ROTEM USE – SCH

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- This guideline directs clinicians in the interpretation and use of results generated by the Rotem.
- Management of the bleeding patient utilises a clear step by step algorithm approach, utilising Point of Care results generated by The Rotem
- Initial management steps include administration of tranexamic acid and correction of the Fibtem A5 to at least 12 mm

CHANGE SUMMARY

- Due for mandatory review. No changes made in the guideline; however, the appendices have been updated and appendix 3 is new.

READ ACKNOWLEDGEMENT

- The following staff should read and acknowledge they have read this guideline:
  - SCH Anaesthetists
  - Relevant ICU staff
  - Relevant Emergency staff

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy Procedure and Guideline Committee	
Date Effective:	1st May 2023	**Review Period:** 3 years
Team Leader:	Senior Staff Specialist	**Area/Dept:** Anaesthetics POW

TABLE OF CONTENTS

Introduction

The ROTEM system utilises thromboelastography. These systems are designed for invitro diagnostics in the POC (Point of Care) environment. Bleeding during or after surgery requires differentiation between surgical induced bleeding and haemostasis disorders. The ROTEM system provides a quantitative and qualitative indication of the coagulation state of a blood sample in real time. The system records the kinetic changes in a sample of citrated whole blood during clot formation as well as when the sample clot retracts and /or lyses. Different parameters of the clotting are measured, analysed, monitored, interpreted, and charted for this purpose. The graphical presentation reflects the various physiological results, which describe the interaction between components such as coagulation factors and inhibitors, fibrinogen, platelets, and the fibrinolysis system. Additionally, the effect of certain drugs influencing haemostasis, in particular anticoagulants, can be detected. The use of Rotem has been widely established in paediatric anaesthesia and critical care medicine ([1,2,3,4]).

Purpose and Scope

This Guideline is for Clinicians who wish to utilise data from the Rotem. The guideline directs clinicians in the interpretation and use of results generated by the Rotem. Quality Control calibration and troubleshooting technical issues associated with running Rotem tests is beyond the scope of this Guideline.

Credentialing

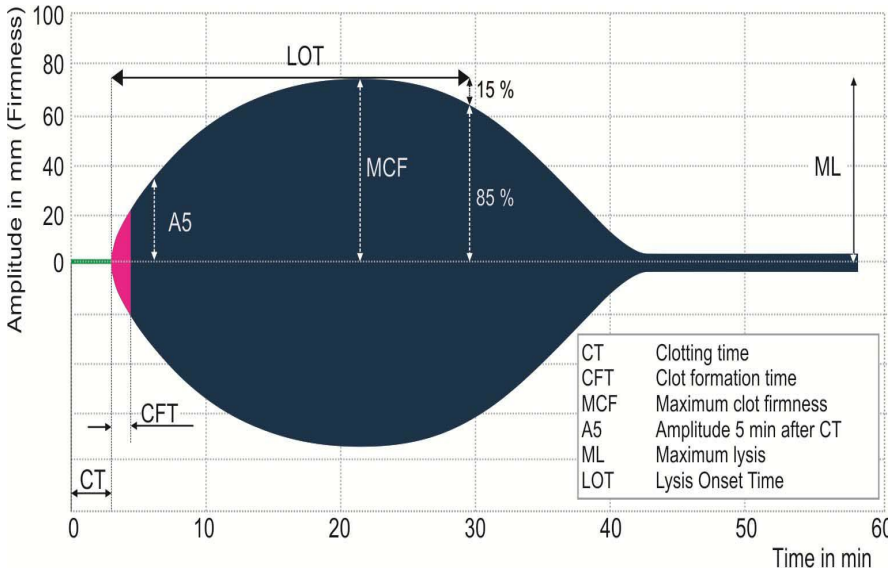
Medical officers and nursing staff running Rotem tests and Quality Controls must undergo training by the Anaesthesia CNC in charge of Rotem in RCOS.

Staff wishing to utilise the data from Rotem must read this Guideline. Staff are also encouraged to attend Rotem workshops that are organised annually in February or March by the Rotem working Party. This training has ANZCA CPD approval for the Mandatory Massive Transfusion CPD component.

