Renata Medical™

Instructions for Use (IFU)

Minima™ Stent System

℞ ONLY Caution: Federal (USA) law restricts this device to sale by or on order of a physician

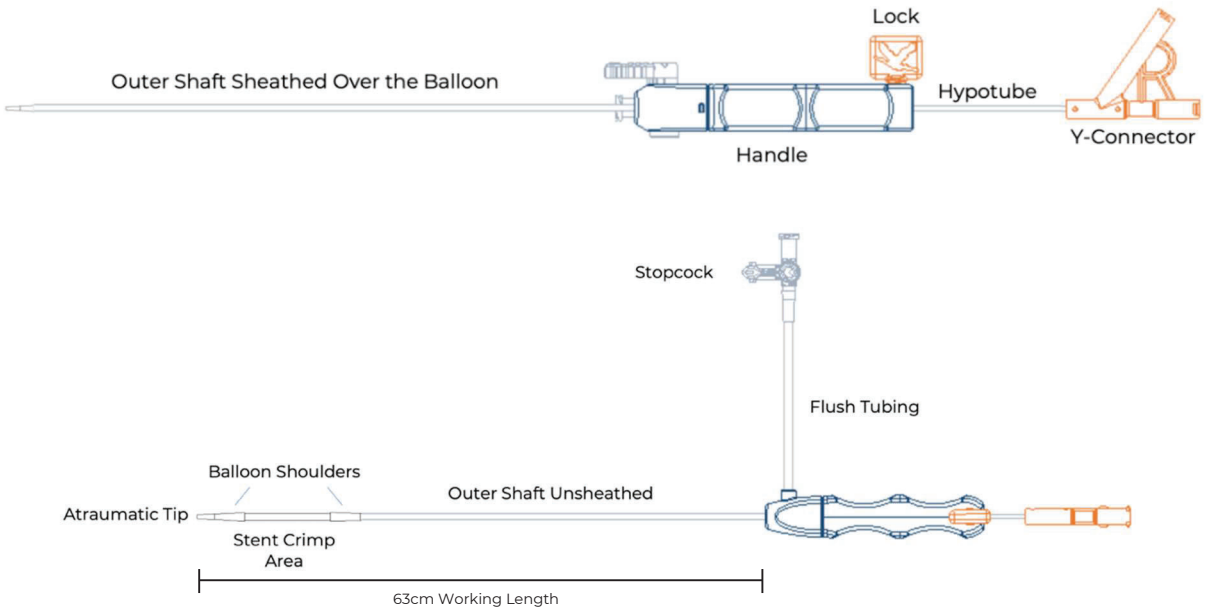
It is important to read the Instructions for Use with careful attention to cautions, notes, and warnings prior to use of this product.

Non-Pyrogenic

Renata Medical Minima™ Stent (FG-0001, FG-0002) Instructions for Use

1.0 Device Description

The Minima™ Stent is a cobalt chromium stent indicated for use in the treatment of native or acquired pulmonary artery stenoses or coarctation of the aorta in neonates, infants, and children at least 1.5 kg in weight. The stent comes packaged on a specifically designed delivery system which allows for sheath-less delivery to the target lesion. The entire system is packaged and sterilized with ethylene oxide gas and is single use only. Refer to below figures for more information about the stent and delivery system.



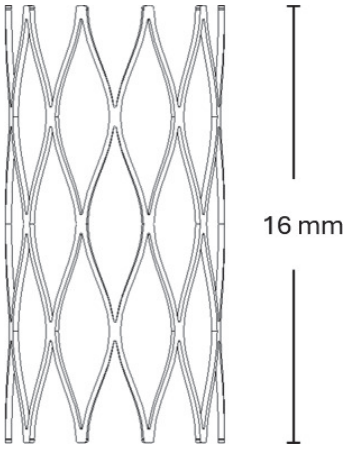


Table 1: Balloon Inflation Dimensions

Inflation Pressure (atm)	Nominal Stent OD (mm)	
	6mm	8mm
4	5.1	6.9
6	5.4	7.3
8	5.8	7.7
10	6.3	7.9
12	6.7	8.2
14*	7.1	8.5

*14 atm is Rated Burst Pressure (RBP) for both systems. The stent has a length of approximately 16mm for all the diameters listed in Table 1.

2.0 Indications for Use

The Minima™ Stent System is indicated for use in the treatment of native or acquired pulmonary artery stenoses or coarctation of the aorta in neonates, infants, and children at least 1.5 kg in weight.

3.0 Contraindications

- Active bloodstream infection requiring antibiotic therapy within 7 days prior to stent implantation.
- History of or active endocarditis (active treatment with antibiotics) within 180 days prior to stent implantation
- Aortic or pulmonary artery aneurysm
- Known hypersensitivity to aspirin or heparin and cannot be treated with other antiplatelet and/or antithrombotic medications.
- Known hypersensitivity to cobalt-chromium or contrast media that cannot be adequately pre-medicated.

4.0 Warnings

This device was sterilized with ethylene oxide and is for single use only. Do not reuse or re-sterilize this device. Attempts to re-sterilize this device can cause a malfunction, insufficient sterilization, or harm to the patient.

- Do not use the device if the sterile package is open or damaged.
- Use on or before the expiration date that is printed on the product packaging label.
- Patients who are allergic to cobalt chromium or nickel can have an allergic reaction to this device
- Accurate measurements of the target lesion and surrounding vessel are required for correct stent choice and placement
- Embolized devices may require surgical removal
- Do not exceed the RBP of the balloon. An inflation device with a pressure gauge is recommended.
- Stent geometry does not allow for dilation beyond 24mm.

