# Interpreting the clotting screen

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# Outcomes

- Take a bleeding history
- Describe how a PT, APTT & INR are performed
- Outline the causes of isolated prolongation in the PT and APTT
- Apply your knowledge to clinical problem-solving

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# How does blood clot?

- Vessel injury/Tissue factor
- Platelets
- Fibrinogen
- Clotting factors
- Red blood cells

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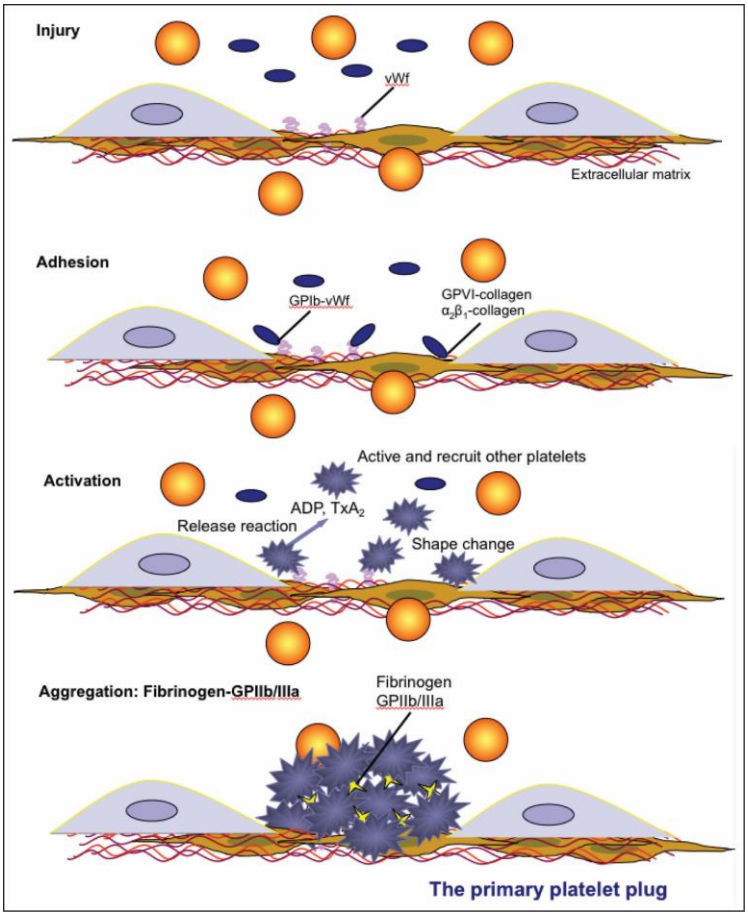


