

Irinogen® Irinotecan Hydrochloride

Solution for injection
For Intravenous use only

Prescription Only

Made In Argentina

WARNINGS

Irinogen® injection should be administered only under the supervision of a physician who is experienced in the use of cancer chemotherapeutic agents. Appropriate management of complications is possible only when adequate diagnostic and treatment facilities are readily available. **Irinogen®** can induce both early and late forms of diarrhea that appear to be mediated by different mechanisms. Both forms of diarrhea may be severe. Early diarrhea (occurring during or shortly after infusion of irinotecan) may be accompanied by cholinergic symptoms of rhinitis, increased salivation, miosis, lacrimation, diaphoresis, flushing, and intestinal hyperperistalsis that can cause abdominal cramping. Early diarrhea and other cholinergic symptoms may be prevented or ameliorated by atropine. Late diarrhea (generally occurring more than 24 hours after administration of irinotecan) can be life threatening since it may be prolonged and may lead to dehydration, electrolyte imbalance, or sepsis. Late diarrhea should be treated promptly with loperamide. Patients with diarrhea should be carefully monitored and given fluid and electrolyte replacement if they become dehydrated, or antibiotic therapy if they develop ileus, fever, or severe neutropenia. Administration of **Irinogen®** should be interrupted and subsequent doses reduced if severe diarrhea occurs. Severe myelosuppression may occur.

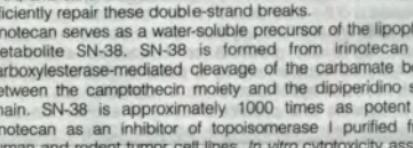
COMPOSITION

Irinogen® is supplied as a sterile, pale yellow, clear, aqueous solution. It is available in 5 mL-filled vials containing 100 mg of irinotecan hydrochloride. Each milliliter of solution contains 20 mg of irinotecan hydrochloride (on the basis of the trihydrate salt), 45 mg of sorbitol NF powder, 0.9 mg of lactic acid USP and water for injection to 1 mL. The pH of the solution has been adjusted to 3.5 (range, 3.0 to 3.8) with sodium hydroxide or hydrochloric acid. **Irinogen®** is intended for dilution with 5% Dextrose injection, USP (D5W), or 0.9% Sodium Chloride injection, USP, prior to intravenous infusion. The preferred diluent is 5% Dextrose injection, USP.

DESCRIPTION

ATC Code: L01XX19

Irinogen® injection (irinotecan hydrochloride injection) is an antineoplastic agent of the topoisomerase I inhibitor class. Irinotecan hydrochloride was clinically investigated as CPT-11. Irinotecan hydrochloride is a semisynthetic derivative of camptothecin, an alkaloid extract from plants such as *Camptotheca acuminata* or is chemically synthesized. The chemical name is (S)-4,11-diethyl-3,4,12,14-tetrahydro-4-hydroxy-3,14-dioxo-1H-pyrido[3',4':6,7]-indolizino[1,2-b]quinolin-9-yl-[1,4'bipiperidine]-1'-carboxylate, monohydrochloride, trihydrate. Its structural formula is as follows:



Irinotecan hydrochloride is a pale yellow to yellow crystalline powder, with the empirical formula $C_{33}H_{38}N_4O_8 \cdot HCl \cdot 3H_2O$ and a molecular weight of 677.19. It is slightly soluble in water and organic solvents.

CLINICAL PHARMACOLOGY

Irinotecan is a derivative of camptothecin. Camptothecins interact specifically with the enzyme topoisomerase I which relieves torsional strain in DNA by inducing reversible single-strand breaks. Irinotecan and its active metabolite SN-38 bind to the topoisomerase I-DNA complex and prevent religation of these single-strand breaks. Current research suggests that the cytotoxicity of irinotecan is due to double-strand DNA damage produced during DNA synthesis when replication enzymes interact with the ternary complex formed by topoisomerase I, DNA, and either irinotecan or SN-38. Mammalian cells cannot efficiently repair these double-strand breaks.

Irinotecan serves as a water-soluble precursor of the lipophilic metabolite SN-38. SN-38 is formed from irinotecan by carboxylesterase-mediated cleavage of the carbamate bond between the camptothecin moiety and the dipiperidino side chain. SN-38 is approximately 1000 times as potent as irinotecan as an inhibitor of topoisomerase I purified from human and rodent tumor cell lines. *In vitro* cytotoxicity assays show that the potency of SN-38 relative to irinotecan varies from 2-to 2000-fold. However, the plasma area under the concentration versus time curve (AUC) values for SN-38 are 2% to 8% of irinotecan and SN-38 is 95% bound to plasma proteins compared to approximately 50% bound to plasma proteins for irinotecan. The precise contribution of SN-38 to the activity of irinotecan is thus unknown. Both irinotecan and SN-38 exist in an active lactone form and an inactive hydroxy acid anion form. A pH-dependent equilibrium exists between the two forms such that an acid pH favors the formation of the lactone, while a more basic pH favors the hydroxy acid anion form.

Administration of irinotecan has resulted in antitumor activity in mice bearing cancers of rodent origin and in human carcinoma xenografts of various histological types.

Pharmacokinetics

After intravenous infusion of irinotecan in humans, irinotecan plasma concentrations decline in a multiexponential manner, with a mean terminal elimination half-life of about 6 to 12 hours. The mean terminal elimination half-life of the active metabolite SN-38 is about 10 to 20 hours. The half-lives of the lactone (active) forms of irinotecan and SN-38 are similar to those of total irinotecan and SN-38, as the lactone and hydroxy acid forms are in equilibrium. Over the recommended dose range of 50 to 350 mg/m², the AUC of irinotecan increases linearly with dose; the AUC of SN-38 increases less than proportionally with dose. Maximum concentrations of the active metabolite SN-38 are generally seen within 1 hour following the end of a 90-minute infusion of irinotecan. Pharmacokinetic parameters for irinotecan and SN-38 following a 90-minute infusion of irinotecan at dose levels of 125 and 340 mg/m² determined in two clinical studies in patients with solid tumors are summarized in following table.

