TEG – MONITORING & TREATING BLEEDING PATIENTS

Naomi Rahimi-Levene MD, MHA
Director of the Blood Bank
Assaf Harofeh Medical Center
Zerifin, Israel

The Versailles wedding hall collapse Jerusalem 2001

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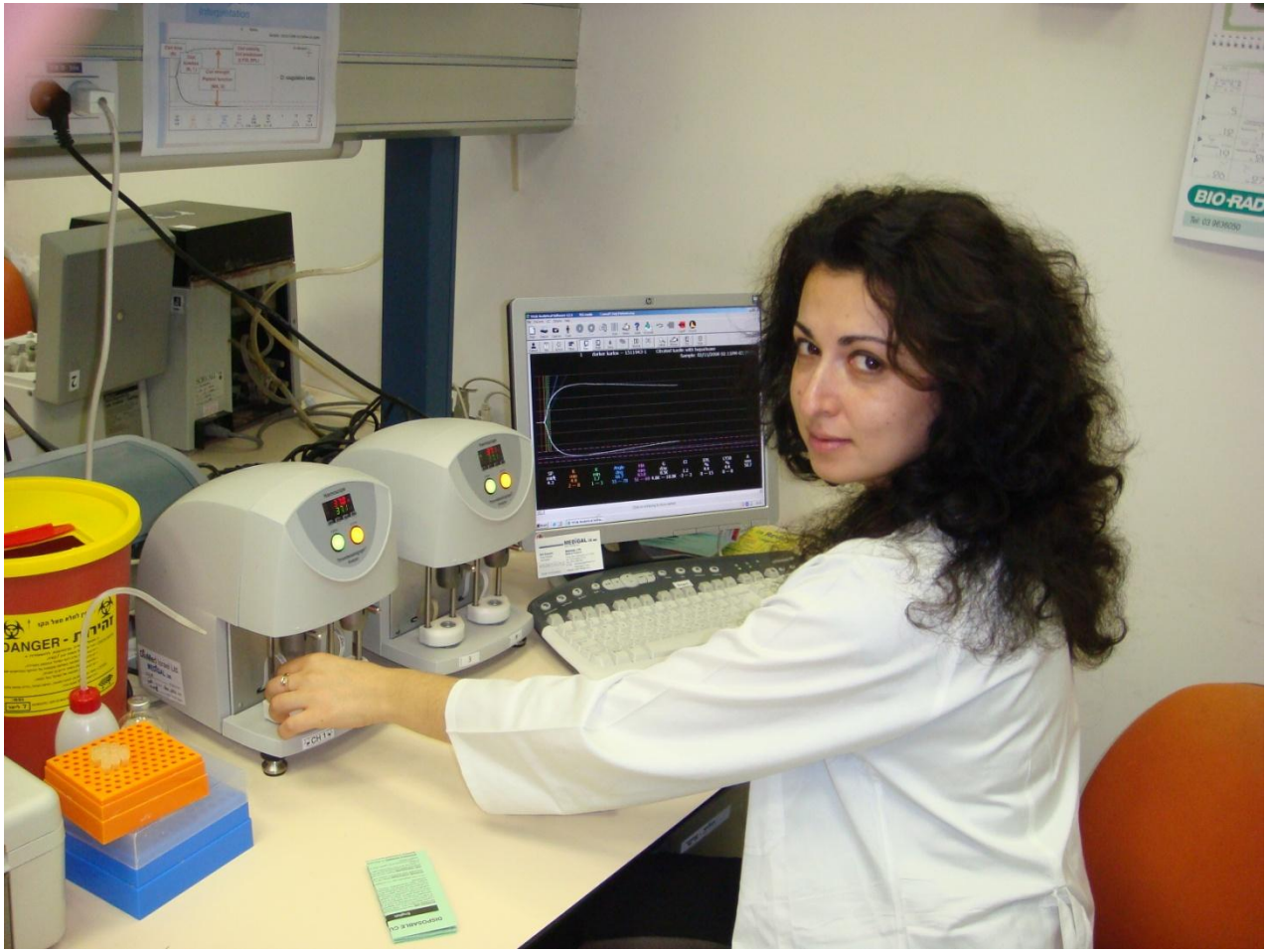
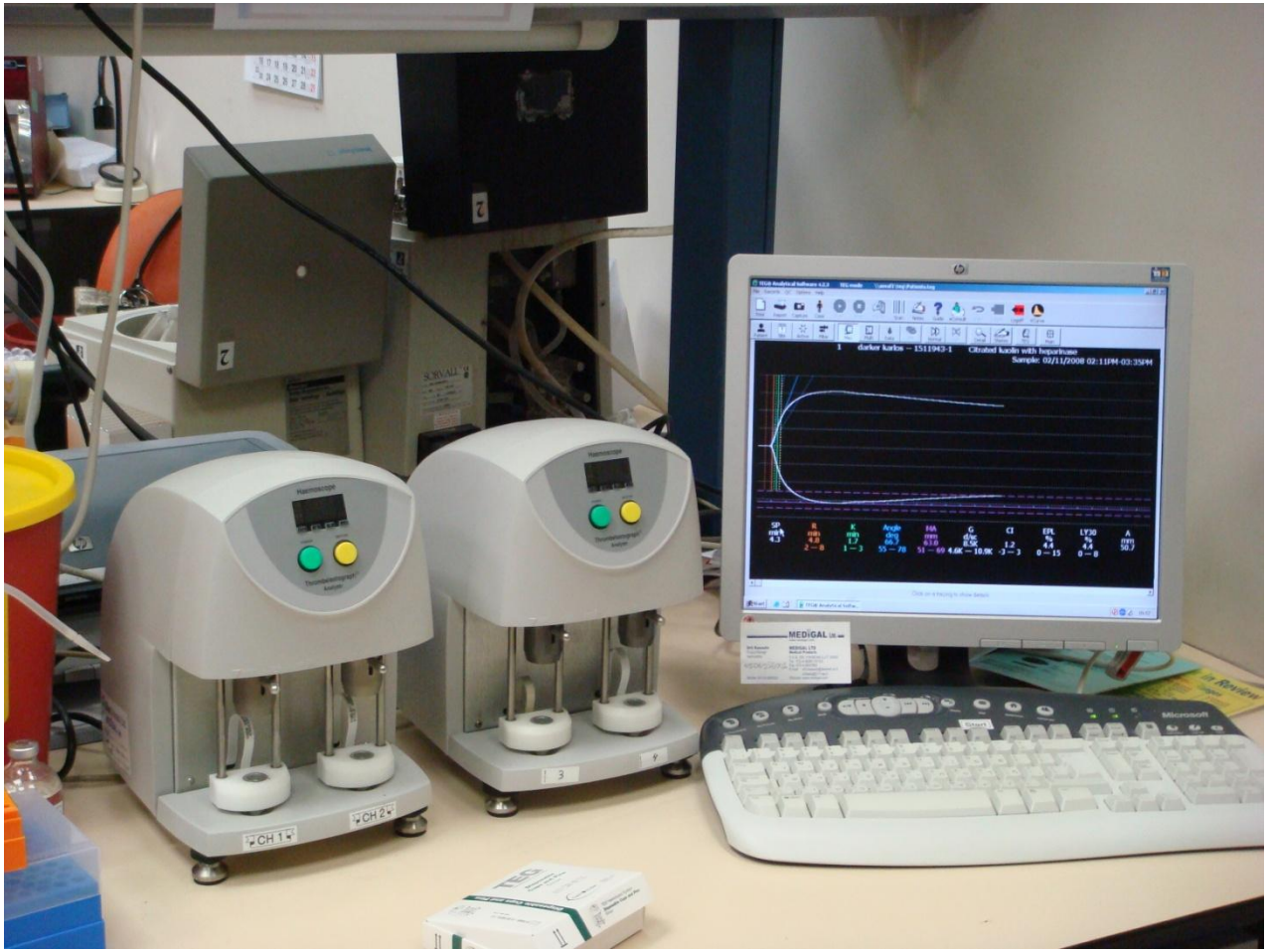
Sample Arrives
Blood Bank

