

Scandinavian Sarcoma Group and  
Sarcoma Group of the AIO, Germany

**Short (12 months) versus long (36 months) duration of adjuvant treatment with the tyrosine kinase inhibitor imatinib mesylate of operable GIST with a high risk for recurrence:**

**A randomized phase III study**

Trial SSG XVIII is a Scandinavian Sarcoma Group and Sarcoma Group of the AIO multicenter, prospective, randomized study for evaluation of adjuvant treatment with the tyrosine kinase inhibitor imatinib mesylate of operable gastrointestinal stroma cells tumor (GIST) with a high risk for recurrence. The study is open to any specialized cancer center network and that fulfills all the protocol criteria.

All patients with GIST treated according to this program must be reported to the Scandinavian Sarcoma Group secretariat.

Prepared by the Working Committee of the Scandinavian Sarcoma Group and the Sarcoma Group of the AIO.

## Preface

The Scandinavian countries (Denmark, Finland, Iceland, Norway and Sweden) have a total population of about 25 million. They possess similar social structures, a modern medical service covering all inhabitants, and an effective registration system for all cancer patients. This serves as a good base for cooperation. Accordingly, the Scandinavian Sarcoma Group (SSG) was founded in 1979. The aim of the Group was to improve the prognosis for sarcoma patients in the area. Guidelines for diagnosis, pathology, and treatment have been drawn which are now generally accepted by sarcoma centers in Scandinavia.

Our first randomized adjuvant chemotherapy trial for high-grade soft tissue sarcoma was done during 1981–1986. A total of 240 patients were included also in the large metaanalysis, where adjuvant chemotherapy improved metastasis-free survival and local tumor control.

In 2003 all Scandinavian Sarcoma Group members agreed on “Recommendations for the diagnosis and treatment of abdominal, pelvic and retroperitoneal sarcomas”, see under [www.ssg-org.net](http://www.ssg-org.net) under ongoing trials. The present SSG XVIII protocol will be the third study of soft tissue sarcoma with gastrointestinal stroma cell tumor (GIST) with a high risk for recurrence and this time a randomized adjuvant treatment with the tyrosine kinase inhibitor imatinib mesylate of operable GIST.

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The SSG XVIII will be activated December 1, 2003.

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## Protocol synopsis

### **Title of study: Short (12 months) versus long (36 months) duration adjuvant treatment with the tyrosine kinase inhibitor imatinib mesylate of operable GIST with a high risk for recurrence: A randomized phase III study**

**Number of centers:** Multicenter study

**Anticipated dates:** First Patient First Visit: December 2003  
Last Patient First Visit: August 2008  
Interim safety/ toxicity analysis: Mid 2009  
Final Analysis for RFS: After all randomized patients have completed their first visit following one year of adjuvant therapy (the study month 15 visit) and at least 110 events (GIST recurrence or death) have been recorded.  
Follow-up Analysis for overall survival: Approximately 5 years after the Final Analysis.

### **Objectives**

#### *Primary objective:*

To compare the recurrence-free survival (RFS) in GIST patients with a high (>50%) risk of disease recurrence within the first 5 years following the diagnosis and treated with adjuvant imatinib mesylate either for 12 or 36 months.

#### *Secondary objectives:*

To compare feasibility of adjuvant imatinib therapy, overall survival, and GIST-specific survival in GIST patients estimated to have a high risk of disease recurrence and treated with adjuvant imatinib either for 12 or 36 months following macroscopically radical surgery. Furthermore, to evaluate clinical benefit of treatment of recurred GIST after previous adjuvant treatment within the protocol.

**Methodology:** Open-label, randomized, prospective, phase III, multicenter study.

**Number of patients:** 400

### **Main inclusion/exclusion criteria:**

#### **Key inclusion criteria:**

1. histologically confirmed GIST, CD117 (KIT) positive,
2. >50% risk of disease recurrence within the first 5-years following surgery (this is defined as tumor diameter >5.0 cm and mitotic count >5/50 high power fields (HPFs); or tumor diameter >10.0 cm, any mitotic count; or tumor of any size with a mitotic count >10/50 HPFs; or tumors ruptured into the peritoneal cavity.
3. ECOG performance status  $\leq 2$ ,
4. adequate organ function,
5. written informed consent.

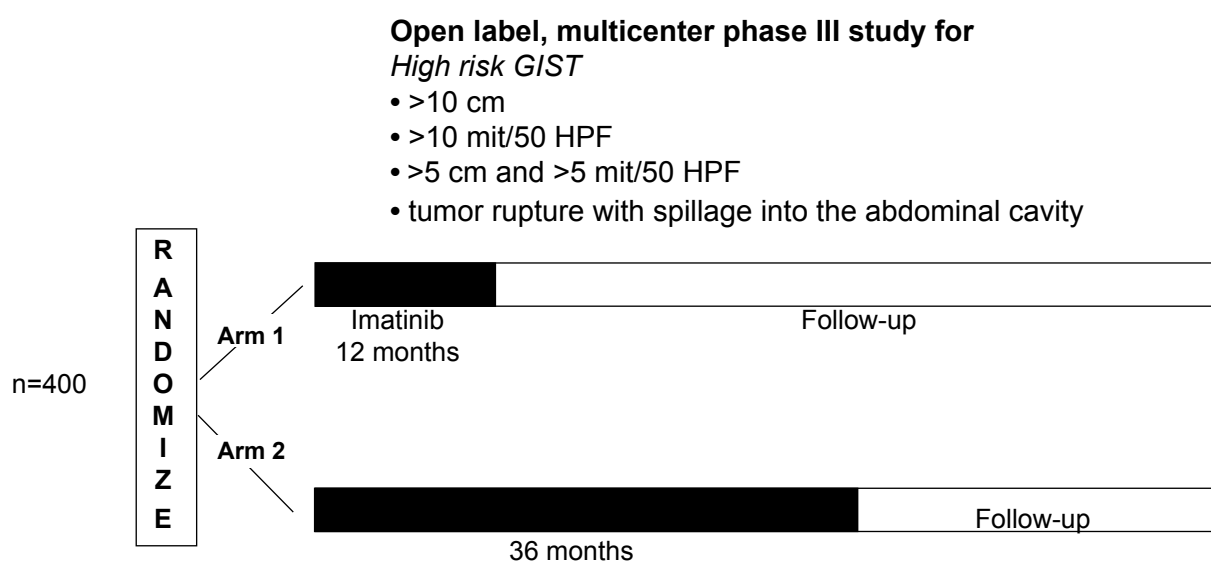
**Key exclusion criteria:**

1. inoperable or metastatic GIST,
2. <1 week or >12 weeks has elapsed from surgery,
3. recurrent GIST,
4. severe uncontrolled medical disease,
5. chemotherapy following surgery,
6. neoadjuvant imatinib therapy.

**Treatments:** Glivec 400 mg/day. Dose reduction is permitted for recurred grade 2 nonhematological toxicity, and for grade 3 or 4 hematological or nonhematological toxicity.

**Investigational drug:** Open label Glivec, 100 mg tablets by orally, taken with food.

**Study design and duration of treatment:** Arm 1: 12 months, Arm 2: 36 months.

**Observation period:**

**For Final Analysis:** Until the date when all randomized patients have completed their first visit following one year of adjuvant therapy (the study month 15 visit). At least 110 events will be required to achieve this.

**For Follow-up Analysis:** until the Final Analysis plus approximately 5 years counting from the date of the Final Analysis.

**Criteria for evaluation**

**Efficacy:** Primary endpoint: recurrence-free survival. Study participants are monitored longitudinally with computed tomography (CT) or MRI at 6 month intervals during the study.

**Safety:** Safety assessments will consist of evaluating adverse events and serious adverse events, laboratory parameters including blood hematology, serum chemistry and body weight.

**Sample size and precision of statistical estimates:**

The yearly RFS rate is assumed to be 7% during the study treatment, 16% for 6-12 months after the end of study treatment and 25% for later than 12 months after the end of study treatment. To show a statistically significant difference between the 12 months and 36 months treatment using a 2-sided significance level of 0.05, a total of 160 patients per group are needed to achieve a power of at least 80%. At least 110 events will be required to achieve a power of at least 80% with 160 patients. To account for a drop-out rate of 20% 400 patients will be randomized.

