

HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use SORAFENIB TABLETS safely and effectively. See full prescribing information for SORAFENIB TABLETS.

SORAFENIB tablets, for oral use

Initial U.S. Approval: 2005

INDICATIONS AND USAGE

Sorafenib tablets are a kinase inhibitor indicated for the treatment of

- Unresectable hepatocellular carcinoma (1.1)
- Advanced renal cell carcinoma (1.2)
- Locally recurrent or metastatic, progressive, differentiated thyroid carcinoma (DTC) refractory to radioactive iodine treatment (1.3)

DOSAGE AND ADMINISTRATION

The recommended dosage is 400 mg orally twice daily without food. (2.1)

DOSAGE FORMS AND STRENGTHS

Tablets: 200 mg (3)

CONTRAINDICATIONS

- Sorafenib tablets are contraindicated in patients with known severe hypersensitivity to sorafenib or any other component of sorafenib tablets. (4)
- Sorafenib tablets in combination with carboplatin and paclitaxel are contraindicated in patients with squamous cell lung cancer. (4)

WARNINGS AND PRECAUTIONS

- **Cardiovascular Events:** Consider temporary or permanent discontinuation of sorafenib tablets. (2.2, 5.1)
- **Hemorrhage:** Discontinue sorafenib tablets if needed. (5.2)
- **Hypertension:** Monitor blood pressure weekly during the first 6 weeks and periodically thereafter. Consider temporary or permanent discontinuation for severe or persistent hypertension despite antihypertensive therapy. (5.3)
- **Dermatologic Toxicities:** Interrupt and/or decrease dose. Discontinue for severe or persistent reactions, or if Stevens-Johnson syndrome and toxic epidermal necrolysis is suspected. (5.4)

- **Gastrointestinal Perforation:** Discontinue sorafenib tablets. (5.5)
- **Risk of Impaired Wound Healing:** Withhold sorafenib tablets for at least 10 days prior to elective surgery. Do not administer for at least 2 weeks following major surgery and until adequate wound healing. The safety of resumption of Sorafenib tablets after resolution of wound healing complications has not been established. (5.7)
- **QT Prolongation:** Monitor electrocardiograms and electrolytes in patients at increased risk for ventricular arrhythmias. Correct electrolytes. Interrupt if QTc greater than 500 msec or increases greater than 60 msec from baseline. (2.2, 5.9, 12.2)
- **Drug-Induced Liver Injury:** Monitor liver function tests regularly; discontinue for unexplained transaminase elevations. (5.10)
- **Embryo-Fetal Toxicity:** Sorafenib may cause fetal harm. Advise patients of the potential risk to a fetus and to use effective contraception. (5.11, 8.1, 8.3)
- **Impairment of Thyroid Stimulating Hormone Suppression (TSH) in DTC:** Monitor TSH monthly and adjust thyroid replacement therapy in patients with thyroid cancer. (5.12)

ADVERSE REACTIONS

The most common adverse reactions ($\geq 20\%$) are diarrhea, fatigue, infection, alopecia, hand-foot skin reaction, rash, weight loss, decreased appetite, nausea, gastrointestinal and abdominal pains, hypertension, and hemorrhage. (6)

To report SUSPECTED ADVERSE REACTIONS, contact Torrent Pharma Inc. at 1-800-912-9561 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS

- Strong CYP3A Inducers: Avoid strong CYP3A4 inducers. (7.1)

USE IN SPECIFIC POPULATIONS

- **Lactation:** Advise women not to breastfeed. (8.2)

See 17 for PATIENT COUNSELING INFORMATION and FDA-Approved Patient Labeling

Revised: 9/2023

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FULL PRESCRIBING INFORMATION

1 INDICATIONS AND USAGE

1.1 Hepatocellular Carcinoma

Sorafenib tablets are indicated for the treatment of patients with unresectable hepatocellular carcinoma (HCC).

1.2 Renal Cell Carcinoma

Sorafenib tablets are indicated for the treatment of patients with advanced renal cell carcinoma (RCC).

1.3 Differentiated Thyroid Carcinoma

Sorafenib tablets are indicated for the treatment of patients with locally recurrent or metastatic, progressive, differentiated thyroid carcinoma (DTC) that is refractory to radioactive iodine treatment.

2 DOSAGE AND ADMINISTRATION

2.1 Recommended Dosage

The recommended dosage of sorafenib tablets are 400 mg orally twice daily without food (at least 1 hour before or 2 hours after a meal) until the patient is no longer clinically benefiting from therapy or until unacceptable toxicity.

2.2 Dosage Modifications for Adverse Reactions

Recommended Dosage Modifications

The recommended dosage modifications for adverse reactions are provided in Tables 1, 2, and 3.

Table 1: Recommended Dose Reductions for Adverse Reactions

Dose Reduction	Hepatocellular Carcinoma and Renal Cell Carcinoma	Differentiated Thyroid Carcinoma
First Dose Reduction	400 mg orally once daily	400 mg orally in the morning and 200 mg orally in the evening about 12 hours apart OR 200 mg orally in the morning and 400 mg orally in the evening about 12 hours apart
Second Dose Reduction	200 mg orally once daily OR 400 every other day	200 mg orally twice daily

Third Dose Reduction	None	200 mg orally once daily
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Table 2: Recommended Dosage Modifications of Sorafenib Tablets for Adverse Reactions

Adverse Reaction	Severity ¹	Sorafenib Tablets Dosage Modification
Cardiovascular Events [see <i>Warnings and Precautions (5.1)</i>]		
Cardiac Ischemia and/or Infarction	Grade 2 and above	Permanently discontinue.
Congestive Heart Failure	Grade 3	Interrupt ² until Grade 1 or less, resume at reduced dose by 1 dose level. ³
	Grade 4	Permanently discontinue.
Hemorrhage [see <i>Warnings and Precautions (5.2)</i>]	Grade 2 and above requiring medical intervention	Permanently discontinue.
Hypertension [see <i>Warnings and Precautions (5.3)</i>]	Grade 2 (symptomatic/persistent) OR Grade 2 symptomatic increase by greater than 20 mm Hg (diastolic) or greater than 140/90 mm Hg if previously within normal limits OR Grade 3	Interrupt until symptoms resolve and diastolic blood pressure less than 90 mm Hg, then resume at reduced dose by 1 dose level. ³ If needed, reduce another dose level. ³
	Grade 4	Permanently discontinue.
Gastrointestinal Perforation [see <i>Warnings and Precautions (5.5)</i>]	Any grade	Permanently discontinue.
QT Interval Prolongation [see <i>Warnings and Precautions (5.9)</i>]	Greater than 500 milliseconds OR Increase from baseline of 60 milliseconds or greater	Interrupt and correct electrolyte abnormalities (magnesium, potassium, calcium). Use medical judgement before restarting.

Drug-Induced Liver Injury [<i>see Warnings and Precautions (5.10)</i>]	Grade 3 ALT or higher in the absence of another cause ⁴ OR AST/ALT greater than 3 × upper limit normal (ULN) with bilirubin greater than 2 × ULN in the absence of another cause ⁴	Permanently discontinue.
Non-hematological toxicities [<i>see Adverse Reactions (6.1)</i>]	Grade 2	Continue treatment at reduced dose by 1 dose level.
	Grade 3	
	1 st occurrence	Interrupt until Grade 2 or less, then resume at reduced dose by 1 dose level.
	No improvement within 7 days OR 2 nd or 3 rd occurrence	Interrupt until Grade 2 or less, then resume at reduced dose by 2 dose levels.
	4 th occurrence	Interrupt until Grade 2 or less, then resume at reduced dose by 2 dose levels for HCC and RCC or 3 dose levels for DTC.
Grade 4	Permanently discontinue.	

¹ Adverse reactions graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).
² If no recovery after 30 day interruption, discontinue treatment unless the patient is deriving clinical benefit.
³ If more than 2 dose reductions are required, permanently discontinue treatment.
⁴ In addition, any grade increased alkaline phosphatase in the absence of known bone pathology and Grade 2 or worse increased bilirubin; any 1 of the following: INR of 1.5 or greater, ascites and/or encephalopathy in the absence of underlying cirrhosis or other organ failure considered to be due to drug-induced liver injury.

Table 3: Recommended Dosage Modifications for Dermatologic Toxicities

Dermatologic Toxicity Grade	Occurrence	Sorafenib tablets Dosage Modification	
		Hepatocellular and Renal Cell Carcinoma	Differentiated Thyroid Carcinoma
Grade 2: Painful erythema and swelling of the	1 st occurrence	Continue sorafenib tablets and consider topical therapy for symptomatic relief.	Decrease sorafenib tablets to 600 mg daily. If no

hands or feet and/or discomfort affecting the patient's normal activities		If no improvement within 7 days, see below.	improvement within 7 days, see below.
	No improvement within 7 days at reduced dose OR 2 nd and 3 rd occurrence	Interrupt sorafenib tablets until resolved or improved to Grade 0 to 1.	Interrupt sorafenib tablets until completely resolved or improved to Grade 1.
		When resuming treatment, decrease dose by 1 dose level.	When resuming treatment, decrease dose by 1 dose level for 2 nd occurrence and 2 doses levels for 3 rd occurrence.
4 th occurrence	Discontinue sorafenib tablets treatment.		
Grade 3: Moist desquamation, ulceration, blistering, or severe pain of the hands or feet, resulting in inability to work or perform activities of daily living	1 st occurrence	Interrupt sorafenib tablets until resolved or improved to Grade 0 to 1	Interrupt sorafenib tablets until completely resolved or improved to Grade 1.
		When resuming treatment, decrease dose by 1 dose level.	When resuming treatment, decrease dose by 1 dose level.
	2 nd occurrence	Interrupt sorafenib tablets until resolved or improved to Grade 0 to 1	Interrupt sorafenib tablets until completely resolved or improved to Grade 1.
		When resuming treatment, decrease dose by 1 dose level.	When resuming treatment, decrease dose by 2 dose levels.
3 rd occurrence	Discontinue sorafenib tablets treatment.		

