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Disseminated Intravascular Coagulation

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Plan

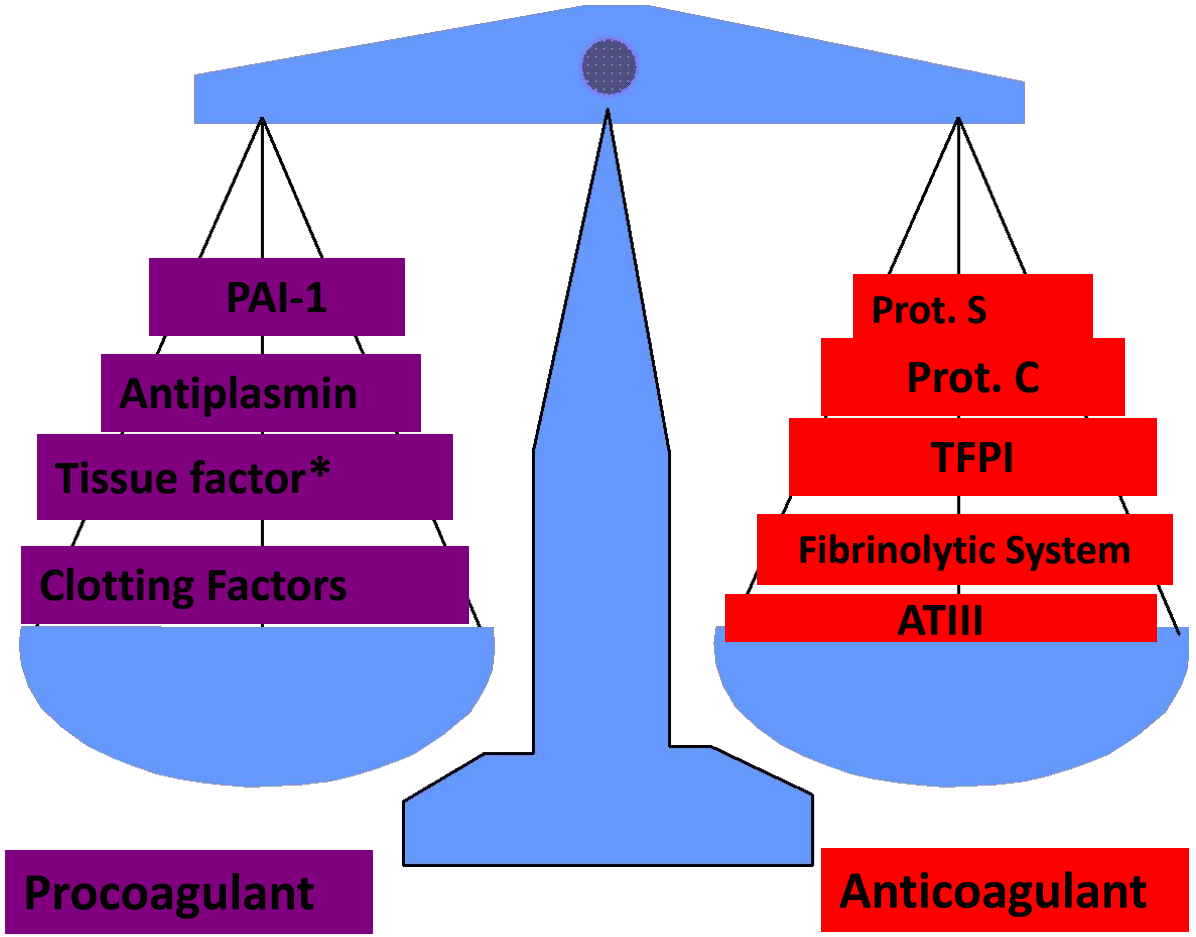
- Definition
- Laboratory methods and their description
- DIC scoring system
- Conclusion