# 1 Introduction

## 1.1 GIST

Gastrointestinal stromal tumors (GISTs) are relatively rare tumors of the gastrointestinal tract, mesentery, omentum, and retroperitoneum. Despite their relative rarity as compared with gastrointestinal tract carcinomas, GIST is the most common sarcoma of the gastrointestinal tract and has been reported to account for about 5% of all sarcomas.<sup>1</sup> The annual incidence of GIST has been estimated to be about 10 to 20 cases per million.<sup>2</sup> Based on clinical, histopathological, ultrastructural, and molecular biology findings it is now clear that GIST is a separate entity from leiomyoma and leiomyosarcoma, which were formerly considered to be the most common types of soft tissue neoplasms in the gastrointestinal tract.<sup>3</sup>

GISTs occur in both genders at about similar frequency, but some series show male predominance.<sup>3</sup> The median age at diagnosis is about 60. GISTs are most commonly found in the stomach (40–70%), but they can occur also in all other parts of the gastrointestinal tract. About 20–40% of GISTs arise from the small intestine, and 5–15% from the colon and the rectum.<sup>1, 2</sup> Fifteen to 50% of GISTs present with overtly metastatic disease. The most common sites of metastases are the peritoneum and the liver, whereas regional lymph node metastases are rare.<sup>4</sup> Assessing the malignant potential of any given primary GIST lesion is often difficult, and even small GISTs (<2 cm in diameter) may be viewed as having uncertain malignant potential.<sup>5</sup> The reported overall or disease-specific 5-year survival is 28–60% among patients with malignant GIST, and the median disease-specific survival is about 5 years for primary disease, and 10 to 30 months in recurrent or metastatic disease.

Unlike leiomyosarcomas, practically all GISTs express the KIT protein (CD117) in immunohistological staining. KIT is a tyrosine kinase receptor. The ligand of the KIT receptor is the stem cell factor (SCF, also known as the mast cell growth factor or the Steel factor). GISTs often express also CD34 in immunohistochemical staining (60–70%) and occasionally also smooth muscle actin (SMA, 30–40%). GIST are rarely positive for desmin (1–2%) or S100 (about 5%), whereas smooth muscle neoplasms express SMA and desmin, and they are occasionally positive for CD34.<sup>3</sup> Most GISTs (about 85%) have mutated *KIT* gene, which leads to production of ceaselessly activated mutated KIT protein. Activated KIT phosphorylates down-stream proteins, which leads to constitutive activation of intracellular signal cascades and cell proliferation. Most *KIT* mutations are located in exons 11 and 9.<sup>5-7</sup>

GIST needs to be completely removed by surgery whenever possible. The 5-year survival following complete surgery is only about 50%, but many GISTs recur later than during the first 5 years of follow-up. Metastatic GIST is notoriously resistant to conventional chemotherapy.

## 1.2 Imatinib mesylate

Glivec® (Imatinib mesylate) is a protein-tyrosine kinase inhibitor that inhibits selectively the KIT tyrosine kinase. Imatinib inhibits also a few other tyrosine kinases including BCR-ABL, ABL, ARG, and the platelet derived growth factor receptors (PDGFRs). Imatinib is administered orally and taken with food to avoid upper gastrointestinal irritation. The most commonly used daily dosages range between 400 and 800 mg.

The pharmacokinetics of Glivec have been evaluated in healthy subjects and in population pharmacokinetic studies in over 900 patients. Imatinib is well absorbed after oral administration with  $C_{\max}$  achieved within 2–4 hours post-dose. Mean absolute bioavailability

for the capsule formulation is 98%. Following oral administration in healthy volunteers, the elimination half-lives of imatinib and its major active metabolite, the N-desmethyl derivative, were approximately 18 and 40 hours, respectively. Mean imatinib AUC increased proportionally with increasing dose in the range 25 mg–1000 mg. There was no significant change in the pharmacokinetics of imatinib on repeated dosing, and accumulation is 1.5–2.5 fold at steady state when Glivec is dosed once daily. At clinically relevant concentrations of imatinib, binding to plasma proteins in *in vitro* experiments is approximately 95%, mostly to albumin and  $\alpha_1$ -acid glycoprotein. CYP3A4 is the major enzyme responsible for metabolism of imatinib. Other cytochrome P450 enzymes, such as CYP1A2, CYP2D6, CYP2C9, and CYP2C19, play a minor role in its metabolism.

### 1.3 Efficacy of imatinib in advanced GIST

Imatinib is the first effective systemic treatment for advanced GIST.<sup>8,9</sup> In one study 147 patients with inoperable/metastatic GIST were randomized to receive either 400 mg or 600 mg imatinib orally qd for up to 24 months. Patients ranged in age from 18 to 83 years old and had a pathologic diagnosis of KIT-positive malignant GIST.

The primary outcome of the study was objective response rate. Tumors were required to be measurable at entry in at least one site of disease, and response characterization was based on South-Western Oncology Group (SWOG) criteria. All patients have had greater than 9 months of follow-up. Results are shown in table below.

#### Responses to Glivec in patients with advanced GIST

Best Response	Glivec 400 mg n = 74	Glivec 600 mg n = 74	All Doses n = 147
Complete response	0	0	0
Partial response (95% CI)	49 % (37.4–61.3)	58 % (46.1–69.5)	54 % (45.3–62.0)
Stable disease (95% CI)	32 % (21.1–43.4)	24 % (15.1–35.7)	28 % (20.8–35.9)
Progressive disease	16 %	11 %	14 %
Not evaluable	3 %	7 %	6 %

Complete Response: disappearance of all measurable and evaluable disease;

Partial Response: = 50 percent decrease in the summed products of the perpendicular diameters of all measurable lesions, no progression, and no new lesions;

Stable Disease: does not qualify for Complete Response, Partial Response, or Disease Progression;

Disease Progression: = 50 percent increase or an increase of 10 cm<sup>2</sup> (whichever is smaller) in the summed products of the perpendicular diameters of all measurable lesions, worsening of an evaluable lesion or reappearance of any lesion, a new lesion, or failure to return for evaluation due to progression.

The median time to objective response was 13 weeks. Reduction in tumor bulk for patients achieving a PR ranged from 50–96%. Responses have been durable for more than 46 weeks and median duration of response has not yet been reached (median follow-up: 24 weeks following onset of response). ECOG performance scores (PS) improved with Glivec therapy consistent with objective antitumor activity. By month 4 of the study, the number of patients with normal functional status (PS=0) increased to 64 % from 42 % at study entry.

This study was not adequately powered to distinguish efficacy between treatment groups and there was no statistically significant difference between dose levels. Three out of nine patients, however, achieved sustained partial response or stable disease following crossover to the 600

mg dose. Similar results were obtained in another study carried out by the EORTC.<sup>10</sup> Additional trials are currently being conducted by the NCI and EORTC to determine the optimum dose (400 mg vs. 800 mg).

Glivec was approved for use in GIST by the FDA in February, 2002. This was followed by approval in Switzerland and several other countries and European Commission approval in May, 2002.

## 1.4 Adverse reactions of imatinib

Treatment with Glivec was generally well tolerated in GIST, although nearly every patient experienced at least some minor adverse events. The most frequently reported adverse events were edema, nausea, diarrhea, musculoskeletal pain, fatigue, rash, headache, and abdominal pain. Most events were of mild to moderate severity. Superficial edema, most frequently periorbital or lower limb edema, was managed with diuretics, other supportive measures, or by reducing the dose of Glivec. Severe (CTC grade 3/4) superficial edema was observed in 2 patients including face edema in one patient. No major differences were seen in the severity of adverse events between the 400 mg or 600 mg treatment groups, although overall incidence of adverse events was somewhat higher in the 600 mg treatment group. Adverse events with a suspected relationship to therapy occurring in greater than 10 % of patients in any group are presented in table below.

### Adverse events with suspected relationship to therapy in GIST (> 10 % in any group)

Preferred terms	All grades			Grade 3 / 4		
	400 mg n = 73	600 mg n = 74	All doses n = 147	400 mg n = 73	600 mg n = 74	All doses n = 147
Any AE	97	99	98	21	22	21
Edema/fluid retention	71	77	74	1	1	1
Periorbital edema	45	50	48	0	0	0
Edema lower limb	26	15	20	0	0	0
Face edema	8	12	10	1	0	1
Edema	7	14	10	0	0	0
Eyelid edema	7	8	8	0	0	0
Nausea	51	54	52	1	1	1
Diarrhea	40	50	45	1	3	2
Myalgia / musculoskeletal pain	37	42	40	0	0	0
Fatigue	30	39	35	0	0	0
Dermatitis / rash	25	37	31	3	3	3
Headache	19	32	26	0	0	0
Abdominal pain	26	26	26	1	0	1
Flatulence	19	24	22	0	0	0
Vomiting	14	12	13	0	1	1
Any hemorrhage	11	14	12	4	5	5
Tumor hemorrhage	1	4	3	1	4	3
Upper GI bleed / perforation	4	3	3	4	1	3
Dyspepsia	10	12	11	0	0	0
Lacrimation increased	7	12	10	0	0	0
Anemia	6	12	9	1	3	2
Loose stools	7	10	8	0	0	0
Taste disturbance	3	14	8	0	0	0

There was no hyperuricemia or evidence of tumor lysis syndrome, even in patients with very rapid decreases in tumor volume. The most medically significant adverse events were gastrointestinal or intra-abdominal hemorrhage in patients with large bulky tumors, which occurred in approximately 5 % of patients.

