C It is usually caused by deletion of β globin genes

D It may be diagnosed antenatally

The right answer. D By cord blood or DNA analysis on chorion villous biopsy.

30. Which ONE of these statements is TRUE about β-thalassaemia major?

A It presents at birth

B It is caused by a defect in α globin synthesis

C It is associated with splenomegaly

D It is associated with an increased risk of bone infarction

The right answer. C

31. Which ONE of the following is NOT TRUE about α-thalassaemia?

A It may cause haemoglobin H disease

B It causes a microcytic hypochromic blood picture

C It ameliorates β-thalassaemia

D It is a cause of hydrops fetalis

E It is rare except in the Far East

The right answer. E It occurs in other tropical areas of the Middle East.

32. Which ONE of the following statements is TRUE about β-thalassaemia trait?

A It is associated with a raised haemoglobin A₂ level

B It is associated with iron overload

C It is associated with a reticulocytosis

D It is associated with splenomegaly

The right answer. A
33. **Which ONE of these statements is TRUE concerning sickle cell trait?**

A It is a cause of anaemia  
B It protects against malaria  
C It occurs mainly in females  
D It is a cause of frequent sickle cells in the peripheral blood  

The right answer. **B**

34. **Which ONE of the following is NOT TRUE about sickle cell anaemia?**

A The oxygen dissociation curve is shifted to the right (i.e. the haemoglobin gives up o2 more easily than normal)  
B It is associated with stunted growth  
C It may cause ankle ulcers  
D It is associated with stroke  
E It is associated with atrophy of the colon  

The right answer **B**. This is not a major feature.

35. **Which ONE of the following is NOT TRUE about neutropenia?**

A It may be caused by acute myeloid leukaemia  
B It occurs in aplastic anaemia  
C It is caused by aspirin  
D It is associated with systemic lupus erythematosus  
E It is a cause of mouth ulcers  

The right answer. **C**

36. **Which ONE of the following is NOT a tissue macrophage?**

A Kupffer cells
The right answer. A There is only one type of light chain on each individual immunoglobulin.

44. Which ONE of these statements is TRUE concerning generation of the immunoglobulin heavy chain gene (IGH) in a B cell?

A Recombinase enzymes are used to generate diversity between V and J regions

B There are multiple V region gene segments within the gene

C Somatic mutation occurs in the RNA transcript of the gene

D Most B cells have two in-frame copies of IGH

The right answer. B

45. Which ONE of these statements is NOT TRUE concerning the complement?

A Macrophages and neutrophils have C3b receptors and phagocytose C3b-coated cells

B The most abundant protein is C3

C The alternate pathway is usually activated by antibody binding to cells or soluble antigen

D The terminal complement components C5–C9 punch holes in the target cell

The right answer. C This activates the classic pathway.

46. Which ONE of these statements is NOT TRUE concerning human leucocyte antigens (HLA)?

A HLA molecules present peptide antigens to T cells

B HLA genes are the most polymorphic gene family in the human genome

C HLA class II molecules consist of an alpha chain and a beta chain
When $O_2$ is unloaded the $\beta$ chains are pulled apart, permitting entry of the metabolite 2,3-diphosphoglycerate (2,3-DPG) and resulting in a lower affinity of the molecule for $O_2$.

The right answer. A It is 95% - and 70% in venous blood.

**78. Which ONE of these conditions is described by this phrase?**

'A clinical state in which circulating haemoglobin is present with iron in the oxidized (Fe$^{3+}$) instead of the usual Fe$^{2+}$ state.'

A Methaemalbuminuria
B Methaemoglobinaemia
C Congenital dyserythropoietic anaemia
D Glucose-6-phosphate dehydrogenase deficiency

The right answer. B

**79. Which ONE of these statements is NOT TRUE concerning the red cell?**

A Each cell travels an estimated 480 km in its lifetime
B It has a maximum diameter of 3.5 $\mu$mol so that it can pass through vessels of this size
C It generates energy as adenosine triphosphate (ATP) by the anaerobic glycolytic (Embden-Meyerhof) pathway
D It generates reducing power as NADH by the E-M pathway and as reduced nicotinamide adenine dinucleotide phosphate (NADPH) by the hexose monophosphate shunt

The right answer. B It has diameter of 8 $\mu$mol but is very flexible so that is can pass through vessels of 3.5 $\mu$mol.
The right answer. A It is expressed on fibroblasts of the adventitia and small muscle of the vessel wall and in the bloodstream on microparticles, and on other non-vascular cells.

86. Which ONE of these statements is NOT TRUE concerning stabilization of the platelet plug by fibrin?

A. Following vascular injury, the formation of extrinsic Xase (VIIa, TF, PL and Ca$^{2+}$) initiates the coagulation cascade

B. The incorporation of plasminogen and tPA helps to stabilize the clot

C. Thrombin generated at the injury site converts soluble plasma fibrinogen into fibrin

D. Platelet aggregation and release reactions accelerate the coagulation process by providing abundant membrane phospholipid

The right answer. B They lead to digestion of the clot.

87. Which ONE of these statements is TRUE concerning fibrinolysis?

A. Plasminogen is a key protein and is activated following conversion into tissue plasminogen activator (tPA)

B. tPA is released after stimuli such as trauma or exercise

C. Fibrinolysis is systemic and not localized to the clot

D. Fibrinolytic agents are too powerful to allow their therapeutic use

The right answer. B It then converts plasminogen to plasmin.

