3/1/2021

1

The mother of a six-year-old girl mentions that she frequently takes a trip to the kitchen late night to snack on ice cubes. She is worried that this behavior is becoming more frequent…

What lab abnormality do you expect this child to have?

A) An elevated hemoglobin level.
B) An increased MCHC.
C) Thrombocytosis.
D) A high serum ferritin level.
E) Reticulocytosis.

2

A CBC was obtained on an otherwise healthy 5-year-old boy because his parent is worried he's anemic because he's been a ' picky eater' for the past 3 years. The only abnormality on the CBC was a platelet count of 9,000 / mm^3. The CBC was repeated as the PCP didn't believe it's a true value since there are no other abnormalities in the patient's history or physical exam. Other routine labs drawn with the repeat CBC include normal chemistries, CRP, ESR, LDH and coagulation studies.

What is likely to be going on?

How can this situation be resolved?

3

A 10-year-old girl who is known to have sickle cell anemia presents to the emergency room with a 3-hour history of progressive right sided weakness and difficulty walking. She has a history of frequent admissions due to pain crisis and acute chest syndrome. She is currently undergoing evaluation of what may be causing this issue.

What treatment will she need initiated urgently in the next few hours?

4

T is a 7-year-old boy with severe hemophilia A. He is brought to the emergency room by his worried father 30 minutes after he falls off the bike hitting his head against the concrete pavement. He is now complaining of moderate headache, but no neurologic abnormalities can be appreciated and the child looks completely well to you.

What's next?

A) Discharge home with instruction on what to look for and when to come back.
B) Admit for observation.
C) Send for a STAT head CT with contrast.
D) Send for a STAT head CT without contrast.
E) Administer factor VIII intravenously.

5

A 10-year-old male is transferred to the ICU with a profuse lower GI bleeding secondary to acute GHVD. Over the first 8 hours, he was transfused with 25 ml/kg of packed red blood cells. And you anticipate that this will continue for the next days.

What are you worried about?

Massive transfusion

1) Circulatory overload.
2) Hypothermia.
3) Hyperkalemia.
4) Citrate related: alkalosis, coagulation defect, hypocalcemia.
5) Platelet and coagulation factors loss.

6

You start a 5-year-old male on iron replacement therapy to treat iron deficiency anemia. He follows up in clinic 6 weeks after iron therapy was initiated and his hemoglobin has corrected from 10.5 gm/dl at diagnosis to the age appropriate normal value of 12 mg/dl.

How is IDA diagnosed?

After diagnosing someone with IDA, what should be done before starting iron replacement therapy?

What is your plan for iron replacement therapy at this point?

7 (an actual patient case)

A three-year-old male patient presents to the emergency room with petechiae on the lower limb. Parents note a progressive decrease in activity over the past few months and fussiness, but no fevers and he didn't seem to be in pain. You note that the child is very pale and order blood testing. A CBC shows a total white count of 1,000/ mm^3 with an ANC of 200/ mm^3, a hemoglobin of 3.4 gm/dl and a platelet count of 28,000 /mm^3.

What are you suspecting?

What's your next step?

BMX/BMA

- A bone marrow biopsy showed poor cellularity but no increased blast population by morphology. The pathologist notes megaloblastic changes in the marrow.

What would you like to do now?

Further history shows that the family are strict vegans. They said that the child eats everything ‘ like a champ’ because they didn’t want the team to lecture them on this like his PCP always does.

Vitamin B12 level is profoundly low (2% of low normal value).

What's next?

Alternative possibility

Bone marrow testing shows a severely hypocellular marrow at 5% cellularity with normal morphology and a 1.5% blast population.

One more alternative scenario

Bone marrow testing shows a decreased precursors of all cell types with a 5-15% cellularity and abnormal looking megakaryocytes. There is a blast population of 8%

Yet one more

The bone marrow is hypocellular with a blast population of 12%. Later, cytogenetic studies confirm an inversion 16 mutation in the abnormal marrow cell population.