## 1.5 Adjuvant use of imatinib in GIST

About 40% of all patients diagnosed with GIST have a greater than 50% risk of sarcoma recurrence within the first 5 years following surgery despite complete surgical removal of all macroscopic tumor tissue. Although imatinib mesylate has proved safe and highly effective in the treatment of patients with overtly metastatic GIST, the median time of treatment failure is between 1 to 2 years in these patients, and it is currently not known whether any proportion of GIST patients with metastatic disease can be permanently cured with imatinib. The use of imatinib in the adjuvant setting might result in a higher proportion of cured patients than can be achieved when this therapy is deferred to metastatic disease. In breast cancer, for example, adjuvant use of 5 years of tamoxifen reduces mortality by approximately one third and prevents breast cancer recurrence by almost 50% in women with estrogen receptor positive disease, whereas deferred tamoxifen therapy is no longer curative in advanced breast cancer.

Patients who have a high risk for recurrence can be identified reasonable well using a combination of prognostic factors. Large primary tumors (>10 cm in diameter), tumors with a high mitotic count (>10/50 HPFs), and tumors that manifest with both of these features (>5 cm in diameter and >5 mitotic figures/50 HPFs) are associated with less than 50% 5-year overall survival (see table below). These patients have only about 30% 5-years recurrence-free survival. Patients who have overtly metastatic disease but have been rendered free from macroscopic metastases by surgery are at a very high risk of recurrence, which approaches 100%. Of note, some recurrences may be detected only 10 to 15 years after primary surgery, further emphasizing the unfavorable long-term outcome of high-risk GIST patients when treated with surgery alone.

### Assessment of the risk of recurrence in operable GIST<sup>11</sup>

	Size	Mitotic count
Very low risk	<2 cm	<5/50 HPFs
Low risk	2–5 cm	<5/50 HPFs
Intermediate risk	<5 cm	6-10/50 HPFs
	5–10 cm	<5/50 HPFs
High risk	>10 cm	Any mitotic rate
	any size	>10/50 HPFs
	>5 cm	>5/50 HPFs
Very high risk <sup>a</sup> -intra-abdominal metastases removed at surgery -tumor spillage at surgery	Any	Any

<sup>a</sup>the very high risk category is not included in the risk assessment by Fletcher et al.<sup>11</sup>

The optimal duration of adjuvant therapy with imatinib is not known. The median time to response is about 4 months in the metastatic setting, but the time to the best response varies considerably between patients, and a few tumors may continue to shrink up to 1 year following the start of imatinib therapy. Prolonged therapy lasting many months or a few years appears to be mandatory in most patients who have metastatic disease, and therapy interruptions may be life-threatening. Long duration of imatinib therapy might benefit also high-risk patients in the adjuvant setting, but longer treatments may also be associated with greater toxicity and costs without any clinical benefit.

Ongoing or planned U.S. and EORTC studies will randomize intermediate and high risk GIST patients to 1 or 2-year imatinib treatment or to observation without adjuvant therapy. These pivotal trials will targeted the intermediate-high risk patient population, where randomization to a no-treatment arm is considered acceptable. The current trial will focus on the high risk-very

high risk subjects (except patients with metastatic disease) with an estimated risk of disease recurrence ranging between 50 and 100%. Since 1- and 2-year treatment times are used in the U.S. and EORTC adjuvant trials, the present study on 1-year versus 3-year imatinib treatment complements the other ongoing adjuvant trials, and will generate efficacy and tolerability data on different durations of imatinib therapy.

## 2 Study objectives

### Primary objective

To compare the recurrence-free survival (RFS) in GIST patients with a high (>50%) risk of disease recurrence within the first 5 years following the diagnosis and treated with adjuvant imatinib mesylate either for 12 or 36 months.

### Secondary objectives

To compare GIST patients estimated to have a high risk of disease recurrence and treated with adjuvant imatinib either for 12 or 36 months following macroscopically radical surgery with respect to feasibility of adjuvant imatinib therapy, overall survival, and GIST-specific survival. Furthermore, to evaluate clinical benefit of treatment of recurred GIST after previous adjuvant treatment within the protocol.

## 3 Investigational plan

### 3.1 Overall study design

This is an open-label, multicenter, prospective, randomized phase III study conducted to investigate the efficacy and safety of Glivec in GIST patients who had all tumor tissue removed macroscopically at surgery, and who are estimated to be at a high risk for disease recurrence. The study participants are randomly assigned to two different durations of adjuvant treatment with Glivec. In Arm 1 Glivec is administered at a daily dosage of 400 mg p.o./day for 12 months, and in Arm 2 at the dosage of 400 mg p.o./day for 36 months. All patients will be monitored for treatment toxicity during adjuvant therapy with longitudinal blood cell counts and blood chemistry, and followed up until the date of the Final Analysis (to be carried out when all randomized patients have completed their first visit following 1 year of adjuvant treatment and at least 110 events have been recorded) and for a time period of approximately 5 years that follows the Final Analysis. Clinical follow-up visits will be performed at the same time intervals in both treatment arms. Treatment after disease recurrence is at the discretion of the investigator, but data on treatment type, duration and response to treatment will be captured on the CRFs. A total of 400 patients will be enrolled.

### 3.2 Study population

#### 3.2.1 Patient population

The median overall survival time of the GIST patients in the high risk category as defined by

- 1) tumor diameter >5.0 cm and mitotic count >5/50 HPFs,
- 2) tumor diameter >10.0 cm with any mitotic count, and
- 3) tumors of any size, where the mitotic count is >10/50 HPFs is about 55 months. The present study will also accrue patients with tumor spillage into the abdominal cavity at surgery and patients who have microscopically infiltrated margins.

### 3.2.2 Inclusion and exclusion criteria

#### Inclusion criteria

1. Patients  $\geq 18$  years of age.
2. Histologically documented diagnosis of GIST, which is resectable.
3. GIST removed at open surgery (laparoscopic and endoscopic surgery as the sole surgical procedures are not accepted).
4. Immunohistochemical documentation of KIT (immunostaining for KIT/CD117) must be positive on a tumor sample taken within 12 weeks of the study entry. Mutation analysis of the *KIT* gene is **not** required for study entry.
5. High risk of tumor recurrence as defined as one or more of the following:
  - 1) the largest tumor diameter greater than 10.0 cm (with any mitotic count). The tumor size needs to be 10.0 cm or greater in the resected tissue specimen when measured by a pathologist.
  - 2) mitotic count  $>10$  mitoses per 50 high power fields (HPFs) (of any tumor size)
  - 3) the largest tumor diameter  $> 5.0$  cm (measured by a pathologist) *and* the mitotic count  $> 5/50$  HPFs
  - 4) tumor spillage into the abdominal cavity at surgery (tumor rupture may have occurred either before surgery or taken place during surgery)
  - 5) patients who have microscopically infiltrated margins (or suspected microscopical infiltration, R1) are allowed to enter the study.
6. Performance status 0, 1 or 2 (ECOG) (see Section 8)
7. Adequate end organ function, defined as the following:  
total bilirubin  $<1.5 \times$  ULN (upper limit of normal), serum AST (SGOT) and ALT (SGPT)  $<2.5 \times$  UNL, creatinine  $<1.5 \times$  ULN, ANC (neutrophil count)  $>1.5 \times 10^9/L$ , platelets  $>100 \times 10^9/L$ .
8. Female patients of childbearing potential must have negative pregnancy test within 7 days before initiation of study drug dosing. Postmenopausal women must be amenorrheic for at least 12 months to be considered of non-childbearing potential. Male and female patients of reproductive potential must agree to employ an effective barrier method of birth control throughout the study and for up to 3 months following discontinuation of study drug.
9. Written, voluntary informed consent.

#### Exclusion criteria

1. Inoperable GIST.
2. Metastatic disease (within or outside the abdomen).
3. Less than 1 week or more than 12 weeks has elapsed from surgery. This time interval is counted from the date of the definite surgery aimed for cure, and cases where diagnostic or emergency surgery has been carried out  $>12$  weeks prior to the study entry are allowed to be entered.
4. Recurrent GIST.
5. Patient has received any investigational agents within 28 days as calculated from the first day of the study drug dosing.
6. Patient is less than 5 years free of another primary malignancy except: if the other primary malignancy is not currently clinically significant nor requiring active intervention, or if other primary malignancy is a basal cell skin cancer or a cervical carcinoma in situ. Existence of any other malignant disease is not allowed.
7. Patient with Grade III/IV cardiac problems as defined by the New York Heart Association

- Criteria (i.e., congestive heart failure, myocardial infarction within 6 months of study).
8. Female patients who are pregnant or breast-feeding.
  9. Patient has a severe and/or uncontrolled medical disease (i.e., uncontrolled diabetes, severe chronic renal disease, or active uncontrolled infection). The concurrent use of warfarin or acetaminophen are not allowed with imatinib, and need to be replaced by other medications (e.g. by low molecular heparins in case of warfarin).
  10. Patient has known chronic liver disease (i.e., chronic active hepatitis, and cirrhosis).
  11. Patient has a known diagnosis of human immunodeficiency virus (HIV) infection.
  12. Patient has received chemotherapy for GIST.
  13. Patient received neoadjuvant imatinib therapy prior to randomization.
  14. Patient has received radiotherapy to  $\geq 25$  % of the bone marrow.
  15. Patient with any significant history of non-compliance to medical regimens or with inability to grant reliable informed consent.

