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Disseminated Intravascular Coagulation (DIC)

Definition / Supporting Information

Disseminated intravascular coagulation (DIC) is a pathological process characterised by widespread activation of the clotting cascade.

- This results in formation of fibrin clots in small blood vessels
  - Leading to tissue ischaemia and organ failure
- Severe bleeding also occurs as a result of consumption of clotting factors and platelets
- DIC is always secondary to an underlying disease process
  - Usually occurs in the presence of critical illness

Keywords / as known as: clotting, bleeding disorder, excessive bleeding

Essential History

Evaluation should progress only after the ABCs (airway, breathing, and circulation) of resuscitation have been addressed.

- See Paediatric Advanced Life Support (PDF), Resuscitation Council UK

Ask about:

- Clinical manifestations of bleeding and / or thrombosis
  - Bleeding
    - Bleeding from venepuncture sites and intravascular access sites (intra-arterial lines) is an important early indication of DIC
    - Bleeding from surgical wounds
    - Epistaxis
    - Gum bleeding
    - Gastrointestinal bleeding (see Haematemesis / Melaena)
    - Haematuria
    - Petechiae and purpura
  - Thrombosis
    - Colour changes in digits, genitalia, and nose
    - Purpura fulminans
      - Initially erythematous macules progressing rapidly to areas of blue-black haemorrhagic necrosis
      - May be a family history of protein C or protein S deficiency

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  - Infections
    - Bacterial (eg, *Neisseria meningitidies*)
    - Viruses (eg, human immunodeficiency virus, cytomegalovirus, varicella, hepatitis)
    - Fungal (eg, Histoplasma)
    - Parasitic (eg, malaria)
  - Trauma
  - Malignancy
    - Including solid tumours and leukaemia
  - Vascular abnormalities
    - Kasabach–Merritt syndrome – large haemangioma
    - Large vascular aneurysms
- Immunological / autoimmune conditions
  - Systemic lupus erythematosus
  - Autoimmune haemolytic anaemia
  - Crohn's disease
  - Ulcerative colitis
  - Transplant rejection
- Miscellaneous
  - Snake bites
  - Recreational drugs
  - Poisoning
  - Burns
  - Massive transfusions

'Red Flag' Symptoms and Signs

Ask about:

- Gastrointestinal bleeding (see Haematemesis / Melaena)
- Bleeding from venepuncture sites
- Symptoms of raised intracranial pressure

Look for:

- Purpura
- Purpura fulminans
- Bleeding from surgical sites or lines
- Altered consciousness
- Respiratory compromise
- Circulatory compromise (shock)

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Differential Diagnosis / Conditions

- Thrombotic thrombocytopenic purpura
- Haemolytic–uraemic syndrome
  - A triad of microangiopathic haemolytic anaemia, thrombocytopenia, and renal insufficiency
- Fulminant hepatic failure
- Purpura fulminans (causes may include):
  - Severe acute infection
  - Severe congenital protein C deficiency
  - Acquired protein C deficiency (eg, ill preterm infant, galactosaemia, severe liver disease)
  - Severe congenital protein S deficiency
  - Autoimmune protein S deficiency / C deficiency
  - Coumarin induced skin necrosis
  - Ill preterm infant
- Massive transfusion
  - Defined as replacement of greater than one blood volume in 24 hours, or replacement of 50% of total blood volume within 3 hours
- HELLP (haemolysis, elevated liver function tests, and low platelets) syndrome
  - Commonly associated with pregnancy
- Chronic DIC (Trousseau's syndrome)
  - Rare in children
  - Commonly associated with certain types of cancer
    - Mucinous adenocarcinomas
    - Ovarian cancer
    - Pancreatic tumours

Investigations

Evaluation should progress only after the ABCs of resuscitation have been addressed

- See Paediatric Advanced Life Support (PDF), Resuscitation Council UK

To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Haematology / Paediatric Infectious Disease / Paediatric Intensive Care Team(s)):

- Full blood count
- Blood film
  - Presence of fragmented erythrocytes (schistocytes) confirms the diagnosis of microvascular angiopathy