TEG in the Blood Bank



TEG in the Blood Bank



TEG viewed in my office

TEG viewed at home

TEG viewed at home

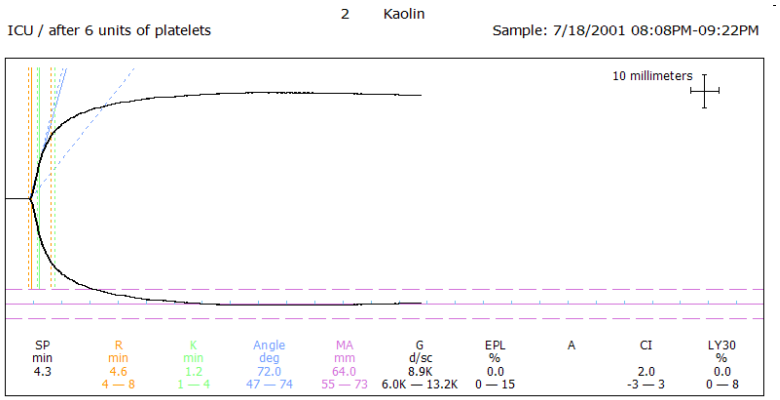
TEG® analyzer
Features

Temperature display & control

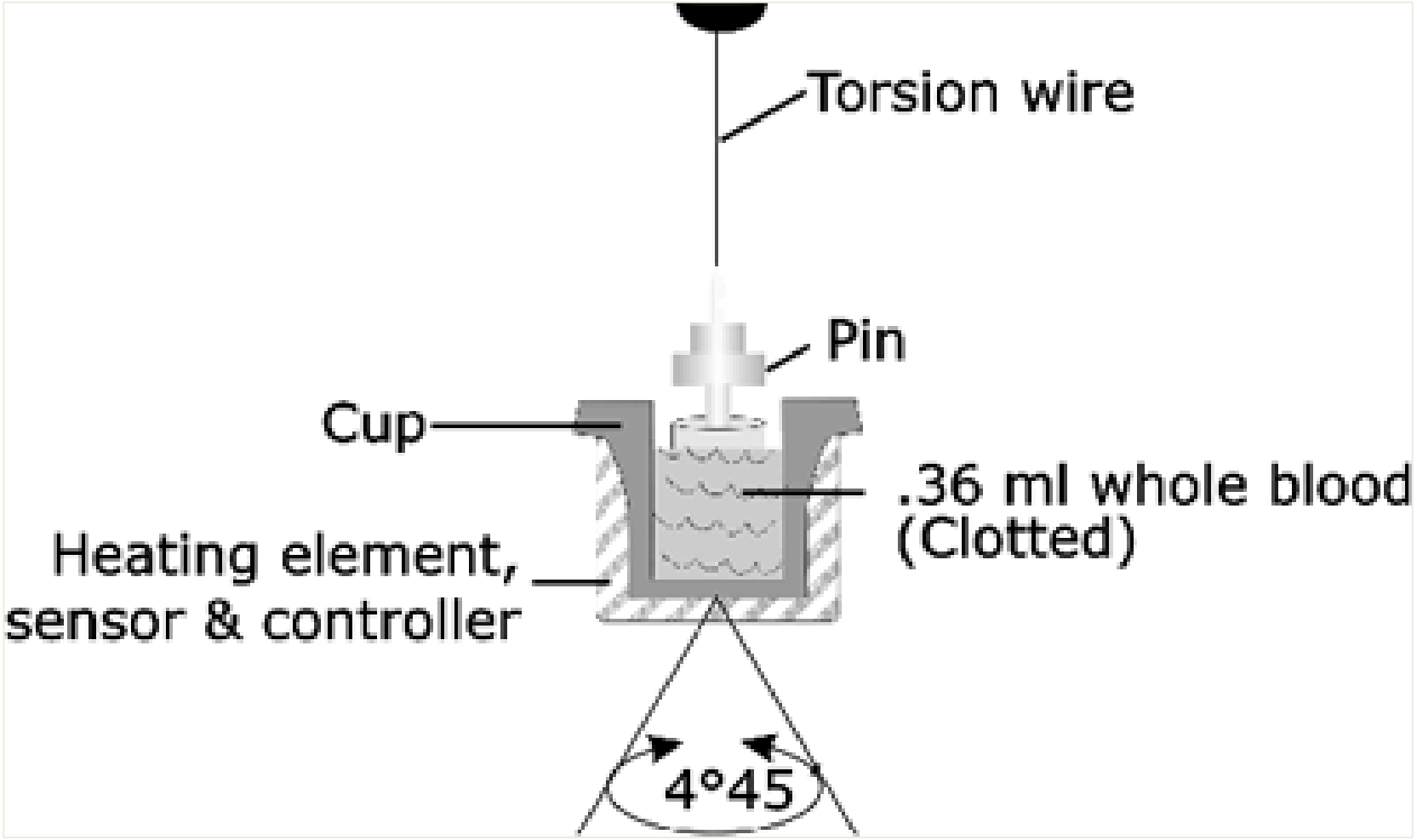
Two independent channels

Computerized data collection & storage

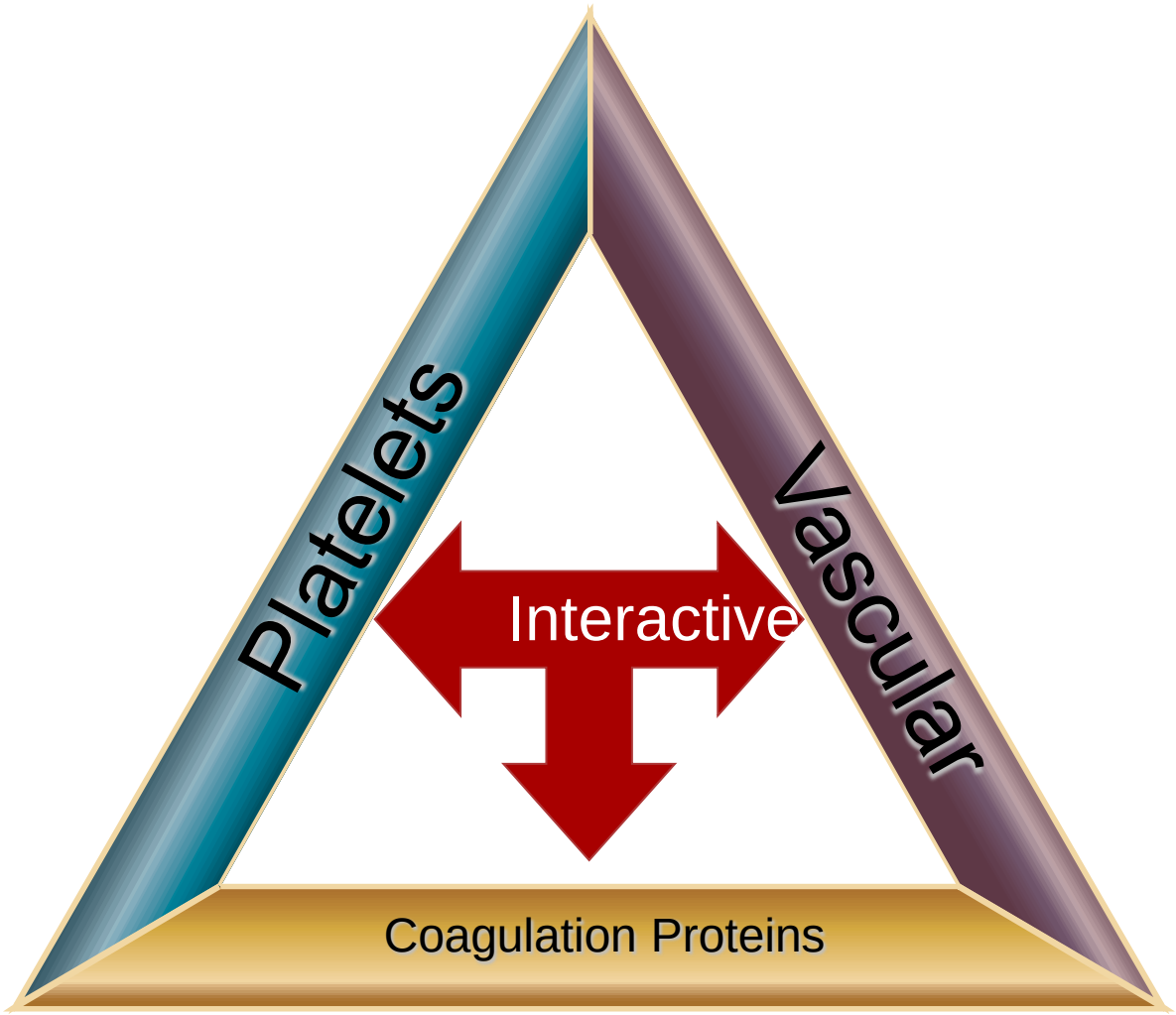
The TEG® analyzer



TEG® Technology
How it works

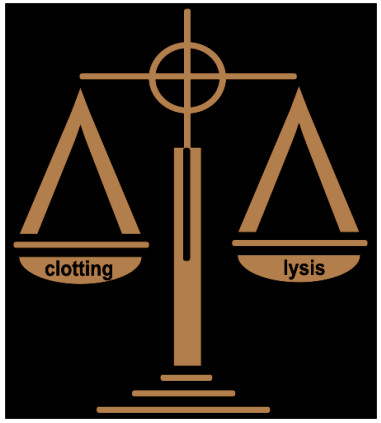


Hemostasis Components:
Virchow's triad

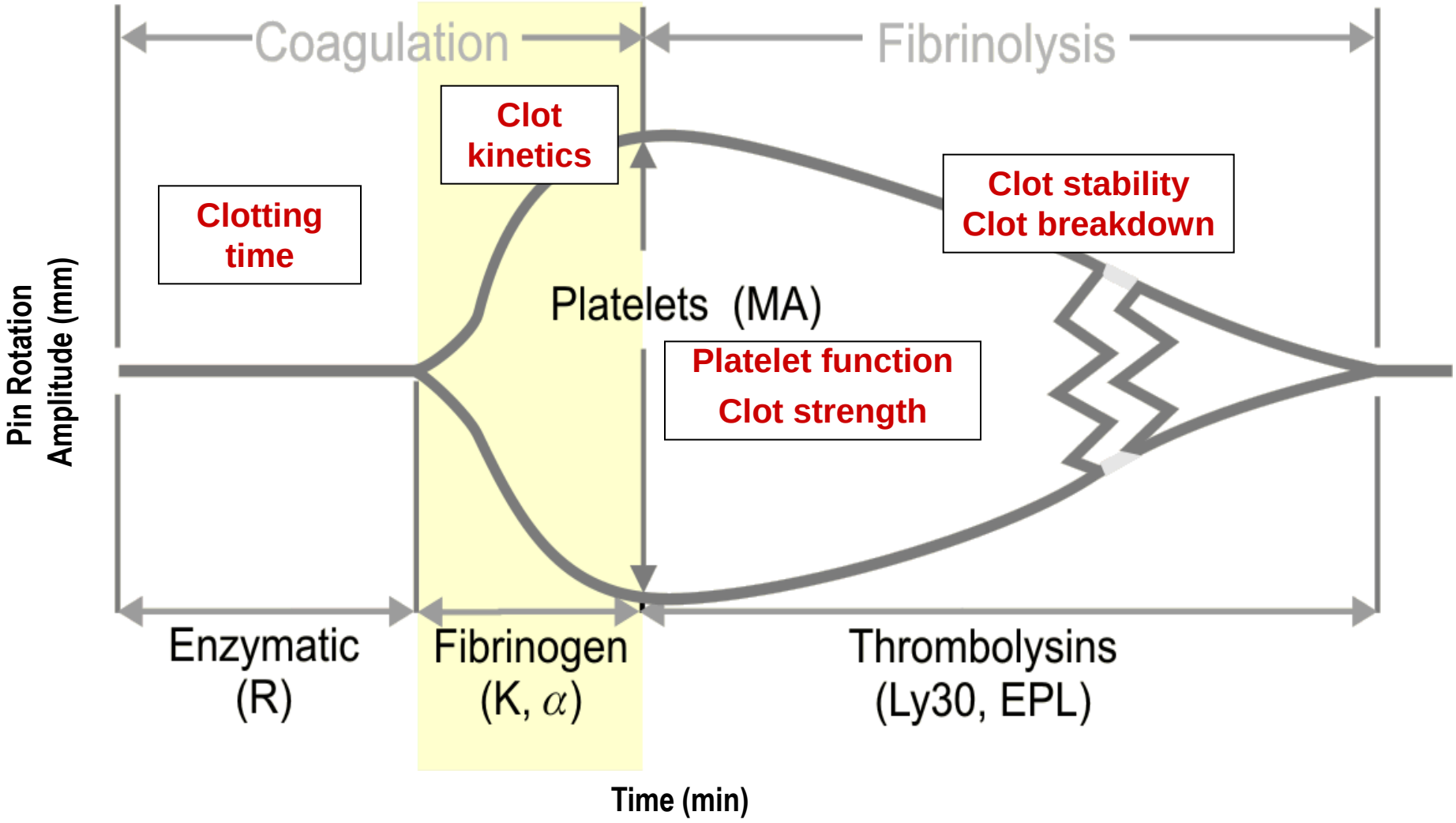


Normal Haemostasis

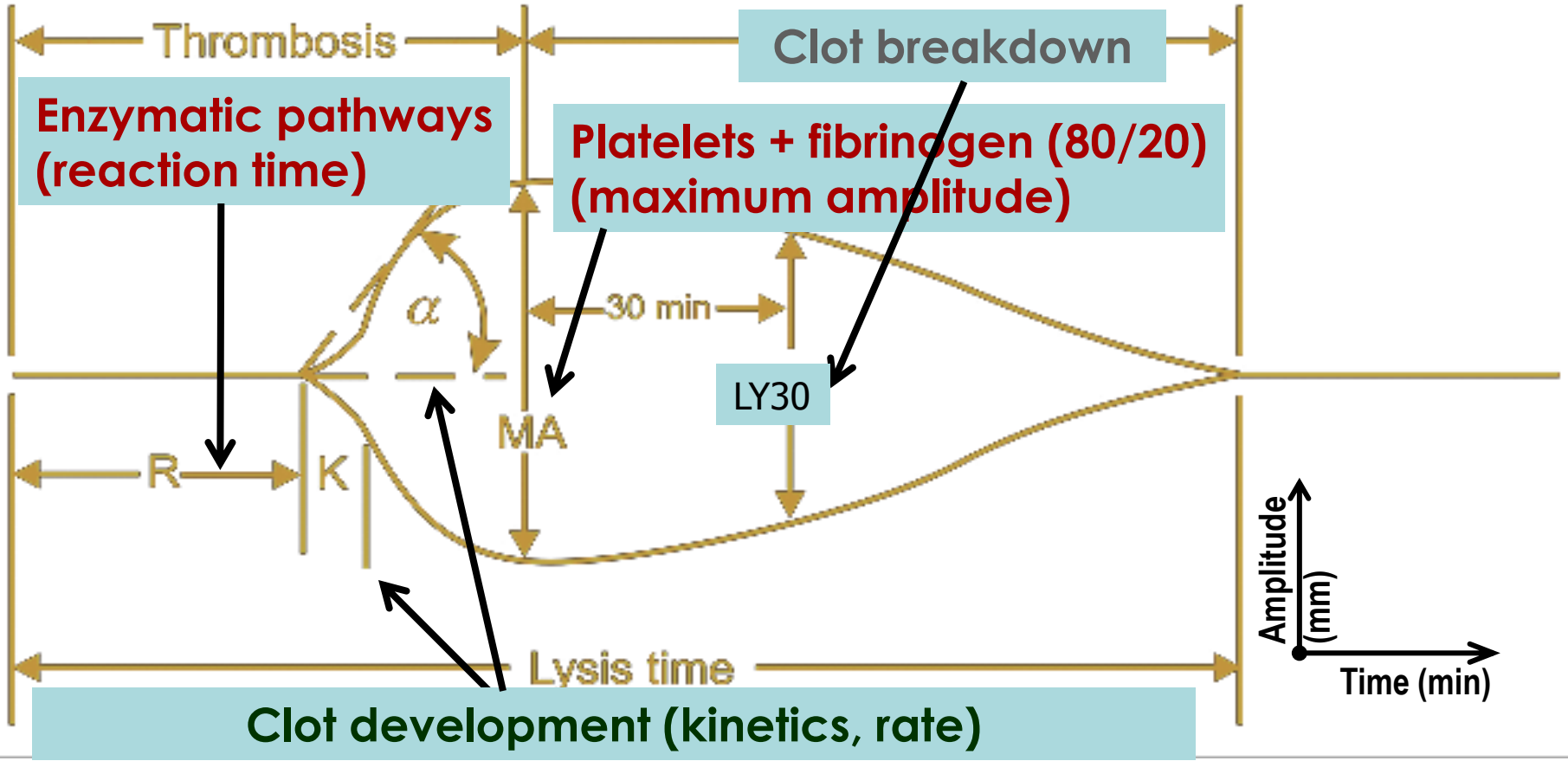
…is controlled activation of clot formation and clot lysis that stops haemorrhage without permitting inappropriate clotting (thrombosis)…



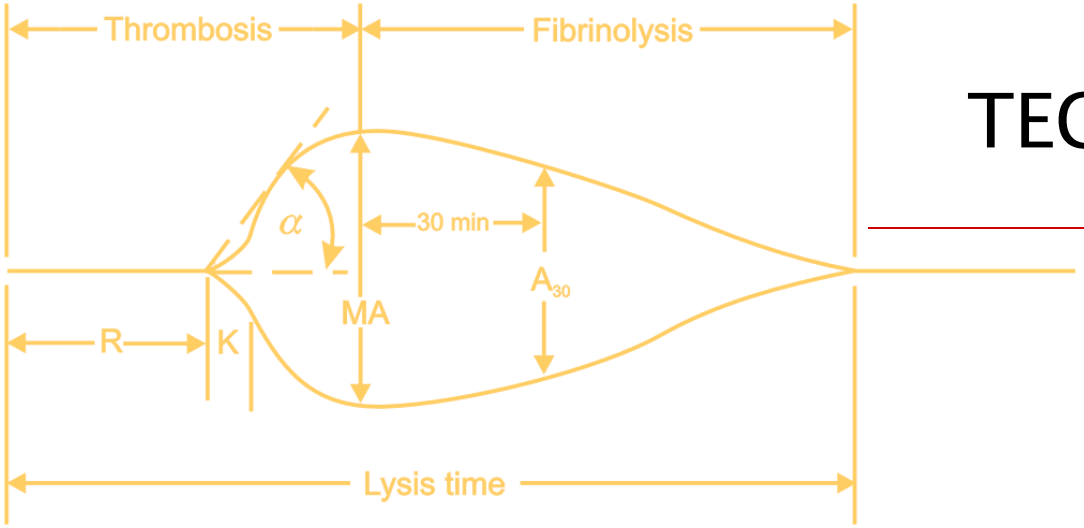
TEG® Technology
Hemostasis profile



Clot Parameters



CI = global coagulation index (linear expression of R, MA, K, angle)



TEG® Tracing

R	R is the time of latency from the time that the blood was placed in the TEG® analyzer until the initial fibrin formation.
α	The α value measures the rapidity (kinetics) of fibrin build-up and cross-linking, that is, the speed of clot strengthening.
K	K time is a measure of the rapidity to reach a certain level of clot strength.
MA	MA, or Maximum Amplitude, is a direct function of the maximum dynamic properties of fibrin and platelet bonding and represents the ultimate strength of the fibrin clot.
LY30 (EPL)	LY30 measures the rate of amplitude reduction 30 minutes after MA. This measurement gives an indication of the stability of the clot.

Treatment Protocol