TABLE 1: SUMMARY OF MEAN (\pm STANDARD DEVIATION) IRINOTECAN AND SN-38 PHARMACOKINETIC PARAMETERS IN PATIENTS WITH SOLID TUMORS

Dose (mg/m ²)	Irinotecan			SN-38				
	C _{max} (ng/mL)	AUC ₀₋₂₄ (ng·h/mL)	t _{1/2} (h)	V _Z (L/m ²)	CL (L/h·m ²)	C _{max} (ng/mL)	AUC ₀₋₂₄ (ng·h/mL)	t _{1/2} (h)
125 (N=64)	1,660 ± 797	10,200 ± 3,270	5.8 ^a ± 0.7	110 ± 48.5	13.3 ± 6.01	26.3 ± 11.9	229 ± 108	10.4 ^a ± 3.1
340 (N=6)	3,392 ± 874	20,604 ± 6,027	11.7 ^b ± 1.0	234 ± 69.6	13.9 ± 4	56 ± 28.2	474 ± 245	21 ^b ± 4.3

C_{max} - Maximum plasma concentration
AUC₀₋₂₄ - Area under the plasma concentration-time curve from time 0 to 24 hours after the end of the 90-minute infusion

t_{1/2} - Terminal elimination half-life

V_Z - Volume of distribution of terminal elimination phase

CL - Total systemic clearance

a Plasma specimens collected for 24 hours following the end of the 90-minute infusion.

b Plasma specimens collected for 48 hours following the end of the 90-minute infusion. Because of the longer collection period, these values provide a more accurate reflection of the terminal elimination half-lives of irinotecan and SN-38.

Irinotecan exhibits moderate plasma protein binding (30% to 68% bound). SN-38 is highly bound to human plasma proteins (approximately 95% bound). The plasma protein to which irinotecan and SN-38 predominantly binds is albumin.

Metabolism and excretion

The metabolic conversion of irinotecan to the active metabolite SN-38 is mediated by carboxylesterases enzymes and primarily occurs in the liver. *In vitro* studies indicate that irinotecan, SN-38 and another metabolite, aminopenetane carboxylic acid (APC), do not inhibit cytochrome P-450 isozymes. SN-38 is subsequently conjugated predominantly by the enzyme UDP-glucuronosyl transferase 1A1 (UGT1A1) to form a glucuronide metabolite. UGT1A1 activity is reduced in individuals with genetic polymorphisms that lead to reduced enzyme activity such as the UGT1A1*28 polymorphism. Approximately 10% of the North American population is homozygous for the UGT1A1*28 allele (also referred to as UGT1A1 7/7 genotype). In a prospective study, in which irinotecan was administered as a single-agent (350 mg/m²) on a once-every-3-week schedule, patients with the UGT1A1 7/7 genotype had a higher exposure to SN-38 than patients with the wild-type UGT1A1 allele (UGT1A1 6/6 genotype). SN-38 glucuronide had 1/50 to 1/100 the activity of SN-38 in cytotoxicity assays using two cell lines *in vitro*. The disposition of irinotecan has not been fully elucidated in humans. The urinary excretion of irinotecan is 11% to 20%; SN-38, <1%, and SN-38 glucuronide, 3%. The cumulative biliary and urinary excretion of irinotecan and its metabolites (SN-38 and SN-38 glucuronide) over a period of 48 hours following administration of irinotecan in two patients ranged from approximately 25% (100 mg/m²) to 50% (300 mg/m²).

Pharmacokinetics in special populations

Geriatric

The pharmacokinetics of irinotecan administered using the weekly schedule was evaluated in a study of 183 patients that was prospectively designed to investigate the effect of age on irinotecan toxicity. Results from this trial indicate that there are no differences in the pharmacokinetics of irinotecan, SN-38, and SN-38 glucuronide in patients <65 years of age

compared with patients ≥65 years of age. In a study of 162 patients that was not prospectively designed to investigate the effect of age, small (less than 18%) but statistically significant differences in dose-normalized irinotecan pharmacokinetic parameters in patients <65 years of age compared to patients ≥65 years of age were observed. Although dose-normalized AUC₀₋₂₄ for SN-38 in patients ≥65 years of age was 11% higher than in patients <65 years of age, this difference was not statistically significant. No change in the starting dose is recommended for geriatric patients receiving the weekly dosage schedule of irinotecan.

Gender

The pharmacokinetics of irinotecan do not appear to be influenced by gender.

Race

The influence of race on the pharmacokinetics of irinotecan has not been evaluated.

Hepatic insufficiency

Irinotecan clearance is diminished in patients with hepatic dysfunction while exposure to the active metabolite SN-38 is increased relative to that in patients with normal hepatic function. The magnitude of these effects is proportional to the degree of liver impairment as measured by elevations in total bilirubin and transaminase concentrations. However, the tolerability of irinotecan in patients with hepatic dysfunction (bilirubin greater than 2 mg/dL) has not been assessed sufficiently, and no recommendations for dosing can be made.

Renal insufficiency

The influence of renal insufficiency on the pharmacokinetics of irinotecan has not been evaluated. Therefore, caution should be undertaken in patients with impaired renal function. Irinotecan is not recommended for use in patients on dialysis.

Drug-Drug interactions

5-fluorouracil and leucovorin

In a phase 1 clinical study involving irinotecan, 5-fluorouracil (5-FU), and leucovorin (LV) in 26 patients with solid tumors, the disposition of irinotecan was not substantially altered when the drugs were coadministered. Although the C_{max} and AUC₀₋₂₄ of SN-38, the active metabolite, were reduced (by 14% and 8%, respectively) when irinotecan was followed by 5-FU and LV administration compared with when irinotecan was given alone, this sequence of administration was used in the combination trials and is recommended. Formal *in vivo* or *in vitro* drug interaction studies to evaluate the influence of irinotecan on the disposition of 5-FU and LV have not been conducted.

Anticonvulsants

Exposure to irinotecan and its active metabolite SN-38 is substantially reduced in adult and pediatric patients concomitantly receiving the CYP3A4 enzyme-inducing anticonvulsants phenytoin, phenobarbital or carbamazepine. The appropriate starting dose for patients taking these anticonvulsants has not been formally defined. The following drugs are also CYP3A4 inducers: rifampin, rifabutin. For patients requiring anticonvulsant treatment, consideration should be given to substituting non-enzyme inducing anticonvulsants at least 2 weeks prior to initiation of irinotecan therapy. Dexamehtasone does not appear to alter the pharmacokinetics of irinotecan.

St. John's Wort

St. John's Wort is an inducer of CYP3A4 enzymes. Exposure to the active metabolite SN-38 is reduced in patients receiving concomitant St. John's Wort. St. John's Wort should be discontinued at least 2 weeks prior to the first cycle of irinotecan, and St. John's Wort is contraindicated during irinotecan therapy.