88. Which of the following causes thrombocytopenia?

A. Essential thrombocytopenia

B. Aspirin
103. Which ONE of these is NOT a typical feature of disseminated intravascular coagulation?

A Reduced platelet count
B Fibrinogen concentration is increased
C High levels of fibrin degradation products (d-dimers)
D PT and APTT are often prolonged

The right answer. C

104. Which ONE of these statements is NOT TRUE concerning thromboelastography?

A It is a technique for global assessment of haemostatic function
B It can be used as a stand alone test for primary haemostatic disorders
C The reaction of platelets with the protein coagulation cascade is observed from the time of the initial platelet fibrin interaction through platelet aggregation, clot strengthening and fibrin cross-linkage to eventual clot lysis
D The normal trace shows the rate of initial fibrin formation and the time to formation of a clot

The right answer. B

105. Which ONE of the following is a major risk factor for venous thrombosis?

A Smoking
B Raised low density lipoprotein (LDL) cholesterol
C Cancer
D Hypertension
109. Which ONE of these statements concerning risk factors for thrombosis is UNTRUE?

A Obesity is a risk factor for thrombosis in postoperative patients
B Protein C deficiency can lead to skin necrosis if patients are treated with warfarin
C Antithrombin deficiency is a sex linked disorder
D Mucin secreting adenocarcinomas may cause disseminated intravascular coagulation

The right answer C Autosomal dominant inheritance.

110. Which ONE of these is NOT used in the investigation of thrombophilia?

A Serum cholesterol
B Anticardiolipin and anti-β2-GPI antibodies
CPT (prothrombin) and APTT tests
D Protein C and protein S assays

The right answer. A This is a risk factor for atherosclerosis.

111. Which ONE of these is NOT useful in clinical assessment of the probability of a deep vein thrombosis?

A Numbness in toes
B Pitting oedema
C History of cancer within the last 6 months
D Tenderness along veins
120. **Which ONE of these is NOT generally considered as a cause of failure to respond to erythropoietin in patients with chronic renal failure?**

A. Folate deficiency  
B. Iron overload  
C. Infection  
D. Hyperparathyroidism  

The right answer. B Iron deficiency can be a problem.

121. **Which ONE of these is NOT seen in association with liver disease?**

A. Positive direct antiglobulin test (DAT)  
B. Prolonged prothrombin time  
C. Haemolysis  
D. Thrombocytopenia  

The right answer. A

122. **Which ONE of these is NOT associated with malaria infection?**

A. Myelofibrosis  
B. Intravascular haemolysis  
C. Splenomegaly  
D. Thrombocytopenia  

The right answer. A
126. Which ONE of these is NOT a feature of the blood count and bone marrow in patients with aplastic anaemia?

A Abnormal ‘blast’ cells on the blood film
B Hypoplastic bone marrow with replacement by fat
C Normal appearance of neutrophils on the blood film
D Normochromic normocytic anaemia

The right answer. A This is seen in leukaemia.

127. Which of these statements is NOT TRUE concerning the management of aplastic anaemia?

A FACS analysis of CD55 and CD59 expression is useful in diagnosis
B Ciclosporin is a useful agent in treatment
C Anti-lymphocyte globulin is of benefit in around half the cases
D Allogeneic stem cell transplantation offers only temporary remission

The right answer. D This may offer a permanent cure.

128. Which ONE of these is best defined by this statement? ‘This is a rare autosomal recessive syndrome characterized by varying degrees of cytopenia,
134. A 6-year-old boy in Kenya develops swelling of the jaw. The mass responds rapidly to chemotherapy. What is the most likely diagnosis?

A Burkitt's lymphoma
B Follicular lymphoma
C Mycosis fungoides
D Lymphoblastic lymphoma

The right answer. A

135. A 70-year-old man presents with persistent red patches on his skin. Examination reveals hepatomegaly. What is the most likely subtype of lymphoma?

A Diffuse large B-cell lymphoma
B Anaplastic lymphoma
C Mycosis fungoides
D Mucosa-associated lymphoid tissue (MALT) lymphoma

The right answer. C This is a T-cell lymphoma that affects the skin and internal organs.

136. A 65-year-old woman gives a history of swelling in the neck for 9 months. She is otherwise well and investigation reveals a normal blood count. What is the most likely diagnosis?

A Diffuse large B-cell lymphoma
B Follicular lymphoma
C Sézary syndrome
D Toxoplasmosis

The right answer. B
The right answer. A It is gamma rays.

146. **Which ONE of these is TRUE concerning the use of radiotherapy in Hodgkin's lymphoma?**

A It is highly effective in curing early stage disease  
B It is less effective when used in combination with chemotherapy  
C Its use is often associated with the late development of mastitis  
D It is associated with bone marrow failure

**The right answer. A** It is now often combined with chemotherapy in order to allow the dosage of radiation to be reduced as this limits long-term side-effects.

