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Goal-directed bleeding management

Mohd Fitry Zainal Abidin

Consultant Anaesthesiologist

Universiti Malaya, Malaysia

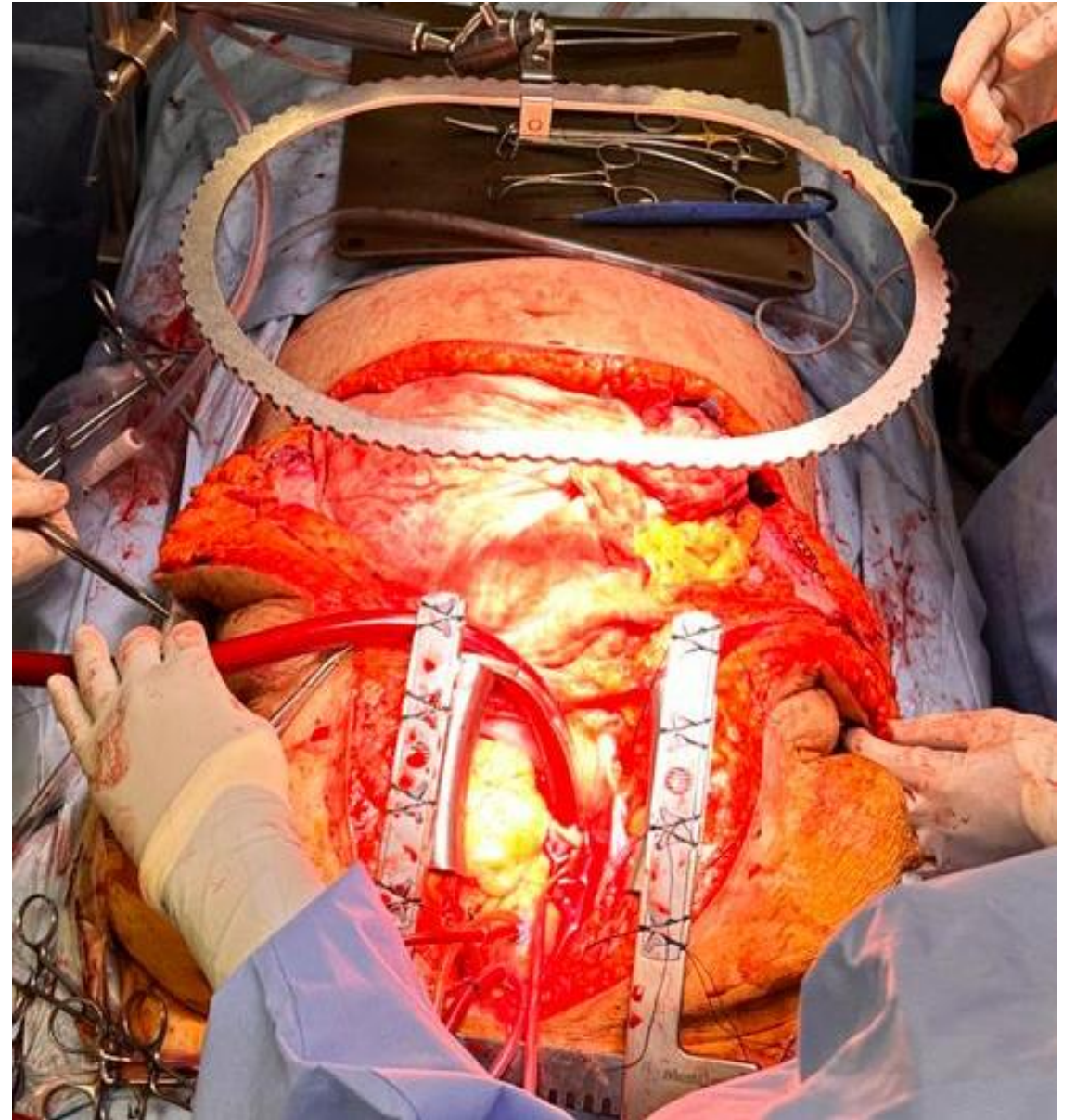
11th Annual Symposium of The Korean Society for Patient Blood Management (KPBIM)

October 2025

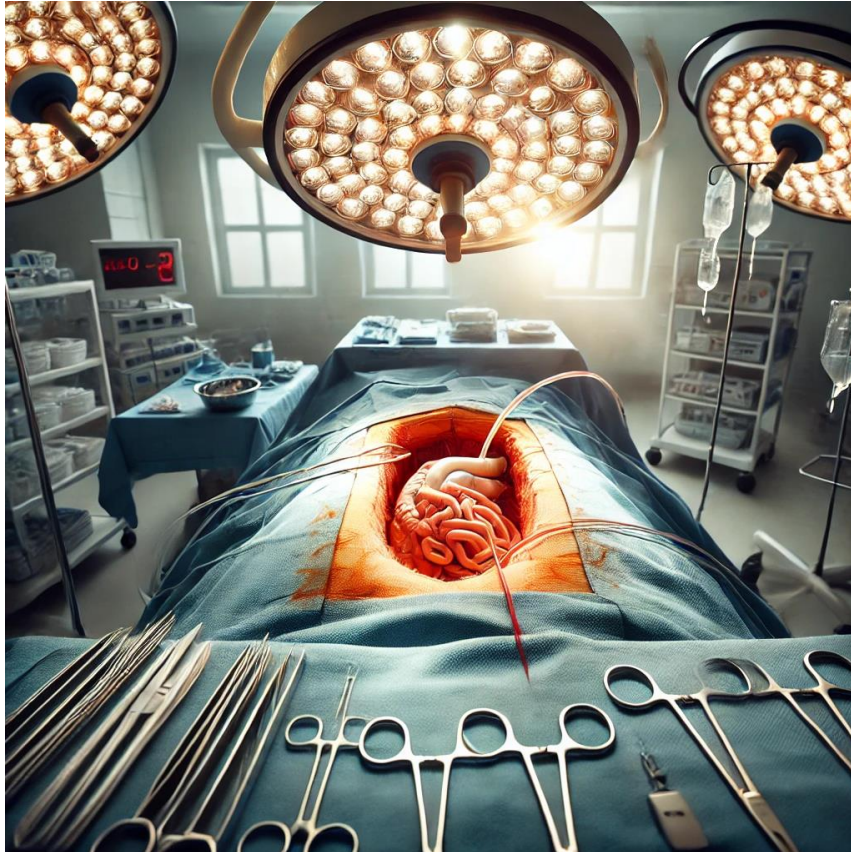




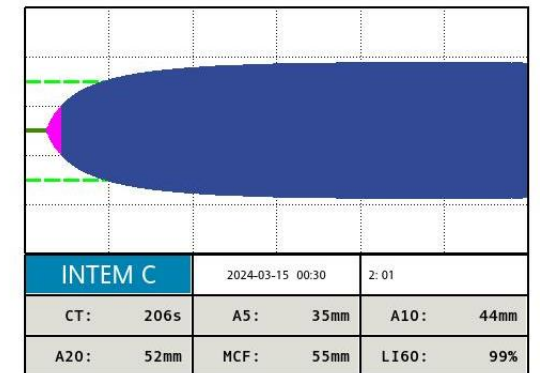
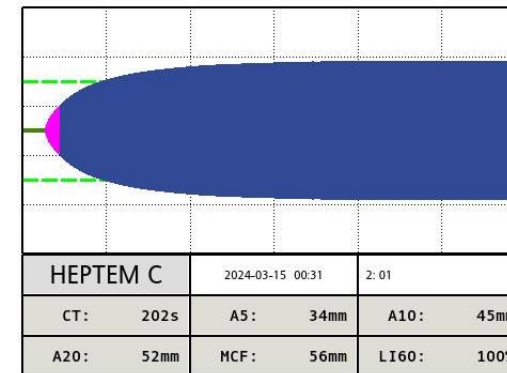
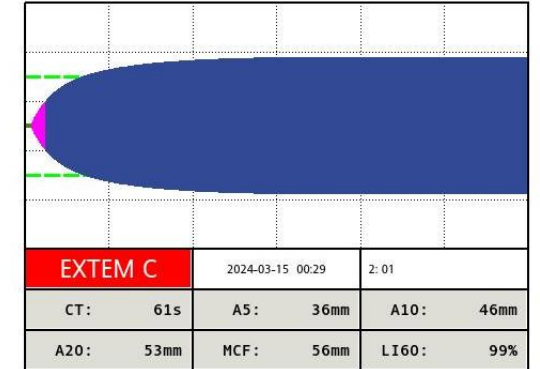
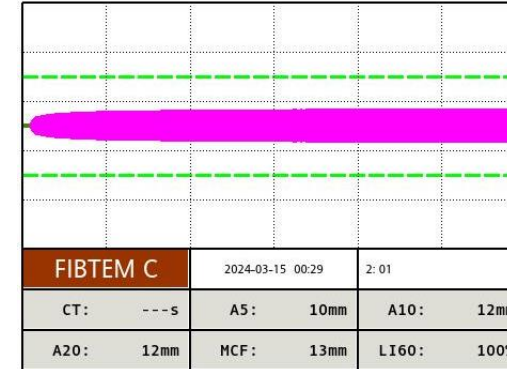
Bleeding



Goal



Bleeding stops



Normal laboratory parameters

Concept of resuscitation a bleeding patient



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graph TD; A[Concept of resuscitation a bleeding patient] --> B[Improve oxygen delivery]; A --> C[Stop the bleeding]; B --> D[Oxygen carrying capacity]; B --> E[Circulating volume]; C --> F[Secure bleeder]; C --> G[Correction of coagulopathy];
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The diagram is a hierarchical flowchart. At the top is an orange box with the text 'Concept of resuscitation a bleeding patient'. A blue line connects this box to two blue boxes below it: 'Improve oxygen delivery' on the left and 'Stop the bleeding' on the right. From 'Improve oxygen delivery', a purple line connects to two purple boxes: 'Oxygen carrying capacity' and 'Circulating volume'. From 'Stop the bleeding', a purple line connects to two boxes: 'Secure bleeder' (purple) and 'Correction of coagulopathy' (red).

