Drugs.com
Know more. Be sure.

Interferon Alfa-2b

Medically reviewed by Drugs.com. Last updated on Apr 24, 2020.

Pronunciation

(in ter FEER on AL fa too bee)

Index Terms

- INF-alpha 2
- Interferon Alpha 2b
- Interferon Alpha-2b
- rLFN-α2
- α-2-interferon

Dosage Forms

Excipient information presented when available (limited, particularly for generics); consult specific product labeling.

Solution, Injection:

Intron A: 6,000,000 units/mL (3.8 mL); 10,000,000 units/mL (3.2 mL) [contains edetate disodium, metacresol, polysorbate 80]

Solution Reconstituted, Injection [preservative free]:

Intron A: 10,000,000 units (1 ea); 18,000,000 units (1 ea); 50,000,000 units (1 ea) [contains albumin human]

Brand Names: U.S.

- Intron A

Pharmacologic Category

- Antineoplastic Agent, Biological Response Modulator
- Biological Response Modulator
- Interferon

Pharmacology

Interferon alfas bind to a specific receptor on the cell membrane to initiate intracellular activity; multiple effects can be detected including induction of gene transcription. It inhibits cellular growth, alters the state of cellular differentiation, interferes with oncogene expression, alters cell surface antigen expression, increases phagocytic activity of macrophages, and augments cytotoxicity of lymphocytes for target cells

Distribution

V_d: 31 L; but has been noted to be much greater (370 to 720 L) in leukemia patients receiving continuous infusion IFN; IFN does not penetrate the CSF

Metabolism

Primarily renal, filtered and absorbed at the renal tubule

Time to Peak

Serum: IM, SubQ: ~3 to 12 hours; IV: By the end of a 30-minute infusion

Half-Life Elimination

IV: ~2 hours; IM, SubQ: ~2 to 3 hours

Use: Labeled Indications

AIDS-related Kaposi sarcoma: Treatment of AIDS-related Kaposi sarcoma in select patients ≥18 years of age.

Chronic hepatitis B: Treatment of chronic hepatitis B in patients ≥1 year of age with compensated liver disease.

Condylomata acuminata: Treatment of condylomata acuminata involving external surfaces of the genital and perianal areas in patients ≥18 years of age.

Follicular lymphoma: Initial treatment of clinically aggressive follicular non-Hodgkin lymphoma in conjunction with anthracycline-containing combination chemotherapy in patients ≥18 years of age. **Note:** Indications in the manufacturer's labeling may not reflect current clinical practices.

Hairy cell leukemia: Treatment of hairy cell leukemia in patients ≥18 years of age.

Melanoma (malignant): Adjuvant to surgical treatment of malignant melanoma in patients ≥18 years of age who are free of disease but at high risk for systemic recurrence within 56 days of surgery. **Note:** Indications in the manufacturer's labeling may not reflect current clinical practices.

Off Label Uses

Adult T-cell leukemia/lymphoma

Data from small studies, a meta-analysis, a retrospective review, and clinical experience support the use of interferon alfa (in combination with zidovudine) in the treatment of adult T-cell leukemia/lymphoma [Bazarbachi 2010], [Bazarbachi 2011], [Gill 1995], [Hermine 2002], [Hodson 2011], [Matutes 2001]. Data from another small study support the use of interferon alfa (in combination with zidovudine and arsenic trioxide) in the treatment of adult T-cell leukemia/lymphoma [Kchour 2009].

Behçet syndrome (mucocutaneous ulcers)

Data from a limited number of patients studied in an uncontrolled trial and from a literature review suggest that interferon alfa-2b may be of benefit in the treatment of the mucocutaneous manifestations of Behçet syndrome [Hamuryudan 1994], [Kötter 2004].

Chronic myeloid leukemia (alternate therapy in patients unable to take tyrosine kinase inhibitors)

Data from case reports and clinical experience suggest that interferon alfa may be used in pregnant females with chronic myeloid leukemia [Al Bahar 2004], [Berman 2018], [Kuroiwa 1998], [Lipton 1996].

According to the **European LeukemiaNet Recommendations for Management of chronic myeloid leukemia (CML)**, other contemporary therapies have replaced the use of interferon alfa in the treatment of CML. Interferons are generally only used in instances where tyrosine kinase inhibitors cannot be utilized; interferon alfa is an option when tyrosine kinase inhibitor therapy is discontinued in pregnant females. An international consensus panel for management of hematologic malignancies during pregnancy and the European Society of Medical Oncology guidelines for cancer, pregnancy and fertility also suggest interferon alfa therapy for pregnant patients with CML if WBC and platelet counts have risen to a level associated with CML symptom onset [Lishner 2016], [ESMO [Peccatori 2013]].

Cutaneous T-cell lymphomas (mycosis fungoides/Sézary syndrome)

Data from a controlled study support the use of interferon alfa-2b (in combination with psoralen and ultraviolet A therapy) in the management of early stage mycosis fungoides [Rupoli 2005]. Data from a retrospective analysis support the use of interferon alfa in the treatment of mycosis fungoides/Sézary syndrome [Hughes 2015].

Clinical experience suggests interferon alfa may be of benefit for early stage treatment of mycosis fungoides/Sézary syndrome, and as second-line therapy for advanced disease [Olsen 2003], [Whittaker 2016].

Desmoid tumors

Data from a retrospective study with a limited number of patients suggest interferon alfa (with or without tretinoin) may be of benefit after surgery for management of extra-abdominal desmoid tumors [Leithner 2000].

Essential thrombocythemia (advanced)

Data from a small study demonstrated a clinical benefit with the use of interferon alfa-2b for management of newly diagnosed or previously treated advanced essential thrombocythemia, particularly when JAK2V617F mutation positive, with a higher overall hematologic response rate in JAK2V617F+ patients [Huang 2014].

Myelofibrosis, early

Data from a small study demonstrated clinical benefit when interferon alfa-2b was used in the management of early (low or intermediate-1 with ≥15% hematopoietic bone marrow foci) myelofibrosis [Silver 2017].

Neuroendocrine tumors, GI carcinoid tumors (alternate therapy)

Clinical experience suggests interferon alfa (either alone or in combination with somatostatin analogs) may be of benefit in the treatment of GI carcinoid tumors in patients who either do not tolerate or who have become refractory to somatostatin analogs [Oberg 2003], [Pavel 2013].

Polycythemia vera (advanced)

Data from a small study demonstrated a clinical benefit with the use of interferon alfa-2b for management of newly diagnosed or previously treated advanced polycythemia vera, particularly when JAK2V617F mutation positive, with a higher overall molecular response rate in JAK2V617F+ patients [Huang 2014].

West Nile virus, neurologic symptoms

Data from case reports and a limited number of patients in a retrospective study suggest interferon alfa may be of benefit in the treatment of neurologic symptoms of West Nile virus [Kalil 2005], [Sayao 2004].