147. **Which of these is TRUE regarding the appearance on the CT scan at the end of treatment for Hodgkin's lymphoma?**

A It is essential that all the lymph node masses have disappeared  
B Normal CT scan is associated with a 50% cure rate  
C Some residual tissue mass may remain and PET scan is valuable in determining if this is scar tissue or residual tumour  
D The lymph node masses rarely disappear

**The right answer. C** A positive PET scan suggests the tissue is lymphoma.

148. **Approximately what percentage of patients are cured of Hodgkin's lymphoma?**

A 55  
B 65  
C 75  
D 85

**The right answer. D**
152. **Which ONE of the following is a feature of chronic lymphocytic leukaemia?**

A Herpes zoster infection

B Meningeal involvement

C Increased blasts in the bone marrow

D Bone lesions

The right answer. A

153. **Which ONE of the following is present in >50% of newly presenting cases of chronic lymphocytic leukaemia?**

A Serum paraprotein

B Autoimmune haemolytic anaemia

C CD5-positive lymphocytes in peripheral blood

D Thrombocytopenia

E Lymphadenopathy

The right answer. C

154. **Which ONE of these statements is most correct concerning the epidemiology of B-cell chronic lymphocytic leukaemia (B-CLL)?**

A It has an equivalent incidence across the world with a peak age of onset at 60-80 years

B It is more common in Caucasian populations with a bimodal peak of incidence at 50 and 80 years

C It has an increased frequency in first-degree relatives of affected individuals

D There is an increased incidence following radiotherapy or chemotherapy

The right answer. C  
Research is now proceeding to identify the genes that are responsible for determining this risk.
158. Which ONE of these statements is NOT TRUE regarding R-FC (rituximab; fludarabine; cyclophosphamide) treatment for B-CLL?

A Treatment is given at monthly intervals continuously for several years
B Treatment reduces the white cell count and increases the risk of infection
C This is considered as optimal first-line therapy in patients below the age of 65 years
D Infusion reactions may be associated with use of rituximab

The right answer. A Usually each treatment course lasts 4-6 months.

159. Which of these is NOT TRUE regarding prolymphocytic leukaemia (PLL)?

A B-cell PLL is more common than T cell PLL
B The prolymphocyte is twice the size of a normal lymphocyte
C There is massive lymphadenopathy and little splenomegaly
D Response to treatment is less satisfactory than that seen in CLL

The right answer. C The opposite is true.

160. Which ONE of these is the most likely clinical presentation with hairy cell leukaemia?

A A 50-year-old man with infection and abdominal swelling. Blood count shows pancytopenia and monocytopenia
B A 70-year-old woman with anaemia. Blood count shows markedly raised white cell count
C A 30-year-old man with anaemia and a marked thrombocytopenia. Presents with purpura
D A 40-year-old woman with swollen lymph node in left side of neck. Increased platelet count on blood film
164. Which ONE of these is the most likely clinical presentation of a child with acute lymphoblastic leukaemia?

A A 6-month history of fatigue and repeated upper respiratory tract infection
B Poor appetite and abdominal pain resulting from swollen spleen
C Swollen gums in the mouth
D Recent history of bruising and tiredness

The right answer. D Thrombocytopenia and anaemia are common.

165. Which ONE of these is least likely to be considered in the differential diagnosis of acute lymphoblastic leukaemia (ALL) in an child?

A Aplastic anaemia
B Chronic lymphocytic leukaemia
C Neuroblastoma
D Acute myeloid leukaemia

The right answer. B A disease of adults.

166. Which ONE of these is NOT associated with poor clinical prognosis in acute lymphoblastic leukaemia?

A Hyperdiploidy
B High presenting white cell count
C Philadelphia chromosome
D Presentation in infants less than 1 year old

The right answer. A This has good prognosis
173. **Which ONE of these is the most common finding in myelodysplastic syndromes (MDS)?**

A Hypocellular bone marrow and reduced blood cell counts  
B Hypocellular bone marrow and increased blood cell counts  
C Hypercellular bone marrow and reduced blood cell counts  
D Hypercellular bone marrow and increased blood cell counts

**The right answer. C**  
The bone marrow is overactive but there is much apoptosis and many of the cells that are generated are defective.

174. **Which ONE of these is NOT associated with dysplastic changes in the bone marrow?**

A Haemolytic anaemia  
B Excess alcohol intake  
C Treatment with G-CSF  
D Recovery from cytotoxic chemotherapy

**The right answer. A**

175. **Which ONE of these is NOT a feature of peripheral blood cells in myelodysplastic syndromes?**

A Increased haemoglobin concentration in red cells  
B Macrocytic red cells  
C Hypogranular neutrophils  
D Bilobed nucleus in neutrophils

**The right answer. A**  
Red cells are usually hypochromic.
The right answer. B There is rarely severe anaemia and the platelet count tends to be raised, as is often seen in myeloproliferative disease.

201. Which outcome is inferior for thiotepa-based vs cyclophosphamide/total body irradiation (TBI)-based myeloablative conditioning for allogeneic hematopoietic stem cell transplantation (allo-HSCT)?

- Leukemia-free survival
- OS
- 2-yr cumulative incidence of chronic GVHD
- None of the answers is correct
- All of the answers are correct

The right answer. B Answer Explanation: None of the answers is correct. Myeloablative conditioning using thiotepa produced satisfactory outcomes compared to TBI, and significant differences were not observed for the 2-year cumulative incidence of chronic GVHD, non-relapse mortality or relapse incidence. Similar acute GVHD grade I-IV, leukemia-free survival and OS were also observed.

202. Which is more often observed in adult survivors of childhood acute lymphoblastic leukemia (ALL) who were treated with anthracyclines?