8

You were consulted to evaluate a 13-year-old female in the ICU with anemia and thrombocytopenia. She was initially admitted 7 days for observation after developing confusion following the recovery of a viral febrile illness. Her platelet count and hemoglobin declined gradually over the following days and today they are at 25,000/mm3 and 7.9 gm/dl respectively. You also noted her creatinine has been rising during this time frame and nephrology is consulted to evaluate that.

What test can help confirm your suspicion?

A) Bone marrow biopsy.
B) Peripheral blood smear.
C) Anti-platelet antibodies.
D) Flowcytometry on peripheral blood to rule out leukemia.
E) Fibrinogen degradation products.

9

A 10-year-old boy presents with intermittent hematuria over the past 2 months. A complete blood count shows a Hb of 8 gm/dl and a platelet count of 45,000/mm^3. other significant lab findings include a slightly elevated total serum bilirubin. Bone marrow biopsy shows a cellularity of 20%.

What test can confirm the potential diagnosis?

This child is at risk for which of the following?

A) Renal vein thrombosis.
B) Developing colon cancer in the future.
C) HUS.
D) TTP.
E) Developing a brain tumor.

10

A 15-year-old male patient presents for a routine surgical procedure. Baseline pre op CBC showed a hemoglobin of 11.8 gm/dl. MCV is normal at 85 fl. A peripheral smear is significant for normocytic red blood cells and hyper segmented neutrophils.

What is the likely cause of anemia?

Vitamin B12 level came back low confirming your suspicion.

But, how can you explain the normocytic anemia?

11

You are consulted to evaluate a 6-month-old infant who has been in the NICU since birth. The infant has been on TPN since early after birth and enteral feeds could not be initiated yet. The reason you are consulted is progressively worsening neutropenia over the past several weeks (ANC 300 today). Hemoglobin is normal but you note that the infant received several transfusions already since birth due to multiple reasons.

This neutropenia may be explained by which of the following?

A) Iron deficiency.
B) Copper deficiency.
C) Folic acid deficiency.
D) Vitamin B12 deficiency.
E) Transfusion related neutropenia.

12

A 3-day old male neonate is noted to have dysmorphic features consistent with Downs syndrome. A complete blood count is significant for a total white blood cell count of 23,000 and a peripheral blood blast percentage of 12%. Flow cytometry on peripheral blood confirms that the blast population is positive for CD42 and CD61 (Megakaryocyte specific antigens).

What is the best approach to manage this condition?

13

An otherwise healthy 8-year-old female is discharged from the emergency room after suturing multiple cut wonds. She comes back an hour later after her parents notice a bluish discoloration of the face.

How do you proceed?

14

A 4-month-old female patient is referred to you for anemia work up. She has a normochromic normocytic anemia with a blood hemoglobin value of 7 gm/dl. Her CBC is normal otherwise apart from a slightly depressed platelet count at 135,000/mm^3. you notice during your exam that the infant has occasional random eye movement. You proceed to neurological exam to notice that she also has a mild myoclonus.

What initial work up would you like to order?

15

A 12-year-old boy is being treated for ALL. He is 1 year from his diagnosis today and is on maintenance chemotherapy. A bone marrow aspirate and biopsy were done today due to worsening neutropenia even with holding chemotherapy. It shows featues of AML.

What is going on here?

How is this typically managed?

16

You start a 5-year-old child on oral iron replacement therapy for iron deficiency anemia.

2 months later, he presents to your clinic for follow up and hemoglobin today is 7.9 gm/dl. It was 8.2 2 months ago at diagnosis.

What is the most common cause of failure of oral iron replacement therapy?

17 (Bonus)

A 9-year-old female patient is on induction chemotherapy for treatment of ALL. She develops DVT.

What chemotherapy agent commonly used in treating leukemias is known to cause thrombosis …. And diabetes ?