https://healthjade.net/coagulation/

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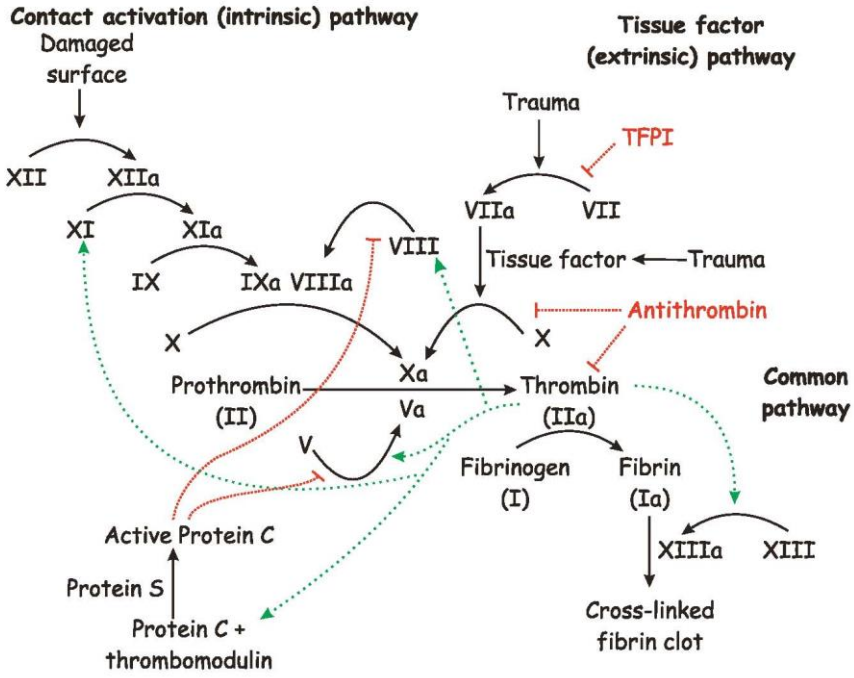
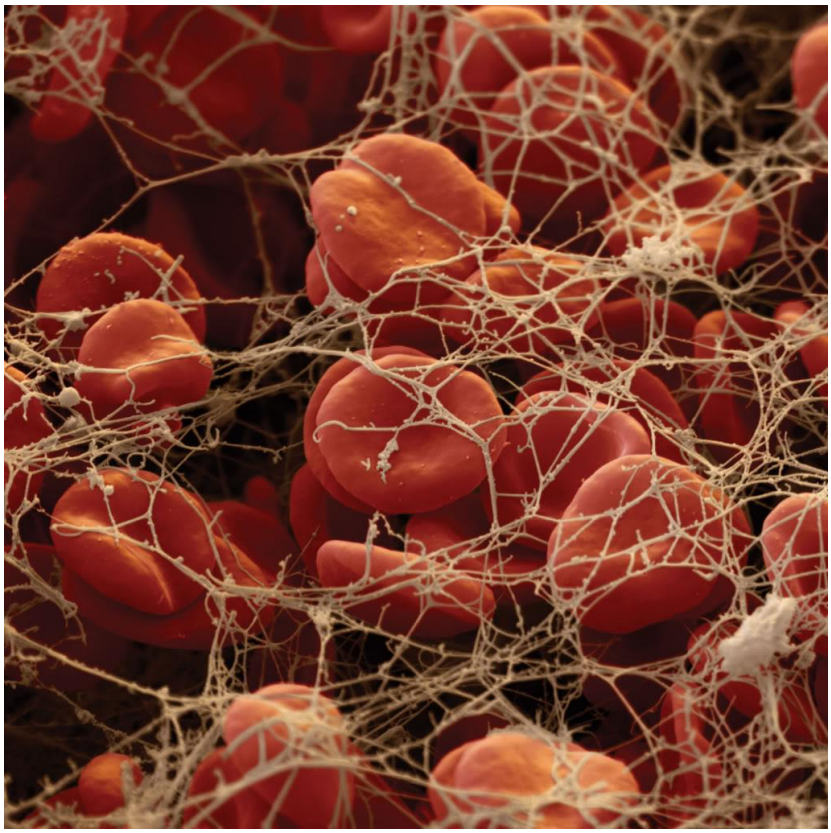
# Classical coagulation cascade





# Taking a bleeding history

- PMHx
- DHx
- FHx
- Previous surgical challenges/dental procedures/pregnancies
- Type of bleeding eg mucosal, muscle, joint, dental, menorrhagia
- Extent and duration of bleeding
- Complications & treatment of previous bleeding episodes

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# Testing for problems of haemostasis

- PT/INR
- aPTT
- (FBC)

- Fibrinogen
- D-dimers

- Thrombin time/Reptilase time
- Factor assays
- Viscoelastic assays (TEG/ROTEM)

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# Taking a citrated sample

- Choose the right tube
- Fill to the line
- Invert 3-4 times
- Do not over-agitate
- Process within 2-4 hours
- Beware of line contamination


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# PT & APTT

PT

PPP
TF
Calcium

APTT

PPP
Activator
PL
Calcium

NB. No platelets in the clotting screen
PPP = platelet poor plasma

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# PT

- Sensitive to levels of FII, FV, FVII & FX

Isolated prolongation in:
FVII deficiency (rare!)
(Vitamin K deficiency)
(Warfarin)

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# aPTT

- Sensitive to levels of FII, FV, FX, FVIII, FIX, FXI & FXII
- Can be sensitive to low levels of vWF

Isolated prolongation in:
FVIII deficiency (Haemophilia A)
FIX deficiency (Haemophilia B)
FXI deficiency
FXII deficiency (clinically silent)
Severe vWD
Presence of a factor inhibitor

