busulfan (byoo-sul-fan)

Classifications
Therapeutic: antineoplastics
Pharmacologic: alkylating agents

Pregnancy Category D

Indications
PO: Treatment of chronic myelogenous leukemia (CML) and bone marrow disorders. IV: With cyclophosphamide as a conditioning regimen before autologous hematopoietic progenitor cell transplantation for CML.

Contraindications
Active infections; Hypersensitivity; Failure to respond to previous courses; Contraindications/Precautions

‡After administration of last dose
†Complete recovery may take up to 20 mo

PO 1–2 wk weeks up to 1 mo†

ROUTE ONSET PEAK DURATION

Half-life: 2.5 hr.
Metabolism and Excretion: Unknown.
Distribution: Absorption: Rapidly absorbed from the GI tract.

Pharmacokinetics

Therapeutic Effects:
Disrupts nucleic acid function and protein synthesis (cell-cycle phase–nonspecific).

Action
Disrupts nucleic acid function and protein synthesis (cell-cycle phase–nonspecific).

PO: Treatment of chronic myelogenous leukemia (CML) and bone marrow disorders. IV: With cyclophosphamide as a conditioning regimen before autologous hematopoietic progenitor cell transplantation for CML.

Derm:
— itching, rash, pruritus, dermatitis, hyperpigmentation.

Endo:
— sterility

EENT:
— cataracts

GI:
— drug-induced diarrhea, nausea, vomiting, abdominal enlargement, pancreatitis, constipation, diarrhea, dyspepsia, hepatomegaly, enterocolitis, stomatitis.

GU:
— oliguria, dysuria, hematuria.

Hemat:
BONE MARROW DEPRESSION.

MS:
— arthralgia

Resp:
— PULMONARY FIBROSIS

CV:
— pericardial effusion, ventricular extrasystoles.

Gastrointestinal:
— hyperglycemia, nausea, vomiting, anorexia, abdominal pain, diarrhea, constipation, stomatitis.

Hypersensitivity:
— hyperpigmentation, rash, pruritus, dermatitis, hypocalcemia.

Neurological:
— SEIZURES, CEREBRAL HEMORRHAGE/COMA, anemia

Musculoskeletal:
— myalgia

Pharmacodynamics:

Death of rapidly growing cells, especially malignant ones.

Potential for serious side effects in fetus or infant.

Drug-Drug Interactions
Concurrent or previous (within 72 hr) use of acetaminophen may [elimination and toxicity. Concurrent use with intramuscular or phenytoin blood level effectiveness. Long-term continuous therapy with thioguanine may [risk of hepatic toxicity. Bone marrow suppression with other antineoplastics or radiation therapy. May [the antibody response to and risk of adverse reactions from live-virus vaccines.

Interactions

Drug-Drug: Concurrent or previous (within 72 hr) use of acetaminophen may [elimination and toxicity. Concurrent use with intramuscular or phenytoin blood level effectiveness. Long-term continuous therapy with thioguanine may [risk of hepatic toxicity. Bone marrow suppression with other antineoplastics or radiation therapy. May [the antibody response to and risk of adverse reactions from live-virus vaccines.

Route/Dosage

PO (Adults): Induction—1.8 mg/m2/day or 60 mg (0.16 mg/kg) daily until WBCs 15,000/mm3. Usual dose is 4–8 mg/day (range 1–12 mg/day). Maintenance—1–3 mg/day.

Contraindications
Contraindicated in: Hypersensitivity. Patients to respond to previous courses; OB, Lactation: Potential for serious side effects in fetus or infant.

Use Cautiously in: Allergic reactions may [risk of hepatitis. May [bone marrow suppression with other antineoplastics or radiation therapy. May [the antibody response to and risk of adverse reactions from live-virus vaccines.

PO (Adults): Induction—1.8 mg/m2/day or 60 mg (0.16 mg/kg) daily until WBCs 15,000/mm3. Usual dose is 4–8 mg/day (range 1–12 mg/day). Maintenance—1–3 mg/day.
PO (Children): 0.06–0.12 mg/kg/day or 1.8–4.6 mg/m²/day initially. Titrate dose to maintain WBC of approximately 20,000/mm³.

