive Transfusion Protocol (MTP).
2. The score incorporates clinical and laboratory data, including haemoglobin and base excess obtained from arterial blood gas analysis, which are usually available within 15 minutes in the Emergency and Trauma Department (ETD).
3. The TASH score shall be calculated using TASH score slip in MTP activation kit.
4. Tash score slip shall be sent to Blood Bank alongside with other components in the MTP activation kit.
5. The calculated total TASH score must be documented in the patient's Bed Head Ticket (BHT) for audit and quality assurance purposes by the Blood Bank team following each MTP activation.
6. The TASH score does not indicate that a patient should automatically receive blood transfusion; rather, it identifies patients who may require activation of the Massive Transfusion Protocol. Clinicians should remain aware that uncrossmatched group O blood remains available through standard urgent transfusion pathways prior to MTP activation.

2.2 MTP Activation Criteria

Activation of the Massive Transfusion Protocol should fulfil the following criteria:

1. MTP activation must be authorised by an attending specialist (Emergency Physician, General Surgeon, or Anaesthesiologist).

2. A TASH score ≥17 is considered the threshold for MTP activation (≈50% probability of requiring massive transfusion); in such cases, authorisation by **one** attending specialist is sufficient.

3. If the TASH score is <17, MTP activation requires agreement from attending specialists from two different departments (e.g., Emergency Medicine, Surgery, or Anaesthesiology), based on clinical judgement.

2.3 Exclusion Criteria

MTP should generally not be activated if:

1. The patient is haemodynamically stable; or
2. The patient is planned for further imaging in the Radiology Department prior to definitive management.

2.4 Location of MTP Activation

MTP may be activated in the following clinical areas:

1. Emergency and Trauma Department (ETD)
2. Operation Theatre (OT)

2.5 Personnel Authorised to Activate MTP

The following specialists may initiate MTP activation:

1. Emergency Physician
2. General / Trauma Surgeon
3. Anaesthesiologist

2.6 Exceptional Circumstances

In situations where the TASH score cannot be reliably calculated (e.g., inability to obtain blood samples, arterial blood gas analyser failure in ETD, or unreliable laboratory parameters), the decision to activate MTP should be based on **clinical assessment and**

judgement by attending specialists from a t l e a s t two different departments (Emergency Physician, General Surgeon, or Anaesthesiologist).

2.7 Communication during MTP Activation

- Once decision for MTP activation has been made, the medical officer will call the Blood Bank MO on call and convey only these essential messages:
  - Name of patient
  - Patient ID / passport
  - Diagnosis
  - TASH Score (calculated from the TASH score slip)
  - Name of Specialist / Specialists who activates the MTP (depending on TASH score)
  - MTP clinical coordinator (medical officer) - name, phone number or speed dial
  - History of Safe O / blood component transfusion
  - Location of activation
  - Estimated patient body weight (in 10 kg increments, e.g. 80 kg), to guide cryoprecipitate dosing if ROTEM indicates low fibrinogen.
- No other details should be given.

- In response to that, Blood Bank MO should convey the following instruction/information if MTP activation is allowed; Clinical coordinator to:
  - Send samples and forms from MTP Activation Kit (3 tubes including one ROTEM tube, and 3 GXM forms and 1 TASH Score Slip),
  - Be informed that MTP will start with Box1a.
  - To strictly use walkie talkie to Blood Bank coordinator (MO BB during office hour and MLT BB after office hour)
  - Update MTP continuation/termination after 60 minutes of supply of every MTP cycle.

- When the MTP is ongoing, both the Clinical Coordinator and Blood Bank Coordinator must:

  - Be fully aware of the contents and quantity of blood/blood components in each MTP box.
  - Clearly identify the current MTP phase and box, whether:
    - Box A: PRBC ± other empirical components, or
    - Box B: targeted blood component therapy based on ROTEM result.
  - Ensure the Runner is assigned, available, and understands their responsibilities throughout the MTP process.

2.8 Termination of Massive Transfusion Protocol (MTP)

• The Massive Transfusion Protocol (MTP) should be terminated once appropriate clinical endpoints have been achieved in order to optimise resource utilisation and avoid unnecessary transfusion.

• Clinical endpoints suggesting termination of MTP include **haemodynamic stabilisation, effective control of the bleeding source, and absence of ongoing major haemorrhage**.

• The responsibility to terminate the MTP lies with the attending specialist:
– In the **Emergency and Trauma Department (ETD)**, the Emergency Physician or General Surgeon is responsible for terminating the MTP.
– In the **Operation Theatre (OT) or Intensive Care Unit (ICU)**, the Anaesthesiologist or General Surgeon is responsible.

• For subsequent MTP boxes, the **MTP coordinator** must contact the Blood Bank to inform whether the next MTP box is required or if the protocol should be stood down.

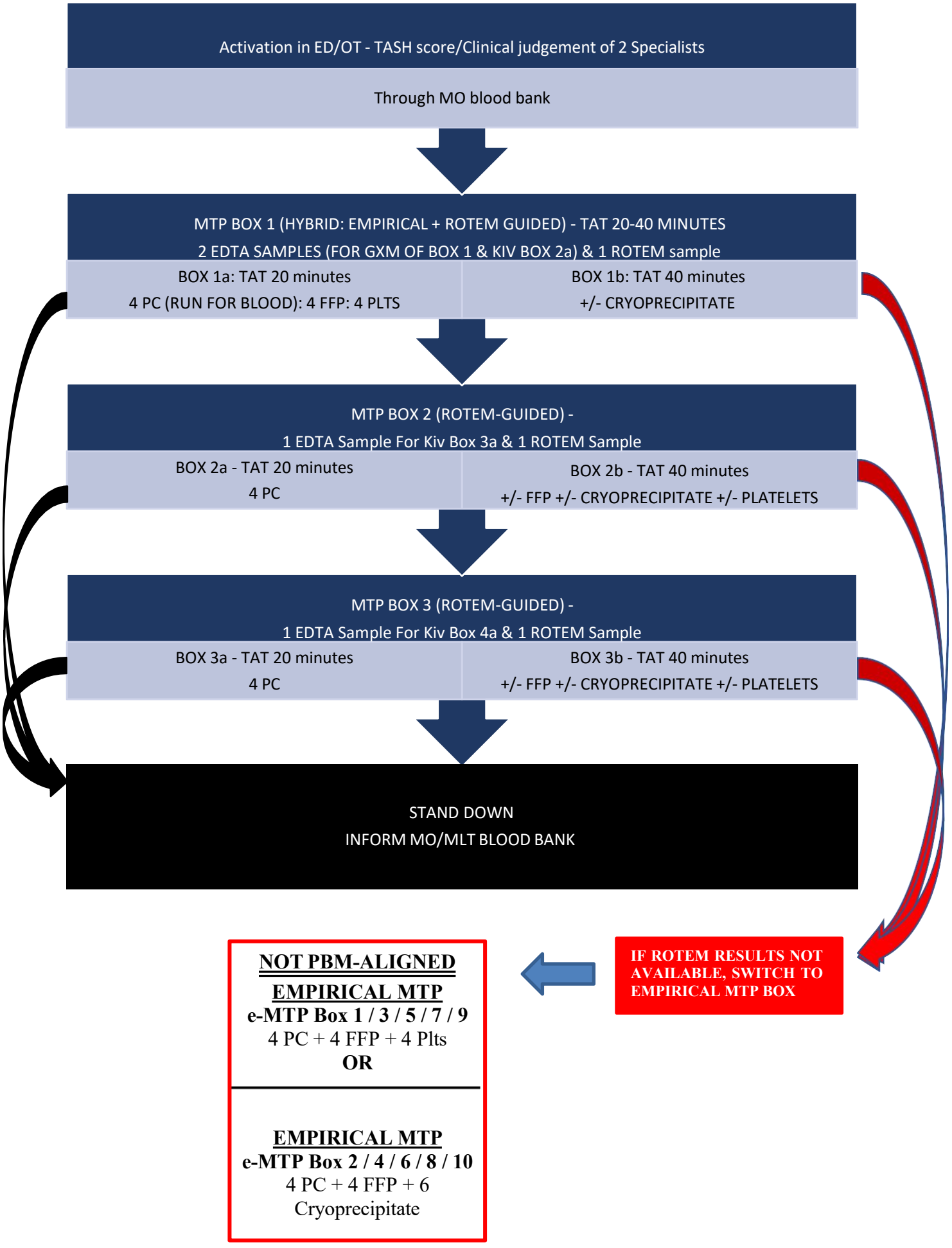
• If no update is received, **Blood Bank staff will contact the MTP coordinator one hour after the release of an MTP box** to confirm whether the MTP should be continued or terminated. Clear communication between both parties is required before standing down the MTP.