Ketoconazole

Ketoconazole is a strong inhibitor of CYP3A4 enzymes. Patients receiving concomitant ketoconazole have increased exposure to irinotecan and its active metabolite SN-38. Patients should discontinue ketoconazole at least 1 week prior to starting irinotecan therapy and ketoconazole is contraindicated during irinotecan therapy.

Neuromuscular blocking agents

Interaction between irinotecan and neuromuscular blocking agents cannot be ruled out. Irinotecan has anticholinesterase activity, which may prolong the neuromuscular blocking effects of suxamethonium and the neuromuscular blockade of non-depolarizing drugs may be antagonized.

Atazanavir sulfate

Coadministration of atazanavir sulfate, a CYP3A4 and UGT1A1 inhibitor has the potential to increase systemic exposure to SN-38, the active metabolite of irinotecan. Physicians should take this into consideration when co-administering these drugs.

INDICATIONS AND USAGE

Irinogen® injection is indicated as a component of first-line therapy in combination with 5-FU and LV for patients with metastatic carcinoma of the colon or rectum. **Irinogen®** is also indicated for patients with metastatic carcinoma of the colon or rectum whose disease has recurred or progressed following initial fluorouracil-based therapy.

CONTRAINDICATIONS

Irinogen® injection is contraindicated in patients with a known hypersensitivity to the drug or its excipients.

WARNINGS

General

Outside of a well-designed clinical study, **Irinogen®** injection should not be used in combination with the "Mayo Clinic" regimen of 5-FU/LV (administration for 4-5 consecutive days every 4 weeks) because of reports of increased toxicity, including toxic deaths. **Irinogen®** should be used as recommended.

In patients receiving either irinotecan/5-FU/LV or 5-FU/LV in the clinical trials, higher rates of hospitalization, neutropenic fever, thromboembolism, first-cycle treatment discontinuation, and early deaths were observed in patients with a baseline performance status of 2 than in patients with a baseline performance status of 0 or 1.

Diarrhea

Irinogen® can induce both early and late forms of diarrhea that appear to be mediated by different mechanisms. Early diarrhea (occurring during or shortly after infusion of **Irinogen®**) is cholinergic in nature. It is usually transient and only infrequently is severe. It may be accompanied by symptoms of rhinitis, increased salivation, miosis, lacrimation, diaphoresis, flushing, and intestinal hyperperistalsis that can cause abdominal cramping. Early diarrhea and other cholinergic symptoms may be prevented or ameliorated by administration of atropine.

Late diarrhea (generally occurring more than 24 hours after administration of **Irinogen®**) can be life threatening since it may be prolonged and may lead to dehydration, electrolyte imbalance, or sepsis. Late diarrhea should be treated promptly with loperamide. Patients with diarrhea should be carefully monitored, should be given fluid and electrolyte replacement if they become dehydrated, and should be given antibiotic support if they develop ileus, fever, or severe neutropenia. After the first treatment, subsequent weekly chemotherapy treatments should be delayed in patients until return of pretreatment bowel function for at least 24 hours without need for anti-diarrhea medication. If grade 2, 3, or 4 late diarrhea occurs subsequent doses of **Irinogen®** should be decreased within the current cycle.

Neutropenia

Deaths due to sepsis following severe neutropenia have been reported in patients treated with irinotecan. Neutropenic complications should be managed promptly with antibiotic support. Therapy with **Irinogen®** should be temporarily omitted during a cycle of therapy if neutropenic fever occurs or if the absolute neutrophil count drops below 1000/mm³. After the patient recovers to an absolute neutrophil count ≥1000/mm³, subsequent doses of **Irinogen®** should be reduced depending upon the level of neutropenia observed.

Routine administration of a colony-stimulating factor (CSF) is not necessary, but physicians may wish to consider CSF use in individual patients experiencing significant neutropenia.

Patients with Reduced UGT1A1 Activity

Individuals who are homozygous for the UGT1A1*28 allele (UGT1A1 7/7 genotype) are at increased risk for neutropenia following initiation of irinotecan treatment.

In a study of 66 patients who received single-agent irinotecan (350 mg/m² once every 3-weeks), the incidence of grade 4 neutropenia in patients homozygous for the UGT1A1*28 allele was 50%, and in patients heterozygous for this allele (UGT1A1 6/7 genotype) the incidence was 12.5%. No grade 4 neutropenia was observed in patients homozygous for the wild-type allele (UGT1A1 6/6 genotype).

In a prospective study (n=250) to investigate the role of UGT1A1*28 polymorphism in the development of toxicity in patients treated with irinotecan (180 mg/m²) in combination with infusional 5-FU/LV, the incidence of grade 4 neutropenia in patients homozygous for the UGT1A1*28 allele was 4.5%, and in patients heterozygous for this allele the incidence was 5.3%. Grade 4 neutropenia was observed in 1.8% of patients homozygous for the wild-type allele.

In another study in which 109 patients were treated with irinotecan (100-125 mg/m²) in combination with bolus 5-FU/LV, the incidence of grade 4 neutropenia in patients homozygous for the UGT1A1*28 allele was 18.2%, and in patients heterozygous for this allele the incidence was 11.1%. Grade 4 neutropenia was observed in 6.8% of patients homozygous for the wild-type allele.

When administered in combination with other agents, or as a single-agent, a reduction in the starting dose by at least one level of irinotecan should be considered for patients known to be homozygous for the UGT1A1*28 allele. However, the precise dose reduction in this patient population is not known and subsequent dose modifications should be considered based on individual patient tolerance to treatment.

Hypersensitivity

Hypersensitivity reactions including severe anaphylactic or

anaphylactoid reactions have been observed.

Colitis/Ileus

Cases of colitis complicated by ulceration, bleeding, ileus, and infection have been observed. Patients experiencing ileus should receive prompt antibiotic support.

Renal impairment/Renal failure

Rare cases of renal impairment and acute renal failure have been identified, usually in patients who became volume depleted from severe vomiting and/or diarrhea.

Thromboembolism

Thromboembolic events have been observed in patients receiving irinotecan-containing regimens; the specific cause of these events has not been determined.

Pulmonary toxicity

Interstitial Pulmonary Disease (IPD)-like events, including fatalities, have been reported in patients receiving irinotecan (in combination and as monotherapy) for treatment of colorectal cancer and other advanced solid tumors. In the event of an acute onset of new or progressive, unexplained pulmonary symptoms such as dyspnea, cough and fever, irinotecan and other co-prescribed chemotherapeutic agents should be interrupted pending diagnostic evaluation. If IPD is diagnosed, irinotecan and other chemotherapy should be discontinued and appropriate treatment instituted as needed.