Following improvement of Grade 2 or 3 dermatologic toxicity to Grade 0 or 1 for at least 28 days on a reduced dose of sorafenib tablets, the dose of sorafenib tablets may be increased 1 dose level from the reduced dose. Approximately 50% of patients requiring a dose reduction for dermatologic toxicity are expected to meet these criteria for resumption of the higher dose and roughly 50% of patients resuming the previous dose are expected to tolerate the higher dose (that is, maintain the higher dose level without recurrent Grade 2 or higher dermatologic toxicity).

3 DOSAGE FORMS AND STRENGTHS

Tablets: 200 mg sorafenib, round biconvex, red film-coated tablets, debossed with "F11" on one side and plain on the other side.

4 CONTRAINDICATIONS

- Sorafenib tablets are contraindicated in patients with known severe hypersensitivity to sorafenib or any other component of sorafenib tablets.
- Sorafenib tablets in combination with carboplatin and paclitaxel are contraindicated in patients with squamous cell lung cancer [see *Warnings and Precautions (5.8)*].

5 WARNINGS AND PRECAUTIONS

5.1 Cardiovascular Events

In the SHARP (HCC) study, the incidence of cardiac ischemia/infarction was 2.7% in sorafenib tablets-treated patients compared with 1.3% in those receiving placebo; in the TARGET (RCC) study, the incidence of cardiac ischemia/infarction was higher in the sorafenib tablets-treated group (2.9%) compared with patients receiving placebo (0.4%), and in the DECISION (DTC) study, the incidence of cardiac ischemia/infarction was 1.9% in the sorafenib tablets-treated group compared with 0% in patients receiving placebo. Patients with unstable coronary artery disease or recent myocardial infarction were excluded from this study. In multiple clinical trials, congestive heart failure has been reported in 1.9% of sorafenib tablets-treated patients (N=2,276) [see *Adverse Reactions (6.2)*].

Consider temporary or permanent discontinuation of sorafenib tablets in patients who develop cardiovascular events [see *Dosage and Administration (2.2)*].

5.2 Hemorrhage

An increased risk of bleeding may occur following sorafenib tablets administration. In the SHARP (HCC) study, the rates of bleeding from esophageal varices (2.4% and 4%) and of bleeding with a fatal outcome from any site (2.4% and 4%) were similar in sorafenib tablets-treated patients and those receiving placebo, respectively. In the TARGET (RCC) study, bleeding was reported in 15.3% of patients in the sorafenib tablets-treated group and 8.2% of patients receiving placebo. The incidence of Grade 3 and 4 bleeding was 2% and 0%, respectively, in sorafenib tablets-treated patients, and 1.3% and 0.2%, respectively, in those receiving placebo. There was one fatal hemorrhage in each treatment group in the TARGET (RCC) study. In the DECISION (DTC) study, bleeding was reported in 17.4% of sorafenib tablets-treated patients and 9.6% of those receiving placebo; however, the incidence of Grade 3 bleeding was similar (1% and 1.4%) in sorafenib tablets-treated patients and in those receiving placebo.

If any bleeding necessitates medical intervention, consider permanent discontinuation of sorafenib tablets [see *Dosage and Administration (2.2)*]. Due to the potential risk of bleeding, treat tracheal, bronchial, and esophageal infiltration with local therapy prior to administering sorafenib tablets in patients with DTC.

5.3 Hypertension

In the SHARP (HCC) study, hypertension was reported in 9.4% of sorafenib tablets-treated patients and 4.3% of patients receiving placebo. In the TARGET (RCC) study, hypertension was reported in 16.9% of sorafenib tablets-treated patients and 1.8% of patients receiving placebo. In the DECISION (DTC) study, hypertension was reported in 40.6% of sorafenib tablets-treated patients and 12.4% of patients receiving placebo. Hypertension was usually mild to moderate, occurred early in the course of treatment, and was managed with standard antihypertensive therapy. Permanent discontinuation due to hypertension occurred in 1 of 297 sorafenib tablets-treated patients in the SHARP (HCC) study, 1 of 451 sorafenib tablets-treated patients in the TARGET (RCC) study, and 1 of 207 sorafenib tablets-treated patients in the DECISION (DTC) study.

Monitor blood pressure weekly during the first 6 weeks of sorafenib tablets. Thereafter, monitor blood pressure and treat hypertension, if required, in accordance with standard medical practice. In cases of severe or persistent hypertension despite institution of antihypertensive therapy, consider temporary or permanent discontinuation of sorafenib tablets [see *Dosage and Administration (2.2)*].

5.4 Dermatologic Toxicities

Hand-foot skin reaction and rash represent the most common adverse reactions attributed to sorafenib tablets. Rash and hand-foot skin reaction are usually Grade 1 and 2 and generally appear during the first six weeks of treatment with sorafenib tablets. Permanent discontinuation of therapy due to hand-foot skin reaction occurred in 4 (1.3%) of 297 sorafenib tablets-treated patients with HCC, 3 (0.7%) of 451 sorafenib tablets-treated patients with RCC, and 11 (5.3%) of 207 sorafenib tablets-treated patients with DTC.

Management of dermatologic toxicities may include topical therapies for symptomatic relief, temporary treatment interruption and/or dose reduction of sorafenib tablets, or in severe or persistent cases, permanent discontinuation of sorafenib tablets [see *Dosage and Administration (2.2)*].

There have been reports of severe dermatologic toxicities, including Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN). These cases may be life-threatening. Discontinue sorafenib tablets if SJS or TEN are suspected.

5.5 Gastrointestinal Perforation

Gastrointestinal perforation has been reported in less than 1% of patients taking sorafenib tablets. In some cases this was not associated with apparent intra-abdominal tumor. In the event of a gastrointestinal perforation, permanently discontinue sorafenib tablets.

5.6 Increased Risk of Bleeding with Concomitant Use of Warfarin

Infrequent bleeding or elevations in the International Normalized Ratio (INR) have been reported in some patients taking warfarin while on sorafenib. Monitor patients taking concomitant warfarin regularly for changes in prothrombin time (PT), INR or clinical bleeding episodes.

5.7 Risk of Impaired Wound Healing

Impaired wound healing can occur in patients who receive drugs that inhibit the VEGF signaling pathway. Therefore, sorafenib has the potential to adversely affect wound healing.

Withhold sorafenib tablets for at least 10 days prior to elective surgery. Do not administer for at least 2 weeks following major surgery and until adequate wound healing. The safety of resumption of sorafenib tablets after resolution of wound healing complications has not been established.

5.8 Increased Mortality Observed with Sorafenib Administered in Combination with Carboplatin/Paclitaxel and Gemcitabine/Cisplatin in Squamous Cell Lung Cancer

In a subset analysis of two randomized controlled trials in chemo-naive patients with Stage IIIB-IV non-small cell lung cancer, patients with squamous cell carcinoma experienced higher mortality with the addition of sorafenib compared to those treated with carboplatin/paclitaxel alone (HR 1.81; 95% CI 1.19, 2.74) and gemcitabine/cisplatin alone (HR 1.22; 95% CI 0.82, 1.80). The use of sorafenib in combination with carboplatin/paclitaxel is contraindicated in patients with squamous cell lung cancer. Sorafenib in combination with gemcitabine/cisplatin is not recommended in patients with squamous cell lung cancer. The safety and effectiveness of sorafenib has not been established in patients with non-small cell lung cancer.

5.9 QT Interval Prolongation

Sorafenib can prolong the QT/QTc interval. QT/QTc interval prolongation increases the risk for ventricular arrhythmias.

Avoid sorafenib tablets in patients with congenital long QT syndrome. Monitor electrolytes and electrocardiograms in patients with congestive heart failure, bradyarrhythmias, drugs known to prolong the QT interval, including Class Ia and III antiarrhythmics. Correct electrolyte abnormalities (magnesium, potassium, calcium). Interrupt sorafenib tablets if QTc interval is greater than 500 milliseconds or for an increase from baseline of 60 milliseconds or greater [*see Clinical Pharmacology (12.2)*].

5.10 Drug-Induced Liver Injury

Sorafenib-induced hepatitis is characterized by a hepatocellular pattern of liver damage with significant increases of transaminases which may result in hepatic failure and death. Increases in bilirubin and INR may also occur. The incidence of severe drug-induced liver injury, defined as elevated transaminase levels above 20 times the upper limit of normal or transaminase elevations with significant clinical sequelae (for example, elevated INR, ascites, fatal, or transplantation), was two of 3,357 patients (0.06%) in a global monotherapy database.

