

**STUDY PROTOCOL on the
Quality of Spinal Cord Stimulation as an Additional
Therapy for Chronic Refractory Angina Pectoris**

Group XVII: Visceral and other Chest Pain (Taxonomy rapport page 137)

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GENERAL OUTLINE

Rationale

Angina Pectoris. The clinical manifestations of angina pectoris are typically provoked through exercise and vanish during rest. During exercise, patients with advanced coronary artery disease (CAD) often experience a crushing, constrictive, suffocating discomfort, usually in the upper sub-sternal area, sometimes radiating to adjacent areas (predominately left side), such as arms, neck, throat, jaw, and teeth. The provoked nociception is characterized by its vaguely distributed, 'emotionally' charged aspects, and by the influence of emotions on the experience of the angina pectoris. The patient suffering from effort angina commonly can predict the amount of physical exercise that causes angina. At maximal exercise the failing in blood flow through the diseased coronaries implies a fixed narrowing (stenosis) in the coronary arteries. At rest, the angina threshold is influenced by a/o. emotional stress, exposure to cold weather, superfluous meals and smoking. These aspects suggest a dynamic stenosis in a coronary artery. As a consequence, the variability of the angina threshold is determined by the interplay between the fixed and the variable obstruction in the coronary arteries. In general, angina pectoris is not a very specific indicator for occlusive coronary disease, since it is a relatively late, inconsistent, and non-specific phenomenon.

Therapies for Stable Angina Pectoris. In addition to improvement in lifestyle, the conventional way to improve myocardial ischemia is by either reducing the oxygen demand (β -blockers, calcium-channel blockers) or by improving the supply (nitrates, revascularization procedures such as percutaneous transluminal coronary angioplasty [PTCA] or, coronary artery bypass surgery [CABS]). Additive measures, such as lipid lowering, inhibition of platelet aggregation and, interference in the renin-angiotensin system have become established therapies for stable angina pectoris. In the vast majority of patients these strategies are sufficient to control the symptoms.

Chronic Refractory Angina Pectoris. The angina pectoris of patients is considered to be refractory when in spite of optimal anti-anginal pharmacological treatment and in the presence of significant coronary artery disease (i.e. > 75% stenosis in one or more major coronary arteries) in conjunction with persistent reversible myocardial ischemia, revascularization is no longer feasible. This definition excludes patients with cardiac syndrome X. The patients with chronic refractory angina are usually characterized by a long history of coronary artery disease, they lead severely restricted lives, and they are able to perform only limited activities. Moreover, the psychological stress caused by the awareness of the increased risk on a myocardial infarction often forms an additional burden on the patient and his family. Therapies that reduce their angina not only improve their quality of life but will ameliorate their psychosocial status also. In addition to anti-anginal medication, they often have been treated with one or more percutaneous transluminal coronary angioplasty or coronary artery bypass surgery. The majority of patients suffering from chronic refractory angina pectoris is relatively young, predominantly male, with a moderate hampered left ventricular ejection fraction.^{1,2}

An increasing number of patients, surviving various ischemic sequels, is suffering from severe chronic angina pectoris, refractory to these conventional strategies. From a psychosocial point of view it is debatable whether a SCS should be withheld from a 30-40 year old patient with class II CCS, but is indicated for a 80 year old patient in class III CCS. It is to the decision of the physician whether or not the young patient receives the SCS, albeit that a patient in class II CCS cannot be enrolled in this study. It is estimated that the prevalence for these patients with chronic refractory angina class III-IV CCS ranges about 100,000 patients in the USA and an equal number in Europe.³ For the Netherlands the prevalence is calculate to be at least 1,500 and the incidence 500.⁴

Justification for Study Given Risk/Benefit Outcome

Any additional therapy that relieves the complaints of these severely disabled patients, without adversely affecting their chronic disease is worth to be taken into consideration. An extra argument to pay attention to improvement of quality of life is particularly valid with respect to the prognosis of these patients who survive their end-stage heart disease for such a long period of time as expressed in an annual cardiac mortality of about 5% and 7-8% over-all mortality.¹ The targeted study population consists of patients who have exhausted conventional methods of improving myocardial blood flow or reducing effective myocardial consumption of oxygen. For them, the only way to cope with the angina pain is to use short-acting nitrates extensively and to avoid physical activity as much as possible. As a consequence their tolerance to exercise diminishes and a vicious cycle is initiated, afflicting patient quality of life.^{10,5} Their lifestyle is severely restricted; they cannot perform work outside the home, and have a very limited ability to perform household duties.

