Bleeding/Bruising

Vascular system defect
(bleeding, but BT, INR, PTT all normal)

Congenital
→Connective tissue disorders
→Hereditary telangiectasia (porous blood vessels incr bleeding)

Acquired
→Vasculitis (inflammation in artery)
→Steroids

Platelet Defect
(↑ bleeding/closure time, PTT/INR usually normal)
Petechiae, purpura of mucosal membrane

(Quantitative) Thrombocytopenia (<150x10^9/L)

↑ Sequestration
→hypersplenism
→splenomegaly

↓ production

↓ Megakaryopoiesis
→*aplastic anemia*
→*toxic marrow damage* (i.e. chemotherapy)
→*infiltrative displacement of megakaryocytes* (i.e. leukemia, multiple myeloma, tumor)
→chronic liver/kidney disease (low TPO)

Ineffective megakaryopoeisis
→B12/folate deficiency
→Folate antagonist
→Immunosuppressive drugs (i.e. methotrexate)

↑Destruction or ↑ consumption
(more common)

Immune
→auto-immune (ITP, SLE, CLL)
→Allo-immune (anti-HLA, HPL-1a antigen)
→Drugs (quinidine, etc)

Non-immune
→DIC (exception: high PTT/INR, low fibrinogen)
→TTP/HUS (less clotting factor consumption than DIC, PTT/INR normal)
→Infection
→HELLP (pregnancy)
→Foreign surface (i.e. prosthetic heart valve)
→Heparin-induced thrombocytopenia (HIT)

(Qualitative) Defective function

Congenital (rare)
(defective sticking of platelets)
→glanzmann thrombasthenia
→bernard-soulier syndrome (1b glycoprotein)

Acquired
→Drugs (i.e. **ASA** – ↓ thromboxane production, ↓ plt aggregation)
→Any of the Anti-platelet drugs
→Renal disease (low TPO production, incr toxins in blood)

Coagulation Proteins defect
(normal bleeding time, PTT/INR abnormal)
Bleeding into deeper tissues (muscle, joints)
Delayed bleeding after initial stop

Congenital
(↑PTT, not PT)
→vWF deficiency
(↑ bleeding time too)
→Factor 8/9 deficiency
→Other deficiencies

Acquired
(↑PT and PTT)
→DIC (factor 8 + fibrinogen are low - consumed)
→Vitamin K deficiency
→Liver Disease (factor 8 + fibrinogen are high b/c they're acute phase reactants)
→*(Liver disease can also lead to blood clotting – less anti-coagulants produced!)*

"-penia" = low/deficient
"-asthenia" = weak

Coagulation Protein Tests (PT and PTT)

↑ aPTT, Normal PT
(Intrinsic pathway: factors 12, 11, 9, 8)

No Bleeding Tendency
(high aPTT is artifact of testing condition)

Acquired
→Lupus-type inhibitors (i.e. antiphospholipid antibodies)
→Not bleeding, but can cause thrombosis and ↓ plts!
(more common)
Plasma mixing study – results in continued high PTT
(50% of pts have SLE)

Congenital
→Factor 12 deficiency
→PK (Fletcher) deficiency
→HMWK (Fitzgerald) deficiency
(rarer)

Bleeding tendency

Acquired

Drugs
→ *Heparin* (inhibits factors 10, 2; also 11 & 9)

Auto-antibodies
→Factor 8 inhibitor (acquired hemophilia; no hemarthrosis)
→Other factor inhibitors (rare)
Tx: immunosuppression

Congenital
→**vWF-deficiency – *with low factor 8*** (autosomal dominant)
→**Factor 8/9 deficiency** (Hemophilia A &B: X-linked recessive)
→**Factor 11 deficiency** (autosomal recessive)

↑ aPTT, ↑ PT
(Common pathway: factors 10, 5, 2, 1)

Drugs
→*Heparin* (inhibits factors 10, 2 with anti-thrombin)

Factor deficiency
(10/5 = 2/1)

Congenital
→Factor 10, 5, 2 (prothrombin), 1 (fibrinogen) deficiency

Acquired

DIC
→↓ plts. ↓ fibrinogen (1), ↓ factor 8 (consumed)
→↑ BT as well
→Products of fibrinolysis exist (D-dimers, etc)
→Death is Coming (only seen in ICU patients)

Vit K problem
→Lack of factors 10, 9, 7, 2 activation
→Coumadin (vit K antagonist)

Liver Disease
→ ↓ synthesis of factors 10, 5, 2 (signs of chronic liver disease)
(factor 8 and 1 levels are high – acute phase reactants!)

Normal aPTT, ↑ PT
(Extrinsic pathway: TF, factor 7, Vit K)

Sufficient Vit K
→Factor 7 deficiency
→Factor 3 (tissue factor) deficiency

Insufficient VitK
(factors 2, 7, 9, 10 are affected)

Vit K antagonist
→ *Warfarin*
(check this first!!)

Vit K deficiency
→***Antibiotics*** (killing V-K producing flora in gut)
→***Fat malabsorption*** (i.e. low bile from cholestasis, low lipase from chronic pancreatitis)
→***Vit A & E ingestion***
→***Poor nutrition*** (no veggies whatsoever)
→***Hemorrhagic disease of the newborn*** (readily prevented now)