Contraindications

Hypersensitivity to interferon alfa or any component of the formulation; decompensated liver disease; autoimmune hepatitis.

Combination therapy with interferon alfa-2b and ribavirin is also contraindicated in females who are pregnant, in males with pregnant partners; in patients with hemoglobinopathies (eg, thalassemia major, sickle-cell anemia); CrCl <50 mL/minute; or hypersensitivity to ribavirin or any ribavirin component.

Documentation of allergenic cross-reactivity for interferons is limited. However, because of similarities in chemical structure and/or pharmacologic actions, the possibility of cross-sensitivity cannot be ruled out with certainty.

Dosing: Adult

Coronavirus disease 2019 (COVID-19): Interferon alfa-2b is currently under investigation for use in the treatment of COVID-19 (see **ClinicalTrials.gov**) and should **only** be given as part of a clinical trial (HHS 2020). At this time, safety and efficacy have not been established.

Note: Consider premedication with acetaminophen prior to administration to reduce the incidence of some adverse reactions. Not all dosage forms and strengths are appropriate for all indications; refer to product labeling for details. Interferon alfa-2b at doses ≥10 million units/m^2 is associated with a moderate emetic potential; antiemetics may be recommended to prevent nausea and vomiting.

Adult T-cell leukemia/lymphoma (off-label use): SubQ: 5 million units once daily (in combination with zidovudine); if interferon is tolerated, may escalate dose after 1 week to 10 million units once daily; continue until at least 4 weeks after achieving a complete remission or for 1 year in the absence of a complete remission (Gill 1995) **or** 3 to 5 million units once daily or once every other day (in combination with zidovudine), may escalate dose if well tolerated (Matutes 2001) **or** 5 million units once daily (in combination with zidovudine and arsenic trioxide) (Kchour 2009).

AIDS-related Kaposi sarcoma: IM, SubQ: 30 million units/m^2 3 times a week; continue until disease progression or until maximal response has been achieved after 16 weeks.

Behçet syndrome (mucocutaneous ulcers) (off-label use; based on limited data): SubQ: 5 million units 3 times/week for 6 weeks, followed by 5 million units once a week for 10 weeks (Hamuryudan 1994). The optimal dose, frequency, and duration of interferon alfa-2b therapy for management of Behçet syndrome is unclear; dosing from case reports and small studies is variable (ranging from ~2 to 5 million units/dose) (Kötter 2004).

Chronic hepatitis B: IM, SubQ: 5 million units once daily or 10 million units 3 times a week for 16 weeks.

Chronic myeloid leukemia (alternate therapy in patients unable to take tyrosine kinase inhibitors) (off-label use; based on limited data): SubQ: 3 million units once daily; if needed (based on WBC counts), may increase to 6 million units once daily (Kuroiwa 1998) **or** 4 million units 5 days/week (Lipton 1996).

Condyloma acuminata: Intralesionally: 1 million units/lesion (maximum: 5 lesions per treatment) 3 times a week (on alternate days) for 3 weeks. May administer a second course at 12 to 16 weeks.

Cutaneous T-cell lymphomas (mycosis fungoides/Sézary syndrome) (off-label use): *Early stage disease (in combination with psoralen and ultraviolet A therapy [PUVA]):* SubQ: 1.5 million units once daily during week 1, followed by 3 million units once daily during week 2, followed by 6 million units 3 times/week during week 3 (on the day prior to PUVA) until complete response or for a maximum of 2 months, then maintenance therapy of 3 million units 3 times/week for 2 months followed by 3 million units 2 times/week for 10 months (Rupoli 2005).

Desmoid tumors (off-label use; based on limited data [dosing extrapolated from interferon alfa-2c]): SubQ: 3.5 million units 3 times/week (with or without tretinoin) until disease progression or unacceptable toxicity (Leithner 2000).

Essential thrombocythemia, advanced (off-label use): SubQ: 3 million units 3 times a week for 2 years, followed by 5 million units twice a week (Huang 2014).

Hairy cell leukemia: IM, SubQ: 2 million units/m^2 3 times a week for up to 6 months (may continue treatment with sustained treatment response); discontinue for disease progression or failure to respond after 6 months.

Lymphoma (follicular): SubQ: 5 million units 3 times a week for up to 18 months (initially in combination with an anthracycline-containing combination chemotherapy regimen, and then as monotherapy after completion of the chemotherapy regimen).

Melanoma (malignant): Induction: 20 million units/m^2 IV for 5 consecutive days per week for 4 weeks, followed by maintenance dosing of 10 million units/m^2 SubQ 3 times a week for 48 weeks.

Myelofibrosis, early (off-label use): SubQ: 0.5 to 1 million units 3 times a week, gradually increasing to 2 to 3 million units 3 times a week as tolerated (Silver 2017).

Neuroendocrine tumors, gastrointestinal carcinoid tumors (alternate therapy) (off-label use; based on limited data): SubQ: 3 to 5 million units 3 times a week (Oberg 2003; Pavel 2013) **or** 5 million units (median dose) every other day (range: 3 to 9 million units once daily or every other day), titrate to a dose that maintains leukocyte count <3,000/mm^3 (Oberg 2003).

Polycythemia vera, advanced (off-label use): SubQ: 3 million units 3 times a week for 2 years, followed by 5 million units twice a week (Huang 2014).

West Nile virus, neurologic symptoms (off-label use; based on limited data): SubQ: 3 million units once daily for 14 days (Kalil 2005; Sayao 2004).

Dosage adjustment for concomitant therapy: Significant drug interactions exist, requiring dose/frequency adjustment or avoidance. Consult drug interactions database for more information.

Dosing: Geriatric

Refer to adult dosing.

Dosing: Pediatric

Coronavirus disease 2019 (COVID-19): Interferon alfa-2b is currently under investigation for use in the treatment of COVID-19 (see **ClinicalTrials.gov**) and should **only** be given as part of a clinical trial (Dulek 2020; HHS 2020). At this time, safety and efficacy have not been established.

Note: Consider premedication with acetaminophen to reduce the incidence of some adverse reactions. Not all dosage forms and strengths are appropriate for all indications; refer to product labeling for details.

Hepatitis B, chronic: Children and Adolescents: SubQ: 3 million units/m^2/dose 3 times per week for 1 week; then 6 million units/m^2/dose 3 times per week; maximum dose: 10 million units/dose; total duration of therapy is 16 to 24 weeks. **Note:** In HIV-exposed/-positive patients, higher doses may be used for retreatment of failed lower-dose therapy: 10 million units/m^2/dose 3 times per week for 6 months (HHS [OI pediatric 2016]).