Electrical neuromodulation applied at the spinal cord and therefore generally referred to as Spinal Cord Stimulation (SCS) has been used in the Netherlands since 1986 as an additional therapy for angina pectoris, refractory to conventional strategies.⁶ Since then SCS has become a useful clinical adjunct therapy, resulting in more than 100 publications in the literature (Medline). The effectiveness has already been proven in the past by means of many prospective, open, and randomized studies (see reviews^{3,7}). In addition, many studies have demonstrated the safety of this therapy, since SCS employs anti-ischaemic effects,^{8,9,10,11} does not conceal complaints of angina pectoris during an acute myocardial infarction,^{12,13,14} and appears not to influence mortality.^{1,15,16}

SCS has enjoyed a successful history of use, and has been established as a safe, effective, and reversible treatment for chronic pain. Risks associated with this treatment have been mitigated wherever possible, and are essentially equivalent to risks associated with the currently marketed indications for use. Considering the desperate state of patients with chronic, intractable angina pectoris, SCS provides an opportunity for significant pain relief and quality of life improvement with minimal risk.

However, by means of an inquiry of clinical practice in The Netherlands we recognized the same reimbursement problems for 'chronic refractory angina pectoris' as has occurred in other areas where neuromodulatory techniques were indicated. The present

study has therefore not been designed as another study on the efficacy, but rather as a study with the same outlines and goals as the “Study Neuromodulation”, c.q. monitoring of quality indicators. Subsequently, the same procedures will be followed during this study as in this “Study Neuromodulation”. Furthermore, a limited number of centers has been selected for the study, to strengthen the team approach by ensuring full cooperation of the cardiologist, the implanting physician, and the person who is performing the follow-up. In addition, sufficient implantation capacity has to be guaranteed to perform the Study in the defined time-span. Finally, for this feasibility study an open observational design has been chosen, since there is no need for a control group, a cross-over, or a randomized design.

Before patients are enrolled into the study, a consensus between participating medical specialties has to be established, resulting in a dataset to be monitored. Following the Study, a set of parameters has to be determined, meant to be used as quality indicators for the maintenance of the module in the future. These parameters will be introduced into a stand-alone software system to be developed further during the Study. The consequence of a valuable outcome of this study will be that SCS becomes a regular part of the clinical practice in the treatment of patients with chronic refractory angina, within the Neuromodulation Centers in the Netherlands. The organizational structure after the Study will be discussed at that stage and within the Foundation Quality System Neuromodulation, The Netherlands.

Of note, soon after the SCS implantation, patients are often experiencing an increase in exercise capacity enabling them to have another life. In this regard, they often pose many questions. Therefore, follow-up, preferably in a rehabilitation program, should be more frequent at the start of the study, then at the end.

Objectives

Primary: The primary objective of this study is to evaluate, within the limits supplied by the Quality System Neuromodulation, the appreciation (*i.e. Patients satisfaction with the therapy by means of satisfaction scales and Quality of Life measures*) of SCS treatment for patients with chronic refractory angina pectoris.

Secondary: Patients related complications
Device related complications

Optional: Cardiac indices to be determined (exercise duration, maximum ST depression etc.).

Methods

Design. Since this study has not been designed to investigate the efficacy, but is rather addressing the quality of medical management with respect to SCS therapy, the study is therefore open and non-randomized. Furthermore, this design has been chosen, since there is no need to discriminate patient outcomes caused by the SCS from outcomes caused by other factors, nor is it necessary to minimizing the chance of bias. This will be performed by register in the Case Report Form (CRF) all data with respect to baseline characteristics, implantation data and, follow-up. At baseline are scored: demographic data, exercise duration, CCS class number of anginal attacks and nitroglycerine consumption/ per day, Left Ventricular Ejection Fraction (preferably by means of Radio Nuclide Angiography) and, Quality of Life measures.