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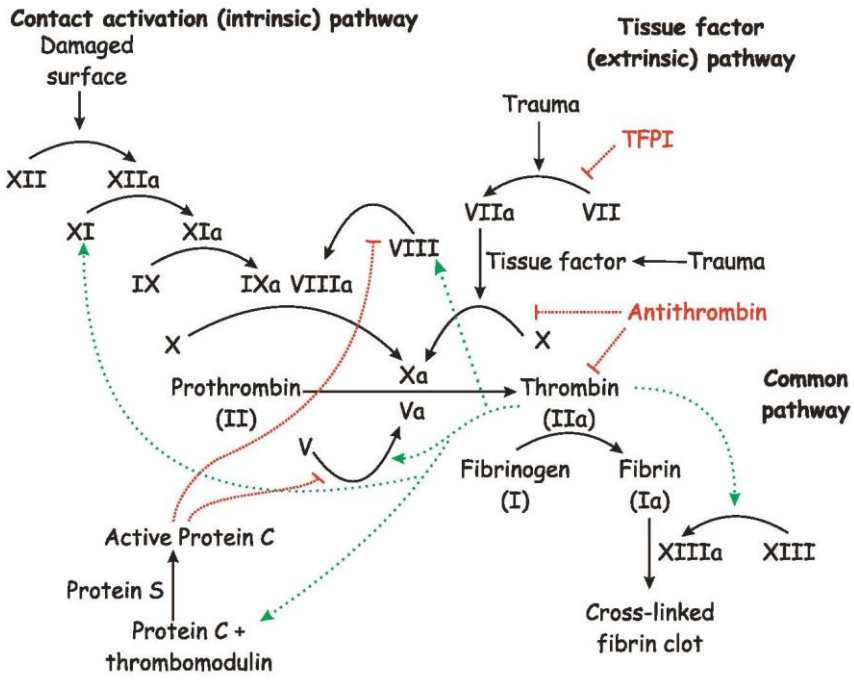
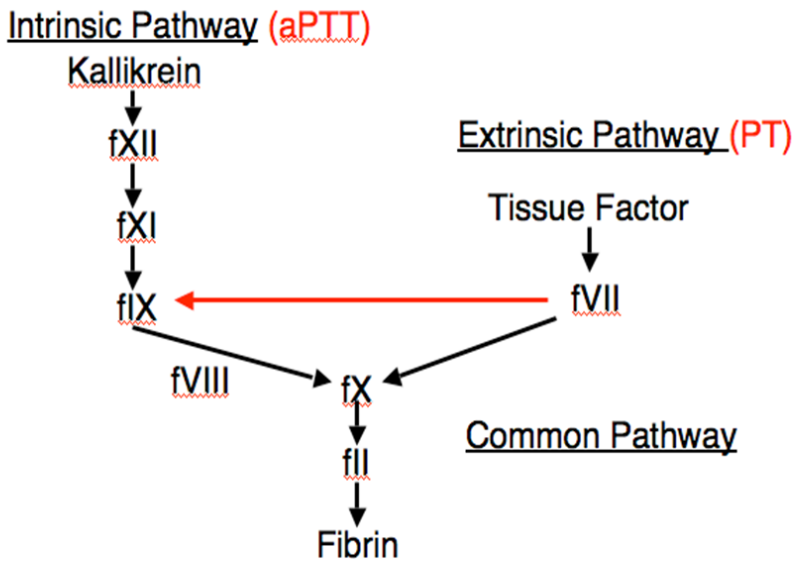
# Classical coagulation cascade

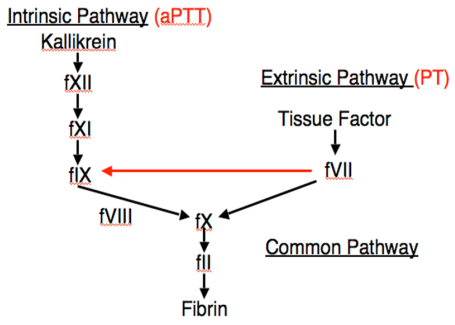


# Basic coagulation cascade



A 58-year-old woman attends for a preoperative assessment ahead of an elective TAH-BSO. She has previously had spinal surgery and a recent tooth extraction without any bleeding. She has no history of spontaneous bleeding or bruising. She has a normal FBC and her coagulation screen shows a PT of 11.0s (normal) and an APTT of 75s (normal range 26-34s). What is the single most likely diagnosis?