Hepatitis C, chronic: Note: Interferon-free therapies are generally preferred in the treatment of hepatitis C (AASLD/IDSA 2017; WHO 2016): Children ≥3 years and Adolescents: IM, SubQ: 3 million units/m^2/dose 3 times per week in combination with ribavirin

Dosage adjustment for concomitant therapy: Significant drug interactions exist, requiring dose/frequency adjustment or avoidance. Consult drug interactions database for more information.

Dosage adjustment for toxicity:

Hematologic toxicity (also refer to indication specified adjustments below): Children and Adolescents: ANC <500/mm^3 or platelets <25,000/mm^3: Discontinue treatment.

Hypersensitivity reaction (acute, serious), ophthalmic disorders (new or worsening), thyroid abnormality development (which cannot be normalized with medication), signs or symptoms of liver failure: Children and Adolescents: Discontinue treatment.

Liver function abnormality, pulmonary infiltrate development, evidence of pulmonary function impairment, or autoimmune disorder development, persistently elevated triglycerides (eg, >1,000 mg/dL in adults): Children and Adolescents: Monitor closely and discontinue if appropriate.

Neuropsychiatric disorders (during treatment): Children and Adolescents:

Clinical depression or other psychiatric problem: Monitor closely during and for 6 months after treatment.

Severe depression or other psychiatric disorder: Discontinue treatment.

Persistent or worsening psychiatric symptoms, suicidal ideation, aggression towards others: Discontinue treatment and follow with appropriate psychiatric intervention.

Indication-specific, manufacturer-recommended adjustments:

Chronic hepatitis B: Children and Adolescents:

WBC <1500/mm^3, granulocytes <750/mm^3, or platelet count <50,000/mm^3, or other laboratory abnormality or severe adverse reaction: Reduce dose by 50%; may re-escalate to starting dose upon resolution of hematologic toxicity. Discontinue for persistent intolerance.

WBC <1000/mm^3, granulocytes <500/mm^3, or platelet count <25,000/mm^3: Permanently discontinue.

Hepatitis C, chronic: Children and Adolescents: Severe toxicity: Reduce dose by 50% or temporarily withhold until subsides; permanently discontinue for persistent toxicities after dosage reduction.

In other oncology uses, the following have been used in adult patients:

Lymphoma (follicular): Adults:

Neutrophils >1,000/mm^3 to <1,500/mm^3: Reduce dose by 50%; may re-escalate to starting dose when neutrophils return to >1,500/mm^3

Severe toxicity (neutrophils <1,000/mm^3 or platelets <50,000/mm^3): Temporarily withhold.

AST >5 times ULN or serum creatinine >2 mg/dL: Permanently discontinue.

Hairy cell leukemia: Adults:

Platelet count <50,000/mm^3: Do not administer intramuscularly (administer SubQ instead).

Severe toxicity: Reduce dose by 50% or temporarily withhold and resume with 50% dose reduction; permanently discontinue if persistent or recurrent severe toxicity is noted.

AIDS-related Kaposi sarcoma: Adults: Severe toxicity: Reduce dose by 50% or temporarily withhold; may resume at reduced dose with toxicity resolution; permanently discontinue for persistent/recurrent toxicities.

Malignant melanoma (induction and maintenance): Adults:

Severe toxicity, including neutrophils >250/mm^3 to <500/mm^3 or ALT/AST >5 to 10 times ULN: Temporarily withhold; resume with a 50% dose reduction when adverse reaction abates.

Neutrophils <250/mm^3, ALT/AST >10 times ULN, or severe/persistent adverse reactions: Permanently discontinue.

Dosing: Adjustment for Toxicity

Hematologic toxicity (also refer to indication specified adjustments below): ANC <500/mm^3 or platelets <25,000/mm^3: Discontinue treatment.

Hypersensitivity reaction (acute, serious), ophthalmic disorders (new or worsening), thyroid abnormality development (which cannot be normalized with medication), signs or symptoms of liver failure: Discontinue treatment.

Liver function abnormality, pulmonary infiltrate development, evidence of pulmonary function impairment, or autoimmune disorder development, triglycerides >1,000 mg/dL: Monitor closely and discontinue if appropriate. Permanently discontinue for severe (grade 3) hepatic injury or hepatic decompensation (Child-Pugh class B and C [score >6]).

Neuropsychiatric disorders (during treatment):

Clinical depression or other psychiatric problem: Monitor closely during and for 6 months after treatment.

Severe depression or other psychiatric disorder: Discontinue treatment.

Persistent or worsening psychiatric symptoms, suicidal ideation, aggression towards others: Discontinue treatment and follow with appropriate psychiatric intervention.

Manufacturer-recommended adjustments, listed according to indication:

Lymphoma (follicular):

Neutrophils >1000/mm^3 to <1,500/mm^3: Reduce dose by 50%; may re-escalate to starting dose when neutrophils return to >1,500/mm^3

Severe toxicity (neutrophils <1000/mm^3 or platelets <50,000/mm^3): Temporarily withhold.

AST >5 times ULN or serum creatinine >2 mg/dL: Permanently discontinue.

Hairy cell leukemia:

Platelet count <50,000/mm^3: Do not administer intramuscularly (administer SubQ instead).

Severe toxicity: Reduce dose by 50% or temporarily withhold and resume with 50% dose reduction; permanently discontinue if persistent or recurrent severe toxicity is noted.

Chronic hepatitis B:

WBC <1,500/mm^3, granulocytes <750/mm^3, or platelet count <50,000/mm^3, or other laboratory abnormality or severe adverse reaction: Reduce dose by 50%; may re-escalate to starting dose upon resolution of hematologic toxicity. Discontinue for persistent intolerance.

WBC <1,000/mm^3, granulocytes <500/mm^3, or platelet count <25,000/mm^3: Permanently discontinue

AIDS-related Kaposi sarcoma: Severe toxicity: Reduce dose by 50% or temporarily withhold; may resume at reduced dose with toxicity resolution; permanently discontinue for persistent/recurrent toxicities.

Melanoma, malignant (induction and maintenance):

Severe toxicity including neutrophils >250/mm^3 to <500/mm^3 or ALT/AST >5 to 10 times ULN: Temporarily withhold; resume with a 50% dose reduction when adverse reaction abates.

Neutrophils <250/mm^3, ALT/AST >10 times ULN, or severe/persistent adverse reactions: Permanently discontinue.

Reconstitution

Powder for injection: The manufacturer recommends reconstituting vial with the diluent provided (SWFI). When reconstituted with SWFI 1 mL, the 10 million unit vial concentration is 10 million units/mL, the 18 million unit vial concentration is 18 million units/mL, and the 50 million unit vial concentration is 50 million units/mL. Swirl gently. To prepare solution for infusion, further dilute appropriate dose in NS 100 mL. The final concentration of solutions diluted for infusion should not be <10 million units/100 mL.