### 3.3 Interruption or discontinuation of treatment

All interruptions and reductions regarding the study drug must be captured on the CRF. Patients who discontinue adjuvant imatinib will be followed up according to the same visit schedule (see Section 3.6.1) as those individuals who continue study treatment.

If the patient discontinues study medication during the trial, the reason is categorized in the CRF as one of the following:

1. Unsatisfactory therapeutic effect (GIST recurrence)
2. Adverse event(s) / Abnormal laboratory value(s)
3. Withdrawal of consent
4. Death
5. Other (for example Protocol violation, Administrative problems etc.)

A complete end of study visit must be collected for any patient discontinuing study treatment for an adverse event or an abnormal laboratory value and within 4 weeks after the last drug intake. End of study evaluations will include adverse events, physical examination, ECOG Performance Status, biochemistry, and hematology. Relevant information that is related to the reason for treatment discontinuation including contributory factors is included in the CRF. In case of recurred GIST, data regarding treatment given for recurrence will be collected.

### 3.4 Dose modifications for non-hematological toxicity

#### Grade 2

If the patient experiences a Grade 2 non-hematologic toxicity, study drug must be withheld until the toxicity has resolved to  $\leq$  Grade 1. Glivec may then be resumed at the same daily dose. If the Grade 2 toxicity recurs, Glivec must be withheld until the toxicity has resolved to  $\leq$  Grade 1, and the daily dose must be reduced to 300 mg once daily.

#### Grade 3/4

If the patient experiences Grade 3/4 toxicity study drug must be withheld until the toxicity has resolved to  $\leq$  Grade 1 and the daily dose must be reduced to 300 mg once daily. If the Grade 3/4 toxicity recurs, Glivec must be withheld until the toxicity has resolved to  $\leq$  Grade 1. If treatment needs to be interrupted for toxicity for a time period of 4 weeks or longer, the study treatment will be discontinued.

Dose reductions below the dose of 300 mg/day should be avoided if possible, but such dose reductions are permitted if grade 2/3/4 non-hematological toxicity recurs.

### **Dose modifications for hematological toxicity**

#### **Grade 2**

No dose interruptions or reductions will be performed for Grade 1/2 hematological toxicity.

#### **Grade 3/4**

If patient experiences a Grade 3/4 hematological toxicity, defined as an ANC (neutrophil count)  $<1 \times 10^9/L$ , or a platelet count  $<50 \times 10^9/L$ , Glivec must be withheld until the toxicity has resolved to  $\leq$ Grade 2 (ANC  $\geq 1.0$  and platelet count  $\geq 50 \times 10^9/L$ ). ANC takes precedence over a leukocyte count (WBC) in determining the degree of neutropenia (doses should not be interrupted for a patient with a WBC  $< 2.0 \times 10^9/L$  but ANC  $>1 \times 10^9/L$ ). If the toxicity resolves within two weeks, Glivec treatment may be resumed at the same dose. If the Grade 3/4 toxicity recurs or persists for longer than two weeks, Glivec must be withheld and then recommenced at the dose of 300 mg once daily, once toxicity has resolved to  $\leq$ Grade 2. If treatment needs to be interrupted for hematological toxicity for a time period of 4 weeks or longer, the study treatment will be discontinued.

No dose reductions will be performed for grade 3/4 anemia. If the patient develops anemia, she/he may be transfused at the discretion of the investigator.

Dose reductions below the dose of 300 mg/day should be avoided if possible, but such dose reductions are permitted if grade 3/4 hematological toxicity recurs.

### **Dose modifications for other reasons**

The optimal dose of Glivec in GIST is unknown, but doses below 300 mg once daily may no longer be sufficient to inhibit KIT. If vomiting occurs, no additional trial medication should be taken that day in an effort to replace the material that has been vomited.

## **3.5 Treatments**

### **3.5.1 Investigational therapy**

Glivec (imatinib mesylate) 400 mg once daily. Arm 1 will be randomly assigned to 12 months of treatment and Arm 2 to 36 months of treatment. Imatinib will be administered until:

- GIST recurrence
- unacceptable toxicity
- withdrawal of consent
- the assigned duration of drug therapy has been achieved (either 12 or 36 months).

Treatment after disease recurrence is at the discretion of the investigator, but data on treatment type, duration and response to treatment will be captured on the CRFs.

Glivec will be provided as 100 mg tablets packaged in blister packs.

Daily treatment will be withheld only in the case of limiting toxicities (see Section 3.4). The prescribed dose should be administered orally, with a meal and a large glass of water. The dose of 400 mg should be administered once daily. Patients should keep normal eating habits, however low-fat (i.e. continental) breakfast is recommended avoiding xanthine (e.g. caffeine) or grapefruit containing food or beverages. Minimum of 1 hour should be allowed between last drug intake

and going to bed. If vomiting occurs, no additional trial medication should be taken that day in an effort to replace the material that has been vomited.

### **3.5.2 Treatment assignment**

Informed consent must be obtained before any testing for the purpose of determining a patient's eligibility is performed.

Each patient will be assigned a unique patient number. Once assigned, numbers for any non-evaluable or discontinued patient will not be reused.

Randomization will be performed based on computer generated random numbers at the randomization center located at the SSG secretariat. At randomization, the patients are stratified into 2 strata: 1: local disease (1 tumor); 2: intra-abdominal disease (intra-abdominal tumor spillage, or microscopic disease left behind at surgery (R1 resection)).

Patients who meet the inclusion criteria for study treatment will be registered and given a randomization number at the SSG secretariat.

### **3.5.3 Concomitant therapy**

In general, concomitant medications and therapies deemed necessary for the supportive care and safety of the patient are allowed, provided their use is documented in the patient records. The administration of any other anticancer agents including chemotherapy and biologic agents is NOT permitted. Similarly, the use of other concurrent investigational drugs is not allowed. Post-operative radiation therapy should not be given or re-excision done in case of suspicion of disease left behind (R1 surgery).

Because of the inherent risk of either reduced activity or enhanced toxicity of the concomitant medication and/or Glivec, drugs known to interact with the same CYP450 isoenzymes (2D6 and 3A4) as Glivec should be used with caution (Appendix 1). Patients using concomitant medications known to be metabolized by these cytochrome p450 enzymes will not be excluded from the study. However, the patients must be carefully monitored for potentiation of toxicity due to individual concomitant medication. Consideration should be given to using alternative agents with less potential for interaction with Glivec. Special care has to be given to the concomitant use of acetaminophen (paracetamol) (e.g. Panadol<sup>®</sup>, Tylenol<sup>®</sup> or Percocet<sup>®</sup>) with Glivec. A patient with leukemia who was treated with imatinib and acetaminophen died from hepatic failure.

Since warfarin is metabolized through the CYP450 system, no therapeutic anticoagulation with warfarin (e.g. Marevan<sup>®</sup>, Coumadin<sup>®</sup>, Coumadine<sup>®</sup>) will be permitted in patients participating in this study. As an alternative, therapeutic anticoagulation may be accomplished using low-molecular weight heparin (e.g. Fragmin) or heparin. In general, the use of Coumadin<sup>®</sup> is discouraged on this protocol.

The routine use of systemic corticosteroid therapy is not permitted. Corticosteroid therapy may only be administered after consultation with the principal investigator.

Prophylactic anti-emetics should be withheld until the patient has experienced grade 1 nausea or vomiting.

Prophylactic use of loperamide (e.g. Imodium<sup>®</sup>, with suggested dosing as start: 4 mg p.o. × 1, than 2 mg p.o. after each loose stool, max 16 mg/d) is recommended for patients experiencing grade 1 or 2 diarrhea, before dose interruption.

Use of erythropoietin or darbepoietin is allowed at the discretion of the treating physician to treat anaemia (B-hemoglobin <11 g/L). The use of granulocyte growth factors (G-CSF or GM-CSF) is not allowed to support the granulocyte counts.

### **3.5.4 Handling of study medication**

All study medication will be supplied by Novartis. All drug supplies are to be used only for this protocol and not for any other purpose. Drug supplies must be kept in an appropriate, secure area (e.g. locked cabinet) and stored according to the conditions specified on the drug labels.