Definitions

Rotem	Rotational thromboelastometry
Clotting Time (CT) s	Time from the beginning of the test until the time when an amplitude of 2 mm is achieved
Maximum Clot Firmness (MCF) mm	The maximum amplitude that is reached before the clot in mm
Lysis index at 30 min (LI30) %	The fibrinolysis 30 min after CT. It is the relation of the amplitude to the maximum clot firmness (% remaining clot firmness).
Maximum lysis (ML) %	The degree of fibrinolysis relative to maximum clot firmness (MCF) achieved during the measurement (% clot firmness lost).
A5, A10, A15 or A20 value	Clot firmness (or amplitude) obtained after 10, 15 or 20 minutes
Extem A5	Maximum amplitude of Extem Temogram at 5 minutes
Extem Maximum Lysis (ML)	% decrease in Extem amplitude at 60 min
Fibtem A5	Maximum amplitude of Fibtem at 5 minutes

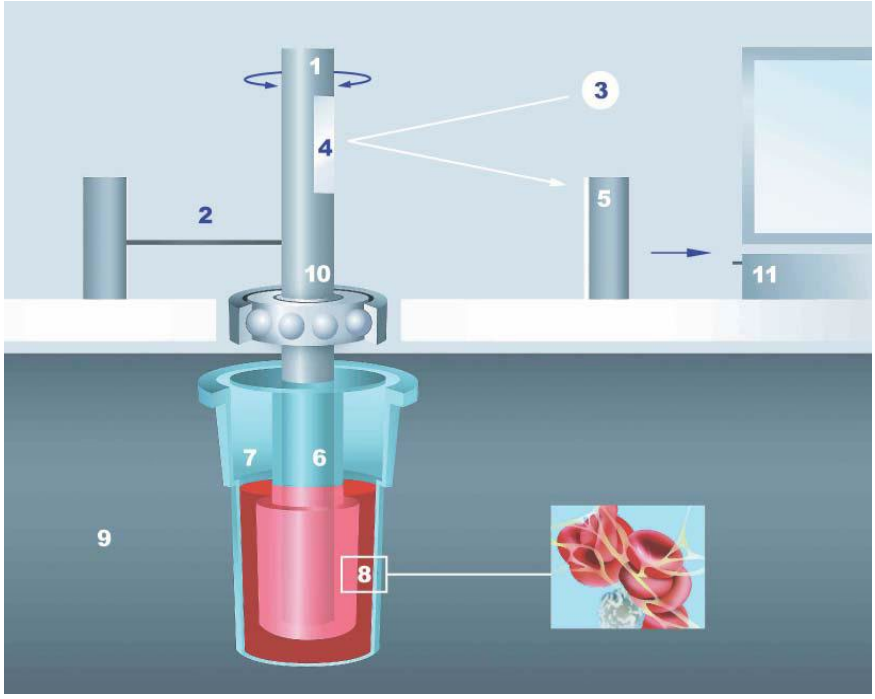
Thromboelastogram Parameters



The most important routine parameters

Background

ROTEM technology is based on a fixed cylindrical cup and a permanently oscillating vertical axis. For the measurement, the channel's measurement axis moves down into the plastic pin in the disposable cartridge. The blood sample is filled into the cartridge cup. The plastic pin is immersed into the blood sample. The rotation is detected optically via a mirror plate at the upper end of the axis, a diode as light source and a light sensitive sensor. If no clotting takes place, the movement is not obstructed. When a clot is formed and attaches itself between pin and cup surfaces, the movement is obstructed.



The result is a balance between the spring tension and the tension of the clot. As the clot becomes firmer, the rotational amplitude of the axis is reduced.

