T-ZAAA503

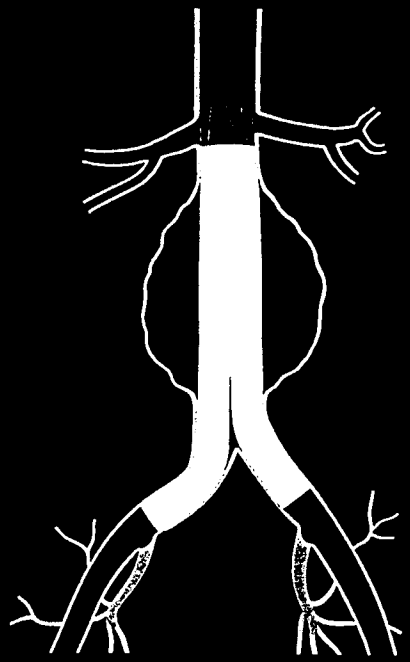
52

Zenith®

AAA Endovascular Graft

with the H&L-B One-Shot™
Introduction System

Suggested Instructions for Use



COOK®

Patient I.D. Card Included

ENGLISH

TABLE OF CONTENTS

ZENITH® AAA ENDOVASCULAR GRAFT WITH THE H&L-B ONE-SHOT™ INTRODUCTION SYSTEM

SUGGESTED INSTRUCTIONS FOR USE

Read all instructions carefully. Failure to properly follow the instructions, warnings and precautions may lead to serious surgical consequences or injury to the patient.

CAUTION: Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.

1 DEVICE DESCRIPTION

1.1 Aortic Main Body and Iliac Leg Components

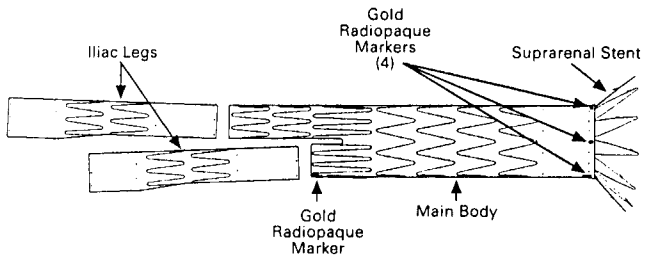


Figure 1. Zenith® AAA Endovascular Graft

The Zenith® AAA Endovascular Graft is a modular system consisting of three components, a bifurcated aortic main body and two iliac legs. (**Figure 1**) The graft modules are constructed of full-thickness woven polyester fabric sewn to self-expanding stainless steel Cook-Z® stents with braided polyester and monofilament polypropylene suture. The modules are fully stented to provide stability and the expansile force necessary to open the lumen of the graft during deployment. Additionally, the Cook-Z® stents provide the necessary attachment and seal of the graft to the vessel wall.

The bare suprarenal stent at the proximal end of the graft contains barbs that are placed at 3 mm increments for additional fixation of the device. To facilitate fluoroscopic visualization of the stent graft, gold radiopaque markers are positioned as follows: one on the lateral aspect of the most distal stent on the contralateral limb of the bifurcated section of the main body and four in a circumferential orientation within 2 mm of the most superior aspect of the graft material.

1.2 Main Body Delivery System

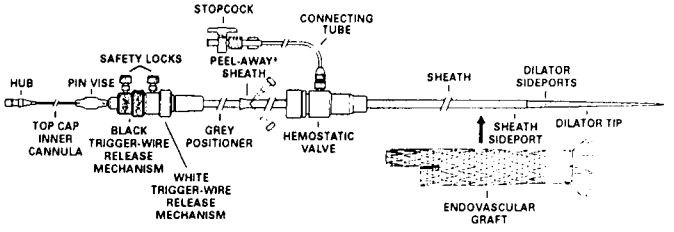


Figure 2. H&L-B One-Shot™ Introduction System (Main Body)

The Zenith™ AAA Endovascular Graft main body is shipped preloaded onto the H&L-B One-Shot™ Introduction System. (**Figure 2**) It has a sequential deployment method with built-in features to provide continuous control of the endovascular graft throughout the deployment procedure. The H&L-B One-Shot™ Introduction System enables precise positioning and allows readjustment of the final graft position before deployment of the barbed suprarenal stent.

The main body graft delivery system uses an 18 French or 20 French H&L-B One-Shot™ Introduction System. Dual trigger-wire release mechanisms lock the endovascular graft onto the delivery system until released by the physician. All systems are compatible with a .035 inch wire guide.

1.3 Iliac Leg Delivery System

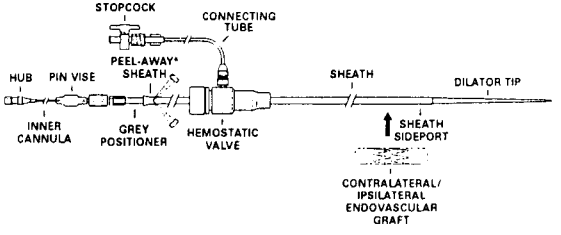


Figure 3. H&L-B One-Shot™ Introduction System (Iliac Legs)

The Zenith® AAA Endovascular Graft iliac legs are shipped preloaded onto the H&L-B One-Shot™ Introduction System. (**Figure 3**) The delivery system is designed for ease of use with minimal preparation. The iliac leg delivery system uses a 14 French or 16 French H&L-B One-Shot™ Introduction System. All systems are compatible with a .035 inch wire guide.

1.4 Zenith® AAA Endovascular Graft Ancillary Components

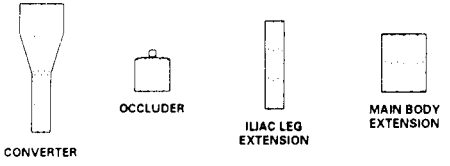


Figure 4. Zenith® AAA Endovascular Graft Ancillary Components

Additional ancillary endovascular components (main body extensions, iliac leg extensions, converters and occluders) are available. (**Figure 4**) Zenith® AAA Endovascular Graft ancillary components are constructed from the same polyester fabric, self-expanding stainless steel Cook-Z® stents and polypropylene suture used in constructing the principal graft modules.

The aortic main body extensions and iliac leg extensions can be used to provide additional length to their respective portions of the endovascular graft. The converters and occluders can be used to convert a bifurcated graft into an aorto-uniiliac graft, if necessary (e.g., cases of Type III endoleak, limb occlusion or unattainable contralateral limb cannulation).

1.5 Main Body Extensions

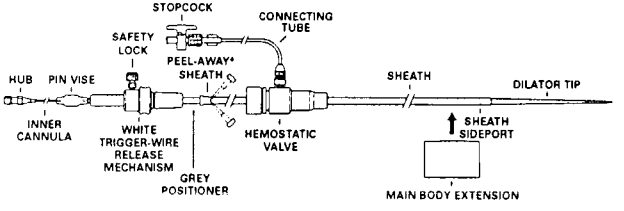


Figure 5. H&L-B One-Shot™ Introduction System (Main Body Extension)

Main body extensions utilize 18 French and 20 French H&L-B One-Shot™ Introduction Systems. (**Figure 5**) The main body extension introduction system contains a single trigger-wire release mechanism. No top cap is included with the dilator tip because the main body extension component does not contain a barbed, uncovered suprarenal stent.

1.6 Iliac Leg Extensions

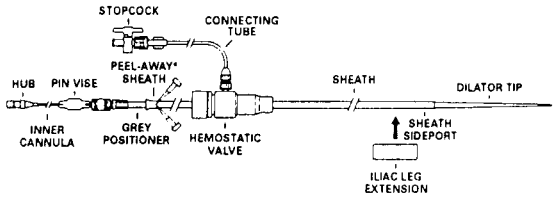


Figure 6. H&L-B One-Shot™ Introduction System (Iliac Leg Extension)

Iliac leg extensions are deployed using the 14, 16 and 18 French H&L-B One-Shot™ Introduction Systems similar to that used to deploy the iliac legs. (**Figure 6**) These delivery systems have no trigger-wire release mechanism or top cap assembly. Deployment is achieved by sheath retraction.

1.7 Converters

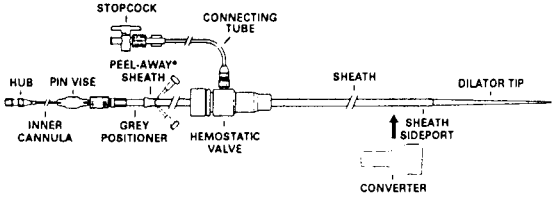


Figure 7. H&L-B One-Shot™ Introduction System (Converter)

Converters utilize 18 French and 20 French H&L-B One-Shot™ Introduction Systems. (**Figure 7**) The converter introduction system has no trigger-wire release mechanism or top cap assembly. Deployment of the converter is achieved by sheath retraction.

1.8 Occluder

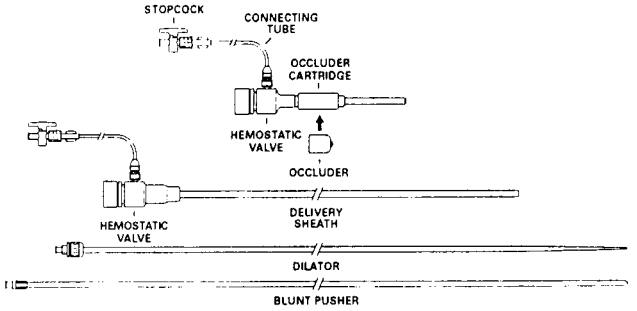


Figure 8. Occluder Cartridge Delivery System

The occluder is preloaded into a cartridge for deployment. (**Figure 8**) The device is packaged with a blunt pusher and an 18 French delivery sheath. To deploy the occluder, the preloaded cartridge containing the occluder is docked with the back of the hemostatic valve on the end of the sheath, after the sheath has been placed within the iliac artery. A blunt pusher is used to push the occluder out of the cartridge and into the sheath, transferring it to the H&L-B One-Shot™ Introduction System. Once transferred, the occluder is then advanced with the blunt pusher through the sheath to the desired location within the artery.

2 INDICATIONS FOR USE

The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System and ancillary components is indicated for the endovascular treatment of patients with abdominal aortic or aorto-iliac aneurysms having morphology suitable for endovascular repair, including:

- Adequate iliac/femoral access compatible with the required introduction systems,
- Non-aneurysmal infrarenal aortic segment (neck) proximal to the aneurysm:
  - with a length of at least 15 mm,
  - with a diameter measured outer wall to outer wall of no greater than 28 mm and no less than 18 mm,
  - with an angle less than 60 degrees relative to the long axis of the aneurysm, and
  - with an angle less than 45 degrees relative to the axis of the suprarenal aorta.
- Iliac artery distal fixation site greater than 10 mm in length and 7.5-20 mm in diameter (measured outer wall to outer wall).

3 CONTRAINDICATIONS

There are no known contraindications for these devices.

4 WARNINGS AND PRECAUTIONS

4.1 General

- Read all instructions carefully. Failure to properly follow the instructions, warnings and precautions may lead to serious consequences or injury to the patient.
- The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System should only be used by physicians and teams trained in vascular interventional techniques and in the use of this device. Specific training expectations are described in *Section 10.1, Physicians Training Program.*
- **The long-term performance of endovascular grafts has not yet been established.** All patients should be advised that endovascular treatment requires life-long, regular follow-up to assess their health and the performance of their endovascular graft. Patients with specific clinical findings (e.g., endoleaks, enlarging aneurysms or changes in the structure or position of the endovascular graft) should receive enhanced follow-up. Specific follow-up guidelines are described in *Section 12, Imaging Guidelines and Post-Operative Follow-Up.*
- After endovascular graft placement, patients should be regularly monitored for perigraft flow, aneurysm growth or changes in the structure or position of the endovascular graft. At a minimum, annual imaging is required, including: 1) abdominal radiographs to examine device integrity (separation between components, stent fracture or barb separation) and 2) contrast and non-contrast CT to examine aneurysm changes, perigraft flow, patency, tortuosity and progressive disease. If renal complications or other factors preclude the use of image contrast media, abdominal radiographs and duplex ultrasound may provide similar information.
- The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System is not recommended in patients unable to undergo, or who will not be compliant with the necessary preoperative and post-operative imaging and implantation studies as described in *Section 12, Imaging Guidelines and Post-Operative Follow-Up.*
- Intervention or conversion to standard open surgical repair following initial endovascular repair should be considered for patients experiencing enlarging aneurysms, unacceptable decrease in fixation length (vessel and component overlap) and/or endoleak. An increase in aneurysm size and/or persistent endoleak may lead to aneurysm rupture.
- Patients experiencing reduced blood flow through the graft limb and/or leaks may be required to undergo secondary interventions or surgical procedures.
- Always have a vascular surgery team available during implantation or reintervention procedures in the event that conversion to open surgical repair is necessary.