18

A 19-year-old female who was diagnosed with SLE at the age of 15 presents to clinic for routine follow up. She has not been very compliant with the treatments prescribed to her for most of the past 4 years. Her hemoglobin has been sitting at 11.1 gm/dl for the past year. it's noted on her CBC that she has a mid range normal MCV with an RDW index within normal range.

What is the likely cause of her anemia?

What causes it?

What is the main reason of the male-female hemoglobin value discrepancy?

19

A 14-year-old male patient with osteosarcoma presents to the emergency room 8 days after finishing his last chemotherapy cycle that included a high dose of methotrexate. He's here today due to severe oral mucosal pain preventing solid and liquid intake. Inspection shows multiple oral mucosal ulcers some of which are bleeding. You also noted some drooling.

What is mucositis?

How do you treat it?

20

A 14-year-old male patient with osteosarcoma (yes, our very same friend from question 19) presents to the emergency room 9 days after finishing his last chemotherapy cycle that included cisplatin. This time he has a fever of 39.8 Celsius and he was told to come back if he ever has a fever. CBC shows a total WBC count of 300 cells/mm^3 with an ANC of 0. Hb at 6 gm/dl and a platelet count of 20,000/mm^3.

What is neutropenic fever?

21

You are called to evaluate a 4-year-old boy who was admitted 2 days ago for observation after being diagnosed with ITP. His platelet count this morning was 15,000/ mm^3.

His nurse reports that when she went to check on him 10 min ago, he was irritable and not acting him self. The child keeps pointing to his head as if it hurts.

What does ITP stand for?

What is the mechanism of this disorder?

How is it managed?

What could this child's complaint be due to?

What's the likelihood of this occurring in a patient with ITP?

How is it managed?

22

A 5-year-old boy who was diagnosed with Burkitt's lymphoma 5 days ago is 4 days into his chemotherapy cycle.

While rounding this morning you notice that his creatine has been climbing over the past 48 hours and is at 1.2 mg/dl with critically elevated uric acid at 9 mg/dl.

How is this condition managed?

23

The parent of a 1-year-old boy brings him to clinic because she is worried that he may have sickle cell disease. Both parents carry the sickle cell trait. Mom states that there have been no sickle cell related symptoms so far.

Is there a problem here?

Is it possible for patients with sickle cell disease not to have any symptoms by the age of 1 year?

What is the probability that the child has sickle cell?

Hb electrophoresis shows: Hb A 72%, Hb S 20%, Hb F 7% and Hb A2 1%

Does he have sickle cell disease?

What are patients with sickle cell trait at higher risk for?

- Rhabdomyolysis
- Renal medullary carcinoma
- Splenic ischemia/ infarction
- Glaucoma