• Premature termination of MTP should be avoided, as this may lead to delayed or reactive transfusion and compromise effective haemostatic resuscitation.

TABLE 1: Trauma Associated Severe Haemorrhage (TASH) Score

Variables	Points
Haemoglobin (g/dl) < 7 < 9 < 10 < 11 < 12	 8 6 4 3 2
Base excess (mmol/L) < -10 < - 6 < - 2	 4 3 1
Systolic Blood Pressure (mmHg) < 100 < 120	 4 1
Heart rate (beats/min) > 120	2
Free intraabdominal fluid (e.g. by FAST)	3
Clinically unstable pelvic fracture	6
Open or dislocated femur fracture	3
Male gender	1

3.0 ROTEM-GUIDED MTP ALGORITHM (R-MTP)



3.1 Content of Blood Box

In R-MTP, every cycle of MTP will have two boxes, Box a and Box b.

- **MTP Box 1a:**
  - 2 or 4 units emergency cross-matched PC (depending on the previous Safe O supplied),
  - 4 units FFP, 4 units Platelet.
- **MTP Box 1b:**
  - Cryoprecipitate if indicated based on ROTEM results
  - Untransfused non-indicated FFP/platelets from Box 1a should be returned to transfusion medicine laboratory
  - After one hour after receiving Box 1, the Blood Bank coordinator should be notified if MTP is to be continued.
- **MTP Box 2a:**
  - 4 units emergency cross-matched PC only
- **MTP Box 2b**
  - ± FFP ± Platelet ± Cryoprecipitate based on ROTEM results
  - Box 2b can be NOT supplied at all if ROTEM indicated normal temogram results. (need to convey to the Surgeon or Anaesthesiologist in the OT)

Subsequent MTP Box

- Follow as per MTP Box 2a and 2b

All unused blood and products must be returned to blood bank immediately upon stand-down.

3.2 ROTEM Sampling and Processing Requirements

1. Timing of Sampling
   ROTEM sampling shall be performed at least 10 minutes after the last haemostatic component transfusion (FFP, platelets, or cryoprecipitate; excluding packed cells) to avoid inaccurate results.
2. Sample Tube Specification
   ROTEM testing requires a 2.7 mL sodium citrate tube, which is supplied exclusively in the MTP Kit. This tube must not be substituted with a 1.8 mL sodium citrate tube.
3. Sample Volume Requirement
   The blood sample must be filled exactly to the 2.7 mL mark. Underfilling may result in test failure and wastage of the ROTEM cartridge.
4. Sample Collection Technique

If the tube vacuum is insufficient to achieve the required fill volume, the cap may be carefully removed to allow blood transfer from a syringe. Blood should be allowed to flow passively into the tube. Do not apply pressure on the syringe during transfer, as this may affect test integrity.

5. Sample Source Consideration
   Arterial blood sampling is not recommended as first-line and should only be performed if clinically necessary. If arterial sampling is used, a non-heparinised syringe must be used, as pre-filled heparin may interfere with ROTEM results
6. Sample Handling
   The tube shall be gently inverted three (3) times immediately after collection to ensure adequate mixing.

3.3 Failure of ROTEM Testing

If ROTEM testing cannot be performed (e.g. sample rejection or failure of result transmission), management shall revert to empirical MTP (E-MTP):

- Box 2: PRBC ×4, FFP ×4, Cryoprecipitate ×6
- Box 3: PRBC ×4, FFP ×4, Platelets ×4

3.4 Turnaround Time for R-MTP Box b

The expected turnaround time for every R-MTP Box b is approximately **40 minutes**, comprising:

- 15 minutes: ROTEM result availability
- 20 minutes: Preparation of haemostatic components
- 5 minutes: Registration and processing

4.0 TARGET OF R-MTP

No	TYPE OF TARGETS	PARAMETERS	TARGET VALUES
1	**PRIMARY HAEMOSTATIC TARGET**	**ROTEM Parameters**	Normal within reference ranges **OR** Abnormal values not meeting thresholds for blood component transfusion intervention
2	ADJUNCT HAEMATOLOGIC TARGET	Hb	7-9 g/dl
3	ADJUNCT HAEMOSTATIC TARGET	Platelets	>50 × 10^9/L Traumatic brain injury: Platelet >100 x 10^9/L
		PT ratio or APTT ratio	<1.5
		Fibrinogen	>2.0 g/L
4	ADJUNCT PERFUSION TARGET	Lactate	<4 mmol/L
		Base excess	≥–6 mmol/L
5	ADJUNCT PHYSIOLOGY TARGET	Ionised Ca^{2+}	1.1-1.3mmol/L
		pH	>7.2
		Core Temperature	≥36℃

5.0 MTP SAMPLE COLLECTION AND BLOOD REQUEST

5.1 Initial Considerations

If an initial blood sample is not available, the patient must be transfused with Safe O blood, followed by blood sampling as soon as feasible.

5.2 Sample Requirements

5.2.1 MTP Activation

- Two (2) EDTA tubes
- One (1) Sodium Citrate tube (2.7 mL) for ROTEM

5.2.2 MTP Continuation

- One (1) EDTA tube
- One (1) Sodium Citrate tube (2.7 mL) for ROTEM

5.3 Sample Volume Requirement

No	Sample tube	Indication	Volume	Effect of insufficient sample
1	EDTA	ABO grouping Urgent Crossmatching for packed cells	1.5 - 2.5mls	Crossmatched and ABO grouping cannot be tested Inaccurate ABO grouping
2	ROTEM (Sodium Citrate)	ROTEM	2.7ml NOT 1.8ml	Cannot proceed ROTEM test, but wasting cartridge (~RM700/cartridge)

Therefore, total sample requirement from a single venepuncture will be 9-10mls for MTP activation and 6-7mls MTP continuation.

5.4 Blood Request Form Requirements (GXM form = PER-SS-BT 105 (Pind. 1/2016) form]

- For MTP Activation: Three (3) completed GXM forms are required
- For MTP Continuation: Two (2) completed GXM forms are required
- All GXM forms must be completed accurately and submitted together with the corresponding specimens

5.5 Patient Identification and Specimen Labelling

- Patient Name
- Identification Number (IC or Passport)
- Registration Number (RN – ETD Registration Number)
- Labelling must be clear, legible and consistent across all specimens and forms

5.6 Acceptable Identification Discrepancy

- Minor discrepancies may be accepted if at least two (2) out of three (3) identifiers are correct
- Must be verified and discussed with the treating doctor prior to processing

5.7 Unknown Patient Identification

- UNKNOWN + ED RN + Year (e.g., UNKNOWN 1234523 2026)
- Must be used consistently and **REMAIN UNCHANGED** until identity is confirmed or MTP is terminated

5.8 Additional Required Information

- Patient location
- Name and contact number of the MTP Activator
- Name and contact number of the MTP Coordinator

5.9 Baseline Laboratory Investigations

- Full Blood Count (FBC)
- Arterial Blood Gas (ABG)
- Grouping and Crossmatch (GXM)
- Renal profile (BUSE/Creatinine)
- Coagulation profile: PT/APTT and Fibrinogen level

5.10 MTP Labelling Requirement

- All GXM forms must be stamped “MTP” in red ink
- MTP stamp is available in ETD and OT

6.0 MTP KITS AND EQUIPMENTS

6.1 MTP Kit Preparation and Availability

- Dedicated personnel are responsible for preparation of MTP kits
- A minimum of five (5) kits must be available in ETD and OT

6.2 MTP Kit Composition

6.2.1 MTP Activation Kit (Box 1)

- Two (2) EDTA tubes
- One (1) Sodium Citrate tube (2.7 mL)
- Three (3) GXM forms
- TASH score calculation table - to be filled and sent together with the GXM forms (Appendix 4 & 5).