Pregnancy

Irinotecan may cause fetal harm when administered to a pregnant woman. Radioactivity related to ¹⁴C-irinotecan crosses the placenta of rats following intravenous administration of 10 mg/kg (which in separate studies produced an irinotecan C_{max} and AUC about 3 and 0.5 times, respectively, the corresponding values in patients administered 125 mg/m²). Administration of 6 mg/kg/day intravenous irinotecan to rats (which in separate studies produced an irinotecan C_{max} and AUC about 2 and 0.2 times, respectively, the corresponding values in patients administered 125 mg/m²) and rabbits (about one-half the recommended human weekly starting dose on a mg/m² basis) during the period of organogenesis, is embryotoxic as characterized by increased post-implantation loss and decreased numbers of live fetuses. Irinotecan was teratogenic in rats at doses greater than 1.2 mg/kg/day (which in separate studies produced an irinotecan C_{max} and AUC about 2/3 and 1/40th, respectively, of the corresponding values in patients administered 125 mg/m²) and in rabbits at 6.0 mg/kg/day (about one-half the recommended human weekly starting dose on a mg/m² basis). Teratogenic effects included a variety of external, visceral, and skeletal abnormalities. Irinotecan administered to rat dams for the period following organogenesis through weaning at doses of 6 mg/kg/day caused decreased learning ability and decreased female body weights in the offspring. There are no adequate and well-controlled studies of irinotecan in pregnant women. If the drug is used during pregnancy, or if the patient becomes pregnant while receiving this drug, the patient should be apprised of the potential hazard to the fetus. Women of childbearing potential should be advised to avoid becoming pregnant while receiving treatment with Irinogen®.

PRECAUTIONS

General

Care of intravenous site

Irinogen® injection is administered by intravenous infusion. Care should be taken to avoid extravasation, and the infusion site should be monitored for signs of inflammation. Should extravasation occur, flushing the site with sterile water and applications of ice are recommended.

Premedication with Antiemetics

Irinotecan is emetogenic. It is recommended that patients receive premedication with antiemetic agents. In clinical studies of the weekly dosage schedule, the majority of patients received 10 mg of dexamethasone given in conjunction with another type of antiemetic agents, such as a 5-HT3 blocker (e.g., ondansetron or granisetron). Antiemetic agents should be given on the day of treatment, starting at least 30 minutes before administration of Irinogen®.

Physicians should also consider providing patients with an antiemetic regimen (e.g., prochlorperazine) for subsequent use as needed.

Treatment of Cholinergic symptoms

Prophylactic or therapeutic administration of 0.25 to 1 mg of intravenous or subcutaneous atropine should be considered (unless clinically contraindicated) in patients experiencing rhinitis, increased salivation, miosis, lacrimation, diaphoresis, flushing, abdominal cramping, or diarrhea (occurring during or shortly after infusion of irinotecan). These symptoms are expected to occur more frequently with higher irinotecan doses.

Immunosuppressant effects/increased susceptibility to infections

Administration of live or live-attenuated vaccines in patients immunocompromised by chemotherapeutic agents including irinotecan, may result in serious or fatal infections. Avoid vaccination with a live vaccine in patients receiving irinotecan. Killed or inactivated vaccines may be administered; however, the response to such vaccines may be diminished.

Patients at particular risk

In patients receiving either irinotecan/5-FU/LV or 5-FU/LV in the clinical trials, higher rates of hospitalization, neutropenic fever, thromboembolism, first-cycle treatment discontinuation, and early deaths were observed in patients with a baseline performance status of 2 than in patients with a baseline performance status of 0 or 1. Patients who had previously received pelvic/abdominal radiation and elderly patients with comorbid conditions should be closely monitored.

The use of irinotecan in patients with significant hepatic dysfunction has not been established. In clinical trials of either dosing schedule, irinotecan was not administered to patients with serum bilirubin >2.0 mg/dL, or transaminase >3 times the upper limit of normal if no liver metastasis, or transaminase >5 times the upper limit of normal with liver metastasis.

In clinical trials of the weekly dosage schedule, patients with modestly elevated baseline serum total bilirubin levels (1.0 to 2.0 mg/dL) had a significantly greater likelihood of experiencing first-cycle, grade 3 or 4 neutropenia than those with bilirubin levels that were less than 1.0 mg/dL (50% [19/38] versus 18% [47/226]; p<0.001). Patients with deficient glucuronidation of bilirubin, such as those with Gilbert's syndrome, may also be at greater risk of myelosuppression when receiving therapy with irinotecan.

Ketoconazole, enzyme-inducing anticonvulsants and St. John's wort are known to have drug-drug interactions with irinotecan therapy.

Irinotecan commonly causes neutropenia, leucopenia, and anemia, any of which may be severe and therefore should not be used in patients with severe bone marrow failure. Patients must not be treated with irinotecan until resolution of the bowel obstruction. Patients with hereditary fructose intolerance should not be given irinotecan, as this product contains sorbitol.

Information for patients

Patients and patients' caregivers should be informed of the expected toxic effects of Irinogen®, particularly of its gastrointestinal complications, such as nausea, vomiting, abdominal cramping, infection and diarrhea. Each patient should be instructed to have loperamide readily available and to begin treatment for late diarrhea (generally occurring more than 24 hours after administration of irinotecan) at the first episode of poorly formed or loose stools or the earliest onset of bowel movements more frequent than normally expected for the patient. One dosage regimen for loperamide used in clinical trials consisted of the following (Note: this dosage regimen exceeds the usual dosage recommendations for loperamide): 4 mg at the first onset of late diarrhea and then 2 mg every 2 hours until the patient is diarrhea-free for at least 12 hours. Loperamide is not recommended to be used for more than 48 consecutive hours at these doses, because of the risk of paralytic ileus. During the night, the patient may take 4 mg of loperamide every 4 hours. Premedication with loperamide is not recommended. The use of drugs with laxative properties should be avoided because of the potential for exacerbation of diarrhea. Patients should be advised to contact their physician to discuss any laxative use. Patients should be instructed to contact their physician or nurse if any of the following occur: diarrhea for the first time during treatment; black or bloody stools; symptoms of dehydration, such as fainting, lightheadedness, dizziness; or faintness; inability to take fluids by mouth due to nausea or vomiting; inability to get diarrhea under control within 24 hours; or fever or evidence of infection.

Patients should be warned about the potential for dizziness or visual disturbances which may occur within 24 hours following the administration of irinotecan, and advised not to drive or operate machinery if these symptoms occur.