4.2 Patient Selection, Treatment and Follow-Up

- The safety and effectiveness of the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System has not been evaluated in the following patient populations:
  - traumatic aortic injury
  - leaking, pending rupture or ruptured aneurysms
  - mycotic aneurysms
  - pseudoaneurysms resulting from previous graft placement
  - revision of previously placed endovascular grafts
  - uncorrectable coagulopathy
  - indispensable mesenteric artery
  - genetic connective tissue disease (e.g., Marfans or Ehlers-Danlos Syndromes)
  - concomitant thoracic aortic or thoracoabdominal aneurysms
  - patients with active systemic infections
  - pregnant or nursing females
  - morbidly obese patients
  - less than 18 years of age
  - patients with less than 15 mm in length or greater than 60 degrees angulation of the proximal aortic neck relative to the long axis of the aneurysm.

- Access vessel diameter (measured inner wall to inner wall) and morphology (minimal tortuosity, occlusive disease, and/or calcification) should be compatible with vascular access techniques and delivery systems of the profile of a 16 French to 20 French vascular introducer sheath. Vessels that are significantly calcified, occlusive, tortuous or thrombus-lined may preclude placement of the endovascular graft and/or may increase the risk of embolization.
- Key anatomic elements that may affect successful exclusion of the aneurysm include severe proximal neck angulation (> 60 degrees for infrarenal neck to axis of AAA or > 45 degrees for suprarenal neck relative to the immediate infrarenal neck); short proximal aortic neck (<15 mm); an inverted funnel shape (greater than 10% increase in diameter over 15 mm of proximal aortic neck length); and circumferential thrombus and/or calcium at the arterial implantation sites, specifically the proximal aortic neck and distal iliac artery interface. Irregular calcification and/or plaque may compromise the fixation and sealing of the implantation sites. Necks exhibiting these key anatomic elements may be more conducive to graft migration.
- The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System is not recommended in patients who cannot tolerate contrast agents necessary for intra-operative and post-operative follow-up imaging.
- The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System is not recommended in patients exceeding weight and/or size limits which compromise or prevent the necessary imaging requirements.
- The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System is not recommended in patients with known sensitivities or allergies to stainless steel, polyester, solder (tin, silver), polypropylene or gold.
- Patients with a systemic infection may be at increased risk of endovascular graft infection.
- Inability to maintain patency of at least one internal iliac artery or occlusion of an indispensable inferior mesenteric artery may increase the risk of pelvic/bowel ischemia.
- Multiple large, patent lumbar arteries, mural thrombus and a patent inferior mesenteric artery may all predispose a patient to Type II endoleaks. Patients with uncorrectable coagulopathy may also have an increased risk of Type II endoleak or bleeding complications.

4.3 Implant Procedure

- Systemic anticoagulation should be used during the implantation procedure based on hospital and physician preferred protocol. If heparin is contraindicated, an alternative anticoagulant should be considered.
- Minimize handling of the constrained endoprosthesis during preparation and insertion to decrease the risk of endoprosthesis contamination and infection.
- Maintain wire guide position during delivery system insertion.

- Do not bend or kink the delivery system. Doing so may cause damage to the delivery system and the Zenith® AAA Endovascular Graft.
- Always use fluoroscopy for guidance, delivery and observation of any Zenith® AAA Endovascular Graft components within the vasculature.
- The use of the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System requires administration of intravascular contrast. Patients with pre-existing renal insufficiency may have an increased risk of renal failure post-operatively. Care should be taken to limit the amount of contrast media used during the procedure.
- To avoid any twist in the endovascular graft, during any rotation of the delivery system, be careful to rotate all of the components of the system together (from outer sheath to inner cannula).
- Inaccurate placement and/or incomplete sealing of the Zenith® AAA Endovascular Graft within the vessel may result in increased risk of endoleak, migration or inadvertent occlusion of the renal or internal iliac arteries. Renal artery patency must be maintained to prevent/reduce the risk of renal failure and subsequent complications.
- Inadequate fixation of the Zenith® AAA Endovascular Graft may result in increased risk of migration of the stent graft. Incorrect deployment or migration of the endoprosthesis may require surgical intervention.
- The Zenith® AAA Endovascular Graft incorporates a suprarenal stent with fixation barbs. Exercise extreme caution when manipulating interventional devices in the region of the suprarenal stent.
- Do not continue advancing any portion of the delivery system if resistance is felt during advancement of the wire guide or delivery system. Stop and assess the cause of resistance. Vessel or catheter damage may occur. Exercise particular care in areas of stenosis, intravascular thrombosis or in calcified or tortuous vessels.
- Unless medically indicated, do not deploy the Zenith® AAA Endovascular Graft in a location that will occlude arteries necessary to supply blood flow to organs or extremities. Do not cover significant renal or mesenteric arteries (exception is the inferior mesenteric artery) with the endoprosthesis. Vessel occlusion may occur. During the clinical study, this device was not studied in patients with two occluded internal iliac arteries.
- Take care during manipulation of catheters, wires and sheaths within an aneurysm. Significant disturbances may dislodge fragments of thrombus which can cause distal embolization.
- Before deployment of the suprarenal stent, verify that the position of the access wire guide extends just distal to the aortic arch.
- Verify that the predetermined contralateral iliac leg is selected for insertion on the contralateral side of the patient before implantation.

- Care should be taken not to damage the graft or disturb graft positioning after graft placement in the event reinstrumentation of the graft is necessary.

Molding Balloon Use

- Confirm complete deflation of balloon prior to repositioning.
- Do not inflate balloon in iliac vessel outside of graft.

Main Body Extension

- Care should be taken not to displace the main body graft during the placement and deployment of the main body extension.

4.4 MRI Safety and Compatibility

- The MR safety and compatibility of the Zenith(®) AAA Endovascular Graft has been evaluated through bench testing in MRI systems with static fields of ≤ 1.5 Tesla, gradient magnetic fields of ≤ 20 Tesla/second and whole body averaged specific absorption rate (SAR) of 1.2 W/kg for 30 minutes of imaging. The Zenith® AAA Endovascular Graft was found to exhibit significant deflection and torque of the stainless steel metallic component of the endovascular graft and therefore did not meet standard 'MR Safe' bench test criteria.
- Adverse events have not been reported clinically in patients who have undergone MRI. However, sufficient data are not available to demonstrate MRI safety and there may be potential risks (e.g., device migration, vessel damage) that could be associated with forces applied to the metallic components of the Zenith® AAA Endovascular Graft. Therefore, a careful assessment of these potential risks and the potential benefits to the patient should be completed prior to use of MR imaging. In addition the facility for MRI should be appropriately selected to allow for prompt intervention if necessary.
- The Zenith® AAA Endovascular Graft may affect image quality (image artifact) depending on the pulse sequence that is used for MR imaging.

5 ADVERSE EVENTS

5.1 Observed Adverse Events

A U.S. multicenter, prospective study conducted at 15 centers which included 352 endovascular patients (200 standard risk, 100 high risk and 52 roll-in) and 80 control patients provide the basis of the observed adverse event rates in **Table 5.1.1.** Patients were enrolled in the standard risk arm if they were physiologically capable of withstanding an open or endovascular repair and had anatomy suitable for treatment with the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System. Patients with suitable anatomy, but at higher risk of morbidity or mortality with open repair were enrolled into the high risk arm. Initial patients treated in the study were enrolled in the roll-in arm. The control group included patients whose vascular anatomy may not have been suitable for endovascular AAA repair.

Table 5.1.1 Death and Rupture from Clinical Study

Death and Rupture	Zenith Standard Risk[1]	Surgical Standard Risk	*P* value	Zenith High Risk	Zenith Roll-in
All death					
(0-30 days)[2]	0.5% (1/199)	2.5% (2/80)	.20	2.0% (2/100)	1.9% (1/52)
(31-365 days)[3]	3.0% (6/198)	1.3% (1/78)	.68	7.1% (7/98)	9.8% (5/51)
AAA-related	0.0% (0/198)	1.3% (1/78)	.29	3.1% (3/98)	0.0% (0/51)
Non-AAA-related	3.0% (6/198)	0.0% (0/78)	.19	4.1% (4/98)	9.8% (5/51)
(0-365 days)[2,3,4]	3.5% (7/199)	3.8% (3/80)	>.99	9.0% (9/100)	11.5% (6/52)
AAA-related	0.5% (1/199)	3.8% (3/80)	.07	5.0% (5/100)	1.9% (1/52)
Non-AAA-related	3.0% (6/199)	0.0% (0/80)	.19	4.0% (4/100)	9.6% (5/52)
Rupture					
(0-30 days)	0.0% (0/199)	n/a	n/a	0.0% (0/100)	0.0% (0/52)
(31-365 days)	0.0% (0/198)	n/a	n/a	1.0% (1/98)	0.0% (0/51)
(0-365 days)	0.0% (0/199)	n/a	n/a	1.0% (1/100)	0.0% (0/52)

[1]Denominator of 199 because one standard risk patient did not receive a device.

[2]All deaths (0-30 days) were considered AAA and procedure related.

[3]Of the deaths (31-365 days), four were considered AAA related: 1 surgical (septic shock from ischemic colitis) and 3 high risk (pancreatitis with renal failure and sepsis, hemorrhage from upper abdominal aneurysm [not treated AAA] and multiple system failure).

[4]Of the deaths (0-365 days), ten were considered AAA related: 1 standard risk (cardiac failure), 3 surgical (massive hemorrhage, mesenteric ischemia and septic shock from ischemic colitis), 5 high risk (respiratory failure, cardiac failure with pulmonary embolism, pancreatitis with renal failure and sepsis, hemorrhage from upper abdominal aneurysm [not treated AAA] and multiple system failure) and 1 roll-in (suspected cardiac failure).

Table 5.1.2 Adverse Events[1] in Clinical Study

	Zenith Standard Risk		Surgical Standard Risk		P value	Zenith High Risk		Zenith Roll-in	
Freedom from Morbidity (0-30 days)	80%	(160/200)	58%	(46/80)	<.001	68%	(68/100)	73%	(38/52)
Cardiovascular[2]	3.0%	(6/200)	11%	(9/80)	.02	14%	(14/100)	1.9%	(1/52)
Pulmonary[3]	1.0%	(2/200)	15%	(12/80)	<.001	2.0%	(2/100)	0.0%	(0/52)
Renal[4, 9]	2.5%	(5/200)	10%	(8/80)	.01	6.0%	(6/100)	5.8%	(3/52)
Bowel[5]	1.0%	(2/200)	3.8%	(3/80)	.14	1.0%	(1/100)	1.9%	(1/52)
Wound[6]	4.5%	(9/200)	7.5%	(6/80)	.38	2.0%	(2/100)	3.8%	(2/52)
Neurologic[7]	0.0%	(0/200)	2.5%	(2/80)	.08	0.0%	(0/100)	0.0%	(0/52)
Vascular[8,11]	11%	(21/200)	31%	(25/80)	<.001	20%	(20/100)	19%	(10/52)
Freedom from Morbidity (31-365 days)	91%	(181/198)	86%	(67/78)	.25	79%	(77/98)	86%	(44/51)
Cardiovascular[2]	2.5%	(5/198)	3.8%	(3/78)	.69	5.1%	(5/98)	2.0%	(1/51)
Pulmonary[3]	0.5%	(1/198)	1.3%	(1/78)	.49	4.1%	(4/98)	0.0%	(0/51)
Renal[4, 10]	0.5%	(1/198)	0.0%	(0/78)	>.99	3.1%	(3/98)	0.0%	(0/51)
Bowel[5]	0.5%	(1/198)	1.3%	(1/78)	.49	0.0%	(0/98)	0.0%	(0/51)
Wound[6]	2.0%	(4/198)	5.1%	(4/78)	.23	3.1%	(3/98)	2.0%	(1/51)
Neurologic[7]	1.0%	(2/198)	0.0%	(0/78)	>.99	1.0%	(1/98)	3.9%	(2/51)
Vascular[8]	3.0%	(6/198)	3.8%	(3/78)	.72	8.2%	(8/98)	5.9%	(3/51)
Freedom from Morbidity (0-365 days)	76%	(151/200)	49%	(39/80)	<.001	55%	(55/100)	62%	(32/52)
Cardiovascular[2]	5.0%	(10/200)	14%	(11/80)	.02	19%	(19/100)	3.8%	(2/52)
Pulmonary[3]	1.5%	(3/200)	16%	(13/80)	<.001	6.0%	(6/100)	0.0%	(0/52)
Renal[4, 9, 10]	2.5%	(5/200)	10%	(8/80)	.01	9.0%	(9/100)	5.8%	(3/52)
Bowel[5]	1.5%	(3/200)	3.8%	(3/80)	.36	1.0%	(1/100)	1.9%	(1/52)
Wound[6]	5.5%	(11/200)	13%	(10/80)	.08	5.0%	(5/100)	5.8%	(3/52)
Neurologic[7]	1.0%	(2/200)	2.5%	(2/80)	.32	1.0%	(1/100)	3.8%	(2/52)
Vascular[8,11]	12%	(24/200)	33%	(26/80)	<.001	25%	(25/100)	23%	(12/52)

[1]From the morbidity index.