**Improve
oxygen
delivery**

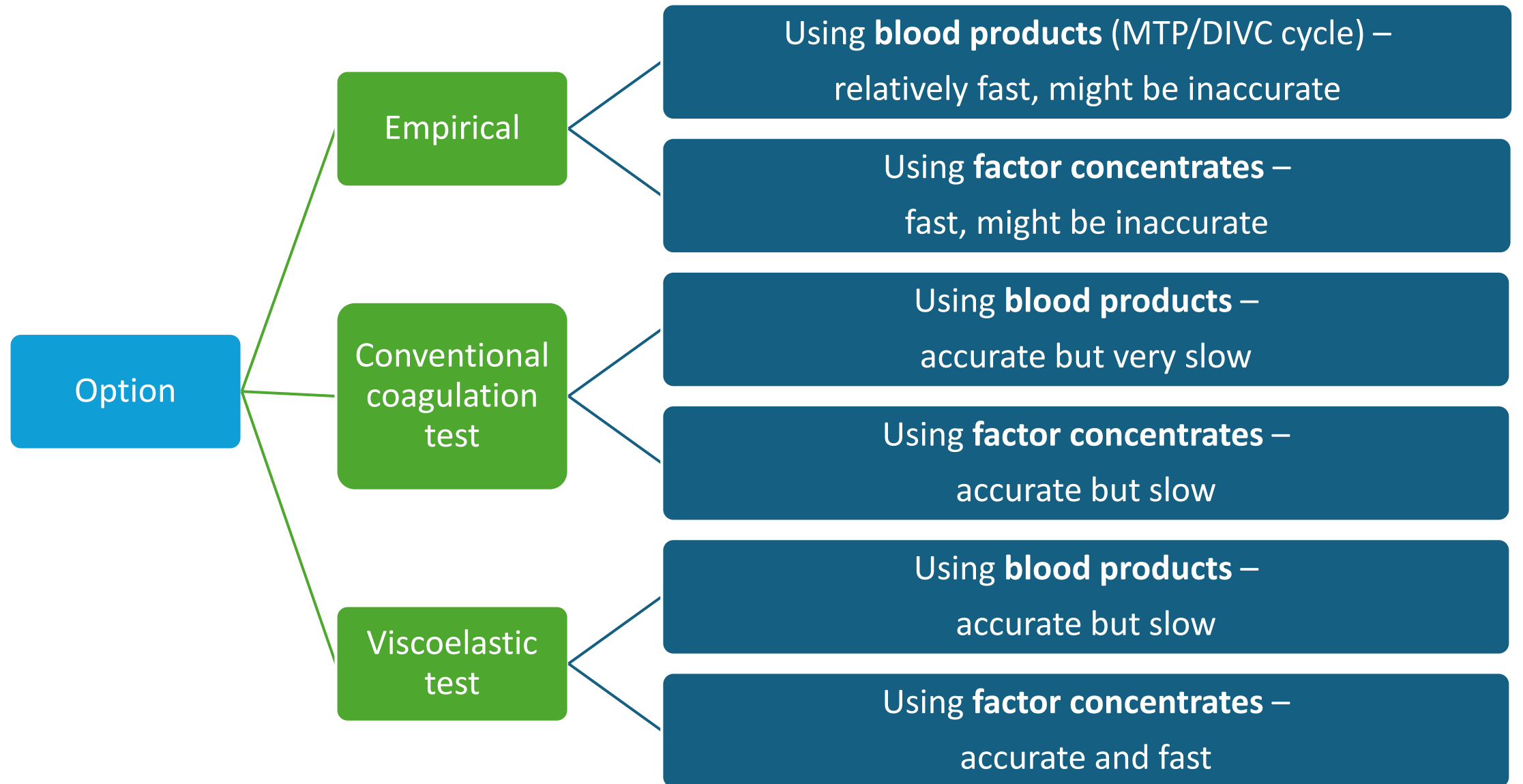
**Stop the
bleeding**

**Oxygen
carrying
capacity**

**Circulating
volume**

Secure bleeder

**Correction of
coagulopathy**





Surgical bleed



Medical bleed

How to correct medical bleed?

Fresh frozen
plasma/Prothrombin
complex concentrate

Cryoprecipitate/Fibrinogen
concentrate

Platelet

Which one?

Antifibrinolytics

Reversal of anticoagulant

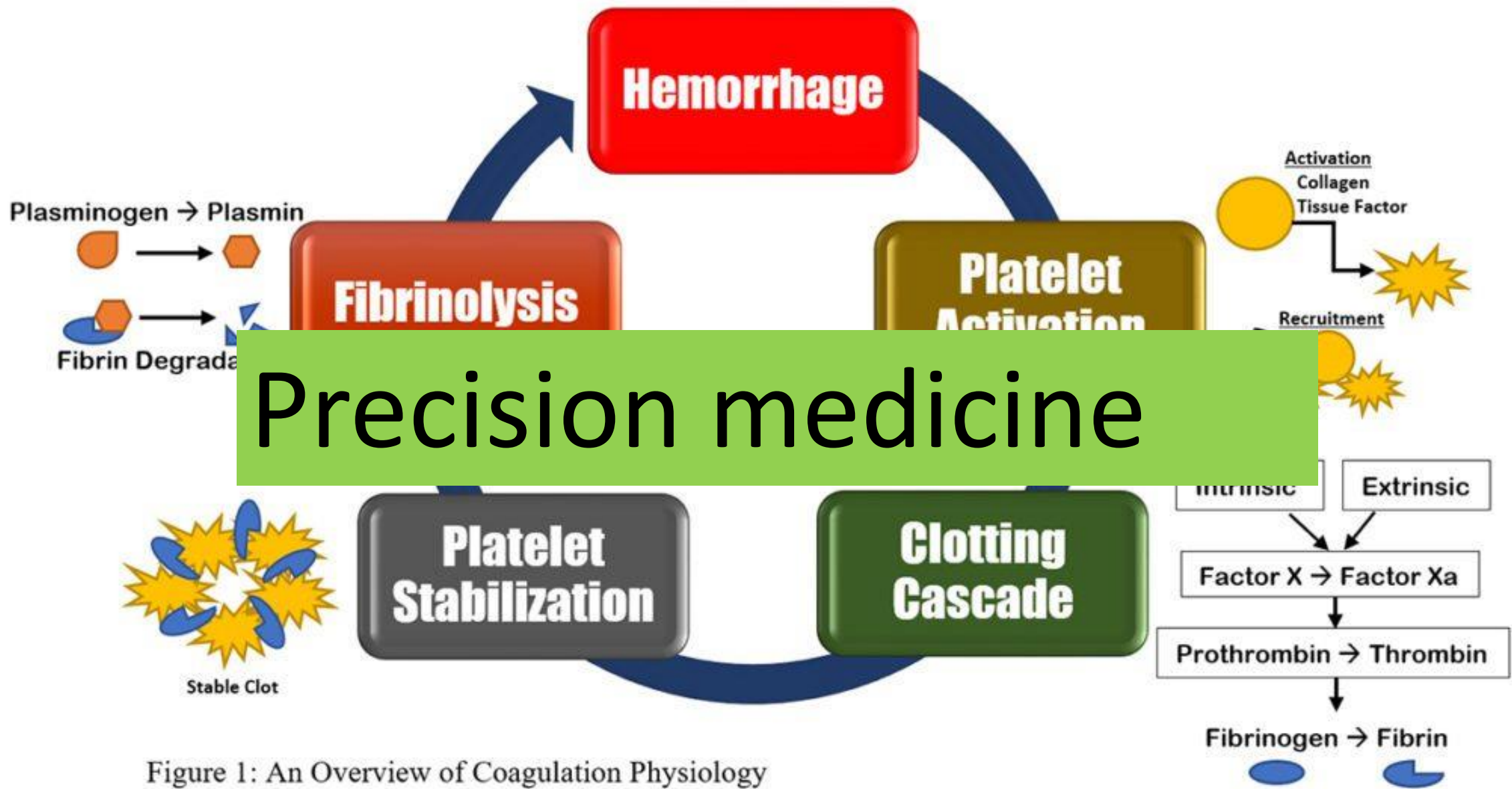
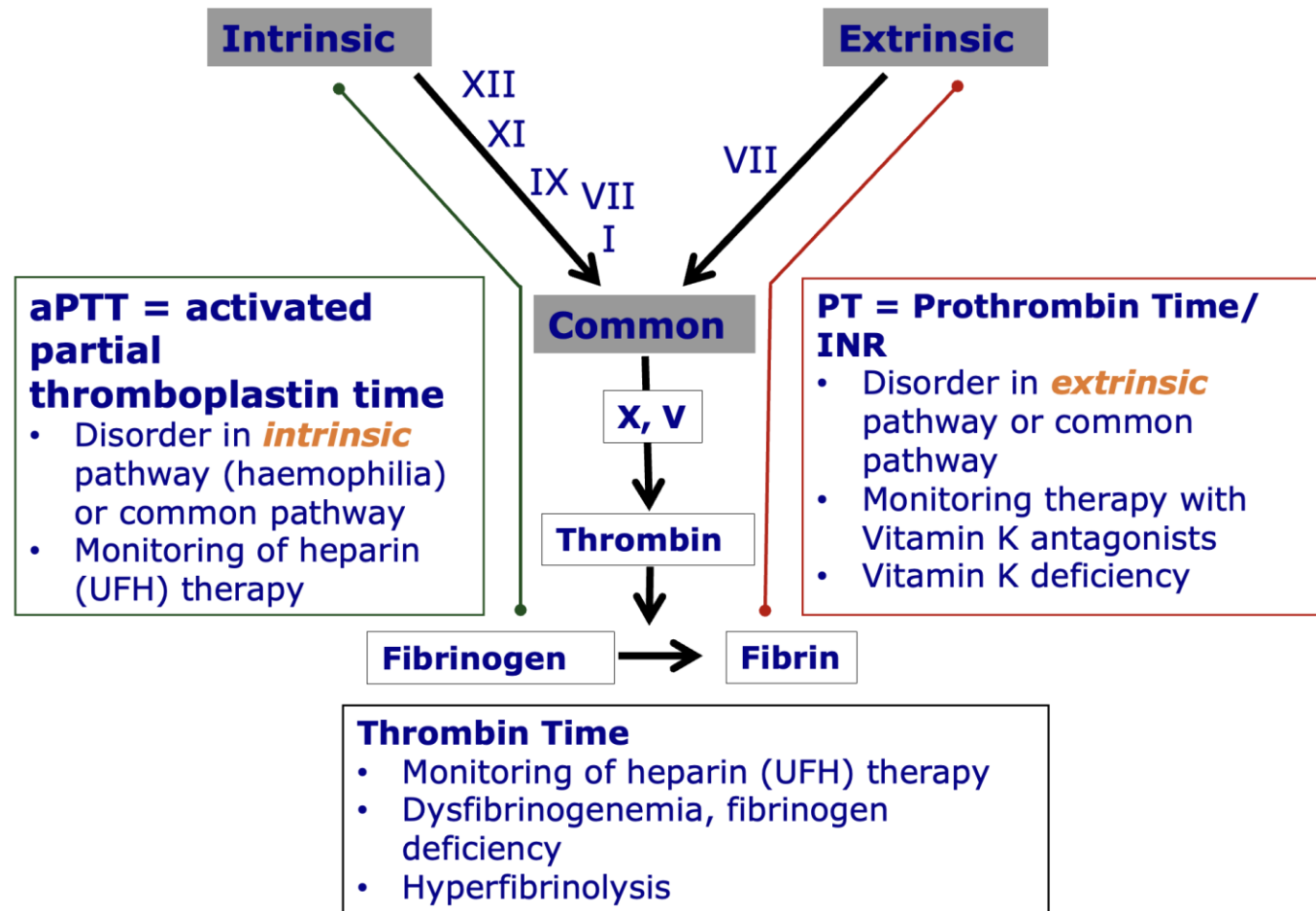