- Impaired left ventricular (LV) diastolic function
- Reduced peak oxygen uptake (VO2 max)
- Neither answer is correct
- Both answers are correct

Answer Explanation: Both answers are correct. A cross-sectional study of adult childhood ALL survivors showed that anthracycline exposure was inversely correlated with LV diastolic function (P=0.009). Impaired exercise capacity evaluated by reduced VO2 max/kg was also seen in 56% of anthracycline-treated survivors compared to 17% of anthracycline naive survivors (P<0.001).

203. Which is observed for Mito-FLAG with Ara-C as bolus (B) compared to continuous infusion (CI) in patients with primary refractory or relapsed AML?

- All of the answers are correct
- Longer median DFS
**Answer Explanation:** True. Although a recent study found that Wienecke criteria can be an appropriate points-scoring system to predict prognosis for adrenocortical tumors in children. Complete surgical resection with negative margins is optimal for survival.

**207. All of the following are the most typical morphologic changes of red cells in most thalassemia carriers, EXCEPT:**

- Microcytosis
- Hypochromia
- Anisopoikilocytosis
- Basophilic stippling

**Answer Explanation:** Basophilic stippling. Which is a less common finding.

**208. The hematological diagnosis of beta-thalassemia major is based on reduced hemoglobin levels of:**

- <5 g/dL
- <6 g/dL
- <7 g/dL
- <8 g/dL
- <9 g/dL

**Answer Explanation:** <7 g/dL. And very low mean corpuscular hemoglobin (MCH) <20 pg.

**209. The cause of beta-thalassemia is a genetic defect of 1 or 2 beta-globin genes located on which chromosome?**

- 9
- 10
- 11
- 12

**Answer Explanation:** 11. The genetic defect is located on chromosome 11 (p15.5).

**210. Identify the most common cause of death in transfusion-dependent thalassemia patients:**
225. For those patients who cannot make it into the office, OTC permethrin provides a comparably effective treatment for head lice. True or False?

Answer Explanation: False. Recent clinical studies found a marked decline in the effectiveness of permethrin and synergized pyrethrins, probably because of resistance arising from widespread and indiscriminate use, and the emergence of knockdown resistance mutations.

226. The Olympics always brings its fair share of exciting sporting events, but controversies surrounding the use of performance-enhancing drugs (PEDs) persist. Which narcotic is NOT prohibited by the World Anti-Doping Agency (WADA)?

- Oxycodone
- Pentazocine
- Tramadol
- Buprenorphine

Answer Explanation: Tramadol. The others are prohibited as of January 2016 by the WADA.

227. Calmare therapy significantly decreases the numerical pain score in patients with which type of cancer-related neuropathic pain?

- Chemotherapy-induced peripheral neuropathy
- Metastatic bone pain
- Post-surgical neuropathic pain
- All of the answers are correct
- None of the answers is correct

Answer Explanation: All of the answers are correct. A recent study showed calmare therapy significantly decreased numerical pain scores, improved overall Brief Pain Inventory scores, and decreased consumption of rescue opioids in patients with cancer-related neuropathic pain. The treatment was found satisfactory by 50% of patients.

228. The addition of pregabalin to palliative radiotherapy for the management of cancer-induced bone pain improves which outcome?

- Average pain
- Pain interference
Breakthrough pain duration

All of the answers are correct

**Answer Explanation:** Breakthrough pain duration. A recent study showed that while the primary endpoints of a decrease of ≥2 points on a numerical pain scale were not achieved, pregabalin treated patients did have improvements in mood and breakthrough pain duration.

229. **Continuous lidocaine infusion is NOT an effective treatment strategy for managing opioid-refractory pain in pediatric cancer patients. True or False?**

**Answer Explanation:** False. In a retrospective review of pediatric cancer patients with opioid-refractory pain, median pain score prior to infusion was 8/10, with scores falling to 2/10 following infusion. In most cases, pain scores were improved beyond infusion termination.

230. **Which pain management strategy from the WHO three-step guideline is more effective in cancer patients with moderate pain?**

- Step II weak opioids
- Low-dose step III strong opioids (morphine)
- No difference between the two strategies

**Answer Explanation:** Low-dose step III strong opioids (morphine). A recent study of cancer patients with moderate pain showed that the primary outcome (88.2% vs 57.7%) and percentage of responders was improved with low-dose morphine treatment. Tolerability was similar between the 2 groups.

231. **Adding magnesium sulfate to morphine improves which outcome in patients with cancer pain?**

- Pain intensity
- Functional performance and quality of life
- Dose of morphine used
- All of the answers are correct
- None of the answers is correct
238. **After a physical examination and patient history, you order labs. Which is NOT a laboratory finding suggestive of von Gierke’s disease?**

- Hypertriglyceridemia
- Hyperuricemia
- Lactic acidosis
- All of the answers are correct – none are suggestive
- None of the answers is correct – all are suggestive

**Answer Explanation:** None of the answers is correct – all are suggestive.

Including hypoglycemia after a 4-6 hr fast. von Gierke’s disease is caused by a deficiency of glucose-6-phosphatase.