The patient may be dispensed up to about 3 months supply of medication (until the next study visit). The pharmacy must maintain an individual record for the patient where the drug formulation, dose, number of tablets dispensed, received, and returned must be recorded.

Patients will be asked to return all unused medication at the end of the study.

## **3.6 Visit schedule and assessments**

### **3.6.1 Visit schedule**

Patient must be followed at the study center according to the table “Visit schedule and assessments” on the next page. Following the 3 first years on study the subjects will be followed up at 6-month intervals until study month 84 (7 years from study entry), and at 12-month intervals thereafter for a minimum of 10 years as calculated from the date of study entry. When clinically indicated or when preferred by the investigator, more frequent follow-up visits may be organized.

All routine assessments must be performed within  $\pm 14$  days of the day indicated on the visit schedule.

Patients who discontinue imatinib prematurely for toxicity or other reasons will be followed up in a similar fashion as those who continue to take imatinib as scheduled. In case of GIST recurrence, data regarding treatment given for recurrence will be collected.

## Visit schedule and assessments

Month on Therapy	0 <sup>a</sup>	1	2	3	4	5	6	9	12	15, 18, 21, 24, 27, 30, 33, 36	42, 48, 54, 60, 66, 72, 78, 84, 96, 108, 120 <sup>g</sup>	At re-lapse					
Week on Therapy		2	4	6	8	12	16	20	24	30	36	42	48	52			
Medical History	X																X
Adverse Events		X			X			X		X				X	X		
Current Medication	X	X			X			X		X				X	X	X	X
Physical exam	X	X			X			X		X				X	X	X	X
Weight	X	X			X			X		X				X	X		
Height	X																
ECOG Perform. Status	X	X			X			X		X				X	X	X	X
CBC/Diff. Count/Platelets	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X <sup>e</sup>	X	X
AST/ALT/LDH Bilirubin/Alk Phos Creatinine/protein/albumin	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X <sup>e</sup>	X	X
Pregnancy test <sup>b</sup>	X																
Chest X-ray or CT	X																
CT or MRI of abdomen and pelvis (with contrast)	X							X						X	18, 24, 30, 36 mo	X	X <sup>f</sup>
FDG-PET (optional, but recommended)	X																
Serum for Banking <sup>c</sup>	X													X	18, 24, 30, 36 mo	X	X
Plasma concentration												X <sup>h</sup>			X <sup>h</sup>		
Tumor Tissue for Central Path Review <i>KIT</i> , and <i>PDGFRA</i> mutation analysis <sup>d</sup>	X																X
Left ventricular ejection fraction (LVEF) measurement (by either echocardiography or MUGA scan (optional))	X				X									X	24 mo		

<sup>a</sup> baseline laboratory tests must be performed after laparotomy and within 2 weeks prior to randomization, and baseline imaging examinations within 4 weeks prior to randomization

<sup>b</sup> for premenopausal women and for post-menopausal women amenorrheic for less than 12 months. In case of doubt, serum FSH needs to be determined.

<sup>c</sup> at baseline 3 mL and >1mL during subsequent samplings.

<sup>d</sup> paraffin-embedded tissue required. Storage of frozen tissue recommended.

<sup>e</sup> blood cell counts, liver transaminase levels and creatinine will be monitored at 6 weeks intervals in patients who receive imatinib

<sup>f</sup> the protocol specified CT/MRI examinations need not to be repeated if recurrence is first detected in these exams

<sup>g</sup> blood tests and imaging examinations are optional at visits performed 96, 108 and 120 months after study entry

<sup>h</sup> to be performed (optional) once during the first year of treatment and once during the third year

### 3.6.2 Screening assessments

Written informed consent must be obtained before any study specific medical procedures are performed. Laboratory screening assessments and physical examination including performance status, weight, and serum pregnancy test for females of child-bearing potential must be performed. In the event that hematology or biochemistry evaluation is performed within 14 days of the first dose of study drug as part of the screening evaluation, this evaluation need not be repeated, and may be used as the Day 1 values. Immunohistochemical confirmation of KIT overexpression must exist at the study entry.

Tumor measurements by CT or MRI must be performed within 28 days of the first dose of study drug. Positron emission tomography (PET) using fluorodeoxyglucose (FDG) as the tracer is recommended as a staging examination (optional).

Left ventricular ejection fraction may be measured either by echocardiography or by isotope cardiography (MUGA) prior to initiation of imatinib therapy (optional).

#### Screening assessments

Assessment	Includes
Inclusion/exclusion criteria	Patient eligibility is to be assessed including serum pregnancy test in females of child-bearing potential
Demographics	Date of birth and sex.
Relevant medical history / Current medical conditions	Relevant past medical history, and current medical conditions not related to the diagnosis of GIST.
Disease history	Information related to diagnosis of GIST.
Previous antineoplastic treatment	Previous: surgery, radiotherapy and systemic therapy
Physical examination / Vital signs	Total body examination, pulse rate, blood pressure.
Performance status/ Body weight	Body weight and performance status according to ECOG criteria (see Section 8).
Tumor assessment	CT or MRI of the abdomen and pelvis
Hematology	Hemoglobin, total WBC count, platelet count, and a differential count including neutrophils, lymphocytes, monocytes, eosinophils and basophils.
Biochemistry	Creatinine, total bilirubin, alkaline phosphatase, AST (SGOT), ALT (SGPT), LDH, serum total protein and albumin.
Concomitant Medications/Therapies	Concomitant medications and/or non-drug therapies and the reason for administration.

### 3.6.3 Efficacy assessments

#### Efficacy

Tumor assessments should be performed by a CT or MRI scan, throughout the study. All assessments should be performed within 14 days of the scheduled day of assessment, and whenever clinically indicated otherwise.

### 3.6.4 Safety assessments

Safety assessments will consist of evaluating adverse events and serious adverse events, laboratory parameters including hematology, chemistry and body weight. Monitoring of the LVEF may be carried out at the investigator's discretion. The use of the same method throughout the study is

recommended. It is recommended that the LVEFs will be measured at baseline, and 12 weeks, 52 weeks and 24 months after starting adjuvant imatinib. In case of more than 15% decrease in the LVEF as compared to the baseline value, or more than 10% decrease to a value less than 50%, consultation of a cardiologist and the principal investigator is recommended.

### 3.6.4.1 Adverse events

Information about adverse events, whether volunteered by the patient, discovered by investigator questioning, or detected through physical examination, laboratory test or other means, will be collected and recorded on the CRF and followed as appropriate. An adverse event is any undesirable sign, symptom or medical condition occurring after starting study treatment, even if the event is not considered to be treatment-related.

Medical conditions/diseases present before starting study treatment are only considered adverse events if they worsen after starting study treatment. Abnormal laboratory values or test results constitute adverse events only if they induce clinical signs or symptoms or require therapy, when they are recorded on the Adverse Events CRF under the signs, symptoms or diagnosis associated with them.

As far as possible, each adverse event will also be described by the NCI/NIH Common Toxicity Criteria severity grades 1–4 (Appendix 2).

The severity grade of an adverse event provides a qualitative assessment of the extent or intensity of an adverse event, as determined by the investigator or as reported by the patient. The severity grade does not reflect the clinical seriousness of the event, only the degree or extent of the affliction or occurrence (e.g. severe nausea, mild seizure), and does not reflect the relationship to study drug.

#### Severity grade for events not listed in the NCI/NIH CTC

1 = Grade 1	Mild
2 = Grade 2	Moderate
3 = Grade 3	Severe
4 = Grade 4	Life-threatening

Any Adverse Event occurring by the time of study completion (within two weeks of last drug intake) must be recorded on the Adverse Event page.

#### Serious Adverse Events

A Serious Adverse Event (SAE) is an undesirable sign, symptom or medical condition which:

1. is fatal or life-threatening (any grade 4 toxicity, any new cancer)
2. required hospitalization or prolonged hospitalization
3. results in persistent or significant disability/incapacity
4. constitutes a congenital anomaly or a birth defect
5. is medically significant, in that it may jeopardize the subject and may require medical or surgical intervention to prevent one of the outcomes listed above.

Events **not** considered to be SAEs are hospitalizations for the:

- routine treatment or monitoring of the studied indication, not associated with any deterioration in condition.
- treatment, which was elective or pre-planned, for a pre-existing condition that is unrelated to the indication under study and did not worsen

- admission to a hospital or other institution for general care, not associated with any deterioration in condition
- treatment on an emergency, outpatient basis for an event **not** fulfilling any of the definitions of serious given above and **not** resulting in hospital admission.

Any SAE occurring after protocol specified procedures begin and until 4 weeks after study drug discontinuation must be reported.

In addition any pregnancy or fathering of a child within 84 days (12 weeks or 3 months) after the last Glivec intake has to be reported and recorded as an SAE.

SAEs occurring more than 4 weeks after study drug discontinuation need only to be reported if a relationship to the Novartis study drug (or therapy) is suspected.