[2]Cardiovascular included: Q-wave and non-Q-wave myocardial infarctions, congestive heart failure, arrhythmias requiring new medication or treatment, cardiac ischemia requiring intervention, inotropic support, medically intractable hypertension.

[3]Pulmonary included: reintubation or ventilation > 24 hours, pneumonia requiring antibiotics, supplemental oxygen at discharge.

[4]Renal included: dialysis in patients with normal preoperative renal function, creatinine rise > 30% from baseline on two or more follow-up tests.

[5]Bowel included: bowel obstruction, bowel ischemia, aorto-enteric fistula, paralytic ileus > 4 days.

[6]Wound included: infection requiring antibiotic treatment, hernia, lymph fistula, dehiscence, necrosis requiring debridement.

[7]Neurological includes: stroke, TIA, spinal cord ischemia/paralysis.

[8]Vascular included: limb thrombosis, distal embolization resulting in tissue loss or requiring intervention, transfusion post-procedure (resulting from pseudoaneurysm, vascular injury, aneurysm leak or other procedure-related causes), pseudoaneurysm, vascular injury (such as inadvertent occlusion, dissection or other procedure related causes), aneurysm leak or rupture, increase in aneurysm size by more than 0.5 cm relative to the smallest of any prior measurement.

[9]Investigators reported one additional high risk patient to have occlusion of an accessory renal artery and one additional high risk patient to have chronic renal insufficiency as "other" adverse events.

[10]Investigators reported one additional roll-in patient to have renal insufficiency and one additional surgical patient to have renal insufficiency as "other" adverse events.

[11]Investigators reported one additional roll-in patient to have experienced intraoperative aortic plaque rupture resulting in renal artery occlusion as an "other" adverse event.

5.2 Potential Adverse Events

Adverse events that may occur and/or require intervention include, but are not limited to:

- Amputation
- Anesthetic complications and subsequent attendant problems (e.g., aspiration)
- Aneurysm enlargement
- Aneurysm rupture and death
- Aortic damage, including perforation, dissection, bleeding, rupture and death
- Arterial or venous thrombosis and/or pseudoaneurysm
- Arteriovenous fistula
- Bleeding, hematoma or coagulopathy
- Bowel complications (e.g., ileus, transient ischemia, infarction, necrosis)
- Cardiac complications and subsequent attendant problems (e.g., arrhythmia, myocardial infarction, congestive heart failure, hypotension, hypertension)
- Claudication (e.g. buttock, lower limb)
- Death
- Edema
- Embolization (micro and macro) with transient or permanent ischemia or infarction
- Endoleak
- Endoprosthesis: improper component placement; incomplete component deployment; component migration; suture break; occlusion; infection; stent fracture; graft material wear; dilatation; erosion; puncture; perigraft flow; barb separation and corrosion
- Fever and localized inflammation
- Genitourinary complications and subsequent attendant problems (e.g., ischemia, erosion, fistula, incontinence, hematuria, infection)
- Graft or native vessel occlusion
- Hepatic failure
- Impotence
- Infection of the aneurysm, device or access site, including abscess formation, transient fever and pain
- Lymphatic complications and subsequent attendant problems (e.g., lymph fistula)
- Neurologic local or systemic complications and subsequent attendant problems (e.g., stroke, transient ischemic attack, paraplegia, paraparesis, paralysis)
- Occlusion of device or native vessel

- Pulmonary/respiratory complications and subsequent attendant problems (e.g., pneumonia, respiratory failure, prolonged intubation)
- Renal complications and subsequent attendant problems (e.g., artery occlusion, contrast toxicity, insufficiency, failure)
- Surgical conversion to open repair
- Vascular access site complications, including infection, pain, hematoma, pseudoaneurysm, arteriovenous fistula
- Vessel damage
- Wound complications and subsequent attendant problems (e.g., dehiscence, infection)
- Vascular spasm or vascular trauma (e.g., iliofemoral vessel dissection, bleeding, rupture, death)

Device Related Adverse Event Reporting

Any adverse event (clinical incident) involving the Zenith® AAA Endovascular Graft should be reported to COOK INCORPORATED immediately. To report an incident, call the Customer Relations Department at 800-457-4500 (24 hour) or 812-339-2235.

6 SUMMARY OF CLINICAL STUDIES

6.1 Objectives

The primary objective of the clinical study was to evaluate the safety and effectiveness of the Zenith® AAA Endovascular Graft as an alternative to open surgical repair in the primary treatment of infrarenal abdominal aortic aneurysms. Study hypotheses examined whether standard risk patients experienced less 30-day morbidity, equivalent 30-day survival rates, equivalent 12-month survival rates, equivalent 12-month treatment success and improved clinical utility measures compared to surgical control patients. Safety was determined by evaluating whether the Zenith® AAA Endovascular Graft subjects would have reduced 30-day morbidity, equivalent 30-day and 12-month survival and equivalent 12-month treatment success compared to the subjects treated with open surgical treatment. Effectiveness was based on exclusion of the aneurysm including the absence of any endoleak, the absence of aneurysm enlargement (≥ 5 mm) and the absence of major device adverse events evaluated through one year follow-up. Secondary objectives included an assessment of clinical benefit and quality-of-life measures.

6.2 Study Design

The U.S. clinical study was a multicenter, non-randomized study comparing standard medical risk patients who received an endovascular graft to an open surgical control. There were two additional study arms for high medical risk and roll-in treatment groups. Fifteen centers enrolled 200 standard risk, 80 surgical control, 100 high risk and 52 roll-in patients. The control group included patients whose vascular anatomy may not have been suitable for endovascular AAA repair. Follow-up evaluations were scheduled for pre-discharge, 1 month, 6 months, 12 months and 24 months. Patient follow-up and accountability at one month, 12 months and 24 months are presented in **Table 6.2.1** as these were the primary data analysis time points. Imaging data provided in this summary is based on findings from an independent centralized image analysis laboratory (Core Lab) which reviewed CT scans and abdominal X-rays to assess aneurysm diameter changes, device and relative component migration, device integrity (wire and graft) and the presence and type of endoleaks. Clinical events were adjudicated by an independent clinical events committee and safety was monitored by a data safety monitoring committee.

Surgical and Zenith standard risk patients met identical pathophysiologic risk criteria. The endovascular groups excluded circumferential thrombus in the proximal neck, proximal neck less than 15 mm in length, outer wall to outer wall proximal neck diameter less than 18 or greater than 28 mm, severe proximal neck angulation, outer wall to outer wall iliac artery diameter less than 7.5 mm or greater than 20 mm at distal fixation site or iliac artery distal fixation site less than 10 mm in length.

Patients were considered at higher risk for surgical repair if they had age greater than 80, baseline creatinine > 2.0 mg/dl, home oxygen therapy, FEV_1 < 1 liter, ejection fraction < 25%, disabling COPD, New York Heart Classification 3 or 4, hostile abdomen, dialysis, MI within last 6 months, medically intractable hypertension, previous stroke with residual deficit, cultural objection to receipt of blood or blood products, previous renal bypass surgery or inflammatory aneurysm.

Before enrolling patients into the pivotal trial, centers without Zenith® AAA Endovascular Graft experience were required to treat initial patients under the supervision of a proctor. These roll-in patients were a combination of standard and high risk patients and were followed according to the same schedule as the patients in the pivotal trial.

Table 6.2.1 Patient Follow-up and Accountability[1]

Treatment	Zenith Standard Risk			Surgical Standard Risk		
Interval	1 mo.	12 mo.	24 mo.	1 mo.	12 mo.	24 mo.
No device	1	1[2]	1[2]	0	0	n/a
Conversion to open repair	0	2[2]	2[2]	n/a	n/a	n/a
Expired	1	7	17	2	3	n/a
Withdrawn/lost to follow-up	0	0	2	0	4	n/a
Available	198	190	178	78	73	n/a
Site CT imaging	191	168	110	69	58	n/a
Core lab CT imaging	190	165	99	69	59	n/a
Site KUB imaging	179	153	108	n/a	n/a	n/a
Core lab KUB imaging	178	149	93	n/a	n/a	n/a
Site evaluated for endoleak	187	163	107	n/a	n/a	n/a
Core lab evaluated for endoleak	161	148	92	n/a	n/a	n/a
Site evaluated for aneurysm enlargement	n/a	149	104	n/a	n/a	n/a
Core lab evaluated for aneurysm enlargement	n/a	151	94	n/a	n/a	n/a

[1]Data analysis sample size varies for each of the timepoints above and in the following tables. This variability is due to patient availability for follow-up, as well as, quantity and quality of images available from specific timepoints for evaluation. For example, the number and quality of images available for evaluation of endoleak at 12 months is different than the number and quality of images available at 24 months due to variation in the number of image exams performed, the number of images provided from the clinical site to the Core Lab and/or the number of images with acceptable evaluation quality. Totals at time points are not cumulative, unless otherwise noted.

[2]Totals at time points are cumulative.

6.3 Patient Demographics

Tables 6.3.1 and 6.3.2 compare the subject characteristics and initial aneurysm diameter of the Zenith® AAA Endovascular Graft and open surgical population, respectively.

Table 6.3.1 Comparison of Subject Characteristics

Item	Zenith Standard Risk	Surgical Standard Risk	*P* value	Zenith High Risk	Zenith Roll-in
Age (years)	71 ± 7	69 ± 7	.03	77 ± 7	74 ± 8
Gender male	94% (187/200)	89% (71/80)	.22	92% (92/100)	90% (47/52)
Current medical conditions					
Peripheral vascular disease	16% (31/195)	25% (19/76)	.12	24% (23/96)	9.6% (5/52)
Hypertension	64% (127/200)	83% (65/78)	.001	68% (67/99)	67% (35/52)
Renal failure	0.0% (0/197)	0.0% (0/79)	>.99	5.2% (5/97)	1.9% (1/52)
COPD	20% (39/199)	18% (14/78)	.87	34% (33/98)	22% (11/51)
Thromboembolic event	4.5% (9/199)	7.7% (6/78)	.38	7.1% (7/99)	1.9% (1/52)
Liver disease	2.1% (4/192)	5.1% (4/79)	.24	1.0% (1/99)	1.9% (1/52)
Diabetes mellitus	12% (24/199)	15% (12/79)	.55	17% (17/99)	14% (7/51)
Insulin-dependent	17% (4/24)	8.3% (1/12)	.65	24% (4/17)	43% (3/7)
Previous medical conditions					
MI	39% (74/192)	29% (23/80)	.13	35% (34/98)	35% (18/52)
Congestive heart failure	5.0% (10/199)	12% (9/78)	.07	16% (16/100)	10% (5/50)
Angina	49% (98/198)	39% (31/79)	.14	45% (44/98)	44% (23/52)
Arrhythmia	20% (40/197)	22% (17/78)	.87	28% (27/98)	24% (12/51)
Cerebrovascular disease	9.5% (19/199)	16% (13/79)	.14	20% (20/99)	9.8% (5/51)
Systemic infection	1.0% (2/196)	0.0% (0/78)	>.99	3.1% (3/97)	0.0% (0/49)
Cancer	22% (43/200)	19% (15/80)	.74	31% (31/99)	29% (15/51)
Family history of aneurysmal disease	16% (24/150)	27% (17/63)	.09	14% (11/77)	26% (10/38)
Previous surgery at site	10% (20/200)	15% (12/79)	.22	10% (10/99)	14% (7/51)
Previous radiation at site	0.5% (1/197)	0.0% (0/79)	>.99	2.0% (2/100)	2.0% (1/51)
Excessive alcohol use	3.6% (7/193)	10% (8/77)	.04	3.1% (3/96)	4.0% (2/50)
Tobacco use					
Never smoked	10% (20/193)	5.0% (4/80)		14% (13/96)	24% (12/49)
Past smoker	69% (133/193)	60% (48/80)	.03	69% (66/96)	57% (28/49)
Still smokes	21% (40/193)	35% (28/80)		18% (17/96)	18% (9/49)

Due to inclusion criteria, high risk patients were older (P<.001), had more renal failure (P=.004), COPD (P=.01), congestive heart failure (P=.004) and cerebrovascular disease (P=.02) than standard risk patients.