Patients should be alerted to the possibility of alopecia.

Laboratory tests

Careful monitoring of the white blood cell count with differential, hemoglobin and platelet count is recommended before each dose of Irinogen®.

UGT1A1 testing

A laboratory test is available to determine the UGT1A1 status of patients. Testing can detect the UGT1A1 6/6, 6/7 and 7/7 genotypes.

DRUG INTERACTIONS

The adverse effects of irinotecan, such as myelosuppression and diarrhea, would be expected to be exacerbated by other antineoplastic agents having similar adverse effects. Patients who have previously received pelvic/abdominal irradiation are at increased risk of severe myelosuppression following the administration of irinotecan. The concurrent administration of irinotecan with irradiation has not been adequately studied and is not recommended.

Lymphocytopenia has been reported in patients receiving Irinogen®, and it is possible that the administration of

dexamethasone as antiemetic prophylaxis may have enhanced the likelihood of this effect. However, serious opportunistic infections have not been observed, and no complications have specifically been attributed to lymphocytopenia.

Hyperglycemia has also been reported in patients receiving irinotecan. Usually, this has been observed in patients with a history of diabetes mellitus or evidence of glucose intolerance prior to administration of irinotecan. It is probable that dexamethasone, given as antiemetic prophylaxis, contributed to hyperglycemia in some patients.

The incidence of akathisia in clinical trials of the weekly dosage schedule was greater (8.5%, 4/47 patients) when prochlorperazine was administered on the same day as irinotecan than when these drugs were given on separate days (1.3%, 1/80 patients). The 8.5% incidence of akathisia, however, is within the range reported for use of prochlorperazine when given as a premedication for other chemotherapies.

It would be expected that laxative use during therapy with irinotecan would worsen the incidence or severity of diarrhea, but this has not been studied.

In view of the potential risk of dehydration secondary to vomiting and/or diarrhea induced by irinotecan, the physician may wish to withhold diuretics during dosing with irinotecan and, certainly, during periods of active vomiting or diarrhea.

Drug-Laboratory Test Interactions

There are no known interactions between irinotecan and laboratory tests.

CARCINOGENESIS, MUTAGENESIS & IMPAIRMENT OF FERTILITY

Long-term carcinogenicity studies with irinotecan were not conducted. Rats were, however, administered intravenous doses of 2 mg/kg or 25 mg/kg irinotecan once per week for 13 weeks (in separate studies, the 25 mg/kg dose produced an irinotecan C_{max} and AUC that were about 7.0 times and 1.3 times the respective values in patients administered 125 mg/m² weekly) and were then allowed to recover for 91 weeks. Under these conditions, there was a significant linear trend with dose for the incidence of combined uterine horn endometrial stromal polyps and endometrial stromal sarcomas. Neither irinotecan nor SN-38 was mutagenic in the *in vitro* Ames assay. Irinotecan was clastogenic both *in vitro* (chromosome aberrations in Chinese hamster ovary cells) and *in vivo* (micronucleus test in mice). No significant adverse effects on fertility and general reproductive performance were observed after intravenous administration of irinotecan in doses of up to 6 mg/kg/day to rats and rabbits. However, atrophy of male reproductive organs was observed after multiple daily irinotecan doses both in rodents at 20 mg/kg (which in separate studies produced an irinotecan C_{max} and AUC about 5 and 1 times, respectively, the corresponding values in patients administered 125 mg/m² weekly) and dogs at 0.4 mg/kg (which in separate studies produced an irinotecan C_{max} and AUC about one-half and 1/15th, respectively, the corresponding values in patients administered 125 mg/m² weekly).

PREGNANCY

Pregnancy, Category D.

Nursing mothers

Radioactivity appeared in rat milk within 5 minutes of intravenous administration of radiolabeled irinotecan and was concentrated up to 65-fold at 4 hours after administration relative to plasma concentrations. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants, it is recommended that nursing be discontinued when receiving therapy with irinotecan.

PEDIATRIC USE

The effectiveness of irinotecan in pediatric patients has not been established. Results from two open-label, single arm studies were evaluated. One hundred and seventy children with refractory solid tumors were enrolled in one phase 2 trial in which 50 mg/m² of irinotecan was infused for 5 consecutive days every 3 weeks. Grade 3-4 neutropenia was experienced by 54 (31.8%) patients. Neutropenia was complicated by fever in 15 (8.8%) patients. Grade 3-4 diarrhea was observed in 35 (20.6%) patients. This adverse event profile was comparable to that observed in adults. In the second phase 2 trial of 21 children with previously untreated rhabdomyosarcoma, 20 mg/m² of irinotecan was infused for 5 consecutive days on Weeks 0, 1, 3 and 4. This single agent therapy was followed by multimodal therapy. Accrual to the single agent irinotecan phase was halted due to the high rate (28.6%) of progressive disease and the early deaths (14%). The adverse event profile was different in this study from that observed in adults; the most significant grade 3 or 4 adverse events were dehydration experienced by 6 patients (28.6%) associated with severe hypokalemia in 5 patients (23.8%) and hyponatremia in 3 patients (14.3%); in addition Grade 3-4 infection was reported in 5 patients (23.8%) (across all courses of therapy and irrespective of causal relationship).

Pharmacokinetic parameters for irinotecan and SN-38 were determined in 2 pediatric solid-tumor trials at dose levels of 50 mg/m² (60-min infusion, n=48) and 125 mg/m² (90-min infusion, n=6). Irinotecan clearance (mean ± S.D.) was 17.3 ± 6.7 L/h/m² for the 50mg/m² dose and 16.2 ± 4.6 L/h/m² for the 125 mg/m² dose, which is comparable to that in adults. Dose-normalized SN-38 AUC values were comparable between adults and children. Minimal accumulation of irinotecan and SN-38 was observed in children on daily dosing regimens [daily x 5 every 3 weeks or (daily x 5) x 2 weeks every 3 weeks].

GERIATRIC USE

Patients greater than 65 years of age should be closely monitored because of a greater risk of early and late diarrhea in this population. The starting dose of Irinogen® in patients 70 years and older for the once-every-3-week-dosage schedule should be 300 mg/m².

ADVERSE REACTIONS

First-line combination therapy

A total of 955 patients with metastatic colorectal cancer received the recommended regimens of irinotecan in combination with 5-FU/LV, 5-FU/LV alone, or irinotecan alone.

In the two phase 3 studies, 370 patients received irinotecan in combination with 5-FU/LV, 362 patients received 5-FU/LV alone, and 223 patients received irinotecan alone.