Figure 1: An Overview of Coagulation Physiology

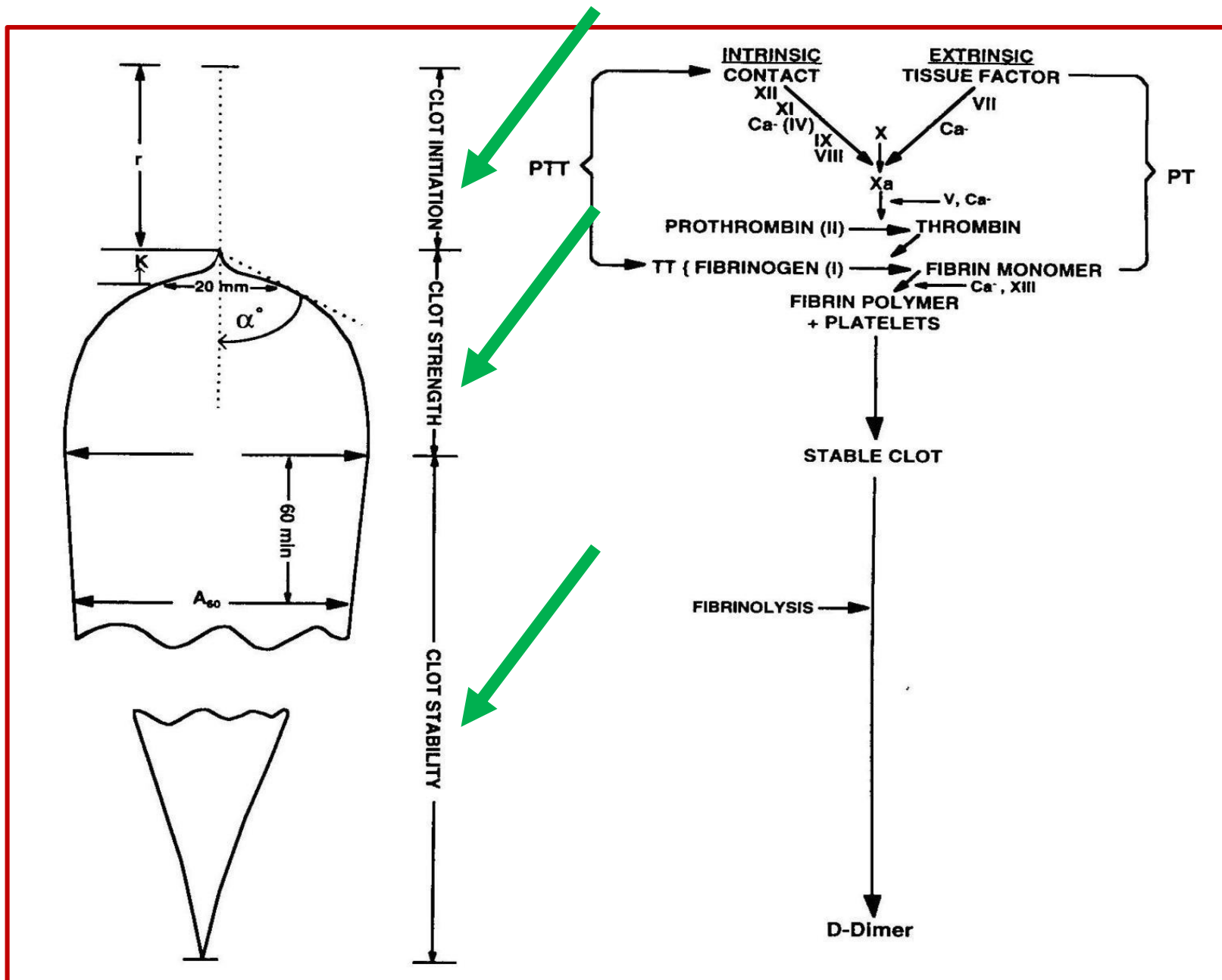
<https://www.jems.com/patient-care/fdic-2023-preview-the-physiology-of-coagulation-and-blood-product-transfusions/>

Standard Laboratory Tests for Coagulation Monitoring



Viscoelastic Testing (VET)

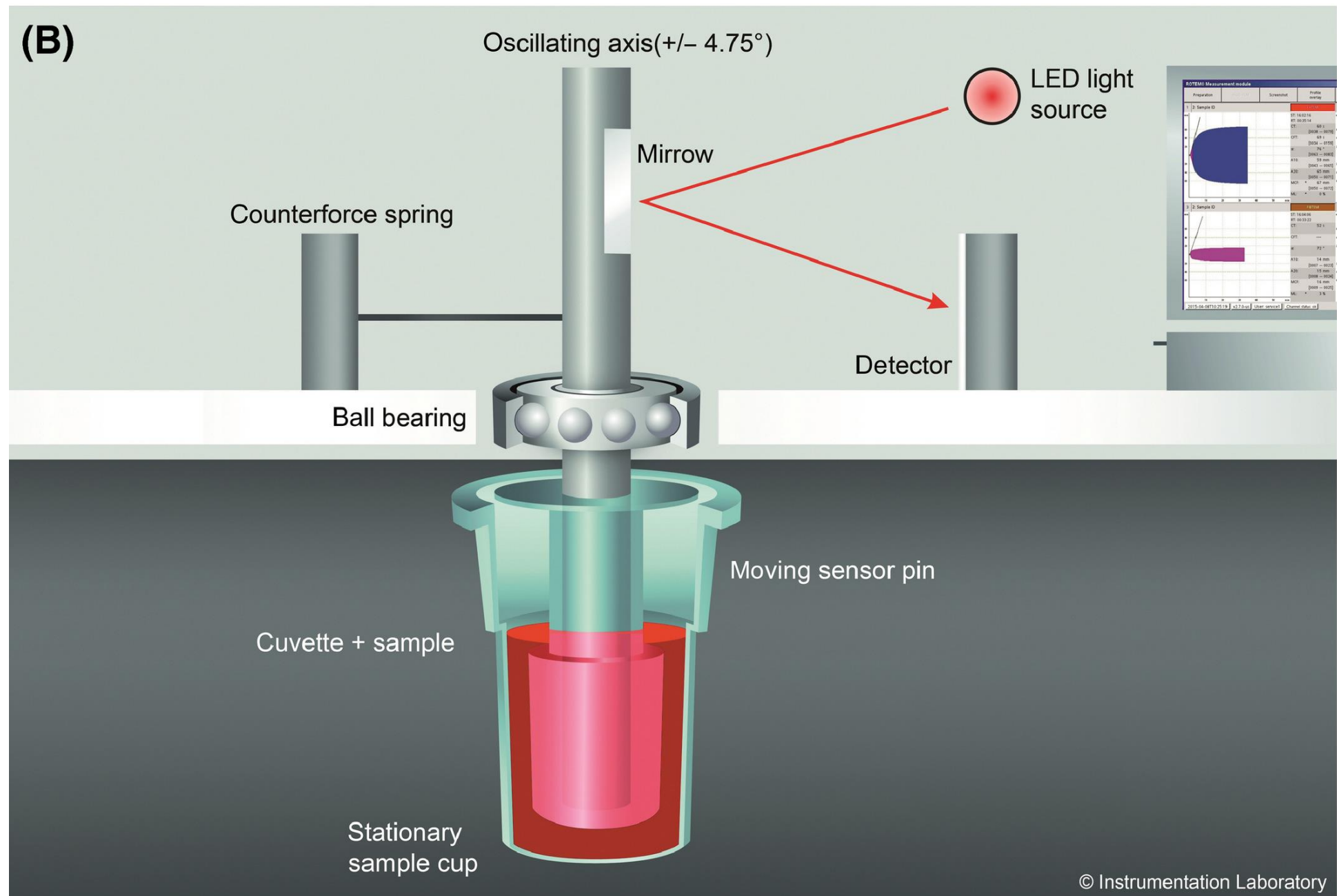
- Viscoelastic Testing in general refers to several point of care tests that allow for a **global assessment of coagulation using whole blood.**
- The analyzer imitates the sluggish venous blood flow and derives measurements of kinetics of each stage of coagulation
 - **Clot initiation**
 - **Clot Strength**
 - **Clot Lysis**