Table 6.3.2 Aneurysm Diameter Distribution

Diameter Range	Zenith Standard Risk	Surgical Standard Risk	Zenith High Risk	Zenith Roll-in
< 30 mm	0.0% (0/199)	0.0% (0/78)	0.0% (0/100)	0.0% (0/52)
30-39 mm	0.5% (1/199)	0.0% (0/78)	1.0% (1/100)	0.0% (0/52)
40-49 mm	23% (45/199)	7.7% (6/78)	15% (15/100)	13% (7/52)
50-59 mm	48% (95/199)	33% (26/78)	47% (47/100)	40% (21/52)
60-69 mm	24% (47/199)	29% (23/78)	27% (27/100)	42% (22/52)
70-79 mm	3.0% (6/199)	21% (16/78)	5.0% (5/100)	1.9% (1/52)
80-89 mm	2.5% (5/199)	6.4% (5/78)	1.0% (1/100)	0.0% (0/52)
≥ 90 mm	0.0% (0/199)	2.6% (2/78)	1.0% (1/100)	0.0% (0/52)

Aneurysm diameter distribution was not assessed in three high and one roll-in patient.

6.4 Results

Data gathered in **Tables 6.4.1** through **6.4.3** were collected by the clinical study sites and Core Lab. Where available, 24-month data are provided. Control patients were not followed beyond 12 months and some data have not yet been adjudicated beyond 12 months. Therefore, some results are presented to 12 months while other results are presented to 24 months in this section. **Table 6.4.1** describes the devices implanted in clinical study patients. **Table 6.4.2** describes the primary results from the clinical study. **Figures 6.4.1** and **6.4.2** are the Kaplan-Meier plots of all-cause and AAA-related survival to 24 months, respectively. An independent clinical events committee adjudicated all deaths for possible relationship to aneurysm repair. All early deaths (0-30 days) were considered AAA-related. Deaths after 30 days were considered AAA-related if AAA disease or device involvement was confirmed. **Table 6.4.3** presents Success Measures and **Figure 6.4.3** is the Kaplan-Meier plot of Freedom from Morbidity.

Table 6.4.1 Devices Implanted

Item	Zenith Standard Risk	Zenith High Risk	Zenith Roll-in
Main body and legs	99.5% (199/200)*	100% (100/100)[1]	100% (52/52)
Main body extension[2]	1.5% (3/199)	1.0% (1/100)	5.8% (3/52)
Ipsilateral iliac leg extension[3,5]	9.5% (19/199)	11% (11/100)	0.0% (0/52)
Contralateral iliac leg extension[4,5]	11% (21/199)	11% (11/100)	13.5% (7/52)
Converter	0.5% (1/199)**	0.0% (0/100)	0.0% (0/52)
Occluder	0.0% (0/199)	0.0% (0/100)	0.0% (0/52)

* One standard risk patient did not receive a device due to tortuosity and calcification of the access vessel.

** Converter was used without occluder.

[1]One device was custom.

[2]Two standard risk and one high risk patient received main body extensions post-procedure; one standard risk patient received two main body extensions.

[3]Two standard risk and one high risk patient received ipsilateral leg extensions post-procedure.

[4]Four standard risk, two high risk and one roll-in patient received contralateral leg extensions post-procedure.

[5]Three standard risk and three high risk patients received both ipsilateral and contralateral extensions during the procedure; one standard risk received both ipsilateral and contralateral extensions post-procedure.

Table 6.4.2 Primary Results

Item	Zenith Standard Risk[1]	Surgical Standard Risk	*P* value	Zenith High Risk	Zenith Roll-in
All death (0-30 days)[2]	0.5% (1/199)	2.5% (2/80)	.20	2.0% (2/100)	1.9% (1/52)
All death					
(31-365 days)[2,3]	3.0% (6/199)	1.3% (1/80)	.68	7.0% (7/100)	9.6% (5/52)
AAA-related	0.0% (0/199)	1.3% (1/80)	.29	3.0% (3/100)	0.0% (0/52)
Non-AAA-related	3.0% (6/199)	0.0% (0/80)	.19	4.0% (4/100)	9.6% (5/52)
All death					
(0-365 days)[2,3,4]	3.5% (7/199)	3.8% (3/80)	>.99	9.0% (9/100)	11.5% (6/52)
AAA-related	0.5% (1/199)	3.8% (3/80)	.07	5.0% (5/100)	1.9% (1/52)
Non-AAA-related	3.0% (6/199)	0.0% (0/80)	.19	4.0% (4/100)	9.6% (5/52)
Rupture					
(0-30 days)	0.0% (0/199)	n/a	n/a	0.0% (0/100)	0.0% (0/52)
(31-365 days)	0.0% (0/199)	n/a	n/a	1.0% (1/100)	0.0% (0/52)
(0-365 days)	0.0% (0/199)	n/a	n/a	1.0% (1/100)	0.0% (0/52)
Conversion					
(0-30 days)	0.0% (0/199)	n/a	n/a	0.0% (0/100)	0.0% (0/52)
(31-365 days)[5]	1.0% (2/199)	n/a	n/a	1.0% (1/100)	0.0% (0/52)
(0-365 days)[5]	1.0% (2/199)	n/a	n/a	1.0% (1/100)	0.0% (0/52)
Adverse events					
(0-30 days)[6]	20% (40/200)	43% (34/80)	<.001	32% (32/100)	27% (14/52)
(31-365 days)[6]	8.6% (17/199)	14% (11/78)	.25	21% (21/98)	14% (7/51)
(0-365 days)[6]	25% (49/200)	51% (41/80)	<.001	45% (45/100)	38% (20/52)

[1]Denominator of 199 because one standard risk patient did not receive a device.

[2]All deaths (0-30 days) were considered AAA and procedure related.

[3]Of the deaths (31-365 days), four were considered AAA related: 1 surgical (septic shock from ischemic colitis) and 3 high risk (pancreatitis with renal failure and sepsis, hemorrhage from upper abdominal aneurysm [not treated AAA] and multiple system failure).

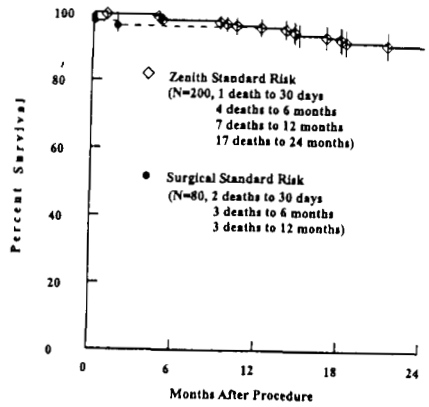
[4]Of the deaths (0-365 days), ten were considered AAA related: 1 standard risk (cardiac failure), 3 surgical (massive hemorrhage, mesenteric ischemia and septic shock from ischemic colitis), 5 high risk (respiratory failure, cardiac failure with pulmonary embolism, pancreatitis with renal failure and sepsis, hemorrhage from upper abdominal aneurysm [not treated AAA] and multiple system failure) and 1 roll-in (suspected cardiac failure).

[5]Standard risk patients underwent conversions due to a persistent, proximal Type I endoleak and a new suprarenal aortic aneurysm. Three surgical patients had massive hemorrhages, of which 2 required re-operation and one died.

[6]Adverse events included in the morbidity index.

Zenith® AAA Endovascular Graft patients exhibited no significant differences between males and females for survival and freedom from major adverse events. (Error bars in **Figures 6.4.1, 6.4.2** and **6.4.3** represent 95% confidence limits.) **Figure 6.4.1** presents all-cause survival to 24 months. The accompanying table presents the Kaplan-Meier analysis at 1, 6, 12 and 24 months.

Figure 6.4.1 Survival at 24 Months



	1 month n	1 month % survival	6 months n	6 months % survival	12 months n	12 months % survival	24 months n	24 months % survival
Zenith standard risk	198*	99.5	194	98.0	190	96.5	97	90.9
Surgical standard risk	78	97.5	73	96.2	67	96.2	n/a	n/a

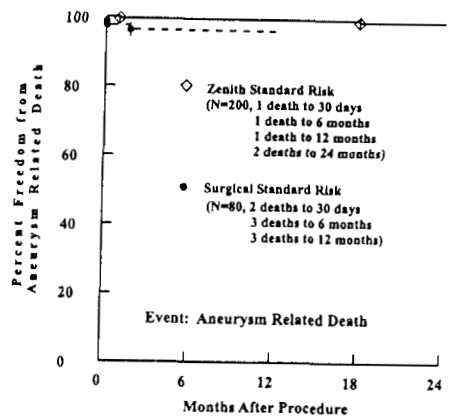
n= Patients alive and available for follow-up at the end of the interval

P = .81

*One patient expired before 1 month and one patient did not receive a device.

Figure 6.4.2 presents AAA-related survival (determined by Clinical Events Committee) to 24 months. The accompanying table presents the Kaplan-Meier analysis at 1, 6, 12 and 24 months.

Figure 6.4.2 AAA-Related Survival at 24 Months



	1 month n	1 month % survival	6 months n	6 months % survival	12 months n	12 months % survival	24 months n	24 months % survival
Zenith standard risk	198*	99.5	194	99.5	190	99.5	97	99.0
Surgical standard risk	78	97.5	73	96.2	67	96.2	n/a	n/a

n= Patients alive and available for follow-up at the end of the interval

P = .04

*One patient expired before 1 month and one patient did not receive a device.

Table 6.4.3 Success Measures

Item	Zenith Surgical Risk	Zenith Surgical Risk	Zenith High Risk	Zenith Roll-in
Technical success[1]	99.5% (199/200)	98.8% (79/80)	100% (100/100)	100% (52/52)
Procedural success at 30 days[2]	95.1% (155/163)	88% (60/68)	86% (70/81)	91% (30/33)
Treatment success at 12 months[3]	89% (122/137)	85% (52/61)	70% (44/63)	87% (26/30)

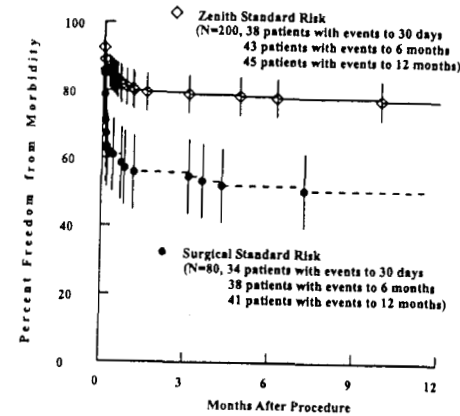
[1]Patent graft following deployment.

[2]Technical success with no major complications, patent graft and no Type I or Type III endoleaks at 30 days.

[3]Procedural success extended to 12 months with no aneurysm enlargement (> 5 mm).

Figure 6.4.3 presents freedom from morbidity (events in the morbidity index) to 12 months. The accompanying table presents the Kaplan-Meier analysis at 1, 6 and 12 months.

Figure 6.4.3 Freedom from Morbidity (0-365 days)



	1 month n	1 month %	6 months n	6 months %	12 months n	12 months %
Zenith standard risk	162	81.0	154	78.5	133	77.4
Surgical standard risk	45	57.1	39	52.0	33	47.8

n= Patients alive and free of morbidity at the end of the interval

P < .001

Tables 6.4.4 through 6.4.7 describe results of the Zenith® AAA Endovascular Graft subjects as reported by the Core Lab. Device performance factors analyzed by the Core Lab include device integrity (Table 6.4.4), device patency (Table 6.4.5), migration (Table 6.4.6) and limb separation (Table 6.4.7).