Monitor liver function tests regularly. In case of significantly increased transaminases without alternative explanation, such as viral hepatitis or progressing underlying malignancy, discontinue sorafenib tablets [*see Dosage and Administration (2.2)*].

5.11 Embryo-Fetal Toxicity

Based on its mechanism of action and findings in animals, sorafenib tablets may cause fetal harm when administered to a pregnant woman. Sorafenib caused embryo-fetal toxicities in animals at maternal exposures that were significantly lower than the human exposures at the recommended dose of 400 mg twice daily. Advise pregnant women and females of reproductive potential of the potential risk to a fetus. Advise females of reproductive potential to use effective contraception during treatment and for 6 months following the last dose of sorafenib tablets. Advise male patients with female partners of reproductive potential and pregnant partners to use effective contraception during treatment and for 3 months following the last dose of sorafenib tablets [*see Use in Specific Populations (8.1, 8.3)*].

5.12 Impairment of Thyroid Stimulating Hormone Suppression in Differentiated Thyroid Carcinoma

Sorafenib impairs exogenous thyroid suppression. In the DECISION (DTC) study, 99% of patients had a baseline thyroid stimulating hormone (TSH) level less than 0.5 mU/L. Elevation of TSH level above 0.5 mU/L was observed in 41% of sorafenib tablets-treated patients as compared with 16% of those receiving placebo patients. For patients with impaired TSH suppression while receiving sorafenib, the median maximal TSH was 1.6 mU/L and 25% had TSH levels greater than 4.4 mU/L.

Monitor TSH levels monthly and adjust thyroid replacement medication as needed in patients with DTC.

6 ADVERSE REACTIONS

The following clinically significant adverse reactions are discussed elsewhere in the labeling:

- Cardiovascular events [*see Warnings and Precautions (5.1)*]
- Hemorrhage [*see Warnings and Precautions (5.2)*]
- Hypertension [*see Warnings and Precautions (5.3)*]
- Dermatologic toxicities [*see Warnings and Precautions (5.4)*]

- Gastrointestinal perforation [see Warnings and Precautions (5.5)]
- QT interval prolongation [see Warnings and Precautions (5.9) and Clinical Pharmacology (12.2)]
- Drug-induced liver injury [see Warnings and Precautions (5.10)]
- Impairment of TSH suppression in DTC [see Warnings and Precautions (5.12)]

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

The data described reflect exposure to sorafenib tablets in 955 patients who participated in placebo-controlled studies in hepatocellular carcinoma (N=297), advanced renal cell carcinoma (N=451), or differentiated thyroid carcinoma (N = 207). The most common adverse reactions ($\geq 20\%$), which were considered to be related to sorafenib tablets, in patients with HCC, RCC or DTC are diarrhea, fatigue, infection, alopecia, hand-foot skin reaction, rash, weight loss, decreased appetite, nausea, gastrointestinal and abdominal pains, hypertension, and hemorrhage.

Hepatocellular Carcinoma

Table 4 shows the percentage of patients in the SHARP (HCC) study experiencing adverse reactions that were reported in at least 10% of patients and at a higher rate in the Sorafenib tablets-treated group than in those receiving placebo.

Table 4: Adverse Reactions Reported in at Least 10% of Patients and at a Higher Rate in Sorafenib Tablets Arm than the Placebo Arm – SHARP (HCC)

Adverse Reaction ¹	Sorafenib Tablets N=297			Placebo N=302		
	All Grades %	Grade 3 %	Grade 4 %	All Grades %	Grade 3 %	Grade 4 %
Any Adverse Reaction	98	39	6	96	24	8
Gastrointestinal						
Diarrhea	55	10	<1	25	2	0
Anorexia	29	3	0	18	3	<1
Nausea	24	1	0	20	3	0
Vomiting	15	2	0	11	2	0

Constipation	14	0	0	10	0	0
Constitutional symptoms						
Fatigue	46	9	1	45	12	2
Weight loss	30	2	0	10	1	0
Pain						
Pain, abdomen	31	9	0	26	5	1
Dermatology/skin						
Hand-foot skin reaction	21	8	0	3	<1	0
Rash/desquamation	19	1	0	14	0	0
Alopecia	14	0	0	2	0	0
Pruritus	14	<1	0	11	<1	0
Dry Skin	10	0	0	6	0	0
Hepatobiliary/pancreas						
Liver dysfunction	11	2	1	8	2	1

¹Adverse reactions graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).

Hypertension was reported in 9% of patients treated with sorafenib tablets and 4% of those receiving placebo. Grade 3 hypertension was reported in 4% of sorafenib tablets-treated patients and 1% of those receiving placebo.

Hemorrhage/bleeding was reported in 18% of those receiving sorafenib tablets and 20% of patients receiving placebo. The rates of Grade 3 and 4 bleeding were also higher in patients receiving placebo (Grade 3 to 3% sorafenib tablets and 5% placebo and Grade 4 to 2% sorafenib tablets and 4% placebo). Bleeding from esophageal varices was reported in 2.4% in sorafenib tablets-treated patients and 4% of patients receiving placebo.

Renal failure was reported in <1% of patients treated with sorafenib tablets and 3% of patients receiving placebo. Clinical pancreatitis was reported in 1 of 297 sorafenib tablets-treated patients (Grade 2).

The rate of adverse reactions (including those associated with progressive disease) resulting in permanent discontinuation was similar in both the sorafenib tablets-treated patients and those receiving placebo (32% of sorafenib tablets-treated patients and 35% of patients receiving placebo).

Laboratory test abnormalities reported in SHARP are presented in Table 5.

Table 5: Laboratory Test Abnormalities Reported in SHARP (HCC)

Laboratory Parameter ¹	Sorafenib Tablets N=297		Placebo N=302	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Hypoalbuminemia	59	0	47	0
Elevated Lipase	40	9	37	9
Lymphopenia	47	NR	42	NR
Thrombocytopenia	46	4	41	<1
Elevated INR	42	4	34	2
Hypophosphatemia	35	11	11	2
Elevated Amylase	34	2	29	2
Hypocalcemia	27	2.4	15	1
Hypokalemia	10	<1	6	<1

¹ Laboratory parameters graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).

NR = not reported

Renal Cell Carcinoma

Table 6 shows the percentage of patients in the TARGET (RCC) study experiencing adverse reactions that were reported in at least 10% of patients and at a higher rate in sorafenib tablets-treated patients arm than in those receiving placebo.

The rate of adverse reactions (including those associated with progressive disease) resulting in permanent discontinuation was similar in both the sorafenib tablets-treated patients and patients receiving placebo (10% and 8%, respectively).

Clinical pancreatitis was reported in 3 of 451 sorafenib tablets-treated patients (one Grade 2 and two Grade 4).

Table 6: Adverse Reactions Reported in at Least 10% of Patients and at a Higher Rate in sorafenib tablets Arm than the Placebo Arm – TARGET (RCC)

Adverse Reaction ¹	Sorafenib Tablets N=451			Placebo N=451		
	All Grades %	Grade 3 %	Grade 4 %	All Grades %	Grade 3 %	Grade 4 %
Any Adverse Reactions	95	31	7	86	22	6
Gastrointestinal symptoms						
Diarrhea	43	2	0	13	<1	0
Nausea	23	<1	0	19	<1	0
Anorexia	16	<1	0	13	1	0
Vomiting	16	<1	0	12	1	0
Constipation	15	<1	0	11	<1	0
Dermatology/skin						
Rash/desquamation	40	<1	0	16	<1	0
Hand-foot skin reaction	30	6	0	7	0	0
Alopecia	27	<1	0	3	0	0
Pruritus	19	<1	0	6	0	0
Dry skin	11	0	0	4	0	0
Constitutional symptoms						
Fatigue	37	5	<1	28	3	<1
Weight loss	10	<1	0	6	0	0
Cardiovascular, General						
Hypertension	17	3	<1	2	<1	0
Hemorrhage/bleeding						
Hemorrhage – all sites	15	2	0	8	1	<1
Pulmonary						

Dyspnea	14	3	<1	12	2	<1
Neurology						
Neuropathy-sensory	13	<1	0	6	<1	0
Pain						
Pain, abdomen	11	2	0	9	2	0
Pain, headache	10	<1	0	6	<1	1
Pain, joint	10	2	0	6	<1	0

¹ Adverse reactions graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).

Laboratory test abnormalities reported in TARGET are presented in Table 7.

Table 7: Laboratory Test Abnormalities Reported in TARGET (RCC)

Laboratory Parameter ¹	Sorafenib Tablets N=451		Placebo N=451	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Hypophosphatemia	45	13	11	3
Anemia	44	2	49	4
Elevated Lipase	41	12	30	7
Elevated Amylase	30	1	23	3
Lymphopenia	23	13	13	7
Neutropenia	18	5	10	2
Thrombocytopenia	12	1	5	0
Hypocalcemia	12	2	8	<1
Hypokalemia	5	1	<1	<1

¹ Laboratory parameters graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).

