Surgery and Coagulopathy: pre-op assessment and optimisation

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Intro…

- Despite advances in laboratory medicine, little has changed in tests used for pre-assessment of bleeding risk
- Screening tests and bleeding history remain remarkably effective in evaluating risk of bleeding in the surgical setting.
- The challenge remains to ensure that all patients at risk are evaluated so that bleeding complications are minimised

Aims

- Taking a bleeding history
- Basic screening tests and role of specialist testing
- Optimisation of coagulopathy:
    - Liver disease
    - Inherited coagulopathies
    - Acquired coagulopathies
- Perioperative management
- Will not cover….
  - Perioperative anticoagulation
  - Who gets a coag screen
  - Surgical techniques

Bleeding history

- The clinical history remains the cornerstone of preoperative assessment.
- History alone may be insufficient - a role for lab testing in some patients:
  - “Forgetful” Clinician : Inadequate bleeding history
  - The "unreliable" patient :
    - Omission - eg patient reports no prior surgical history
      - overlooked procedures inc circumcision, childbirth and assoc procedures (eg, episiotomy), epistaxis, and menorrhagia
    - Patients may recall procedures but do not consider the bleeding as excessive, having no basis for comparison
  - The "unprovoked" patient:
    - history uninformative unless positive family history of bleeding.
  - The "acquired disorder" – may have no history of excessive bleeding because their haemostatic defect is more recent in onset

Typical screening questions…

- Do you experience excess bleeding in your mouth or frequent nosebleeds?
- Have you bled into a muscle or a joint?
- Do you have profuse menstrual bleeding?
- Do you develop large bruises even in the absence of obvious injury? Have you bled excessively after small wounds?
- Have you had teeth extracted? How long did you bleed? Was bleeding immediate or delayed?
- What operations have you undergone, inc minor procedures? Was there any bleeding, either immediate or delayed?
- Do you have other medical probs? Have you ever required a transfusion of whole blood, red blood cells, platelets, plasma, or blood clotting factors?
- What medications are you taking? Have you taken aspirin or other pain relievers within last 10 days? OTC, supplements, or herbal preparations?
- Have any relatives had excessive bleeding following surgery?

Physical exam

- Petechiae/ecchymoses : ?thrombocytopenia or abnormal platelet function
- Telangiectasias:
  - liver disease (eg, spider naevi, often on trunk or face)
  - hereditary hemorrhagic telangiectasia (characteristically mouth & lips)
- Evidence of past haemarthroses : in patient with positive bleeding history suggests severe factor deficiency
- Haematomas
- Collagen-vascular disorders such as Ehlers-Danlos syndrome can be associated with prolonged bleeding
  - haematologic studies are usually normal.
  - hyperelasticity of the skin, poor healing and hyperextendable joints.
  - Other disorders assoc with bleeding inc scurvy and Cushing's syndrome

Lab testing

- Several retrospective studies suggest routine lab testing is unnecessary if history and physical examination do not suggest presence of a bleeding disorder
- Basic screen pre-op:
  - FBC
  - PT and APTT
- If family history and/or physical examination suggests presence of a bleeding disorder, appropriate screening tests should be performed
  - Specialist testing likely required to establish/confirm diagnosis.
- Haemophilia carriers can have normal levels or may have low levels
  - They may have a normal APTT but still have significantly reduced factor levels
  - should have factor level tested prior to invasive procedure or surgery.

Summary

- Each patient should have an individualised assessment before deciding whether **any** preoperative lab screening for coagulation disorders is necessary
- Balance info from bleeding history, the physical exam, inherent bleeding risk of planned surgery, and appropriate lab tests
- Basic lab screen consists of:
  - FBC, PT and APTT
  - Consider Cr and LFTs
- Specialist testing:
  - Where there are abnormal screening tests
  - Abnormal bleeding history +/- abnormal screening tests
  - Investigation in relation to family history of bleeding excess