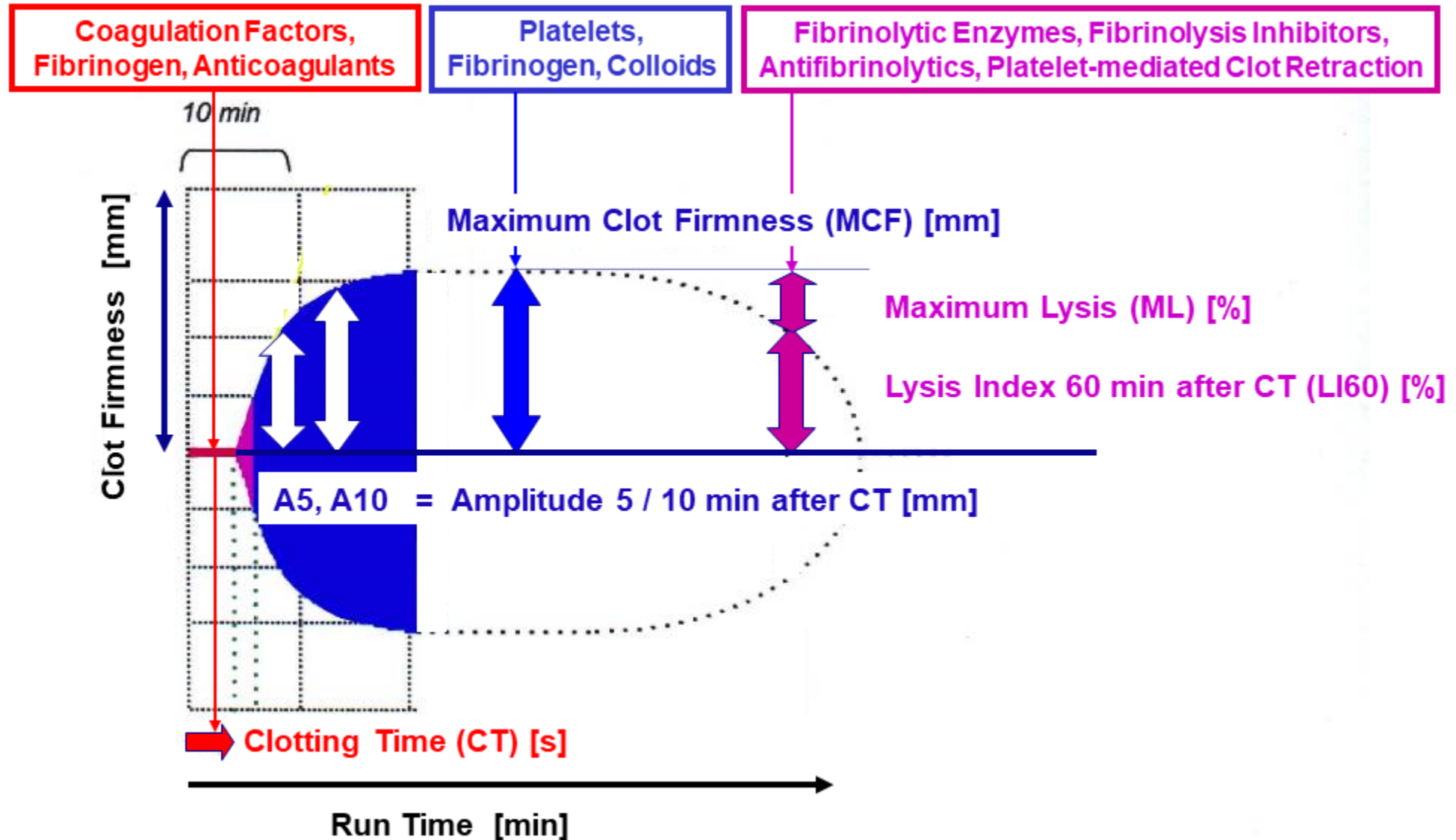


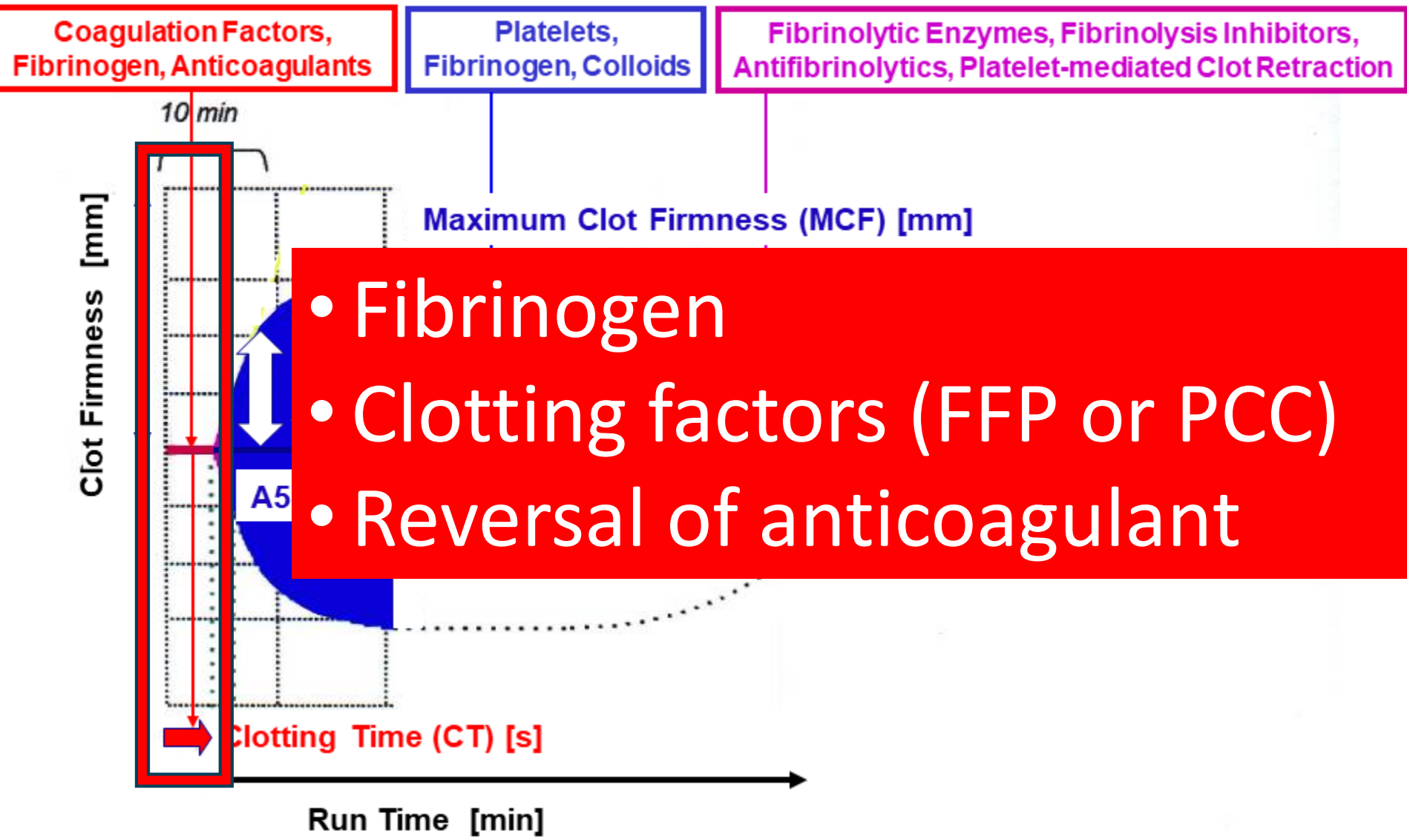
How VET works?

(B)