Differentiated Thyroid Carcinoma

The safety of sorafenib tablets was evaluated in DECISION in 416 patients with locally recurrent or metastatic, progressive differentiated thyroid carcinoma (DTC) refractory to radioactive iodine (RAI) treatment randomized to receive 400 mg twice daily sorafenib tablets (n=207) or matching placebo (n=209) until disease progression or intolerable toxicity in a double-blind trial [see *Clinical Studies (14.3)*]. The data described below reflect a median exposure to sorafenib tablets for 46 weeks (range 0.3 to 135). The population exposed to sorafenib tablets was 50% male, and had a median age of 63 years.

Dose interruptions for adverse reactions were required in 66% of patients receiving sorafenib tablets and dose reductions were required in 64% of patients. Adverse reactions that resulted in treatment discontinuation were reported in 14% of sorafenib tablets-treated patients compared to 1.4% of patients receiving placebo.

Table 8 shows the percentage of DTC patients experiencing adverse reactions at a higher rate in sorafenib tablets-treated patients than in patients receiving placebo in the double-blind phase of the DECISION study. Grade 3 adverse reactions occurred in 53% of sorafenib tablets-treated patients compared to 23% of patients receiving placebo. Grade 4 adverse reactions occurred in 12% of sorafenib tablets-treated patients compared to 7% of patients receiving placebo.

Table 8: Selected Adverse Reactions Occurring at a Higher Incidence in Sorafenib - Treated Patients [Between Arm Difference of $\geq 5\%$ (All Grades)¹ or $\geq 2\%$ (Grades 3 and 4)]

Adverse Reaction	Sorafenib Tablets N = 207		Placebo N = 209	
	All Grades (%)	Grades 3 and 4 (%)	All Grades (%)	Grades 3 and 4 (%)
Skin and subcutaneous tissue disorders				
PPES ⁵	69	19	8	0
Alopecia	67	0	8	0
Rash	35	5	7	0
Pruritus	20	0.5	11	0
Dry skin	13	0.5	5	0
Erythema	10	0	0.5	0
Hyperkeratosis	7	0	0	0
Gastrointestinal disorders				
Diarrhea	68	6	15	1

Adverse Reaction	Sorafenib Tablets N = 207		Placebo N = 209	
	All Grades (%)	Grades 3 and 4 (%)	All Grades (%)	Grades 3 and 4 (%)
Stomatitis ³	24	2	3	0
Nausea	21	0	12	0
Abdominal pain ²	20	1	7	1
Constipation	16	0	8	0.5
Oral pain ⁴	14	0.5	6	0
Vomiting	11	0	3	0
Investigations				
Weight loss	49	6	14	1
General disorders and administration site conditions				
Fatigue	41	5	20	1
Asthenia	12	0	7	0
Pyrexia	11	1	5	0
Vascular disorders				
Hypertension ⁶	41	10	12	2
Metabolism and nutrition disorders				
Decreased appetite	30	2	5	0
Nervous system disorders				
Headache	17	0	6	0
Dysgeusia	6	0	0	0
Musculoskeletal and connective tissue disorders				
Pain in extremity	15	1	7	0
Muscle spasms	10	0	3	0
Respiratory, thoracic and mediastinal disorders				
Dysphonia	13	0.5	3	0
Epistaxis	7	0	1	0
Neoplasms benign, malignant and unspecified				

Adverse Reaction	Sorafenib Tablets N = 207		Placebo N = 209	
	All Grades (%)	Grades 3 and 4 (%)	All Grades (%)	Grades 3 and 4 (%)
Squamous cell carcinoma of skin	3	3	0	0

¹ National Cancer Institute Common Terminology Criteria for Adverse Events Version 3.0

² Includes the following terms: abdominal pain, abdominal discomfort, hepatic pain, esophageal pain, esophageal discomfort, abdominal pain lower, abdominal pain upper, abdominal tenderness, abdominal rigidity

³ Includes the following terms: stomatitis, aphthous stomatitis, mouth ulceration, mucosal inflammation

⁴ Includes the following terms: oral pain, oropharyngeal discomfort, glossitis, burning mouth syndrome, glossodynia

⁵ Palmar-plantar erythrodysesthesia syndrome (Hand-foot skin reaction)

⁶ Includes the following terms: hypertension, blood pressure increased, blood pressure systolic increased

The relative increase for the following laboratory abnormalities observed in sorafenib tablets-treated patients as compared to patients receiving placebo in the DECISION study is similar to that observed in the RCC and HCC studies: lipase, amylase, hypokalemia, hypophosphatemia, neutropenia, lymphopenia, anemia, and thrombocytopenia. Hypocalcemia was more frequent and more severe in patients with DTC, especially those with a history of hypoparathyroidism, compared to patients with RCC or HCC. Other laboratory test abnormalities reported in DECISION are presented in Table 9

Table 9: Laboratory Test Abnormalities Reported in DECISION (DTC)

Laboratory Parameter ¹	Sorafenib Tablets N=207		Placebo N=209	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Elevated ALT	59	4	24	0
Elevated AST	54	2	15	0
Hypocalcemia	36	10	11	3

¹ Laboratory parameters graded according to National Cancer Institute Common Terminology Criteria for Adverse Events version 3.0 (NCI CTCAE v3.0).

Additional Data from Multiple Clinical Trials

The following additional drug-related adverse reactions and laboratory abnormalities were reported from clinical trials of sorafenib tablets (*very common* 10% or greater, *common* 1 to less than 10%, *uncommon* 0.1% to less than 1%, *rare* less than 0.1 %):

Cardiovascular: *Common*: congestive heart failure*†, myocardial ischemia and/or infarction
Uncommon : hypertensive crisis* *Rare*: QT prolongation*

Dermatologic: *Very common*: erythema *Common*: exfoliative dermatitis, acne, flushing, folliculitis, hyperkeratosis *Uncommon*: eczema, erythema multiforme

Digestive: *Very common*: increased lipase, increased amylase *Common*: mucositis, stomatitis (including dry mouth and glossodynia), dyspepsia, dysphagia, gastrointestinal reflux *Uncommon*: pancreatitis, gastritis, gastrointestinal perforations*, cholecystitis, cholangitis

Note that elevations in lipase are very common (41%, see below); a diagnosis of pancreatitis should not be made solely on the basis of abnormal laboratory values

General Disorders: *Very common*: infection, hemorrhage (including gastrointestinal* and respiratory tract* and uncommon cases of cerebral hemorrhage*), asthenia, pain (including mouth, bone, and tumor pain), pyrexia, decreased appetite *Common*: influenza-like illness

Hematologic: *Very common*: leukopenia, lymphopenia *Common*: anemia, neutropenia, thrombocytopenia *Uncommon*: INR abnormal

Hepatobiliary disorders: *Rare*: drug-induced liver injury (including hepatic failure and death)

Hypersensitivity: *Uncommon*: hypersensitivity reactions (including skin reactions and urticaria), anaphylactic reaction

Metabolic and Nutritional: *Very common*: hypophosphatemia *Common*: transient increases in transaminases, hypocalcemia, hypokalemia, hyponatremia, hypothyroidism *Uncommon*: dehydration, transient increases in alkaline phosphatase, increased bilirubin (including jaundice), hyperthyroidism

Musculoskeletal: *Very common*: arthralgia *Common*: myalgia, muscle spasms

Nervous System and Psychiatric: *Common*: depression, dysgeusia *Uncommon*: tinnitus, reversible posterior leukoencephalopathy*

Renal and Genitourinary: *Common*: renal failure, proteinuria *Rare*: nephrotic syndrome

Reproductive: *Common*: erectile dysfunction *Uncommon*: gynecomastia

Respiratory: *Common:* rhinorrhea *Uncommon:* interstitial lung disease-like events (includes reports of pneumonitis, radiation pneumonitis, acute respiratory distress, interstitial pneumonia, pulmonitis and lung inflammation)

In addition, the following medically significant adverse reactions were uncommon during clinical trials of sorafenib tablets: transient ischemic attack, arrhythmia, and thromboembolism. For these adverse reactions, the causal relationship to sorafenib has not been established.

*adverse reactions may have a life-threatening or fatal outcome.

†reported in 1.9% of patients treated with sorafenib tablets (N= 2,276).

6.2 Postmarketing Experience

The following adverse reactions have been identified during postapproval use of sorafenib tablets. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

Blood and lymphatic disorders: Thrombotic microangiopathy (TMA)

Dermatologic: Stevens-Johnson syndrome and toxic epidermal necrolysis (TEN)

Hypersensitivity: Angioedema

Musculoskeletal: Rhabdomyolysis, osteonecrosis of the jaw

Respiratory: Interstitial lung disease-like events (which may have a life-threatening or fatal outcome)

Vascular: Arterial (including aortic) aneurysms, dissections, and rupture

7 DRUG INTERACTIONS

7.1 Effect of Other Drugs on Sorafenib

Strong CYP3A4 Inducers

The concomitant use of Sorafenib with rifampin, a strong CYP3A4 inducer decreased the mean AUC of sorafenib, which may decrease the antitumor activity [see *Clinical Pharmacology (12.3)*]. Avoid concomitant use of sorafenib with strong CYP3A4 inducers, when possible, because these drugs can decrease the systemic exposure to sorafenib.