TEG® value	Clinical Cause	Suggested Treatment
R between 7 - 10 min	↓ clotting factors	x 1 FFP or 4 ml/kg
R between 11-14 min	↓↓ clotting factors	x 2 FFP or 8 ml/kg
R greater than 14 min	↓↓↓ clotting factors	x 4 FFP or 16 ml/kg
MA between 49 -54 mm	↓ platelet function	0.3mcg/kg DDAVP
MA between 41 -48 mm	↓↓ platelet function	x5 platelet units
MA at 40 mm or less	↓↓↓ platelet function	x10 platelet units
α less than 47	↓↓ fibrinogen level	.06 u/kg cryo
LY30 7.5% or greater, CI less than 3.0	Primary fibrinolysis	antifibrinolytic of choice
LY30 7.5% or greater, CI greater than 3.0	Secondary fibrinolysis	anticoagulant of choice

Pattern Recognition

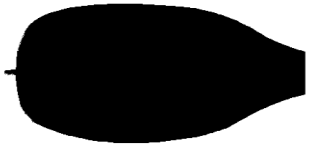
Normal
R;K;MA;Angle = Normal

Anticoagulants/hemophilia
Factor Deficiency
R;K = Prolonged;
MA;Angle = Decreased

Platelet Blockers
Thrombocytopenia/
Thrombocytopathy
R ~ Normal; K = Prolonged;
MA = Decreased

Fibrinolysis (UK, SK, or t-PA)
Presence of t-PA
R ~ Normal;
MA = Continuous decrease
LY30 > 7.5%; WBCLI30 < 97.5%;
Ly60 > 15.0%; WBCLI60 < 85%

Hypercoagulation
R;K = Decreased;
MA;Angle = Increased



D.I.C
Stage 1
Hypercoagulable state with
secondary fibrinolysis

Stage 2
Hypocoagulable state

Haemostasis issues facing Clinicians

Identify Haemostatic Imbalance

- Before Surgery
  - Prothrombotic
  - Platelet Function
  - Excess Fibrinolysis
- During Surgery
  - Platelet Function
  - Excess Fibrinolysis
  - Factor deficiency vs residual circulating anti-coagulant
- After Surgery

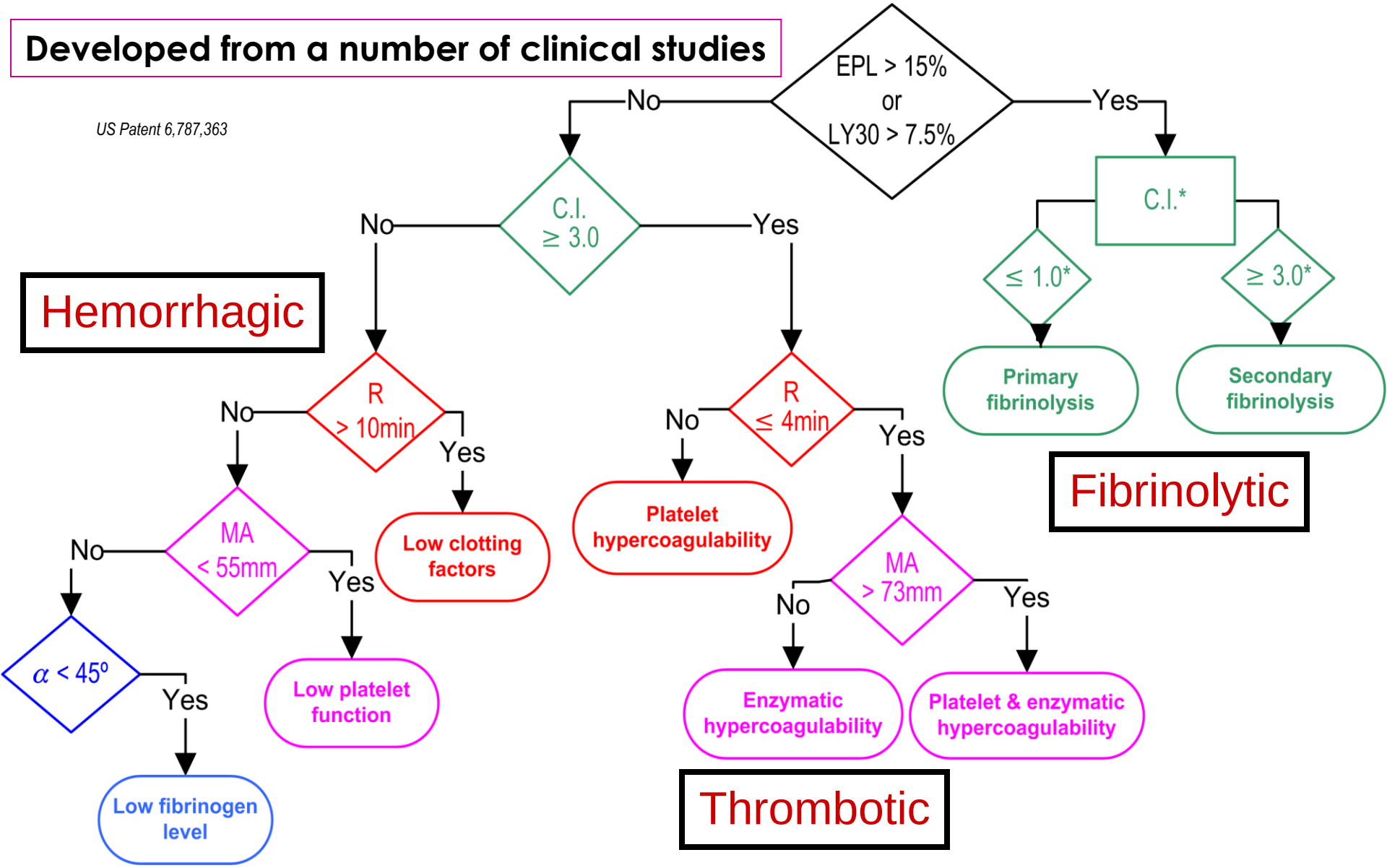
(If the patient is bleeding how it should be treated)