5.0 Precautions

- The safety and effectiveness of the Minima™ Stent have not been established when the stent is dilated beyond 10 mm as there are currently limited engineering data on the structural integrity and no clinical data available on the Minima™ Stent dilated to greater than 10 mm in diameter.
- Patients must have a body weight ≥1.5kg.
- Do not proceed if anatomic lesion does not lend to the safe placement of a stent.
- Target vessels must be within the range of the Minima™ System balloon sizes.
- This device must be implanted by physicians who are trained in standard transcatheter techniques.
- Patient must be a candidate for procedures that use this device.
- The physician must exercise clinical judgment in situations that involve the use of anticoagulants and antiplatelet drugs before, during, and/or after the use of this device.

- Patients must have an activated clotting time (ACT) of greater than or equal to 250 seconds prior to device placement unless the patient has a significant risk for bleeding and is unable to be anti-coagulated.
- Store in a dry place.
- Do not use contrast power injection with delivery catheter.
- Catheter lab personnel must exercise caution when handling the stent system.
- Refrain from excessively torquing the system more than 180 degrees in either direction while tracking the delivery system to the target location.
- The balloon is rated to be expanded up to two (2) times.

6.0 Potential Adverse Events

Potential adverse effects (e.g., complications) associated with the use of the device include but are not limited to:

- Aortic aneurysm/ pseudoaneurysm, dissection, or rupture
- Arrhythmia
- Bleeding
- Death
- Endocarditis
- Femoral artery injury, thrombosis, or pseudoaneurysm
- Hematoma
- Infection
- Jailed side branches of the pulmonary arteries
- Jailed subclavian artery
- Myocardial infarction
- Pulmonary artery aneurysm/pseudoaneurysm, dissection, or rupture
- Stent fracture with loss of structural integrity
- Stent malposition dislodgement/migration or embolization requiring transcatheter or surgical adjustment or retrieval
- Stent stenosis
- Stroke or transient ischemic attack
- Thrombosis
- Vessel perforation/injury/dissection/rupture/tear

7.0 MRI Safety Information

MRI Safety Information 

A patient with the Renata Medical CoCr Cardiac Stent may be safely scanned under the following conditions. Failure to follow these conditions may result in injury to the patient.

Name/Identification of device	Renata Medical CoCr Cardiac Stent
Nominal value(s) of Static Magnetic Field [T]	1.5 T or 3 T
Maximum Spatial Field Gradient [T/m and gauss/cm]	30 T/m (3000 gauss/cm)
RF Excitation	Circularly Polarized (CP)
Maximum SAR [W/kg] under Normal Operating Mode	Whole Body: 2.0 W/kg Head: 3.2 W/kg
Limits on Scan Duration	Whole Body: 2.0 W/kg whole body average SAR for 1 hour of continuous RF (a sequence or back-to-back series/scan without breaks)
MR Image Artifact	The presence of this implant may produce an image artifact of 10 mm.
If information about a specific parameter is not included, there are no conditions associated with that parameter.	

8.0 Patient Considerations

Ensure the patient meets the following screening criteria:

- Vascular stenosis measuring ≤ 50% of normal adjacent vessel diameter.
- Patency of at least one femoral vein, femoral artery, jugular vessel, or both carotid arteries able to accommodate the delivery system.
- Adjacent vessel to stenosis measuring ≥ 4mm in diameter.

- Adjacent vessel allows for interaction with the deployed stent on initial inflation, when using the appropriate pre-mounted stent.

Warning: *Compliant lesions and lesions with large surrounding native vessel diameter can contribute to an increased risk of intraprocedural stent movement when crossing the stent with catheters during the procedure. A low-pressure angioplasty balloon that has the same diameter as the surrounding native vessel diameter can be used to assess the compliance of the stenosis, prior to prepping the Minima™ System. If no waist is seen when inflating the balloon, do not treat the lesion with a Minima™ Stent unless the surrounding vessel diameter will allow for engagement of the stent apices.*

9.0 Directions for Use

Materials recommended for use with this device:

- 0.014”-0.018” Guidewire
- Pressure manometer inflation device
- Stopcock
- >10cc syringe

10.0 Storage

Store the device between 15°C to 30°C (59°F to 86°F) and away from direct sunlight. Appropriate inventory control should be maintained so that systems with the earliest use by dates are preferentially implanted to avoid device expiration.

11.0 Procedure

11.1 Access and Target Site Measurement

Prepare the patient for a standard transcatheter procedure. Once vascular access is achieved, administer anticoagulation to achieve an activated clotting time (ACT) of greater than 250 seconds prior to device placement, unless the patient has a significant risk for bleeding and is unable to be anticoagulated.

Perform a right and/or a left heart catheterization as indicated.

The covered system allows for sheathless delivery, with the entire system having an outer diameter equivalent to a 4 Fr sheath, making it suitable for use in neonates, infants, and young children. If a physician elects to use a sheath, a 6 Fr sheath is required.

Take hemodynamic measurements as indicated

Perform selective angiography of the target lesion to measure stenosis diameter as well as the adjacent non-stenotic vessel diameter both proximal and distal to the target lesion. Measure the desired stent length to treat the target lesion.

Warning: *Accurate measurements of the target lesion and surrounding vessel are required for proper stent and balloon size selection.*

Perform measurements for stent selection. Ensure the following measurements are taken:

- Target lesion stenosis diameter
- Proximal normal vessel diameter
- Distal normal vessel diameter
- Desired stent length

Choose the appropriate pre-mounted stent balloon diameter.

11.2 Device Preparation

Examine the packaging and system, and if any abnormalities are seen, replace with a new unit.

Ensure the lock is engaged with the hypotube.