IV (Adults): 0.8 mg/kg q6h r (dose based on ideal body weight or actual weight, whichever is less; in obese patients, dosage should be based on adjusted ideal body weight) for 4 days (total of 16 doses); given in combination with cyclophosphamide.

NURSING IMPLICATIONS

Assessment
- **High Alert:** Monitor for bone marrow depression. Assess for bleeding (bleeding gums, sore throat, cough, bruising, petechiae, guaiac stools, urine, emesis) and avoid IM injections and taking rectal temperatures. Apply pressure to venipuncture sites for at least 10 min. Assess for signs of infection (fever, chills, sore throat, cough, hematuria, lower back or side pain, difficulty or painful urination) during neutropenia. Anemia may occur. Monitor for increased fatigue, dyspnea, and orthostatic hypotension. Notify health care professional if these symptoms occur.
- **Monitor intake and output ratios and daily weights. Report significant changes in totals.**
- **Monitor for symptoms of gout (increased uric acid, joint pain, lower back or side pain, swelling of feet or lower legs). Encourage patient to drink at least 2 L of fluid each day. Allopurinol may be given to decrease uric acid levels. Alkalinization of urine may be ordered to increase excretion of uric acid.**
- **Assess for pulmonary fibrosis (fever, cough, shortness of breath) periodically during and after therapy. Discontinue therapy at the first sign of pulmonary fibrosis. Usually occurs 8 mo–10 yr (average 4 yr) after initiation of therapy.**
- **IV: Premedicate patient with phenytoin before IV administration to minimize the risk of seizures.**
- **Lab Test Considerations: Monitor CBC with differential and platelet count before and weekly during therapy. The nadir of leukopenia occurs within 10–15 days and the nadir of WBC at 11–30 days. Recovery usually occurs within 12–20 wk. Notify health care professional if WBC in <=5,000/mm³ or platelet count in <=150,000/mm³. Bone marrow depression may be severe and progressive, with recovery taking 1 mo–2 yr after discontinuation of therapy.**
- **Monitor serum ALT, bilirubin, alkaline phosphatase, and uric acid before and periodically during therapy.**
- **May cause false-positive cytology results of breast, bladder, cervix, and lung tissue.**

Potential Nursing Diagnoses

- Disturbed body image (Side Effects)
- Risk for injury (Side Effects)
- Risk for infection (Side Effects)

Implementation

- **High Alert:** Fatalities have occurred with chemotherapeutic agents. Before administering, clarify all ambiguous orders; double check single, daily, and course-of-therapy dose limits; have second practitioner independently double check order, calculation, and infusions pump settings.
- **DO NOT confuse Myleran with Alkeran or Leukeran.**
- **PO:** Administer at the same time each day. Administer on an empty stomach to decrease nausea and vomiting.