6.2.2 MTP Continuation Kit (Box 2)

- One (1) EDTA tube
- One (1) Sodium Citrate tube (2.7 mL)
- Two (2) GXM forms

6.3 Equipment Requirements

- Level 1 fast flow fluid warmer with air detector
- Standard blood administration set with filter

6.4 MTP Blood Box Design and Handling

- MTP boxes must be used instead of standard ward boxes
- Platelets placed in sealed bags and attached outside
- GXM forms attached outside with box number and component details

A text here
Appendix 4

7.0 MTP COORDINATION, COMMUNICATION AND LOGISTICS

7.1 MTP Coordinator

• The initial MTP clinical coordinator shall be the Surgical Medical Officer (MO) on call in ETD when the MTP is activated in the Emergency and Trauma Department.

• The coordinator is responsible for ensuring that:

- Blood samples are sent promptly to the Blood Bank
- MTP boxes are received and distributed appropriately
- Communication with the Blood Bank is maintained throughout the MTP activation

• Once the patient is transferred to the Operating Theatre (OT), the role of MTP coordinator will be handed over to the Anaesthesiology MO or Anaesthesiology Specialist in charge of the OT.

• All MTP coordinators will be provided with a walkie-talkie to facilitate direct communication with the Blood Bank staff.

7.2 Blood Bank Coordinator

The Blood Bank coordinator responsible for communication during MTP activation will be:

• Office hours: Blood Bank Medical Officer (MO)
• After office hours: Blood Bank Medical Laboratory Technologist (MLT)

The Blood Bank coordinator will manage:

- Preparation and release of MTP boxes
- Communication with the clinical MTP coordinator
- Monitoring of the MTP cycle until stand-down

7.3 Runner

• The runner is responsible for collecting MTP boxes from the Blood Bank and delivering them to the clinical area.

• The first MTP box will be collected by the House Officer from ETD.

• Subsequent MTP boxes will be collected by the House Officer from the male surgical ward, who will also carries walkie-talkie MTP2.

- Upon transfer of patient to OT, the runner will be the same House Officer from surgical department.

- After collecting MTP Box A, the runner must personally return to the Blood Bank counter and remain on standby (KIV) for collection of Box B.

7.4 Walkie-Talkie Communication System

Once MTP is activated, the House Officer will proceed to the Blood Bank to collect MTP Box 1 together with the walkie-talkies.

Three walkie-talkies are designated for MTP communication:

Walkie-Talkie	Assigned User
WT MTP1	Clinical MTP Coordinator (Surgical / Anesth)
WT MTP2	Runner responsible for transporting MTP boxes
WT MTP3	*Blood Bank Coordinator

* Office hour - MO BB
* After office hour - MLT BB

Communication between the clinical coordinator and the Blood Bank coordinator should be maintained through the walkie-talkies throughout the MTP activation until MTP stand-down.

If there is poor walkie-talkie signal coverage (e.g., OT 7–10) or battery exhaustion, communication should be established via telephone between the clinical coordinator and Blood Bank coordinator (MO BB, whether during office hour or after office hour).

7.5 Walkie-Talkie Handover

• MTP1 will initially be held by the Surgical coordinator in ETD.

• If the patient is transferred to the Operating Theatre, MTP1 must be handed over to the Anaesthesiology coordinator in OT.

• MTP2 will be carried by the runner (usually the House Officer) who is responsible for transporting the MTP boxes.

• When the patient is transferred from ETD to OT, the Surgical runner will hand over MTP2 to the OT runner.

• Upon MTP stand-down, all walkie-talkies must be returned to the Blood Bank for safekeeping and charging.

7.6 MTP Box Collection

• MTP boxes are stored in the Blood Bank.

• When collecting MTP boxes, do not delay collection by performing additional checks at the Blood Bank counter or OT airlock.

• However, it is mandatory for two personnel to perform bedside verification of patient identity and blood components prior to transfusion (Positive Patient Identification)

• Rapid transport of MTP boxes to the clinical area is essential to ensure timely transfusion during massive haemorrhage.

7.7 Blood Transfusion Documentation

• Blood transfusion charts, blood labels, checklists and relevant stickers will be made available in:

- Emergency Department (ETD)
- Operating Theatre (OT)

• These documents must be completed appropriately during each MTP cycle.

7.8 Sequence of Blood and Blood Products Transfusion

When multiple blood components are indicated and must be transfused sequentially through the same intravenous line, the following sequence is recommended:

1. Single Intravenous Access

• Platelet Concentrate → Cryoprecipitate → Fresh Frozen Plasma (FFP) → Packed

Cells (PC)

Platelets should be transfused first as they are more susceptible to loss of function and should not be delayed.

2. Dual Intravenous Access

When two IV lines are available, components may be administered simultaneously:

First IV access:

• Packed Cells (PC)

Second IV access (sequential):

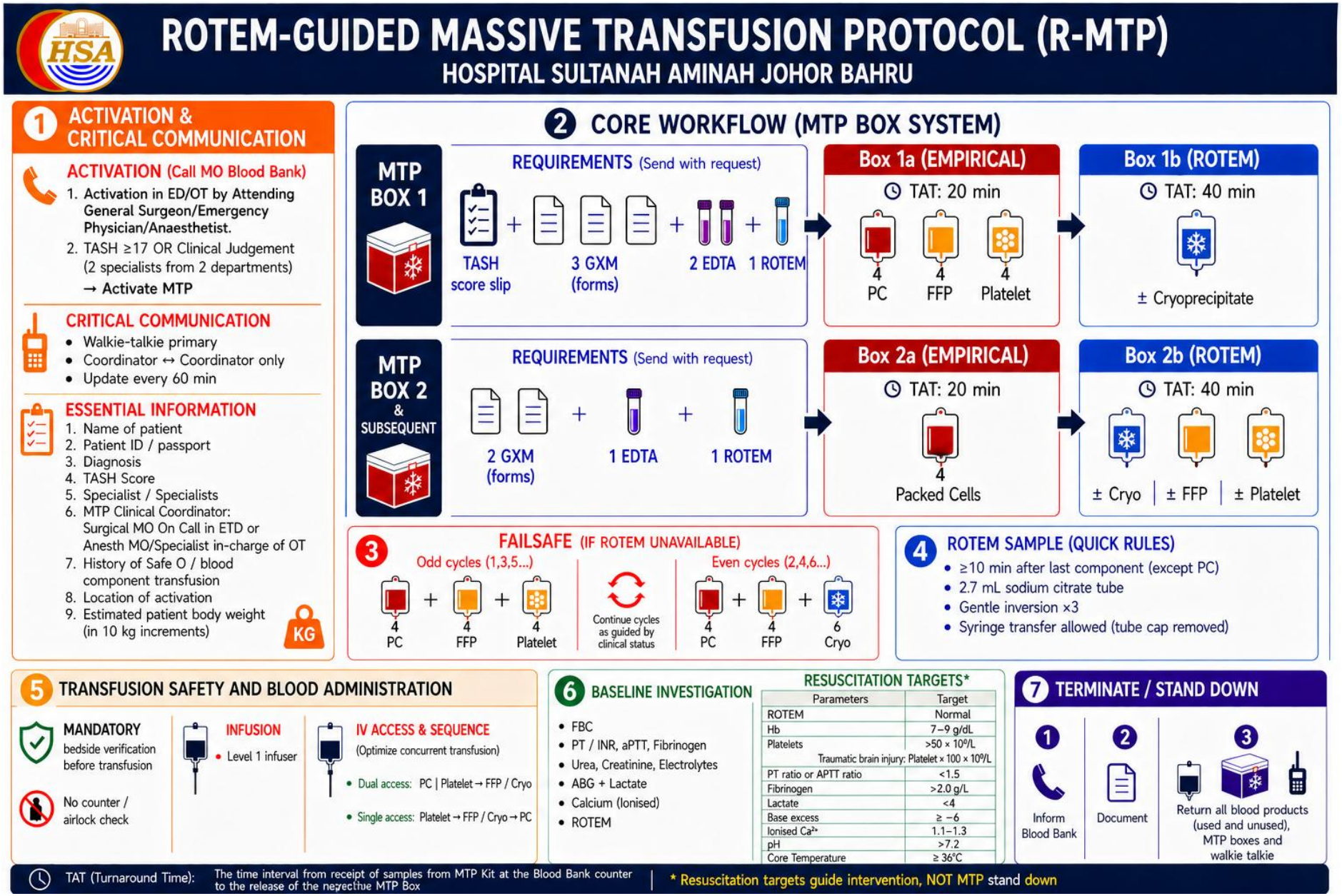
• Platelet Concentrate → Cryoprecipitate → Fresh Frozen Plasma (FFP)

Notes

• Platelets should ideally be transfused through a dedicated line whenever possible.