Administration

Administer dose in the evening (if possible) to enhance tolerability. Not all dosage forms are recommended for all administration routes; refer to manufacturer's labeling. Interferon alfa-2b at doses ≥10 million units/m^2 is associated with a moderate emetic potential; antiemetics may be recommended to prevent nausea and vomiting.

IM: Rotate injection sites; preferred sites for injection are anterior thigh, deltoid, and superolateral buttock. Some patients may be appropriate for self-administration with appropriate training. Allow to reach room temperature prior to injection. In hairy cell leukemia treatment, if platelets are <50,000/mm^3, do not administer intramuscularly (administer SubQ instead).

IV: Infuse over ~20 minutes

SubQ: Suggested for those who are at risk for bleeding or are thrombocytopenic. Rotate SubQ injection site; preferred sites for injection are abdomen (except around the navel), anterior thigh, and outer upper arm. Patient should be well hydrated. Some patients may be appropriate for self-administration with appropriate training. Allow to reach room temperature prior to injection.

Intralesional: Inject at an angle nearly parallel to the plane of the skin, directing the needle to center of the base of the wart to infiltrate the lesion core and cause a small wheal. Only infiltrate the keratinized layer; avoid administration which is too deep or shallow. Allow to reach room temperature prior to injection.

Storage

Store intact vials at 2°C to 8°C (36°F to 46°F); do not freeze. After reconstitution of powder for injection, product should be used immediately, but may be stored under refrigeration for ≤24 hours.

Drug Interactions

Aldesleukin: Interferons (Alfa) may enhance the adverse/toxic effect of Aldesleukin. In particular, risks of myocardial and renal toxicity may be increased by this combination. Management: Consider using lower doses to minimize toxicity of this combination. Only coadminister aldesleukin and interferons (alfa) in patients in whom potential benefits outweigh the risk of severe toxicity. Monitor renal and cardiac function closely if combined. *Consider therapy modification*

BCG (Intravesical): Myelosuppressive Agents may diminish the therapeutic effect of BCG (Intravesical). *Avoid combination*

Chloramphenicol (Ophthalmic): May enhance the adverse/toxic effect of Myelosuppressive Agents. *Monitor therapy*

Cladribine: May enhance the myelosuppressive effect of Myelosuppressive Agents. *Avoid combination*

CloZAPine: Myelosuppressive Agents may enhance the adverse/toxic effect of CloZAPine. Specifically, the risk for neutropenia may be increased. *Monitor therapy*

CloZAPine: CYP1A2 Inhibitors (Weak) may increase the serum concentration of CloZAPine. Management: Drugs listed as exceptions to this monograph are discussed in further detail in separate drug interaction monographs. *Monitor therapy*

Deferiprone: Myelosuppressive Agents may enhance the neutropenic effect of Deferiprone. Management: Avoid the concomitant use of deferiprone and myelosuppressive agents whenever possible. If this combination cannot be avoided, monitor the absolute neutrophil count more closely. *Consider therapy modification*

Dipyrone: May enhance the adverse/toxic effect of Myelosuppressive Agents. Specifically, the risk for agranulocytosis and pancytopenia may be increased *Avoid combination*

Mesalamine: May enhance the myelosuppressive effect of Myelosuppressive Agents. *Monitor therapy*

Methadone: Interferons (Alfa) may increase the serum concentration of Methadone. *Monitor therapy*

Promazine: May enhance the myelosuppressive effect of Myelosuppressive Agents. *Monitor therapy*

Ribavirin (Oral Inhalation): Interferons (Alfa) may enhance the adverse/toxic effect of Ribavirin (Oral Inhalation). Hemolytic anemia has been observed. *Monitor therapy*

Ribavirin (Systemic): Interferons (Alfa) may enhance the adverse/toxic effect of Ribavirin (Systemic). Hemolytic anemia has been observed. *Monitor therapy*

Telbivudine: Interferon Alfa-2b may enhance the adverse/toxic effect of Telbivudine. Specifically, the risk for peripheral neuropathy may be increased. *Avoid combination*

Theophylline Derivatives: CYP1A2 Inhibitors (Weak) may increase the serum concentration of Theophylline Derivatives. **Exceptions:** Dyphylline. *Monitor therapy*

TiZANidine: CYP1A2 Inhibitors (Weak) may increase the serum concentration of TiZANidine. Management: Avoid these combinations when possible. If combined use is necessary, initiate tizanidine at an adult dose of 2 mg and increase in 2 to 4 mg increments based on patient response. Monitor for increased effects of tizanidine, including adverse reactions. *Consider therapy modification*

Vitamin K Antagonists (eg, warfarin): Interferons (Alfa) may enhance the anticoagulant effect of Vitamin K Antagonists. *Monitor therapy*

Zidovudine: Interferons may enhance the adverse/toxic effect of Zidovudine. Interferons may decrease the metabolism of Zidovudine. *Monitor therapy*

Adverse Reactions

>10%:

Central nervous system: Fatigue (8% to 96%), headache (21% to 62%), chills (45% to 54%), rigors (2% to 42%), depression (3% to 40%), drowsiness (1% to 33%), dizziness (≤23%), vertigo (≤23%), irritability (≤22%), pain (3% to 18%), right upper quadrant pain (≤15%), malaise (3% to 14%), paresthesia (≤13%), confusion (≤12%), insomnia (≤12%)

Dermatologic: Alopecia (8% to 38%), skin rash (1% to 25%), diaphoresis (1% to 13%), pruritus (1% to 11%)

Endocrine & metabolic: Weight loss (≤13%), amenorrhea (≤12%)

Gastrointestinal: Anorexia (1% to 69%), nausea and vomiting (66%; children: 40%), nausea (17% to 66%), gastrointestinal disease (≤7%; children: 46%), diarrhea (2% to 35%), vomiting (2% to 40%), dysgeusia (≤24%), xerostomia (1% to 22%), abdominal pain (≤20%), constipation (≤14%)

Hematologic & oncologic: Neutropenia (≤92%; grades 3/4: 26%; children: 13% to 14%), granulocytopenia (31% to 92%), decreased white blood cell count (9% to 68%), leukopenia (<5%; malignant melanoma, grades 3/4: ≤26%), anemia (≤22%), decreased platelet count (1% to 15%), thrombocytopenia (≤10%; children: 3%)

Hepatic: Increased serum aspartate aminotransferase (4% to 63%), increased serum alkaline phosphatase (4% to 13%), increased serum alanine aminotransferase (2% to 13%)

Local: Injection site reaction (≤20%; children: 5%)

Neuromuscular & skeletal: Myalgia (16% to 75%), asthenia (≤63%), musculoskeletal pain (1% to 21%), arthralgia (3% to 19%), back pain (1% to 19%)

Renal: Increased blood urea nitrogen (2% to 12%)