A. Factor VII deficiency
B. Factor VIII deficiency
C. Factor X deficiency
D. Factor XI deficiency
E. Factor XII deficiency

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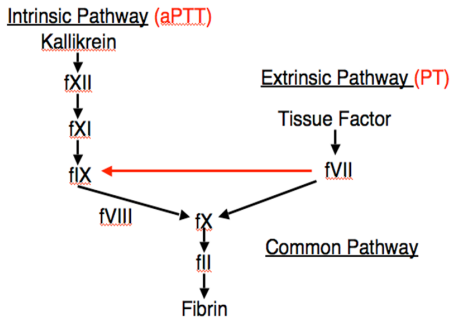
A 58-year-old woman attends for a preoperative assessment ahead of an elective TKR. She has no children or surgical challenges but has previously had protracted bleeding following dental extraction and a has a history of easy bruising. She has a normal FBC and her coagulation screen shows a PT of 11.0s (normal) and an APTT of 75s (normal range 26-34s). What is the single most likely diagnosis?

A. Factor VII deficiency
B. Factor VIII deficiency
C. Factor X deficiency
D. Factor XI deficiency
E. Factor XII deficiency

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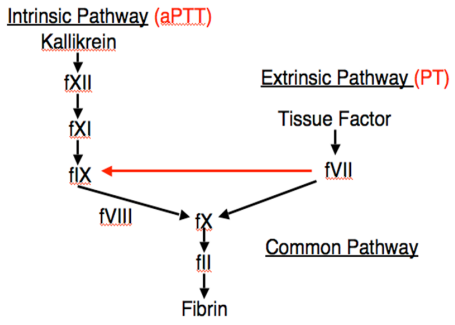
A 18-year-old man attends for a preoperative assessment ahead of an arthroscopy He has a history of easy bruising, epistaxis and has required clotting factor replacement before a tonsillectomy when he was younger. He has a normal FBC and her coagulation screen shows a PT of 16.0s (normal range 10.0 – 12.0s) and an APTT of 48s (normal range 26-34s). What is the single most likely diagnosis?

A. Factor VII deficiency
B. Factor VIII deficiency
C. Factor X deficiency
D. Factor XI deficiency
E. Factor XII deficiency

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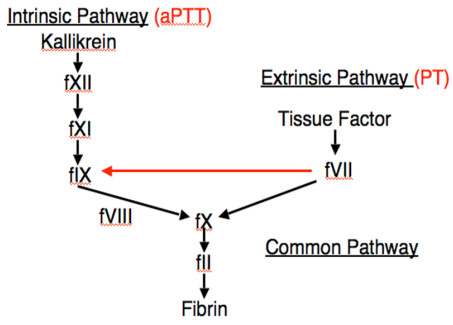
A 21 year old male attends A&E with severe epistaxis. He has a significant history of spontaneous bleeding, especially gingival bleeding and epistaxis. The patient has previously received treatment with rFVIIa but can't remember his diagnosis. His FBC and clotting screen are normal. What is the single most likely diagnosis?

A. Acquired Haemophilia A
B. Severe von Willebrand Disease
C. Combined FV / FVIII deficiency
D. Factor VII deficiency
E. Glanzmann's Thrombasthenia