Liver disease

- In patients with a prolonged PT, standard practice has been to correct with vitamin K +/- FFP
- PT does not correlate well with risk of bleeding in patients with cirrhosis.
  - Need to optimise:
    - the platelet count >50
    - fibrinogen level >1.0
    - renal function
- Optimal surgical technique and maintenance of low central venous pressure may reduce blood loss and may be more important than attempting to correct the prothrombin time

Haemostasis in Liver disease

- Patients with liver disease are heterogenous and multiple abnormalities of haemostatic function may coexist in an individual patient.
- All stages of the haemostatic process may be abnormal
  - Deficiencies of factors produced by liver (fibrinogen, thrombin, V, VII, IX, X, & XI)
    - Factor VIII, VWF and Factor XIII not made by liver
  - Abnormal post-translational effects on clotting factors
  - platelet adhesion and activation, and number
  - generation and crosslinking of fibrin
  - fibrinolysis
- Patients with severe liver disease and abnormalities of coagulation testing should not be assumed to be "auto-anticoagulated,"
  - Risks of bleeding and thrombosis are not well reflected in PT or aPTT
    - These don’t assess prothrombotic and fibrinolytic changes

Thrombocytopenia in liver disease

- Poor correlation with clinical bleeding if platelets >50
  - Lower the platelet count, the greater bleeding risk
- Mechanisms include:
  - impaired platelet production; decreased thrombopoietin
  - bone marrow suppression: HCV infection or alcohol use, other infection, or antiviral therapy;
  - increased splenic sequestration
- In advanced liver disease, may have reduced platelet function:
  - due to coexisting ureamia, infection, and/or endothelial abnormalities
  - increases in endogenous heparinoids which act as anticoagulants
- Increased fibrinolysis:
    - promotes premature clot dissolution and interferes with clot formation due to consumption of clotting factors.

Prothrombotic changes in Liver disease

- Standard test of coagulation do not measure these abnormalities:
  - Liver produces endogenous anticoagulants:
    - protein S, protein C, AT III and fibrinolytic factors
  - increases in acute phase reactants, such as PAI-1, and decreased levels of VWF cleaving ADAMTS13, and inflammatory changes in endothelial cells
  - Reduced vascular flow
- Global dynamic testing with TEG/ROTEM produce a trace that reflects changes in clot formation and lysis
- Studies of TEG and ROTEM in patients with liver disease have shown decreased use of blood products at time of surgery due to ability of these devices to confirm relatively preserved haemostatic function
  - evidence of value of dynamic testing in liver disease remains limited.

Management of coagulopathy of liver disease

- Not necessary to correct coag unless bleeding or having a procedure
  - Should be based on clinical assessment rather than lab testing alone
- Management depends on the following:
  - Are other comorbidities present (eg, infection, uraemia)?
  - Is patient vitamin K deficient (esp likely with cholestatic disease)?
  - What is fibrinogen level and function? Hyperfibrinolysis?
  - Is the platelet count adequate?
- Manage Comorbidities – Infection ; ureamia; portal hypertension; DIC; Anticoagulation
- Give Vitamin K 10mg for three days
  - Little evidence but toxicities negligible
- In absence of bleeding or procedure, platelets transfusion not required unless platelet count <10,000/microL.

Summary of management of bleeding pt with liver disease

- Aim to normalise PT and APTT :
  - give Vit K 10mg for three days
  - FFP 15mls/kg
- Aim to keep fibrinogen >1 – cryoprecipitate 2 bags
- Tranexamic acid 1g
- Aim platelets >50 whilst bleeding
- Managing comorbidities and infections

Other causes of coagulopathy:

- Hypothermia
- Haemodilution
- Massive transfusion
- Acquired coagulopathies

Case 1: Mr A

- Mr A:
- Admitted electively to surgical ward for arterial bypass – known PVD
  - PT 14
  - APTT 42
- Surgery delayed to facilitate investigation
- No bleeding symptoms and no history of bleeding with procedures
- Not on anticoagulants

Case 1: Mr A

- 50:50mix – doesn’t correct
- Factor VIII 200
- Factor IX 75
- Factor XI 88
- Factor XII 90
- Lupus anticoagulant positive