Disseminated Intravascular Coagulation

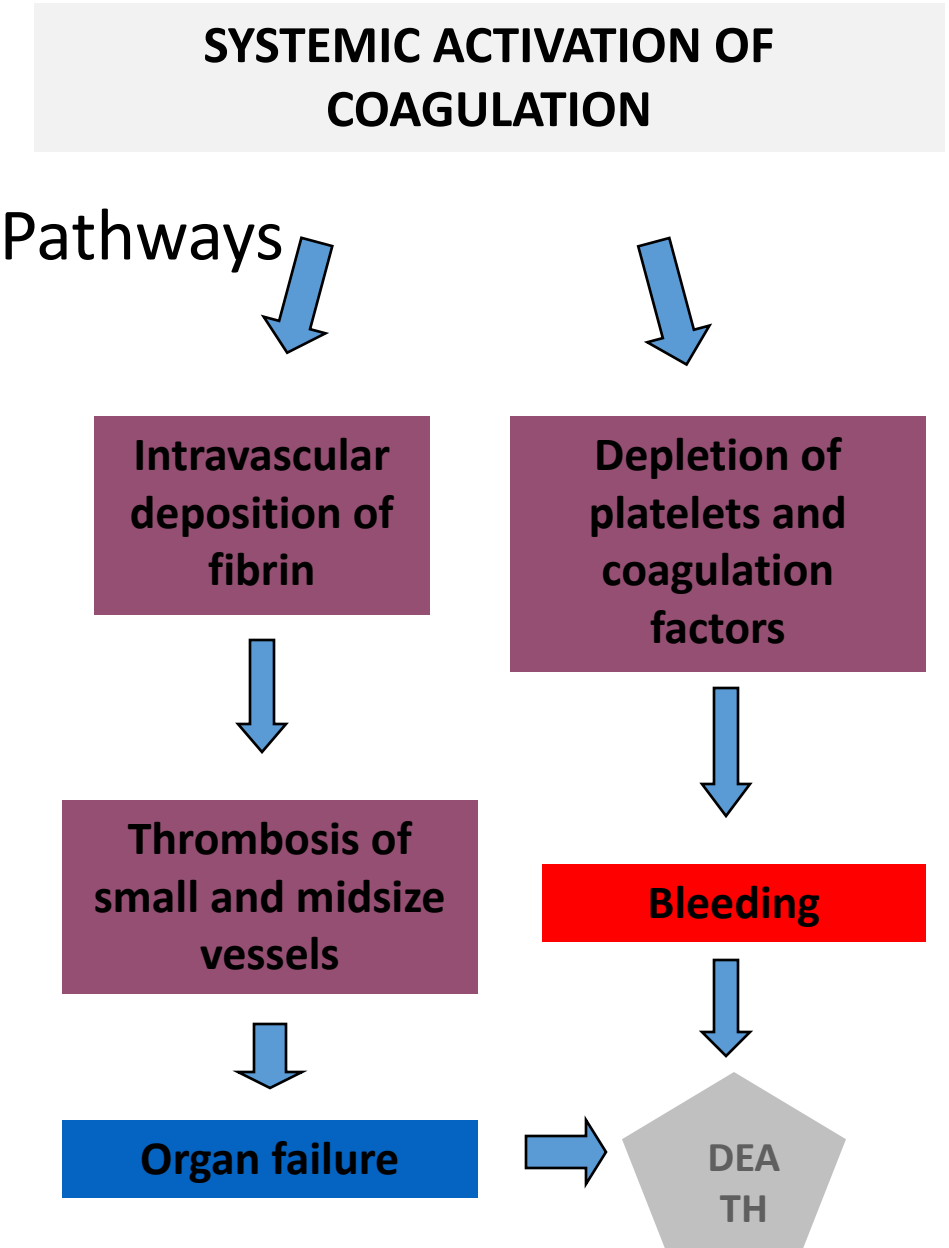
Definition

- Is considered an “acquired bleeding disorder”
- Is not a disease entity but an event that can accompany various disease processes
- Is an alteration in the blood clotting mechanism:abnormal acceleration of the *coagulation cascade*, resulting in thrombosis