Information about all SAEs and assessment of its relationship to Novartis treatment will be recorded in English by the investigator on the SAE Report Form. To ensure patient safety each SAE must also be reported to the SSG secretariat fax +46-46-188143 and to the local Novartis Clinical Safety & Epidemiology (CS&E) Department within 24 hours of learning of its occurrence even if it is not felt to be related to treatment.

The original copy of the SAE form and the fax confirmation sheet must be kept with the CRF documentation at the study site.

Each re-occurrence, complication or progression of the original event should be reported as a follow-up to that event. The follow-up information should describe whether the event has resolved or continues, if and how it was treated, and whether the patient continued or discontinued study participation. The follow-up SAE report should state that it is a follow-up report of a prior SAE, and the date of the initial SAE report should be included. If a SAE occurs in the same individual as a previously reported SAE and is considered completely non-associated to the previously reported one, a new SAE form should be sub-mitted as an initial report. The form and fax confirmation sheet must be retained.

### **Suspected Unexpected Serious Adverse Reactions**

If the serious adverse event is not documented in the investigator brochure (i.e. unexpected) and is thought to be related to the Novartis study drug (or therapy), a Clinical Safety & Epidemiology Department associate may urgently require further information from the investigator prior to the submission of the reported event to the Health Authority. If warranted, to fulfill the regulatory requirement, Novartis may need to issue an investigator notification, to inform all investigators involved in any study with the same drug (or therapy) that this suspected unexpected & serious adverse reaction (SUSAR) has been reported.

### **Pregnancies**

In the event that a female patient on study drug becomes pregnant, the pregnancy must be reported to the local Novartis CS&E Department and followed to term. All initial and follow-up information obtained regarding any pregnancy conceived during the study must be reported to the sponsor within 24 hours of the investigator's receipt of such information. A Novartis Clinical Trial Pregnancy Form is provided for this purpose. An assessment should be made between the outcome of pregnancy and the Novartis investigational drug. An abortion is to be regarded always as a SAE and assessed as 'other medically significant event' if no other seriousness criterion is fulfilled. These assessments should be entered on the Clinical Trial Pregnancy Form. A female study patient who becomes pregnant must immediately discontinue study drug. If a female study patient experiences a SAE while pregnant (associated with the pregnancy or not) this event

must be reported as instructed for SAEs, using the SAE report form. The pregnancy should be followed up to determine details of birth, outcome, including spontaneous or voluntary abortion, the presence or absence of any birth defects or congenital abnormalities or any maternal/newborn hazards.

### **3.6.4.2 Laboratory evaluations**

The institution will perform laboratory analyses according to the Visit Schedules. Laboratory values will be recorded on the Adverse Events Form (circle the correct range) even if normal.

#### **Hematology**

Hematology includes assessment of hemoglobin, total WBC count, platelet count, and a differential count including neutrophils, lymphocytes, monocytes and eosinophils, basophils and will be performed according to the Visit Schedules. If the patient experiences any internal bleeding, analyses of bleeding time, platelet aggregation, and PT and PTT measurements, should be performed if at all possible.

#### **Biochemistry**

Biochemistry includes creatinine, albumin, total protein, total bilirubin, alkaline phosphatase, AST (SGOT), ALT (SGPT), and LDH, and will be performed according to the Visit Schedules.

#### **Physical examinations**

A physical examination including pulse rate and blood pressure will be performed according to the Visit Schedules. Information about the physical examination must be present in the source documentation at the study site. Significant GIST symptoms present prior to the start of study drug will be recorded in the CRF. Data on concomitant diseases will not be captured on the CRFs. Significant findings made after the start of study drug which meet the definition of an adverse event must be recorded on the Adverse Event Form. There are no CRF to capture routine normal findings from physical examinations assessments.

#### **Performance status/Body weight**

Measurements of performance status and body weight will be performed according to the Visit Schedules. The ECOG Performance Status Scale will be used in this study. In addition, patients are encouraged to otherwise measure their body weight weekly and report to the study investigator any body weight change of more than 2 kg as compared to their pre-study body weight.

## **4 Data management**

Data items are collected to the CRF by the investigators and entered centrally into the study database, located at the SSG secretariat.

## 5 Mutation analyses, central pathology review, and analysis of serum KIT and the KIT ligand (SCF) etc

All tissue samples will be shipped to one of the three Central Laboratories of the study located at the Department of Pathology, University of Bonn Medical School (Sigmund-Freud-Strasse 25 53127 Bonn, Germany; Dr. Eva Wardelmann), Department of Pathology, University of Helsinki (Haartmaninkatu 3, FIN-00014 Helsinki, Finland, Dr. Maarit Sarlomo-Rikala) and Department of Musculoskeletal Pathology, Division of Cancer Studies, University Medical School of Birmingham, Birmingham, United Kingdom; Dr. Lars-Gunnar Kindblom) for central review.

### Central pathology screening

Immunohistochemistry for CD117 (KIT) and GIST pathology will be reviewed centrally. A representative tumor tissue block and mounted tissue sections will be shipped to a Central Laboratory. Collection of tissue for histopathological screening and mutation analyses will start when the 100th patient has been randomized to the study for the first 100 patients. Collection of the paraffin blocks of the patients with a study code 101-200 will be initiated when the 200th patient has been accrued.

### Mutation analysis of the KIT and PDGFR genes

Mutation analysis of *KIT* and *PDGFR* genes will be carried out from tumor tissue biopsies. A representative tumor tissue biopsy (usually a paraffin tissue block containing GIST tissue, frozen tumor tissue, or, alternatively, extracted tumor DNA) is required for this analysis. DNA extracted from the tissue is analyzed for the presence of *KIT* exon 9, 11, 13 and 17 and *PDGFR* exon 12 and 18 mutations using dHPLC, followed by sequencing of any abnormal findings. The analyses will be carried out at the University of Helsinki, Helsinki, Finland, and/or at the University of Bonn, Germany. The mutation analysis results will be correlated with patient outcome.

### Serum Soluble KIT and KIT Ligand (SCF) Analyses

Serum samples are collected from the patients treated with adjuvant imatinib therapy 1) before starting imatinib and 2) at the times of disease status evaluations, and 3) at disease recurrence. Serum ( $\geq 2$  ml,  $\geq 3$  ml at baseline) is collected to ordinary serum test tubes, and stored  $-20^{\circ}\text{C}$  or colder. These samples will be subjected for analysis of serum soluble KIT and stem cell factor (SCF) levels, or other serum proteins relevant to the study in line with the Patient Informed Consent. The serum protein levels will be correlated with the clinical and outcome data. Samples are collected at the study center, and shipped to the P.I. of the study and on a mutually agreed date (prof. Heikki Joensuu, the Department of Oncology, Helsinki University Central Hospital, Haartmaninkatu 4, P.O. Box 180, FIN-00029 Helsinki, Finland, fax. 358-9-471 74202, email heikki.joensuu@hus.fi).

### Plasma concentration

A plasma sample (appr. 5 ml) may be collected during the first and third year of imatinib administration for measurement of imatinib plasma concentration (optional). The results will be correlated with clinical and laboratory parameters. They will not be communicated to the study participants during the study, and must not influence the imatinib dose administered.

### Tumor tissue microarray (TMA)

A tumor tissue microarray (TMA) may be constructed from the paraffin tissue blocks containing GIST by taking 3 to 4 coarse needle biopsies (0.6 to 1.0 mm in diameter) from each block. These biopsies will be mounted on a recipient tissue block to form a TMA, each TMA containing approximately 100 small (0.6 to 1.0 mm in diameter) tissue biopsies. Thin (4 to 5  $\mu\text{m}$  thick)

sections may then be cut from each TMA block for staining with immunohistochemistry or for analysis of gene copy numbers using in situ hybridization. Such tissue microarrays will be used to identify proteins or amplifications or deletions of genes that may be associated with resistance or response to imatinib therapy (related to drug resistance, cell signalling, alternative growth factor receptors, cell cycle progression or apoptosis) or may be associated with prognosis and with GIST recurrence (cell cycle proliferation rate-related proteins and genes, apoptosis-related proteins and genes, or GIST differentiation-related proteins and genes). The TMAs will be prepared and stored at the University of Helsinki, Finland, or/and at the University of Bonn, Germany. A full TMA with tissue from all study patients will be stored both at the University of Helsinki and at the University of Bonn.

### **Serum soluble factors related to imatinib metabolism, adverse effects of imatinib, treatment compliance or progression of GIST**

Imatinib failure may be a consequence of several factors, such as new cancer cell mutations affecting either KIT or PDGFRA, cell signalling via alternative pathways, pharmacological factors or a poor patient compliance with imatinib therapy. Many of the factors related to imatinib resistance and drug toxicity are still poorly known. Adjuvant imatinib therapy may induce changes in the levels of serum electrolytes, enzymes and other proteins, hormones and soluble growth factors, which may be of importance with regard of GIST recurrence, treatment safety, and accuracy of disease outcome prediction. In the absence of metastatic disease, research serum samples collected from patients who receive adjuvant imatinib therapy are well suited for such studies. Analyses of serum electrolyte levels, and levels of soluble enzymes and cell matrix structural proteins, hormones, soluble growth factors and their cognate receptors will be analyzed from the research serum samples provided by the study participants.