Primary Objective. The primary objective of this study is to evaluate the value of SCS treatment for patients with chronic refractory angina. The boundaries for the study are determined by the Quality System Neuromodulation. The value of the therapy will be studied by means of monitoring the satisfaction with the therapy and the quality of life of the patients. This will be executed by scoring the Canadian Classification Score (CCS) for Angina by the Physician and by asking the patient to fill in on a regular base a diary and the Seattle Angina questionnaire.

Secondary Objectives: are related to the quality of the therapy;

a. Patients related complications, satisfaction with the therapy and, quality of Life. In addition, a simple query is performed with regard to retrospect analysis of admissions and physician visits during the past year. The following parameters are examined: the Canadian Cardiovascular Society (CCS) angina class; nitrate consumption; and the reported number of angina episodes (taken from the patient diary); Seattle Angina Questionnaire; patient satisfaction; cardiac-related hospitalizations & physician visits; patient complication rate;

b. Device related complications. The SCS equipment has to be reliable in technical sense during the study. It is advisable to continue collecting data of all patients in this respect until the second implant of the pulse generator. All Major Adverse Cardiac Events (MACE) and device sequelae are registered in the CRF.

Optional objectives. Cardiac indices to follow-up like exercise tests (exercise duration, time to angina and maximum ST-segment depression etc) are optional and are to be determined by the investigator.

Number of patients needed. A total number of 60 patients will be enrolled i.e. (average 10 per "A" center), within 1 year. More than 10 devices may be implanted in one center if another center is not able to enroll enough patients. However, each center should include at least 6 patients during the study and centers should not be include more than 15 in the study in order to have a proportional representation over the country.

Monitoring. A monitor will be reporting on the progress of the study on a regular base. The coordination and registration will be executed by the Thorax Trial Coordination Center (TCC) based at the University Hospital of Groningen. This is the contact for the participating centers in the country (Groningen, Leeuwarden, Alkmaar, Nieuwegein, Maastricht and Rotterdam).

Patient Population

Selection of Study Candidates. Study candidates will be evaluated prior to implantation as suitable candidates for SCS surgery. The screening will constitute and establish a baseline for comparison with post-implantation data and information. Evaluations must include the inclusion and exclusion criteria. The selection of “suitable” candidates is primarily performed by the screening cardiologists. Once the patient is selected, following approval of all data available by the study coordinator, the patient is referred to the implanting specialist (either neurosurgeon and / or anesthesiologist) for information and implantation. At that moment, an informed consent will have to be signed by the patient holding the same general information as was used during the Study Neuromodulation. From the patient perspective it has to be clear that at all times ending cooperation for the study is permitted.

Patient Selection and Enrollment (Visit 0). The first step of the screening phase of the study participants is to check whether or not the patient meets the admission criteria. Screening includes: coronary angiography to document the presence of coronary artery disease (acceptable if documented prior to this 12-week period), evidence of myocardial ischemia (exercise stress testing, stress echocardiography, or myocardial nuclear imaging); myocardial functional assessment (left ventricular ejection fraction); physical examination; medical history; and angina / medication status. The next step is to let the candidate sign the informed consent. The third and last part comprises the baseline evaluations of study for the (no revascularization option) candidates. These tests will be executed within 12 weeks prior to system implantation in suitable candidates.

Prior to surgical implantation of a spinal cord stimulation system, study participants will be provided with education intended to familiarize them with spinal cord stimulation and the spinal cord stimulation system. This instruction is standard for all chronic pain patients who are candidates for spinal cord system implantation. Patients will demonstrate competence in using the stimulator’s transmitter prior to being implanted with a system.

Baseline (visit 1). The baseline assessment will be completed 2-4 weeks prior to system implantation (Baseline) and comprises APPENDIX 1 and 2. Initial baseline assessments will be completed up to 2 weeks (initial visit) prior to system implantation in approved subjects. Initial baseline evaluation shall consist of the following (see appendix 1 and 2):

- **APPENDIX 1: Baseline characteristics and inclusion criteria**

Patient and contact information; Medication; History; Additional General and Cardiac Information: Gender; Age; Extend coronary artery disease (ie 1,2, 3 Vessel Disease; Left Main; grafts); Exercise test; Radio Nuclide Angiography; Canadian Cardiovascular Society class (CCS); Diary (AP and NTG scores) Seattle Angina Questionnaire; Number of hospital admissions and physicians visits in the past year.