In study 1, 49 (7.3%) patients died within 30 days of last study treatment: 21 (9.3%) received irinotecan in combination with 5-FU/LV, 15 (6.8%) received 5-FU/LV alone, and 13 (5.8%) received irinotecan alone. Deaths potentially related to treatment occurred in 2 (0.9%) patients who received irinotecan in combination with 5-FU/LV (2 neutropenic fever/sepsis), 3 (1.4%) patients who received 5-FU/LV alone (1 neutropenic fever/sepsis, 1 CNS bleeding during thrombocytopenia, 1 unknown) and 2 (0.9%) patients who received irinotecan alone (2 neutropenic fever). Deaths from any cause within 60 days of first study treatment were reported for 15 (6.7%) patients who received irinotecan in combination with 5-FU/LV, 16 (7.3%) patients who received 5-FU/LV alone, and 15 (6.7%) patients who received irinotecan alone. Discontinuations due to adverse events were reported for 17 (7.6%) patients who received irinotecan in combination with 5-FU/LV, 14 (6.4%) patients who received 5-FU/LV alone, and 26 (11.7%) patients who received irinotecan alone.

In study 2, 10 (3.5%) patients died within 30 days of last study treatment: 6 (4.1%) received irinotecan in combination with 5-FU/LV and 4 (2.8%) received 5-FU/LV alone. There was one potentially treatment-related death, which occurred in a patient who received irinotecan in combination with 5-FU/LV (0.7%, neutropenic sepsis). Deaths from any cause within 60 days of first study treatment were reported for 3 (2.1%) patients who received irinotecan in combination with 5-FU/LV alone, and 2 (1.4%) patients who received 5-FU/LV alone. Discontinuations due to adverse events were reported for 9 (6.2%) patients who received irinotecan in combination with 5-FU/LV and 1 (0.7%) patients who received 5-FU/LV alone.

The most clinically significant adverse events for patients receiving irinotecan-based therapy were diarrhea, nausea, vomiting, neutropenia, and alopecia. The most clinically significant adverse events for patients receiving 5-FU/LV therapy were diarrhea, neutropenia, neutropenic fever, and mucositis. In study 1, grade 4 neutropenia, neutropenic fever (defined as grade 2 fever and grade 4 neutropenia), and mucositis were observed less often with weekly irinotecan/5-FU/LV than with monthly administration of 5-FU/LV.

TABLE 2. STUDY 1: PERCENT (%) OF PATIENTS EXPERIENCING CLINICALLY RELEVANT ADVERSE EVENTS IN COMBINATION THERAPIES*

Adverse events	Study 1					
	Irinotecan + Bolus 5-FULV weekly x 4 q 6 weeks N=225		Bolus 5-FULV daily x 5 q 6 weeks N=219		Irinotecan weekly x 4 q 6 weeks N=223	
	Grade 1-4	Grade 3-4	Grade 1-4	Grade 3-4	Grade 1-4	Grade 3-4
Total adverse events	100	53.3	100	45.7	99.6	45.7
Gastrointestinal						
Diarrhea	84.9	22.7	69.4	13.2	83	31
grade 3	—	15.1	—	5.9	—	18.4
grade 4	—	7.6	—	7.3	—	12.6
Nausea	45.8	4.9	31.5	1.4	43	6.7
Vomiting	79.1	15.6	67.6	8.2	81.6	16.1
Abdominal pain	63.1	14.6	50.2	11.5	67.7	13
Anorexia	60.4	9.7	46.1	4.1	62.8	12.1
Constipation	34.2	5.8	42	3.7	43.9	7.2
Mucositis	41.3	3.1	31.5	1.8	32.3	0.4
Hematologic						
Neutropenia	96.9	53.8	98.6	66.7	96.4	31.4
grade 3	—	29.8	—	23.7	—	19.3
grade 4	—	24	—	42.5	—	12.1
Leukopenia	96.9	37.8	98.6	23.3	96.4	21.5
Anemia	96.9	8.4	98.6	5.5	96.9	4.5
Neutropenic fever	—	7.1	—	14.6	—	5.8
Thrombocytopenia	96	2.6	98.6	2.7	96	1.7
Neutropenic						

infection	-	1.8	-	0	-	2.2
Body as a whole						
Asthenia	70.2	19.5	64.4	11.9	60.1	13.9
Pain	30.7	9.1	26.9	3.6	22.9	2.2
Fever	42.2	1.7	32.4	3.6	43.5	0.4
Infection	22.2	0	16	1.4	13.9	0.4
Metabolic and Nutritional						
↑ Bilirubin	87.6	7.1	92.2	8.2	83.9	7.2
Dermatologic						
Exfoliative dermatitis	0.9	0	3.2	0.5	0	0
Rash	19.1	0	26.5	0.9	14.3	0.4
Alopecia*	43.1	-	26.5	-	46.1	-
Respiratory						
Dyspnea	27.6	6.3	16	0.5	22	2.2
Cough	26.7	1.3	18.3	0	20.2	0.4
Pneumonia	6.2	2.7	1.4	1	3.6	1.3
Neurologic						
Dizziness	23.1	1.3	16.4	0	21.1	1.8
Somnolence	12.4	1.8	4.6	1.8	9.4	1.3
Confusion	7.1	1.8	4.1	0	2.7	0
Cardiovascular						
Vasodilation	9.3	0.9	5	0	9	0
Hypotension	5.8	1.3	2.3	0.5	5.8	1.7
Thromboembolic events†	9.3	-	11.4	--	5.4	-

* Severity of adverse events based on NCI CTC (version 1.0).

† Complete hair loss = Grade 2.

‡ Includes angina pectoris, arterial thrombosis, cerebral infarct, cerebrovascular accident, deep thromboembolism, embolus lower extremity, heart arrest, myocardial infarct, myocardial ischemia, peripheral vascular disorder, pulmonary embolus, sudden death, thromboembolism, thrombosis, vascular disorder.