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- Screening tests for extrinsic / intrinsic coagulation cascade abnormalities
  - Prothrombin time (PT) and activated partial thromboplastin time are prolonged in 50–60% of patients
  - Concentrations of fibrinogen–fibrin degradation products and D-dimers are increased in most patients
- Prothrombin fragment 1.2 and thrombin–antithrombin complexes are the most sensitive tests for diagnosis
- Protein C and protein S levels, if purpura fulminans (discuss with haematologist)
- The International Society for Thrombosis and Hemostasis Scientific Standardization, Subcommittee on DIC proposed a scoring system based on a five-step algorithm, assigning a score based on severity of abnormality for each of the following:
  - Platelet count
    - > 100×10^9 cells/L = 0
    - < 100×10^9 cells/L = 1
    - < 50×10^9 cells/L = 2
  - Elevated levels of fibrin-related markers
    - No increase = 0
    - Moderate increase = 2
    - Strong increase = 3
  - Prolonged PT
    - < 3 seconds = 0
    - ≥ 3 seconds but < 6 seconds = 1
    - ≥ 6 seconds = 2
  - Fibrinogen level
    - > 1 g/L = 0
    - < 1 g/L = 1
  - Total score of 5 or more is considered compatible with DIC
  - The algorithm should be applied only if an underlying disorder known to be associated with DIC is present

Treatment Approach

Treatment should progress only after the ABCs of resuscitation have been addressed.

- See Paediatric Advanced Life Support (PDF), Resuscitation Council UK

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To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Haematology / Paediatric Infectious Disease / Paediatric Intensive Care Team(s)):

- The fundamental principle of DIC treatment is the specific and vigorous treatment of the underlying disorder
  - In some cases, DIC completely resolves within hours after resolution of the underlying condition, eg:
    - Administration of antibiotics in sepsis
    - Surgical drainage of an abscess in patients with severe infection
  - In some cases, supportive measures are required to control DIC until the underlying condition is resolved, eg:
    - Use of all-trans-retinoic acid and chemotherapy for treating acute promyelocytic leukaemia and DIC

Specific Treatment

- Anticoagulants – used in cases of DIC where the thrombosis predominates
  - Heparin or other anticoagulants to inhibit thrombin generation
  - Safety is debatable
  - Therapeutic doses of heparin are indicated in:
    - Clinically overt thromboembolism
    - Chronic DIC
    - Extensive fibrin deposition, as seen in purpura fulminans or acral ischaemia
- Supportive therapy
  - Management of underlying disease (eg, antibiotics for sepsis)
  - Multi-organ support may be required
    - Ventilatory support
    - Circulatory resuscitation or inotropic agents
    - Haemodialysis
  - Blood product support may be needed if there is evidence or risk of active bleeding, or if the patient requires an invasive procedure
    - Platelets if platelet count is $< 50 \times 10^9$ cells/L
    - Fresh frozen plasma if clotting times are prolonged
      - Dose = 15 mL/kg
      - Large volumes of plasma may be necessary to correct the coagulation defect
    - Cryoprecipitate to keep fibrinogen level > 100 mg/dL
      - Dose = 1–1.5 bags/10 kg
    - Packed red blood cell transfusion
      - Dose = 10 mL/kg
    - Recombinant factor VIIa for intractable bleeding or volume overload

  - Dose = 75 micrograms/kg every 2 hours
- Protein C concentrate for protein C deficiency
  - Consult with haematologist regarding dose
  - Fresh frozen plasma may be given if delay in obtaining protein C concentrate

When to Refer

Refer (arrange emergency transfer) to specialist practitioners (eg, Emergency Department / Paediatric Intensive Care Team(s)):

- Any child with suspected DIC
- In many cases children with DIC will already be on an intensive care unit

'Safety Netting' Advice

- Advise patients at risk of DIC (see Essential History), or their parents / carers, to seek urgent medical advice if they develop any bleeding

Patient / Carer Information

Please note: whilst these resources have been developed to a high standard they may not be specific to children.

- Disseminated intravascular coagulation (Web page), Patient

Resources

Suggested Resources

Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.

Paediatric Advanced Life Support (PDF), Resuscitation Council UK

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