ROTEM Parameters



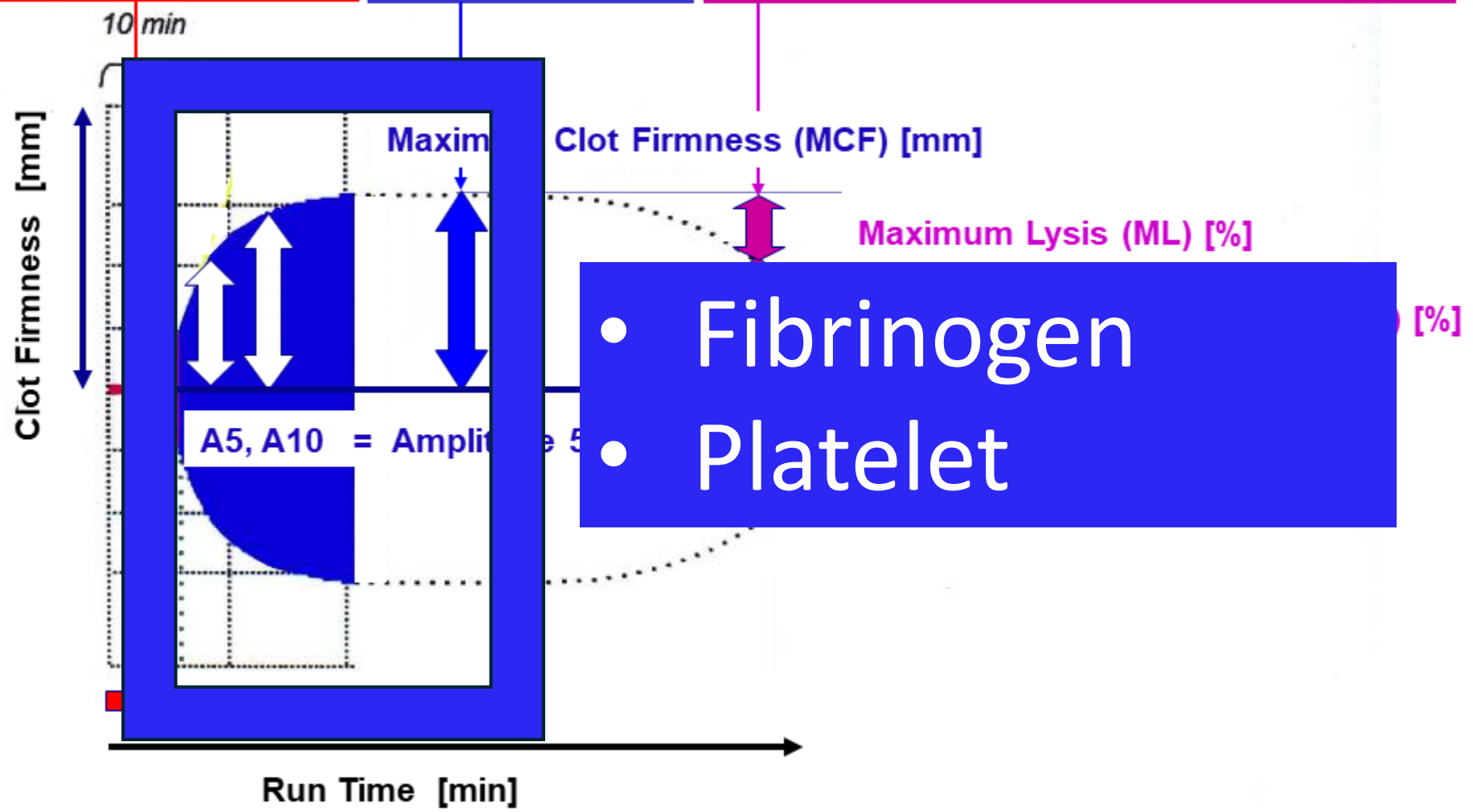


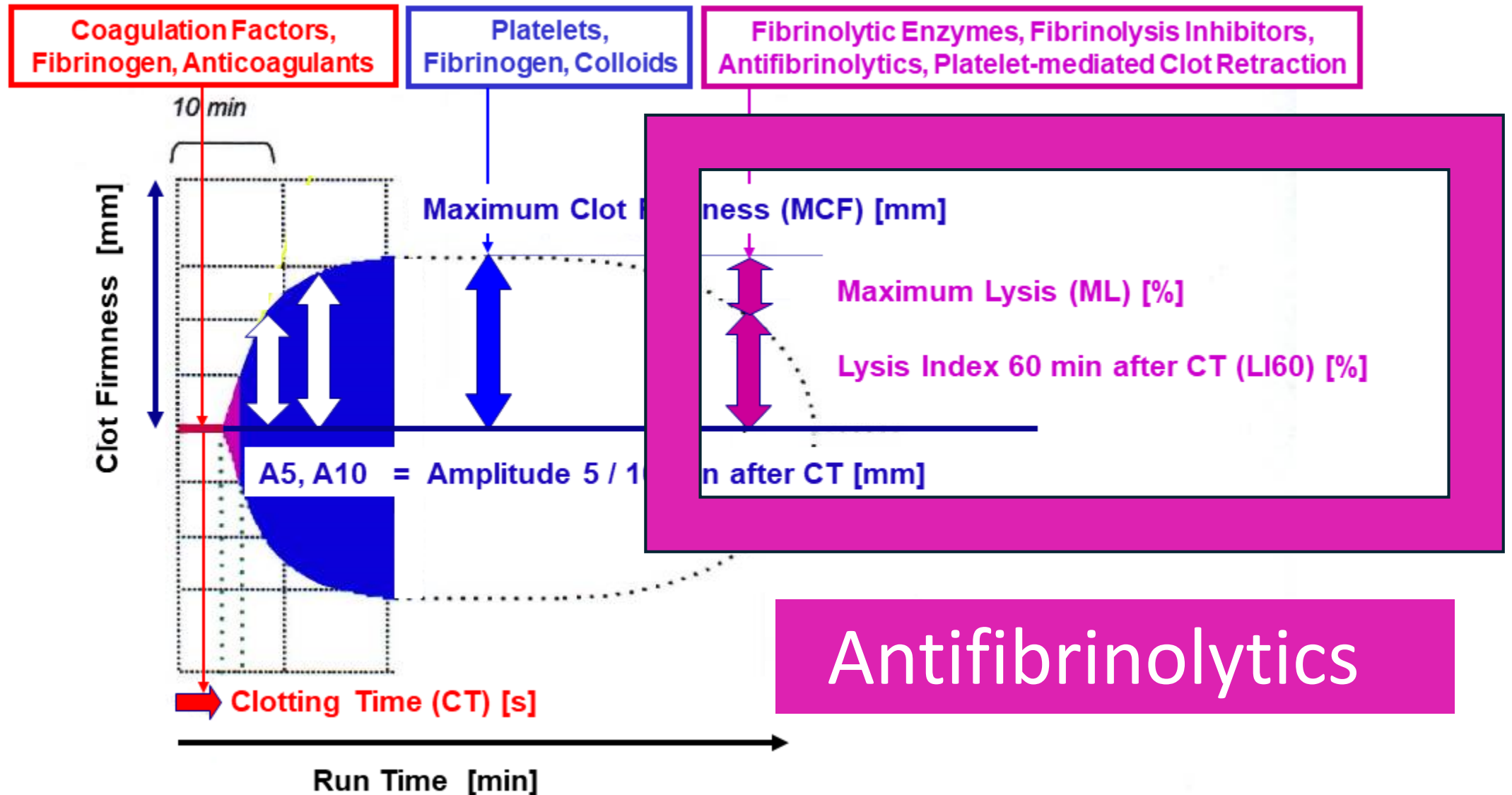
- Fibrinogen
- Clotting factors (FFP or PCC)
- Reversal of anticoagulant

Coagulation Factors,
Fibrinogen, Anticoagulants

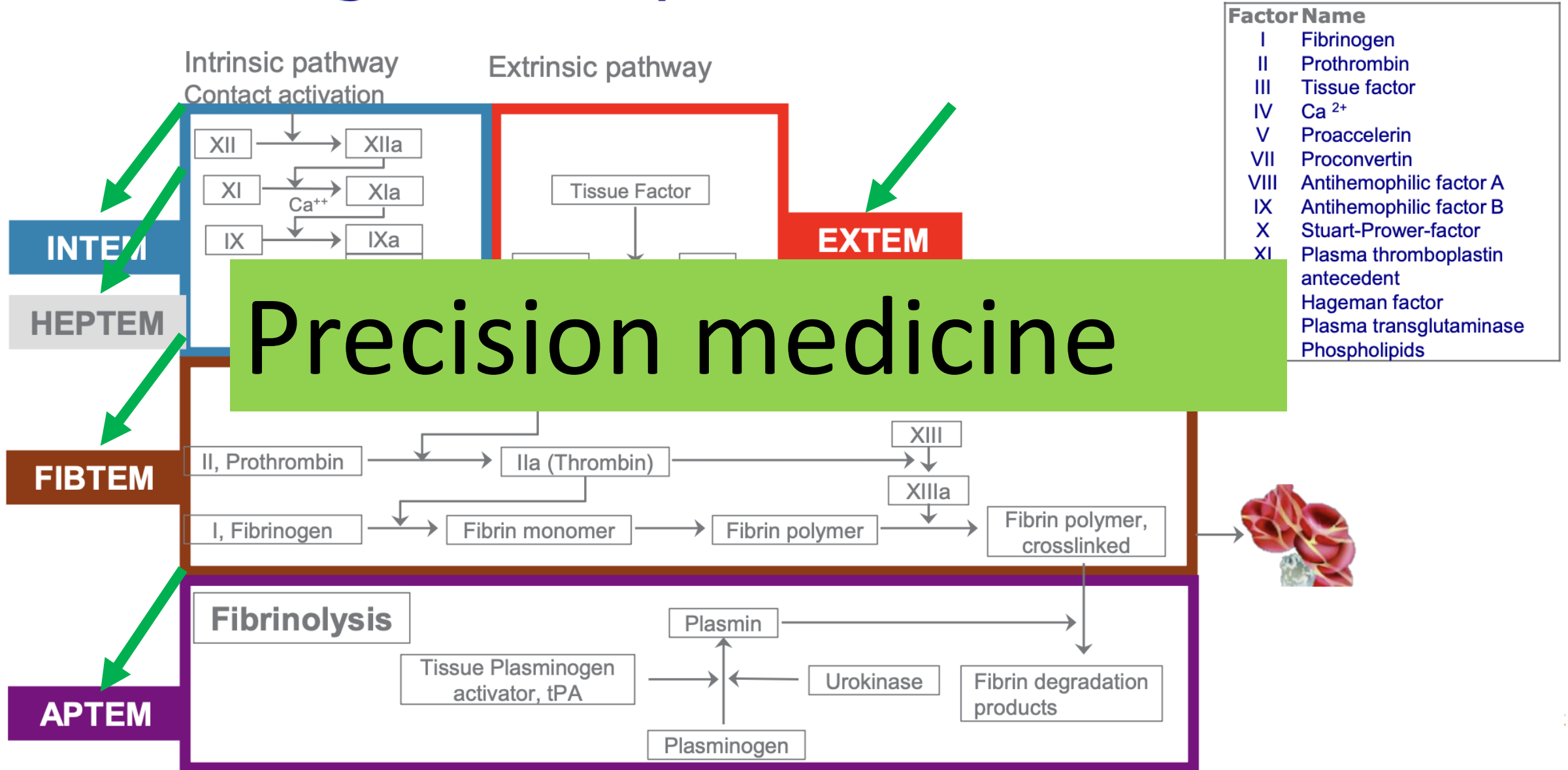
Platelets,
Fibrinogen, Colloids

Fibrinolytic Enzymes, Fibrinolysis Inhibitors,
Antifibrinolytics, Platelet-mediated Clot Retraction





