



## Oral Chemotherapy

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1. Patient AB is undergoing procarbazine, lomustine, and vincristine chemotherapy for a brain tumor. Teaching points regarding procarbazine include
  - a. Alcohol may be ingested in moderation.
  - b. Take the procarbazine at the same time as the lomustine to enhance efficacy.
  - c. Avoid foods and beverages with high tyramine content during procarbazine therapy.
  - d. Take the medication at bedtime because drowsiness is a common adverse effect, and do not operate machinery or motor vehicles while taking procarbazine.
2. Several months later, AB returns to the clinic. He will leave today with a prescription for five daily doses of temozolomide to treat his progressive tumor. AB has experienced some confusion recently and comes to you with his wife for education regarding his new treatment regimen prior to leaving the clinic. You tell Mr. and Mrs. AB
  - a. To take the medication with breakfast to minimize the risk of nausea.
  - b. To plan ahead for a refill so temozolomide will be available on day six and therapy will not be interrupted.
  - c. To contact the physician to obtain antiemetic medication only if AB experiences nausea or emesis during therapy.
  - d. To expect the medication to be dispensed in five daily dose packs by the pharmacy and to question the pharmacist if the temozolomide is not dispensed in this fashion.
3. Patient CD takes oral methotrexate as one component of a treatment protocol for lymphoma. Because methotrexate is subject to numerous drug interactions, you decide to review her medication profile. Which of these medications can be administered safely concurrently with methotrexate?
  - a. Aspirin
  - b. Cotrimoxazole
  - c. Prochlorperazine
  - d. Leucovorin
4. Patient EF takes capecitabine as a single agent to treat her refractory breast cancer. You are working with the physician to assess EF's tolerance of this regimen. She is responding to therapy and is feeling well, except for a slight tingling in the palms of her hands. Your assessment and advice include
  - a. Apply cold packs to her hands, and ask the physician to reduce her dose.
  - b. Ask the physician to consider stopping capecitabine and changing EF to another regimen.
  - c. Encourage EF to continue therapy, monitor the tingling, and report any worsening of symptoms.
  - d. Thoroughly review EF's medication list because capecitabine is not associated with this symptom.
5. This drug is an orally administered epidermal growth factor receptor (EGFR) inhibitor.
  - a. Imatinib
  - b. Gefitinib
  - c. Cetuximab
  - d. Bortezomib
6. Patient GH is undergoing induction chemotherapy for acute promyelocytic leukemia (APL). The induction regimen includes tretinoin (all-trans retinoic acid [ATRA], Vesanoid®, Roche Laboratories, Inc., Nutley, NJ). You will closely monitor GH for signs and symptoms of retinoic acid-APL syndrome or "differentiation" syndrome, including
  - a. Weight loss.
  - b. Hyperuricemia.
  - c. Fever and dyspnea.
  - d. Hives and urticaria.
7. Patient IJ is being initiated on thalidomide 100 mg a day by mouth. What common side effect should you discuss with IJ?
  - a. Sedation
  - b. Diarrhea
  - c. Insomnia
  - d. Hypertension
8. Your patient, KL, is beginning treatment with imatinib for chronic myelogenous leukemia. To minimize gastrointestinal distress, you instruct KL to
  - a. Take imatinib with food and a full glass of water.
  - b. Take imatinib with a full glass of grapefruit juice.
  - c. Take imatinib on an empty stomach with a sip of water.
  - d. Take imatinib on an empty stomach with a full glass of water.
9. While consulting with your patient, MN, who is commencing bexarotene treatment for cutaneous T cell lymphoma, nursing considerations should include
  - a. Educating the patient to increase vitamin A intake.
  - b. Monitoring serum triglyceride and cholesterol levels.
  - c. Instructing the patient to get plenty of sun exposure to avoid vitamin D deficiency.
  - d. Suggesting the administration of lipid-lowering agents such as a "statin" and gemfibrozil.

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Digital Object Identifier: 10.1188/05.CJON.107-109

10. General teaching points for patients who will self-medicate with an oral cytotoxic agent in the home include
  - a. Any missed dose always and immediately should be replaced by taking two doses.
  - b. Any patient with a dry mouth should crush all medications and mix with water or other liquid to facilitate swallowing.
  - c. Child-resistant containers are never recommended because these may interfere with many patients' ability to comply with therapy.
  - d. Oral cytotoxics should be stored in a safe location out of reach of children and pets, using child-resistant packaging whenever possible.

