**Acute and Chronic Myeloid Leukemia**

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1. A 13-year-old boy with an elevated white count of 18,000/mm3 with 35% blasts, hemoglobin of 7.8 g/dL, platelets of 9,000/mm3, and mild hepatosplenomegaly is referred to you. He has a history of failure to thrive due to exocrine pancreatic insufficiency, chronic neutropenia and poor academic performance. He has also had persistent anemia for several years despite iron supplementation. Your physical exam reveals short stature.

What findings are most likely to be seen for this patient?

A. Blasts containing Auer rods, CD13+ surface marker, and a *SBDS* mutation

B. Blasts with blebs on the surface, CD61+ cell surface marker, and a *GATA1* mutation

C. A variety of blasts and early lymphoid and myeloid precursors, BCR/ABL+ PCR, and basophilia

D. Elevated hemoglobin F, absolute monocyte count greater than 1 × 109/L, and hypersensitivity of bone marrow precursors to GM-CSF

E. Blasts with minimal cytoplasm, CD10+ surface marker, and t(12:21) cytogenetics

**Explanation**

This patient’s presenting history and physical exam suggest a constitutional abnormality preceding his leukemia. In this case, based on these specific characteristics, the diagnosis strongly suggests Schwachman-Diamond Syndome (SDS). These patients are at significant risk of developing acute myeloid leukemia. It is important to recognize the physical and historical signs and symptoms associated with SDS, including those in this question in addition to rib and/or spine skeletal anomalies. Answer E is characteristic of acute lymphoblastic leukemia. Answer B is characteristic of acute megakaryocytic leukemia, seen in a high proportion of patients with Down syndrome but not SDS. Answer D is characteristic of juvenile myelomonocytic leukemia, seen in higher proportions of patients with Noonan syndrome or neurofibromatosis type 1. Answer C is characteristic of chronic myeloid leukemia (in blast crisis with these values), which does not have a higher-than-expected incidence in congenital disorders.

2. You have a new 7-year-old female patient with a WBC count of 6,000/mm3, hemoglobin of 7.2 g/dL, and platelet count of 30,000/mm3. A bone marrow aspirate reveals 14% blasts with a monocytic morphologic appearance that are surface marker positive for CD33. You receive a call from the fluorescence *in situ* hybridization (FISH) lab that the bone marrow is positive for KMT2A rearrangement in 68% of cells. Your staff asks whether this represents a diagnosis of acute leukemia in the current classification scheme for this type of hematologic malignancy.

What would you say?

A. No, because for a diagnosis of acute leukemia you must have 30% or more blasts in the marrow.

B. No, because for a diagnosis of acute leukemia you must have 20% or more blasts in the marrow.

C. No, because the cytogenetics do not include +21, monosomy 7, or trisomy 8.

D. Yes, because the morphology is monocytic.

E. Yes, because the FISH is positive for KMT2A rearrangement.

**Explanation**

The patient has a myeloid neoplasm by virtue of the presenting histochemical findings and cell surface markers. The current classification (ie, World Health Organization [WHO]) uses a minimum of 20% blasts in the marrow for a designation of acute myeloid leukemia (AML) versus myelodysplastic syndrome if there are fewer than 20% blasts. In the old French-American-British classification scheme, this cutoff had been 30% or more for a diagnosis of AML. A crucial feature of the WHO classification is that a patient need not have 20% blasts in the marrow for a diagnosis of AML if they have one of a growing list of AML-defining recurrent genetic abnormalities detected by conventional karyotype, fluorescence *in situ* hybridization (FISH), or molecular profiling. These include translocations involving the *KMT2A* gene at chromosome 11q23, formerly known as *MLL*. The most common translocation in AML is the t(9;11)(p21.3;q23.3), which results in the *MLLT3-KMT2A* fusion protein.

3. A 7-year-old girl is found to have a white count of 55,000/mm3 with 20% neutrophils, 10% lymphocytes, and 70% blasts. Bone marrow aspirate and biopsy shows 75% blasts. The blasts on flow cytometry show CD33, CD13, and CD34 to be positive; CD7 to be minimally positive; and TdT, CD3 (surface and cytoplasmic), and CD10 to be negative.

Which of the choices is most important to further define risk-based therapy in this patient’s leukemia?