Principle of thromboelastometry with ROTEM

1 Axis (~4.75 °)
2 Spring
3 Light source/diode
4 Mirror
5 Detection device (electric camera)
6 Sensor pin
7 Cartridge cup filled with blood
8 Fibrin fibers and platelet aggregate
9 Heated cartridge
10 Ball bearings
11 Data processing

Reaction curve and parameters in thromboelastometry

Like in classical thrombolastography, the ROTEM system generates a reaction curve and calculates different numeric parameters in a mathematical analysis of that curve. The parameters are determined in real time during the tests, calculated, and are represented graphically in TEMograms. The rotation amplitude of the pin is converted into a graphical amplitude; thus, the following definition applies for the ROTEM system:

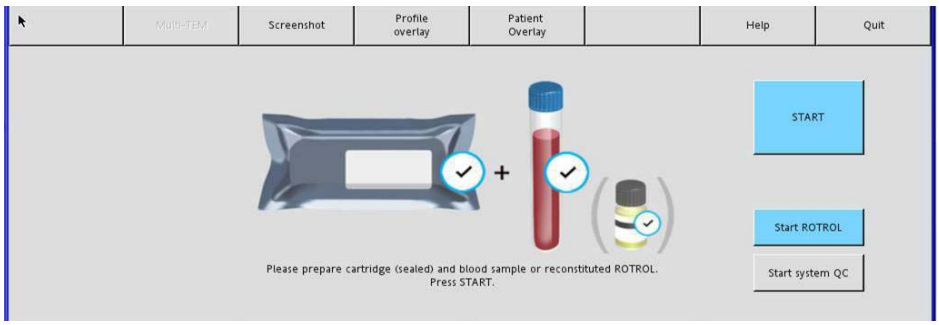
The ROTEM tests

Blood sample collection

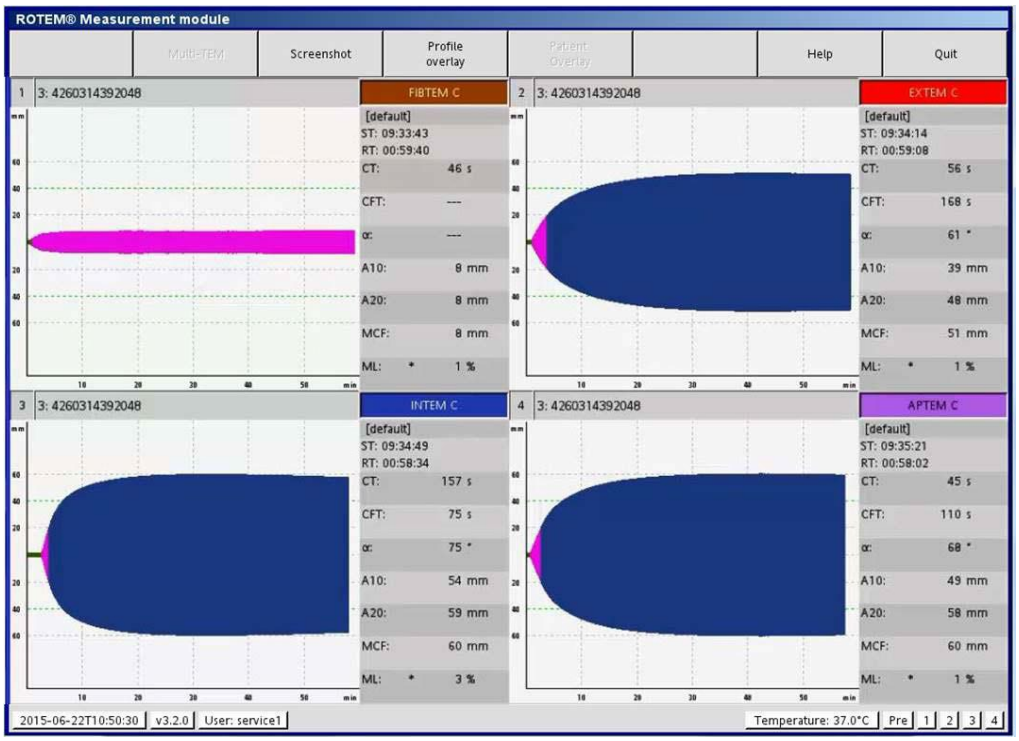
A minimum of 2.7 mL placed in a blue top citrated tube. Do not remove the top of the tube. Ensure the vacuum is not lost.

Performing patient measurements

1. Start the sequence with the START button



2. Follow the menu navigation.
3. During measurement, the Multi-TEM overview of all four channels evolves. Refer to the ROTEM Algorithm and SCH Rotem Dosage Schedule for interpretation and patient management. Only the Fibtem and Extem are used in the SCH Rotem algorithm.