## Answers

**Question 1:** The correct answer is c, avoid foods and beverages with high tyramine content during procarbazine therapy. Procarbazine is a weak monoamine oxidase inhibitor and may interact with substances that have a high tyramine content. Examples include aged cheeses, some wines, yogurt, and bananas (not a complete list). Choice a, alcohol may be ingested in moderation, is incorrect; alcohol should be avoided because of the potential for a disulfiram-like reaction to occur with procarbazine. Choice b, take the procarbazine at the same time as the lomustine to enhance efficacy, is incorrect. Procarbazine, lomustine, and vincristine regimen includes lomustine only on day one and procarbazine later in the cycle, so these drugs are not taken simultaneously. Choice d, take the medication at bedtime because drowsiness is a common adverse effect, and do not operate machinery or motor vehicles while taking procarbazine, is incorrect. Procarbazine alone generally does not cause drowsiness. However, research has suggested that procarbazine in combination with other central nervous system depressants may enhance this effect. Patients with brain tumors often are not able to drive safely and should be cautioned in this regard, but procarbazine use alone is not necessarily a limiting factor.

**Question 2:** The correct answer is d, to expect the medication to be dispensed in five daily dose packs by the pharmacy and to question the pharmacist if the temozolomide is not dispensed in this fashion. Pharmacists are instructed to dispense temozolomide in daily dose packs to facilitate patient understanding and compliance. The manufacturer recommends administration on an empty stomach to minimize the risk of nausea and emesis, making choice a, to take the medica-

tion with breakfast to minimize the risk of nausea, incorrect. Even so, the incidence of nausea and emesis is high enough to justify prophylactic antiemetics with the first dose; therefore, choice c, to contact the physician to obtain anti-nausea medication only if AB experiences nausea or emesis during therapy, is incorrect. Choice b, To plan ahead for a refill so temozolomide will be available on day six and therapy will not be interrupted, is incorrect because the approved temozolomide regimen consists of a five-day cycle every 28 days. Fatal medication errors with temozolomide have occurred, apparently related to patient misunderstanding of the five-day cycle. Exceptions to the five-day cycle may occur in the context of a clinical trial.

**Question 3:** The correct answer is c, prochlorperazine. Fortunately, antiemetics in general are safe to administer with methotrexate. This includes phenothiazines such as prochlorperazine, dexamethasone or other steroids, and serotonin antagonists such as ondansetron, dolasetron, and granisetron. Choices a, aspirin, and b, cotrimoxazole, are incorrect because salicylates and sulfa drugs can exacerbate the toxicity of methotrexate via two mechanisms: displacement of methotrexate from protein-binding sites and competition with renal tubular secretion sites, thus reducing renal clearance. Choice d, leucovorin, is incorrect. Leucovorin often is indicated for methotrexate "rescue," but these two agents should not be given concurrently. Rather, leucovorin should be given after methotrexate. Check specific treatment protocols for details of timing and administration.

**Question 4:** The correct answer is c, encourage EF to continue therapy, monitor the tingling, and report any worsening of symptoms. According to the product information, tingling without other symptoms is a grade 1 hand-foot syndrome. Although a dose reduction is not recommended for this level of toxicity, EF should be monitored for any worsening of symptoms because higher-grade hand-foot syndrome will necessitate disruption of therapy and/or dose reduction. Choice a, apply cold packs to her hands, and ask the physician to reduce her dose, is incorrect. Topical emollient or oral pyridoxine may help relieve the symptoms of hand-foot syndrome, but no evidence supports application of cold packs. Choice b, ask the physician to consider stopping capecitabine and changing EF to another regimen, is also incorrect. As previously stated, the symptoms described represent a grade 1 toxicity that does not justify a therapy change in a patient who is responding to treatment. Choice d, thoroughly review EF's medication list because capecitabine is not associated with this

symptom, is incorrect. Hand-foot syndrome often presents with tingling in the palms of hand or soles of feet and is a common adverse effect of capecitabine.

**Question 5:** The correct answer is b, gefitinib. Choice a, imatinib, is a signal transduction inhibitor that does not act by EGFR inhibition and therefore is not correct. Choice c, cetuximab, is incorrect because this is an EGFR inhibitor but is not given orally. Choice d, bortezomib, is an injected proteasome inhibitor and thus is incorrect.