Respiratory: Flu-like symptoms (≤45%; children: 100%), dyspnea (≤15%), cough (≤13%)

Miscellaneous: Fever (34% to 94%)

1% to 10%:

Cardiovascular: Hypertension (≤9%), chest pain (≤8%; includes substernal), peripheral edema (≤6%), edema (≤5%), peripheral vascular insufficiency (≤5%), angina pectoris (<5%), arteritis (<5%), atrial fibrillation (<5%), bradycardia (<5%), cardiac arrhythmia (<5%), cardiac failure (<5%), cardiomegaly (<5%), cardiomyopathy (<5%), cerebrovascular accident (<5%), coronary artery disease (<5%), extrasystoles (<5%), flushing (<5%), heart valve disease (<5%), hypotension (<5%), orthostatic hypotension (<5%), palpitations (<5%), polyarteritis nodosa (<5%), peripheral ischemia (<5%), phlebitis (<5%), pulmonary embolism (<5%), Raynaud disease (<5%), syncope (<5%), tachycardia (<5%), thrombosis (<5%), varicose veins (<5%), facial edema (≤3%)

Central nervous system: Anxiety (≤9%), lack of concentration (≤8), agitation (≤7%), hypothermia (≤5%), abnormal dreams (<5%), abnormal gait (<5%), abnormality in thinking (<5%), aggressive behavior (<5%), altered sense of smell (<5%), amnesia (<5%), apathy (<5%), aphasia (<5%), ataxia (<5%), Bell palsy (<5%), carpal tunnel syndrome (<5%), central nervous system dysfunction (<5%), coma (<5%), delirium (<5%), dysphasia (<5%), emotional lability (<5%), exacerbation of depression (<5%), extrapyramidal reaction (<5%), hyperesthesia (<5%), hyperthermia (<5%), hypertonia (<5%), hypoesthesia (<5%), hyporeflexia (<5%), intoxicated feeling (<5%), loss of consciousness (<5%), manic depressive reaction (<5%), manic reaction (<5%), migraine (<5%), myasthenia (<5%), neuralgia (<5%), neuritis (<5%), neuropathy (<5%), nightmares (<5%), paresis (<5%), personality disorder (<5%), polyneuropathy (<5%), psychoneurosis (<5%), psychosis (<5%), seizure (<5%), speech disturbance (<5%), twitching (<5%), voice disorder (<5%), nervousness (1% to 3%), attempted suicide (≤2%), suicidal ideation (≤2%),

Dermatologic: Xeroderma (≤9%), dermatitis (1% to 8%), injection site pruritus (≤5%), abnormal hair texture (<5%), acne vulgaris (<5%), cellulitis (<5%), cold and clammy skin (<5%), eczema (<5%), epidermal cyst of skin (<5%), erythema (<5%), erythema nodosum (<5%), erythematous rash (<5%), exacerbation of psoriasis (<5%), folliculitis (<5%), furunculosis (<5%), genital pruritus (<5%), lichenoid dermatitis (<5%), maculopapular rash (<5%), nail disease (<5%), pallor (<5%), psoriasis (<5%), skin depigmentation (<5%), skin discoloration (<5%), skin photosensitivity (<5%), toxic epidermal necrolysis (<5%), urticaria (<5%), vitiligo (<5%)

Endocrine & metabolic: Cachexia (≤5%), decreased libido (≤5%), dehydration (≤5%), hypercalcemia (≤5%), hyperglycemia (≤5%), increased thirst (≤5%), weight gain (≤5%), albuminuria (<5%), cutaneous nodule (<5%), exacerbation of diabetes mellitus (<5%), goiter (<5%), gynecomastia (<5%), heavy menstrual bleeding (<5%), hypertrichosis (<5%), hot flash (<5%), hyperthyroidism (<5%), hypertriglyceridemia (<5%), hypothyroidism (<5%), menstrual disease (<5%), increased lactate dehydrogenase (≤1%)

Gastrointestinal: Dyspepsia (2% to 8%), gingivitis (1% to 7%), hernia of abdominal cavity (≤5%), abdominal distention (<5%), ageusia (<5%), aphthous stomatitis (<5%; including non-herpetic cold sore), biliary colic (<5%), cholelithiasis (<5%), colitis (<5%), dental disease (<5%), dysphagia (<5%), eructation (<5%), esophagitis (<5%), flatulence (<5%), gastric ulcer (<5%), gastritis (<5%), gastroenteritis (<5%), gastrointestinal hemorrhage (<5%), gingival hemorrhage (<5%), gingival hyperplasia (<5%), halitosis (<5%), hemorrhoids (<5%), increased appetite (<5%), melanosis (<5%), melena (<5%), mucositis (<5%), oral leukoplakia (<5%), oral mucosa ulcer (<5%), sialorrhea (<5%), stomatitis (<5%), tongue disease (<5%), loose stools (≤2%)

Genitourinary: Mastitis (≤5%), penile swelling (≤5%), scrotal edema (≤5%), urinary tract infection (≤5%), herpes genitalis (1% to 5%), cystitis (<5%), dysmenorrhea (<5%), dysuria (<5%), hematuria (<5%), impotence (<5%), leukorrhea (<5%), nocturia (<5%), pelvic pain (<5%), penile disease (<5%), proteinuria (<5%), sexual disorder (<5%), urinary frequency (<5%), urinary incontinence (<5%), urination disorder (<5%), uterine hemorrhage (<5%), vaginal dryness (<5%), virilization (<5%), genital candidiasis (≤1%)

Hematologic & oncologic: Lymphadenitis (≤5%), lymphadenopathy (≤5%), purpuric rash (≤5%), hematoma (<5%), hemolytic anemia (<5%), hypochromic anemia (<5%), lipoma (<5%), lymphocytosis (<5%), oral hemorrhage (<5%), rectal hemorrhage (<5%), thrombotic thrombocytopenic purpura (<5%)

Hepatic: Abnormal hepatic function tests (<5%), ascites (<5%), hepatic encephalopathy (<5%), hepatic failure (<5%), hepatitis (<5%), hyperbilirubinemia (<5%), jaundice (<5%)

Hypersensitivity: Hypersensitivity reaction (≤5%; includes acute reaction)

Infection: Infection (≤7%; including hemophilus), viral infection (7%), abscess (<5%), bacterial infection (<5%), fungal infection (<5%), herpes zoster infection (<5%), parasitic infection (including trichomonas), sepsis (<5%)

Local: Bleeding at injection site (≤5%), burning sensation at injection site (≤5%), local pain (pleural: ≤5%), pain at injection site (≤5%), inflammation at injection site (1% to 5%), local discoloration (gastrointestinal mucosa: <5%)