• Blood components must be transfused through a standard blood administration set with a filter (170–200 μm).

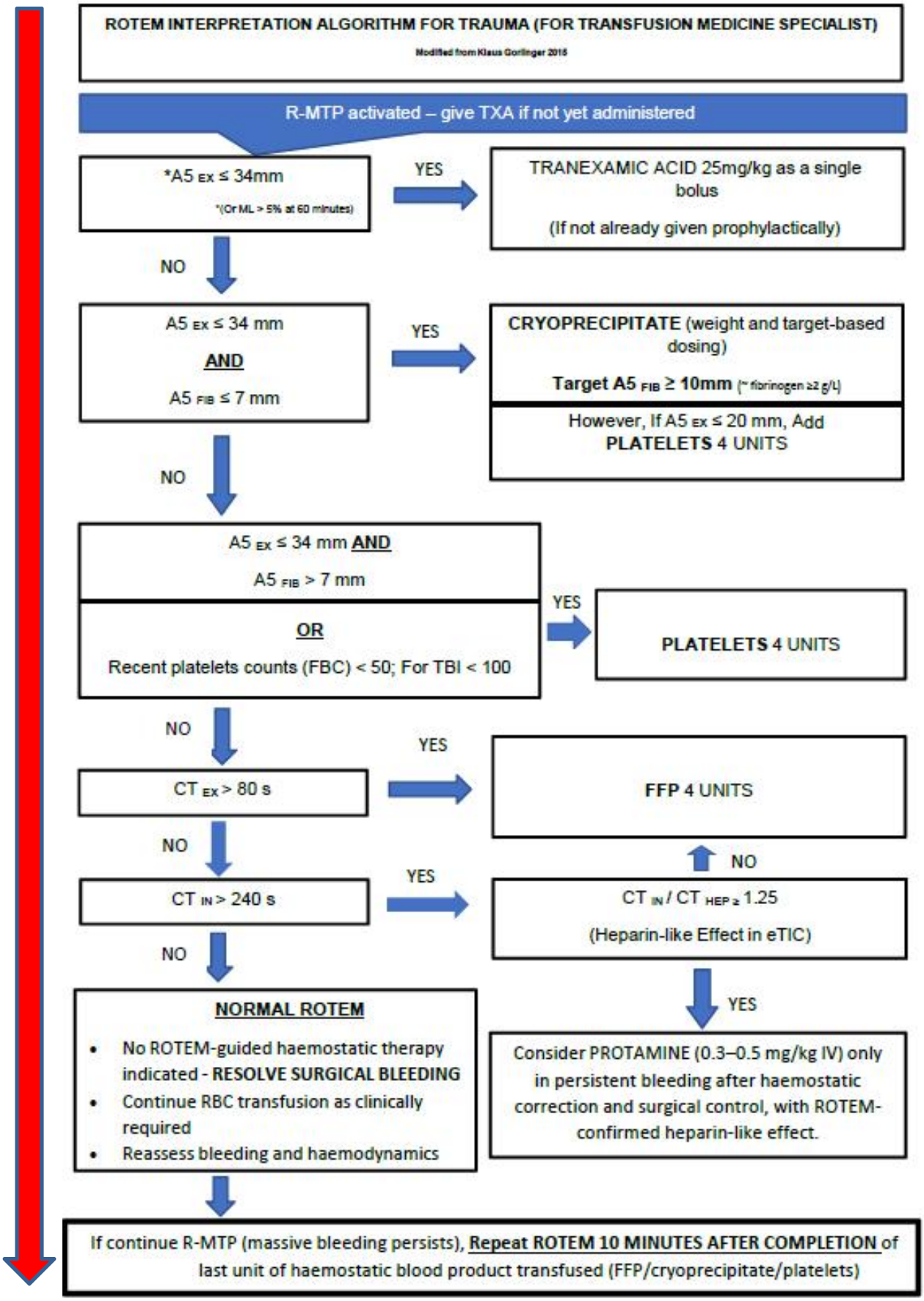
ONE PAGE SUMMARY FOR R-MTP WORKFLOW **APPENDIX 1**



ROTEM INTERPRETATION ALGORITHM FOR TRAUMA **APPENDIX 2**

Appendix 4

(FOR TRANSFUSION MEDICINE SPECIALIST)

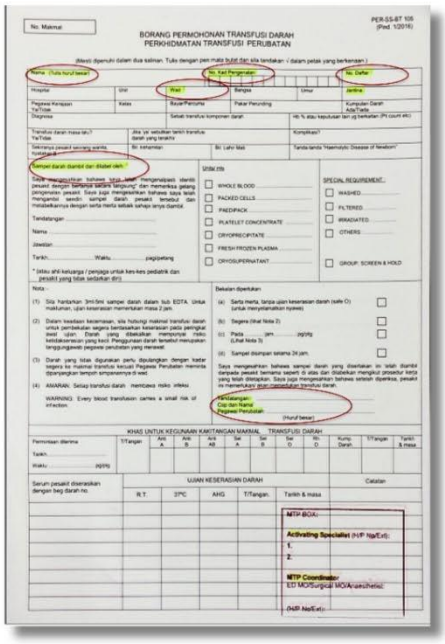


MTP ACTIVATION KIT **APPENDIX 3**

MTP ACTIVATION KIT

3 GXM MTP forms

2 EDTA tubes



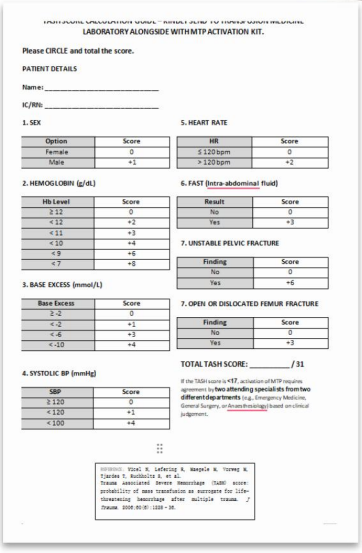
1 ROTEM tube

1 biohazard plastic bag

Tube filling mark

*ROTEM Tube

- 2.7mls Sodium Citrate Tube (not 1.8mls)
- Sample must NOT be less than 2.7 ML (refer tube filling mark)
- Labelled with 3 identifiers



LABORATORY ALONGSIDE WITH MTP ACTIVATION KIT.

Please CIRCLE and total the score.

PATIENT DETAILS

Name:_____

IC/RN: _____

1. SEX

Option	Score
Female	0
Male	+1

2. HEMOGLOBIN (g/dL)

Hb Level	Score
≥ 12	0
< 12	+2
< 11	+3
< 10	+4
< 9	+6
< 7	+8

3. BASE EXCESS (mmol/L)

Base Excess	Score
≥ -2	0
< -2	+1
< -6	+3
< -10	+4

4. SYSTOLIC BP (mmHg)

SBP	Score
≥ 120	0
< 120	+1
< 100	+4

5. HEART RATE

HR	Score
≤ 120bpm	0
> 120bpm	+2

6. FAST (Intra-abdominal fluid)

Result	Score
No	0
Yes	+3

7. UNSTABLE PELVIC FRACTURE

Finding	Score
No	0
Yes	+6

7. OPEN OR DISLOCATED FEMUR FRACTURE

Finding	Score
No	0
Yes	+3

TOTAL TASH SCORE: _____ / 31

If the TASH score is ≥17, activation of MTP requires agreement by **two attending specialists from two different departments** (e.g., Emergency Medicine, General Surgery, or Anaesthesiology) based on clinical judgment.

REFERENCE: Vidal M, Lefering R, Maegele M, Yorvey M, Tjardes T, Ruchholtz S, et al. Trauma associated Severe Hemorrhage (TASH) score: probability of mass transfusion as surrogate for life-threatening hemorrhage after multiple trauma. J Trauma. 2008;60(6):1228–36.