Table 6.4.4 Abdominal Radiographic Findings – Device Integrity

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
Stent Fractures[1]						
Pre-discharge	0.0%	(0/172)	0.0%	(0/81)	0.0%	(0/39)
30 day	0.0%	(0/172)	0.0%	(0/83)	0.0%	(0/43)
6 month	0.0%	(0/166)	0.0%	(0/78)	0.0%	(0/35)
12 month	0.0%	(0/148)	0.0%	(0/60)	0.0%	(0/28)
24 month	0.0%	(0/93)	0.0%	(0/42)	0.0%	(0/19)
Barb Separation[2]						
Pre-discharge	0.0%	(0/176)	0.0%	(0/86)	0.0%	(0/39)
30 day	0.0%	(0/178)	0.0%	(0/86)	0.0%	(0/43)
6 month	1.2%	(2/167)	2.5%	(2/80)	0.0%	(0/35)
12 month	2.0%	(3/149)	1.7%	(1/60)	0.0%	(0/28)
24 month	1.1%	(1/93)	0.0%	(0/42)	0.0%	(0/19)
Graft material rupture						
Pre-discharge	0.0%	(0/176)	0.0%	(0/86)	0.0%	(0/39)
30 day	0.0%	(0/178)	0.0%	(0/86)	0.0%	(0/43)
6 month	0.0%	(0/167)	0.0%	(0/80)	0.0%	(0/35)
12 month	0.0%	(0/149)	0.0%	(0/60)	0.0%	(0/28)
24 month	0.0%	(0/93)	0.0%	(0/42)	0.0%	(0/19)

[1]Stent fracture percentages are for main body. There were also no right iliac leg, left iliac leg, occluder, converter, left iliac extension, right iliac extension or main body extension fractures observed by the core lab.

[2]Patients with separation of 1 or 2 barbs (of 10 or 12 total); no adverse clinical sequelae.

Table 6.4.5 CT Findings – Graft Patency

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
Graft patency						
30 day	100%	(185/185)	99%	(85/86)	100%	(47/47)
6 month	99%	(183/184)	100%	(74/74)	100%	(39/39)
12 month	99%	(153/155)	100%	(62/62)	100%	(30/30)
24 month	100%	(96/96)	100%	(33/33)	100%	(25/25)

Table 6.4.6 CT Findings – Graft (Main Body) Migration

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
Graft migration (>5 mm) at 12 months						
with clinical sequelae[1] or intervention	0.0%	(0/162)	0.0%	(0/71)	0.0%	(0/34)
without clinical sequelae[1] or intervention	2.5%	(4/162)	2.8%	(2/71)	0.0%	(0/34)
Graft migration (>10 mm)	0.0%	(0/162)	0.0%	(0/71)	0.0%	(0/34)

[1]Migration with clinical sequelae would include endoleak, conversion, rupture or AAA-related death.

Table 6.4.7 Abdominal Radiograph Findings – Limb Separation

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
Limb separation						
Pre-discharge	0.0%	(0/176)	0.0%	(0/86)	0.0%	(0/39)
30 day	0.0%	(0/178)	0.0%	(0/86)	0.0%	(0/43)
6 month	0.0%	(0/167)	0.0%	(0/80)	0.0%	(0/35)
12 month	0.0%	(0/149)	0.0%	(0/60)	0.0%	(0/28)
24 month	0.0%	(0/93)	0.0%	(0/42)	0.0%	(0/19)

6.5 Endoleak Management

During the clinical study Type I endoleaks were treated during the initial procedure by use of additional balloon seating or if unsuccessful, additional prostheses. Type II endoleaks were observed for a period of one to six months to determine if they would spontaneously thrombose, or in the absence of enlarging aneurysms, they were treated with endovascular techniques at the discretion of the practicing physician. If the aneurysm enlarged, treatment by embolization or ligation was considered and, in some cases performed. Type III endoleaks caused by graft defects, inadequate seal or disconnection of the modular components were treated with additional ballooning or prostheses. As reported by the angiographic core lab, there were no Type IV endoleaks during the U.S. clinical study. The graft material used to manufacture the Zenith® AAA Endovascular Graft is of standard thickness and is the same material used in open surgical procedures. Table 6.5.1 presents the incidence of endoleaks by evaluation interval, as identified by the Core Lab for the standard risk, high risk and roll-in patients, respectively.

Table 6.5.1 Endoleaks (All Types, New and Persistent)

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
Endoleaks						
Pre-discharge	15%	(23/153)	14%	(11/78)	12%	(3/26)
30 day[1]	9.9%	(16/161)	12%	(9/75)	6.3%	(2/32)
6 month[1]	8.7%	(15/172)	11%	(8/70)	8.6%	(3/35)
12 month[1]	7.4%	(11/148)	8.8%	(5/57)	3.4%	(1/29)

[1]Includes both persistent endoleaks and new observations

Tables 6.5.2 – 6.5.4 present the incidence of first occurrence of an endoleak according to evaluation interval, as identified by the Core Lab at or before the 30 day, 6 month and 12 month exams for the standard risk, high risk and roll-in patients, respectively. The number of patients who are leak-free thereafter is also given.

Table 6.5.2 First Occurrence of Endoleak[1] for Standard Risk Patients

	To One Month Exam N=179			Six Month Exam N=172			Twelve Month Exam[3] N=148		
Item	%	Endo-Leak[1]	Leak-free Thereafter[2]	%	Endo-leak[1]	Leak-free Thereafter[2]	%	Endo-leak[1]	Leak-free Thereafter[2]
Endoleaks	17	31	17	2.3	4	3	3.4	5	2
Proximal Type I	2.8	5	4	0.0	0	0	0.0	0	0
Distal									
Type I	1.7	3	1	0.0	0	0	0.7	1	1
Type II	9.5	17	9	2.3	4	3	1.4	2	1
Type III	1.1	2	2	0.0	0	0	0.7	1	0
Type IV	0.0	0	0	0.0	0	0	0.0	0	0
Multiple	1.1	2	1	0.0	0	0	0.0	0	0
Unknown	1.1	2	0	0.0	0	0	0.7	1	0

[1]Identified by Core Lab.

[2]Subsequent endoleaks may have been of different type than original.

[3]Only 2 patients had new endoleaks after 12 months; follow-up after 24 months not available.

Table 6.5.3 First Occurrence of Endoleak[1] for High Risk Patients

Item	To One Month Exam N=88 %	Endo-Leak[1]	Leak-free Thereafter[2]	Six Month Exam N=70 %	Endo-leak[1]	Leak-free Thereafter[2]	Twelve Month Exam[3] N=57 %	Endo-leak[1]	Leak-free Thereafter[2]
Endoleaks	18	16	6	2.9	2	0	3.5	2	1
Proximal Type I	2.3	2	1	0.0	0	0	0.0	0	0
Distal Type I	1.1	1	1	0.0	0	0	0.0	0	0
Type II	9.1	8	3	1.4	1	0	1.8	1	0
Type III	0.0	0	0	1.4	1	0	1.8	1	1
Type IV	0.0	0	0	0.0	0	0	0.0	0	0
Multiple	4.5	4	0	0.0	0	0	0.0	0	0
Unknown	1.1	1	1	0.0	0	0	0.0	0	0

[1]Identified by Core Lab.

[2]Subsequent endoleaks may have been of different type than original.

[3]No endoleaks after 12 months; follow-up after 24 months not available.

Table 6.5.4 First Occurrence of Endoleak[1] for Roll-in Patients

Item	To One Month Exam N=36 %	Endo-Leak[1]	Leak-free Thereafter[2]	Six Month Exam N=35 %	Endo-leak[1]	Leak-free Thereafter[2]	Twelve Month Exam[3] N=29 %	Endo-leak[1]	Leak-free Thereafter[2]
Endoleaks	11	4	2	2.9	1	0	0.0	0	0
Proximal Type I	0.0	0	0	0.0	0	0	0.0	0	0
Distal Type I	0.0	0	0	0.0	0	0	0.0	0	0
Type II	5.6	2	1	2.9	1	0	0.0	0	0
Type III	2.8	1	0	0.0	0	0	0.0	0	0
Type IV	0.0	0	0	0.0	0	0	0.0	0	0
Multiple	0.0	0	0	0.0	0	0	0.0	0	0
Unknown	2.8	1	1	0.0	0	0	0.0	0	0

[1]Identified by Core Lab.

[2]Subsequent endoleaks may have been of different type than original.

[3]No endoleaks after 12 months; follow-up after 24 months not available.

6.6 Aneurysm Change

Tables 6.6.1 - 6.6.3 present the change in aneurysm diameter for the endovascular patients, as identified by the Core Lab. **Table 6.6.1** *presents maximum aneurysm diameter change by interval.* **Tables** 6.6.2 and 6.6.3 present aneurysm change and endoleak at 12 and 24 months, respectively.

Table 6.6.1 Change in Maximum Aneurysm Diameter by Interval*

Item	Zenith Standard Risk		Zenith High Risk		Zenith Roll-in	
From pre-discharge 30-day						
Decrease >5 mm	1.7%	(3/180)	4.8%	(4/84)	0.0%	(0/40)
Unchanged	97%	(174/180)	94%	(79/84)	97.5%	(39/40)
Increase >5 mm	1.7%	(3/180)	1.2%	(1/84)	2.5%	(1/40)
Change from pre-discharge 6-month						
Decrease >5 mm	36%	(63/173)	41%	(30/73)	49%	(18/37)
Unchanged	62%	(108/173)	59%	(43/73)	51%	(19/37)
Increase >5 mm	1.2%	(2/173)	0.0%	(0/73)	0.0%	(0/37)
Change from pre-discharge 12-month						
Decrease >5 mm	68%	(102/151)	63%	(39/62)	67%	(20/30)
Unchanged	31%	(47/151)	35%	(22/62)	33%	(10/30)
Increase >5 mm	1.3%	(2/151)	1.6%	(1/62)	0.0%	(0/30)
Change from pre-discharge 24-month						
Decrease >5 mm	78%	(74/94)	75%	(27/36)	71%	(17/24)
Unchanged	19%	(18/94)	25%	(9/36)	25%	(6/24)
Increase >5 mm	2.1%	(2/94)	0.0%	(0/36)	4.2%	(1/24)

*Only includes subjects with interpretable films and measurements of aneurysm change from 1 to 24 months.

Table 6.6.2 Change in Aneurysm Size and Endoleak at 12 Months

Item	Zenith Standard Risk N=140 N	Endoleak n	%	Zenith High Risk N=53 N	Endoleak n	%	Zenith Roll-in N=27 N	Endoleak n	%
Aneurysm size change from pre-discharge to 12 months									
Decrease >5 mm	96	3	3.0	35	3	9.0	20	0	0.0
Unchanged	42	8	19	17	2	12	7	1	14
Increase >5 mm	2	0	0.0	1	0	0.0	0	0	0.0

Table 6.6.3 Change in Aneurysm Size and Endoleak at 24 Months

Item	Zenith Standard Risk N=90 N	Endoleak n	%	Zenith High Risk N=31 N	Endoleak n	%	Zenith Roll-in N=21 N	Endoleak n	%
Aneurysm size change from pre-discharge to 24 months									
Decrease >5 mm	71	3	4.0	24	1	4.0	16	0	0.0
Unchanged	18	1	6.0	7	3	43	5	0	0.0
Increase >5 mm	1	1	100	0	0	0.0	0	0	0.0

6.7 AAA-related Secondary Interventions

AAA-related secondary interventions within the first year were performed in 11% of the Zenith standard risk, 13% Zenith high risk and 5.8% Zenith roll-in subjects as shown in **Table 6.7.1**. Greater than 50% of the secondary interventions involved catheterization to treat an endoleak. AAA-related secondary interventions within the second year were performed in 4.2% of the Zenith standard risk, 2.2% Zenith high risk and 2.3% Zenith roll-in subjects as shown in **Table 6.7.2**.