Flush the guidewire lumen of the balloon catheter and the injection port of the outer shaft using saline until saline visibly exits the distal end of the guidewire lumen and outer shaft.

Attach a balloon inflation device to the y-connector. De-air the balloon using a saline and contrast mixture.

11.3 Device Tracking

Introduce the guidewire into the vasculature and advance across the target lesion.

Track the stent delivery system over the guidewire to the target location.

Once at the intended deployment position, unlock the outer shaft by twisting the lock counterclockwise. Once unlocked, unsheathe the stent by pulling the outer shaft back while holding the balloon shaft stationary. Ensure outer shaft is fully retracted with the balloon y-connector flush with the handle.

Adjust the catheter position until the stent is in the desired location. If needed, check the location in relation to patient anatomy by hand injecting contrast through the outer shaft using the injection port.

11.4 Device Deployment

Deploy the stent by inflating the balloon to the pressure needed to achieve the desired stent diameter as listed in Table 1. Once the desired stent expansion is obtained, deflate the balloon.

***Warning**: Do not rotate the delivery system while the balloon is inflated, as this can result in increased inflation and deflation times.*

Confirm proper stent deployment using a contrast injection through the outer sheath injection port.

11.5 Device Withdrawal

Ensure that the balloon is fully deflated prior to retracting it back through the stent over the guide wire.

Perform a final angiogram to make sure the stent is properly positioned, the stenosis has been adequately expanded, and there is no vascular damage.

When using the break-away handle feature, rotate the proximal end of the handle away from your body to separate the proximal and distal portions of the handle. Once the portions of the handle are separated, pull the balloon shaft and proximal handle out over the guidewire, ensure wire position is maintained. This system has been qualified to accommodate a 4Fr or smaller pigtail catheter for post-deployment angiography.

***Warning:** Do not use contrast power injection with delivery catheter. If power injection is required, track a pigtail catheter over the guidewire and through the proximal seal.*

11.6 Post-Procedure Care

Monitor the patient post-procedure. Perform a transthoracic echocardiogram and/or X-ray to ensure the stent is in the correct position before the patient is released. Give endocarditis prophylaxis for 6 months. Prophylaxis beyond 6 months is at the physician's discretion. Prescribe aspirin for 6 months. Aspirin treatment beyond 6 months is at the physician's discretion.

11.7 Post-Procedure Instructions

Instruct the patient on when to seek medical attention.

Implant Card: An implant card is located in each device box. Complete the patient and implant information sections.

11.8 Disposal

The carton is recyclable. Discard all packaging materials appropriately. Use solid biohazard waste procedures to discard devices.

12.0 Post Implant Stent Re-Dilation

Precaution: Limited clinical data are available to support re-dilating the Minima™ Stent following initial implantation.

Please see Section 14 for the available clinical data.

The following information regarding re-dilating the Minima™ Stent is based on the limited clinical experience available.

12.1 Contraindications

- Evidence of vessel wall damage (i.e. artery aneurysm) in the area of planned re-dilation
- Stent deformity or loss of structural integrity judged by the implanting physician to not lend to the safe re-dilation of the stent
- Access site or patient vasculature judged by the implanting physician to not lend to the safe re-catheterization using a balloon catheter approved for the stent location.

12.2 Patient Considerations

Ensure the patient meets **one** of the following criteria:

Development of an increase in the pressure gradient across the stent and/or stent lumen diameter less than the nominal adjacent vessel diameter, as defined as:

- Peak Doppler echo gradient ≥ 30 mmHg and/or a mean Doppler gradient ≥20 mmHg across the stented vessel
- Stented lumen diameter is ≤ 75% of normal vessel
- Physician is performing a concurrent catheterization, and the stented diameter is < normal vessel diameter

13.0 Re-Dilation Procedure

13.1 Access and Target Site Measurement

Prepare the patient for a standard transcatheter procedure. Once vascular access is achieved, administer anticoagulation to achieve an activated clotting time (ACT) of greater than 250 seconds prior to device placement, unless the patient has a significant risk for bleeding and is unable to be anticoagulated.

Perform a right and/or a left heart catheterization as indicated.

Perform baseline hemodynamic and angiography to assess the desired stent diameter based upon the surrounding normal vessel diameter.

13.2 Device Selection

Choose a standard angioplasty balloon that is as long as the deployed stent length and no more than 2 mm larger than the stent diameter. Cross the stented vessel with a guide wire compatible with the angioplasty balloon selected. Refer to Table 2 for the foreshortening measurements of the stent for dilations 10-24mm.

13.3 Stent Re-dilation

When re-expanding the Minima™ Stent, increase the diameter of the stent incrementally by using serial balloon dilation with balloon in 2mm increments. This ensures even expansion across all cells of the stent.

Once the desired diameter has been achieved perform repeat hemodynamics and angiography. Reinstitution of antibiotic prophylaxis and antiplatelet therapy is at the discretion of the physician. Re-dilation foreshortening lengths are listed in Table 2 for a range of dilations.

- **Warning:** *Stent geometry does not allow for dilation beyond 24mm.*

- **Precaution:** The safety and effectiveness of the Minima™ Stent has not been established

when the stent is dilated beyond 10 mm as there are currently limited engineering data on the structural integrity and no clinical data available on the Minima™ Stent dilated to greater than 10 mm in diameter.

Table 2: Re-dilation Dimensions

Stent OD (mm)	**Length** (mm)
10	15.6
12	15.1
14	13.9
16	12.1
18	11.5
20	9.2
22	6.5
24	5.1

Note:
Stent foreshortening was calculated through a range of dilations, from 10 to 24 mm.