ROTEM Sigma Assays



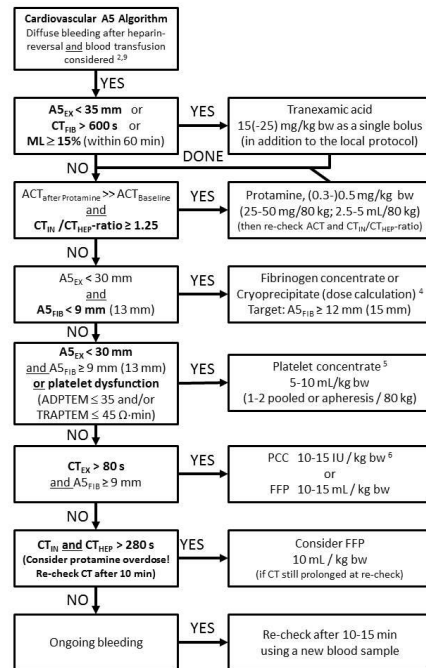


PRECISION MEDICINE

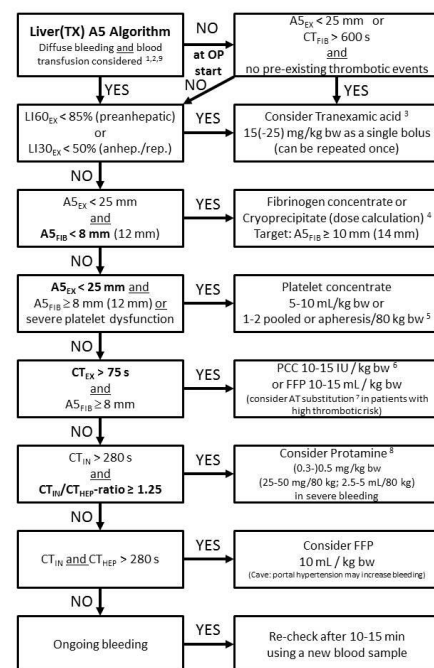
The role of evidence-based algorithms for rotational thromboelastometry-guided bleeding management

Klaus Görlinger^{1,2}, Antonio Pérez-Ferrer³, Daniel Dirkmann¹, Fuat Saner⁴, Marc Maegele^{5,6}, Ángel Augusto Pérez Calatayud⁷, and Tae-Yop Kim⁸