TASH Score Slip

Appendix 4

ROTEM GUIDED-MASSIVE TRANSFUSION PROTOCOL (R-MTP):

TASH SCORE CALCULATION SLIP

Please fill up this form and send to Transfusion Medicine Laboratory **alongside with items from MTP Activation Kit.**

PATIENT DETAILS

Name: _____

IC/RN: _____

***Please CIRCLE and total the score.**

1. SEX

Option	Score
Female	0
Male	+1

2. HEMOGLOBIN (g/dL)

Hb Level	Score
≥ 12	0
< 12	+2
< 11	+3
< 10	+4
< 9	+6
< 7	+8

3. BASE EXCESS (mmol/L)

Base Excess	Score
≥ -2	0
< -2	+1
< -6	+3
< -10	+4

4. SYSTOLIC BP (mmHg)

SBP	Score
≥ 120	0
< 120	+1
< 100	+4

5. HEART RATE

HR	Score
≤ 120 bpm	0
> 120 bpm	+2

6. FAST (Intra-abdominal fluid)

Result	Score
No	0
Yes	+3

7. UNSTABLE PELVIC FRACTURE

Finding	Score
No	0
Yes	+6

7. OPEN OR DISLOCATED FEMUR FRACTURE

Finding	Score
No	0
Yes	+3

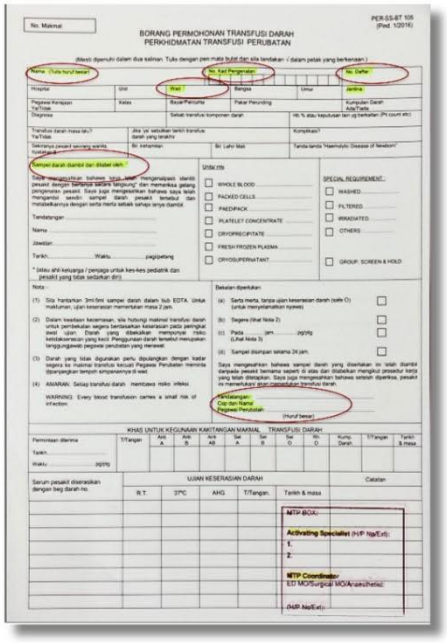
TOTAL TASH SCORE: _____ / 31

If the TASH score is **<17**, activation of MTP requires agreement by **two attending specialists from two different departments** (e.g., Emergency Medicine, General Surgery, or Anaesthesiology) based on clinical judgement.

REFERENCE: Yücel N, Lefering R, Maegele M, Vorweg M, Tjardes T, Ruchholtz S, et al. Trauma Associated Severe Hemorrhage (TASH) score: probability of mass transfusion as surrogate for life-threatening hemorrhage after multiple trauma. *J Trauma.* 2006;60(6):1228–36.

MTP CONTINUATION KIT

2 GXM MTP forms



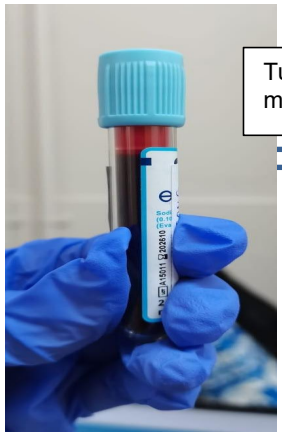
1 EDTA tubes

1 ROTEM tube

1 biohazard plastic bag

*ROTEM Tube

- 2.7mls Sodium Citrate Tube (not 1.8mls)
- Sample must NOT be less than 2.7 ML (refer tube filling mark)
- Labelled with 3 identifiers



Tube filling mark

MTP BLOOD REQUEST FORM

APPENDIX 6

No. Makmal:

PER-SS-BT 105
(Pind. 1/2016)

BORANG PERMOHONAN TRANSFUSI DARAH
PERKHIDMATAN TRANSFUSI PERUBATAN

(Mesti dipenuhi dalam dua salinan. Tulis dengan pen mata bulat dan sila tandakan √ dalam petak yang berkenaan.)

Nama (Tulis huruf besar)		No. Kad Pengenalan			No. Daftar
Hospital	Unit	Wad	Bangsa	Umur	Jantina
Pegawai Kerajaan Ya/Tidak	Kelas	Bayar/Percuma	Pakar Perunding		Kumpulan Darah Ada/Tiada
Diagnosa		Sebab transfusi komponen darah			Hb % atau keputusan lain yg berkaitan (Plt count etc)
Transfusi darah masa lalu? Ya/Tidak	Jika 'ya' sebutkan tarikh transfusi darah yang terakhir				Komplikasi?
Sekiranya pesakit seorang wanita, nyatakan #	Bil. kehamilan	Bil. Lahir Mati			Tanda-tanda "Haemolytic Disease of Newborn"

Sampel darah diambil dan dilabel oleh:

Saya mengesahkan bahawa saya telah mengenalpasti identiti pesakit dengan bertanya secara langsung* dan memeriksa gelang pengenalan pesakit. Saya juga mengesahkan bahawa saya telah mengambil sendiri sampel darah pesakit tersebut dan melabelkannya dengan serta merta sebaik sahaja ianya diambil.

Tandatangan .....

Nama .....

Jawatan.....

Tarikh.....Waktu.....pagi/petang

* (atau ahli keluarga / penjaga untuk kes-kes pediatrik dan pesakit yang tidak sedarkan diri)

Units/ mls

- ☐ WHOLE BLOOD .....
- ☐ PACKED CELLS .....
- ☐ PAEDIPACK .....
- ☐ PLATELET CONCENTRATE .....
- ☐ CRYOPRECIPITATE .....
- ☐ FRESH FROZEN PLASMA .....
- ☐ CRYOSUPERNATANT.....

SPECIAL REQUIREMENT :

- ☐ WASHED.....
- ☐ FILTERED.....
- ☐ IRRADIATED.....
- ☐ OTHERS : .....
- ☐ GROUP, SCREEN & HOLD

Nota: -

(1) Sila hantarkan 3ml-5ml sampel darah dalam tiub EDTA. Untuk makluman, ujian keserasian memerlukan masa 2 jam.

(2) Dalam keadaan kecemasan, sila hubungi makmal transfusi darah untuk pembekalan segera berdasarkan keserasian pada peringkat awal ujian. Darah yang dibekalkan mempunyai risiko ketidakserasian yang kecil. Penggunaan darah tersebut merupakan tanggungjawab pegawai perubatan yang merawat.

(3) Darah yang tidak digunakan perlu dipulangkan dengan kadar segera ke makmal transfusi kecuali Pegawai Perubatan meminta dipanjangkan tempoh simpanannya di wad.

(4) AMARAN: Setiap transfusi darah membawa risiko infeksi.

WARNING: Every blood transfusion carries a small risk of infection.

Bekalan diperlukan

(a) Serta merta, tanpa ujian keserasian darah (safe O) (untuk menyelamatkan nyawa) ☐

(b) Segera (lihat Nota 2) ☐

(c) Pada ..... jam.....pg/ptg (Lihat Nota 3) ☐

(d) Sampel disimpan selama 24 jam. ☐

Saya mengesahkan bahawa sampel darah yang disertakan ini telah diambil daripada pesakit bernama seperti di atas dan dilabelkan mengikut prosedur kerja yang telah ditetapkan. Saya juga mengesahkan bahawa setelah diperiksa, pesakit ini memerlukan/ akan memerlukan transfusi darah.

Tandatangan: .....
Cop dan Nama
Pegawai Perubatan: .....
(Huruf besar)

KHAS UNTUK KEGUNAAN KAKITANGAN MAKMAL TRANSFUSI DARAH

Permintaan diterima Tarikh..... Waktu .....pg/ptg	T/Tangan	Anti A	Anti B	Anti AB	Sel A	Sel B	Sel O	Rh D	Kump. Darah	T/Tangan	Tarikh & masa

Serum pesakit diserasikan dengan beg darah no.	UJIAN KESERASIAN DARAH					Catatan
	R.T.	37°C	AHG	T/Tangan.	Tarikh & masa	

*For unknown patient, his/her name will be identified as **UNKNOWN + ED RN + YEAR**
Example: **UNKNOWN 1234523**.
This UNKNOWN identification must be maintained until MTP termination.

MTP BOX:

Activating Specialist (H/P No/Ext):
1.
2.