Hemostatic Balance

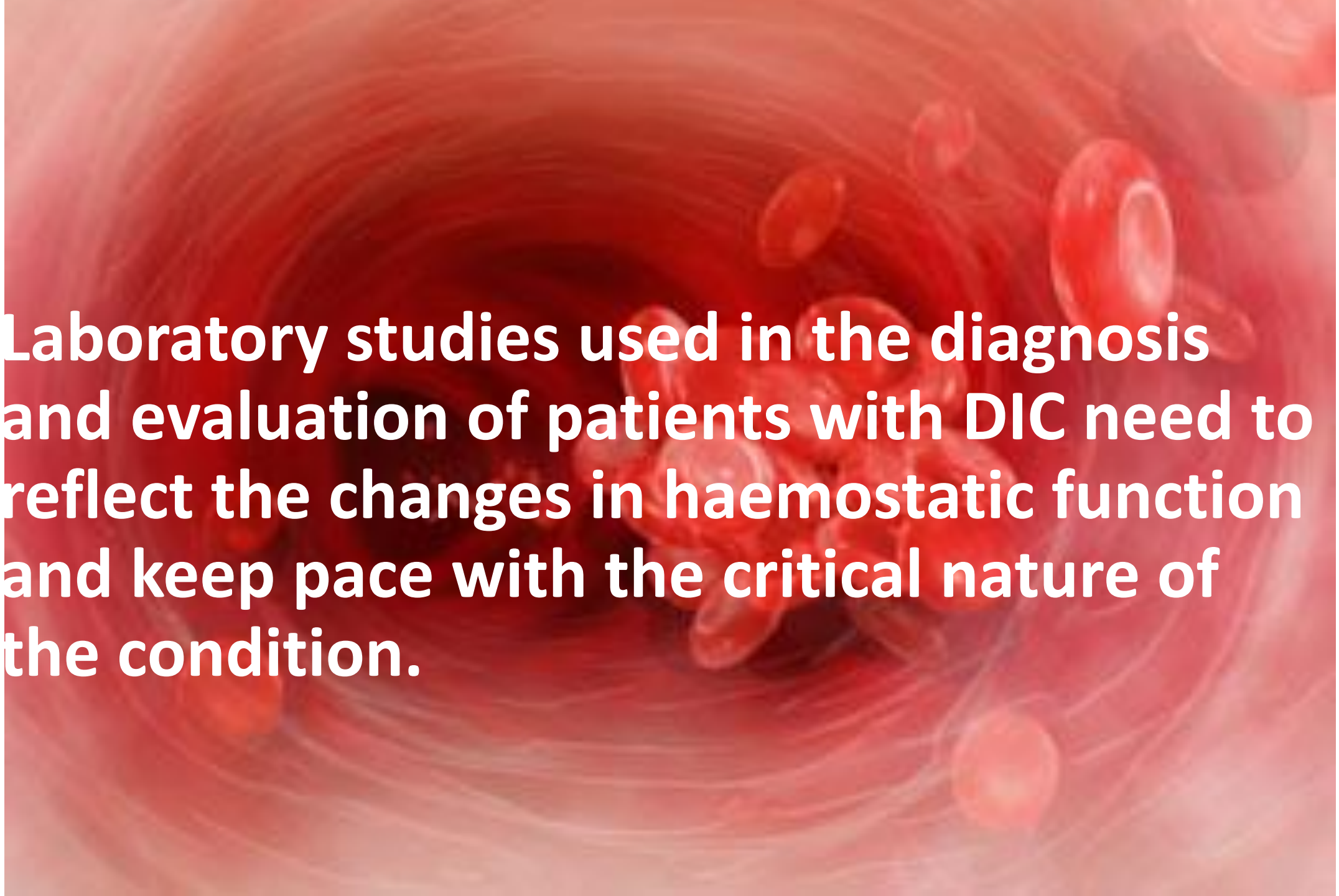


- Activation of Blood Coagulation
- Suppression of Physiologic Anticoagulant Pathways
- Impaired Fibrinolysis
- Cytokines



Conditions Associated With DIC

- Infectious/Septicemia
  - Bacterial
    - Gm - / Gm +
  - Viral
    - CMV
    - Varicella
    - Hepatitis
  - Fungal
- Intravascular hemolysis
- Acute Liver Disease
- Tissue Injury
  - trauma
  - extensive surgery
  - tissue necrosis
  - head trauma
- Obstetric
  - Amniotic fluid emboli
  - Placental abruption
  - Eclampsia
  - Missed abortion


Laboratory studies used in the diagnosis and evaluation of patients with DIC need to reflect the changes in haemostatic function and keep pace with the critical nature of the condition.