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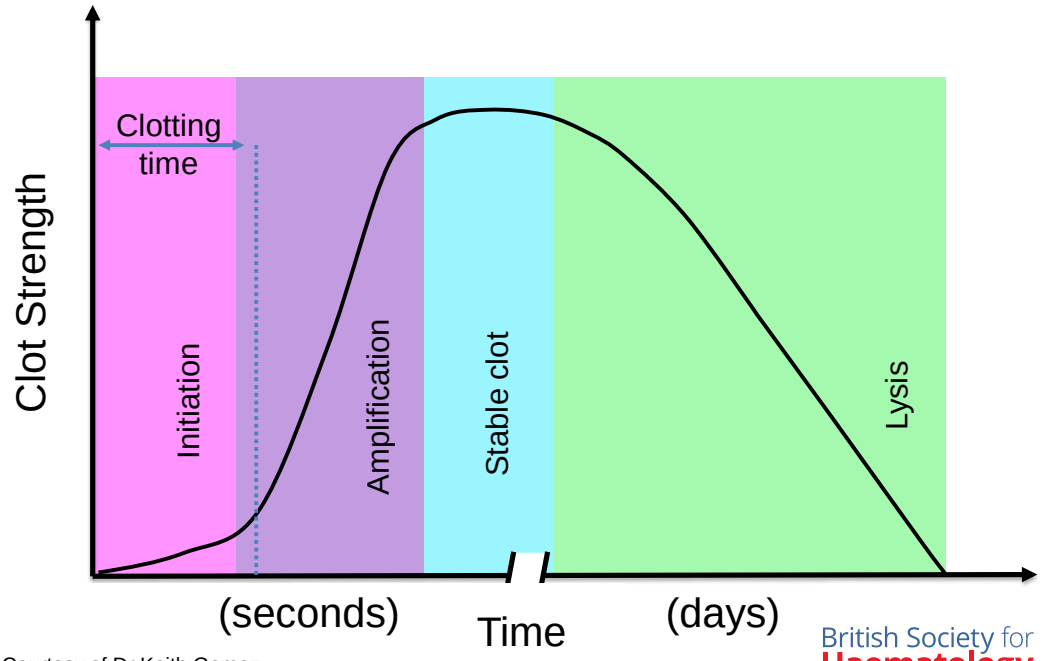
# What is measured by a PT or APTT?




Courtesy of Dr Keith Gomez

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A previously well 83 yo woman presents with new epistaxis and bleeding from a venepuncture site. She is covered in bruising. She has an Hb of 92g/L and normal platelet count. PT is 11.2s (normal range 10.0 – 12.0s) and APTT 95s (normal range 26-34s). She is not on any anti-platelet or anticoagulant drugs. What is the next most appropriate test to request?

A) aPTT 50:50 mix
B) Lupus anticoagulant screen
C) Reptilase time
D) Thrombin time

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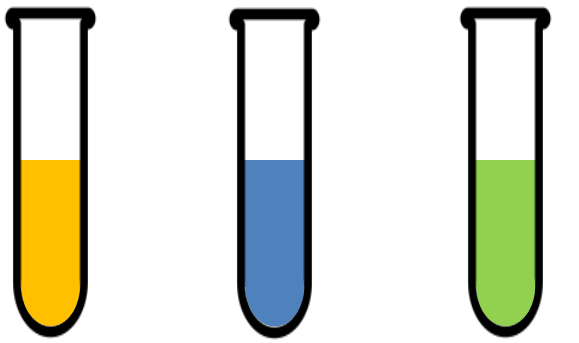
# Factor deficiency




| Patient | Control | 50:50 mix |
|---|---|---|
| APTT 75s | APTT 30s | APTT 33s |
| FVIII:C <1 | FVIII:C 100 | FVIII:C 50 |

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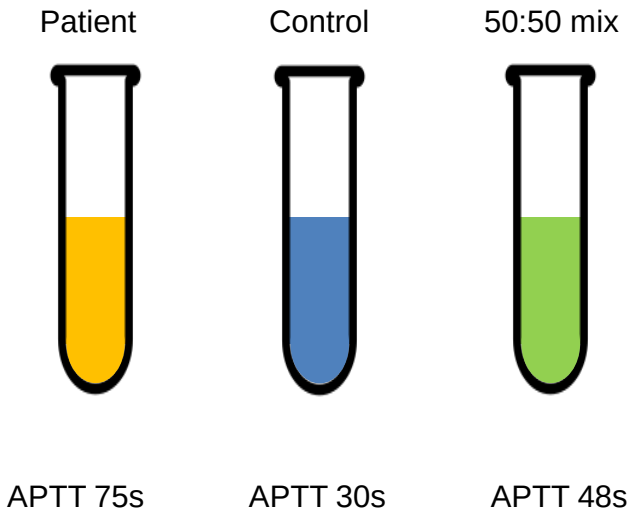
# Factor inhibitors