## **6 Statistical methods**

### **6.1 Sample size and power considerations**

The sample size calculation is based on the analysis of the primary objective, i.e. comparison of the recurrence-free survival from time of randomization in patients with adjuvant imatinib either for 12 or 36 months. The patients will be allocated to the treatment groups using an even allocation (1:1).

Based on the results of the interim analysis of an adjuvant GIST study (ACOSOG Z9001) comparing 12 months on imatinib therapy, the sample size was re-estimated assuming the following event (GIST recurrence or death) rates:

- In the 12 months group, the yearly event rate will be 7% for 18 months, 16% between 18 and 24 months, and 25% after 24 months.
- In the 36 months group, the yearly event rate will be 7% until 42 months, 16% between 42 and 48 months, and 25% after 48 months.

The sample size was calculated by simulating log-rank tests using the above assumptions. A power of at least 80% is achieved with 160 patients per group. Under these assumptions, the overall hazard ratio is expected to be about 0.44 in favour of 36 months treatment group. At least 110 events will be required for the final analysis to achieve a power of at least 80% with 160 patients. Assuming a drop-out rate of 20%, altogether 400 patients will be randomized (200 patients per treatment group). The sample size calculation was performed with nQuery Advisor version 6.0. A two-sided significance level of 0.05 was used.

The final analysis comparing the treatment groups will be performed after all randomized patients have completed the visit that takes place after one year of adjuvant therapy (study month 15 visit) and at least 110 events have been recorded. To prepare for the time of the final analysis, the number of events will be monitored closely by the study statistician after all patients have been treated for 1 year.

## 6.2 Populations

The efficacy data will be analyzed in three populations:

- **Efficacy Population:** Primary efficacy population will consist of patients who have a confirmed GIST, signed an informed consent and were randomized to the study. In this population, patients who started using imatinib after the study treatment period will be censored at the start of the out-of-study treatment and second cancers will not be considered as RFS events.
- **Intention-To-Treat (ITT):** ITT population will consist of all randomized patients, who have signed an informed consent. In this population, patients who started using imatinib after the study treatment period will not be censored and second cancers will be considered as RFS events.
- **Per Protocol (PP):** The PP population will be similar to the primary efficacy population, but will exclude the patients with major violations in inclusion or exclusion criteria.

The Primary efficacy population will be used for the publication and is in agreement with the decisions made in the investigators' meetings. For the purposes of reporting the data to the regulatory authorities ITT population will be used by Novartis. Additionally, PP analysis may be done.

The Safety Analyzable Population includes all patients who receive at least one dose of imatinib.

## 6.3 Efficacy evaluation

### *Final analysis*

The study is designed to investigate whether a longer duration of therapy (36 months) results in an improvement of recurrence free survival (RFS) as compared to a short duration of therapy (12 months). A two-sided significance level of 0.05 will be used.

The primary endpoint RFS will be measured from the date of randomization to the date of first documentation of recurrence or death (from any cause), whichever occurs first. Second cancers are not considered to be RFS events. Patients who are alive and have not recurred are censored at the date of last follow-up. Survival estimates for RFS will be calculated using the Kaplan-Meier estimator. Comparison of the treatment groups will be based on log-rank test. The overall treatment effect will be quantified by hazard ratio which will be estimated using a Cox proportional hazards regression model with the treatment group only in the model.

In the Primary efficacy population patients who started using imatinib after the study treatment period will be censored at the start of the out-of-study treatment. In ITT population, patients who started using imatinib after the study treatment period will not be censored.

A number of supportive analyses will be performed for the primary endpoint:

- Log-rank test and Cox proportional hazards stratified by type of disease (local disease or intra-abdominal disease, i.e. stratification factor used in the randomization).
- A Cox proportional hazard model estimating the treatment effect while adjusting for the main prognostic variables, such as the primary tumor diameter, mitotic count, and presence of intra-abdominal implants/hepatic metastases. In addition, the center or country and other relevant

baseline variables may be included in the model.

- Wilcoxon test (giving greater weight to early events).
- A piecewise Cox proportional hazards model estimating the treatment effect within specific periods (0-12 months, 12-36 months, >36 months). The hazard ratio and 95% CIs will be plotted against time.
- The recurrence rate in the short duration group after 12 months (i.e. after the study treatment has been completed) will be compared to the recurrence rate in the long duration group after 36 months (i.e. after the study treatment has been completed). The estimated risk profiles will be presented using a smoothed hazard plot.
- The events that have occurred after 12 months treatment will be compared with similar methods as the primary analysis. The patients, who have had an event before the 12 months treatment will be considered as having withdrawn from follow-up at the time of the event<sup>12</sup>.
- An analysis of RFS, counting also the second cancers as recurrences.
- The RFS and GIST-specific survival will also be analyzed by means of the competing risks method, i.e. estimation of the cumulative incidence function for the specific cause<sup>13</sup>, if the proportion of competing risks is not negligible. The competing risks for RFS are deaths and withdrawals from the study and for the GIST-specific survival deaths due to other causes and withdrawals from the study.

Overall survival and GIST-specific survival will be analyzed as secondary endpoints in the final analysis, based on the early data detected by the time of the analysis. Overall survival will be measured from the date of randomization to the date of death resulting from any cause. Patients alive are censored at the time of last follow-up. Similar methods as for the primary variable will be used in the data analysis.

GIST-specific survival will be measured from the date of randomization to the date of death considered to be caused by GIST. Patients alive are censored at the time of last follow-up, and patients who have died of a competing cause of death are censored on the date of death resulting from the intercurrent cause. Similar methods as for the primary variable will be used in the data analysis.

The presence of second cancers will be tabulated.

#### ***Follow-up analysis 5 years after the Final analysis***

A follow-up analysis will be conducted approximately 5 years after the final analysis has been conducted. The follow-up analysis is designed to investigate whether a longer duration of therapy (36 months) results in an improvement of overall survival as compared to a short duration of therapy (12 months). A two-sided significance level of 0.05 will be used.

In addition to the overall survival, the analysis of other endpoints (RFS, GIST-specific survival, presence of second cancers) will be updated. Methods similar to the final analysis will be used.

A further exploratory analysis will compare data on systemic medical treatments, surgery for metastatic disease, and radiation therapy given to treat recurred (usually overtly metastatic) GIST and the best responses to first-line imatinib in the metastatic setting. These variables will be tabulated by treatment group. Time from the date of randomization to the date of first progression of overtly metastatic GIST (as defined by RECIST; a new node within a metastatic lesion, i.e. "a node within a mass", is also considered disease progression) or death will be compared between the treatment groups (TTP-Met). In this analysis patients whose GIST has not recurred or whose metastatic GIST has not progressed will be censored at the time of the last follow-up. Patients

who had overt metastases at the time of randomization will be excluded from the TTP-Met analysis. TTP-Met will also be calculated excluding from the analysis those subjects whose first-line systemic treatment for metastatic disease was some other agent than imatinib.

#### 6.4 Safety evaluation

Feasibility of therapy will be estimated by 1) the proportion of patients who received the study medication for the assigned period of time, 2) the total frequency of serious adverse events and the annual frequency of serious adverse events, 3) the total frequency and the annual frequency of hematological and nonhematological grade 3 or 4 adverse events.

In addition, the number of patients who reduced the imatinib dose and the imatinib treatment interruptions will be summarized.

The occurrence of the following cardiac complications will be tabulated:

- diagnosis of myocardial infarction since study entry
- diagnosis of cardiac failure since study entry
- diagnosis of coronary artery disease since study entry
- diagnosis of other cardiac diseases since study entry
- cardiac intervention (e.g. surgery, artery dilatation) since study entry.

The safety analysis will be conducted two times, in the final analysis and in the follow-up analysis. Both total frequencies and annual frequencies will be reported in the safety analysis.