Neomycin

The concomitant use of sorafenib with neomycin decreased the mean AUC of sorafenib, which may decrease the antitumor activity. Avoid concomitant use of sorafenib with neomycin. The effects of other antibiotics on the pharmacokinetics of sorafenib have not been studied [see *Clinical Pharmacology (12.3)*].

7.2 Concomitant Use of Warfarin

The concomitant use of Sorafenib and warfarin may increase the risk of bleeding or increased the INR. Monitor INR and for clinical bleeding episodes in patients taking warfarin while receiving sorafenib [see *Warnings and Precautions (5.6)*].

7.3 Drugs That Prolong the QT Interval

Sorafenib tablets are associated with QTc interval prolongation. Avoid coadministration of sorafenib tablets with medicinal products with a known potential to prolong QT/QTc interval [see *Warnings and Precautions (5.9)*, *Clinical Pharmacology (12.2)*].

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Risk Summary

Based on findings from animal studies and its mechanism of action [see *Clinical Pharmacology (12.1)*], sorafenib may cause fetal harm when administered to a pregnant woman. There are no available data in pregnant women to inform a drug-associated risk. In animal reproduction studies, oral administration of sorafenib to pregnant rats and rabbits during the period of organogenesis resulted in embryo-fetal toxicities at maternal exposures that were significantly lower than human exposures at the recommended dose of 400 mg twice daily (*see Data*). Advise pregnant women and females of reproductive potential of the potential risk to a fetus.

The background risk of major birth defects and miscarriage for the indicated population is unknown. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2% to 4% and 15% to 20%, respectively.

Data

Animal Data

In animal reproduction studies, sorafenib was teratogenic and induced embryo-fetal toxicity (including increased post-implantation loss, resorptions, skeletal retardations, and retarded fetal weight) when administered orally to pregnant rats and rabbits during the period of organogenesis. The effects occurred at doses considerably below the recommended human dose of 400 mg twice daily (approximately 500 mg/m²/day on a body surface area basis). Adverse intrauterine development effects were seen at doses >0.2 mg/kg/day (1.2 mg/m²/day) in rats and ≥0.3 mg/kg/day (≥3.6 mg/m²/day) in rabbits. These doses result in exposures (AUC) that are approximately 0.008 times the AUC in patients at the recommended dose.

8.2 Lactation

Risk Summary

There are no data on the presence of sorafenib or its metabolites in human milk, or its effects on the breast-fed child or on milk production. Sorafenib was present in milk of lactating rats (*see Data*). Because of the potential for serious adverse reactions in a breastfed child from sorafenib tablets, advise women not to breastfeed during treatment with sorafenib tablets and for 2 weeks after the last dose.

Data

Animal Data

Following administration of radiolabeled sorafenib to lactating Wistar rats, approximately 27% of the radioactivity was secreted into milk. The milk to plasma AUC ratio was approximately 5:1.

8.3 Females and Males of Reproductive Potential

Sorafenib tablets may cause fetal harm when administered to a pregnant woman [*see Use in Specific Populations (8.1)*].

Pregnancy Testing

Verify the pregnancy status of females of reproductive potential prior to the initiation of sorafenib tablets.

Contraception

Females

Advise females of reproductive potential to use effective contraception during treatment and for 6 months following the last dose of sorafenib tablets.

Males

Based on genotoxicity and findings in animal reproduction studies, advise males with female partners of reproductive potential and pregnant partners to use effective contraception during treatment with sorafenib tablets and for 3 months following the last dose of sorafenib tablets [*see Use in Specific Populations (8.1), Nonclinical Toxicology (13.1)*].

Infertility

Males

Based on findings in animal studies, sorafenib may impair fertility in males of reproductive potential [see *Nonclinical Toxicology* (13.1)].

8.4 Pediatric Use

The safety and effectiveness of sorafenib tablets have not been established in pediatric patients.

Juvenile Animal Toxicity Data

Repeat dosing of sorafenib to young and growing dogs resulted in irregular thickening of the femoral growth plate at daily sorafenib doses ≥ 600 mg/m² (approximately 0.3 times the AUC at the recommended human dose), hypocellularity of the bone marrow adjoining the growth plate at 200 mg/m²/day (approximately 0.1 times the AUC at the recommended human dose), and alterations of the dentin composition at 600 mg/m²/day. Similar effects were not observed in adult dogs when dosed for 4 weeks or less.

8.5 Geriatric Use

In total, 59% of HCC patients treated with sorafenib tablets were age 65 years or older and 19% were 75 and older. In total, 32% of RCC patients treated with sorafenib tablets were age 65 years or older and 4% were 75 and older. No differences in safety or efficacy were observed between older and younger patients, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.

8.6 Renal Impairment

No dose adjustment is necessary for patients with mild, moderate or severe renal impairment who are not on dialysis. The pharmacokinetics of sorafenib have not been studied in patients who are on dialysis [see *Clinical Pharmacology* (12.3)].

8.7 Hepatic Impairment

No dose adjustment is necessary for patients with mild or moderate hepatic impairment. The pharmacokinetics of sorafenib have not been studied in patients with severe (Child-Pugh C) hepatic impairment [see *Clinical Pharmacology* (12.3)].

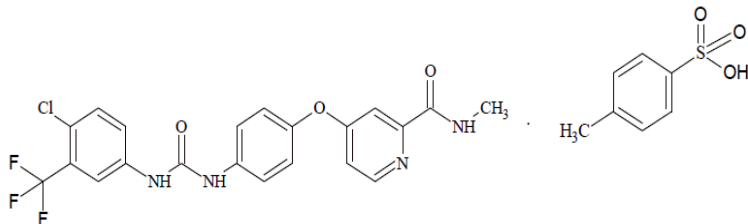
10 OVERDOSAGE

The adverse reactions observed at a dose of 800 mg twice daily (2 times the recommended dose) were primarily diarrhea and dermatologic. No information is available on symptoms of acute overdose in animals because of the saturation of absorption in oral acute toxicity studies conducted in animals.

In cases of suspected overdose, withhold sorafenib tablets and institute supportive care.

11 DESCRIPTION

Sorafenib, a kinase inhibitor, is the tosylate salt of sorafenib. Sorafenib tosylate has the chemical name 4-(4-{3-[4-Chloro-3-(trifluoromethyl)phenyl]ureido}phenoxy)-*N*²-methylpyridine-2 carboxamide mono(4-methylbenzenesulfonate). The molecular formula of sorafenib tosylate is $C_{21}H_{16}ClF_3N_4O_3 \times C_7H_8O_3S$ and the molecular weight of sorafenib tosylate is 637.03 g/mole. Its structural formula is:



Sorafenib tosylate, USP is a White to slightly yellowish to brownish powder. Sorafenib tosylate is practically insoluble in aqueous media and in heptane, slightly soluble in ethanol.

Sorafenib tablets, USP for oral use are supplied as film-coated tablets containing 200 mg sorafenib equivalent to 274 mg sorafenib tosylate, USP and the following inactive ingredients: croscarmellose sodium, hypromellose, magnesium stearate, microcrystalline cellulose, sodium lauryl sulphate, opadry 04F550007 Red. Opadry 04F550007 Red contains Hypromellose, titanium dioxide, polyethylene glycol and ferric oxide red.

FDA approved dissolution test specifications differ from USP.

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

Sorafenib is a kinase inhibitor that decreases tumor cell proliferation *in vitro*. Sorafenib was shown to inhibit multiple intracellular (c-CRAF, BRAF and mutant BRAF) and cell surface kinases (KIT, FLT- 3, RET, RET/PTC, VEGFR-1, VEGFR- 2, VEGFR- 3, and PDGFR- β). Several of these kinases are thought to be involved in tumor cell signaling, angiogenesis and apoptosis. Sorafenib inhibited tumor growth of HCC, RCC, and DTC human tumor xenografts in immunocompromised mice. Reductions in tumor angiogenesis were seen in models of HCC and RCC upon sorafenib treatment, and increases in tumor apoptosis were observed in models of HCC, RCC, and DTC.

12.2 Pharmacodynamics

Cardiac Electrophysiology

The effect of sorafenib tablets 400 mg twice daily on the QTc interval was evaluated in a multi-center, open- label, non-randomized trial in 53 patients with advanced cancer. No large changes

in the mean QTc intervals (that is, >20 ms) from baseline were detected in the trial. After one 28-day treatment cycle, the largest mean QTc interval change of 8.5 ms (upper bound of two-sided 90% confidence interval, 13.3 ms) was observed at 6 hours post-dose on day 1 of cycle 2 [*see Warnings and Precautions (5.9), Drug Interactions (7.3)*].

12.3 Pharmacokinetics

Multiple doses of sorafenib tablets for 7 days resulted in a 2.5- to 7-fold accumulation compared to a single dose. Steady-state plasma sorafenib concentrations were achieved within 7 days, with a peak-to-trough ratio of mean concentrations of less than 2.