Case 1: Mr A

- No cover required
- Thromboprophylaxis
- Advised to repeat LA and ACA no sooner than 12 weeks to confirm whether persistently positive or not

Case 2: Mr B

- 65yr old man
- Due for elective open AAA repair – picked up on screening program
- Previous vasectomy some years ago with no bleeding problems reported
- Dental extractions – bled for couple of days afterwards
- No other surgeries
- On aspirin for ~12mths
- No known family history of bleeding
- Diabetic, hypertensive, BMI 32 (~105kg)

Case 2: Mr B

- Coag screen performed routinely pre-op:
- PT 13.2 (normal 12-16)
- APTT 45.1 (normal 22-35)
- Fibrinogen 3.65
- TT and RT normal
- APTT 50:50 mix = 33.6

Case 2: Mr B

- Factor assays:
  - FVIII 129
  - FIX 6
  - FXI 68
  - FXII 37

  (normal ranges for FVIII, IX and XII 50-150iu/dl; normal range for Factor XI 70-150iu/dl)
- Confirmed on repeat testing
- Subsequent genetics sample – consistent with mild haemophilia B

Case 2: Mr B

- Aneurysm surgery:
  - Given 11,000units benefix pre-op
  - Confirmed FIX level safe prior to surgery commencing: peak 142 iu/dl (15mins post factor)
  - Daily 6000units daily post op for 5days with FIX level monitoring
  - Received clexane 20mg whilst FIX levels>100iu/dl

Case 2: Mr B

- Two daughters – obligate carriers
- 1st daughter – two sons : both affected
- 2nd daughter
  - One son - affected
  - One daughter:
    - normal FIX level
    - test for genetics once older

Case 3: Mr C

- Presented with bleeding, needing surgery
- Known history of VWD
- Treated with plasma products and DDAVP in past
- Initial Hb119 – dropped to 98g/l
- WC 3.0; Plts 52; MCV 79; HCT 0.38; N 1.6
- PT 16.5; APTT 46.9
- 50:50 APTT mix – 34 secs

Case 3 : Mr C

- Fibrinogen 1.6; TT 26.9; Reptilase 22
- Alb 31; LFTs otherwise NAD
- Factor levels:
  - FVIII 82;
  - FIX 33;
  - FXI 31;
  - FXII 117
- VWF Ag 93; VWF ricof (activity) 71

Case 3: Mr C

- Known HCV infection and cirrhosis with splenomegaly
- Normalised VWF levels
  - Historic levels:
    - PT 11; APTT 60
    - FVIII 22; VWF Ag 33; VWF Ricof 20
- Now: Low IX and XI levels due to liver disease
- Coagulopathy of liver disease and cirrhosis

Case 3 : Mr C

- Vitamin K 10mg for 3 days
- Platelets
- FFP 15mls/kg as bleeding

Case 4: Miss D

- 20year old female due tonsillectomy
- No previous surgeries
- Menorrhagia
- Personal history of easy bruising
- Family history of easy bruising and bleeding with procedures
- Coag screen and FBC normal

Case 4: Miss D

- Specialist testing:
  - Von willebrands factor Ag and Activity normal
  - FXIII normal
  - Normal platelet aggregometry
  - Platelet nucleotides: increased ATP/ADP ratio: 3.2
- Diagnosis:
  - Platelet storage pool disorder
- Haemostatic plan for surgery:
  - Tranexamic acid 1g TDS started night before op
  - DDAVP(Octim) 0.3mcg/kg sc given 1 hr pre op

Case 5: Mrs E

- 45yr old nurse
- Vascular Ehlers Danlos
- POTS
- Previous DVT
- Extensive bleeding and failure to heal with multiple procedures
  - Includes delayed bleeding
- Prolapses
- LT urinary catheters and recurrent infections
- Poor venous access

Case 5: Mrs E

- Multidisciplinary discussions:
  - Recurrent infections and sepsis
  - Increasingly difficult venous access & need for secure LT venous access
  - Decision made for Portacath insertion
- Haemostatic plan:
  - Tranexamic acid 1g TDS started evening prior
  - Double dose of bisoprolol given pre DDAVP
  - DDAVP 0.3mcg/kg sub cut given 1hr pre op