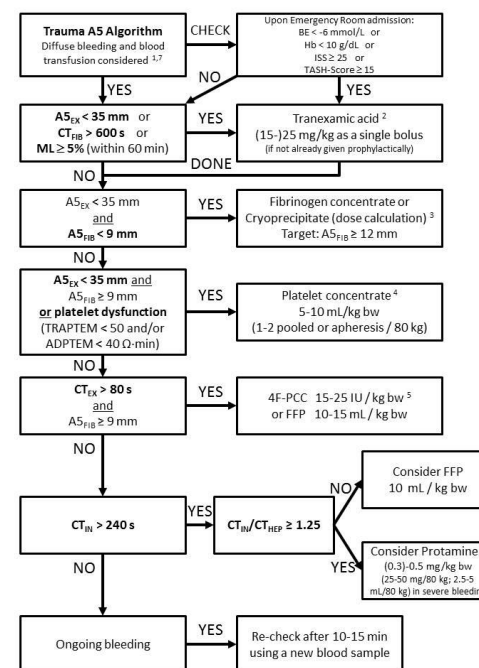
Cardiovascular



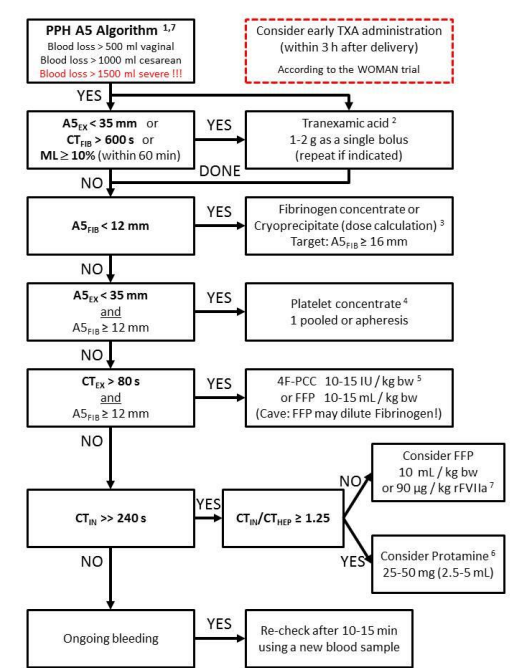
Liver/Abdominal

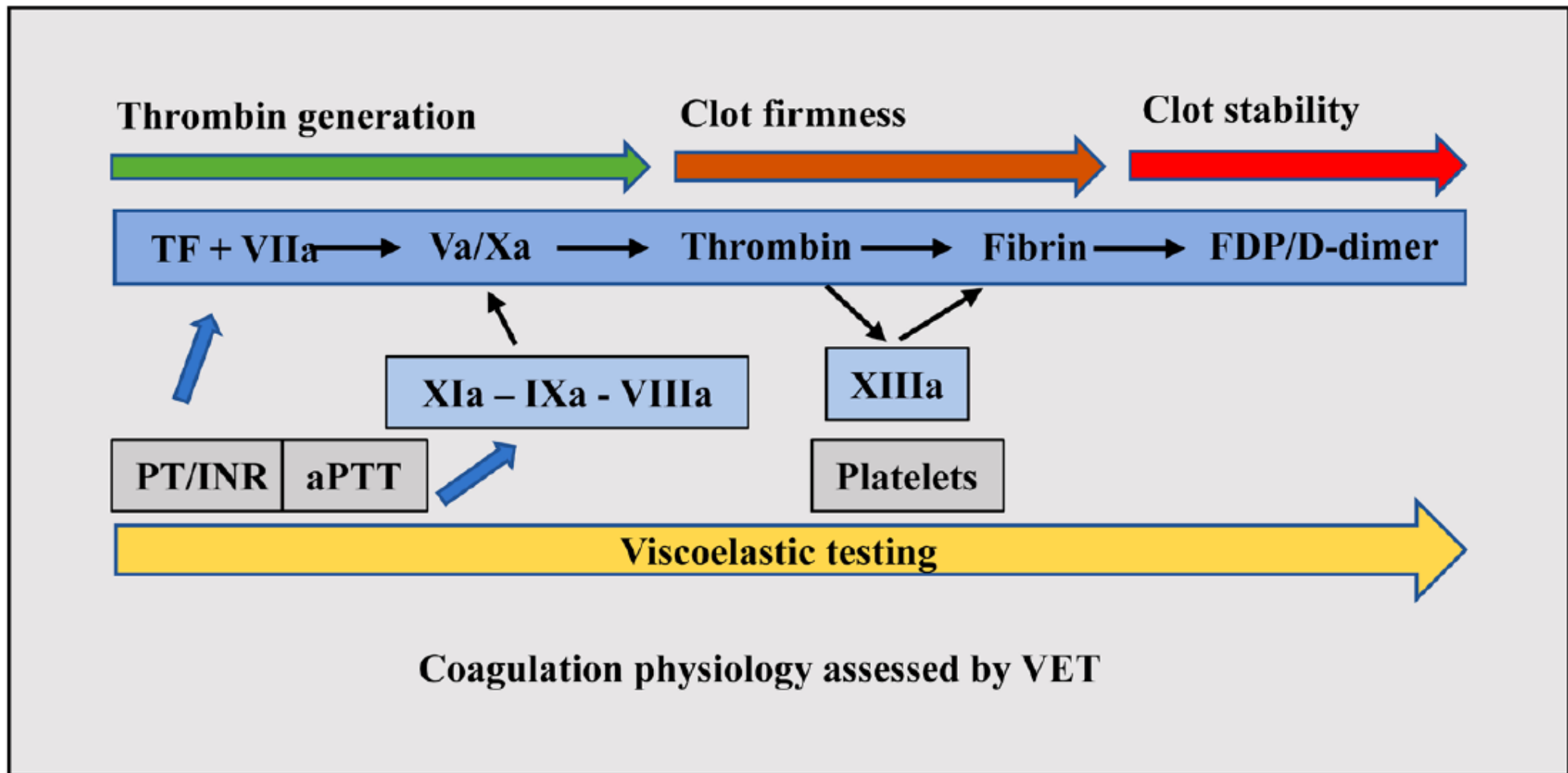


Trauma/Orthopedics



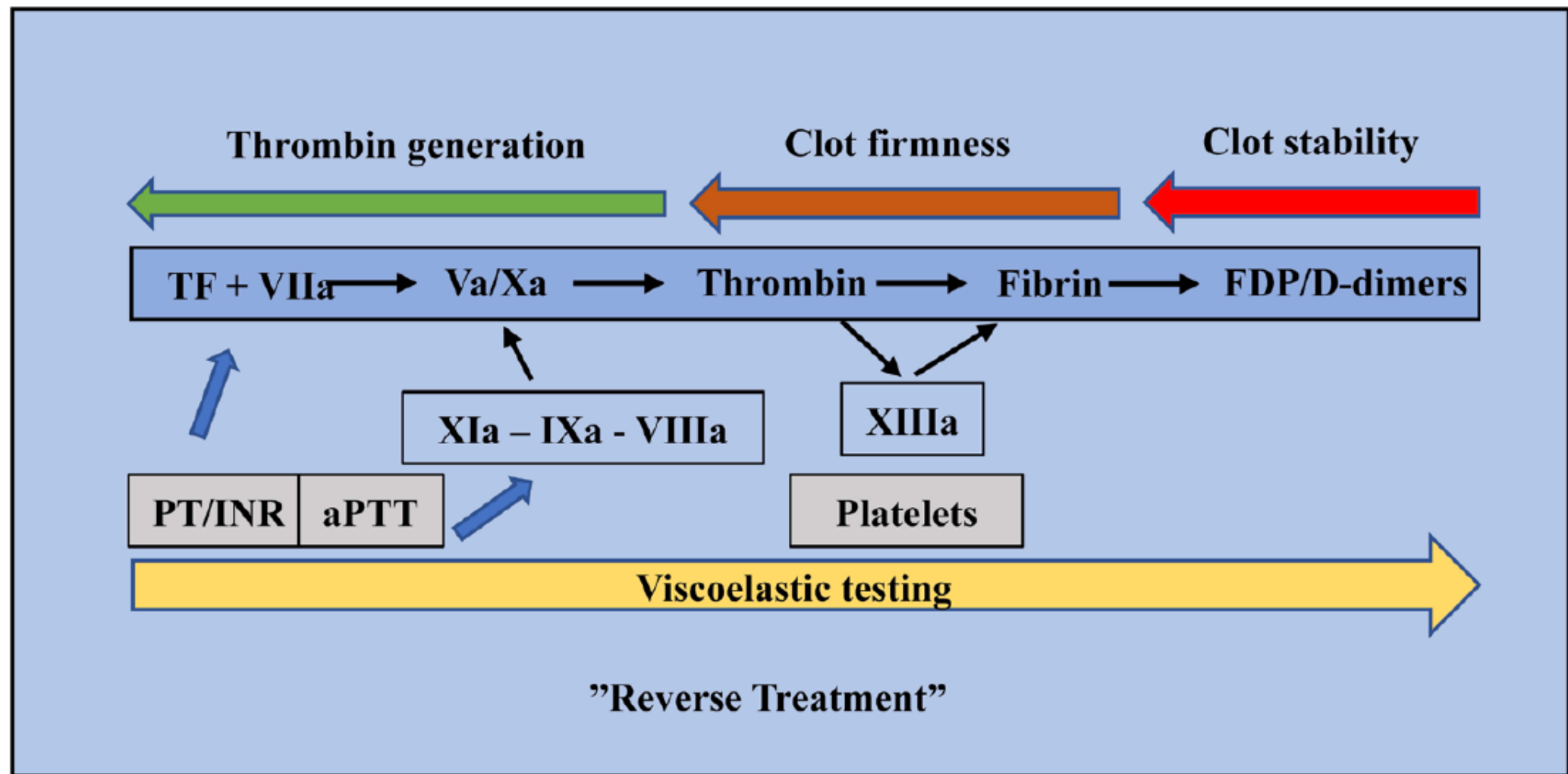
Obstetrics/PPH





Early Goal-Directed Hemostatic Therapy for Severe Acute Bleeding Management in the Intensive Care Unit: A Narrative Review

Tomaz Crochemore, MD,*†‡ Klaus Görlinger, MD,§|| and Marcus Daniel Lance, MD, PhD¶

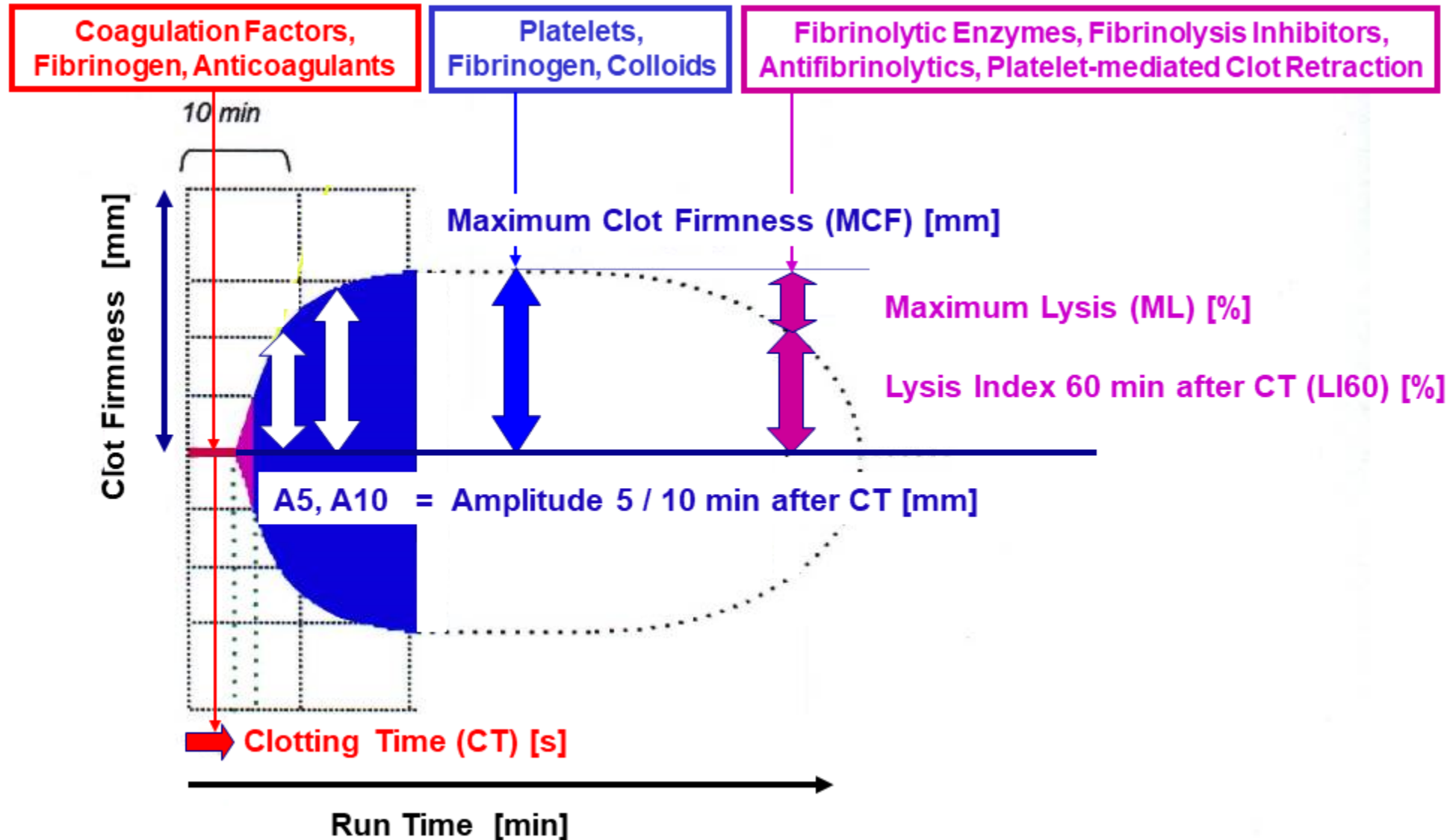


“Reverse treatment”: The sequential approach in the opposite direction to clot formation.

**Early Goal-Directed Hemostatic Therapy for Severe
Acute Bleeding Management in the Intensive Care
Unit: A Narrative Review**

Tomaz Crochemore, MD,*†‡ Klaus Görlinger, MD,§|| and Marcus Daniel Lance, MD, PhD¶||

ROTEM Parameters



2 parameters

A5

CT

Low A5 EXTEM (<35mm)

A yellow rounded rectangle with a black border, containing the text "Tranexamic Acid".

Tranexamic Acid

Except for liver transplant

Low A5 EXTEM

Platelet

A5 fibtem
normal

Platelet

Fibrinogen

A5 fibtem
low

Cryoprecipitate/
Fibrinogen concentrate

Prolonged CT

Thrombin generation

A5 fibtem normal

Fresh frozen plasma/
Prothrombin complex
concentrate

Fibrinogen

A5 fibtem low

Cryoprecipitate/
Fibrinogen concentrate

Heparin-protamine
management

CT in:hep ratio

Protamine/
Fresh frozen plasma

A close-up, high-contrast image of a fingerprint. The ridges and valleys are clearly visible in shades of grey and black. A red crosshair, consisting of a vertical line and a horizontal line, is centered over the fingerprint. The word "Evidence" is written in a white, sans-serif font, positioned directly below the intersection of the red crosshair.

Evidence

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery

Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology (ESC)

Endorsed by the European Society of Anaesthesiology and Intensive Care (ESAIC)

Recommendation Table 17 — Recommendations for intra- and post-operative complications associated with blood loss

Recommendations	Class ^a	Level ^b
In patients undergoing surgery with expected blood loss of ≥ 500 mL, use of washed cell salvage is recommended. ^{377,378}	I	A
It is recommended to use point-of-care diagnostics for guidance of blood component therapy, when available. ^{370,379–383}	I	A

GUIDELINES

Open Access



The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition

Rolf Rossaint^{1*}, Arash Afshari², Bertil Bouillon³, Vladimir Cerny^{4,5}, Diana Cimpoesu⁶, Nicola Curry^{7,8}, Jacques Duranteau⁹, Daniela Filipescu¹⁰, Oliver Grottke¹, Lars Grønlykke¹¹, Anatole Harrois⁹, Beverley J. Hunt¹², Alexander Kaserer¹³, Radko Komadina¹⁴, Mikkel Herold Madsen², Marc Maegele¹⁵, Lidia Mora¹⁶, Louis Riddez¹⁷, Carolina S. Romero¹⁸, Charles-Marc Samama¹⁹, Jean-Louis Vincent²⁰, Sebastian Wiberg¹¹ and Donat R. Spahn¹³

Key messages

- Immediate detection and management of traumatic coagulopathy improves outcomes of severely injured patients.
- This guideline follows management of the severe trauma patient in chronological order, with a focus on prevention of possible exsanguination.
- These structured recommendations support measures that prioritise the optimisation of resources for the benefit of bleeding control based on scientific evidence.
- Empirical management should not be implemented unless no method of monitoring bleeding and coagulation is available.
- Optimal organisation of the resuscitation team for the bleeding trauma patient includes implementation of these guidelines.