MTP Coordinator
ED MO/Surgical MO/Anaesthetist:

(H/P No/Ext):

MTP BOX **APPENDIX 7**

LABELS FOR MTP BOXES ARE COLOUR CODED.
BOX A IS **RED IN COLOUR.**
BOX B IS **BLUE IN COLOUR.**
AFTER MTP STANDDOWN, CLINICAL TEAM SHALL RETURN ALL THE BOXES FOR SUBSEQUENT CASES.

WALKIE TALKIE COMMUNICATION **APPENDIX 8**

Communication

Walkie-talkie:

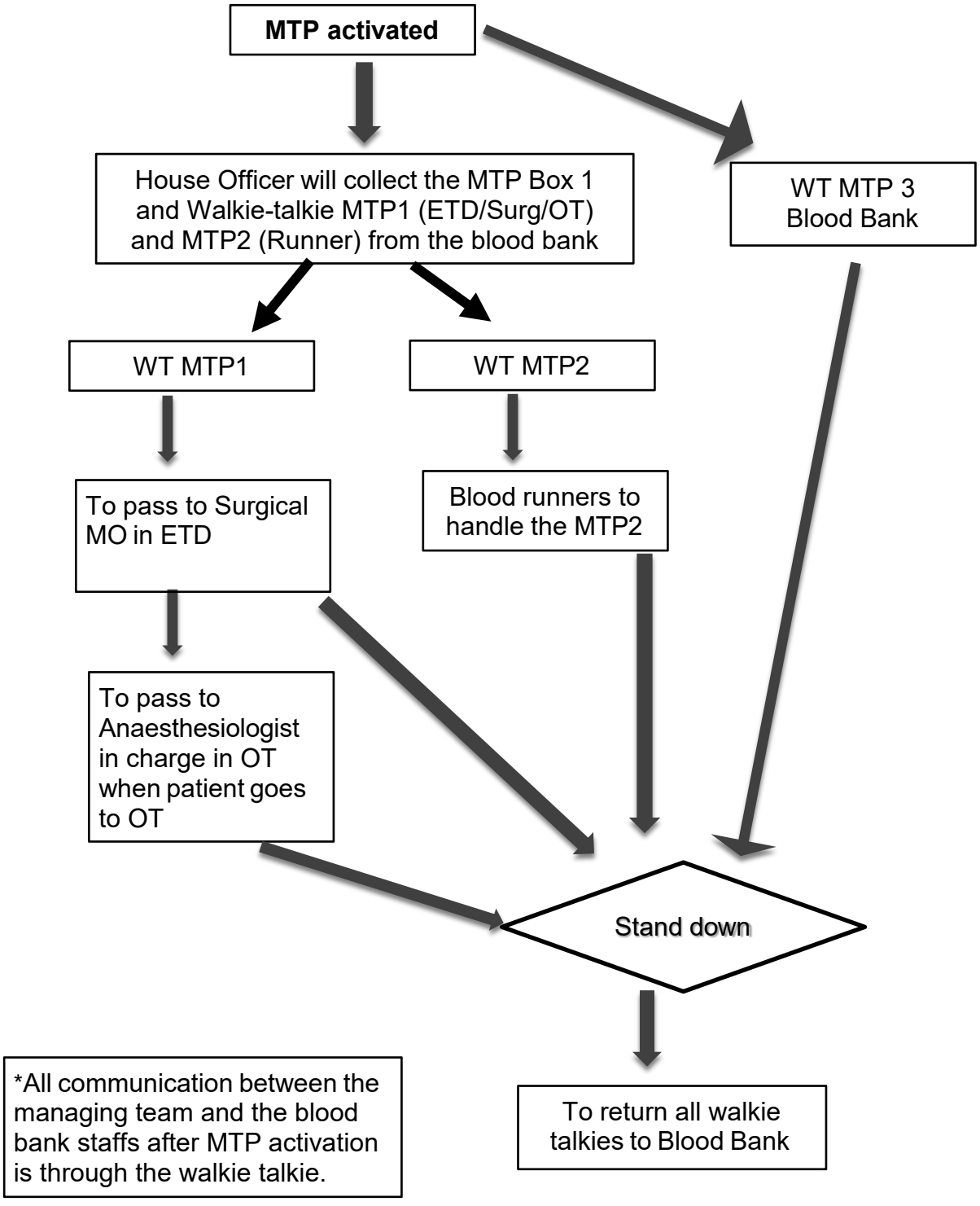
MTP 1 (Clinical Coordinator)

MTP 2 (Runner)

MTP 3 (BloodBank)

- Office hour – MO Blood Bank
- After Office hour – MLT 2 Blood Bank

WALKIE TALKIE COLLECTION, DISTRIBUTION AND RETURN APPENDIX 9



WALKIE TALKIE COMMUNICATION GUIDE **APPENDIX 10**

Standard Radio Format Appendix 4

- Use CLOSED-LOOP communication:

Caller → Receiver → Message → Confirm (Roger) → Roger and out

Caller
Blood Bank to Coordinator x2

Receiver
Coordinator to Blood Bank x2

Message
Blood Bank → Coordinator: ***Box 1b supplied already. Over***

Confirm
Coordinator → Blood Bank: ***Roger.***

End
Blood Bank → Coordinator: ***Roger and out.***

Other examples of message:

- Coordinator to Blood Bank x2— Walkie talkie received and communication channel established. Over.
- Runner to Blood Bank x2— Runner at counter ready to collect blood. Over.

Communication code:
”Over” – Menandakan anda telah selesai bercakap dan menunggu jawapan
”Roger” – Menandakan anda telah menerima dan memahami mesej
”Out” –Menandakan anda telah selesai berbual dan tidak menunggu jawapan ”Do you copy?” – Adakah anda boleh mendengar saya?
”Loud and clear” – Jelas
”Say again” – Ulang sekali lagi

- Always state who you are calling and who you are. Repeat two times.
- Use short and clear messages. Avoid long explanations.
- Only ONE communication channel to Blood Bank (via Coordinator-Coordinator).
- Confirm critical instructions such as MTP continuation, component supply, and stand-down.
- If no response, repeat walkie talkie twice before escalating to phone communication

MTP AUDIT FORM

APPENDIX 11

SECTION A: PATIENT'S AND MTP ACTIVATION DETAILS			
MTP reference number (e.g. 01/26)		**MTP Activating Specialists (2 Sp if TASH score <17)**	1.
Patient's name			2.
ID number			
RN number		**MTP Clinical Coordinator and Contact Number**	Surgical
Location			OT (Anaest):
Diagnosis		**Blood bank coordinator (MO / MLT 2)**	
Blood group (if available)		**MLT in-charge**	MLT 1:
			MLT 2:
Activation time and date			Additional MLT:

SECTION B: SAMPLE RECEIPT AND BLOOD PRODUCT ISSUANCE (TO BE FILLED BY MLT)			
Package No.	**Sample received (MLT)**	**Complete box preparation (MLT)**	**Collection (HO-Runner)**
BOX 1 **1a** ☐ 2 group specific (IS) ☐ 4 group specific (IS) 4 FFP 4 PLT	No. of EDTA sample : ROTEM sample : Yes/No Time:	Prepared by MLT 1 and 2 Time:	Collected by: Time:
1b (ROTEM) ☐ CRYO, ____unit		Prepared by MLT 2 Time:	Collected by: Time:
BOX 2 **2a** ☐ 4 group specific PC (IS)	No. of EDTA sample : ROTEM sample : Yes/No Time:	Prepared by MLT 1 Time:	Collected by: Time:
2b (ROTEM) ☐ FFP, ____unit ☐ CRYO, ____unit ☐ PLT, ____unit		Prepared by MLT 2 Time:	Collected by: Time:
In case MTP switch to empirical : **EMPIRICAL BOX 2** ☐ 4 group specific PC (IS) 4 FFP, 6 CRYO	N/A	Prepared by MLT 1 and 2 Time:	Collected by: Time:
BOX 3 **3a** ☐ 4 group specific PC (IS)	No. of EDTA sample : ROTEM sample : Yes/No Time:	Prepared by MLT 1 Time:	Collected by: Time:

3b (ROTEM) ☐ FFP, ____unit ☐ CRYO, ____unit ☐ PLT, ____unit		Prepared by MLT 2 Time:	Collected by: Time:
In case MTP switch to empirical : **EMPIRICAL BOX 3** ☐ 4 group specific PC (IS) 4 FFP 6 PLT	N/A	Prepared by MLT 1 and 2 Time:	Collected by: Time:
BOX 4 **4a** ☐ 4 group specific PC (IS)	No. of EDTA sample : ROTEM sample : Yes/No Time:	Prepared by MLT 1 Time:	Collected by: Time:
4b (ROTEM) ☐ FFP, ____unit ☐ CRYO, ____unit ☐ PLT, ____unit		Prepared by MLT 2 Time:	Collected by: Time:
In case MTP switch to empirical : **EMPIRICAL BOX 4** ☐ 4 group specific PC (IS) 4 FFP 6 CRYO	N/A	Prepared by MLT 1 and 2 Time:	Collected by: Time:
Deactivated by (Specialist)			
Deactivation date and time			
Any MTP Issues (MLT comment)?			