Neuromuscular & skeletal: Amyotrophy (<5%), arthritis (<5%), bone disease (<5%), exacerbation of arthritis (<5%), hyperkinesia (<5%), hypokinesia (<5%), lower limb cramp (<5%), ostealgia (<5%), osteoarthritis (<5%), rheumatoid arthritis (<5%), spondylitis (<5%), tendonitis (<5%), tremor (<5%)

Ophthalmic: Periorbital edema (≤5%), blurred vision (<5%), conjunctivitis (<5%), diplopia (<5%), eye pain (<5%), hordeolum (<5%), lacrimation (<5%), nystagmus (<5%), photophobia (<5%), visual disturbance (<5%), xerophthalmia (<5%)

Otic: Otalgia (≤5%), auditory impairment (<5%), labyrinth disease (<5%), otitis media (<5%), tinnitus (<5%)

Renal: Polyuria (≤10%), increased serum creatinine (2% to 6%), renal insufficiency (<5%)

Respiratory: Bronchitis (≤10%), pharyngitis (≤8%), epistaxis (≤7%), nasal congestion (≤7%), asthma (≤5%), bronchospasm (≤5%), cyanosis (≤5%), hemoptysis (≤5%), hypoventilation (≤5%), laryngitis (≤5%), orthopnea (≤5%), pleural effusion (≤5%), pneumonia (≤5%), pneumonitis (≤5%), pneumothorax (≤5%), pulmonary fibrosis (≤5%), rales (≤5%), respiratory insufficiency (≤5%), respiratory tract disease (≤5%), sneezing (≤5%), tonsillitis (≤5%), tracheitis (≤5%), wheezing (≤5%), rhinitis (<5%), rhinorrhea (<5%), upper respiratory tract infection (<5%), sinusitis (1% to 4%)

Miscellaneous: Inflammation (≤5%), alcohol intolerance (<5%)

<1%, postmarketing, and/or case reports: Anaphylaxis, angioedema, aplastic anemia, autoimmune disease, bronchoconstriction, encephalopathy, erythema multiforme, exacerbation of sarcoidosis, hallucination, hepatotoxicity, homicidal ideation, immune thrombocytopenia, ischemic changes (cerebrovascular events), leukemia (intralesional administration), macular edema, myocardial infarction, myositis, nephrotic syndrome, optic neuritis, pancreatitis, pancytopenia, pericarditis, peripheral neuropathy, pituitary insufficiency, pulmonary hypertension, pulmonary infiltrates, pure red cell aplasia, reactivation of HBV, reduced ejection fraction, renal failure syndrome, retinal detachment (serous), rhabdomyolysis, sarcoidosis, Stevens-Johnson syndrome, suicidal tendencies, supraventricular cardiac arrhythmia, systemic lupus erythematosus, tissue necrosis at injection site, tongue discoloration, vasculitis, Vogt-Koyanagi-Harada syndrome

ALERT: U.S. Boxed Warning

Neuropsychiatric disorders:
Alpha interferons, including interferon alfa-2b, cause or aggravate fatal or life-threatening neuropsychiatric disorders. Patients should be monitored closely with periodic clinical and laboratory evaluations. Patients with persistently severe or worsening signs or symptoms of these conditions should be withdrawn from therapy. In many but not all cases, these disorders resolve after stopping interferon alfa-2b therapy.

Autoimmune disorders:
Alpha interferons, including interferon alfa-2b, cause or aggravate fatal or life-threatening autoimmune disorders. Patients should be monitored closely with periodic clinical and laboratory evaluations. Patients with persistently severe or worsening signs or symptoms of these conditions should be withdrawn from therapy. In many but not all cases, these disorders resolve after stopping interferon alfa-2b therapy.

Ischemic disorders:
Alpha interferons, including interferon alfa-2b, cause or aggravate fatal or life-threatening ischemic disorders. Patients should be monitored closely with periodic clinical and laboratory evaluations. Patients with persistently severe or worsening signs or symptoms of these conditions should be withdrawn from therapy. In many but not all cases, these disorders resolve after stopping interferon alfa-2b therapy.

Infectious disorders:

Alpha interferons, including interferon alfa-2b, cause or aggravate fatal or life-threatening infectious disorders. Patients should be monitored closely with periodic clinical and laboratory evaluations. Patients with persistently severe or worsening signs or symptoms of these conditions should be withdrawn from therapy. In many but not all cases, these disorders resolve after stopping interferon alfa-2b therapy.

Warnings/Precautions

Concerns related to adverse effects:

• Bone marrow suppression: Causes bone marrow suppression, including potentially severe cytopenias, and, very rarely, aplastic anemia. Discontinue treatment for severe neutropenia (ANC <500/mm^3) or thrombocytopenia (platelets <25,000/mm^3). Hemolytic anemia (hemoglobin <10 g/dL) was observed in ~10% of treated patients in clinical trials when combined with ribavirin; anemia occurred within 1 to 2 weeks of initiation of therapy. Use caution in patients with preexisting myelosuppression and in patients with concomitant medications which cause myelosuppression.

• Cerebrovascular events: Hemorrhagic and ischemic cerebrovascular events have been observed.

• Dental and periodontal disorders: In patients receiving combination interferon and ribavirin therapy, dental and periodontal disorders have been reported; additionally, dry mouth can damage teeth and mouth mucous membranes during chronic therapy.

• Flu-like symptoms: Commonly associated with fever and flu-like symptoms; rule out other causes/infections with persistent fever. Use with caution in patients with debilitating conditions.

• GI toxicity: Antiemetics may be recommended to prevent nausea and vomiting; interferon alfa-2b doses of 15 to 30 million units/m^2/day IV are associated with a moderate emetic potential in pediatrics (Paw Cho Sing 2019), and doses ≥10 million units/m^2 are associated with a moderate emetic potential in adults.

• Hepatic effects: May cause hepatotoxicity (including fatality); monitor closely if abnormal LFTs develop. A transient increase in ALT (≥2 times baseline) may occur in patients treated with interferon alfa-2b for chronic hepatitis B. Therapy generally may continue, however, functional indicators (eg, albumin, prothrombin time, bilirubin) should be monitored frequently. Worsening and potentially fatal liver disease, including jaundice, hepatic encephalopathy, and hepatic failure, have been reported in patients receiving interferon alfa for chronic hepatitis B and C with decompensated liver disease, autoimmune hepatitis, history of autoimmune disease, and immunosuppressed transplant recipients; avoid interferon treatment (if appropriate) in these patients (use is contraindicated in decompensated liver disease). Patients with cirrhosis are at increased risk of hepatic decompensation. Therapy should be discontinued for any patient developing signs and symptoms of liver failure. Permanently discontinue for severe (grade 3) hepatic injury or hepatic decompensation (Child-Pugh class B and C [score >6]).