Table 6.7.1 Secondary Interventions (to 12 Months)

	Zenith Standard Risk N=199		Zenith High Risk N=100		Zenith Roll-in N=52	
Intervention	n	%	n	%	n	%
Conversion to open repair	2	1.0	1	1.0	0	0.0
Subjects with >1 intervention	21	11	13	13	3	5.8
Treat an endoleak						
Embolization	5	2.5	3	3.0	1	2.0
Ancillary component	6	3.0	4	4.0	1	2.0
Stent	1	0.5	0	0.0	0	0.0
Angioplasty	0	0.0	1	1.0	0	0.0
Treat an aneurysm increase						
Embolization	0	0.0	0	0.0	0	0.0
Treat a limb occlusion	1	0.5	3	3.0	1	2.0
Treat a limb stenosis	1	0.5	0	0.0	0	0.0
Treat a renal artery	5	2.5	0	0.0	0	0.0
Treat infra-inguinal ischemia	1	0.5	1	1.0	0	0.0
Treat multiple events	1	0.5	1	1.0	0	0.0

Table 6.7.2 Secondary Interventions (>12 to 24 Months)

	Zenith Standard Risk N=190		Zenith High Risk N=90		Zenith Roll-in N=44	
Intervention	n	%	n	%	n	%
Conversion to open repair	1	0.5	1	1.1	0	0.0
Subjects with >1 intervention	8	4.2	2	2.2	1	2.3
Treat an endoleak						
Embolization	3[1]	1.6	0	0.0	1[2]	2.3
Ancillary component	1	0.5	0	0.0	0	0.0
Stent	0	0.0	1	1.1	0	0.0
Angioplasty	0	0.0	0	0.0	0	0.0
Treat an aneurysm increase embolization	1	0.5	0	0.0	1[2]	2.3
Treat a limb occlusion	1	0.5	0	0.0	0	0.0
Treat a limb stenosis	0	0.0	0	0.0	0	0.0
Treat a renal artery	0	0.0	1	1.1	0	0.0
Treat infra-inguinal ischemia	1	0.5	0	0.0	0	0.0
Treat multiple events	1	0.5	0	0.0	0	0.0

[1] Patient also received ancillary component.

[2] Patient underwent intervention to treat aneurysm increase and endoleak.

6.8 Secondary Outcome Measures

As described in **Table 6.8.1**, treatment of AAA with the Zenith® AAA Endovascular Graft compared to the surgical control group demonstrated significant benefits in recovery and quality of life measures.

Table 6.8.1 Secondary Outcomes by Treatment Group

Item	Zenith Standard Risk	Surgical Standard Risk	*P* value	Zenith High Risk	Zenith Roll-in
Anesthesia time (min)	221.6 ± 67.3	304.5 ± 102.7	<.001	218.9 ± 69.6	213.9 ± 57.7
Procedure time (min)	153.2 ± 56.3	238.7 ± 92.2	<.001	153.5 ± 58.6	155.9 ± 43.2
Blood bank products received	5.0% (10/200)	84% (67/80)	<.001	12% (12/100)	3.8% (2/52)
Blood loss (cc)	299 ± 324	1676 ± 1676	<.001	356 ± 514	265 ± 226
Days in ICU	0.4 ± 0.9	3.4 ± 4.6	<.001	0.5 ± 1.2	0.5 ± 0.9
Days to discharge	2.6 ± 1.7	8.8 ± 5.6	<.001	3.0 ± 2.8	2.7 ± 1.5
Days to oral fluids	0.5 ± 0.8	3.9 ± 2.5	<.001	0.5 ± 0.6	0.7 ± 0.5
Days to normal diet	1.3 ± 1.2	6.6 ± 4.9	<.001	1.3 ± 0.8	1.1 ± 0.7
Days to normal bowel function	2.6 ± 1.4	4.2 ± 2.1	<.001	2.6 ± 1.5	2.0 ± 1.2
Days to ambulation	1.2 ± 0.7	3.5 ± 3.4	<.001	1.2 ± 0.7	1.2 ± 0.6
Hours of intubation	1.9 ± 2.2	11.7 ± 13.6	<.001	1.2 ± 1.7	2.6 ± 4.6
Maximum temperature	101.1 ± 1.3	100.7 ± 1.2	.06	100.8 ± 1.1	101.0 ± 1.2

7 PATIENT SELECTION AND TREATMENT

(See Section 4, Warnings and Precautions)

7.1 Individualization of Treatment

Cook recommends that the Zenith® AAA Endovascular Graft component diameters be selected as described in **Tables 10.5.1** through **10.5.6**. The length of the Zenith® AAA Endovascular Graft should extend from the lowest renal artery to just above the internal iliac (hypogastric) artery bifurcation. All lengths and diameters of the devices necessary to complete the procedure should be available to the physician, especially when pre-operative case planning measurements (treatment diameters/lengths) are not certain. This approach allows for greater intraoperative flexibility to achieve optimal procedural outcomes. The risks and benefits previously described in *Section 6, Summary of Clinical Studies* should be carefully considered for each patient before use of the Zenith® AAA Endovascular Graft. Additional considerations for patient selection include but are not limited to:

- Patient's age and life expectancy.
- Co-morbidities (e.g., cardiac, pulmonary or renal insufficiency prior to surgery, morbid obesity).
- Patient's suitability for open surgical repair.
- Patient's anatomical suitability for endovascular repair.
- The risk of aneurysm rupture compared to the risk of treatment with the Zenith® AAA Endovascular Graft.
- Ability to tolerate general, regional or local anesthesia.

- Iliofemoral access vessel size and morphology (minimal thrombus, calcium and/or tortuosity) should be compatible with vascular access techniques and accessories of the delivery profile of a 16 French to 20 French vascular introducer sheath.
- Non-aneurysmal infrarenal aortic segment (neck) proximal to the aneurysm:
  - with a length of at least 15 mm,
  - with a diameter measured outer wall to outer wall of no greater than 28 mm and no less than 18 mm,
  - with an angle less than 60 degrees relative to the long axis of the aneurysm, and
  - with an angle less than 45 degrees relative to the axis of the suprarenal aorta.
- Iliac artery distal fixation site greater than 10 mm in length and 7.5 to 20 mm in diameter (measured outer wall to outer wall).
- Freedom from significant femoral/iliac artery occlusive disease that would impede flow through the endovascular graft.

The final treatment decision is at the discretion of the physician and patient.

8 PATIENT COUNSELING INFORMATION

The physician and patient (and/or family members) should review the risks and benefits when discussing this endovascular device and procedure including:

- Risks and differences between endovascular repair and surgical repair.
- Potential advantages of traditional open surgical repair.
- Potential advantages of endovascular repair.
- The possibility that subsequent interventional or open surgical repair of the aneurysm may be required after initial endovascular repair.

In addition to the risks and benefits of an endovascular repair, the physician should assess the patient's commitment and compliance to post-operative follow-up as necessary to ensure continuing safe and effective results. Listed below are additional topics to discuss with the patient as to expectations after an endovascular repair:

- The long-term performance of endovascular grafts has not yet been established. All patients should be advised that endovascular treatment requires life-long, regular follow-up to assess their health and the performance of their endovascular graft. Patients with specific clinical findings (e.g., endoleaks, enlarging aneurysms or changes in the structure or position of the endovascular graft) should receive enhanced follow-up. Specific follow-up guidelines are described in *Section 12, Imaging Guidelines and Post-Operative Follow-Up.*

- Patients should be counseled on the importance of adhering to the follow-up schedule, both during the first year and at yearly intervals thereafter. Patients should be told that regular and consistent follow-up is a critical part of ensuring the ongoing safety and effectiveness of endovascular treatment of AAAs. At a minimum, annual imaging and adherence to routine post-operative follow-up requirements is required and should be considered a life-long commitment to the patient's health and well-being.
- Physicians must advise all patients that it is important to seek prompt medical attention if he/she experiences signs of limb occlusion, aneurysm enlargement or rupture. Signs of graft limb occlusion include pain in the hip(s) or leg(s) during walking or at rest or discoloration or coolness of the leg. Aneurysm rupture may be asymptomatic, but usually presents as: pain; numbness; weakness in the legs; any back, chest, abdominal or groin pain; dizziness; fainting; rapid heartbeat or sudden weakness.

Physicians should refer the patient to the *Patient Guide* regarding risks occurring during or after implantation of the device. Procedure related risks include cardiac, pulmonary, neurologic, bowel and bleeding complications. Device related risks include occlusion, endoleak, aneurysm enlargement, fracture, potential for reintervention and open surgical conversion, rupture and death (See *Section 5.1, Observed Adverse Events* and *Section 5.2, Potential Adverse Events*). The physician should complete the *Patient I.D. Card* and give it to the patient so that he/she can carry it with them at all times. The patient should refer to the card anytime they visit additional health practitioners, particularly for any additional diagnostic procedures (e.g., MRI).

9 HOW SUPPLIED

- The Zenith® AAA Endovascular Graft is supplied sterile and pre-loaded in peel-open packages.
- The device is intended for single use only. Do not re-sterilize the device.
- Inspect the device and packaging to verify that no damage has occurred as a result of shipping. Do not use this device if damage has occurred or if the sterilization barrier has been damaged or broken. If damage has occurred, do not use the product and return to COOK INCORPORATED.
- Prior to use, verify correct devices (quantity and size) have been supplied for the patient by matching the device to the order prescribed by the physician for that particular patient.
- Do not use after the "USE BY" (expiration) date printed on the label.
- Store in a cool, dry place.

The Zenith® AAA Endovascular Graft components are available in the following lengths and diameters:

Table 9.1 Bifurcated Main Bodies

Cook Reorder Number*	Main Body Diameter	Introduction Sheath French Size	Main Body Length
TFB-22-74	22 mm	18 Fr	74 mm
TFB-22-88	22 mm	18 Fr	88 mm
TFB-22-103	22 mm	18 Fr	103 mm
TFB-22-117	22 mm	18 Fr	117 mm
TFB-22-132	22 mm	18 Fr	132 mm
TFB-24-74	24 mm	18 Fr	74 mm
TFB-24-88	24 mm	18 Fr	88 mm
TFB-24-103	24 mm	18 Fr	103 mm
TFB-24-117	24 mm	18 Fr	117 mm
TFB-24-132	24 mm	18 Fr	132 mm
TFB-26-74	26 mm	18 Fr	74 mm
TFB-26-88	26 mm	18 Fr	88 mm
TFB-26-103	26 mm	18 Fr	103 mm
TFB-26-117	26 mm	18 Fr	117 mm
TFB-26-132	26 mm	18 Fr	132 mm
TFB-28-74	28 mm	20 Fr	74 mm
TFB-28-88	28 mm	20 Fr	88 mm
TFB-28-103	28 mm	20 Fr	103 mm
TFB-28-117	28 mm	20 Fr	117 mm
TFB-28-132	28 mm	20 Fr	132 mm
TFB-30-74	30 mm	20 Fr	74 mm
TFB-30-88	30 mm	20 Fr	88 mm
TFB-30-103	30 mm	20 Fr	103 mm
TFB-30-117	30 mm	20 Fr	117 mm
TFB-30-132	30 mm	20 Fr	132 mm
TFB-32-74	32 mm	20 Fr	74 mm
TFB-32-88	32 mm	20 Fr	88 mm
TFB-32-103	32 mm	20 Fr	103 mm
TFB-32-117	32 mm	20 Fr	117 mm
TFB-32-132	32 mm	20 Fr	132 mm

*TFB-XX-YYY is the bifurcated main body where XX is diameter and YYY is the length on the contralateral side.

Table 9.2 Ipsilateral/Contralateral Iliac Legs

Cook Reorder Number*	Iliac Leg Diameter	Introduction Sheath French Size	Iliac Leg Length
TFLE-8-37	8 mm	14 Fr	37 mm
TFLE-8-54	8 mm	14 Fr	54 mm
TFLE-8-71	8 mm	14 Fr	71 mm
TFLE-8-88	8 mm	14 Fr	88 mm
TFLE-8-105	8 mm	14 Fr	105 mm
TFLE-8-122	8 mm	14 Fr	122 mm
TFLE-10-37	10 mm	14 Fr	37 mm
TFLE-10-54	10 mm	14 Fr	54 mm
TFLE-10-71	10 mm	14 Fr	71 mm
TFLE-10-88	10 mm	14 Fr	88 mm
TFLE-10-105	10 mm	14 Fr	105 mm
TFLE-10-122	10 mm	14 Fr	122 mm
TFLE-12-37	12 mm	14 Fr	37 mm
TFLE-12-54	12 mm	14 Fr	54 mm
TFLE-12-71	12 mm	14 Fr	71 mm
TFLE-12-88	12 mm	14 Fr	88 mm
TFLE-12-105	12 mm	14 Fr	105 mm
TFLE-12-122	12 mm	14 Fr	122 mm
TFLE-14-37	14 mm	14 Fr	37 mm
TFLE-14-54	14 mm	14 Fr	54 mm
TFLE-14-71	14 mm	14 Fr	71 mm
TFLE-14-88	14 mm	14 Fr	88 mm
TFLE-16-37	16 mm	14 Fr	37 mm
TFLE-16-54	16 mm	14 Fr	54 mm
TFLE-16-71	16 mm	14 Fr	71 mm
TFLE-16-88	16 mm	14 Fr	88 mm
TFLE-18-37	18 mm	16 Fr	37 mm
TFLE-18-54	18 mm	16 Fr	54 mm
TFLE-18-71	18 mm	16 Fr	71 mm
TFLE 18-88	18 mm	16 Fr	88 mm
TFLE-20-37	20 mm	16 Fr	37 mm
TFLE-20-54	20 mm	16 Fr	54 mm
TFLE-20-71	20 mm	16 Fr	71 mm
TFLE-20-88	20 mm	16 Fr	88 mm
TFLE-22-37	22 mm	16 Fr	37 mm
TFLE-22-54	22 mm	16 Fr	54 mm
TFLE-22-71	22 mm	16 Fr	71 mm
TFLE-22-88	22 mm	16 Fr	88 mm
TFLE-24-37	24 mm	16 Fr	37 mm
TFLE-24-54	24 mm	16 Fr	54 mm
TFLE-24-71	24 mm	16 Fr	71 mm
TFLE-24-88	24 mm	16 Fr	88 mm

*TFLE-XX-YYY is the contralateral or ipsilateral iliac leg where XX is the diameter and YYY is the length.