14.0 Summary of Clinical Study

Renata Medical performed a clinical study (GROWTH Trial) to establish a reasonable assurance of safety and effectiveness of implantation of the Minima™ Stent for the treatment of congenital and postoperative coarctation of the aorta or pulmonary artery stenosis. A summary of the clinical study is presented below.

14.1 Study Design

Patients were treated with initial stent implantation. There were 42 enrolled patients who underwent initial implant procedures and 36 patients through 6 months of follow-up.

The study was a single arm, prospective, multi-center, open-label, pivotal study. A Data Safety Monitoring Board (DSMB) and Clinical Event Committee (CEC) reviewed study data through collection of 6-month visits and adjudicated results, where applicable.

14.2 Clinical Inclusion and Exclusion Criteria

Enrollment in the GROWTH study was limited to patients who met the following inclusion criteria:

- The subject's legally authorized representative has been informed of the nature of the clinical investigation, agrees to its provisions, and has provided written informed consent
- Requiring treatment* of: native, acquired, or recurrent aortic coarctation, or native, acquired, or recurrent pulmonary artery stenosis.
  *As defined by the patient's medical team
- Patency of at least one femoral vein, femoral artery, jugular vein or both carotid arteries able to accommodate the delivery system
- Adjacent vessel to stenosis measuring > or equal to 4 mm

Patients were not permitted to enroll in the GROWTH study if they met any of the following exclusion criteria:

- Active bloodstream infection requiring antibiotic therapy within 3 days prior to stent implantation
- History of or active endocarditis (active treatment with antibiotics) within 180 days prior to stent implantation
- Aortic or pulmonary artery aneurysm in the location targeted for treatment
- Body weight < 1.5 kg
- Anatomic location of lesion judged by the investigator to not lend to the safe placement of a stent
- Target vessels larger or smaller than the Minima™ System balloon size ranges
- Known genetic syndrome known to be associated with vasculopathies such as

but not limited to Williams syndrome, Loeys-Dietz syndrome, etc.
- Clinical scenario requiring that more than one vessel needs stent implantation at the time of the trial procedure.
- Currently participating in an investigational drug study or another device study
- Major or progressive non-cardiac disease resulting in a life expectancy of less than six months
- Known hypersensitivity to aspirin or heparin and cannot be treated with other antiplatelet and/or antithrombotic medications
- Known hypersensitivity to cobalt-chromium or contrast media that cannot be adequately pre-medicated

To be eligible for stent re-dilation, patients had to meet the following inclusion criteria:

- Development of an increase in the pressure gradient across the stent and/or stent lumen diameter less than the nominal adjacent vessel diameter, as defined as:
    - Peak Doppler echo gradient ≥ 30 mmHg and/or a mean Doppler gradient ≥ 20 mmHg across the stented vessel
    - Stented lumen diameter is ≤ 75% of adjacent native vessel

Patients were not permitted to undergo stent re-dilation if they met any of the following exclusion criteria:
- Evidence of significant vessel wall damage (e.g., aneurysm, dissection) in the area of planned re-dilation
- Stent deformity or loss of structural integrity judged by the investigator to not lend to the safe re-dilation of the stent
- Access site or patient vasculature judged by the investigator to not lend to the safe re-catheterization using a balloon catheter approved for the stent location.

14.3 Follow-up Schedule

The follow-up timepoints after initial implantation of the Minima™ Stent included immediately post-implantation, 1 month (+/- 7 days), 3 months (+/- 7 days), 6 months (+/- 14 days), 12 months (+/- 30 days), and annually for years 2-5 (+/-45 days). Follow-up assessments included physical exams and vital sign assessment, chest X-Ray (post-operatively, 1 month, 3 month, 6 month), transthoracic echocardiogram (TTE), concomitant medication evaluation, evaluation and data collection of any adverse events and/or device deficiencies, concomitant procedure evaluation, and either computed tomography (CT) angiography or catheter-based angiography at 6 months. Following re-dilations, all of the above assessments, except for CT, were to be completed within 24 hours of any Minima™ Stent re-dilation procedure and prior to discharge. Follow-up for re-dilations occurred at 90 days (+/- 14 days) after a re-dilation procedure: physical exam and vital sign assessment, TTE, concomitant medications evaluation, and evaluation and data collection of any adverse events and/or device deficiencies.

14.4 Clinical Endpoints

14.4.1 Primary Safety Endpoint:

Percentage of cases with freedom from procedure- or device-related SAEs resulting in one of the following events: Death, Cardiac arrest and/or emergency ECMO cannulation, Stroke, Limb loss, Vessel dissection of target lesion, Device thrombosis/occlusion, Cardiac perforation requiring percutaneous or open surgical intervention, or Persistent cardiac arrhythmia requiring a pacemaker.

The following hypothesis was tested using a one-sided, one proportion study at the one-sided α=0.025 level of significance:

- Null Hypothesis (H0): Freedom from Serious Device-Related AEs ≤ 78%.
- Alternative Hypothesis (HA): Freedom from Serious Device-Related AEs > 78%.