239. **Early diagnosis and treatment onset are associated with lower odds of complications. Which is a long-term complication of von Gierke’s disease?**

- Proteinuria
- Short stature
- All of the answers are correct
- None of the answers is correct
- Hepatocellular adenomas

**Answer Explanation:** All of the answers are correct. Other long-term complications include osteoporosis or bone mineral loss, kidney disease with hypertension, renal calculi, nephrocalcinosis, pancreatitis secondary to hypertriglyceridemia and potentially life-threatening hypo glycemia.

240. **The risk of malignant transformation of hepatocellular adenomas in adults with von Gierke’s disease is approximately:**

- 5%
- 10%
- 15%
- 20%

**Answer Explanation:** 10%. Hepatocellular adenomas may occur in 22-75% of adults with von Gierke’s disease.
**Answer Explanations:** 30%. Actually, 33% were identified as potentially preventable. Approximately two-thirds of SCD crisis-related pediatric ED visits are not immediately preventable; that percentage is higher in children with asthma.

**248.** Time to opioid administration (TTO) has been suggested as a quality of care measure for patients with SCD with vaso-occlusive crisis. Decreased TTO is independently associated with all of the following, EXCEPT:

- Reduced hospital admission
- Decreased total LOS in ED
- Increased total opioids
- None of the answers is correct

**Answer Explanation:** Reduced hospital admission. TTO was associated with all secondary outcomes but was not associated with hospital admission.

**249.** Children with SCD experience a significantly higher rate of wheezing compared with children of similar age without SCD. True or False?

**Answer Explanation:** True. This according to a recent study evaluating such children.

**250.** Approximately what percent of children with sickle cell disease (SCD) is vitamin D deficient?

- 20%
- 40%
- 60%
- 80%

**Answer Explanation:** 60%. Actually, 59% according to a recent study. Patients with SCD have a high prevalence of vitamin D deficiency.

**251.** In those same patients, serum 25-hydroxyvitamin D is significantly associated with:

- Acute pain
- Acute chest syndrome
- Both answers are correct
294. **Which ONE of these is NOT a monoclonal antibody drug**

A Bortezomib  
B Rituximab  
C Alemtuzumab (Campath)  
D Gemtuzumab  

The right answer. A  This is a proteosome inhibitor.

295. **Clonality can be shown by which ONE of the following?**

A Light chain expression in acute myeloid leukaemia  
B Immunoglobulin gene analysis in acute lymphoblastic leukaemia  
C CD3 expression in T-cell lymphomas  
D Myeloperoxidase expression in acute myeloid leukaemia  

The right answer. B  Clonal rearrangement.

296. **Which ONE of these inherited conditions is NOT associated with an increased risk of haematological malignancy?**

A Cystic fibrosis  
B Ataxia telangiectasia  
C Down's syndrome  
D Fanconi's anaemia  

The right answer. A

297. **Which ONE of these drugs is NOT associated with increased risk of progression to acute myeloid leukaemia (AML)?**

A Hydroxyurea  
B Chlorambucil
- True or
- False?

**Answer Explanation:** True. In a recent study, TEAD4 mRNA expression was upregulated in AT/RT cell lines and the corresponding protein was overexpressed in patient-derived samples. Furthermore, YAP1, MYC, and CCND1 were all upregulated in response to TEAD4 overexpression.

315. **Which variable is NOT positively associated with childhood rhabdomyosarcoma?**

- Incomplete immunization schedules
- Incomplete DPT immunization
- Childhood infections
- None of the answers is correct – all are positively associated

**Answer Explanation:** Childhood infections. Study findings suggest a protective role of routine vaccinations in childhood cancer and specifically in childhood rhabdomyosarcoma.

316. **Attention and working memory are impaired in your pediatric patients who experience seizures during treatment for ALL.**

- True or
- False?

True. In a recent study, attention, working memory, and processing speed were impaired in the patient population outlined above compared to normative scores and a nonseizure control cohort. Cognitive deficits persisted in these patients up to 2 years after therapy.

317. **What is the current cisplatin exposure level for recommended post-treatment audiologic evaluation in your pediatric cancer survivors?**

- >200 mg/m²
- >360 mg/m²
- >420 mg/m²
- >550 mg/m²

**Answer Explanation:** >360 mg/m². According to current guidelines, pediatric cancer patients treated with >360 mg/m² should receive post-therapy audiologic evaluation to establish a baseline and monitor future hearing loss. Carboplatin
• Ewing sarcoma is defined by balanced chromosomal EWS/ETS translocations
• Relapsed tumors show a 2- to 3-fold increased number of mutations
• High-level FGFR1 expressions is a characteristic feature
• None of the statements is false
• All of the statements are false

Answer Explanation: None of the statements is false. FGFR1 may constitute a promising target for novel therapeutic approaches in Ewing sarcoma.

366. Which mutation is associated with FGFR1 expression in those same patients?
• LAMB4
• N546K
• TP53
• CCDC19

Answer Explanation: N546K. The FGFR1 locus frequently shows copy number gain (31.7%) in primary Ewing sarcoma tumors.

367. Which comorbidity has a higher prevalence in childhood cancer survivors?
• Cardiovascular conditions
• Pulmonary dysfunction

Answer Explanation: Pulmonary dysfunction. The estimated cumulative prevalence for a serious chronic disease in childhood cancer survivors is 80% by age 45 years. Pulmonary late effects are often subclinical.