- The severity and extent of DIC can change over time so laboratory testing is often performed at several intervals to monitor a person's status. Some routine tests that may be performed include:
- CBC (complete blood count) – includes a platelet count; in DIC, platelets are often low.
- Blood smears from individuals with DIC often show decreased number of platelets and presence of large platelets and fragmented red cells (schistocytes).
- PT (prothrombin time) – often prolonged with DIC as coagulation factors are consumed
- PTT (partial thromboplastin time) – may be prolonged
- D-dimer – a test that detects a protein that results from clot break-down; it is often markedly elevated with DIC; if normal, then DIC is unlikely.
- Fibrinogen – one of the clotting factors; is low with DIC

Platelet count

- is a sensitive (though not specific) sign of DIC. Thrombocytopenia is a feature in up to 98% of DIC cases with the platelet count $<50 \times 10^9$/l in approximately 50%
- low or decreasing platelet count is not very *specific* for DIC as many of the underlying conditions that are associated with DIC, such as acute leukaemia or sepsis, also may cause a low platelet count in the absence of DIC

Fibrin degradation products and D-dimers

- Detection of neo-antigens on degraded cross linked fibrin
- It is important to remember that many conditions other than DIC, such as trauma, recent surgery or venous thromboembolism, are associated with elevated FDPs including D-dimer.

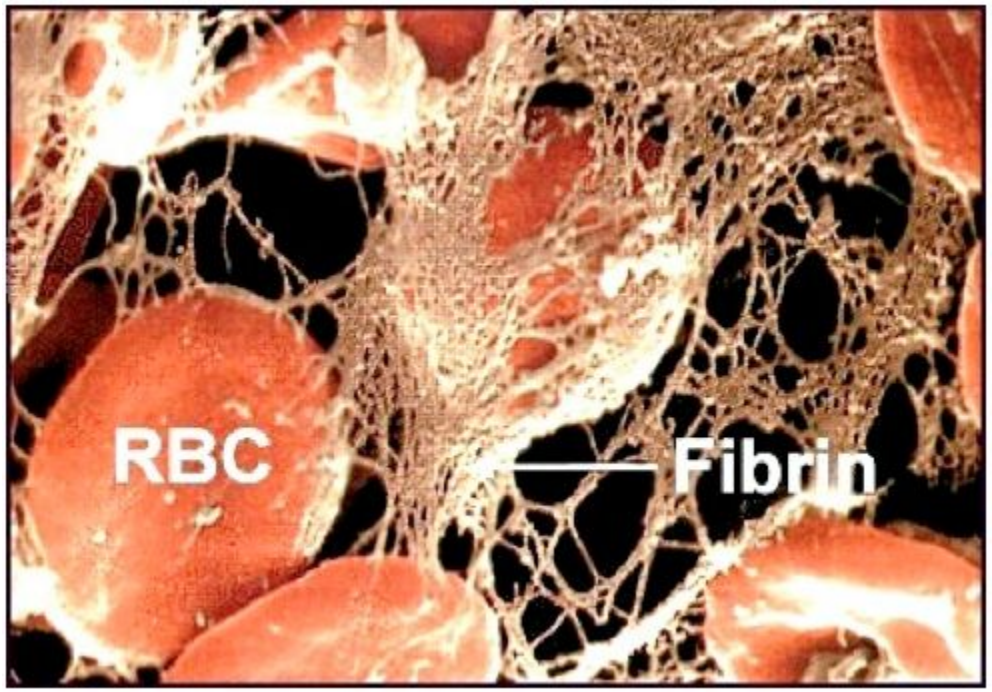
- Soluble fibrin monomer (SF) measurements offer theoretical advantages in DIC in reflecting thrombin action on fibrinogen.