A. Cytogenetics/fluorescence in situ hybridization (FISH) for BCR-ABL1, iAMP21, and ploidy

B. Cytogenetics/FISH for inv(16) and t(8;21), and FLT3 mutation testing

C. WBC greater than 50,000/mm3, cytogenetics for ploidy, and immunohistochemistry for myeloperoxidase

D. Cytogenetics/FISH for t(11;19) and +21, and sequencing for RAS mutation status

E. Cytogenetics/FISH for t(1;22) and trisomy 8, and sequencing for GATA1 mutation status

**Explanation**

This patient’s bone marrow aspirate, biopsy, and flow cytometry are diagnostic of acute myeloid leukemia (AML). Therefore, the important prognostic factors on which initial risk stratification is based include favorable cytogenetics and molecular markers (inv(16), t(8;21), NPM1, CEBPA), unfavorable cytogenetics and molecular markers (monosomy 7, monosomy 5 or deletion 5q, FLT3-ITD high allelic ratio), and induction response. The other choices are prognostic for patients with acute lymphoblastic leukemia (answer A) or do not factor into prognostic classifications for AML (answers C through E).

4. An 18-year-old man has been newly diagnosed with acute myeloid leukemia with myelomonocytic characteristics and a marrow blast percentage of 33%. Cytogenetics reveals a 5q deletion. For this patient, what should the optimal therapy include?

A. An anthracycline, intensive cytarabine, and allogeneic hematopoietic stem cell transplant (HSCT)

B. Intensive cytarabine, an anthracycline, and 1 year of maintenance chemotherapy

C. An anthracycline, cyclophosphamide, etoposide, and HSCT

D. Four-drug induction, consolidation, interim maintenance, delayed intensification, and maintenance chemotherapy

E. HSCT without preceding chemotherapy

**Explanation**

This patient has a diagnosis of acute myeloid leukemia (AML). The backbone of AML therapy includes the intensive administration of anthracyclines and cytarabine without maintenance therapy. Therefore, answers B, C, and D are not appropriate. Optimal therapy for a patient with AML and a high-risk cytogenetic abnormality such as monosomy 7, 5q deletion, or FLT3/ITD high allelic ratio includes remission induction and then allogeneic stem cell transplantation with the best available donor. Proceeding directly to HSCT with 33% blasts in the bone marrow (answer E) would be associated with a very high risk of relapse.

5. A family requests consultation with you after their 2-year-old boy with Down syndrome is diagnosed with acute myeloid leukemia (AML). They are struggling with a decision whether to have their child treated, and, if they do agree to treatment, what it should include. The initial presentation included findings that the leukemia was positive for CD41 and CD61, fluorescence in situ hybridization was only positive for trisomy 21, the initial white count was 75,000/mm3, the liver and spleen were moderately enlarged, and the child is otherwise well and stable.

Based on current literature, what do you recommend that the regimen chosen should include?

A. Induction chemotherapy with anthracyclines and cytarabine, at least one course of intensive cytarabine, and intermittent dosing of intrathecal cytarabine over the course of treatment

B. No therapy, because this will spontaneously resolve

C. Low-dose cytarabine alone

D. Induction chemotherapy with anthracyclines and cytarabine, concluding with a bone marrow transplant if a sibling donor is available

E. Because of the poor prognosis in these children with this type of leukemia, only palliative treatment

**Explanation**

This patient has the typical acute megakaryoblastic leukemia seen in children with Down syndrome. The patient’s age is younger than 4 years. Although the outcome for AML in children with Down syndrome who are younger than 4 years is favorable, it does require therapy, and therefore answers B and E are incorrect. Answer B, observation, is indicated in low- or moderate-risk transient myeloproliferative disorder (TMD), which is restricted to the first 90 days of life, and answer C would be appropriate in high-risk TMD. Studies have shown that the best outcome for a child with this presentation is seen with answer A. Remissions in children with Down syndrome treated with low-dose cytarabine are not sustained. Children with Down syndrome who received a matched sibling transplant actually had a worse outcome than those who received high-dose cytarabine during intensification.

6. A 13-year-old Hispanic girl is found to have a WBC count of 6,500/mm3 with 40% Auer rod–containing granular blasts that, by flow cytometry, express very bright CD33 but are negative for human leukocyte antigen–DR isotype (HLA-DR). She is oozing blood around her peripheral IV site. Coagulation studies reveal an international normalized ratio (INR) of 3.4, a fibrinogen of 170, and a markedly elevated D-dimer. Marrow aspirate shows nearly 90% blasts with a similar morphology. You send the marrow to the fluorescence *in situ* hybridization (FISH) lab and request STAT testing for the most likely recurrent genetic abnormality based on the clinical presentation.