368. As childhood cancer survivors age, rates of subsequent malignant neoplasm increase. True or False?

Answer Explanation: True. Therefore, life-long surveillance is required. It is becoming clear that there is no age after which the occurrence of late effects plateaus and surveillance can be reduced.
377. Which outcome is significantly different between double-unit and single-unit unrelated cord blood (UCB) transplantation in children and young adults with acute leukemia or myelodysplastic syndrome?

- Final relapse risk
- Overall incidence of graft-versus-host disease (GVHD)
- Chronic GVHD

**Answer Explanation:** Chronic GVHD. However, single-UCB transplantation with adequate cell dose remains the standard of care and leads to low transplant-related mortality. Double-unit transplantation should be reserved for patients who lack such units.

378. Identify the most commonly mutated gene in Fanconi anemia:

- FANCA
- GEN1
- FANCP/SLX4

**Answer Explanation:** FANCA. FANCA is essential for resolving DNA interstrand cross-links during replication.

379. Neuroblastoma is a childhood tumor in which MYC oncogenes are commonly activated to drive tumor progression. True or False?

**Answer Explanation:** True. Survival for children with high-risk neuroblastoma remains poor.

380. Living within 50 m of a high-voltage electric power transmission line significantly increases the risk of childhood leukemia. True or False?

**Answer Explanation:** False. Recent study findings did not clearly support an increased childhood leukemia risk associated with close proximity (<50 m) to higher voltage lines, but could be considered a small increased risk (OR 1.4).
importance of screening these patients for iron overload in accordance with guidelines.

418. Which histopathology presents with more extensive disease and aggressive pathology in children with pediatric papillary thyroid carcinoma (PTC)?

- NTRK1/NTRK3 fusion oncogene
- BRAF (V) (600E)

**Answer Explanation:**

NTRK1/NTRK3 fusion oncogene. Fusion oncogene tumors, compared with BRAF (V) (600E) PTCs were associated with large size, solid and diffuse variants and lymphovascular invasion. Additionally, the high prevalence of the NTRK1/NTRK3 fusion oncogene PTC in the US is unusual.

419. Your patient is a child with a supratentorial primitive neuroectodermal tumor (sPNET) who, following surgery, received craniospinal radiotherapy with concurrent carboplatin followed by 6 months of maintenance chemotherapy with cyclophosphamide and vincristine. If similar to other such patients, the 5-year OS for your patient is approximately:

- 30%
- 40%
- 50%
- 60%
- 70%

**Answer Explanation:** 60%. Actually, 58% according to a recent study.

420. Which is a prognostic factor in your patient?

- Extent of resection
- M-stage
- Both answers are correct
- Neither answer is correct

**Answer Explanation:** Extent of resection. Aggressive surgical resection should be attempted if feasible in such patients.
467. **The prognosis of first relapsed acute lymphoblastic leukemia (ALL) in children is associated with:**

- Time of relapse after initial therapy
- Sites of relapse
- Immunophenotype
- All of the answers are correct
- None of the answers is correct – other prognostic factors

**Answer Explanation:** All of the answers are correct. Clonal selection and evolution take place during chemotherapy, resulting in distinct genetic and epigenetic characteristics of relapsed ALL, some of which are linked to drug resistance, a common and problematic feature of ALL after relapse.

468. **Intensification of conventional ALL-type therapy in first relapsed ALL can provide a cure in approximately what percent of patients?**

- 30%
- 40%
- 50%
- 60%
- 70%

**Answer Explanation:** 70%. More than half of relapsed ALL cases are stratified as high-risk.

469. **Chemoresistant relapsed/refractory Hodgkin's lymphoma in children predicts limited both OS and EFS at the time of autologous hematopoietic stem cell transplantation (HSCT). True or False?**

**Answer Explanation:** True. Autologous HSCT plays an important role for the treatment of relapsed/refractory Hodgkin's lymphoma in children and adolescents, and survival rates are better for patients with chemosensitive disease at the time of transplantation.

470. **Which variable correlates with survival in pediatric high-grade brain stem gliomas?**

- Lower-grade tumor histology
- Radiation therapy only in first 9 months post-diagnosis
- Surgical resection
30-day mortality from acute promyelocytic leukemia during the all-trans retinoic acid era, but 7-day mortality has remained high and not improved over time.

496. Patients in which subgroup of medulloblastoma show the highest 5-year PFS after radiation treatment?
   - Sonic hedgehog
   - Group 3
   - Group 4

**Answer Explanation:** Group 4. In patients with medulloblastoma who were older than 3 years of age, those classified as having group 4 tumors showed the highest 5-year PFS, whereas patients with sonic hedgehog-activated tumors showed the lowest PFS.

497. True or false: Children who are in a low-income family during the first 2 years of life are at increased risk of lymphoid leukemia.

**Answer Explanation:** True. A cohort study of children in Oslo showed that poverty during the first 2 years of life was associated with increased risk of lymphoid leukemia. Compared with those in high-income families, children who were in middle-income families during the first 2 years of life had an increased risk of astrocytomas.

498. Monocular nystagmus is a more common presenting sign of optic pathway/hypothalamic glioma in which age group?
   - Younger than 2 years of age
   - Older than 2 years of age
   - About the same incidence

**Answer Explanation:** Younger than 2 years of age. A small study of children with optic pathway/hypothalamic gliomas showed that nystagmus was present in 10 of 22 (45%) patients younger than 2 years of age but not in any of the children who were older than 2 years.