Table 9.3 Converter

Used to convert an *in situ* bifurcated graft to an aorto-uniiliac repair.

Cook Reorder Number*	Converter Proximal Diameter	Introduction Sheath French Size	Converter Distal Diameter	Converter Distal Length
ESC-24-12-80	24 mm	18 Fr	12 mm	80 mm
ESC-28-12-80	28 mm	20 Fr	12 mm	80 mm
ESC-32-12-80	32 mm	20 Fr	12 mm	80 mm

*ESC-XX-YY-ZZ is the converter where XX is the proximal diameter, YY is the distal diameter and ZZ is the length.

Table 9.4 Iliac Leg Extension

Used for extending the distal iliac leg of an *in situ* endovascular graft.

Cook Reorder Number*	Extension Diameter	Introduction Sheath French Size	Extension Length
ESLE-8-55	8 mm	14 Fr	55 mm
ESLE-10-55	10 mm	14 Fr	55 mm
ESLE-12-55	12 mm	14 Fr	55 mm
ESLE-14-55	14 mm	14 Fr	55 mm
ESLE-16-55	16 mm	14 Fr	55 mm
ESLE-18-55	18 mm	16 Fr	55 mm
ESLE-20-55	20 mm	16 Fr	55 mm
ESLE-22-55	22 mm	18 Fr	55 mm
ESLE-24-55	24 mm	18 Fr	55 mm

*ESLE-XX-YY is the iliac leg extension where XX is the diameter and YY is the length.

Table 9.5 Occluder

Used to occlude an iliac artery when an aorto-uniiliac device or a converter has been implanted, and a femoral-to-femoral crossover procedure is required.

Cook Reorder Number*	Occluder Diameter	Introduction Sheath French Size	Occluder Length
ESP-14-20	14 mm	18 Fr	20 mm
ESP-16-20	16 mm	18 Fr	20 mm
ESP-20-20	20 mm	18 Fr	20 mm
ESP-24-20	24 mm	18 Fr	20 mm

*ESP-XX-YY is the occluder where XX is the diameter and YY is the length.

Table 9.6. Main Body Extension

Used for extending the proximal body of an *in situ* endovascular graft.

Cook Reorder Number*	Extension Diameter	Introduction Sheath French Size	Extension Length
ESBE-22-36	22 mm	18 Fr	36 mm
ESBE-24-36	24 mm	18 Fr	36 mm
ESBE 26-36	26 mm	18 Fr	36 mm
ESBE-28-36	28 mm	20 Fr	36 mm
ESBE-30-36	30 mm	20 Fr	36 mm
ESBE-32-36	32 mm	20 Fr	36 mm

*ESBE-XX-YY is the main body extension where XX is the diameter and YY is the length.

10 CLINICAL USE INFORMATION

10.1 Physician Training Program

CAUTION: Always have a vascular surgery team available during implantation or reintervention procedures in the event that conversion to open surgical repair is necessary.

CAUTION: The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System should only be used by physicians and teams trained in vascular interventional techniques and in the use of this device. The recommended skill/knowledge requirements for physicians using the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System are outlined below:

Patient selection:

- Knowledge of the natural history of abdominal aortic aneurysms (AAA) and co-morbidities associated with AAA repair.
- Knowledge of radiographic image interpretation, device selection and sizing.

A multi-disciplinary team that has combined procedural experience with:

- Femoral cutdown, arteriotomy and repair
- Percutaneous access and closure techniques
- Non-selective and selective wire guide and catheter techniques
- Fluoroscopic and angiographic image interpretation
- Embolization
- Angioplasty
- Endovascular stent placement
- Snare techniques
- Appropriate use of radiographic contrast material
- Techniques to minimize radiation exposure
- Expertise in necessary patient follow-up modalities

10.2 Inspection Prior to Use

Inspect the device and packaging to verify that no damage has occurred as a result of shipping. Do not use this device if damage has occurred or if the sterilization barrier has been damaged or broken. If damage has occurred, do not use the product and return to COOK INCORPORATED. Prior to use, verify correct devices (quantity and size) have been supplied for the patient by matching the device to the order prescribed by the physician for that particular patient.

10.3 Materials Required

(Not included in 3-piece modular system)

- Zenith® AAA Endovascular Graft Ancillary Kit
- Fluoroscope with digital angiography capabilities (C-arm or fixed unit)
- Contrast media
- Syringe
- Heparinized saline solution

10.4 Materials Recommended

(Not included in 3-piece modular system)

The following products are recommended:

- .035 inch (0.89 mm) extra stiff wire guide, 260 cm; for example:
  - Cook Amplatz Ultra Stiff Wire Guides (AUS)
  - Cook Lunderquist Extra Stiff Wire Guides (LES)
- .035 inch (0.89 mm) standard wire guide; for example:
  - Cook .035 inch wire guides
  - Cook Nimble™ Wire Guides
- Molding Balloons
- Introducer sets; for example:
  - Cook Check-Flo® Introducer Sets
  - Cook Extra Large Check-Flo® Introducer Sets
  - Cook Flexor® Balkin Up & Over® Contralateral Introducers
- Sizing catheter; for example:
  - Cook Aurous® Centimeter Sizing Catheters
- Angiographic radiopaque tip catheters; for example:
  - Cook Beacon® Tip Angiographic Catheters
  - Cook Beacon® Tip Royal Flush Catheters
- Entry needles; for example:
  - Cook single wall entry needles

10.5 Device Diameter Sizing Guidelines

The choice of diameter should be determined from the outer wall to outer wall vessel diameter and **not** the lumen diameter. Undersizing or oversizing may result in incomplete sealing or comprised flow.

Table 10.5.1 Main Body (TFB) Graft Diameter Sizing Guide*

Intended Aortic Vessel Diameter[1,2] (mm)	Main Body Diameter[3] (mm)	Overall Length to Contralateral Limb/ Overall Length to Ipsilateral Limb (mm)	Introducer Sheath (Fr)
18-19	22	74/104, 88/118, 103/133, 117/147, 132/162	18
20-21	24	74/104, 88/118, 103/133, 117/147, 132/162	18
22	26	74/104, 88/118, 103/133, 117/147, 132/162	18
23-24	28	74/104, 88/118, 103/133, 117/147, 132/162	20
25-26	30	74/104, 88/118, 103/133, 117/147, 132/162	20
27-28	32	74/104, 88/118, 103/133, 117/147, 132/162	20

[1]Maximum diameter along the proximal fixation site.

[2]Round measured aortic diameter to nearest mm.

[3]Additional considerations may affect choice of diameter.

*All dimensions are nominal.

Table 10.5.2 Iliac Leg (TFLE) Graft Diameter Sizing Guide*

Intended Iliac Vessel Diameter[1,2] (mm)	Iliac Leg Diameter[3] (mm)	Iliac Leg Working Length[4] (mm)	Introducer Sheath (Fr)
<8	8	37, 54, 71, 88, 105, 122	14
8-9	10	37, 54, 71, 88, 105, 122	14
10-11	12	37, 54, 71, 88, 105, 122	14
12-13	14	37, 54, 71, 88	14
14-15	16	37, 54, 71, 88	14
16-17	18	37, 54, 71, 88	16
18	20	37, 54, 71, 88	16
19	22	37, 54, 71, 88	18
20	24	37, 54, 71, 88	18

[1]Maximum diameter along the distal fixation site.

[2]Round measured iliac diameter to nearest mm.

[3]Additional considerations may affect choice of diameter.

[4]Overall leg length = working length + 22 mm docking stent.

*All dimensions are nominal.

Table 10.5.3 Main Body Extension (ESBE) Graft Diameter Sizing Guide*

Intended Aortic Vessel Diameter[1,2] (mm)	Main Body Extension Diameter[3] (mm)	Main Body Extension Length (mm)	Introducer Sheath (Fr)
18-19	22	36	18
20-21	24	36	18
22-23	26	36	18
24-25	28	36	20
26-27	30	36	20
28	32	36	20

[1]Maximum diameter along the proximal fixation site.

[2]Round measured aortic diameter to nearest mm.

[3]Additional considerations may affect choice of diameter.

*All dimensions are nominal.

Table 10.5.4 Iliac Leg Extension (ESLE) Graft Diameter Sizing Guide*

Intended Iliac Vessel Diameter[1,2] (mm)	Iliac Leg Extension Diameter[3] (mm)	Iliac Leg Extension Length (mm)	Introducer Sheath (Fr)
<8	8	55	14
8-9	10	55	14
10-11	12	55	14
12-13	14	55	14
14-15	16	55	14
16-17	18	55	16
18	20	55	16
19	22	55	18
20	24	55	18

[1]Maximum diameter along the distal fixation site.

[2]Round measured iliac diameter to nearest mm.

[3]Additional considerations may affect choice of diameter.

*All dimensions are nominal.

Table 10.5.5 Converter (ESC) Graft Diameter Sizing Guide*

Main Body Diameter (mm)	Converter Diameter[1] (mm)	Converter Length (mm)	Introducer Sheath (Fr)
22	24	80	18
24	24	80	18
26	28	80	20
28	28	80	20
30	32	80	20
32	32	80	20

[1]Additional considerations may affect choice of diameter.

*All dimensions are nominal.

Table 10.5.6 Occluder (ESP) Graft Diameter Sizing Guide*

Intended Iliac Vessel Diameter[1,2] (mm)	Occluder Diameter[3] (mm)	Occluder Length (mm)	Introducer Sheath (Fr)
8-10	14	20	18
11-12	16	20	18
13-16	20	20	18
17-20	24	20	18

[1]Maximum diameter along the distal fixation site.

[2]Round iliac diameter to nearest mm.

[3]Additional considerations may affect choice of diameter.

*All dimensions are nominal.

11 DIRECTIONS FOR USE

Prior to use of the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System, review this *Suggested Instructions for Use* booklet. The following instructions embody a basic guideline for device placement. Variations in the following procedures may be necessary. These instructions are intended to help guide the physician and do not take the place of physician judgment.

General Use Information

Standard techniques for placement of arterial access sheaths, guiding catheters, angiographic catheters and wire guides should be employed during use of the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System. The Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System is compatible with .035 inch diameter wire guides.

Pre-Implant Determinants

Verify from pre-implant planning that the correct device has been selected. Determinants include:

1. Femoral artery selection for introduction of the main body system (i.e., define respective contralateral and ipsilateral iliac arteries).
2. Angulation of aortic neck, aneurysm and iliac arteries.
3. Quality of the aortic neck.
4. Diameters of infrarenal aortic neck and distal iliac arteries.
5. Distance from renal arteries to the aortic bifurcation.
6. Length from the aortic bifurcation to the internal iliac arteries/attachment site(s).
7. Aneurysm(s) extending into the iliac arteries may require special consideration in selecting a suitable graft/artery interface site.

Patient Preparation

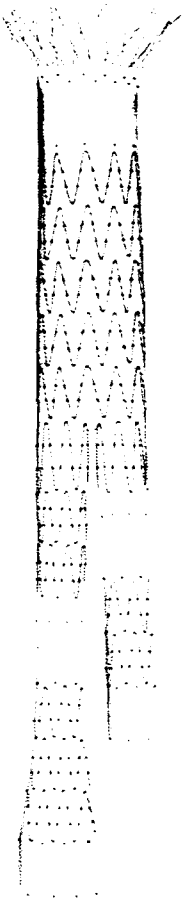
1. Refer to institutional protocols relating to anesthesia, anticoagulation and monitoring of vital signs.
2. Position patient on imaging table allowing fluoroscopic visualization from the aortic arch to the femoral bifurcations.
3. Expose both common femoral arteries using standard surgical technique.
4. Establish adequate proximal and distal vascular control of both femoral vessels.