SECTION C: CLINICAL DETAILS (TO BE FILLED BY MEDICAL OFFICER)		
Primary Diagnosis	1.	
	2.	
Pre-MTP blood transfusion? YES/NO	If yes, please state how many units: _____ PACKED CELLS _____ PLT _____ FFP _____ CRYOPRECIPITATE	
Number of blood products transfused from MTP packages:	_____ PACKED CELLS (Specific Blood Group) _____ PLT _____ FFP _____ CRYOPRECIPITATE	
Any blood product wastage YES / NO	If yes, please state how many units : _____ PACKED CELLS _____ PLT _____ FFP _____ CRYOPRECIPITATE	
Outcome	Mortality within 24 hours	**Yes / No**
	If Yes, Cause of Death	
Any MTP issues (MO comment)?		

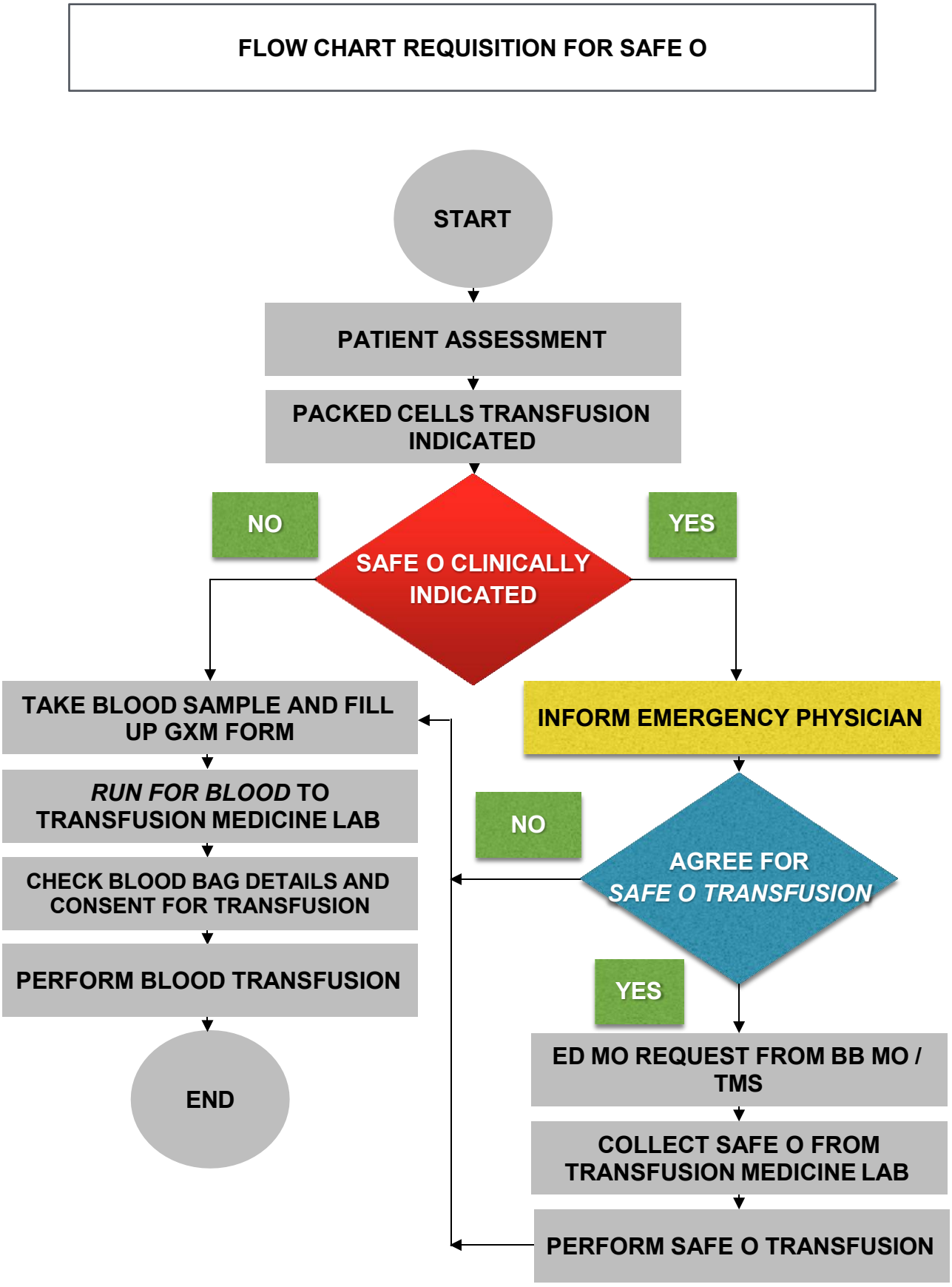
BLOOD AND BLOOD COMPONENT ADMINISTRATION CHART APPENDIX 12

MASSIVE TRANSFUSION PROTOCOL
BLOOD AND BLOOD COMPONENT ADMINISTRATION CHART
HOSPITAL SULTANAH AMINAH JOHOR BAHRU

NAME : _____
HOSPITAL RN # : _____ **ED RN #** : _____
COORDINATOR : _____ **ctc #:** _____

DATE & TIME RECEIVED	BLOOD COMPATIBILITY STICKERS	VERIFIED BY

FLOW CHART REQUISITION FOR SAFE O **APPENDIX 13**



NUMBER OF CRYOPRECIPITATE REQUIRED TO ACHIEVE TARGET A5 FIB OF 10MM; BASED ON PATIENT'S WEIGHT

	Targeted increase in A5FIB (mm)	WEIGHT (KG)								
		20	30	40	50	60	70	80	90	100
Unit of Cryoprecipitate to be supplied	1	1	1	1	1	1	2	2	2	2
	2	1	1	2	2	3	3	3	4	4
	3	1	2	3	3	4	4	5	6	6
	4	2	3	3	4	5	6	7	8	8
	5	2	3	4	5	6	7	8	9	10
	6	3	4	5	6	8	9	10	11	13
	7	3	4	6	7	9	10	12	13	15
	8	3	5	7	8	10	12	13	15	17
	9	4	6	8	9	11	13	15	17	19
	10	4	6	8	10	13	15	17	19	21

1 CRYOPRECIPITATE = 300 MG FIBRINOGEN (HSA LOCAL DATA)

TRAINING: TABLE TOP SIMULATION EXERCISE FOR R-MTP (TRANSFUSION MEDICINE STAFF) APPENDIX 15

1. **Participant Structure**

Role	Number
Role Player – Medical Officer	1
Role Player – MLT	2
Injector / Facilitator	1
Observer – Medical Officer	1
Observer – SO/MLT	1

2. Roles and Responsibilities

MO Blood Bank (MO BB)	MLT 1 – GXM	MLT 2 – ROTEM Processing and component preparation
- Verify MTP activation details and allow/reject MTP activation. - BB coordinator during office hour - **Communicate with clinical coordinator/runner** - **Receive ROTEM interpretation and decision from TMS** - **Coordinate TMS transfusion decisions** - **follow up MTP continuation and stand-down**	Receive EDTA samples - BBIS registration - Perform ABO grouping - Perform emergency crossmatch - Prepare and issue packed cells	- BB coordinator after office hour **- same role as MO (BOLD)** Receive ROTEM samples in analyzer - Verify sample identification and integrity - Register and perform ROTEM testing and inform TMS Prepare and issue blood component if indicated (plt, ffp, cryoprecipitate)

Transfusion Medicine Specialist - interpret ROTEM results and decide any blood product to transfuse (for Box b)

Scenario Background

A 35-year-old trauma patient is brought to the Emergency Department following a road traffic accident with active bleeding. The surgical coordinator activates Massive Transfusion Protocol (MTP).