14.4.2 Secondary Safety Endpoints:

- Freedom from stent embolization or migration through 6 months.
- Freedom from stent fracture that led to reintervention through 6 months
- Freedom from non-elective Minima™ Stent explant at 90-days post re-dilation
- Freedom from procedure- or device-related SAE during re-dilation that results in the following: Death, Cardiac arrest and/or emergency ECMO cannulation, Stroke, Limb loss, Vessel dissection of target lesion, Device thrombosis/occlusion, Cardiac perforation requiring percutaneous or open surgical intervention, Persistent cardiac arrhythmia requiring a pacemaker

14.4.3 Primary Effectiveness Endpoint:

Rate of clinical success, defined as a composite of:

- Stenosis relief, defined by stent outer diameter ≥ 75% of the surrounding vessel immediately after deployment.
- Freedom from open surgical intervention required to treat Minima™ Stent dysfunction through 6 months.
- Maintenance of stented vessel diameter ≥ 50% of post-implant diameter at 6 months; as measured using CT angiography and/or angiography

The following hypothesis was tested using a one-sided, one proportion study at the one-sided α=0.025 level of significance:

- Null Hypothesis (H0): Incidence of clinical success ≤ 77%.
- Alternative Hypothesis (HA): Incidence of clinical success > 77%.

14.4.4 Secondary Effectiveness Endpoints:

- Peak-to-peak pressure gradient (ventricle to arterial or arterial to arterial) < 20 mmHg after stent placement, when applicable.
- Successful stent re-dilation (when indicated) at re-catheterization, defined as an increase in the intra stent angiographic luminal diameter within 2mm of the adjacent native vessel diameter immediately after re-dilation.

14.5 Accountability of PMA Cohort

Of the 49 patients screened for inclusion in the study, 42 subjects met the eligibility criteria. Forty-one (41) of the 42 subjects received a Minima™ Stent in the intended location. Post-procedure data from 6-month follow-up visits were available for all 41 subjects for analysis of the primary effectiveness endpoint. Study accountability is detailed in Table 3.

14.6 Study Population Demographics and Baseline Parameters

The demographics of the study population are representative of those of the indicated population presenting with native and post-operative congenital vascular stenoses within the aortic and pulmonary circulations in the US. The GROWTH study demographics for the entire enrolled population are shown in Table 4. Median (range) age and weight of subjects was 9 months (0 - 112 months) and 7.8 kg (3.4 - 28.3 kg), respectively.

14.7 Safety and Effectiveness Results

14.7.1 Safety Results

The analysis of safety was based on the data available through the 6-month follow-up visit for

all 42 enrolled subjects, regardless of whether successful stent placement was achieved. All 42 (100%) of subjects with attempted implants demonstrated freedom for from serious device-related adverse events (i.e., death, cardiac arrest and/or emergency ECMO cannulation, stroke, limb loss, vessel dissection of target lesion, device thrombosis/occlusion, cardiac perforation requiring percutaneous or open surgical intervention, and/or persistent cardiac arrhythmia requiring a pacemaker), through 6 months as specified in the primary safety endpoint.

The study's primary safety endpoint resulted in 100% success, therefore, the normal approximation to the binomial could not be used to calculate the lower limit of the confidence interval, so the exact method was used instead. The lower limit of the two-sided lower 95% confidence interval was 91.6% using the Clopper-Pearson method, which exceeds the performance goal of 78%; therefore, the primary safety endpoint was met.

The results of the secondary safety endpoint analyses are provided in Table 5. Of 45 stent implant attempts in 42 patients, 42 were completed with no stent embolization or migration through 6 months. No patient experienced stent fracture that led to reintervention through 6 months, non-elective Minima™ Stent explant within 90-days post re-dilation, or procedure- or device-related SAE during re-dilation.

No unanticipated device-related adverse events were identified. Table 6 documents the adverse events determined to be related to the device or procedure that occurred during the GROWTH study. The most common adverse events were procedure-related thrombus formation in 7 patients and device migration/embolization in 3 patients.

Femoral arterial access site complications were noted in 6 subjects, all of whom underwent treatment for coarctation (N = 21). All 6 patients weighed less than 6 kg at the time of the procedure, and all subjects (6/6) have been documented resolution of the event, without sequelae.

One death was reported during the study at 206 days post-procedure (after analysis of the primary effectiveness endpoint). This one subject had an adverse event of "Increased Gradient across Stent" adjudicated as related to the device. The patient had multiple cardiac comorbidities requiring surgical repair and there were concerns that dilation of the stent could result in compression of the left bronchus. Therefore, the patient was treated with open surgical intervention. The Minima Stent was explanted and replaced with a homograft. The patient received several other concurrent intracardiac open surgical procedures and expired 110 days later from worsening pulmonary hypertension and acute respiratory distress syndrome.

14.7.2 Effectiveness Results

The analysis of effectiveness was based on the data through the 6-month follow-up visit for all 42 subjects. Of the 42 subjects, 41 experienced device success, as defined by 1) stenosis relief, 2) freedom from open surgical intervention required to treat Minima™ Stent dysfunction, and 3) maintenance of stented vessel diameter ≥ 50% of post-implant diameter at 6 months, resulting in an overall success rate of 97.6%. The results broken down primary effectiveness component are provided in Table 7.

The primary effectiveness hypothesis was tested by calculating the lower limit of the two-sided 95% confidence interval using the normal approximation to the binomial, with success defined as a lower limit of greater than 77%. Since the calculated lower limit is 93.0%, the primary effectiveness endpoint is successfully met.

Given the sample size and an observed proportion that is close to 100%, the appropriateness of the normal approximation to calculate the confidence limit may be inadequate, so the exact method of Clopper-Pearson was also calculated. The lower limit using this exact method is 87.4%, which still meets the definition of success for the hypothesis test.

Successful deployment of the stent and stenosis relief, defined by a stent outer diameter ≥ 75% of the surrounding vessel immediately after deployment, was achieved in 41 of 42 subjects. Of the 41 patients treated with the Minima™ Stent who met the definition of successful stenosis relief, the median increase in stenosis diameter was 3.6 mm (range: 1.5 to 6.6 mm) after stent implant, as shown in Figure 1. As shown in Figure 2, the median increase in the stent outer diameter compared to the surrounding native vessel was 131% (range: 46 to 483%).