Interpretation of Rotem results and Implementation of Rotem management Algorithm

Refer to Rotem management Algorithm and Dosage Schedule. (Appendix 1 and Appendix 2)

Call Blood Bank and notify that running a Rotem test. Blood bank will then anticipate likely products to be requested.

Dosage

For detailed explanation, please refer to Appendix 4: CRYOPRECIPITATE DOSAGE: BASIS FOR RECOMMENDATION

Apheresis Cryoprecipitate Dosage schedules to Correct Fibtem A5 to ≥ 12 mm

Fibtem A5 mm	Required rise in Fibtem A5 mm	Fibrinogen required mg	Apheresis Cryo. required mL/kg
0 to 3	12	120	8
4 to 5	8	80	5
6 to 7	6	60	4
8 to 9	4	40	3
10 to 11	2	20	1
≥12	0	0	0

Note: Dose calculations assumes 10 mg/kg IV fibrinogen raises Fibtem A5 by 1 mm, Fibtem A5 should be ≥ 12 mm and Fibrinogen concentration in apheresis cryoprecipitate is 15 mg/mL.

SCH Anaesthesia has Ethics approval to audit all Rotem data. Also, the Feisty Jnr trial which will be run at CHW and possibly SCH-Randwick, will function as a dose finding pilot study. Together these evolving dose data will allow fine tuning of dosage schedules into the near future.

Platelet Function studies should be considered when platelet function abnormality is suspected. This can only be provided on weekdays between 0900 and 1600 hours. Refer to appendix 3 for further details.

Documentation

Results of Rotem, including Fibtem A5 and Extem A5 to be included with the Medical Record. In the case of Anaesthesia, this will be with the Anaesthetic Medical Record. Also print a copy of the Temogram and include with the Patient's medical record.

Attachments

1. Appendix 1: Paed Transfusion Algorithm 2023
2. Appendix 2: Paed Cryo fibrinogen Dosing Schedule 2023
3. Appendix 3: Platelet function testing 2023
4. Appendix 4: Cryoprecipitate Dosage: Basis for Recommendation

References

1. Haas T, Goobie S, Spielmann N, Weiss M & Schmugge M. Improvements in patient blood management for pediatric craniosynostosis surgery using a ROTEM®-assisted strategy–feasibility and costs. Pediatric Anesthesia. 2014 July;24(7):774–780 https://doi.org/10.1111/pan.12341
2. Oswald E, Stalzer B, Heitz E, Weiss M, Schmugge M, Strasak A, Innerhofer P & Haas T. Thromboelastometry (ROTEM®) in children: age-related reference ranges and correlations with standard coagulation tests. British Journal of Anaesthesia. 2010 August;105(6): 827–35. https://bjanaesthesia.org/article/S0007-0912(17)33413-X/fulltext
3. Görlinger K, Pérez-Ferrer A, Dirkmann D, Saner F, Maegele M, Calatayud A, & Kim T. The role of evidence-based algorithms for rotational thromboelastometry-guided bleeding management. Korean Journal of Anesthesiology. 2019 August;72(4):297-322. https://doi.org/10.4097/kja.19169
4. Seebold JA, Campbell D, Wake E, Walters K, Ho D, Chan E, Bulmer AC, Wullschlegger M & Winearls J. Targeted fibrinogen concentrate use in severe traumatic haemorrhage. Critical Care and Resuscitation: Journal of the Australasian Academy of Critical Care Medicine. 2019 September; 21(3):171-178 https://anzca.on.worldcat.org/oclc/8212418577
5. Australian Red Cross Blood Service, Blood Products, Cryoprecipitate: https://transfusion.com.au/blood_products/components/cryoprecipitate
6. National Blood Authority Australia, Companion 27 PMB Guidelines: https://www.blood.gov.au/system/files/documents/companion-27-pbm-guidelines.pdf
7. emDocs, The Thromboelastogram (TEG®): A Five Minute Primer for the Emergency Physician: https://www.haemoview.com.au/uploads/2/5/4/9/25498232/the_5_rotem_tests.pdf