The steady-state concentrations of sorafenib following administration of sorafenib tablets 400 mg twice daily were evaluated in DTC, RCC and HCC patients. Patients with DTC have mean steady-state concentrations that are 1.8-fold higher than patients with HCC and 2.3-fold higher than those with RCC. The reason for increased sorafenib concentrations in DTC patients is unknown.

Mean C_{max} and AUC increased less than proportionally beyond oral doses of 400 mg administered twice daily.

Absorption

After administration of sorafenib tablets, the mean relative bioavailability was 38% to 49% when compared to an oral solution. Following oral administration, sorafenib reached peak plasma levels in approximately 3 hours.

Effects of Food

With a moderate-fat meal (30% fat; 700 calories), bioavailability was similar to that in the fasted state. With a high-fat meal (50% fat; 900 calories), bioavailability was reduced by 29% compared to that in the fasted state.

Distribution

In vitro binding of sorafenib to human plasma proteins was 99.5%.

Elimination

The mean elimination half-life of sorafenib was approximately 25 to 48 hours.

Metabolism

Sorafenib undergoes oxidative metabolism by hepatic CYP3A4, as well as glucuronidation by UGT1A9.

Excretion

Sorafenib accounted for approximately 70 to 85% of the circulating analytes in plasma at steady

state. Eight metabolites of sorafenib have been identified, of which 5 have been detected in plasma. The main circulating metabolite of sorafenib, the pyridine N-oxide that comprises approximately 9 to 16% of circulating analytes at steady-state, showed in vitro potency similar to that of sorafenib.

Following oral administration of a 100 mg dose of a solution formulation of sorafenib, 96% of the dose was recovered within 14 days, with 77% of the dose excreted in feces and 19% of the dose excreted in urine as glucuronidated metabolites. Unchanged sorafenib, accounting for 51% of the dose, was found in feces but not in urine.

Specific Populations

A study of the pharmacokinetics of sorafenib indicated that the mean AUC of sorafenib in Asians (N=78) was 30% lower than in Whites (N=40). Sex and age do not have a clinically meaningful effect on the pharmacokinetics of sorafenib.

Patients with Renal Impairment

Mild (CLcr 50 to 80 mL/min), moderate (CLcr 30 to <50 mL/min), and severe (CLcr <30 mL/min) renal impairment do not affect the pharmacokinetics of sorafenib [see *Use in Specific Populations (8.6)*].

Patients with Hepatic Impairment

Mild (Child-Pugh A) and moderate (Child-Pugh B) hepatic impairment do not affect the pharmacokinetics of sorafenib [see *Use in Specific Populations (8.7)*].

Drug Interactions Studies

Effect of Strong CYP3A4 Inhibitors on Sorafenib: Ketoconazole, a strong inhibitor of CYP3A4 and P-glycoprotein, administered at a dose of 400 mg once daily for 7 days did not alter the mean AUC of a single oral dose of sorafenib tablets 50 mg in healthy subjects.

Effect of Strong CYP3A4 Inducers on Sorafenib: Concomitant use of sorafenib tablets with rifampin administered at a dose of 600 mg once daily for 5 days with a single oral dose of sorafenib tablets 400 mg in healthy volunteers resulted in a 37% decrease in the mean AUC of sorafenib.

Effect of Neomycin on Sorafenib: Neomycin administered as an oral dose of 1 g three times daily for 5 days decreased the mean AUC of sorafenib by 54% in healthy subjects administered a single oral dose of sorafenib tablets 400 mg.

Effect of Sorafenib on Other Drugs: Sorafenib tablets 400 mg twice daily for 28 days did not increase the systemic exposure of concomitantly administered midazolam (CYP3A4 substrate), dextromethorphan (CYP2D6 substrate), and omeprazole (CYP2C19 substrate) [see *Clinical Pharmacology (12.3)*].

Drugs that Increase Gastric pH: The aqueous solubility of sorafenib is pH dependent, with higher pH resulting in lower solubility. However, omeprazole, a proton pump inhibitor, administered at a dose of 40 mg once daily for 5 days, did not result in a clinically meaningful change in sorafenib single dose exposure.

In Vitro Studies

Sorafenib competitively inhibited CYP2B6, CYP2C8, CYP2C9, CYP2C19, CYP2D6, and CYP3A4 in vitro. However, sorafenib tablets 400 mg twice daily for 28 days with substrates of CYP3A4, CYP2D6 and CYP2C19 did not increase the systemic exposure of these substrates [see *Drug Interactions (7.3)*].

Sorafenib did not increase CYP1A2 and CYP3A4 activities, suggesting that sorafenib is unlikely to induce CYP1A2 or CYP3A4 in humans.

Sorafenib inhibits glucuronidation by UGT1A1 and UGT1A9 in vitro. Sorafenib tablets could increase the systemic exposure of concomitantly administered drugs that are UGT1A1 or UGT1A9 substrates.

Sorafenib inhibited P-glycoprotein in vitro. Sorafenib tablets could increase the concentrations of concomitantly administered drugs that are P-glycoprotein substrates.

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenicity studies have not been performed with sorafenib. Sorafenib was clastogenic when tested in an in vitro mammalian cell assay (Chinese hamster ovary) in the presence of metabolic activation. Sorafenib was not mutagenic in the in vitro Ames bacterial cell assay or clastogenic in an in vivo mouse micronucleus assay. One intermediate in the manufacturing process, which is also present in the final drug substance (<0.15%), was positive for mutagenesis in an *in vitro* bacterial cell assay (Ames test) when tested independently.

No specific studies with sorafenib have been conducted in animals to evaluate the effect on fertility. However, results from the repeat-dose toxicity studies suggest there is a potential for sorafenib to impair reproductive function and fertility. Multiple adverse effects were observed in male and female reproductive organs, with the rat being more susceptible than mice or dogs. Typical changes in rats consisted of testicular atrophy or degeneration, degeneration of epididymis, prostate, and seminal vesicles, central necrosis of the corpora lutea and arrested follicular development. Sorafenib-related effects on the reproductive organs of rats were manifested at daily oral doses ≥ 5 mg/kg (30 mg/m²). This dose results in an exposure (AUC) that is approximately 0.5 times the AUC in patients at the recommended human dose. Dogs showed tubular degeneration in the testes at 30 mg/kg/day (600 mg/m²/day). This dose results in an exposure that is approximately 0.3 times the AUC at the recommended human dose. Oligospermia was observed in dogs at 60 mg/kg/day (1,200 mg/m²/day) of sorafenib.

14 CLINICAL STUDIES

14.1 Hepatocellular Carcinoma

The SHARP (HCC) study (NCT00105443) was an international, multicenter, randomized, double blind, placebo-controlled trial in patients with unresectable hepatocellular carcinoma. Overall survival was the primary endpoint. A total of 602 patients were randomized; 299 to sorafenib tablets 400 mg twice daily and 303 to matching placebo. All 602 randomized subjects were included in the ITT population for the efficacy analyses.

Demographics and baseline disease characteristics were similar between the sorafenib tablets and placebo arms with regard to age, gender, race, performance status, etiology (including hepatitis B, hepatitis C and alcoholic liver disease), TNM stage (stage I: <1% vs. <1%; stage II: 10.4% vs. 8.3%; stage III: 37.8% vs. 43.6%; stage IV: 50.8% vs. 46.9%), absence of both macroscopic vascular invasion and extrahepatic tumor spread (30.1% vs. 30.0%), and Barcelona Clinic Liver Cancer stage (stage B: 18.1% vs. 16.8%; stage C: 81.6% vs. 83.2%; stage D: <1% vs. 0%). Liver impairment by Child-Pugh score was comparable between the sorafenib tablets and placebo arms (Class A: 95% vs. 98%; B: 5% vs. 2%). Only one patient with Child-Pugh class C was entered. Prior treatments included surgical resection procedures (19.1% vs. 20.5%), locoregional therapies (including radiofrequency ablation, percutaneous ethanol injection and transarterial chemoembolization; 38.8% vs. 40.6%), radiotherapy (4.3% vs. 5.0%) and systemic therapy (3.0% vs. 5.0%).

The trial was stopped for efficacy following a pre-specified second interim analysis for survival showing a statistically significant advantage for sorafenib tablets over placebo for overall survival (HR: 0.69, $p=0.00058$) (see Table 10 and Figure 1). This advantage was consistent across all subsets analyzed.

Final analysis of time to tumor progression (TTP) based on data from an earlier time point (by independent radiologic review) also was significantly longer in the sorafenib tablets arm (HR: 0.58, $p=0.000007$) (see Table 10).