• Hypersensitivity: Acute hypersensitivity reactions (eg, urticaria, angioedema, bronchoconstriction, anaphylaxis) have been reported (rarely) with alfa interferons. If an acute reaction develops, discontinue therapy immediately; transient rashes have occurred in some patients following injection, but have not necessitated treatment interruption.

• Hypertriglyceridemia: Has been reported (discontinue if persistent and severe, particularly if combined with symptoms of pancreatitis).

• Neuropsychiatric disorders: **[US Boxed Warning]: May cause or aggravate severe neuropsychiatric adverse events; monitor closely with clinical evaluations (periodic); discontinue treatment for severe persistent or worsening symptoms; some cases may resolve with discontinuation.** Psychiatric events may include depression psychosis, mania, suicidal ideation, suicide attempts, completed suicides, and homicidal ideation; may occur in patients with or without previous psychiatric symptoms. Effects are usually rapidly reversible upon therapy discontinuation, but have persisted up to 3 weeks. If psychiatric symptoms persist or worsen, or suicidal or homicidal ideation or aggressive behavior towards others is identified, discontinue treatment and follow the patient closely. Careful neuropsychiatric monitoring is recommended during and for 6 months after treatment in patients who develop psychiatric disorders (including clinical depression). New or exacerbated neuropsychiatric or substance abuse disorders are best managed with early intervention. Use with caution in patients with a history of psychiatric disorders. Drug screening and periodic health evaluation (including monitoring of psychiatric symptoms) is recommended if initiating treatment in patients with coexisting psychiatric condition or substance abuse disorders. Suicidal ideation or attempts may occur more frequently in pediatric patients (eg, adolescents) when compared to adults. Higher doses, usually in elderly patients, may result in increased CNS toxicity (eg, obtundation and coma).

• Ocular effects: Decreased or loss of vision, macular edema, optic neuritis, retinal hemorrhages, cotton wool spots, papilledema, retinal detachment (serous), and retinal artery or vein thrombosis have occurred (or been aggravated) in patients receiving alfa interferons. Use caution in patients with preexisting eye disorders; monitor closely; a complete eye exam should be done promptly in patients who develop ocular symptoms; discontinue with new or worsening ophthalmic disorders.

• Pulmonary effects: Dyspnea, pulmonary infiltrates, pulmonary hypertension, interstitial pneumonitis, pneumonia, bronchiolitis obliterans, and sarcoidosis may be induced or aggravated by treatment, sometimes resulting in respiratory failure or fatality. Has been reported more in patients who were treated for chronic hepatitis C, although has also occurred with use for oncology indications. Patients with fever, cough, dyspnea or other respiratory symptoms should be evaluated with a chest x-ray; monitor closely and consider discontinuing treatment with evidence of impaired pulmonary function. Use with caution in patients with a history of pulmonary disease.

Disease-related concerns:

• AIDS-related Kaposi sarcoma: Do not treat patients with visceral AIDS-related Kaposi sarcoma associated with rapidly-progressing or life-threatening disease.

• Autoimmune disease: **[US Boxed Warning]: May cause or aggravate fatal or life-threatening autoimmune disorders; monitor closely with clinical and laboratory evaluations (periodic); discontinue treatment for severe persistent or worsening symptoms; some cases may resolve with discontinuation.** Autoimmune disorders (thrombocytopenia, vasculitis, Raynaud disease, rheumatoid arthritis, lupus erythematosus and rhabdomyolysis) have been associated with alfa interferons. Worsening of psoriasis and sarcoidosis (and the development of new sarcoidosis) have been reported; use caution in patients with these conditions.

• Cardiovascular disease: Use with caution in patients with a history of cardiovascular disease; monitor closely in patients with cardiovascular disease (ischemic or thromboembolic), arrhythmias, hypertension, and in patients with a history of MI and/or prior therapy with cardiotoxic drugs. Patients with preexisting cardiac disease and/or advanced cancer should have baseline and periodic ECGs. May cause hypotension (during administration or delayed up to 2 days), arrhythmia, tachycardia (≥150 bpm), cardiomyopathy (~2% in AIDS-related Kaposi sarcoma patients), and/or myocardial infarction (MI); some experiencing cardiovascular adverse effects had no prior history of cardiac disease. Supraventricular arrhythmias occur rarely and are associated with preexisting cardiac disease or prior therapy with cardiotoxic agents. Dose modification, discontinuation and/or additional therapies may be necessary. In a scientific statement from the American Heart Association, interferon has been determined to be an agent that may either cause reversible direct myocardial toxicity or exacerbate underlying myocardial dysfunction (magnitude: moderate/major) (AHA [Page 2016]).

• Chronic hepatitis: Patients being treated for chronic hepatitis B or C with a history of autoimmune disease or who are immunosuppressed transplant recipients should not receive interferon alfa-2b.

• Coagulation disorders: Use with caution and monitor closely in patients with coagulation disorders (eg, thrombophlebitis, pulmonary embolism).

• Diabetes: Has been reported; discontinue if diabetes cannot be effectively managed with medication. Use with caution in patients with a history of diabetes mellitus, particularly if prone to DKA.

• Infectious disorders: **[US Boxed Warning]: May cause or aggravate fatal or life-threatening infectious disorders; monitor closely with clinical and laboratory evaluations (periodic); discontinue treatment for severe persistent or worsening symptoms; some cases may resolve with discontinuation.**

• Ischemic disorders: **[US Boxed Warning]: May cause or aggravate fatal or life-threatening ischemic disorders; monitor closely with clinical and laboratory evaluations (periodic); discontinue treatment for severe persistent or worsening symptoms; some cases may resolve with discontinuation.**

• Pulmonary disorders: Use with caution and monitor closely in patients with pulmonary disorders (eg, chronic obstructive pulmonary disease).

• Thyroid disorders: Use with caution in patients with preexisting thyroid disease; thyroid disorders (hyper- or hypothyroidism) have been reported. Thyroid-stimulating hormone levels should be within normal limits prior to initiating interferon; treatment should not be initiated in patients with preexisting thyroid disease who cannot be maintained in normal ranges by medication. Discontinue interferon

use in patients who develop thyroid abnormalities during treatment and in patients with thyroid disease who subsequently cannot maintain normal ranges with thyroid medication. Discontinuation of interferon therapy may or may not reverse thyroid dysfunction.

Concurrent drug therapy issues:

• Combination therapy with ribavirin: Combination therapy with ribavirin is associated with birth defects and/or fetal mortality and hemolytic anemia.

Dosage form specific issues:

• Albumin: Some formulations contain albumin, which may carry a remote risk of viral transmission, including a theoretical risk of Creutzfeldt-Jakob disease transmission.