  - Coagulopathy
  - Excess anti-coagulant
  - Surgical

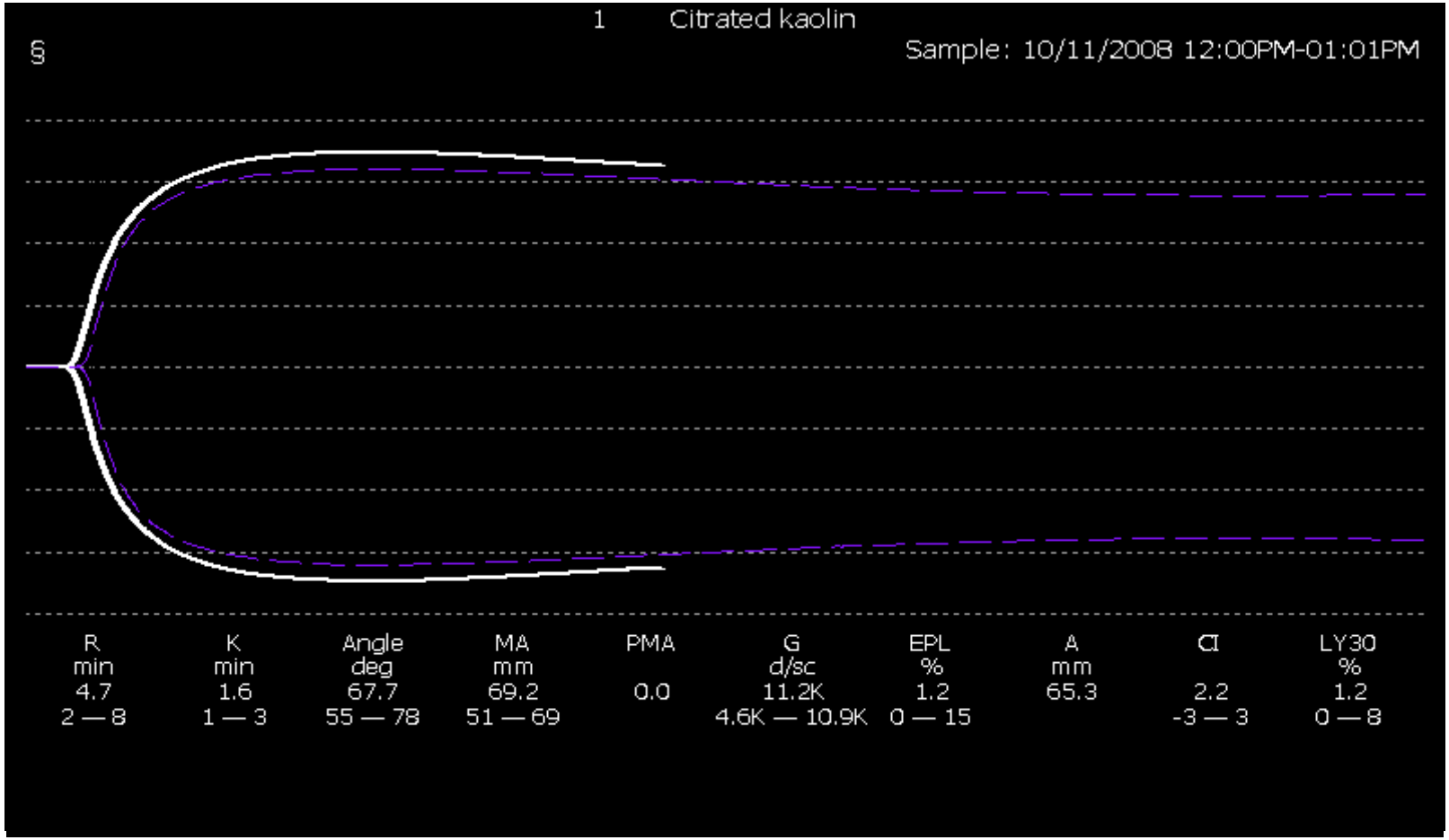
TEG decision tree

Developed from a number of clinical studies

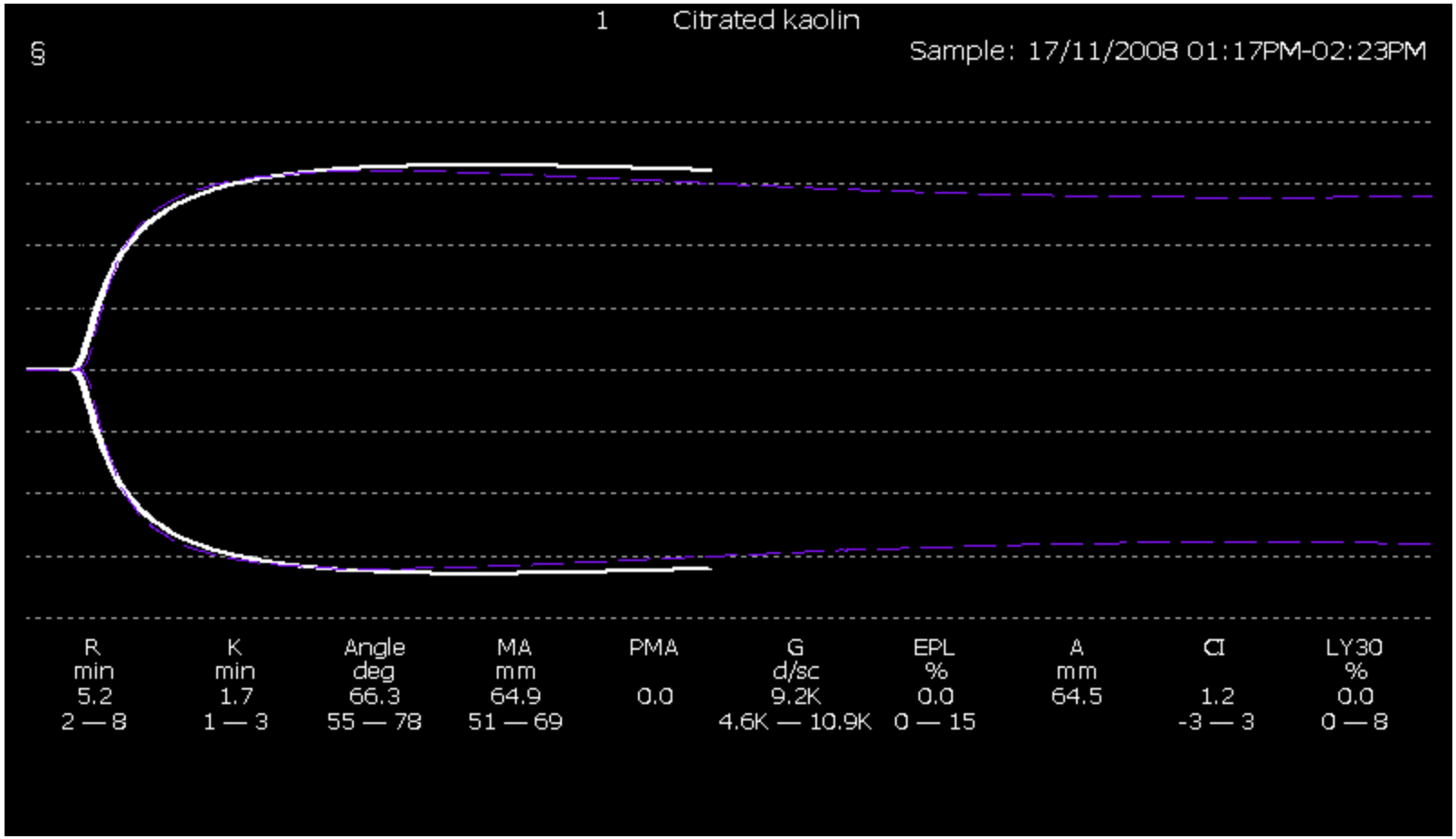
US Patent 6,787,363



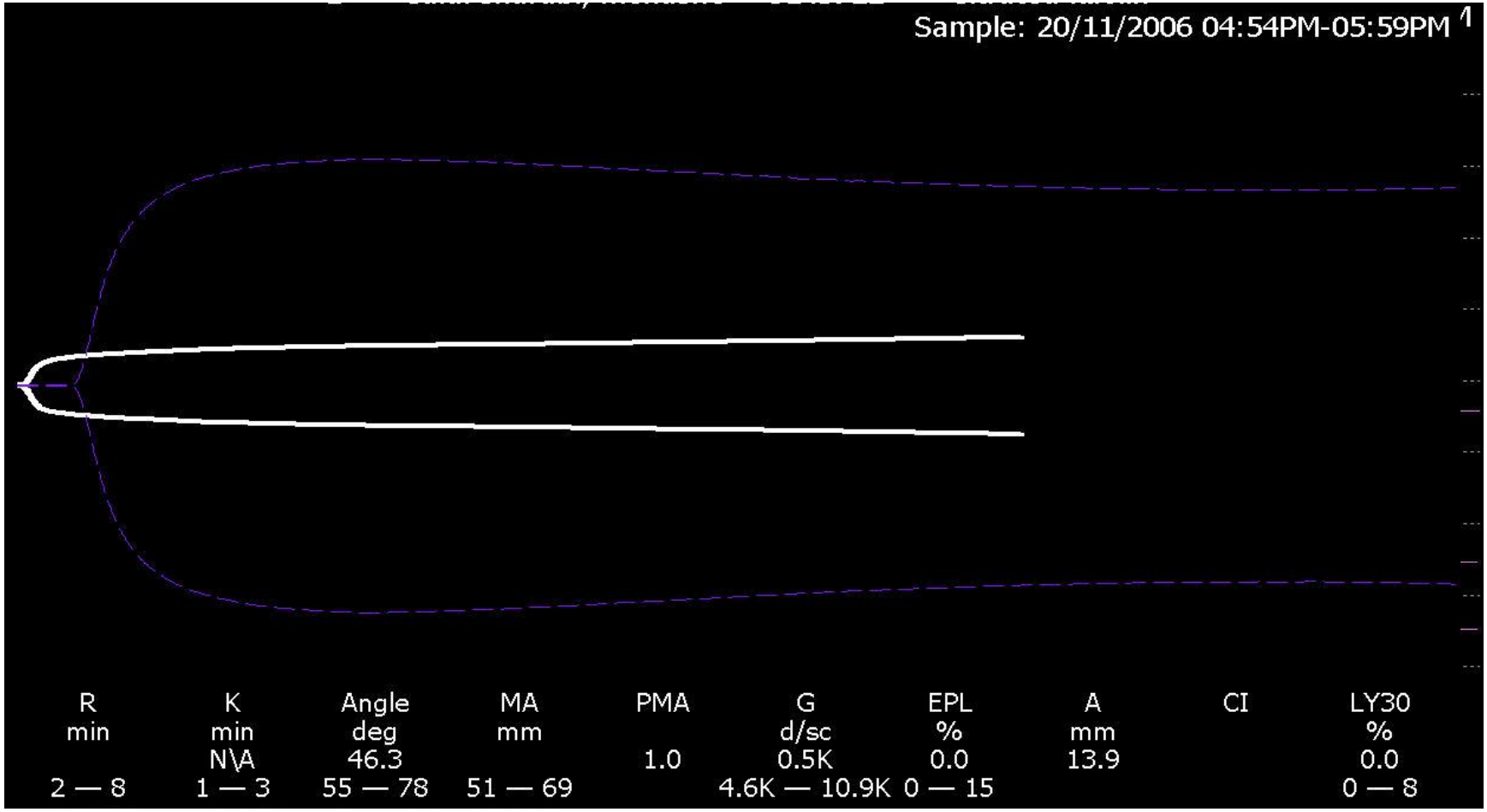
33 years old women with epidural catheter after childbirth 67000 plts