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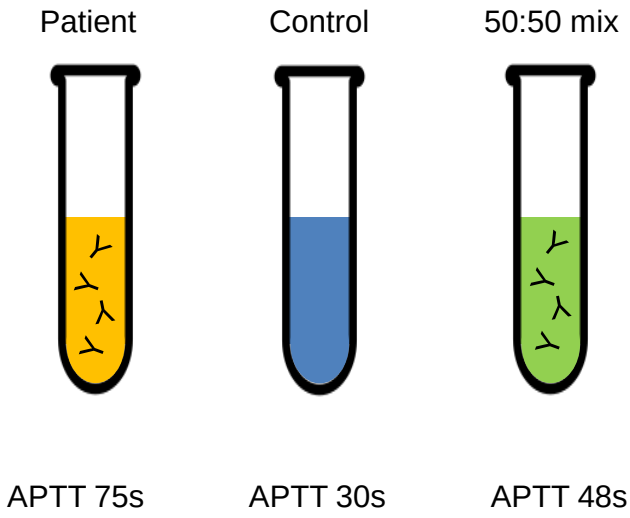
# Factor inhibitors




An antibody inhibits the reaction in the test-tube – this is a factor 'inhibitor'

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# 50:50 mix

- 50% patient + 50% normal plasma
- If full correction – **factor deficiency** (something in the control plasma has replaced something deficient in the patient plasma)
- If partial correction – **factor inhibitor** (something in the patient plasma is inhibiting the correction expected to occur following addition of the control plasma)
- Clinically important inhibitors include Factor VIII inhibitors in acquired haemophilia A. Lupus anticoagulant is also a common inhibitor but does not cause bleeding!

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# INR (International Normalised Ratio)

$$INR = \left( \frac{PT_{patient}}{PT_{meannormal}} \right)^{ISI}$$

- INR used to determine warfarin dosing
- Normalised measurement between labs due to International Sensitivity Index (ISI)
- Poor relationship between INR and bleeding risk in non-warfarinised patients (esp liver patients)

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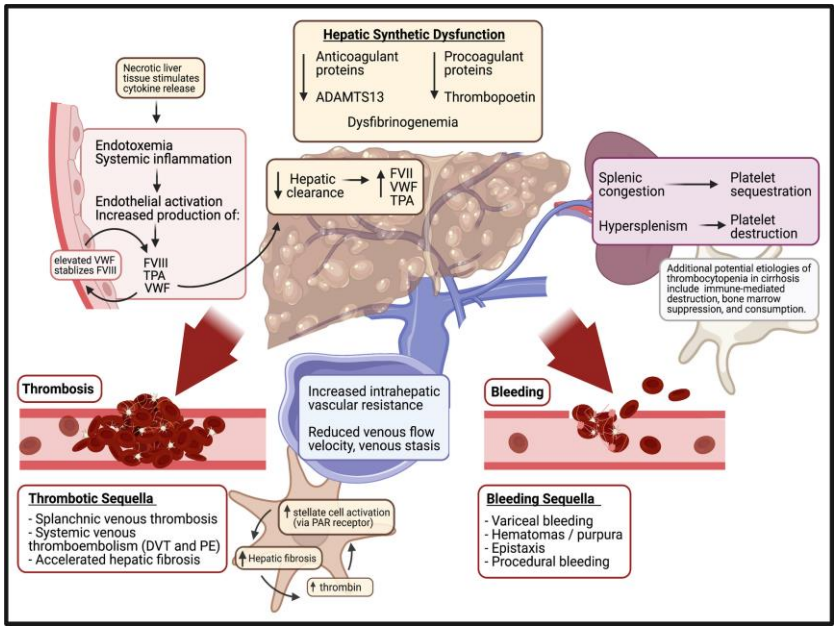
# Coagulopathy of liver disease

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# Take home message

- It is possible to have a severe bleeding disorder with a normal clotting screen
- It is possible to have an significantly abnormal clotting screen with no bleeding disorder
- The clinical history is **critical** –

  If you call for haemostasis advice, you will be expected to know it!

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