• Polysorbate 80: Some dosage forms may contain polysorbate 80 (also known as Tweens). Hypersensitivity reactions, usually a delayed reaction, have been reported following exposure to pharmaceutical products containing polysorbate 80 in certain individuals (Isaksson 2002; Lucente 2000; Shelley 1995). Thrombocytopenia, ascites, pulmonary deterioration, and renal and hepatic failure have been reported in premature neonates after receiving parenteral products containing polysorbate 80 (Alade 1986; CDC 1984). See manufacturer's labeling.

• Product variability: **Due to differences in dosage, patients should not change brands of interferons without the concurrence of their health care provider.**

Monitoring Parameters

General monitoring parameters for *all indications*:

At baseline (repeat during therapy if clinically indicated): Chest x-ray, serum creatinine, albumin, prothrombin time, triglycerides.

At baseline and periodically thereafter: CBC with differential, platelets and hemoglobin, liver function tests, electrolytes and TSH; ophthalmic exam (or with new ocular symptoms); ECG (in patients with pre-existing cardiac abnormalities or in advanced stages of cancer). Monitor serum bilirubin, ALT, AST, alkaline phosphatase and LDH at 2, 8 and 12 weeks following initiation, then every 6 months during treatment. Permanently discontinue for severe (grade 3) hepatic injury or hepatic decompensation (Child-Pugh class B and C [score >6]).

During therapy: Weight; neuropsychiatric changes during and for 6 months after therapy.

Additional *indication-specific* monitoring parameters:

Chronic hepatitis B: CBC with differential and platelets and liver function tests: Baseline, weeks 1, 2, 4, 8, 12, and 16, at the end of treatment, and then 3 and 6 months post treatment.

Condyloma acuminate (intralesional administration): Monitor CBC with differential, liver function tests (elevations have been reported).

Melanoma, malignant: CBC with differential and platelets and liver function tests: Weekly during induction phase, then monthly during maintenance.

Oncology patients: Thyroid function monitoring (Hamnvik 2011): TSH and anti-TPO antibodies at baseline; if TPO antibody positive, monitor TSH every 2 months; if TPO antibody negative, monitor TSH every 6 months.

Reproductive Considerations

Verify pregnancy status prior to administration in females of reproductive potential. Disruption of the normal menstrual cycle may occur. Female patients of reproductive potential should use effective contraception during treatment.

If used in combination with ribavirin, all warnings related to the use of ribavirin and contraception should be followed. Refer to the Ribavirin monograph for additional information.

Pregnancy Considerations

Alfa interferon is endogenous to normal amniotic fluid (Lebon 1982); however, placenta perfusion studies note exogenous interferon alfa does not cross the placenta (Waysbort 1993).

Essential thrombocythemia is associated with an increased risk of thrombosis, bleeding and, when untreated, may increase the risk of pregnancy loss. Maternal use of interferon alfas may improve pregnancy outcomes; use of interferon alfa-2b may be considered in pregnant women when other agents are not appropriate (Lapoirie 2020; Maze 2019; Sakai 2018; Tefferi 2019; Yazdani Brojeni 2012; Yoshida 2017).

The European Society for Medical Oncology (ESMO) has published guidelines for diagnosis, treatment, and follow-up of cancer during pregnancy. The guidelines suggest that interferon-alfa may be used for the treatment of chronic myeloid leukemia (CML) during pregnancy and recommend referral to a facility with expertise in cancer during pregnancy; a multidisciplinary team (obstetrician, neonatologist, oncology team) is encouraged (ESMO [Peccatori 2013]). An international consensus panel suggests use of interferon-alfa in pregnant patients once WBC and platelet counts have risen to a level associated with CML symptom onset (Lishner 2016).

Interferon alfa-2b in combination with ribavirin is contraindicated in pregnant females and males whose female partners are pregnant. Combination therapy with ribavirin may cause birth defects and death in an unborn child. If used in combination with ribavirin, all warnings related to the use of ribavirin and pregnancy should be followed. Refer to the Ribavirin monograph for additional information.

Patient Education

What is this drug used for?

• It is used to treat cancer.

• It is used to treat genital warts.

• It is used to treat perianal warts.

• It is used to treat hepatitis B and C infections.

• It is used to treat skin wounds in patients with AIDS-related Kaposi's sarcoma.

• It may be given for other reasons.

All drugs may cause side effects. However, many people have no side effects or only have minor side effects. Call your doctor or get medical help if any of these side effects or any other side effects bother you or do not go away:

• Weight loss

• Fatigue

• Nausea

• Vomiting

• Injection site irritation

• Dry mouth

• Diarrhea

• Lack of appetite

• Hair loss

• Trouble sleeping

• Change in taste

• Constipation

• Flu-like symptoms

WARNING/CAUTION: Even though it may be rare, some people may have very bad and sometimes deadly side effects when taking a drug. Tell your doctor or get medical help right away if you have any of the following signs or symptoms that may be related to a very bad side effect:

• Lung problems like shortness of breath or other trouble breathing, cough that is new or worse

• Liver problems like dark urine, fatigue, lack of appetite, nausea, abdominal pain, light-colored stools, vomiting, or yellow skin

• High blood sugar like confusion, fatigue, increased thirst, increased hunger, passing a lot of urine, flushing, fast breathing, or breath that smells like fruit

• Depression like thoughts of suicide, anxiety, emotional instability, confusion

• Hallucination

• Psychosis

• Forceful actions

• Infection

• Pancreatitis like severe abdominal pain, severe back pain, severe nausea, or vomiting

• Thyroid problems like change in weight without trying, anxiety, agitation, feeling very weak, hair thinning, depression, neck swelling, trouble focusing, inability handling heat or cold, menstrual changes, tremors, or sweating

• Weakness on 1 side of the body, trouble speaking or thinking, change in balance, drooping on one side of the face, or blurred eyesight

• Bleeding like vomiting blood or vomit that looks like coffee grounds; coughing up blood; blood in the urine; black, red, or tarry stools; bleeding from the gums; abnormal vaginal bleeding; bruises without a reason or that get bigger; or any severe or persistent bleeding

• Severe loss of strength and energy

• Severe dizziness

• Passing out

• Abnormal heartbeat

• Confusion

• Chest pain

• Fast heartbeat

• Shortness of breath

• Excessive weight gain

• Swelling of arms of legs

• Severe headache

• Severe abdominal pain

• Burning or numbness feeling

• Trouble with memory

• Abnormal gait

• Unable to pass urine

• Change in amount of urine passed

• Anxiety

• Teeth or gingival changes

• Vision changes

• Blindness

• Signs of an allergic reaction, like rash; hives; itching; red, swollen, blistered, or peeling skin with or without fever; wheezing; tightness in the chest or throat; trouble breathing, swallowing, or talking; unusual hoarseness; or swelling of the mouth, face, lips, tongue, or throat.

Note: This is not a comprehensive list of all side effects. Talk to your doctor if you have questions.

Further information

Always consult your healthcare provider to ensure the information displayed on this page applies to your personal circumstances.