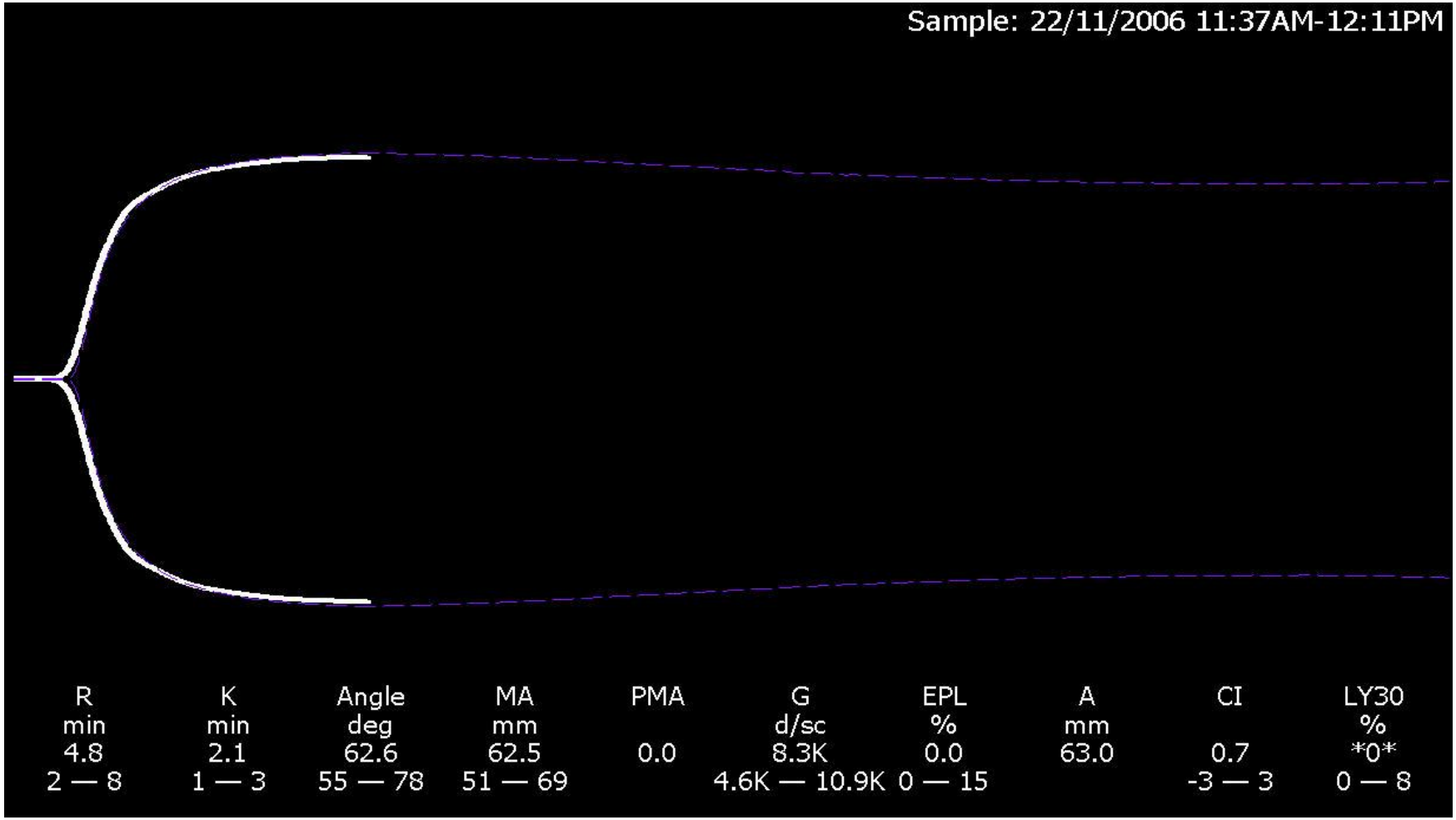
63 years old patient with normal coagulation tests, bleeding after prostatectomy



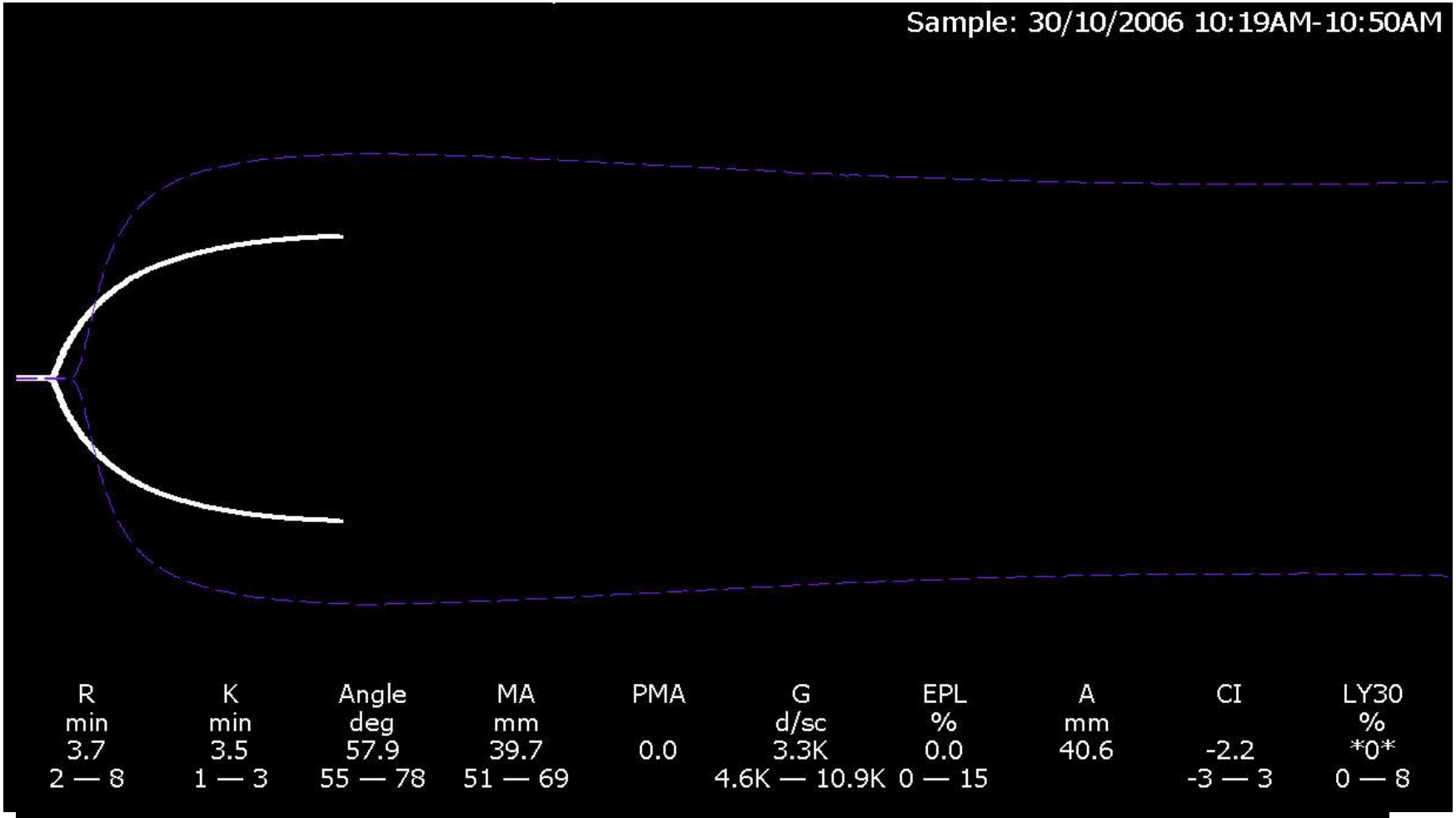
Bleeding patient with pathologic coagulation tests – prolonged INR & APTT – coumadin overdose



The same patient after component treatment
received 7FFP and 2pc



Intensive care patient, massive bleeding, prolonged PT and thrombocytopenia - received 4pc+10FFP+10 cryo+10plts