- **APPENDIX 2: Quality of Life tests: Diary and Seattle Questionnaire**

Patient Diary. Patients will be required to keep a diary prior to each office visit. This diary will be completed for three (3) consecutive days prior to each office visit. The diary will be used for patients to self-report the number of glyceryl-trinitrate (GTN), and the number of angina attacks experienced and the duration and time of each stimulation session. The patients will be given a diary on the initial baseline assessment visit. The patients will continue to make entries until the conclusion of the study.

Seattle Angina Questionnaire. The SAQ consists of a 19-item self-administered questionnaire measuring five dimensions of coronary artery disease: physical limitation, anginal stability, anginal frequency, and treatment satisfaction and disease perception. This questionnaire has been validated and found to be a reliable and sensitive to clinical change when assessing the health of patients with coronary artery disease (Spertus et al. 1994; 1995).

Study Duration

After patient selection, subsequent enrollment and SCS implant, the study duration lasts 12 months. Selection is approximately 1-3 month before SCS system implant. Considering the expected rate of patient accrual, it is estimated that this study will take approximately one year to complete enrollment of all 60 patients.

Outline of the Study

In the Study the following phases are present;

- a) Selection
- b) Baseline tests and enrollment
- c) Implantation
- d) Follow-up

Patient Selection

Selection of the patients is the responsibility of the referring medical specialists i.e. the cardiologists. After selection the following information has to be made available to the study coordinators:

- 1) Does the patient fulfill the inclusion criteria and does he/she not meet the exclusion criteria?
- 2) Baseline data have to be provided with respect to the cardiovascular state.
- 3) Patient baseline measurements
- 4) Signed informed consent

After all data are provided to the monitor, permission will be given to implant.

Inclusion Criteria

1. Stable angina pectoris class III-IV CCS, longer than 3 months
2. Significant coronary artery disease (i.e. ≥ 1 major coronary artery $>75\%$ stenosis), not suitable for revascularization (CABG or PTI),
3. Paralleled by reversible myocardial ischemia, in spite of maximal tolerated anti-anginal medication (during the study medication, other than short acting nitrates, will be kept constant)
4. Age 18 years or older

Exclusion Criteria

1. Subject has been diagnosed with unstable angina pectoris/ myocardial infarction within the last 3 months
2. Study participant has a disease considered to be clinically of greater prognostic significance than angina pectoris with an estimated life expectancy < 1 year
3. Uncontrolled hypertension or diabetes
4. Inappropriate use by the patient of opiates or addictive behavior
5. Psychological inability (persisting mental disorders or psychopathology), which may cause significant instruction or compliance-problems
6. Participant does not understand the therapy, is not able to manage the device, or does not show co-operative behavior.
7. Candidates have been found to be suitable candidates for implanting the spinal cord stimulation system (no insurmountable technical problems with regard to SCS implantation procedure i.e. anatomical abnormalities, impossibility to obtain or to get or bear adequate paraesthesias)
8. Female candidates of child-bearing potential with a positive pregnancy test. The patient must use adequate contraception
9. Subject is likely to require a MRI evaluation in the future
10. Subject has a cardiac pacemaker/ ICD
11. When anti-platelet agents or coumarins cannot be withheld, temporarily.
12. Local infections
13. TENS (has to be withheld for at least 3 months)

Trial phase

Before the surgery all anti-platelet agents are withheld for 1 week and coumarins are titrated in agreement with a suboptimal INR (i.e. during surgery INR < 1.0). The trial phase will be used to assess whether or not the device can deliver the appropriate paresthesia to the painful areas and that the patient can tolerate this feeling. TENS (transcutaneous electrical nerve stimulation) will not be used for screening and is withheld for at least 3 months. The trial will be performed during the implantation phase once the leads have been positioned into place but before the SCS has been implanted.