TABLE 3. STUDY 2: PERCENT (%) OF PATIENTS EXPERIENCING CLINICALLY RELEVANT ADVERSE EVENTS IN COMBINATION THERAPIES*

Adverse events	Study 2			
	Irinotecan + 5-FU/LV infusion d 1 & 2 q 2 weeks N=145		5-FU/LV infusion d 1 & 2 q 2 weeks N=143	
	Grade 1-4	Grade 3-4	Grade 1-4	Grade 3-4
Total adverse events	100	72.4	100	39.2
Gastrointestinal				
Diarrhea				
Iste	72.4	14.4	44.8	6.3
grade 3	-	10.3	-	4.2
grade 4	-	4.1	-	2.1
Cholinergic syndrome‡	28.3	1.4	0.7	0
Nausea	66.9	2.1	55.2	3.5
Abdominal pain	17.2	2.1	16.8	0.7
Vomiting	44.8	3.5	32.2	2.8
Anorexia	35.2	2.1	18.9	0.7
Constipation	30.3	0.7	25.2	1.4
Mucositis	40	4.1	28.7	2.8
Hematologic				
Neutropenia	82.5	46.2	47.9	13.4
grade 3	-	36.4	-	12.7
grade 4	-	9.8	-	0.7
Leukopenia	81.3	17.4	42	3.5
Anemia	97.2	2.1	90.9	2.1
Neutropenic fever	-	3.4	-	0.7
Thrombocytopenia	32.6	0	32.2	0
Neutropenic infection	-	2.1	-	0
Body as a whole				
Asthenia	57.9	9	48.3	4.2
Pain	64.1	9.7	61.5	8.4
Fever	22.1	0.7	25.9	0.7
Infection	35.9	7.6	33.6	3.5
Metabolic and Nutritional				
↑ Bilirubin	19.1	3.5	35.9	10.6
Dermatologic				
Hand and foot syndrome	10.3	0.7	12.6	0.7
Cutaneous signs§	17.2	0.7	20.3	0
Alopecia*	56.6	--	16.8	-
Respiratory				
Dyspnea	9.7	1.4	4.9	0
Cardiovascular				
Hypotension	3.4	1.4	0.7	0
Thromboembolic events†	11.7	--	5.6	-

* Severity of adverse events based on NCI CTC (version 1.0).

† Includes rhinitis, increased salivation, miosis, lacrimation, diaphoresis, flushing, abdominal cramping or diarrhea (occurring during or shortly after infusion of irinotecan).

‡ Complete hair loss = Grade 2.

§ Includes angina pectoris, arterial thrombosis, cerebral infarct, cerebrovascular accident, deep thromboembolism, embolus lower extremity, heart arrest, myocardial infarct, myocardial ischemia, peripheral vascular disorder, pulmonary embolus, sudden death, thromboembolism, thrombosis, vascular disorder.

Tables 2 and 3 list the clinically relevant adverse events reported in studies 1 and 2, respectively.

Second-line single-agent therapy

Weekly dosage schedule

In three clinical studies evaluating the weekly dosage schedule, 304 patients with metastatic carcinoma of the colon or rectum that had recurred or progressed following 5-FU based therapy were treated with irinotecan. Seventeen of the patients died within 30 days of the administration of irinotecan; in five cases (1.6%, 5/304), the deaths were potentially drug-related. These five patients experienced a constellation of medical events that included known effects of irinotecan. One of these patients died of neutropenic sepsis without fever. Neutropenic fever occurred in nine (3.0%) other patients; these patients recovered with supportive care. One hundred nineteen (39.1%) of the 304 patients were hospitalized a total of 156 times because of adverse events; 81 (26.6%) patients were hospitalized for events judged to be related to administration of irinotecan. The primary reasons for drug-related hospitalization were diarrhea, with or without nausea and/or vomiting (18.4%); neutropenia/leukopenia, with or without diarrhea and/or fever (8.2%); and nausea and/or vomiting (4.9%).

Adjustments in the dose of irinotecan were made during the cycle of treatment and for subsequent cycles based on individual patient tolerance. The first dose of at least one cycle of irinotecan was reduced for 67% of patients who began the studies at the 125 mg/m² starting dose. Within-cycle dose reductions were required for 32% of the cycles initiated at the 125 mg/m² dose level. The most common reasons for dose reduction were late diarrhea, neutropenia, and leukopenia. Thirteen (4.3%) patients discontinued treatment with irinotecan because of adverse events. The adverse events in Table 4 are based on the experience of the 304 patients enrolled in the three studies.

TABLE 4. ADVERSE EVENTS OCCURRING IN >10% OF 304 PREVIOUSLY TREATED PATIENTS WITH METASTATIC CARCINOMA OF THE COLON OR RECTUM*

Body System and Event	% of Patients Reporting	
	NCI Grades 1-4	NCI Grades 3 & 4
Gastrointestinal		
Diarrhea (late)*	88	31
7-9 stools/day (grade 3)	-	16
≥10 stools/day (grade 4)	-	14
Nausea	86	17
Vomiting	67	12
Anorexia	55	6
Diarrhea (early)†	51	8
Constipation	30	2
Fatulence	12	0
Stomatitis	12	1
Dyspepsia	10	0
Hematologic		
Leukopenia	63	28
Anemia	60	7
Neutropenia	54	26
<500/mm ³ (grade 3)	-	15
<50/mm ³ (grade 4)	-	12
Body as a whole		
Asthenia	76	12
Abdominal cramping/pain	57	16
Fever	45	1
Pain	24	2
Headache	17	1
Back pain	14	2
Chills	14	0
Minor infection	14	0
Edema	10	1
Abdominal enlargement	10	0
↓ Body weight	30	1
Dehydration	15	4
↑ Alkaline phosphatase	13	4
T SGOT	10	1
Dermatologic		
Alopecia	60	N/A‡
Sweating	16	0
Rash	13	1
Respiratory		
Dyspnea	22	4
↑ Coughing	17	0
Rhinitis	16	0
Neurologic		
Insomnia	19	0
Dizziness	15	0
Cardiovascular		
Vasodilation (flushing)	11	0

* Severity of adverse events based on NCI CTC (version 1.0).

† Occurring >24 hours after administration of irinotecan.

‡ Primarily upper respiratory infections.

§ Not applicable; complete hair loss = NCI grade 2.

Once-Every-3-Week dosage schedule

A total of 535 patients with metastatic colorectal cancer whose disease had recurred or progressed following prior 5-FU therapy participated in the two phase 3 studies: 316 received irinotecan, 129 received 5-FU, and 90 received best supportive care.

Eleven (3.5%) patients treated with irinotecan died within 30 days of treatment. In three cases (1%, 3/316), the deaths were attributed to neutropenic infection, grade 4 diarrhea, and asthenia, respectively. One (0.8%, 1/129) patient treated with 5-FU died within 30 days of treatment; this death was attributed to grade 4 diarrhea.