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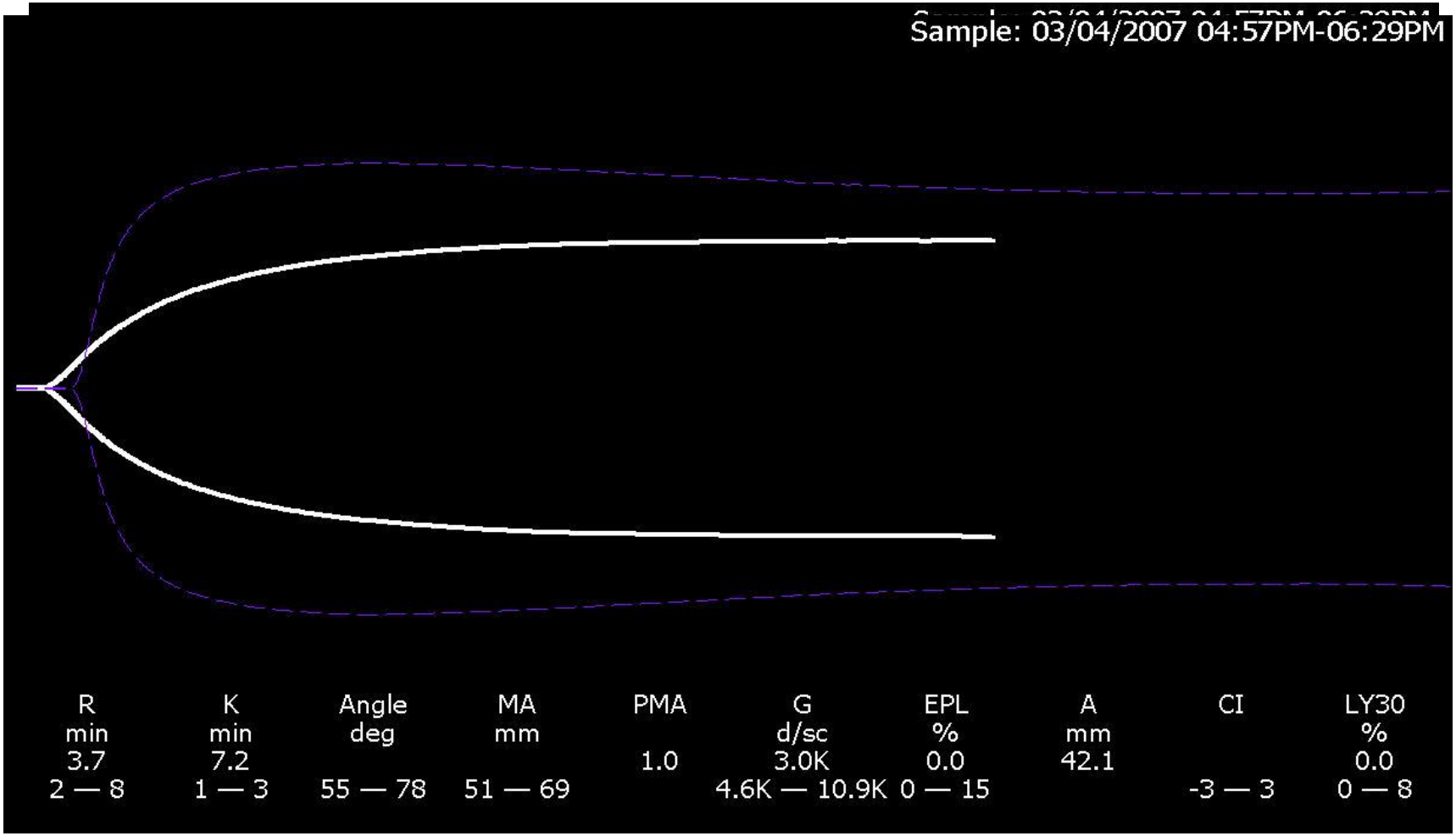
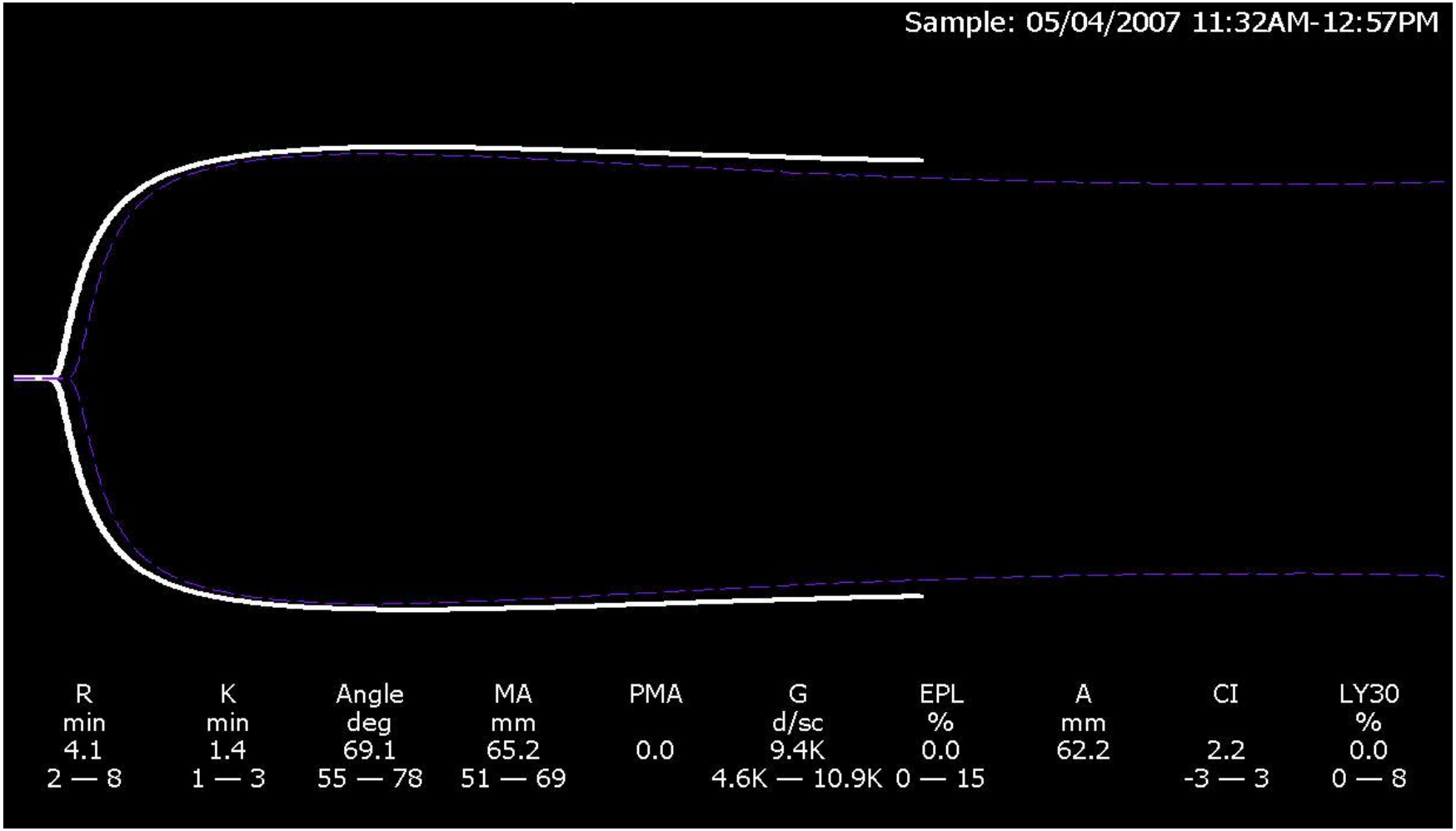
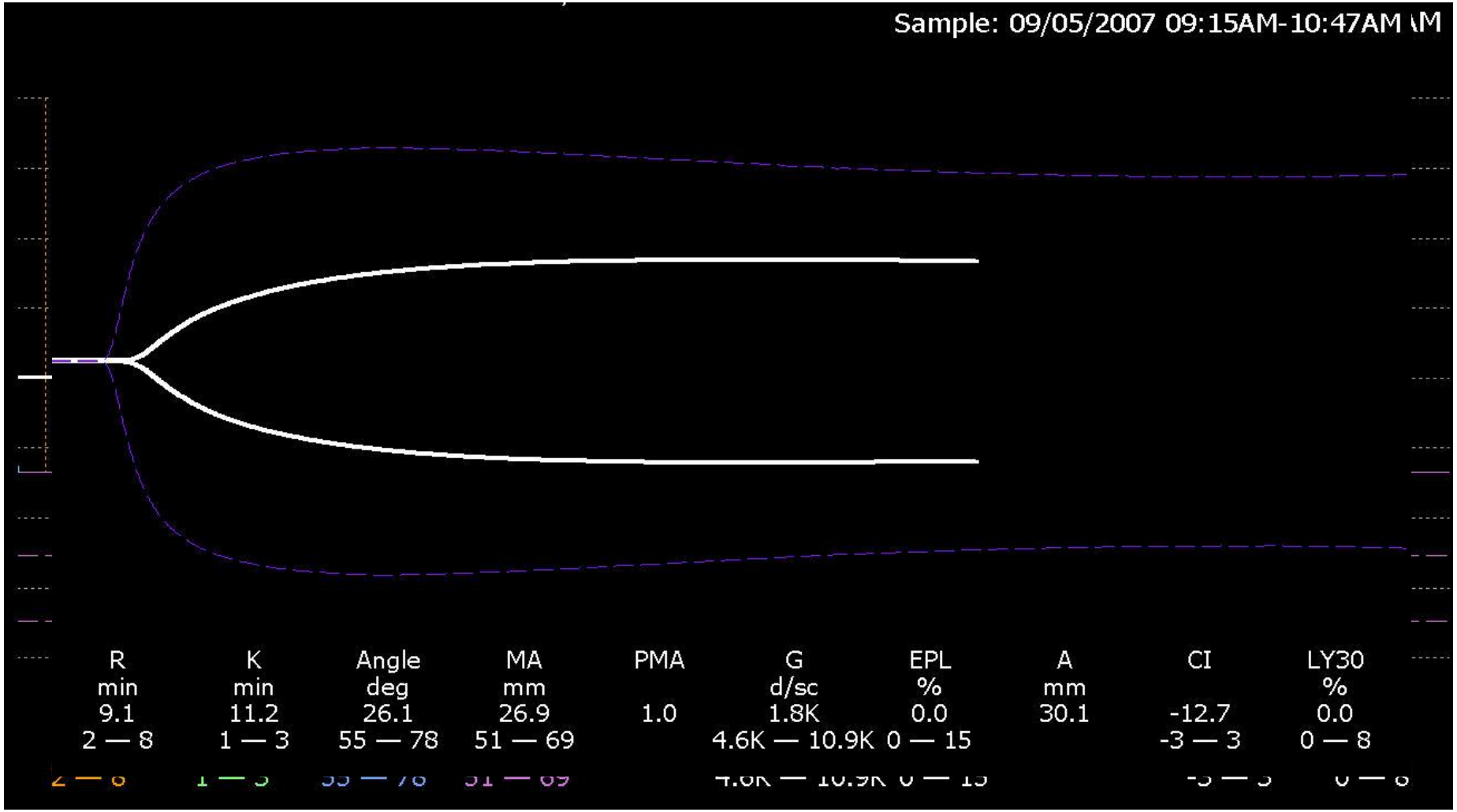


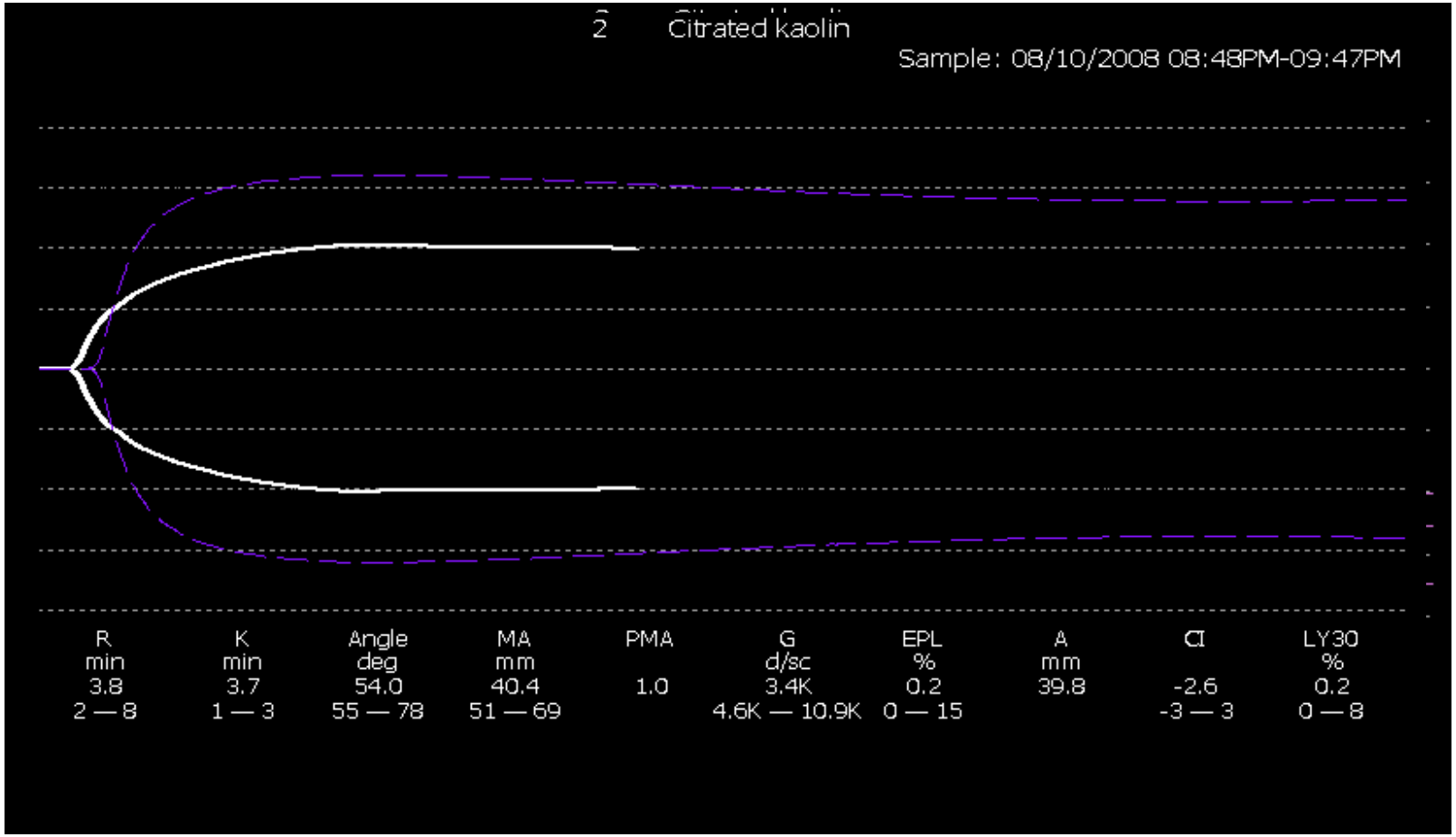
Same patient after 12pc+14FFP+10cryo+15 plts