Prothrombin time and activated partial thromboplastin time

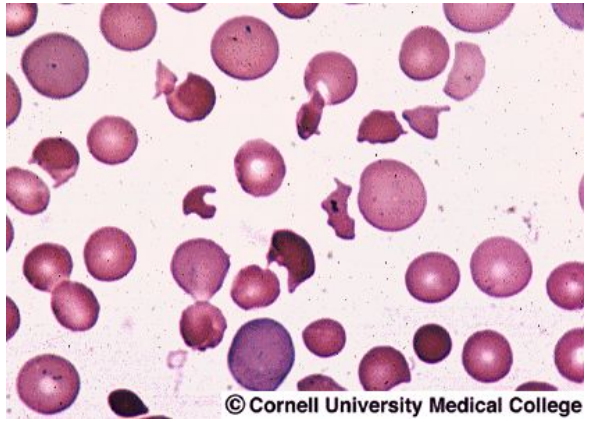
- the PT and aPTT are normal or even shortened. The reasons for normal or shorter times are the presence of circulating activated clotting factors, such as thrombin or Xa, which can accelerate the formation of thrombin

Fibrinogen

- Fibrinogen acts as an acute-phase reactant and despite ongoing consumption, plasma levels can remain well within the normal range for a long period of time.



Blood film



- Fragments
- Schistocytes
- Paucity of platelets

Other markers of haemostasis

- The natural anticoagulants antithrombin and protein C are often reduced in DIC and these have been shown to have prognostic significance

Differential Diagnosis

- Severe liver failure
- Vitamin K deficiency
- Liver disease
- Thrombotic thrombocytopenic purpura
- Congenital abnormalities of fibrinogen
- HELLP syndrome

- The ISTH Sub-Committee of the Scientific and Standardization Committee (SSC) on DIC has recommended the use of a scoring system for overt DIC. Based on the Japanese Ministry of Health and Welfare score, which has demonstrated a close correlation between an increasing score and increasing mortality.

Scoring system for overt DIC

Risk assessment: Does the patient have an underlying disorder known to be associated with overt DIC?

If yes: proceed

If no: do not use this algorithm

Order global coagulation tests (PT, platelet count, fibrinogen, fibrin related marker)

Score the test results

- Platelet count (>100 × 10^9/l = 0, <100 × 10^9/l = 1, <50 × 10^9/l = 2)
- Elevated fibrin marker (e.g. D-dimer, fibrin degradation products) (no increase = 0, moderate increase = 2, strong increase = 3)
- Prolonged PT (<3 s = 0, >3 but <6 s = 1, >6 s = 2)
- Fibrinogen level (>1 g/l = 0, <1 g/l = 1)

Calculate score:

≥5 compatible with overt DIC: repeat score daily

<5 suggestive for non-overt DIC: repeat next 1–2 d

Conclusion

Laboratory diagnosis of DIC is based on tests that demonstrate activation of coagulation and consumption of clotting factors, coagulation inhibitors and platelets.
The first-line tests should ideally be simple, and readily and rapidly available.

Conclusion

- Prothrombin and activated partial thromboplastin times are prolonged.
  Levels of fibrinogen and clotting factors (particularly Factors II, V, VII and X) and platelet counts are reduced.
  A parallel reduction is observed in the levels of physiological inhibitors: antithrombin, but also protein C and protein S.
  Levels of fibrin-related markers are also elevated: markers of fibrin formation such as fibrin monomers and soluble fibrin complexes, markers of fibrinogenolysis (FgDP: fibrinogen degradation products), and markers of fibrinolysis (FnDP, D-dimers).

References:

- **Guidelines for the diagnosis and management of disseminated intravascular coagulation**, British Journal of Haemotology, M. Levi, C. H. Toh, J. Thachil , H. G. Watson
- American Association for Clinical Chemistry: AACC, recommendations for Disseminated Intravascular Coagulation, webpage: https://labtestsonline.org/understanding/conditions/dic/start/2
- DIC scoring system Taylor et al, 2001; Toh & Hoots, 2007,