Implantation phase¹ (APPENDIX 3)

Anticoagulants will be withheld at least four days prior to the implantation procedure. If it is determined by the cardiologist that anticoagulants are needed during this time the patient will be offered (low molecular weight) heparin. Aspirins must be withheld for one week prior to implantation. To effectively treat their angina pectoris, a spinal cord stimulation system must have the potential to target the areas where the angina is felt by the patient. The target area must be provided with pain-relieving paresthesia at tolerable and patient adjustable intensity levels. The system chosen for use in this study will allow the patient to vary paresthesia (stimulation) in location and intensity, as needed.¹⁷

With the patient under local anesthesia, a small puncture is made in the skin with a paramedian approach at an angle of no more than 30-40 degrees.¹⁸ An epidural needle is inserted at the T5 vertebral level and confirmed as having entered into the epidural space. Using fluoroscopic guidance, a lead blank is inserted through the needle into the dorsal epidural space, and is manipulated to establish an appropriate pathway. The octopolar lead is then introduced into the epidural space, either through the needle or through the use of a lead introducer. Proper lead placement is verified through intra-operative trial stimulation, in which paresthesia is experienced by the patient. The electrode should be positioned so that the tip electrode is located between the C8 and T1 vertebral levels. Since angina pectoris is usually provoked during exercise and during surgery the patient is at rest it is advised to determine preoperatively the area where the patient feels the angina. Upon verification of proper lead placement, the lead is secured using a lead anchor and sutures. The pulse generator is implanted by making a pocket incision at the desired location, and creating a subcutaneous pocket by blunt dissection to accommodate the pulse generator. A subcutaneous tunnel is made from the lead incision site to the pulse generator implantation site, using a tunneling tool, and the lead is tunneled to the receiver site. The lead is connected to the pulse generator, the pulse generator is placed in the subcutaneous pocket, and the incisions are closed. An eight-electrode lead is adequate to address the referred chest pain (i.e. angina). The lead would be placed as described above and connected, subcutaneously, to the SCS-type receiver. This implanted system will function using settings, which the study Investigator will program into the study participant's SCS. At the end of the

¹ Additional information regarding system implantation is provided in product labeling.

operative procedure the SCS will be programmed in bipolar mode (since uni-polar is often too painful, shortly after operation).

Post-operative phase

Within 2 days after the implantation the patient's SCS will be checked and when necessary reprogrammed. At this time the patients will receive an optimal stimulation regimen. The SCS can be reprogrammed as needed at any time, but only by the investigator or designated staff. The patient can only operate the SCS by turning the unit ON or adjusting the amplitude to levels, which are comfortable and effective for the particular pain condition of the patient.

Stimulation settings (mainly the output) will be adjusted at levels comfortable for each individual patient while in the sitting position.¹⁷ Additional programs will be available to the patient if needed. It is advised during the study to stimulate 3 times per day 1 hour and additionally during angina pectoris. The remote control will be set within the limits advised by the physician. Standard medical treatment methods now in use will be available to the patient throughout the study to supplement control of the pain if necessary. Study participants will not be denied their current medical treatment.

Patients will be instructed to immediately contact emergency care and discontinue stimulation should they experience chest pain that continues for more than ½ hour and differs at all from their familiar chronic angina. In addition, patient cardiac function will be monitored during the study at each visit scheduled as outlined in the timeline on page 6 to ensure detection of any unhealthy change in the patient's status. Medication (anti-anginal) doses are to be maintained as needed throughout the study unless modifications are required for medical reasons. Short-acting nitroglycerin can be taken at any time during the study.

Data to be registered by the implanting specialist

Assessment phase (APPENDIX 4)

Patients will be assessed during visits at: 2 (two) weeks, (optional 6-8 weeks), 3 (three) months, 6 (six) months, and 12 (twelve) months by designated staff. At these time patients will complete various forms and questionnaires used to assess the effectiveness of the therapy as well as the performance of the device. Follow-up visits will be coordinated by the implanting physician who will also be responsible for the completion of the forms.

Complications and Revisions (APPENDIX 5)

Spinal cord stimulation system implantation for the intended purpose of this investigation shall be performed using the identical procedure prescribed for the currently marketed SCS device components. Complications and anticipated adverse effects associated with spinal cord stimulation implantation (including the currently marketed device) include:

- undesirable changes in stimulation possibly related to cellular changes in tissue around the electrodes, changes in the electrode position, loose electrical connections and/or lead failure;
- placement of an SCS lead in the epidural space is a surgical procedure that may expose the patient to risks of epidural hemorrhage, hematoma, infection, and/or paralysis;
- radicular or abdominal stimulation;
- CSF leakage;
- persistent pain at the electrode site or receiver site;
- implant migration;
- allergic or rejection response to implanted materials;
- local skin erosion over the implanted SCS receiver;
- paralysis, weakness, clumsiness, numbness or pain below the level of implantation and/or;
- diminished, or loss of, pain relief.