Table 10: Efficacy Results from SHARP (HCC)

Efficacy Parameter	Sorafenib Tablets (N=299)	Placebo (N=303)
Overall Survival		
Number of Events	143	178
Median, months	10.7	7.9
(95% CI)	(9.4, 13.3)	(6.8, 9.1)
Hazard Ratio ¹ (95% CI)	0.69 (0.55, 0.87)	

P-value (log-rank test ²)	0.00058	
Time to Progression³		
Number of Events	107	156
Median, months	5.5	2.8
(95% CI)	(4.1, 6.9)	(2.7, 3.9)
Hazard Ratio ¹ (95% CI)	0.58 (0.45, 0.74)	
P-value (log-rank test ²)	0.000007	

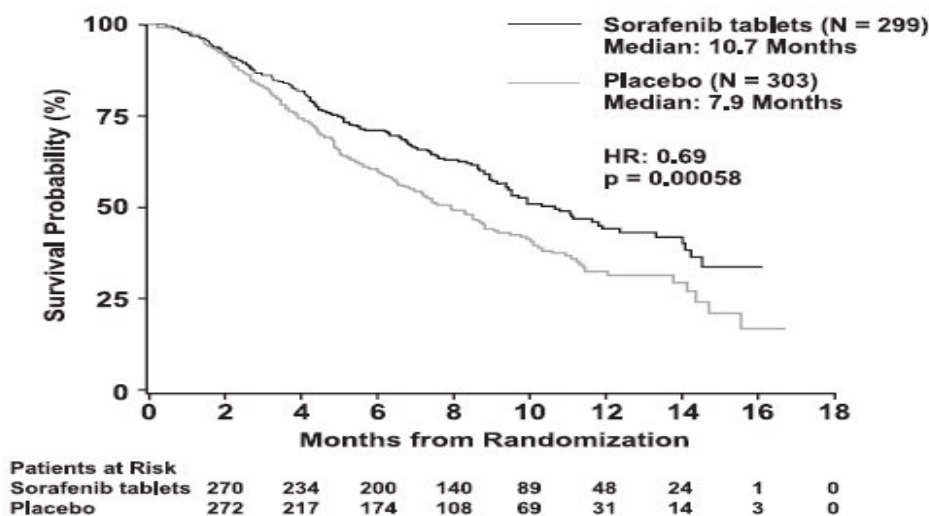
CI=Confidence interval

¹ Hazard ratio, sorafenib/placebo, stratified Cox model

² Stratified log rank (for the interim analysis of survival, the stopping boundary one-sided alpha = 0.0077)

³ The time-to-progression (TTP) analysis, based on independent radiologic review, was based on data from an earlier time point than the survival analysis

Figure 1: Kaplan-Meier Curve of Overall Survival in SHARP (HCC) (Intent-to-Treat Population)



14.2 Renal Cell Carcinoma

The safety and efficacy of sorafenib tablets in the treatment of advanced renal cell carcinoma (RCC) were studied in the following two randomized controlled clinical trials.

TARGET

TARGET (NCT00073307) was an international, multicenter, randomized, double blind, placebo-controlled trial in patients with advanced renal cell carcinoma who had received one prior systemic therapy. Primary study endpoints included overall survival and progression-free survival (PFS). Tumor response rate was a secondary endpoint. The PFS analysis included 769 patients, per protocol, stratified by MSKCC (Memorial Sloan Kettering Cancer Center) prognostic risk category (low or intermediate) and country and randomized to sorafenib tablets 400 mg twice daily (N=384) or to placebo (N=385).

Table 11 summarizes the demographic and disease characteristics of the study population analyzed. Baseline demographics and disease characteristics were well balanced for both treatment groups. The median time from initial diagnosis of RCC to randomization was 1.6 and 1.9 years for the sorafenib tablets and placebo arms, respectively.

Table 11: Demographic and Disease Characteristics – TARGET (RCC)

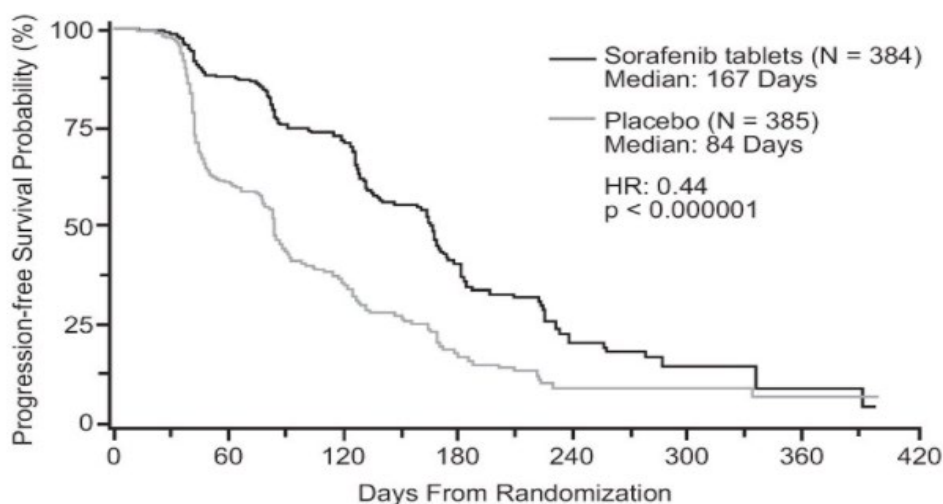
Characteristics	Sorafenib Tablets N=384		Placebo N=385	
	N	(%)	N	(%)
Gender				
Male	267	(70)	287	(75)
Female	116	(30)	98	(25)
Race				
White	276	(72)	278	(73)
Black/Asian/ Hispanic/Other	11	(3)	10	(2)
Not reported ¹	97	(25)	97	(25)
Age group				
< 65 years	255	(67)	280	(73)
≥ 65 years	127	(33)	103	(27)
ECOG performance status at baseline				
0	184	(48)	180	(47)
1	191	(50)	201	(52)
2	6	(2)	1	(<1)
Not reported	3	(<1)	3	(<1)
MSKCC prognostic risk category				

Low	200	(52)	194	(50)
Intermediate	184	(48)	191	(50)
Prior IL-2 and/or interferon				
Yes	319	(83)	313	(81)
No	65	(17)	72	(19)

¹ Race was not collected from the 186 patients enrolled in France due to local regulations. In 8 other patients, race was not available at the time of analysis.

Progression-free survival, defined as the time from randomization to progression or death from any cause, whichever occurred earlier, was evaluated by blinded independent radiological review using RECIST criteria. Figure 2 depicts Kaplan-Meier curves for PFS. The PFS analysis was based on a two-sided Log-Rank test stratified by MSKCC prognostic risk category and country.

Figure 2: Kaplan-Meier Curves for Progression-free Survival – TARGET (RCC)



NOTE: HR is from Cox regression model with the following covariates: MSKCC prognostic risk category and country. P-value is from two-sided Log-Rank test stratified by MSKCC prognostic risk category and country.

The median PFS for patients randomized to Sorafenib tablets was 167 days compared to 84 days for patients randomized to placebo. The estimated hazard ratio (immediate risk of progression or death with sorafenib tablets compared to placebo) was 0.44 (95% CI: 0.35, 0.55).

A series of patient subsets were examined in exploratory univariate analyses of PFS. The subsets included age above or below 65 years, ECOG PS 0 or 1, MSKCC prognostic risk category, whether the prior therapy was for progressive metastatic disease or for an earlier disease setting and time from diagnosis of less than or greater than 1.5 years. The effect of sorafenib tablets on

PFS was consistent across these subsets, including patients with no prior IL-2 or interferon therapy (N=137; 65 patients receiving sorafenib tablets and 72 placebo), for whom the median PFS was 172 days in the sorafenib tablets arm compared to 85 days in the placebo arm.

Tumor response was determined by independent radiologic review according to RECIST criteria. Overall, of 672 patients who were evaluable for response, 7 (2%) patients in the sorafenib tablets and no (0%) patients in the placebo arms had a confirmed partial response. Thus the gain in PFS primarily reflects the stable disease population.

At the time of a planned interim survival analysis, based on 220 deaths, overall survival was longer for those randomized to sorafenib tablets compared with placebo with a hazard ratio of 0.72. This analysis did not meet the prespecified criteria for statistical significance. Additional analyses are planned as the survival data mature.

BAY43-9006

BAY43-9006 (NCT00101413) was a randomized discontinuation trial in patients with metastatic malignancies, including RCC. The primary endpoint was the percentage of randomized patients remaining progression-free at 24 weeks. All patients received sorafenib tablets for the first 12 weeks. Radiologic assessment was repeated at week 12. Patients with <25% change in bi-dimensional tumor measurements from baseline were randomized to sorafenib tablets or placebo for a further 12 weeks. Patients who were randomized to placebo were permitted to cross over to open-label sorafenib tablets upon progression. Patients with tumor shrinkage $\geq 25\%$ continued sorafenib tablets, whereas patients with tumor growth $\geq 25\%$ discontinued treatment.

A total of 202 patients with advanced RCC were enrolled into BAY43-9006, including patients who had received no prior therapy and patients with tumor histology other than clear cell carcinoma. After the initial 12 weeks of sorafenib tablets, 79 patients with RCC continued on open-label sorafenib tablets, and 65 patients were randomized to sorafenib tablets or placebo. After an additional 12 weeks, at week 24, for the 65 randomized patients, the progression-free rate was significantly higher in patients randomized to sorafenib tablets (16/32, 50%) than in patients randomized to placebo (6/33, 18%) ($p=0.0077$). Progression-free survival was significantly longer in the sorafenib tablets arm (163 days) than in the those randomized to placebo (41 days) ($p=0.0001$, HR=0.29).

