1. **Great Questions of the Day**

2. **Hematology Overview**
   - Anemia
   - Bruising/Bleeding

3. **Case 1**
   - 18 month old Laotian boy with pallor and fatigue.
   - Questions:
     - History
       - HPI *PMH
       - Diet *Meds
       - ROS *Family History
     - Physical Exam

4. **Anemia - Diagnosis**
   - History:
     - Duration of symptoms
     - Episodic?
     - Associated symptoms/co-existing illnesses
     - Jaundice/dark urine/yellow eyes
     - Medications
     - Iron source in diet

5. **Anemia - Diagnosis**
   - Diet
     - Iron source
     - What do they eat with iron in it?
     - Family diet restrictions?
     - History of dietary problems?
     - Vomiting/Diarrhea
     - Formula changes
     - Feeding problems

6. **Anemia - Diagnosis**
   - Review of Symptoms
     - Bruising/Bleeding
     - Lymph nodes
     - Joint/Bone pain
     - Fevers
     - Other symptoms
7. Anemia-Diagnosis
   - Family History
     - Any other affected family members?
   - Jaundice
     - Yellow Eyes
     - Early Gallstones (cholecystectomy in the 10-30 year range)
   - Other Symptoms
     - Food intolerance, bleeding, etc.

8. Case 1
   - Duration: 2-3 months
   - Associated symptoms: Vomits milk, has dark tarry stools.
   - Co-existing illnesses: Previous dx of MSPI
   - No Jaundice
   - No medications other than vitamins
   - Diet: milk and sticky rice

9. Anemia-Physical Exam
   - Pallor
   - Oropharynx
   - Palm creases
     - Compare Pt to parent
   - Scleral icterus (bili >3)
   - CV: Tachycardia, Murmur, CHF
   - Lungs: Crackles, wheezes

10. Anemia-Physical Exam
   - Liver/spleen enlargement
   - Ascites
   - Edema

11. Case 1
   - Pale
   - Non-icteric sclera
   - HR 156
   - I-I/VI SEM at LLSB
   - Liver edge palpable, spleen tip not palpable

12. Anemia-Lab Eval
   - Basic Workup:
     - CBC, Peripheral smear, retic count
     - Bili, Coomb's, UA
   - Focused workup:
     - Depends on Hx/PE
       - Iron studies
       - Osmotic fragility
       - Hgb electrophoresis, G-6PD
13. **Case 1**
   - CBC reveals: Hgb 5.1, MCV 59, RDW 21 retic 0.6%.
   - Bili 0.8 total, LDH 600
   - Stools are hematest Positive
   - Ferritin 3, TIBC 368, Serum iron 12

14. **Anemia-Lab Eval**
   - Retic: Gauge of RBC production rate.
   - RDW: Gauge of homogeneity of the RBC population
     - Higher the number, the broader the variation around the MCV

15. **Red Cell Distribution Width**

16. **Anemia-DDX**

17. **Case 1**
   - Microcytic anemia
   - Decreased Retics
   - Increased RDW
   - Herne Positive Stools
   - Diagnosis: ?

18. **Iron Deficiency**
   - Microcytic, hypochromic aregenerative anemia
     - Red Arrow 1:
       - Large area of central pallor
     - Red Arrow 2:
       - Lymphocyte
   - Leading cause of anemia in children (70%)
   - Leading cause of MR and LD in children

19. **Iron Deficiency**
   - Pathophysiology
     - Inadequate dietary intake
       - Infants between 6-12 months
       - Premies after they have doubled their birth weight.
     - Excessive consumption
       - Growth spurts
     - **Excessive Loss**
       - GI blood loss

20. **Iron Deficiency**
   - Excessive Loss must ALWAYS be suspected.
   - Source of Iron Loss is critical in treatment.
     - GI inflammation
     - Ulcers
     - Cancers (in adults)
     - Age Groups at Increased Risk
21. Iron Deficiency
   - Treatment:
     - Finding the site of blood loss
     - Iron replacement
       - Ferrous Sulfate 3-6 mg Elemental Iron /kg/day TID
       - Retics increase in 3-5 days
       - Hgb increases 0.25 grams/dl per week.
         - Treat for 4-6 months Replace BM stores and stores elsewhere.