How do you plan to initiate therapy?

A. Perform a lumbar puncture to determine leukemic involvement, then proceed with induction chemotherapy.

B. Begin therapy with all-trans retinoic acid (ATRA) immediately while aggressively managing coagulopathy with blood product support.

C. Start dexamethasone and hydroxyurea immediately while aggressively managing coagulopathy with blood product support.

D. Start induction chemotherapy, obtain HLA typing, and start a donor search because of the poor prognosis associated with this leukemic phenotype.

E. Refer the patient immediately for leukapheresis because of her severe coagulopathy.

**Explanation**

This case represents a likely diagnosis of acute promyelocytic leukemia (APL; M3 in the French-American-British classification; characterized in most cases by t(15;17) PML-RARA fusion), which has an overall favorable prognosis because of its high event-free survival rates with all-trans retinoic acid (ATRA); arsenic trioxide; and, in high-risk cases, chemotherapy. Thus, stem cell transplant is not indicated in first remission. If the white blood cell count had been greater than 10,000/mm3 at diagnosis, this would define a higher-risk APL rather than lower risk, in which case cytotoxic therapy with either idarubicin or gemtuzumab would be indicated in addition to ATRA and arsenic trioxide to reduce the risk of differentiation syndrome. Recent data have indicated that prolonged remissions may be possible in lower-risk cases with ATRA and arsenic trioxide alone. Coagulopathy due to disseminated intravascular coagulation is present in a high percentage of patients with APL, and therefore this should be evaluated before performing a lumbar puncture to avoid the risk of bleeding. Also, central nervous system disease is rare in APL.

7. Your patient with acute myeloid leukemia (AML) is receiving an intensive course of chemotherapy with high-dose cytarabine. She has been neutropenic for 4 days, has developed severe mucositis, and is now hypotensive.

Which of the following is most likely to be isolated from this patient’s blood culture?

A. *Pneumocystis jiroveci*

B. *Staphylococcus epidermidis*

C. *Aspergillus fumigatus*

D. Herpes simplex virus (HSV)

E. *Streptococcus viridans*

**Explanation**

Children with AML are at high risk of developing bacteremia and specifically *S. viridans,* also known as alpha hemolytic strep. The incidence increases significantly with mucositis or high-dose cytarabine in patients with AML, and they should be covered with empiric antibiotics used in each institution’s neutropenic fever guidelines. *S. epidermidis* is a common cause of bacteremia but is rarely associated with hypotension. *Aspergillus* can be seen in this population but typically in patients with longer periods of neutropenia, and it typically does not cause hypotension as a presenting symptom. Although HSV is associated with mucositis, hypotension is not a characteristic finding. *Pneumocystis* is not a common complication of AML therapy and is not specifically linked with this scenario. Other organisms with similar presentation not listed above include *Staphylococcus aureus,* and the gram-negative organisms and empiric antibiotic choices should also be directed against these organisms.

8. A 13-year-old girl presents with acute myeloid leukemia (AML) and a WBC count of 120,000/mm3. Cytogenetics reveals a normal karyotype, and fluorescence *in situ* hybridization (FISH) tests for inv(16), t(8;21), t(15;17); 11q23 abnormalities; monosomy 7; and 5q deletion are negative. Molecular testing is negative for mutations in FLT3, NPM1, and CEBPA. She is treated with 10 days of daunorubicin, AraC, and gemtuzumab for induction therapy. On day 30, she recovers counts, and a bone marrow aspiration shows 2.2% leukemic blasts by flow cytometry. She receives a second course of treatment with daunorubicin and AraC, and her marrow is now in morphologic remission and is MRD-negative by flow cytometry. She has no HLA-matched siblings, but an unrelated donor search reveals a large number of potential matches.

Which course of treatment is most likely to result in the best outcome?

A. Give two more courses of intensification chemotherapy.

B. Perform an autologous hematopoietic stem cell transplant (HSCT).

C. Give one more course of intensification chemotherapy and then perform a matched unrelated donor HSCT.

D. Give one more course of intensification chemotherapy and then 1 year of maintenance chemotherapy.

**Explanation**

Patients with neither favorable nor unfavorable genetics who have residual leukemia after the first induction course have been shown to have a high risk of relapse with chemotherapy alone. Allogeneic hematopoietic stem cell transplant (HSCT) is likely the optimal therapy in this setting. Continuing chemotherapy alone will be very unlikely to result in cure, and maintenance chemotherapy is not a component of most AML treatment protocols. Similarly, autologous HSCT is also unlikely to provide a curative approach to therapy because of the potential for contaminating leukemia cells in the graft and the lack of a graft versus leukemia effect. Because it will take time to arrange an unrelated allogeneic donor, giving another course of chemotherapy to maintain remission followed by HSCT would be the best of the available treatments.