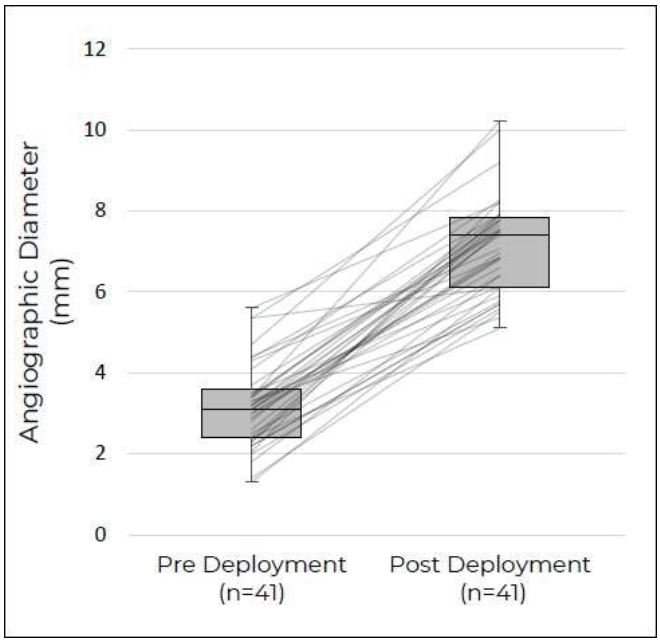


Figure 1. Change in Stenosis Diameter Pre/Post Stent Deployment

Failure to relieve the stenosis occurred in one case (1/42 subjects) of Minima™ Stent placement across the left pulmonary artery. During this case, the stent was initially placed successfully across the left branch of the pulmonary artery. However, the stent was dislodged into the main pulmonary artery during withdrawal of the delivery system and was unable to be readvanced into the left pulmonary artery (LPA). After initial attempts to readvance the deployed stent into the LPA, the stent was deployed in the subject's RPA with a 10mm balloon to ensure effective fixation. Due to the length of procedure required to place the stent into the RPA, a second Minima™ Stent implantation was not attempted at this time. The subject's lesion was instead treated using balloon angioplasty and logged as an efficacy failure as the lesion was not successfully treated using the Minima™ Stent.

In all other cases, the stent was deployed to a diameter at or above 75% of the surrounding native vessel.

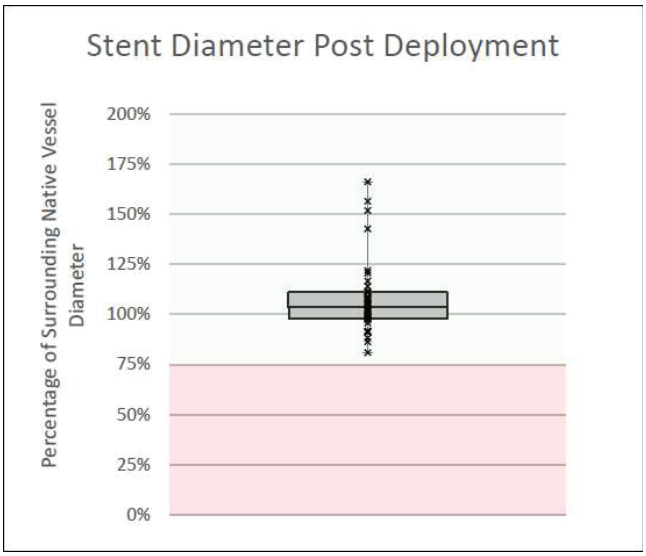


Figure 2. Deployed Stent Outer Diameter Compared to Surrounding Native Vessel (n=41)

The results of the secondary effectiveness endpoint analyses may be found in Table 8. 95.2% of patients (both of all patients and of the aortic

coarctation subgroup only) had a Peak-to-peak pressure gradient < 20 mmHg after stent placement, and stent re-dilation was successful in all of the 12 patients in which it was attempted.

14.7.3 Re-dilation Safety and Effectiveness Outcomes

To date, 12 of the 41 implanted patients have received a stent re-dilation. Eleven (11) subjects have received one additional re-dilation procedure after implantation of the Minima™ Stent, and (1) one subject has received two re-dilation procedures. All 13 re-dilation procedures (initial: n=12, secondary: n=1) have been free from procedure- or device-related SAE during re-dilation, including those listed in the secondary endpoint list of: Death, Cardiac arrest and/or emergency ECMO cannulation, Stroke, Limb loss, Vessel dissection of target lesion, Device thrombosis/occlusion, Cardiac perforation requiring percutaneous or open surgical intervention, or Persistent cardiac arrhythmia requiring a pacemaker. Table 9 shows the patient cohort accountability of re-dilations at time of submission. Table 10 tracks the re-dilation patient's growth from implant to 6-month follow-up. Table 11 provides details of the re-dilation procedure including timeframe and stent diameters.

Of the 13 re-dilation procedures, 10 of the re-dilation procedures were due to the stented lumen diameter being ≤ 75% of adjacent native vessel and 2 were due to an increased gradient across the stented vessel. Three (3) of the re-dilations did not meet inclusion criteria, but the physicians who performed these three re-dilations outside of the GROWTH IDE study inclusion criteria deemed it was in the best interest of the subject's treatment plan. Implanting physicians noted that re-dilation of stents within the pulmonary arteries, prior to the presence of a stenosis caused by somatic growth, might lead to distal vessel growth in some cases.

14.8 Subgroup Analyses

The following preoperative characteristics were evaluated for potential association with outcomes: sex, age, race, implant location, and study site. No significant differences in safety or effectiveness outcomes were identified in subgroup analyses. The results stratified by subgroup are outlined in Table 12.