## 7 Notable scales

See Appendix 2 for the NCI/NIH Common Toxicity Criteria

#### Eastern Cooperative Oncology Group performance status scale

Grade	Description
0	Fully active, able to carry on all pre-disease activities without restriction.
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature e.g. light housework, office work.
2	Ambulatory and capable of all self-care but unable to carry out any work activities. Up and about more than 50% of waking hours.
3	Capable of only limited self care, confined to bed or chair more than 50% of waking hours.
4	Completely disabled. Cannot carry on any self-care. Totally confined to bed or chair.
5	Dead

## 8 Publication policy and authorship

The final publication will be written by the principal investigator. An effort will be made to include every investigator who has entered at least 4% (n=14) of the eligible study patients as a co-author, who have participated in analysis of the study data, in drafting of the manuscript, and who can assume responsibility of the study report, if the space allows. A smaller number of accrued patients than 14 may also suffice for authorship if the space allows, and provided that

the investigator has significantly contributed to acquisition of data and drafting of the manuscript. The number of patients entered will be the major determinant of the sequence of co-authors. The study statistician, pathologist, person(s) responsible for gene mutation and serum growth factor analysis, and appropriate Novartis personnel may also be included as a co-author. All investigators who have included an eligible patient in the study will be acknowledged. Investigators participating in this multicenter study agree not to present data gathered from one center or a small group of centers before the full publication, unless formally agreed to by all other investigators.

The results of this study may be published as one or more publications and presented at scientific meetings. The final report will be published. The Safety Analysis report and results of analyses of tissue or serum biological variables may be published provided that the Study Steering Committee considers their publication to be valuable to the scientific community and/or to advance management of GIST.

Novartis must receive copies of any intended communication in advance of publication (at least 15 working days for an abstract or oral presentation and 45 working days for a journal submission). Novartis will review the communications for accuracy (thus avoiding potential discrepancies with submissions to health authorities), verify that confidential information is not being inadvertently divulged and provide any relevant supplementary information.

## **9 Procedures and instructions**

### **9.1 Administrative procedures**

#### **9.1.1 Changes to the protocol**

Any change or addition (excluding administrative) to this protocol requires a written protocol amendment that must be approved by the Principal Investigator before implementation. Amendments significantly affecting the safety of patient's, the scope of the investigation or the scientific quality of the study require additional approval by the Institutional Review Board/Independent Ethics Committee/Research Ethics Board (IRB/IEC/REB) and by the regulatory authorities. Examples of amendments requiring such approval are:

1. modifications in drug dose or duration of exposure of Glivec outside of the protocol-specified rules,
2. significant changes in the study design (e.g. addition of a control group),
3. increases in the number of invasive procedures to which subjects are exposed
4. addition or deletion of a test procedure required for safety monitoring.

These requirements for approval should in no way prevent any immediate action from being taken by the investigator or by Novartis in the interests of preserving the safety of all patients included in the trial. Examples of administrative changes not requiring formal protocol amendments and IRB/IEC/REB approval include:

1. changes in the staff,
2. minor changes to the exclusion or inclusion criteria used to select study patients,
3. minor changes in the packaging or labeling of study drug.

#### **9.1.2 Monitoring procedures**

The monitoring plan is detailed in an Appendix (Appendix 4) to the protocol.

#### **9.1.3 Recording of data and retention of documents**

The investigator must complete the CRF provided, must store copies of the CRF in a secure place and transmit the data to the SSG secretariat. Data on subjects collected on CRF during the trial will be documented in an anonymous fashion and the subject will only be identified by the subject/randomization number, and by his/her initials if also required. If, as an exception, it is necessary for safety or regulatory reasons to identify the subject, both Novartis and the investigator are bound to keep this information confidential.

The investigator must maintain source documents for each patient in the study, consisting of all demographic and medical information, including laboratory data, electrocardiograms, etc, and keep the signed informed consent form. All information on CRF must be traceable to these source documents in the patient's file.

Essential documents, as listed below, must be retained by the investigator for as long as needed to comply with national and international regulations. The investigator agrees to adhere to the document retention procedures by signing the protocol. Essential documents include:

1. IRB/IEC/REB approvals for the study protocol and all amendments
2. all source documents and laboratory records
3. CRF copies
4. patients' informed consent forms (with study number and title of trial)
5. any other pertinent study document.

#### **9.1.4 Auditing procedures**

Auditing procedures are not required by the protocol.

#### **9.1.5 Disclosure and confidentiality**

By signing the protocol, the investigator agrees to keep all information provided by Novartis in strict confidence and to request similar confidentiality from his/her staff and the IRB/IEC/REB. Study documents (protocols, investigators' brochures, CRF and other material) will be stored appropriately to ensure their confidentiality. The information provided by Novartis to the investigator may not be disclosed to others without direct written authorization from Novartis, except to the extent necessary to obtain informed consent from patients who wish to participate in the trial.

#### **9.1.6 Discontinuation of study**

Novartis reserves the right to discontinue any study under the conditions specified in the clinical trial agreement.

## **9.2 Ethics and Good Clinical Practice**

This study must be carried out in compliance with the protocol and the principles of Good Clinical Practice:

1. ICH Harmonized Tripartite Guidelines for Good Clinical Practice 1996. Directive 91/507/EEC, The Rules Governing Medicinal Products in the European Community.
2. Declaration of Helsinki and amendments, concerning medical research in humans (Recommendations Guiding Physicians in Biomedical Research Involving Human Subjects).

The investigator agrees to adhere to the instructions and procedures described in the protocol and thereby to adhere to the principles of Good Clinical Practice that it conforms to.

### 9.2.1 Institutional Review Board/Independent Ethics Committee

Before implementing this study, the protocol, the proposed informed consent form and other information to subjects, must be reviewed by a properly constituted IRB/IEC/REB. A signed and dated statement that the protocol and informed consent have been approved by the IRB/IEC/REB must be given to the principal investigator before study initiation. Any amendments to the protocol, other than administrative ones, must be approved by this committee.

### 9.2.2 Informed consent

The investigator must explain to each subject (or legally authorized representative) the nature of the study, its purpose, the procedures involved, the expected duration, the potential risks and benefits involved and any discomfort it may entail. Each subject must be informed that participation in the study is voluntary and that he/she may withdraw from the study at any time and that withdrawal of consent will not affect his/her subsequent medical treatment or relationship with the treating physician.

This informed consent should be given by means of a standard written statement, written in non-technical language. The subject should read and consider the statement before signing and dating it, and should be given a copy of the signed document. If the subject cannot read or sign the documents, oral presentation may be made or signature given by the subject's legally appointed representative, if witnessed by a person not involved in the study, mentioning that the patient could not read or sign the documents. No patient can enter the study before his/her informed consent has been obtained.

## 10 References

1. DeMatteo RP, Lewis JJ, Leung D, *et al.* Two hundred gastrointestinal stromal tumors: Recurrence patterns and prognostic factors for survival. *Ann Surg* 2000; 231: 51-8.
2. Miettinen M, Lasota J. Gastrointestinal stromal tumors – definition, clinical, histological, immunohistochemical, and molecular genetic features and differential diagnosis. *Virchows Arch* 2001; 438: 1-12.
3. Joensuu H, Dimitrijevic S, Silberman S, *et al.* Management of gastrointestinal stromal tumours. *Lancet Oncol* 2002; 3: 655-64.
4. Fong Y, Coit DG, Woodruff JM, *et al.* Lymph node metastasis from soft tissue sarcoma in adults. Analysis of data from a prospective database of 1772 sarcoma patients. *Ann Surg* 1993; 217: 72-77.
5. Corless CL, McGreevey L, Haley A, *et al.* KIT mutations are common in incidental gastrointestinal stromal tumors one centimeter or less in size. *Am J Pathol* 2002; 160:1567-72.
6. Rubin BP, Singer S, Tsao C, *et al.* KIT activation is a ubiquitous feature of gastrointestinal stromal tumors. *Cancer Res* 2001; 61: 8118-21.
7. Heinrich MC, Corless CL, Blanke C, *et al.* KIT mutational status predicts clinical response to STI571 in patients with metastatic gastrointestinal stromal tumors (GISTs). *Proc Am Soc Clin Oncol* 2002; 21:2a. (abstract)
8. Joensuu H, Roberts P, Sarlomo-Rikala M, *et al.* Effect of the tyrosine kinase inhibitor STI571 in a patient with metastatic gastrointestinal stromal tumor. *New Engl J Med* 2001; 344: 1052-6.
9. Demetri von Mehren M, Blanke CD, *et al.* Antitumor Effects of an Oral Selective Tyrosine Kinase Inhibitor, Imatinib Mesylate, in Patients with Advanced Gastrointestinal Stromal Tumors. *New Engl J Med* 2002; 347: 472-80.
10. Van Oosterom AT, Judson I, Verweij J, *et al.* Safety and efficacy of imatinib (STI571) in metastatic gastrointestinal stromal tumours: a phase I study. *Lancet* 2001; 358: 1421-3.
11. Fletcher CDM, Berman JJ, Corless C *et al.* Diagnosis of Gastrointestinal stromal tumors: A consensus approach. *Hum Pathol* 2002; 33: 459-65.
12. Freedman LS, De Stavola BL. Comparing the effects of different durations of the same therapy. *Statistics in Medicine* 1998; 7: 1013-1021.
13. Andersen P, Abildstrom S, Rosthøj S. Competing risks as a multi-state model. *Statistical methods in clinical research*, April 2002; 11 (2): 203-215.

# **Appendix**