**Question 6:** The correct answer is c, fever and dyspnea. Fever and dyspnea are common signs of this syndrome. As many as 25% of patients undergoing tretinoin therapy may experience dedifferentiation syndrome. Risk may be increased by leukocytosis at presentation or by rapidly evolving leukocytosis as treatment of the APL commences. Concomitant initial chemotherapy may reduce the risk of dedifferentiation syndrome. This syndrome is characterized by some or all of the following: fever, dyspnea, weight gain, pulmonary infiltrates, and pleural or pericardial effusions. Choice a, weight loss, is not correct because weight gain, not loss, sometimes is associated with this syndrome. Choice b, hyperuricemia, is incorrect because hyperuricemia may occur during induction therapy for acute leukemias, but this abnormality is related to tumor lysis syndrome, not ATRA syndrome. Choice d, hives and urticaria, is incorrect; the syndrome does not include a rash as described.

**Question 7:** The correct answer is a, sedation. Thalidomide initially was developed as a sedative, and sedation is a common adverse effect. Choice c, insomnia, therefore is not correct. Choice b, diarrhea, is incorrect; thalidomide is much more likely to cause constipation than diarrhea. Choice d, hypertension, is not the best choice; thalidomide is not commonly associated with hypertension but can cause orthostatic hypotension. Other thalidomide side effects include human teratogenesis, dizziness, peripheral neuropathy, and headache.

**Question 8:** Choice a, take imatinib with food and a full glass of water, is the correct answer. Imatinib is well absorbed after oral administration but is associated with some gastrointestinal (GI) irritation. The patient should be instructed to take imatinib with food and a full glass of water to help minimize GI distress. Choice b, take imatinib with a full glass of grapefruit juice, is incorrect. Metabolism of imatinib is largely via the cytochrome P450 enzyme system. Concurrent intake of grapefruit juice may inhibit cytochrome P450 and increase the serum level of imatinib. Choices c, take imatinib on an empty stomach with a sip of water, and

d, take imatinib on an empty stomach with a full glass of water, are incorrect. Taking imatinib on an empty stomach may increase the risk of GI irritation.

**Question 9:** The correct answer is choice b, monitoring serum triglyceride and cholesterol levels. Elevated triglyceride and cholesterol levels are fairly common and may be dose limiting. Because bexarotene is a retinoid and chemically related to vitamin A, patients taking the drug should be educated to limit vitamin A intake to avoid possible additive toxicity. Therefore, choice a, educating the patient to increase vitamin A intake, is incorrect. Choice c, instructing the patient to get plenty of sun exposure to avoid vitamin D deficiency, is incorrect. Photosensitivity is possible with vitamin A derivatives, so patients should be instructed to use protection from the sun; for example, apply a sunscreen when going outdoors and stay in the shade as much as possible. Choice d, suggesting the administration of lipid-lowering agents such as a “statin” and gemfibrozil, is incorrect. Preemptive prescribing of lipid-lowering agents is not recommended. Lipid profile should be monitored, however, and therapy initiated as indicated. Drug interactions must be taken into consideration when selecting therapy. Gemfibrozil may elevate bexarotene levels via cytochrome P450 inhibition.

**Question 10:** The correct answer is d, oral cytotoxics should be stored in a safe location out of reach of children and pets, using child-resistant packaging whenever possible. Children and pets must be protected from all inadvertent medication exposure, but oral cytotoxics may be particularly dangerous. Patients who have difficulty opening child-resistant containers must be provided with prescription containers that are easy to manage, but use of such packaging should be an exception and not routine for all patients. Therefore, choice c, child-resistant containers are never recommended because these may interfere with many patients’ ability to comply with therapy, is incorrect. Choice a, any missed dose always and immediately should be replaced by taking two doses, is incorrect. The approach for missed doses cannot be generalized and depends on individual circumstances. In any case, the advice of a healthcare provider should be sought before an oral cytotoxic dose is repeated. Choice b, any patient with a dry mouth should crush all medications and mix with water or other liquid to facilitate swallowing, is incorrect because oral cytotoxic capsules generally are considered to be biohazardous. These drugs are not to be manipulated in such a way as to aerosolize the cytotoxic drug, generate particulate

matter, or otherwise create untoward environment conditions.

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