Table 3. GROWTH Study Cohort Accountability

Activity	Screening*	Procedure**	Discharge	1 Month (± 7days)	3 Months (±7days)	6 Months (± 14 days)	12 Months (± 30 days)	2 years (± 45 days)	3 years (± 45 days)	4 years (± 45 days)	5 years (± 45 days)
% of Eligible, Enrolled Subjects Completed Visit (# completed / # eligible)	85.7% (42/49)	100% (41/42)	100% (41/41)	100% (41/41)	100% (41/41)	100% (41/41)	79% (30/38)	80% (8/10)	N/A (0 eligible at time of submission)		

**All 49 subjects completed the screening, but only 42 met the inclusion criteria for successful screening.*

***All 42 eligible subjects underwent the implant procedure, but the 1 subject who did not achieve successful device placement has not been included in the follow-up visit counts.*

Table 4. GROWTH Study Demographics

Characteristic	Number of Subjects	Percent of Population
Sex, % (n)		
Female	20	48%
Male	22	52%
Age Group		
0-6 months	12	29%
6-24 months	18	43%
>24 months	12	29%
Race, % (n)		
Asian	1	2%
Black or African American	7	17%
Native Hawaiian or Other Pacific Islander	1	2%
White	22	52%
Other	11	26%
Ethnicity, % (n)		
Hispanic or Latino	9	21%
Not Hispanic or Latino	32	76%
Unknown	1	2%
Lesion Description		
Aortic Coarctation	21	50%
Native Coarctation	8	19%
Re-Coarctation	13	30%
Pulmonary Artery Stenosis	21	50%
Single Ventricular LPA	9	21%
Biventricular RPA	5	12%
Biventricular LPA	7	17%

Table 5. Summary of Secondary Safety Endpoints in GROWTH Study

Secondary Safety Endpoint	Rate
Freedom from stent embolization or migration through 6 months	93% (42/45* stent implant attempts)
Freedom from stent fracture that led to reintervention through 6 months	100% (42/42 patients)
Freedom from non-elective stent explant at 90-days post re-dilation	100% (8/8 evaluable patients)
Freedom from procedure- or device-related SAEs during re-dilation	100% (13/13 re-dilation attempts)

* Note: Of the 42 enrolled patients, 39 were treated with 1 Minima™ Stent and 3 patients with 2 Minima™ Stents, for a total of 45 Minima™ Stent Implants.

Table 6. Device- or Procedure-Related Adverse Events in GROWTH

Event	n/N (Event Rate: number of events/number of subjects implanted)
Procedure-related Thrombus Formation	7/42 (17%)
Device-related Thrombus	0/42 (0%)
Device Migration / Embolization	3/42 (7.1%)
Lower Extremity Pulse Loss	1/42 (2.4%)
Rebleed from Arterial Site	1/42 (2.4%)
Transient Heart Block	1/42 (2.4%)
Hematoma	1/42 (2.4%)
Hypertension	1/42 (2.4%)
AV Fistula	1/42 (2.4%)
Pseudoaneurysm	1/42 (2.4%)
In-Stent Narrowing	1/42 (2.4%)
Increased Gradient across Stent	1/42 (2.4%)

Table 7. Primary Effectiveness Endpoint Breakdown by Component Results

Primary Effectiveness Endpoint Component	Timeframe	Event Rate (n/N)
Stenosis relief	Intra-procedure	97.6 % (41/42)
Freedom from open surgical intervention to treat Minima™ Stent dysfunction	Implant procedure through 6 month follow up visit	100% (42/42)
Maintenance of stented vessel ≥ 50% of post-implant diameter at 6 months	6 month follow up visit	97.6% (41/42)

Table 8. Summary of Secondary Endpoints in GROWTH Study

Secondary Effectiveness Endpoint	Rate (n/N)
Peak-to-peak pressure gradient < 20 mmHg after stent placement	All treated: 95.2% (40/42) Aortic Coarctation: 95.2% (20/21)
Successful stent re-dilation, defined as an increase in the intra stent angiographic luminal diameter of within 2mm	100% (12/12)

Table 9. Re-Dilation Subject Cohort Accountability

Activity	Index Procedure	Discharge	1 Month Post-Index (± 7 days)	3 Months Post-Index(± 7 days)	6 Months Post-Index (± 14 days)	12 Months Post-Index (± 30 days)	Re-Dilation Procedure*	Re-Dilation Discharge	3 Months Post-Re-Dilation (± 7 days)	Secondary Re-Dilation	Secondary Re-Dilation Discharge	3 Months Post Secondary Re-Dilation (± 7 days)	2 Years Post-Index (± 45 days)	3 Years Post-Index (± 45 days)	4 years Post-Index (± 45 days)	5 years Post-Index (± 45 days)
% of Eligible Subjects Completed Visit (# completed / # eligible)	100% (12/12)	100% (12/12)	100% (12/12)	100% (12/12)	100% (12/12)	91% (10/11)	100% (12/12)	100% (12/12)	89% (8/9)	100% (1/1)	100% (1/1)	100% (1/1)	83% (5/6)	N/A (0 eligible at time of submission)		

Table 10. Angiographic Diameters of Patients Who Have Undergone Minima™ Stent Re-dilation