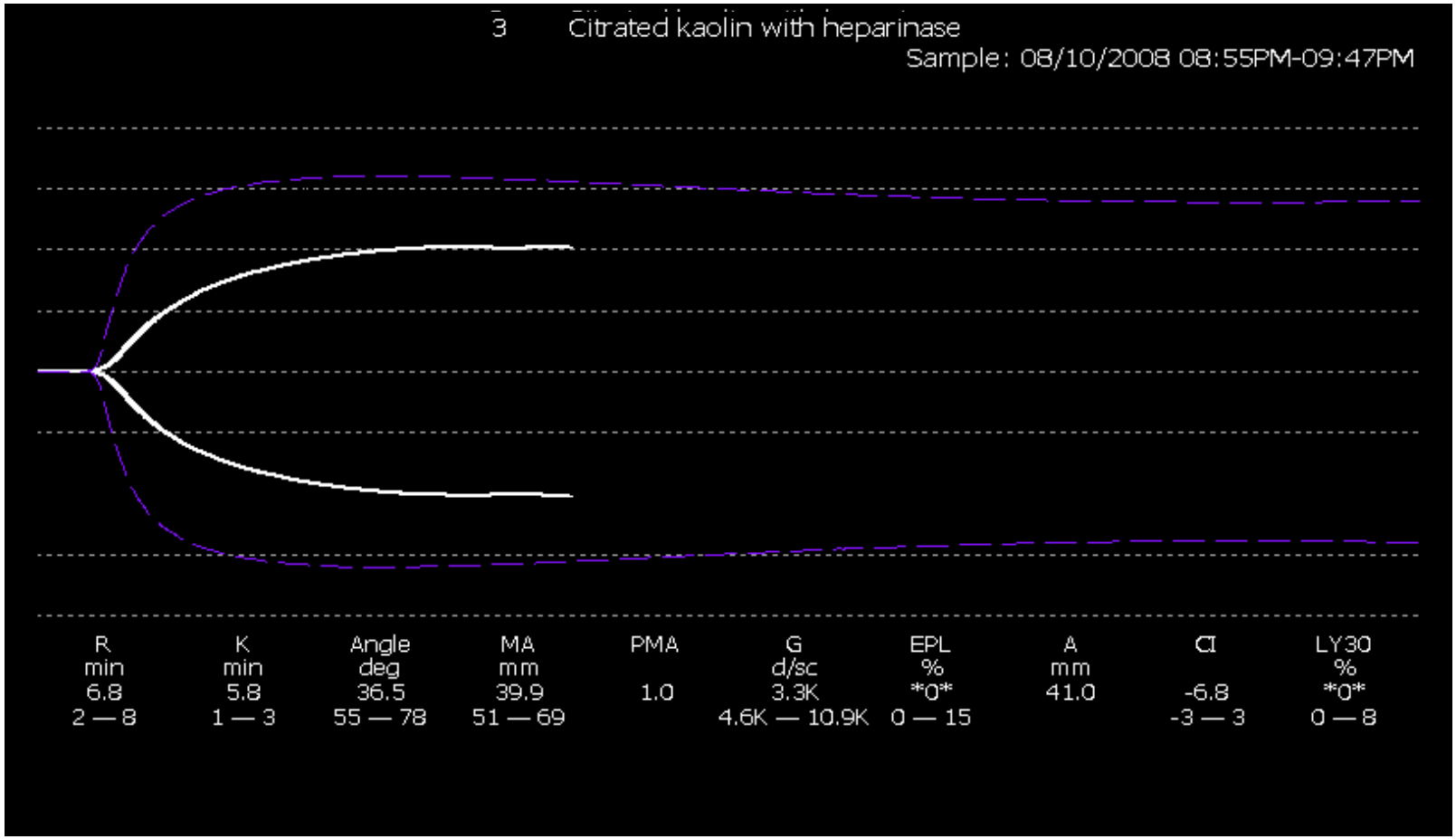
Patient with hematological malignancy – all coagulation tests pathological – bleeding from stomach received 25pc+16FFP+25cryo+30plts



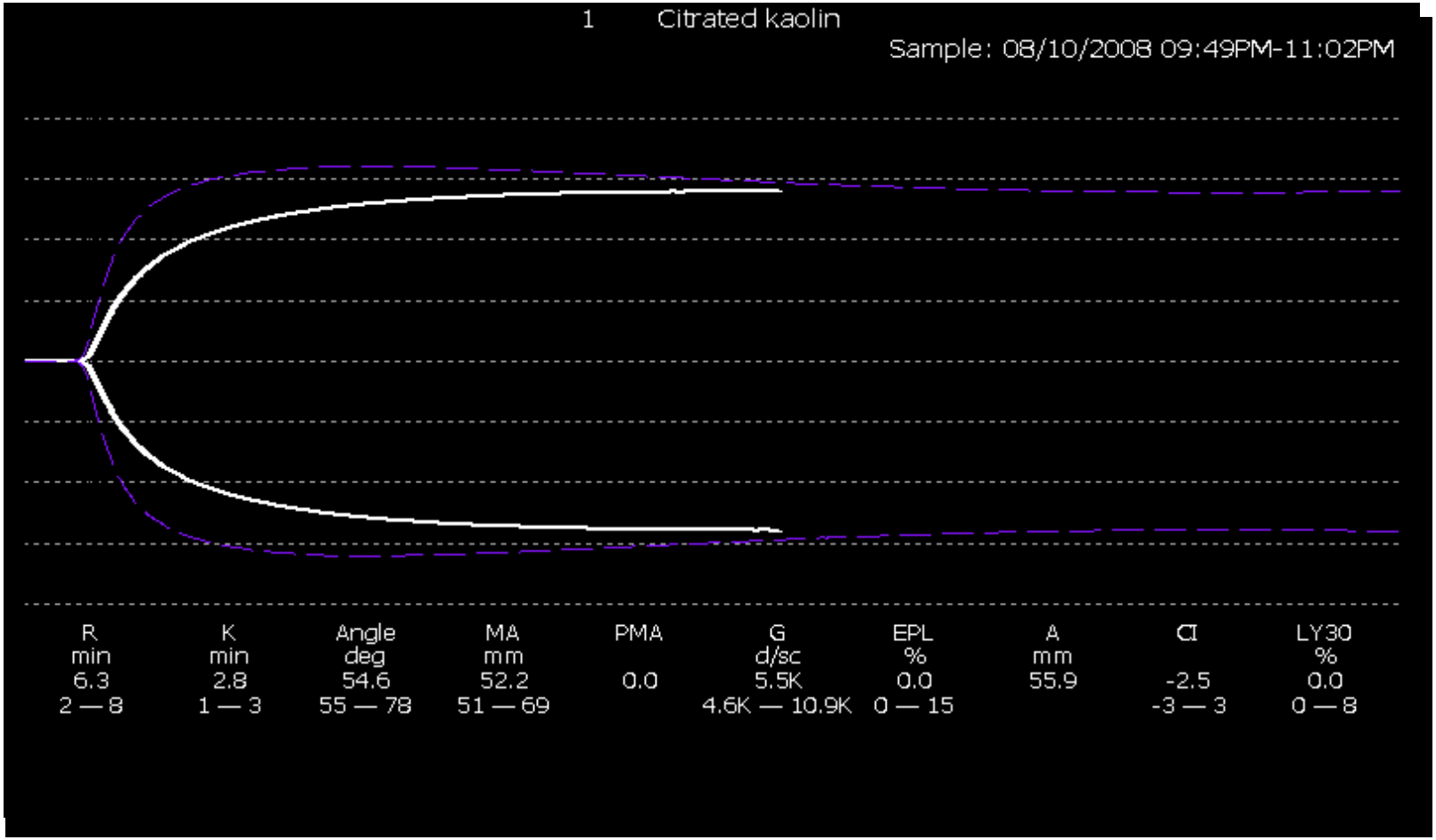
56 years old patient with acute on chronic renal failure, Diabetes mellitus, Morbid obesity, Copd with acute exacerbation, Mechanical ventilation