9. An 18-year old male patient presents with bruising, fatigue, and diffuse extremity pain. He is noted to be tachypneic and hypoxic and has a diffuse interstitial infiltrate on chest x-ray. CBC reveals a WBC count of 285,000/mm3 (85% myeloblasts, with monocytic morphology), hemoglobin of 7.9 g/dL, and platelet count of 36,000/mm3.

What is the most likely cause of the infiltrate and respiratory symptoms and the most appropriate initial treatment?

A. Hyperleukocytosis; initiation of induction chemotherapy

B. Hyperleukocytosis; leukapheresis or manual exchange transfusion and initiation of induction chemotherapy

C. COVID-19 infection; convalescent plasma and prednisone

D. Pneumococcal pneumonia; vancomycin

E. Reactive airway disease; prednisone and albuterol

**Explanation**

WBC counts greater than 100,000/mm3 are associated with the clinical syndrome of hyperleukocytosis, especially when the cause of the elevated WBC count is acute myeloid leukemia. Clinical features of hyperleukocytosis can include central nervous system (CNS) findings (eg, lethargy, focal neurological deficits, intracranial bleeding, hemorrhagic stroke), respiratory findings (tachypnea, dyspnea, hypoxia, and diffuse interstitial infiltrates), and renal dysfunction (often complicated by concomitant tumor lysis syndrome). The pathophysiology of hyperleukocytosis includes increased viscosity of blood and resultant congestion within the capillary beds of the affected organs. Hyperleukocytosis is an acute medical emergency that requires immediate “debulking” of the circulating tumor burden, which is best accomplished by manual exchange transfusion or by leukapheresis. Initiation of chemotherapy should proceed as soon as possible but should not be the first step in management. The other choices are less likely in the clinical scenario presented.

10. Fluorescence in situ hybridization testing on the peripheral blood of a 3-month-old boy with newly diagnosed acute leukemia reveals rearrangement of the *KMT2A* gene at 11q23. Flow cytometry and morphology are consistent with acute myeloid leukemia (AML) with monocytic differentiation. The patient has an identical twin brother, who is currently asymptomatic, and three older healthy siblings. There is no family history of leukemia or other blood disorders.

What do you tell the family regarding the healthy twin?

A. The probability of the healthy twin developing AML is very low (less than 1%) and is no different from the risk of the older siblings developing AML.

B. The probability of the healthy twin developing AML is about 10%, and if he does develop AML, it will probably take years for the AML to develop.

C. The probability of the healthy twin developing AML is very high (more than 50%), but it will probably take years for the twin to develop AML.

D. The probability of the healthy twin developing AML is very high (more than 50%) and is likely to occur within weeks to months, so the twin should be followed very closely, with frequent (every 1 to 2 weeks) exams and blood work.

**Explanation**

The concordance rate of leukemia in monozygotic twins is variable depending on the age that the first twin develops leukemia. In this case, the first twin was diagnosed in infancy and, like most infant leukemias, his was characterized by rearrangement of the *KMT2A* gene at 11q23. The concordance rate in such cases is very high (and therefore answers A and B are not the best answers), and typically the second twin develops leukemia within weeks to months of the first twin’s diagnosis (and therefore answer C is not the best answer). This indicates that infant leukemias typically initiate in utero (and so the preleukemic clone or fully leukemic clone is shared between the twins because of the common placental circulation that is commonly seen in monozygotic twins) and that preleukemic clones with *KMT2A* rearrangements are extremely likely to rapidly progress to full-blown leukemia. Answer B describes a situation in which the first twin was diagnosed in childhood rather than infancy. Answer A describes a situation in which the twins were dizygotic (fraternal), and the placental circulations were separate.

11. A 15-year-old boy presents for a follow-up visit for localized Ewing sarcoma of the pelvis. He was diagnosed 18 months ago and completed therapy 6 months ago. Therapy included 14 cycles of standard chemotherapy and radiation for local control. He was last seen 3 months ago and had negative scans and normal blood work. He presents today with recent onset of fatigue, a white count of 90,000/mm3, hemoglobin of 6.9 g/dL, platelets of 40,000/mm3, and hepatosplenomegaly. You suspect that he has therapy-related acute myeloid leukemia (AML).