14.3 Differentiated Thyroid Carcinoma

The safety and effectiveness of sorafenib tablets was evaluated in a multicenter, randomized (1:1), double-blind, placebo-controlled trial (DECISION; NCT00984282) conducted in 417 patients with locally recurrent or metastatic, progressive differentiated thyroid carcinoma (DTC) refractory to radioactive iodine (RAI) treatment. Randomization was stratified by age (< 60 years versus ≥ 60 years) and geographical region (North America, Europe, and Asia). All 417 subjects were included in the ITT population for the efficacy analyses

All patients were required to have actively progressing disease defined as progression within 14 months of enrollment. RAI-refractory disease was defined based on four criteria that were not

mutually exclusive. All RAI treatments and diagnostic scans were to be performed under conditions of a low iodine diet and adequate TSH stimulation. Following are the RAI-refractory criteria and the proportion of patients in the study that met each one: a target lesion with no iodine uptake on RAI scan (68%); tumors with iodine uptake and progression after RAI treatment within 16 months of enrollment (12%); tumors with iodine uptake and multiple RAI treatments with the last treatment greater than 16 months prior to enrollment, and disease progression after each of two RAI treatments administered within 16 months of each other (7%); cumulative RAI dose \geq 600 mCi administered (34%). The major efficacy outcome measure was progression-free survival (PFS) as determined by a blinded, independent radiological review using a modified Response Evaluation Criteria in Solid Tumors v. 1.0 (RECIST). RECIST was modified by inclusion of clinical progression of bone lesions based on the need for external beam radiation (4.4% of progression events). Additional efficacy outcomes measures included overall survival (OS), tumor response rate, and duration of response.

Patients were randomized to receive sorafenib tablets 400 mg twice daily (n=207) or placebo (n=210). Of the 417 patients randomized, 48% were male, the median age was 63 years, 61% were 60 years or older, 60% were white, 62% had an ECOG performance status of 0, and 99% had undergone thyroidectomy. The histological diagnoses were papillary carcinoma in 57%, follicular carcinoma (including Hürthle cell) in 25%, and poorly differentiated carcinoma in 10%, and other in 8% of the study population. Metastases were present in 96% of the patients: lungs in 86%, lymph nodes in 51%, and bone in 27%. The median cumulative RAI activity administered prior to study entry was 400 mCi.

A statistically significant prolongation of PFS was demonstrated for sorafenib tablets-treated patients compared to those receiving placebo (Figure 3); no statistically significant difference was seen in the final overall survival (OS) analysis (Table 12). Crossover to open label sorafenib tablets occurred in 161 (77%) patients randomized to placebo after investigator-determined disease progression

Table 12: Efficacy Results from DECISION in Differentiated Thyroid Carcinoma

	Sorafenib Tablets N=207	Placebo N=210
Progression-free Survival¹		
Number of Deaths or Progression	113 (55%)	136 (65%)
Median PFS in Months (95% CI)	10.8 (9.1, 12.9)	5.8 (5.3, 7.8)
Hazard Ratio (95% CI)	0.59 (0.46, 0.76)	
P-value ²	<0.001	
Overall Survival³		
Number of Deaths	103 (49.8%)	109 (51.9%)
Median OS in Months (95% CI)	42.8 (34.6, 52.6)	39.4 (32.7, 51.4)

Hazard Ratio (95% CI)	0.92 (0.71, 1.21)	
P-value ²	0.570	
Objective Response		
Number of Objective Responders ⁴	24 (12%)	1 (0.5%)
(95% CI)	(7.6%, 16.8%)	(0.01%, 2.7%)
Median Duration of Response in Months (95% CI)	10.2 (7.4, 16.6)	NE

¹ Independent radiological review

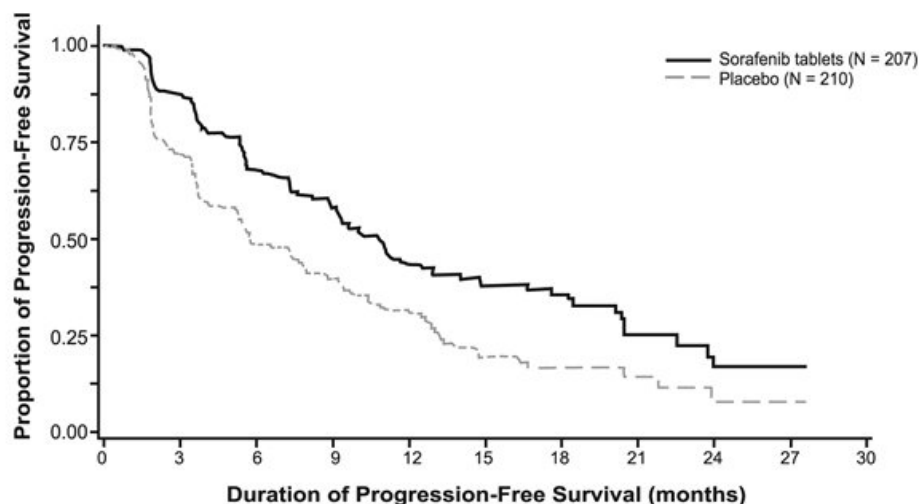
² Two-sided log-rank test stratified by age (< 60 years, ≥ 60 years) and geographic region (North America, Europe, Asia)

³ Conducted after 212 events, which occurred 36 months after the primary PFS analysis.

⁴ All objective responses were partial responses

NR = Not Reached, CI = Confidence interval, NE = Not Estimable

Figure 3: Kaplan-Meier Curve of Progression-Free Survival in DECISION (DTC)



Patients at Risk

Sorafenib tablets	207	159	115	91	60	35	27	13	5	2
Placebo	210	135	78	55	36	14	9	6	2	2

16 HOW SUPPLIED/STORAGE AND HANDLING

Sorafenib tablets are supplied as 200 mg, round biconvex, red film-coated tablets, debossed with "F11" on one side and plain on the other side.

Bottle of 30	NDC 13668-682-30
Bottle of 60	NDC 13668-682-60
Bottle of 120	NDC 13668-682-12
100 (10×10) unit-dose tablets	NDC 13668-682-74

Store at 20° to 25°C (68° to 77°F); excursions permitted between 15°C and 30°C (59°F and 86°F) [see USP Controlled Room Temperature]. Store in a dry place.

17 PATIENT COUNSELING INFORMATION

Advise the patient to read FDA-approved patient labeling (Patient Information).

Cardiovascular Events

Discuss with patients that cardiac ischemia and/or infarction and congestive heart failure, have been reported during sorafenib tablets treatment, and that they should immediately report any episodes of chest pain or other symptoms of cardiac ischemia or congestive heart failure [see *Warnings and Precautions (5.1)*].

Bleeding

Inform patients that sorafenib tablets can increase the risk of bleeding and that they should promptly report any episodes of bleeding [see *Warnings and Precautions (5.2)*].

Inform patients that bleeding or elevations in the International Normalized Ratio (INR) have been reported in some patients taking warfarin while on Sorafenib and that their INR should be monitored regularly [see *Warnings and Precautions (5.6)*].

Hypertension

Inform patients that hypertension can develop during sorafenib tablets treatment, especially during the first six weeks of therapy, and that blood pressure should be monitored regularly during treatment [see *Warnings and Precautions (5.3)*].

Skin Reactions

Advise patients of the possible occurrence of hand-foot skin reaction and rash during sorafenib tablets treatment and appropriate countermeasures [see *Warnings and Precautions (5.4)*].

Gastrointestinal Perforation

Advise patients that cases of gastrointestinal perforation have been reported in patients taking sorafenib tablets [see *Warnings and Precautions (5.5)*].

Risk of Impaired Wound Healing

Advise patients that sorafenib tablets may impair wound healing. Advise patients to inform their healthcare provider of any planned surgical procedure [see *Warnings and Precautions (5.7)*].

QT Interval Prolongation

Inform patients with a history of prolonged QT interval that sorafenib tablets can worsen the condition [see *Warnings and Precautions (5.9)* and *Clinical Pharmacology (12.2)*].

Drug-Induced Liver Injury

Inform patients that sorafenib tablets can cause hepatitis which may result in hepatic failure and death. Advise patients that liver function tests should be monitored regularly during treatment and to report signs and symptoms of hepatitis [see *Warnings and Precautions (5.10)*].

Embryo-Fetal Toxicity

Advise females to inform their healthcare provider if they are pregnant or become pregnant. Inform female patients of the risk to a fetus and potential loss of pregnancy [see *Use in Specific Populations (8.1)*]. Advise females of reproductive potential to use effective contraception during treatment with sorafenib tablets and for 6 months after the last dose. Advise male patients with female partners of reproductive potential or who are pregnant to use effective contraception during treatment with sorafenib tablets and for 3 months after receiving the last dose of sorafenib tablets [see *Warnings and Precautions (5.11)*, *Use in Specific Populations (8.1, 8.3)*].

Lactation

Advise patients not to breastfeed while taking sorafenib tablets and for 2 weeks after receiving the last dose of sorafenib tablets [see *Use in Specific Populations (8.2)*].

Missed Doses

Instruct patients that if a dose of sorafenib tablets is missed, the next dose should be taken at the regularly scheduled time, and not double the dose. Instruct patients to contact their healthcare provider immediately if they take too much sorafenib tablets.

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