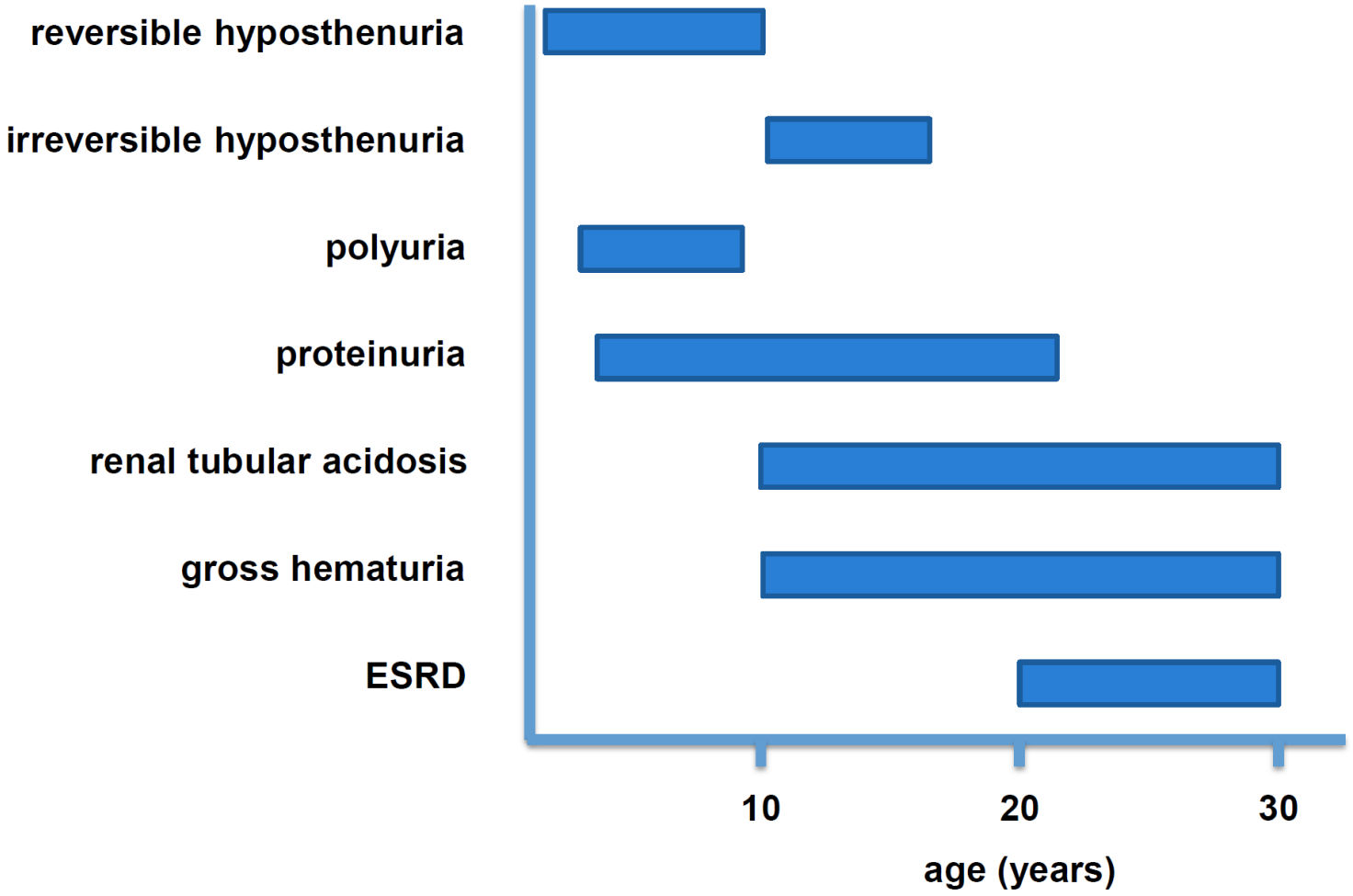
24

You are counseling the parents of a 7-year-old male with Hb SS disease on the natural history of renal complications.

What is the first renal abnormality in a sickle cell patient?

Renal Complications of SCD

by age of onset



What's the expected life span for sickle cell patients?

Life Expectancy

HbSS		HbSC	HbS trait
Male	Female	Male & Female	Male & Female
53 y	58.5 y	Approaches normal	Normal

What consequences do these numbers have?

25

You are taking care of a 5-year-old girl with Hb SS who started having more frequent pain crisis episodes over the past year. She was admitted 8 times in the past 12 months for a total of 45 days for management of pain.

What do you suggest to improve the quality of life of this child?

- Chronic transfusion.
- Hydroxyurea.
- Stem cell transplant.

What should we monitor closely in a patient who is on hydroxyurea?

- Neutropenia
- Anemia.
- Thrombocytopenia.
- Hair loss.
- Mucositis.
- Infections.

26

You are caring for a 4-month-old infant who was diagnosed with Cooley's anemia. Parents have lots of questions that you are trying to help answer today.