Since complications related to the implant (SCS) are to be monitored, it is advised to follow the same criteria as during the Study Neuromodulation. (see Dutch appendices for Complication phase and Revision phase).

Revisions

Since complications related to the implant are to be monitored, it is advised to follow the same criteria as during the Study Neuromodulation

Criteria for Measuring Safety and Effectiveness

Safety Endpoints. All adverse events including those unrelated to the SCS implantation in use will be recorded. Related complications and anticipated and unanticipated adverse effects reported during this study will be evaluated relative to those reported for other SCS implantation and use. All adverse events will be reported and compared for purposes of safety analysis.

Adverse Events and Complications. Throughout the course of the proposed study, all adverse events will be recorded and monitored. Every effort will be made to remain alert to possible adverse experiences and unexpected findings. If adverse experiences occur, the first concern will be the safety of the subject. Appropriate medical intervention will be made.

Study Completion Procedures

Subject Completion. Subjects are considered to have completed the study if they have completed all follow-up examinations through 12 months post implantation.

Subject withdrawal. Subjects may be withdrawn from the study at the discretion of the investigator only for reasons related to the study treatment regimen that would jeopardize the subject's health and welfare if he or she were to continue in the study. Terminated subjects shall be considered part of the study and will not be replaced. Data from these subjects will be analyzed separately. However, every effort will be made to follow withdrawal subjects for safety reasons, using the appropriate case report forms, until the planned end of the study period.

Subject Discontinuation. Subjects may be discontinued from the study for non treatment-related reasons only when no other option is possible. Reasons for discontinuation include, but are not necessarily limited to:

- Missing 2 consecutive follow-up visits.
- Voluntary withdrawal from the study by the subject.
- Subject has moved from the area and is determined to be lost-to-follow-up.
- Subject is unwilling or unable to cooperate with study requirements (medication regimen, follow-up visits, etc.).

The reason for discontinuation will be recorded on the appropriate case report form. Discontinued subjects may not be replaced in the study.

Prior to discontinuing a subject, every effort should be made to contact the subject in an effort either to get the subject back into compliance with the protocol, or to obtain as much follow-up data as possible.

Statistical Plan

The patient demographics, medical history, physical examination, and pain medication status will be tabulated and descriptive statistics will be estimated. These include means (or medians) and standard deviations (or inter-quartile ranges) for continuous or ordinal variables and proportions for categorical variables. Each questionnaire instrument will be analyzed consistent with their validated methodology. The following variables will be evaluated according to the most appropriate statistical test method; Seattle Angina Questionnaire, the Canadian Cardiovascular Society (CCS) angina class, cardiac-related hospitalizations, total complication rate, nitrate consumption, and the reported number of angina episodes.

Risk/Benefit Analysis & Mitigation

General Risks

Spinal cord stimulation system implantation for the intended purpose of this investigation shall be performed using the identical procedure prescribed for the currently marketed SCS device components. General risks associated with spinal cord stimulation implantation (including the currently marketed device) include:

- Undesirable changes in stimulation over time
- Seroma or body fluid which may accumulate with swelling at the implant site
- Lead migration
- Infection
- Pain at sites over the implanted system components
- Cerebrospinal fluid leakage through the dura
- Mechanical failure

This procedure is performed under local anesthesia and is considered to be reversible and non-destructive. A physician will clear participants for surgical implantation.

Interruption of Current Treatment

The Investigator(s) will determine beforehand that alternative, proven therapies are inadequate or inappropriate for study participants. However, the patient will not be required to discontinue or interrupt any current treatment methods.