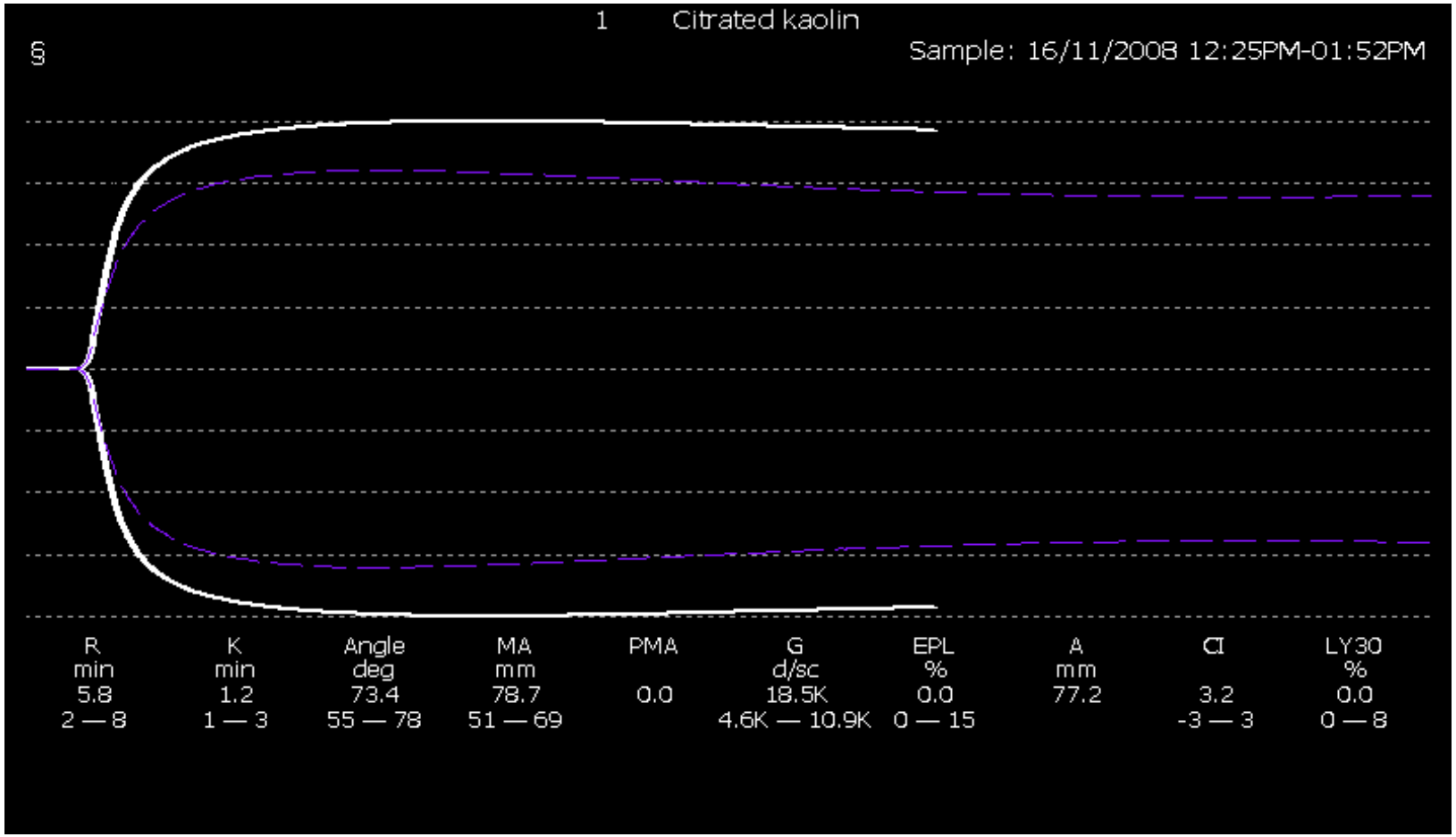
Same patient with heparinase



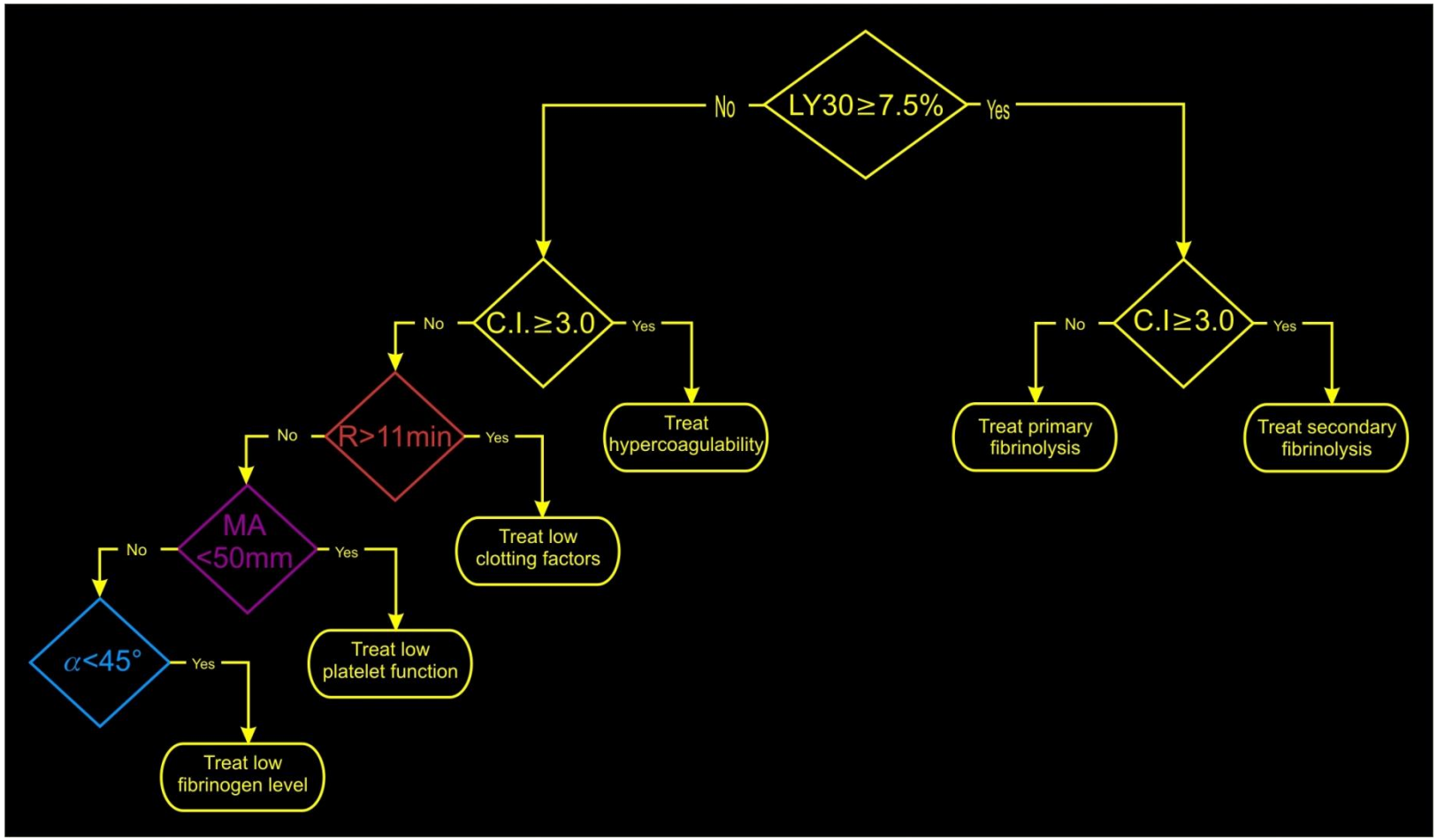
Same patient after component treatment



72 years old patient after TKR with bleeding in knee, PT mildly prolonged and corrected with vit k, PTT, fibrinogen normal, platelets normal



TEG® Decision tree



TEG (1)

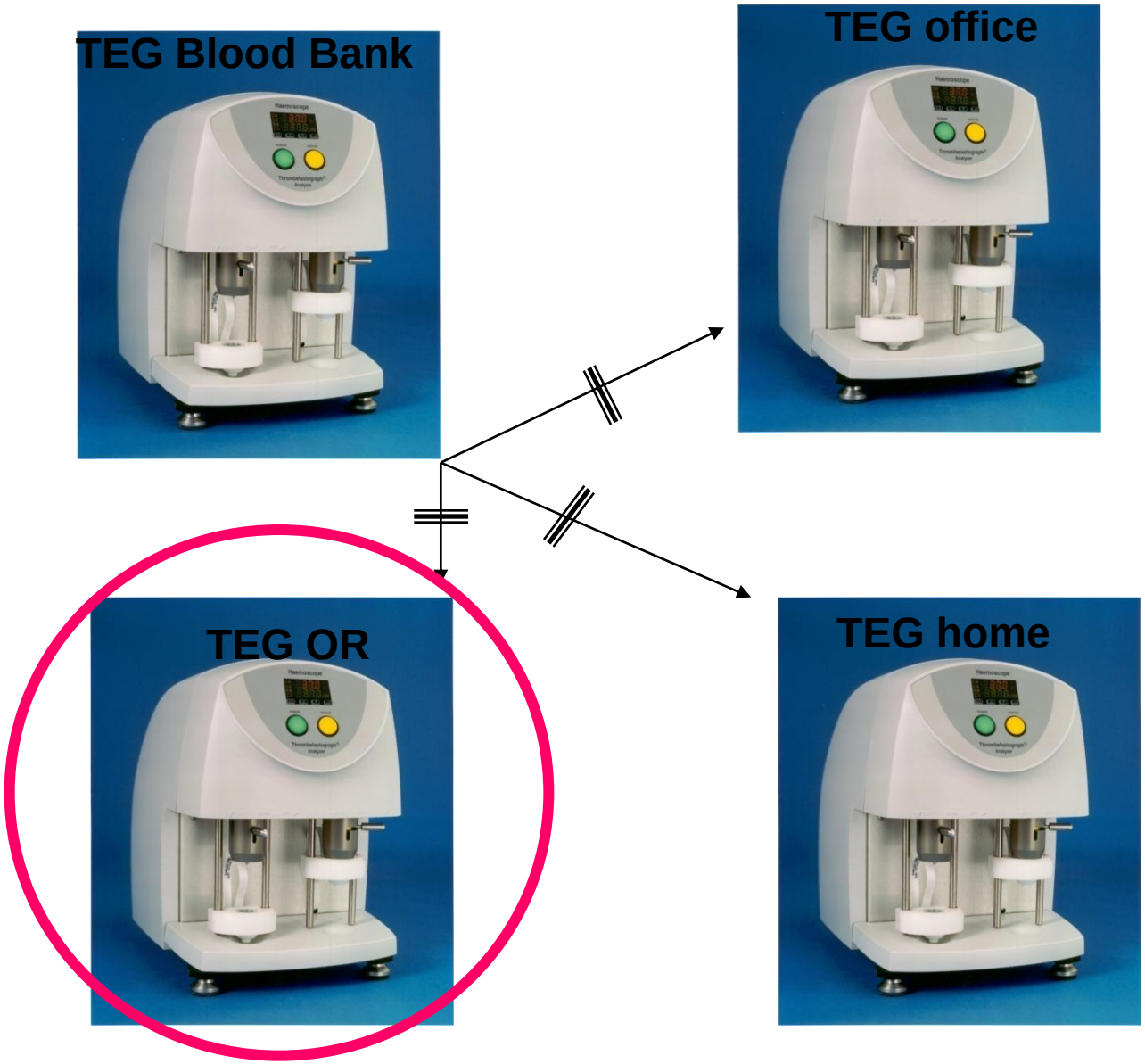
- In a catastrophic event many massively bleeding patients will have to be treated simultaneously, sharing available resources
- Conventional blood tests will not provide a swift enough answer to guide decision making as they can be lengthy and do not necessarily represent the in vivo picture

TEG (2)

- In our hospital TEG is performed in the blood bank and can be viewed online in remote sites (including the operating theater)
- The anesthetists have been tutored in interpreting the TEG and in a short time the need for FFP, cryoprecipitate (fibrinogen) and platelet concentrates can be assessed, allowing prompt on time decision making

TEG (3)

- In an event in which communication online is cutoff the TEG can be transferred and setup in the operating theater, allowing decision making on the spot
- The test can be repeated until the patient is stabilized and has received proper replacement therapy


TEG Blood Bank
TEG office
TEG OR
TEG home


Cooperation

Study Proposal

- Trauma patients – massively bleeding
- TEG on entry OR
- After receiving 1st pack - TEG
- If bleeding continues reevaluate TEG
- TEG when patient stabilizes
- In parallel – CBC, PT, APTT, fibrinogen