	Day 0: Pre-Implantation				Day 0: Post Implantation			Day 180: 6-Month Follow-Up			
		Diameters (mm)			Diameters (mm)				Diameters (mm)		
Lesion Location / Type	Weight (kg)	Proximal Vessel	Distal Vessel	Stenosis Lumen	Proximal Vessel	Distal Vessel	Stent Lumen	Weight (kg)	Proximal Vessel	Distal Vessel	Stent Lumen
1. Aortic vascular (Recurrent)	5.9	7.6	8.9	2.3	7.3	9.17	7.5	9.39	10.7	8.5	5.9
2. Aortic vascular (Recurrent)	7.3	17.8	8.8	3.48	7.1	9.2	7.6	9.73	8.7	8.8	6.5
3. Aortic vascular (Recurrent)	4.0	6.6	5.6	2.4	7	6.5	5.1	7.49	8.1	6.3	3.5
4. Aortic vascular (Recurrent)	3.9	5.4	5.9	2.2	5.4	5.9	5.7	6.29	6.1	6.6	4.14
5. Aortic vascular (Native)	5.1	7.8	7.7	4.4	7.8	7.6	7.1	8.595	7.5	7.5	6.7
6. Aortic vascular (Native)	5.9	13.9	9.6	4.6	13.4	10.4	7.8	8.56	13	12.6	6
7. Pulmonary artery (LPA)	5.1	7.0	5.5	3.5	7.4	5.6	6.1	12.4	4.5	7.8	5.5
8. Pulmonary artery (LPA) *	9.3	6.8	5.5	3.3	5.9	4.4	5.9	10.4	4.6	6.1	5.1
9. Pulmonary artery (LPA)**	7.4	3.9	4.1	1.3	6	6	6.1	9	7	7	7
10. Pulmonary artery (LPA)	10.7	7.7	4.5	3.1	7.7	4.6	6.8	11.3	9.3	5.3	6.6
11. Pulmonary artery (LPA)	11.9	7.6	7.5	2.83	8.4	6.9	7.7	12.8	7.5	6.9	5.2
12. Pulmonary artery (LPA)	6.2	5.3	5.1	1.4	5.4	5.3	5.5	7.77	5.46	6	5.2

Table 11. Stent Diameters Pre and Post Primary Re-dilation

Lesion Location / Type	Day	Weight (kg)	Pre-Primary Re-Dilation Diameters (mm)			Post-Primary Re-Dilation Diameters (mm)		
			Proximal Vessel	Distal Vessel	Stent Lumen	Proximal Vessel	Distal Vessel	Stent Lumen
1. Aortic vascular (Recurrent)	758	13.6	9.5	11.5	3.8	9.5	11.5	7.3
2. Aortic vascular (Recurrent)	308	11.7	14	12.3	6	14.9	11.7	10.1
3. Aortic vascular (Recurrent)	192	9.34	8.6	6.1	2.9	8.8	6.5	5.1
4. Aortic vascular (Recurrent)	203	6.845	6	6.6	4.14	6	6.6	5
5. Aortic vascular (Native)	104	8.59	7.5	7.5	6.7	7.8	7.5	7.2
6. Aortic vascular (Native)	224	9.66	11.9	12.7	5.6	11.5	9.6	8.6
7. Pulmonary artery (LPA)	281	12.8 (1 year visit)	7.8	4.5	5.5	8	6	7.6
8. Pulmonary artery (LPA) *	368	10.6	5.3	7	5.8	6.4	7.3	6.9
9. Pulmonary artery (LPA)**	125	9	5.9	5.7	5.5	10	7.5	7.3
10. Pulmonary artery (LPA)	237	12.5	9.3	5.3	6.6	9.3	5.3	7.6
11. Pulmonary artery (LPA)	419	15.2	10.3	9.6	6.5	10	10	8.2
12. Pulmonary artery (LPA)	364	10.4	6.1	5.7	4	5.5	55.5	4.6

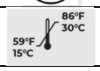
* Patient Number 8: This LPA patient with single ventricle anatomy underwent a second re-dilation on Day 551 post-implantation. Data for this subject are as follows: Day 551 Pre-Secondary Dilations: Weight 11.7 kg, Proximal Vessel Diameter (mm): 7.64; Distal Vessel Diameter (mm): 9.78, Stent Lumen Diameter (mm): 7.3. Day 551 Post-Secondary Dilations: Proximal Vessel Diameter (mm): 6.4; Distal Vessel Diameter (mm): 6.8, Stent Lumen Diameter (mm): 7.5.

** Patient Number 9: This LPA patient had biventricular circulation. All other LPA patients had single ventricle anatomies.

Table 12. Primary Effectiveness Subgroup Analyses

Subgroup	Primary Effectiveness Endpoint (N=42)
Sex	
Female	100% (20/20)
Male	95% (21/22)
P-Value	1.0000
Age	
< 6 months	100% (12/12)
6 to 24 months	83.8% (17/18)
> 24 months	100% (12/12)
P-Value	0.505
Race	
Caucasian	95.2% (21/22)
Non-Caucasian	100% (20/20)
P-Value	1.0000
Implant Location	
Pulmonary	94.4% (20/21)
Aortic	100% (21/21)
P-Value	1.0000

Table 13. Explanation of Symbols on Label and Packaging

Symbol	Description
	Consult Instructions for Use
	n Units per Box
	MR Conditional
	Do Not Resterilize
	Do Not Re-use
	Sterilized Using Ethylene Oxide
	Keep Dry
	Do not use if package is damaged
	Storage Temperature Range
	Caution: Federal (USA) law restricts this device to sale by or on order of a physician
	Manufacturer
	Use-by-Date
REF	Catalogue Number
OTW	Over-the-Wire
LOT	Lot Number
NOM	Nominal Balloon Inflation Pressure
RBP	Rated Burst Pressure
	It is important to read the Instructions for Use with careful attention to cautions, notes, and warnings prior to use of this product.
	Non-Pyrogenic

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