Of the following, which chemotherapy drug is the most likely culprit, and which cytogenetic abnormality is most likely to be present in the leukemia?

A. Doxorubicin; monosomy 7

B. Etoposide; t(9;11)

C. Ifosfamide; t(9;11)

D. Etoposide; monosomy 7

E. Ifosfamide; monosomy 7

**Explanation**

Therapy-related myeloid neoplasms (therapy-related myelodysplastic syndrome [t-MDS] or t-AML) are a dreaded, and fortunately rare, complication of treatment with chemotherapy. The two major classes of chemotherapy with the highest risk of t-MDS/AML are alkylating agents (eg, cyclophosphamide, ifosfamide) and topoisomerase inhibitors (eg, etoposide, doxorubicin). The t-MDS/AML arising from these two classes of agents typically differs in two important ways. First, t-MDS/AML arising after exposure to alkylators typically has a long latency (3 to 5 years) with a long preleukemic MDS phase, whereas that arising after exposure to topoisomerase II inhibitors typically has a short latency (6 to 18 months) with a more explosive presentation. Second, t-MDS/AML arising after alkylator exposure often carries high-risk cytogenetic lesions such as monosomy 7 or 5q-, whereas cases arising after topoisomerase II inhibitor exposure typically are most likely to harbor an MLL rearrangement, most commonly t(9;11). Given the short latency and rapid progression in this case, answer B contains the most likely etiology and cytogenetic results.

12. A 12-year-old boy presents with a WBC count of 220,000/mm3 with 4% blasts and other immature myeloid cells at different stages of differentiation and 12% basophils. His only significant sign or symptom is abdominal pain and a “swollen belly.” The platelet count is 560,000/mm3, and the hemoglobin is 11 g/dL. The uric acid is 3.

What is the most likely diagnosis and optimal treatment for this patient?

A. Chronic myeloid leukemia (CML) in accelerated phase; treat with imatinib and hydroxyurea.

B. CML in chronic phase; treat with dasatinib.

C. Myelodysplastic syndrome transforming into acute myeloid leukemia (AML); treat with induction chemotherapy followed by family donor ablative bone marrow transplantation after remission is achieved.

D. CML in accelerated phase; treat with imatinib followed by matched family donor bone marrow transplantation.

E. AML; treat with induction chemotherapy.

**Explanation**

The high WBC with a “normal” maturation of the myeloid lineage in the peripheral blood (including only a small percentage of myeloblasts and mild basophilia), along with minimal symptoms (in this case due to splenomegaly), are most characteristic of chronic myeloid leukemia (CML) in chronic phase. The high platelet count and mild anemia are also consistent with this. Accelerated phase CML is characterized by at least 10% but less than 20% leukemic blasts in the peripheral blood or bone marrow, or more than 20% basophils in the blood. In addition, thrombocytopenia with a platelet count of less than 100,000/mm3 may accompany accelerated phase CML. Acute myeloid leukemia (AML) is usually associated with increased blasts, anemia, and thrombocytopenia without the “normal” maturation of the myeloid lineage observed on the peripheral smear. Imatinib, or a “second-generation” tyrosine kinase inhibitor (TKI) such as dasatinib or nilotinib, is almost always adequate initial therapy, which will result in an effective cytoreduction in chronic phase CML and, in a majority of cases, leads to a cytogenetic remission and a major molecular response with time. While allogeneic hematopoietic stem cell transplant (HSCT) remains the only proven curative therapy for CML at this time, with increasing recognition of long-term control of CML using chronic TKI therapy, allogeneic HSCT is increasingly considered a second-line “salvage” therapy.

13. A 17-year-old boy has just been diagnosed with chronic myeloid leukemia in chronic phase, and you have initiated therapy with the tyrosine kinase inhibitor (TKI) dasatinib at 100 mg daily.

What can you anticipate in this case?

A. Complete hematologic and cytogenetic remission within 1 month and resolution of splenomegaly within 6 months; you plan to continue dasatinib for a total of 12 months.

B. Complete hematologic remission within 3 months, complete cytogenetic remission (CCyR) within 12 months, and major molecular response (MMR) within 18 months; monitor by peripheral blood RT-qPCR for BCR/ABL1 every 3 to 6 months while continuing dasatinib indefinitely if MMR persists.