IV Administration

- **pH:** 3.4–3.9.
- **Prep:** Prepare solution in a biologic cabinet. Wear gloves, gown, and mask while handling IV medication. Discard IV equipment in specially designated containers.
- **Intermittent Infusion:** Diluent: Dilute with 10 times the volume of busulfan using 0.9% NaCl or D5W. Concentration: 0.5 mg/mL. When drawing busulfan from vial, use needle with 5-micron nylon filter provided, remove calculated volume from vial, remove needle and filter, replace needle and inject busulfan into diluent. Do not use polycarbonate syringes with busulfan. Always add diluent to solution, not solution to diluent. Solution diluted with 0.9% NaCl is stable for 12 hr refrigerated. Administration must be completed during this time. Solution in clear and colorless; do not administer solutions that are discolored or contain a precipitate. Rate: Administer via central venous catheter over 2 hr every 6 hr for a total of 16 doses. Use infusions pump to administer entire dose over 2 hr.
- **Y-Site Compatibility:** acyclovir, amphotericin B lipid complex, amphotericin B liposome, amiodarone, aztreonam, bivalirudin, bleomycin, bleomycin, carboplatin, clozapine, cyclophosphamide, docetaxel, doxorubicin, epirubicin, etoposide, famotidine, fasudil, fentanyl, filgrastim, fludarabine, fludrocortisone, flutamide, fluorouracil, foscarnet, fosphenytoin, gemcitabine, gemtuzumab, gelonin, gentamicin, granisetron, heparin, herceptin, hexamethylphosphoramide, hidroxycamptothecin, ifosfamide, irinotecan, iodixanol, ifosfamide, interferon alfa, interferon beta, irinotecan, itraconazole, juxtaglomerular, lactic dehydrogenase, liposomal doxorubicin, methylprednisolone, mitomycin, mitoxantrone, molsidomine, natalizumab, navelbine, nefazodone, nelfinavir, netropsin, netupitant, nitisinone, noscapine, nystatin, ondansetron, oxaliplatin, paclitaxel, pazopanib, peripherin, pentadecapeptide, pegfilgrastim, periapline, pemetrexed, phenobarbital, pexelizumab, plecanatide, pimozide, pimecrolimus, placebo, pamidronate, pazopanib, paclitaxel, pentazocine,Bernard, posaconazole, prednisone, prednisolone, protriptyline, propofol, ranitidine, romidepsin, vincristine, vincristine, vinorelbine, vorinostat, voriconazole, zoledronic acid, zidovudine.

© 2013 F. A. Davis Company
busulfan

**Genetic Implication.** CAPI TALS indicate life-threatening, underlines indicate most frequent. Strikethrough indicates discontinued.

**Y-Site Incompatibility:** alemtuzumab, azathioprine, busulfan, cyclosporine, etoposide, ifosfamide, irinotecan, mitomycin, mitoxantrone, paclitaxel, pemetrexed, pomalidomide, procarbazine, salinomycin, streptozotocin, temsirolimus, treosulfan, vancomycin, vincristine, voriconazole.

**Y-Site Incompatibility:** idarubicin, thiotepa, vecuronium, voriconazole.

**Y-Site Incompatibility:** tomycin, dexmedetomidine, diltiazem, docetaxel, ertapenem, fenoldopam, granisetron, hetastarch, hydromorphone, levofloxacin, linezolid, lorazepam, meperidine, metronidazole, milrinone, nesiritide, octreotide, ondansetron, paclitaxel, palonosetron, pancuronium, piperacillin/tazobactam, potassium acetate, quinupristin/dalfopristin, rituximab, sodium acetate, tacrolimus, tigecycline, tirofiban, trastuzumab, vasopressin, zoledronic acid.

**Patient/Family Teaching**

- Instruct patient to take medication as directed, at the same time each day, even if nausea and vomiting are a problem. Consult health care professional if vomiting occurs shortly after dose is taken. If dose is missed, do not take at all; do not double doses.
- Advise patient to notify health care professional if fever; sore throat; signs of infection; lower back or side pain; difficult or painful urination; sores in the mouth or on the lips; chills; dyspnea; persistent cough; bleeding gums; bruising; petechiae; or blood in urine, stool, or emesis occurs. Instruct patient to use soft toothbrush and electric razor. Caution patient not to drink alcoholic beverages or take products containing aspirin or NSAIDs.
- Caution patient to avoid crowds and persons with known infections. Health care professional should be informed immediately if symptoms of infection occur.
- Discuss with patient the possibility of hair loss. Explore methods of coping.
- Instruct patient not to receive any vaccinations without advice of health care professional.
- Advise patient to notify health care professional of unusual bleeding; bruising; or flank, stomach, or joint pain occurs. Advise patients on long-term therapy to notify health care professional immediately if cough, shortness of breath, and fever occur or if darkening of skin, diarrhea, dizziness, fatigue, anorexia, confusion, or nausea and vomiting become pronounced.

**Evaluation/Desired Outcomes**

- Decrease in leukocyte count to within normal limits.
- Decreased night sweats.
- Increase in appetite.
- Increased sense of well-being. Therapy is resumed when leukocyte count reaches 50,000/mm³.

**Why was this drug prescribed for your patient?**