Patient Name: Abu bin Ahmad
Patient ic no: 911210-01-5143 RN: 2426364

Time	Injector / Clinical coordinator	Expected response	Communication
MTP Activation Surgical coordinator calls Blood Bank to activate MTP. Information provided: Patient name, ID, trauma diagnosis, TASH score 17.	I am new in surgical. I don't know other details.	**<u>Expected Actions – MO BB</u>** Verify activation details • Ensure details of case: • pt name • pt id • diagnosis • tash score -Remind to write tash score in BHT • activated by which specialist • coordinator • location • estimated body weight (for fibrinogen calculation requirement) - 80kg • history of transfusion Inform: • Allow MTP activation • Send samples, forms and TASH score slip from Mtp Activation Kit • inform we will start with Box1a. • remind to use walkie talkie to BB coordinator (MO BB during	MO BB: -Call TMS -Call MLT on duty to initialize ROTEM and prepare Box 1a.

		office hour and MLT BB after office hour) • remind to update after 60 minutes	
T+0 min – Sample Arrival		MLT 1 actions - Verify 3 patient identifiers - Register BBIS - Perform ABO grouping - Perform emergency crossmatch MLT 2 actions Receive sample ROTEM (sufficient, 3 identifier), Critical communication: Run ROTEM sample and call TMS Thaw FFP and supply platelets in box 1a	MLT 2: Call TMS once running ROTEM 1 sample.
T+ 7 min – Box 1a Issued - 4 RBC - 4 FFP - 4 Platelet	Injector: Need checking of details blood bag/blood card/form at counter?	MLT 1 records product issue in BBIS. MLT 1: continue full crossmatch MLT 2: waiting for decision 1b from MO BB coordinator.	

<table>
<tr>
<td>T + 10 min - ED coordinator</td>
<td>Coordinator → Blood Bankx2:
Walkie-talkie from MTP kit received. Communication line established. Over</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T+15 min –

ROTEM Result 1

ROTEM 1
<table>
<tr><th>Parameter</th><th>Result</th></tr>
<tr><td>A5 EXTEM</td><td>32</td></tr>
<tr><td>A5 FIBTEM</td><td>5</td></tr>
<tr><td>CT EXTEM
CT INTEM</td><td>78
200</td></tr>
</table>
Fibrinogen deficiency</td>
<td>TMS decision: 5mm increment - 10 unit cryoprecipitate for 80kg</td>
<td></td>
<td>TMS: Call MO BB to inform ROTEM results and decision to transfuse cryoprecipitate if needed. If failed to contact MO, call MLT 2.

MO BB: Inform MLT to prepare X unit cryoprecipitate, if needed.</td>
</tr>
</table>

T+33 min – Box 1b Issued			MO BB: WT clinical coordinator: • Decision product to be transfused • Supplied product box1b • To return FFP/platelets if not indicated and not transfused yet. SCRIPT: ***Blood Bank to Coordinatorx2:*** *ROTEM result shows fibrinogen deficiency. TMS decision: transfuse 10 units cryoprecipitate. Make sure runner standby at blood bank counter. Return untransfused FFP dan platelets. Over* ***Coordinator to Blood Bankx2:*** *Copy that. Over*
T+35 min – Clinical Update	Clinical coordinator informs patient will be transferred to Operating Theatre.		
T+59 min – Clinical Update Continuation of MTP Box 2	OT coordinator thru walkie talkie. We want to continue with box 2 since patient still bleed a lot. SCRIPT ***OT Coordinator to Blood Bank 2x:*** *Patient still bleeding. Request continuation of MTP Box 2. Over*	MO BB Runner to send sample from MTP continuation kit. MO BB remind runner to come back after collecting box 2a.	MO BB: Call MLT on duty to prepare Box 2a

	Blood Bank to OT Coordinatorx2: *Roger. Please send MTP continuation samples – 1 EDTA and 1 ROTEM. Over*		
T+65 min – Sample MTP box 2 arrive		MLT 1 actions - Verify 3 patient identifiers - Keep the tube Prepare box 2a (packed cells) MLT 2 actions Receive sample ROTEM (sufficient, 3 identifier),	MLT 2: Call TMS once running ROTEM 2 sample.
T+70 min – Box 2a Issued Packed cells issued in Box 2a.			MO BB: Inform clinical coordinator Box2a supplied. *SCRIPT* ***Blood Bank → OT Coordinator:*** *Box 2a ready – packed cells. Over* ***OT Coordinator → Blood Bank:*** *Roger. Runner coming to collect. Over*

<table>
<tr>
<td>T+73 min – Communication Pressure Inject</td>
<td>Error Inject: ED repeatedly calling blood bank for ROTEM result updates to test communication handling.</td>
<td>MLT divert to MO BB (coordinator)
- Calls handled by MO BB
- Bench staff continue laboratory tasks
- Maintain single communication channel</td>
<td></td>
</tr>
<tr>
<td>T+80 min – ROTEM Results 2 available

Rotem 2
<table>
<tr><th>Parameter</th><th>Result</th></tr>
<tr><td>A5 EXTEM</td><td>32</td></tr>
<tr><td>A5 FIBTEM</td><td>2</td></tr>
<tr><td>CT EXTEM
CT INTEM</td><td>100
300</td></tr>
</table>
</td>
<td>TMS decision: 4 unit FFP, 16 unit cryoprecipitate for 80kg
TMS inform rotem 2 results and decision to transfuse 4unit ffp, 16 unit cryoprecipitate to MO BB.</td>
<td></td>
<td>TMS: Call MO BB to inform ROTEM results and decision to transfuse any blood product if needed. If failed to contact MO, call MLT 2.

MO BB:
- Inform MLT to prepare the components.
- WT clinical coordinator to inform components to transfuse if applicable.

SCRIPT
Blood Bank → Coordinatorx2: ROTEM shows severe fibrinogen deficiency and coagulation factors deficiency. TMS decision: transfuse 4 FFP and 16 cryoprecipitate. Runner to standby. Over
Coordinator → Blood Bankx2: Copy that. Proceed supply. Over</td>
</tr>
</table>

T+100 min – Box 2b supplied			MO BB: WT clinical coordinator and inform box 2b (X component) has been supplied (if applicable) *SCRIPT* ***Blood Bank to Coordinatorx2:*** *We supplied Box 2b – 4 units FFP and 16 cryoprecipitate. Over* ***Coordinator to Blood Bankx2:*** *Roger. Over*
T+115 min – MTP Stand-Down	OT coordinator WT informs bleeding controlled and MTP is stood down. Script ***OT Coordinator to Blood Bankx2:*** *Bleeding controlled. MTP stand down. Over* ***Blood Bank to OT Coordinatorx2:*** *Roger. MTP stand down recorded. Please return unused blood, used blood with blood card, walkie talkie and all MTP boxes. Over*	MO BB confirms stand-down and informs Blood Bank team in whatsapp group. MLT stops preparation, ensures unused components returned, and documents MTP termination.	

REFERENCES

1. Department of Statistics Malaysia. *Statistics on causes of death, Malaysia, 2025*. Putrajaya: Department of Statistics Malaysia; 2025.

2. Thomas Brockamp, Ulrike Nienaber, Manuel Mutschler et al. Predicting on-going hemorrhage and transfusion requirement after severe trauma: a validation of six scoring systems and algorithms on the TraumaRegister DGU Critical care 2012.

3. Cotton BA, Gunter OL, Isbell J, Au BK, Robertson AM, Morris JA Jr, St Jacques P, Young PP: Damage control hematology: The impact of a trauma exsanguination protocol on survival and blood product utilization. J Trauma 2008, 64:1177-1183.

4. Rossaint R, et al. The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition. Critical Care. 2023;27(1):80.

5. Ministry of Health Malaysia. *Consensus statement on patient blood management*. Putrajaya: Medical Development Division, Ministry of Health Malaysia; 2024.

6. Handbook on Clinical Use of Blood 3rd Edition 2020, Pusat Darah Negara.

7. Inaba K, Branco BC, Rhee P, Blackbourne LH, Holcomb JB, Teixeira PG, Shulman I, Nelson J, Demetriades D: Impact of plasma transfusion in trauma patients who do not require massive transfusion. J Am Coll Surg.
2010 Jun; 210(6):957-65