Hospitalizations due to serious adverse events (whether or not related to study treatment) occurred at least once in 60% (188/316) of patients who received irinotecan, 63% (79/129) who received best supportive care, and 39% (50/129) who

received 5-FU-based therapy. Eight percent of patients treated with irinotecan and 7% treated with 5-FU-based therapy discontinued treatment due to adverse events. Of the 316 patients treated with irinotecan, the most clinically significant adverse events (all grades, 1-4) were diarrhea (84%), alopecia (72%), nausea (70%), vomiting (62%), cholinergic symptoms (47%), and neutropenia (30%). Table 5 lists the grade 3 and 4 adverse events reported in the patients enrolled to all treatment arms of the two studies.

TABLE 5. PERCENT OF PATIENTS EXPERIENCING GRADE 3 & 4 ADVERSE EVENTS IN COMPARATIVE STUDIES OF ONCE-EVERY-3-WEEK IRINOTECAN THERAPY*

Adverse events	Study A		Study B	
	Irinotecan N=189	BSC† N=90	Irinotecan N=127	5-FU N=129
Total grade 3/4 adverse events	79	67	69	54
Gastrointestinal				
Diarrhea	22	6	22	11
Vomiting	14	8	14	5
Nausea	14	3	11	4
Abdominal pain	14	16	9	8
Constipation	10	8	8	6
Anorexia	5	7	6	4
Mucositis	2	1	2	5
Hematologic				
Leukopenia/Neutropenia	22	0	14	2
Anemia	7	6	6	3
Hemorrhage	5	3	1	3
Thrombocytopenia	1	0	4	2
Infection				
without grade				
3/4 neutropenia	8	3	1	4
with grade				
3/4 neutropenia	1	0	2	0
Febrile				
without grade				
3/4 neutropenia	2	1	2	0
with grade				
3/4 neutropenia	2	0	4	2
Body as a whole				
Pain	19	22	17	13
Asthenia	15	19	13	12
Metabolic and nutritional				
Hepatic‡	9	7	9	6
Dermatologic				
Hand & foot syndrome	0	0	0	5
Cutaneous signs§	2	0	1	3
Respiratory*	10	8	5	7
Neurologic	12	13	9	4
Cardiovascular	9	3	4	2
Other	32	28	12	14

* Severity of adverse events base on NCI CTC (version 1.0).

† BSC = best supportive care.

‡ Hepatic includes events such as ascites and jaundice.

§ Cutaneous signs include events such as rash.

* Respiratory includes events such as dyspnea and cough.

† Neurologic includes events such as somnolence.

‡ Cardiovascular includes events such as dysrhythmias, ischemia, and mechanical cardiac dysfunction.

§ Other includes events such as accidental injury, hepatomegaly, syncope, vertigo, and weight loss.

Overview of adverse events

Gastrointestinal

Nausea, vomiting, and diarrhea are common adverse events following treatment with irinotecan and can be severe. When observed, nausea and vomiting usually occur during or shortly after infusion of irinotecan. An increased incidence of late diarrhea was observed in two studies, one using a 3-week schedule and the other using a weekly schedule. In the clinical studies testing the every 3-week dosage schedule, the median time to the onset of late diarrhea was 5 days after irinotecan infusion. In the clinical studies evaluating the weekly dosage schedule, the median time to onset of late diarrhea was 11 days following administration of irinotecan. For patients starting treatment at the 125 mg/m² weekly dose, the median duration of any grade of late diarrhea was 3 days. Among those patients treated at the 125 mg/m² weekly dose who experienced grade 3 or 4 late diarrhea, the median duration of the entire episode of diarrhea was 7 days. The frequency of grade 3 or 4 late diarrhea was somewhat greater in patients starting treatment at 125 mg/m² weekly starting dose (34% [65/193] versus 23% [24/102]; p=0.08). The frequency of grade 3 and 4 late diarrhea by age was significantly greater in patients ≥ 65 years than in patients <65 years (40% [53/133] versus 23% [40/171]; p=0.002). In another study of 183 patients treated on the weekly schedule, the frequency of grade 3 or 4 late diarrhea in patients ≥ 65 years of age was 28.6% [26/91] and in patients <65 years of age was 23.9% [22/92].

In one study of the weekly dosage treatment, the frequency of grade 3 and 4 late diarrhea was significantly greater in male than in female patients (43% [25/58] versus 16% [5/32]; p=0.01), but there were no gender differences in the frequency of grade 3 and 4 late diarrhea in the other two studies of the weekly dosage treatment schedule. Colonic ulceration, sometimes with gastrointestinal bleeding, has been observed in association with administration of irinotecan.

Hematology

Irinotecan commonly causes neutropenia, leukopenia (including lymphocytopenia), and anemia. Serious thrombocytopenia is uncommon. When evaluated in the trials of weekly administration, the frequency of grade 3 and 4 neutropenia was significantly higher in patients who received previous pelvic/abdominal irradiation than in those who had not received such irradiation (48% [13/27] versus 24% [67/277]; p=0.04). In these same studies, patients with baseline serum total bilirubin levels of 1.0 mg/dL or more also had a significantly greater likelihood of experiencing first-cycle grade 3 or 4 neutropenia than those with bilirubin levels that were less than 1.0 mg/dL (50% [19/38] versus 18% [47/266]; p<0.001). There were no significant differences in the frequency of grade 3 and 4 neutropenia by age or gender.

In the clinical studies evaluating the weekly dosage schedule, NCI grade 3 or 4 liver enzyme abnormalities were observed in fewer than 10% of patients. These events typically occur in patients with known hepatic metastases.

Dermatologic

Alopecia has been reported during treatment with irinotecan. Rashes have also been reported but did not result in discontinuation of treatment.

Respiratory

Severe pulmonary events are infrequent. In the clinical studies evaluating the weekly dosage schedule, NCI grade 3 or 4 dyspnea was reported in 4% of patients. Over half the patients with dyspnea had lung metastases; the extent to which malignant pulmonary involvement or other preexisting lung disease may have contributed to dyspnea in these patients is unknown.

Interstitial pulmonary disease presenting as pulmonary infiltrates is uncommon during irinotecan therapy. Interstitial pulmonary disease can be fatal. Risk factors possibly associated with the development of interstitial pulmonary disease include pre-existing lung disease, use of pneumotoxic drugs, radiation therapy, and colony stimulating factors.

Patients with risk factors should be closely monitored for respiratory symptoms before and during irinotecan therapy.

Neurologic

Insomnia and dizziness can occur, but are not usually considered to be directly related to the administration of irinotecan. Dizziness may sometimes represent symptomatic evidence of orthostatic hypotension in patients with dehydration.