At what age symptoms/ clinical consequences usually start? What are these consequences?

- 4-6 months.

- Progressive anemia, pallor.
- Hepatosplenomegaly.
- Hypersplenism.
- Extramedullary hematopoiesis.
- Hemochromatosis.
- Failure to thrive.

- At what point will she be started on chronic transfusion?
- How often will that be?
- What are the benefits of / reasons for chronic transfusion?

- Alleviate symptoms of anemia including these due to high output cardiac failure.
- Improve growth.
- Suppress extramedullary hematopoiesis and prevent bone deformities.

At what point is a splenectomy considered? And what are the benefits?

- Massive spleen resulting in organ compression, displacement, discomfort.
- If transfusion needs become more frequent due to hypersplenism (helps decrease iron overload).
- Failure to thrive.

Is this a cure for this disease?

What is the child's life expectancy?

27

A 12-year-old female, previously healthy, is admitted with new onset left sided weakness to the intensive care unit. She is diagnosed with stroke. Parents state that she was getting progressively fatigued over the past couple months and they thought its due to hormonal changes typical of this age.

Her lab work up is significant for a hemoglobin value of 2 gm/dl, platelet count of 90,000/mm^3. otherwise, normal labs.

- What is going on?
- What needs to be done?

- BMA/ BMX shows normal morphology but a scant population of erythroid precursors and a decreased megakaryocyte population.
- Cytogenetic studies from the bone marrow came back a few days later showing a 20% population with monosomy 7.
- What now?

While reviewing her older chart, it was noted that she suffered recurrent febrile urinary tract infections.

And one US done 3 years ago, shoed horseshoe kidneys.

And when we met her, couldn’t but notice the pencil shaped thumbs.

- Bone marrow failure work up:

- CBC.
- Folate and Vitamin B12 levels.
- Genetics consultation.
- Bone marrow aspiration and biopsy.
- Bone marrow cytogenetic studies.
- Chromosomal breakage studies.
- Fanconi anemia gene analysis.
- Telomere length studies.
- DKC gene analysis.
- Ham test, discontinued.
- Flow cytoemtry for CD55/CD59

Congenital Anomalies in FA

Shimamura and Alter, Blood Reviews, 2010

Anomaly	Frequency
Skin (café a lait, hypopigmented)	40%
Short Stature	40%
Upper limb (thumb)	35%
Male genital	25%
Female genital	2%
Skeletal	25%
Eyes	20%
Renal	20%
Cardiac	6%
GI	5%
CNS	3%

28

A 7-year-old girl is admitted to the hospital for management of pneumonia. Her hemoglobin on admission was 10.9 gm/dl and dropped to 9 gm/dl on the second day of admission with a moderately elevated indirect bilirubin. Mom mentions that she got this from her dad's side of the family, where she is always slightly anemic, and it gets worse every time she gets sick with a little bit of jaundice.