499. Which endocrine late effect is significantly increased in CNS, non-Hodgkin lymphoma or Hodgkin lymphoma survivors compared to the general population?
   - None of the answers is correct
   - Diabetes mellitus
526. Which is associated with an increased number of somatic deletions in your childhood patients with acute lymphoblastic leukemia (ALL)?

- Maternal ever-smoking
- Maternal smoking during pregnancy
- Both answers are correct

**Answer Explanation:** Both answers are correct.

In a recent study, maternal ever-smoking, smoking during pregnancy, and smoking during breastfeeding were associated with a greater number of somatic deletions in pediatric patient samples with ALL. Total number of deletions also correlated with the DNA methylation status of the aryl-hydrocarbon receptor repressor (AHRR), a surrogate biomarker for cigarette smoke exposure.

527. Which autosomal trisomy is most commonly observed in adult patients with acute myeloid leukemia (AML)?

- Trisomy 4
- Trisomy 8
- Trisomy 11
- Trisomy 13

**Answer Explanation:** Trisomy 8. In a recent study, trisomy 8 (4.0%) was the most common chromosomal gain observed in adult patients with AML. The frequency of autosomal trisomy increased with patient age.

528. **RUNX1-RUNX1T1** bone marrow transcript levels after allo-HSCT do NOT predict risk of relapse in your patients with t(8;21) AML. True or False?

**Answer Explanation:** False. In a recent study, patients with t(8;21) AML and <3-log reduction of **RUNX1-RUNX1T1** expression within 12 months of allo-HSCT have an increased risk of disease relapse. Patients with <4-log reduction 12 months after transplantation also have an increased risk of recurrence.
patients with double NOTCH1/FBXW7 mutations was not altered by changes in PTEN or Ras.

555. Adult survivors of childhood acute lymphoblastic leukemia (ALL) treated with only chemotherapy have significant deficiencies in each parameter, EXCEPT:

- General intellectual function
- Neurocognitive processing speed
- Neurocognitive executive functions
- Working memory

**Answer Explanation:** General intellectual function.

Very long-term survivors (mean, 22.6 years) of ALL exposed to chemotherapy had significant impairments in neurocognitive functions, but not in general intellect, compared with comparison peers.

556. Which variable may serve as a marker of renal function during and after high-dose methotrexate infusion in children with ALL?

- Plasma creatinine
- Plasma cystatin C concentration
- Plasma and urine neutrophil gelatinase-associated lipocalin (NGAL)
- All of the answers are correct
- None of the answers is correct

**Answer Explanation:** Plasma cystatin C concentration.

Mean plasma cystatin C level increased significantly with high-dose methotrexate. The other variables did not change. Therefore, study results suggest that plasma cystatin C concentration alone is a sensitive marker to monitor renal function in such patients receiving high-dose methotrexate.

457. Patients treated with first-line dasatinib for chronic myeloid leukemia (CML) develop which pattern of mutations in BCR-ABL1 compared with imatinib?

- Narrower spectrum of mutations
- Fewer phosphate-binding loop mutations
- Fewer multiple mutations
- All of the answers are correct
- None of the answers is correct

**Answer Explanation:** All of the answers are correct. Retrospective analysis of patients with newly diagnosed CML treated with dasatinib or imatinib showed that a small subset of patients
65.0%, respectively. Low LMR (<2.60) was identified as an independent adverse prognostic factor in this patient population.

566. Obesity in men is associated with:
- AML
- MDS
- Both
- Neither

**Answer Explanation:** Acute myeloid leukemia (AML). Obesity in women is associated with AML and MDS. Obesity in adulthood is a modifiable risk factor for both MDS and AML.

567. Children with AML who experience a relapse after HSCT in first remission have a good chance of survival with a second HSCT if a second remission is achieved. True or False?

**Answer Explanation:** True. An interval of <24 months between the first and second HSCT was a significant poor prognostic factor.

568. Chromosomal translocations in patients with MDS or chronic myelomonocytic leukemia (CMML) are significantly associated with:
- Shorter survival
- Higher incidence of transformation into AML
- Both answers are correct
- Neither answer is correct

**Answer Explanation:** Neither answer is correct. The association was significant only at univariate analysis; features disappeared after multivariate adjustment for the IPSS-R cytogenetic category.

569. True or False: Children with standard risk acute lymphoblastic leukemia (SR-ALL) experience considerable impairment in health-related QOL at the end of induction, but rapidly improve.

**Answer Explanation:** True. However, many still experience physical and social impairment 3 months post-therapy, suggesting a role for continued family and physical functioning support.

570. Which is the most common manifestation of cytomegalovirus (CMV) disease in pediatric ALL in the nontransplant setting?
- Pneumonitis
- Retinitis
- Hepatosplenic disease
Neither answer is correct - no association

**Answer Explanation:** Thrombocytopenia. In a recent study, researchers found that AML patients with prior cytopenias have features similar to AML with myelodysplasia-related changes, and support the use of prior unexplained thrombocytopenia as an independent marker of high-risk disease.

**589. True or False:** Empiric antibiotic therapy should be initiated in pediatric patients who present with isolated fever at the time of acute lymphoblastic leukemia (ALL) diagnosis.