Myocardial Infarction (see also rationale)

Spinal cord stimulation has been demonstrated to not disguise the pain associated with severe ischemia during infarction.^{9,12,13} Pain associated with an infarction will be apparent to the patient, even while using the stimulation system to reduce the chronic angina pain. When patients experience pain different from their familiar chronic angina pain they will be instructed to immediately contact emergency care, take nitroglycerine s.l., and discontinue stimulation. In addition, patient cardiac function will be routinely monitored during the study to ensure detection of any unhealthy change in the patient's status.

Description of the Device

System Components

The components of the spinal cord stimulation system to be used in this study are currently available for use to treat chronic pain of the trunk and limbs. They include the following:

ANS Octrode Spinal Cord Stimulation Lead (Model #2198) (Qty 1)

The investigator will place a single SCS lead within the epidural space. Further details regarding the engineering and testing of each component are provided in the referenced 510(k)s. Available as a lead kit with components necessary for epidural implantation. Each lead consists of platinum iridium electrodes connected by individually insulated wires to stainless steel terminal sleeves. A biocompatible polyethylene or polyurethane sheath covers the lead wires. The lead is approximately 1.4mm (0.054") in diameter and approximately 58 cm (23") in length.

The lead is implanted percutaneously into the dorsal epidural space of the spinal cord using a special needle, lead blank, and epidural introducer.

ANS Implantable Pulsegenerator (SCS) (Quantity 1)

The SCS is an 8-channel multi-programmable system designed to be connected to one lead of 4 or 8 electrodes or one extension capable of dual leads. It is powered by a hermetically sealed battery within a titanium case and uses microelectronic circuitry to generate constant current electrical stimulation. Stimulation programs can be delivered as either single stimulation or MultiStim® programs depending on the patient's needs.

ANS Programmer (Quantity 1)

The Programmer controls the creation and adjustment of all programming parameters. Powered by three AAA batteries, the programmer communicates through the use of radio-frequency signals from the programmer wand to the implanted SCS. The programmer allows clinicians programming capability and can also function with the PainDoc Computerized Support System.

ANS Test Stimulator (model # TS-8) (Quantity 1)

The test stimulator received clearance under K903814. The test stimulator is designed to provide approximately the same stimulation output as the combination of an Octrode SCS system. The system provides appropriate stimulation signals to the electrodes under test to simplify operation and ensure the system is functioning properly by allowing the physician to evaluate different lead placements and electrode combinations to assess efficacy prior to the permanent implant.

The test stimulator is approximately 4.9" x 2.4" x 0.9" in size and weighs approximately 4.0 ounces.

Regulatory Status

The Genesis SCS has been approved for sale and distribution in the European Community for the treatment of chronic pain of the trunk and limbs. During the Study all implant (also the parts) related data are registered. The Genesis SCS device or its immediate package shall bear a label with the following information:

- The name and place of business of the manufacturer.
- The quantity of contents
- Will be labelled, "CAUTION – For Investigational Device. Limited by Federal (US) law to Investigational use." A copy of the instruction manuals for the physician and patient are provided as Appendix A."
- The manual contains a section that describes all relevant contraindications, hazards, adverse effects interfering substances or devices, warnings, and precautions.

Study Overview

Timing of visit	Activities at visit	Case Report Forms to be completed (Appendix C).
Baseline (after informed consent)	Screening (Patient information; Inclusion/exclusion) Signing informed consent Treadmill exercise Blood sample Scheduled for surgery Diary RNA	Demographics Medical History Diary Seattle Angina Questionnaire
Day of system internalization	Device implanted Programming of the device Collect patient diary data	Diary review Implantation data
2 weeks	Office visit check scar Programming	Programming worksheet
4-6 weeks (optional)	Patient Interview by telephone	
12 weeks after system implantation	Report any complications (Exercise treadmill test); Quality of Life Assessment; Collect the patient diary data	Follow-up evaluation form; Efficacy testing; Seattle Angina Quest; Diary review; Programming worksheet
6 months after system implant	Report any complications; (Exercise treadmill test); Quality of Life Assessment; Collect the patient diary data	Follow-up evaluation form; Efficacy testing; Seattle Angina Quest. Diary review Programming worksheet.
1 year after system implant	Report any complications; (Exercise treadmill test); Quality of Life Assessment; Collect the patient diary data; Study complete.	Follow-up evaluation form; Efficacy testing; Seattle Angina Quest. Diary review Programming worksheet; EXIT

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