Keywords Emergency medicine, Trauma, Traumatic coagulopathy, Major bleeding, Haemostasis, Practice guideline, Diagnostics, Management

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2024 EACTS/EACTAIC Guidelines on patient blood management in adult cardiac surgery in collaboration with EBCP

Filip P. A. Casselman ^{a,*†} (Co-Chairperson) (Belgium), Marcus D. Lance ^{b,*†} (Co-Chairperson) (Kenya), Aamer Ahmed ^{c,d} (United Kingdom), Alice Ascari ^{e,**} (Italy), Juan Blanco-Morillo ^f (Spain), Daniel Bolliger ^g (Switzerland), Maroua Eid ^{h,**} (France), Gabor Erdoes ⁱ (Switzerland), Renard Gerhardus Haumann ^{j,k} (The Netherlands), Anders Jeppsson ^{l,m} (Sweden), Hendrik J. van der Merwe ⁿ (South Africa), Erik Ortmann ^o (Germany), Mate Petricevic ^{p,q} (Croatia), Luca Paolo Weltert ^{r,s} (Italy), Milan Milojevic ^t (Serbia), EACTS/EACTAIC/EBCP Scientific Document Group ^{††}

Recommendation Table 11: Recommendations for transfusion strategies

Recommendations	Class^a	Level^b	Ref^c
Implementation of a patient blood management protocol for the bleeding patient is recommended.	I	B	[414–417]
The use of PRBCs of all ages is recommended because the storage time of the PRBCs does not affect outcomes.	I	A	[425–427]
The use of leucocyte-depleted PRBCs is recommended.	I	B	[424, 429, 430]
Perioperative treatment algorithms for the bleeding patient based on viscoelastic POC testing is recommended to reduce the number of transfusions.	I	A	[42, 45, 47, 442]
Restrictive transfusion triggers (≤ 75 g/L) are recommended over liberal triggers (≤ 90 g/L) if the clinical condition of the patient allows it.	I	A	[449, 450, 452, 453]
For HCT values between 18% and 24%, PRBCs may be considered if other measures are not sufficient to maintain the adequacy of tissue oxygenation during CPB, including DO_2 and cerebral oximetry.	IIb	B	[462]
Platelet concentrate should be considered in bleeding patients with a platelet count below 50 ($10^9/L$) or those patients on antiplatelet therapy with bleeding complications after cardiac surgery.	IIa	C	–

Recommendation Table 10: **Recommendations for procoagulant interventions**

	Recommendations	Class^a	Level^b	Ref^c
	Antifibrinolytic therapy is recommended to reduce bleeding and transfusions of blood products and reoperations for bleeding ^d .	I	A	[369–371]
	The prophylactic use of FFP to reduce bleeding is not recommended.	III	B	[380, 382, 383]
	For rapid reversal of VKAs, PCC should be considered over FFP.	IIa	A	[122, 397]
	Prophylactic fibrinogen administration is not recommended.	III	A	[387, 391]
	In the bleeding patient with a low fibrinogen level (<1.5 g/L) or the equivalent value in viscoelastic testing, fibrinogen supplementation should be considered to reduce postoperative bleeding and transfusions.	IIa	B	[387]
	In patients with significant bleeding after cardiac surgery due to coagulation factor deficiency, the administration of PCC should be considered instead of FFP to reduce postoperative blood transfusions.	IIa	B	[124, 399]
	The prophylactic use of DDAVP is not recommended to reduce bleeding complications.	III	A	[402–404]
	In bleeding patients with platelet dysfunction, the use of DDAVP should be considered to reduce bleeding complications.	IIa	C	[403]
	In bleeding patients with FXIII activity <70% after CPB, the administration of factor FXIII may be considered to reduce coagulopathy and blood transfusions.	IIb	B	[408]
	The prophylactic use of rFVIIa is not recommended to prevent bleeding complications.	III	B	[411, 413]
	In patients with refractory, non-surgical bleeding, off-label use of rFVIIa may be considered to reduce bleeding complications.	IIb	B	[413]

EXPERT CONSENSUS DOCUMENT

Cardiac Surgical Bleeding, Transfusion, and Quality Metrics: Joint Consensus Statement by the Enhanced Recovery After Surgery Cardiac Society and Society for the Advancement of Patient Blood Management



Rawan Salenger, MD,¹ Rakesh C. Arora, MD, PhD,² Arthur Brace, MD,³ Mario D'Oria, MD,⁴ Daniel T. Engelman, MD,⁵ Caroline Evans, MD,⁶ Michael C. Grant, MD, MSE,⁷ Serdar Gunaydin, MD, PhD,⁸ Vicki Morton, DNP,⁹ Sherri Ozawa, MSN, RN,^{10,11} Prakash A. Patel, MD,¹² Jacob Raphael, MD,¹³ Todd K. Rosengart, MD,¹⁴ Linda Shore-Lesserson, MD,¹⁵ Pierre Tibi, MD,¹⁶ and Aryeh Shander, MD^{10,11}

4. Management of Coagulopathy and Viscoelastic Testing

- *Viscoelastic testing algorithms can reduce bleeding, reexploration, and blood component transfusion in cardiac surgery.*
- *Platelet function should be assessed prior to cardiac surgery in patients at risk of bleeding due to platelet dysfunction.*
- *Viscoelastic testing can help to identify the underlying cause of bleeding and direct therapy in real-time.*



Contents lists available at [ScienceDirect](#)


International Journal of Obstetric Anesthesia

journal homepage: www.elsevier.com/locate/ijoa



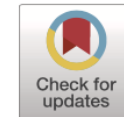
Review Article

Viscoelastic testing in postpartum obstetric hemorrhage: a scoping review commissioned by the Patient-Centered Outcomes Research Institute (PCORI)

C. Janzen^a, D. Zhang^b, S. Herman^b, I. Mendez^b, A. Robertson^b, T. Gilliams^b, K. Sysawang^b, S. Yagyu^b, A. Motala^b, D. Tolentino^b, S. Hempel^{b,*} 

^a Maternal and Fetal Medicine, University California Los Angeles (UCLA), Los Angeles, CA, USA

^b Southern California Evidence Review Center, University of Southern California (USC), Los Angeles, CA, USA



Conclusions: Viscoelastic testing offers point-of-care monitoring of coagulation, enabling real-time decision support to guide transfusion therapy. Protocols may reduce transfusion volume, postoperative bleeding, and prevent overtreatment, but more clinical guidance and rigorous multicenter studies to determine the impact of protocols for use in postpartum hemorrhage care empirically are needed.



How do we move forward?



ROTEM *sigma* complete

FIBTEM C

EXTEM C

INTEM C

APTEM C

ROTEM *sigma* complete + hep

FIBTEM C

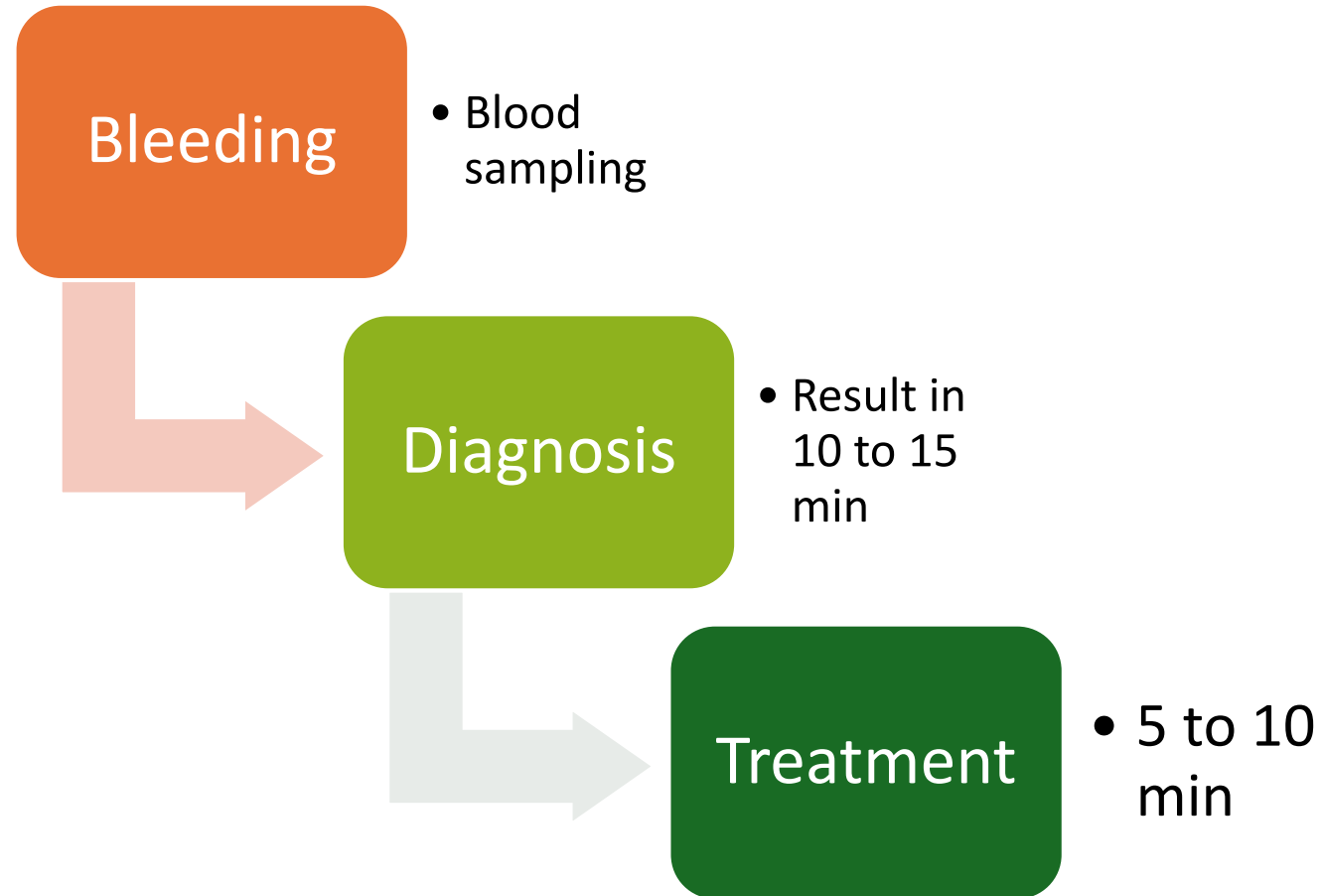
EXTEM C

INTEM C

HEPTEM C



Ideal bleeding management



Key messages

- Good diagnostic tools
- Immediate treatment with factor concentrate
- Suitable protocol for massive bleeding
- Patient-centred management = all Doctors must be on the same page



A green rectangular sign with rounded corners and a white border, mounted on two wooden posts. The sign features the words "Thank You" in a large, white, sans-serif font. The background is a sky with scattered, light-colored clouds.

Thank You