22. Bleeding and Bruising
   - Bleeding disorders come from three sources
     - Vascular Phase: Ehlers-Danlos syndrome
     - Platelet Phase: Thrombocytopenia, VWD
     - Humoral Phase: Hemophilia, DIC
   - Each Phase has a pattern of bleeding.
     - Humoral Phase: Bleeding into soft-tissues/joints
     - Vasc/Platelet: Muco-cutaneous bleeding

23. Bruising in Kids
   - Facts of Life:
     1. Kids are clumsy.
     2. Clumsy kids fall down, and bump into things a lot.
     3. Bruises are the natural result of these events
     4. Kids of varying ages fall and hit different body parts on the way down.
     5. Bleeding sites are therefore predictable if you know what happened and how old the kid is.
     6. Bruises due to accidents are almost always seen on the surfaces exposed to trauma.

24. Bruising in Kids
   - What surfaces are exposed to trauma?
   - Imagine a kid curled up in a ball with his head tucked in.
   - Visualize the surface anatomy of such a child.
   - Extensor surfaces are exposed. Flexor surfaces are not. The shoulders are exposed, the abdomen is not, etc.

25. Bruising in Kids-Diagnostic Rules to Live By
   - All bruises that occur in surfaces of the body not normally exposed, need to be explained.
   - Bruises that occur on trauma-exposed surfaces need to be explained if they don't match the history given or the developmental level of the patient.
   - Bruises that form patterns always need to be explained.

26. Bruises in Kids
   - Bruises age and change color.
   - Bruises that are due to random accidental trauma vary in age and shape.
• Bruises that are from accidents rarely form a pattern (handprint, belt mark)
27. Bleeding in Kids
   - Nosebleeds
     - Most are due to the untoward effects of the child's digital exploration or other local problems (allergies, dry air, etc).

28. Nosebleeds
   - Separation of nosebleeds that are local versus systemic problems.
   - Historical factors
     - Frequency/Duration/Associations
     - What is needed to stop bleeding.
     - Does the bleeding recur?
     - ANY OTHER BLEEDING PROBLEMS
       - Dental, easy bruising, menses
       - Family History

29. Lab Eval
   - Evaluate the phases of coagulation
   - Platelet Phase:
     1. CBC with Platelet count
     2. Platelet Function Tests
     3. Bleeding Time (also vascular phase)
   - Humoral Phase
     - Prothrombin time
     - Partial Thromboplastin Time

30. Lab Eval
   - Clinical Pearls
     - A good history beats a normal lab value
     - Most disorders are mild and variable. You may have missed it.
     - Bleeding Times are unreliable in infants and not very reliable in any hospital that doesn't do a lot of them.

31. Case 2
   - 3 year old girl with bruises
     - Brought by parents and CPS workers m History?
     - PMH?
     - ROS?
     - Family History?
     - PE
     - Labs

32. Case 2
   - History
     - Multiple bruises on shins. Bruises easier than neighbor kids or older brother.
     - No specific incidence of trauma reported.
     - Multiple nosebleeds that last 30-60 minutes.
     - Immunizations UTD, other well child care on schedule. PMH otherwise unrevealing.
33. Case 2
- Family History
  - Mom bruises easy, had multiple hour long nosebleeds, and menorrhagia
  - Mat. Aunt has similar symptoms.
  - Mat. Uncle has nosebleeds and bruising.
  - Family history is suggestive for which inheritance pattern?

34. Case 2
- Physical Exam:
  - Multiple bruises on shins, no other locale.
  - Bruises vary in color from dark purple to brown. No pattern is discernable.
  - Nares: No vascular anomalies, mucosa slightly erythematous, clot in right nostril.
  - Bleeding pattern suggestive of what bleeding phase?

35. Case 2
- Labs:
  - CBC: Normal, Platelet count 320,000
  - PT: 10.8 seconds, INR 1.0 (Normal)
  - PTT: 45 seconds (prolonged)
  - Repeat PTT: 40 seconds (prolonged)
  - What lab test(s) to do next?

36. Case 2:
- Labs:
  - Mixing Study: Correction of PTT
  - VWD Ag 3%, Activity 4%, Multimers Normal
  - Factor VIII Activity: 25%
  - Diagnosis?

37. Case 2:
- Von Willebrand's disease
  - Type 1, Moderate-Severe
- Clinical Pearls:
  - Common, but variable
  - Caution when ruling out abuse
  - Kids with bleeding problems can still get beat up.
  - Menorrhagia may be only symptom in family.
  - Need to be specific and direct with family history.