C. Complete hematologic remission within 2 weeks and cytogenetic remission within 4 weeks; you will monitor RT-qPCR for BCR/ABL1 monthly during the 1-year maintenance therapy with dasatinib.

D. Complete hematologic remission within 6 months and CCyR within 12 months; after CCyR is achieved, you will discontinue RT-qPCR monitoring.

**Explanation**

Initial response to tyrosine kinase inhibitor (TKI) therapy is typically gradual and proceeds in the following order: resolution of splenomegaly and normalization of blood counts, cytogenetic remission of the marrow, and diminution of peripheral blood BCR/ABL1 by RT-qPCR to low or undetectable levels. The expected rate of this resolution is correct in answers B and D. Monitoring for recurrence is recommended by use of peripheral blood RT-qPCR, which is most sensitive. Thus, the correct answer is B. For now, the duration of dasatinib or other TKI administration is thought to be indefinite, although ongoing adult and pediatric long-term follow-up studies that include discontinuation of TKIs (so-called “STOP” trials) will shed more light on this with time.

14. You are seeing a 19-year-old man who was diagnosed with chronic myeloid leukemia 2 years ago. He has been taking imatinib 400 mg daily since diagnosis. He has no siblings, but there are multiple potential matched unrelated donors in the registry. He has been fully compliant with his imatinib, and side effects have been minimal. Bone marrow and peripheral blood 6 months after the patient began imatinib were negative for BCR-ABL1 by fluorescence in situ hybridization (FISH), and FISH in peripheral blood has remained negative up until the 21-month check. Peripheral blood qRT-PCR for BCR-ABL1 was 0.03% (international scale) 1 year after the patient began imatinib and has remained less than 0.1% up until the 21-month check. On 24-month testing, however, peripheral blood FISH is positive at 6% and qRT-PCR is positive at 11.3%. Blood counts remain normal.

What is your next step?

A. Immediately finalize a matched unrelated donor and proceed to transplant.

B. Increase the imatinib dosage to 800 mg daily.

C. Add interferon to imatinib.

D. Send peripheral blood for ABL1 resistance mutation testing and switch from imatinib to dasatinib.

**Explanation**

This patient has developed secondary resistance to imatinib after achieving a complete cytogenetic and major molecular response. Although increasing the imatinib dosage has been effective for some patients in this situation, the second-generation tyrosine kinase inhibitors (TKIs) dasatinib and nilotinib are more likely to reestablish an optimal response. ABL1 sequencing to detect resistance mutations can help guide alternative TKI choice. For example, patients with T315I mutations should receive ponatinib. Although stem cell transplant with a suitable donor may be indicated if alternative TKI therapy proves ineffective, proceeding straight to transplant in this setting would be premature. Interferon rarely has been used since the advent of TKI therapy because of an unfavorable side effect profile.

15. A 9-year-old boy enters the emergency room with a 1-week history of decreasing strength and numbness in his lower extremities along with midthoracic back pain. He has had no fever, bruising, or history of trauma. Examination reveals decreased strength in the lower extremities, reduced deep tendon reflexes, and downgoing toes. There is slight tenderness in the midthoracic region of his back. An MRI reveals a T6 paraspinal mass with spinal cord compression. A CBC reveals a WBC count of 28,000/mm3 with 23% circulating myeloblasts, a platelet count of 25,000/mm3, and a hemoglobin of 10 g/dL.

Which of the following choices is the most appropriate next step in the evaluation and treatment?

A. Urgent radiation oncology and neurosurgical consultation to address the paraspinal mass, followed by diagnostic bone marrow aspiration

B. Flow cytometry of peripheral blood followed by appropriate chemotherapy regimen

C. Diagnostic bone marrow aspiration followed by radiation to paraspinal mass

D. Flow cytometry of peripheral blood followed by radiation to paraspinal mass

E. Diagnostic bone marrow aspiration followed by appropriate chemotherapy regimen

**Explanation**

This patient has acute myeloid leukemia (AML) that is complicated by a paraspinal chloroma (solid mass of AML cells). The clinical syndrome of spinal cord compression is a medical emergency that typically requires immediate local treatment (external beam irradiation or surgery). Steroid and/or chemotherapy treatment is commonly initiated but is not as likely as local treatment to rapidly decompress the spinal cord compression. Thus, systemic therapy should not be considered a substitute for radiation or surgery in this setting. The diagnostic procedures are important but must await the treatment of the medical emergency.