**Answer Explanation:** False. Retrospective analysis of 221 patients with ALL showed that 126 were febrile at diagnosis; only 2 of those patients had bacteremia in blood cultures. Given the rarity of bacteremia in this subpopulation, more judicious use of antibiotics in children with isolated fever at time of ALL diagnosis may be warranted.

- BLIMP1
- XBP1
- IRF4/MUM1

**Answer Explanation:** IRF4/MUM1. BLIMP1 and XBP1 expression were significantly more frequent in SOX11-negative than in -positive cases.

**590. Fluconazole prophylaxis after allogeneic stem cell transplantation (allo-SCT) using peripheral blood stem cells (PBSC) improves which outcome for acute leukemia or myelodysplastic/myeloproliferative syndrome?**

- Incidence of chronic graft-versus-host disease (GVHD)
- All of the answers are correct
- None of the answers is correct
- 3-year OS
- Occurrence of invasive fungal infections (IFI)

**Answer Explanation:** None of the answers is correct. A retrospective analysis showed similar IFI, non-relapse mortality, 3-year overall and DFS, and acute or chronic GVHD, regardless of the administration of fluconazole prophylaxis in these patients. Fluconazole may not be required after allo-SCT using PBSC.

**591. Which hematologic malignancy is associated with the highest risk of developing subsequent invasive malignant melanoma in men up to 49 years of age?**

- Chronic lymphocytic leukemia (CLL)
- Small lymphocytic lymphoma (SLL)
**Answer Explanation:** ETV6/RUNX1. ETV6/RUNX1 is the most common driver mutation in precursor-B ALL and occurs following t(12;21) translocation. A recent study determined ETV6/RUNX1 binds the regulatory region of MIR181A1 causing a downregulation of the resulting gene product.

620. What percentage of children exhibit borderline performance or lower on measures of attention and memory following allogeneic hematopoietic cell transplant (HCT)?

- 10%
- 25%
- 33%
- 50%

**Answer Explanation:** 25%. In a study of 30 children who received allogeneic HCT, mean intellectual and academic abilities were average. Study findings revealed neurocognitive areas of vulnerability in processing speed and memory following HCT that contribute to subsequent academic difficulties.

621. Intensification of conventional therapy can provide a cure in approximately what percentage of patients with standard-risk acute lymphoblastic leukemia (ALL) after first relapse?

- 30%
- 50%
- 70%
- 90%

**Answer Explanation:** 70%. Time to relapse from initial therapy, sites of relapse, and immunophenotype are all prognostic factors for childhood ALL patients after first relapse. However, intensification of conventional ALL-therapy can lead to cures in 70% of first relapse patients with standard-risk features.

622. Which racial group saw the greatest increase in acute lymphoblastic leukemia (ALL) from 1975 to 2010 compared to non-Hispanic whites?

- Non-Hispanic blacks
- Hispanic blacks
630. Hepatitis B seropositivity is associated with an increased risk of:

- Multiple myeloma
- Hodgkin lymphoma
- Neither answer is correct
- Both answers are correct

**Answer Explanation:** Both answers are correct. According to a recent meta-analysis, hepatitis B seropositivity is associated with an increased risk of multiple myeloma and Hodgkin lymphoma. This association was independent of study design or quality.

631. True or False: Bortezomib is effective for relapsed or refractory adult T-cell leukemia/lymphoma (ATL).

**Answer Explanation:** False. In a study of 15 relapsed or refractory ATL patients, bortezomib treatment led to one partial remission and five stable disease responses. Due to minimal clinical activity, the study was terminated as single-agent bortezomib did not appear to be very promising.

632. Approximately what percent of young adults (<40 years of age) with follicular lymphoma (FL) present with advanced disease?

- 10%
- 30%
- 50%
- 70%

**Answer Explanation:** 70%. In a study of 2,652 FL patients in the National LymphoCare Study (NLCS), 6% were young adults. Within this cohort, 69% represented with advanced disease at diagnosis. FL in young adults is uncommon.

633. Which treatment approach is most frequent in young adults with FL?

- Observation
- Rituximab monotherapy
- Chemoimmunotherapy
**Answer Explanation:** Maternal smoking during pregnancy. This according to a recent study of the etiology of childhood acute leukemia.

698. **Up to 30% of newborns with Down syndrome are affected by transient myeloproliferative disorder (TMD), which regresses spontaneously in most cases. True or False?**

**Answer Explanation:** True. TMD is characterized by a GATA-binding protein 1 mutation, and one-quarter of children with TMD progress to acute megakaryoblastic leukemia or myelodysplastic syndrome.

699. **The incidence of osteonecrosis in children with ALL who receive chemotherapy is significantly higher in which population?**

- None of the answers is correct
- Girls
- Patients >10 years old
- Patients with more intensive chemotherapy regimens
- All of the answers are correct

**Answer Explanation:** All of the answers are correct. In a recent study of Taiwanese children with ALL, incidence of osteonecrosis was found to be significantly higher in girls, patients >10 years of age and patients receiving more intensive chemotherapy.

700. **Average lower doses of maintenance 6-mercaptopurine for children with ALL are associated with variant alleles in which gene?**

- SLCO1B1
- TPMT
- MRP4
- MTHFR
- RFC1

**Answer Explanation:** SLCO1B1. Average dose of 6-mercaptopurine was lower in patients with at least 1 SLCO1B1 c.521 T>C variant allele, while the other polymorphisms analyzed had no association with dose or toxicity.