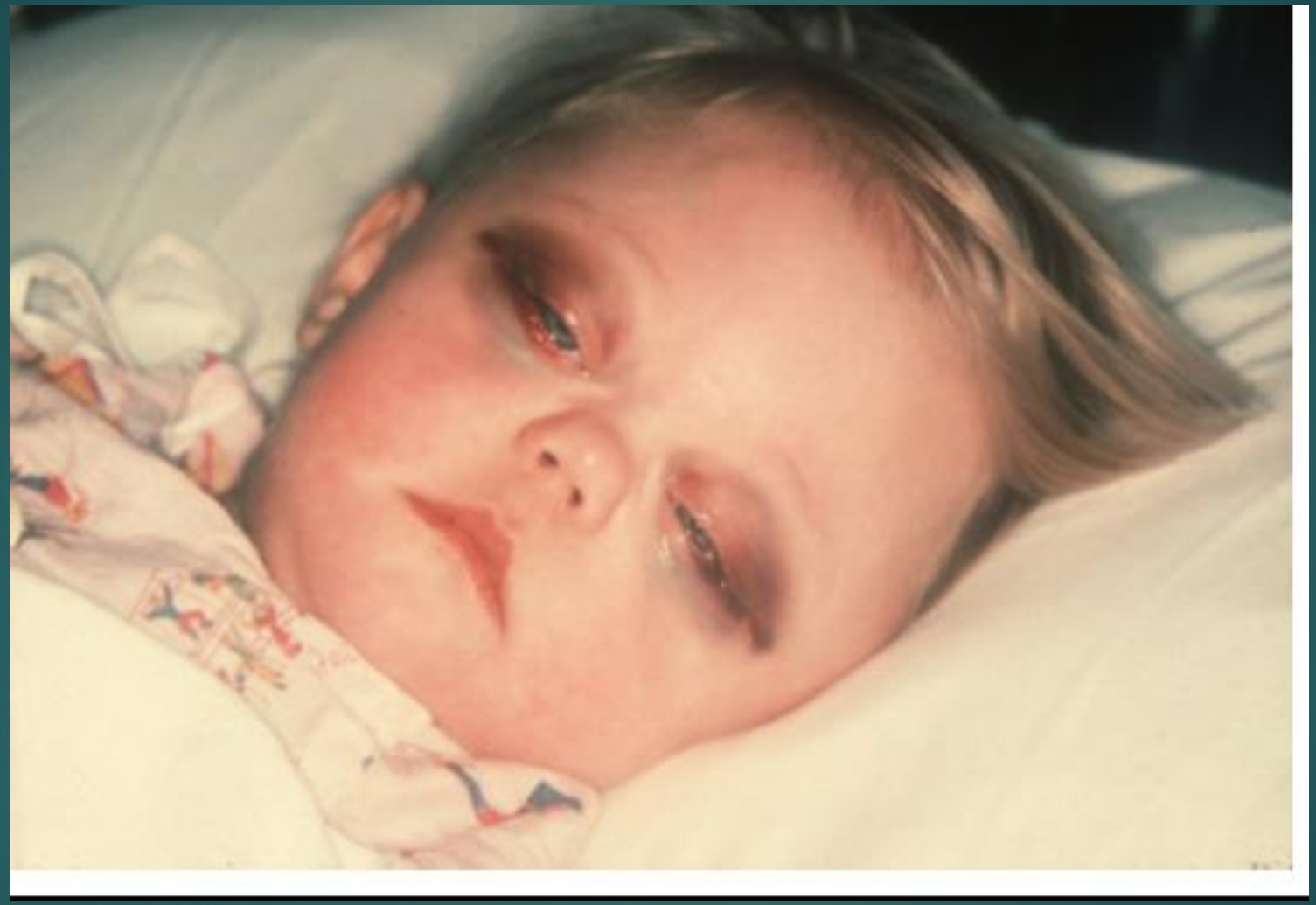
What test can be used to investigate the possible underlying disorder?

Osmotic fragility test came back positive. What can be done to improve this child's anemia?

You advise that the child undergoes a splenectomy to improve her anemia and quality of life. What needs to be done along with that?

29

You are following a 4-year-old boy for anemia that has been worsening over the past 3-4 months. Initially, he was diagnosed with transient erythroblastopenia of childhood but in todays follow up visit, his platelet count is 94,000/ mm^3. you schedule a bone marrow test to investigate this further, but his care giver doesn't show up for the procedures out of fear. 2 months later, he is admitted to the inpatient unit with fatigue and generalized pains and inability to walk. His counts show a HB value of 5.9 gm/dl and a platelet count of 40,000/mm^3.



Which of the following is the pathophysiology of this disorder?

A) Malignant
B) Infectious
C) Nutritional
D) Metabolic
E) This clinical picture can be explained by repetitive traumas (child abuse)

30 Another bonus question!

What are the stages of the development of a new investigational drug or treatment?