Case 5 : Mrs E

- No excess bleeding at time of surgery or immediately post portacath
- Second dose of DDAVP given at 48hr
- Went home and advised to rest
- Represented ~day 6, oozing from wound and wound appeared to be starting to open up
- Wound resutured; Pressure dressing and ice applied

Case 5: Mrs E

- Went home
- Again represented with oozing from wound
- DDAVP (Octim) given, pressure dressing and ice applied
- Wound opened up again
- Despite efforts to keep the portacath inplace and encourage wound to heal up –portacath removed 3 weeks post insertion due to concerns re infection.

Case 6 : Mrs G

- 27yr old with known type II von willebrands:
  - baseline levels VWF antigen 33; Ricof 22
- Seen at 34 weeks gestation: VWF levels have not normalised
- Previous DDAVP trial – known to get an adequate rise
- Previous post-partum haematoma that required drainage
- Haemostatic plan for delivery:
  - DDAVP 0.3 mcg/kg subcut in active labour
  - 1g IV Tranexamic acid given in last stages of labour
  - No **epidural or spinal anaesthetic under any circumstance**:
    - If needs an emergency caesarean needs a general anaesthetic.
  - Given further dose of DDAVP 0.3 mcg/kg 24 hours post delivery
- If major post-partum haemorrhage:
  - give Voncento (VWF containing concentrate) 40units/kg IV

Case 6: Baby G

- Baby may also be affected with von Willebrands disease:
  - Treat as presumed to be affected
  - Ventouse and forceps (other than a low level lift out) should be avoided;
  - Avoid invasive monitoring with scalp electrodes etc
  - Cord blood sample taken immediately following delivery and sent immediately to lab for VWF assay.
    - Once levels are known, we will then know if baby can have intramuscular vitamin K.
    - In interim oral vitamin K given to baby and baby should be closely monitored for signs of bleeding.

Case 7: Mr H

- 19yr old, major haemorhage due to stabbing
- Resus by HEMS in field including Red cell transfusion at scene
- Emergency surgery : femoral vein had been severed and had retracted within abdomen – technically challenging to locate and stem bleeding
- Massive transfusion : 18units of red cells infused in total

Case 7: Mr H

- Once in hospital setting, major haemorhage protocol initiated and received trauma packs which each contained 6 RBC, 4 FFP, 1 Platelets
- On arrival in ITU post op:
  - Hypothermic
  - Prolonged PT ~18; and prolonged APTT ~40
  - Platelets 80
  - Fibrinogen 1.9
  - Low albumin

Case 7: Mr H

- Multifactorial coagulopathy
- Not bleeding
  - Given vitamin K 10mg for three days
  - Slowly rewarmed
  - Electrolytes replaced
  - Inotropes to support BP
  - Haemofiltration
  - Nutrition
- NOT given further plasma products or platelets

Case 8: Mr J

- Sample came through lab labelled “PreOp”:
- Normal PT; APTT 96
- Didn’t correct with 50:50 mix but concerns regarding integrity of sample
- Haematology SpR contacted patient to arrange repeat samples

Case 8: Mr J

- No bleeding or bruising symptoms
- Normal coagulation screen historically
- History of whipple's procedure for pancreatic cancer
  - No bleeding excess
- Awaiting ascitic tap for ?recurrence
- Repeat CS: normal PT; APTT 44
- 50:50mix- didn't correct

Case 8: Mr J

- Factor VIII 30iu/dl
- Lupus anticoagulant
- Inhibitor 0.7BU

- Diagnosis: acquired haemophilia A

- USS guided ascitic tap with green needle
- No cover given but FEIBA on standby
- No bleeding
- Monitoring FVIII level and inhibitor

Summary

- Importance of bleeding history and preop assessment
- Refer for specialist assessments where there are abnormal screening tests or a bleeding history
- Individualised bleeding assessment and investigations
- Multidisciplinary working and logistics!