Patient Guide

Treating your abdominal aortic aneurysm:

A patient's guide

Zenith® AAA Endovascular Graft



About this Booklet

This booklet has been provided as a courtesy from Cook Incorporated. This booklet will help you learn more about an **abdominal aortic aneurysm** (AAA). We hope this information will be helpful to you and your family.

For your convenience, a glossary of medical terms is included on pages 13-14. Words that are in **bold** throughout the text are defined in the glossary.

This booklet is only a guideline. It provides basic information about abdominal aortic aneurysms and their treatment with the Cook **Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System**. It is not intended to diagnose a medical condition. The treatment of abdominal aortic aneurysms may vary according to each individual's unique needs and doctor assessments. As with any surgery or medical procedure, the best source for information and advice is your doctor.

COOK®

Table of Contents

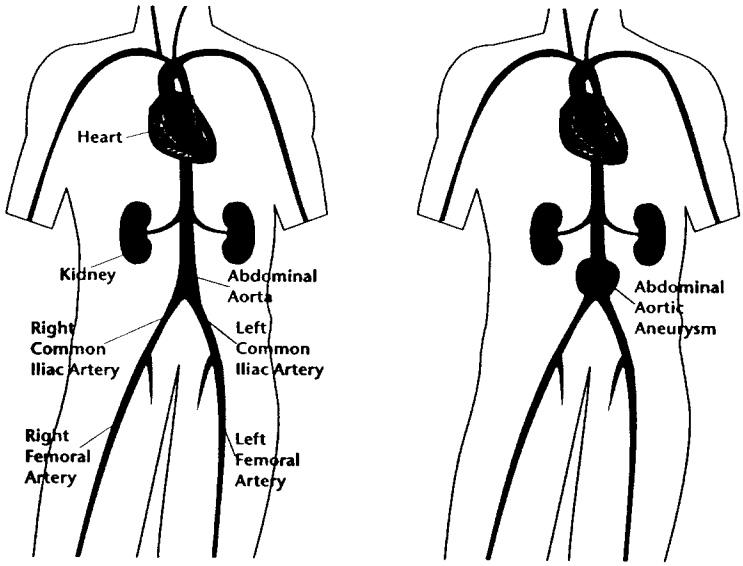
Introduction

What is an abdominal aortic aneurysm (AAA)?

The **aorta** is the main blood vessel that carries blood from the heart to the rest of the body. It extends from the chest to the abdomen, where it branches into the **iliac arteries**. The **iliac arteries** carry blood to lower parts of the body and to the legs. Sometimes with aging or other changes, a section of the **aorta** may weaken and begin to bulge.

This bulge can enlarge over time as the walls of the **aorta** become thinner and stretch (like a balloon). This bulge in the **aorta** is called an **aneurysm**.

Sometimes an **aneurysm** occurs in the part of the **aorta** that runs through the abdomen (the stomach). This is called an **abdominal aortic aneurysm** (AAA).



Is this a serious condition?

In its early stages, when an AAA is small, it may not pose an immediate health risk. However, your doctor will want to check its condition regularly.

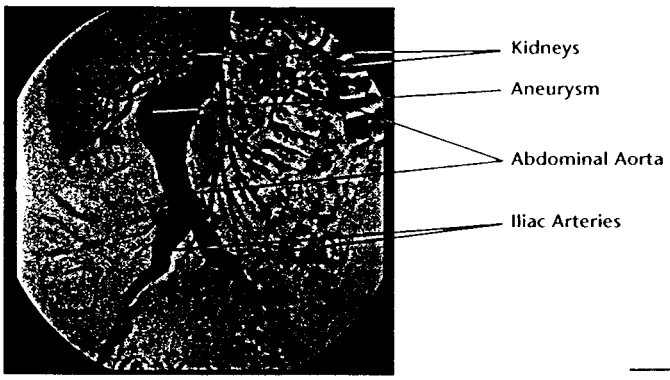
In later stages, if the AAA continues to grow, the aorta's walls can become thin and lose their ability to stretch. The weakened sections of the aortic wall may become unable to support the force of blood flow. Such an **aneurysm** could burst, causing serious internal bleeding.

What are some of the symptoms of an AAA?

Unfortunately, in most cases patients have no symptoms of an AAA. For people who do have symptoms, the most common one is pain. The pain can be in the abdomen, back, or chest. It could be anything from a mild pain to a severe pain or tenderness in the mid or upper abdomen or lower back. Some patients feel the **aneurysm** as a pulsating or throbbing mass in their abdomen. Many patients feel none of these symptoms, yet may still have an AAA.

An AAA is often discovered during an examination being done for other medical reasons. Your doctor may feel a bulge or pulsation (throbbing) in your abdomen. Most often, aneurysms are found during a medical test such as a **CT Scan** or **ultrasound**.

If you know you have an AAA and you develop back pain, abdominal pain or dizziness, call your doctor immediately.



77

What causes an AAA?

Over time, vascular disease, injury, or a hereditary defect of tissue within the arterial wall can cause a weakening of the **aorta**. Blood pressure against the weakened area can cause ballooning (enlarging and thinning) of the **aorta**.

Risk factors for developing an **aneurysm** include family history, smoking, heart disease, and high blood pressure. If you are at risk for developing an **aneurysm**, your doctor may recommend periodic checks. The checks could include a physical exam and possibly a **CT scan** or **ultrasound**.

Treatments of Abdominal Aortic Aneurysm

How do doctors treat an AAA?

When an **aneurysm** is small, your doctor may recommend periodic check-ups to monitor it. If an **aneurysm** is larger, or is rapidly growing, it has more risk of bursting. If your doctor thinks there is a risk the **aneurysm** may burst, he or she may recommend treatment. There are two types of treatment for AAA:

Open Surgical Repair
Endovascular Repair

The goal of all AAA repair is to prevent the **aorta** from bursting.

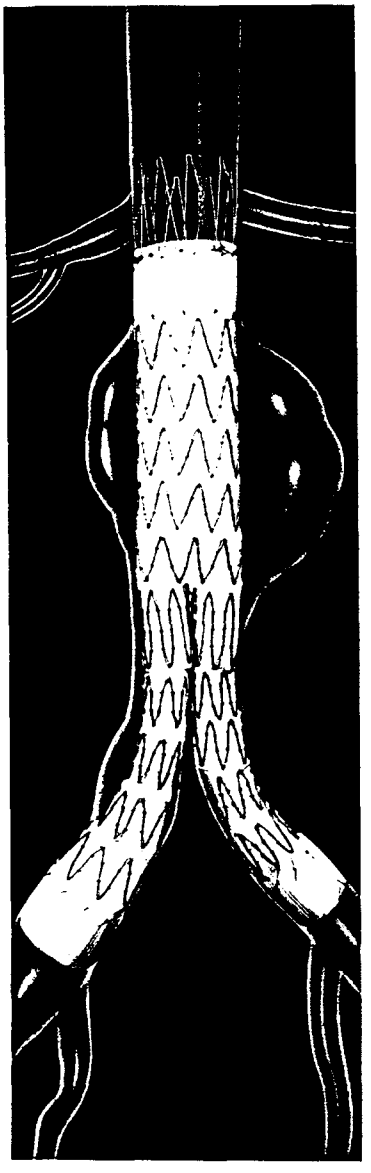
Important Note: Not every patient is a candidate for **endovascular repair**. **Open surgical repair** and **endovascular repair** both have advantages and disadvantages based upon each patient's condition and needs. Discuss the advantages and disadvantages with your doctor.

What is an open surgical repair?

In this approach, surgery is performed to repair the section of the **aorta** that has an **aneurysm**. To reach the **aneurysm**, a doctor makes a cut through the abdomen or the side of the patient. The doctor repairs the **aorta** by replacing the **aneurysm** section with a fabric tube called a "graft." The "graft" is sewn into place and acts as a replacement blood vessel. The blood flow through the **aorta** is stopped while the graft is put in place. The surgery takes about 2 to 4 hours to complete.

Open surgical repair is a proven medical procedure that works. However, it also has a long recovery period. Patients usually stay overnight in the intensive care unit, and stay another 5 to 9 days in the hospital. Many patients are unable to eat normally for 5 to 7 days after the surgery. The overall recovery period can last up to 3 months.

As with any medical procedure, **open surgical repair** has a risk of complications. Discuss these with your doctor.



What is an endovascular repair?

Endovascular Repair is relatively new. "**Endovascular**" means "inside or within a blood vessel." Instead of making a large incision in the abdomen, the doctor makes a small cut near each hip (near the crease between the abdomen and thigh) to get to the **femoral arteries** (blood vessels).

Through these small cuts, a graft (fabric tube) is inserted into the arteries and positioned inside the **aorta**. The **endovascular graft** seals off the **aneurysm**. The graft makes a new path through which the blood flows. The graft remains inside the **aorta** permanently. **Endovascular repair** typically takes 1 to 3 hours to complete.

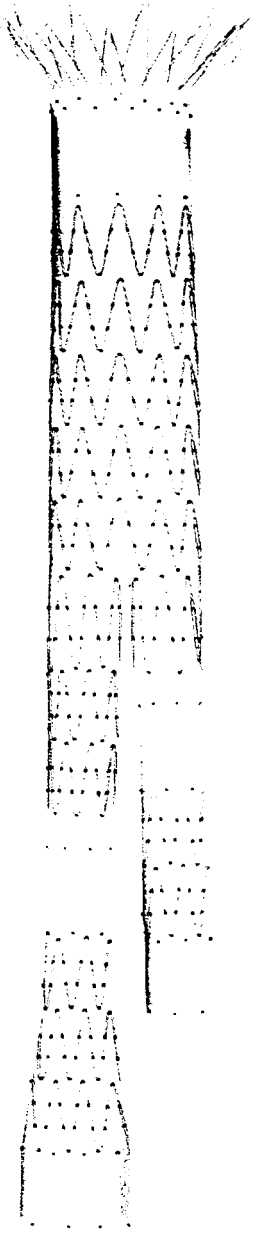
Because there are smaller cuts, **endovascular repair** may result in less discomfort, shorter hospital stay and faster recovery. Patients may have a hospital stay of only a few days. They can usually return to normal activity within 4 to 6 weeks after the procedure.

As with any medical procedure, **endovascular repair** has a risk of complications. **Endovascular repair** also requires routine follow-up visits with your doctor. Tests are done to evaluate the procedure and monitor success of the treatment. Refer to the follow-up section on page 11 for more information. There is also a possibility that additional treatment or surgery may be required after the initial **endovascular repair**.

What results have been seen with the Zenith® AAA Endovascular Graft?

A clinical study of 280 patients in the U.S. compared patients treated with the **Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System** to patients treated with **open surgical repair**. Patients treated with the **Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System** had fewer major problems during treatment and recovery. They lost less blood and were less likely to need a blood transfusion while in the hospital. They spent fewer days in intensive care. They were able to drink and eat sooner, and their bowel function returned to normal sooner. They were able to walk sooner, and were discharged from the hospital sooner. Patients answered questions about how they felt. Patients treated with the **Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System** had more energy, less pain, and felt better.

About the Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System



What is the Zenith® AAA Endovascular Graft?

The **Zenith® AAA Endovascular Graft** is made up of three parts: a "**main body**" and two "legs." The **main body** is positioned in the **aorta**. The legs are positioned in the **iliac arteries** and connect to the **main body**. The graft thus extends from the **aorta** below the **renal arteries** (kidneys) into both **iliac arteries**.

The graft itself is made of a polyester graft material like that used in **open surgical repair**. Standard surgical suture is used to sew the graft material to a frame of stainless steel **stents**. These self-expanding **stents** provide support. The graft has several gold markers to help your doctor see the device during placement. All of these materials have a long history of use in medical implants.

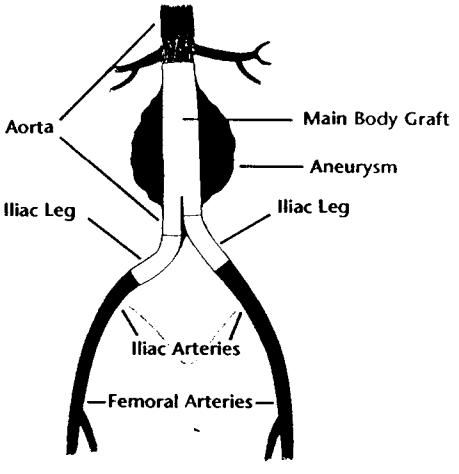
Thousands of patients worldwide have received a **Zenith® AAA Endovascular Graft**.

How is the graft implanted?

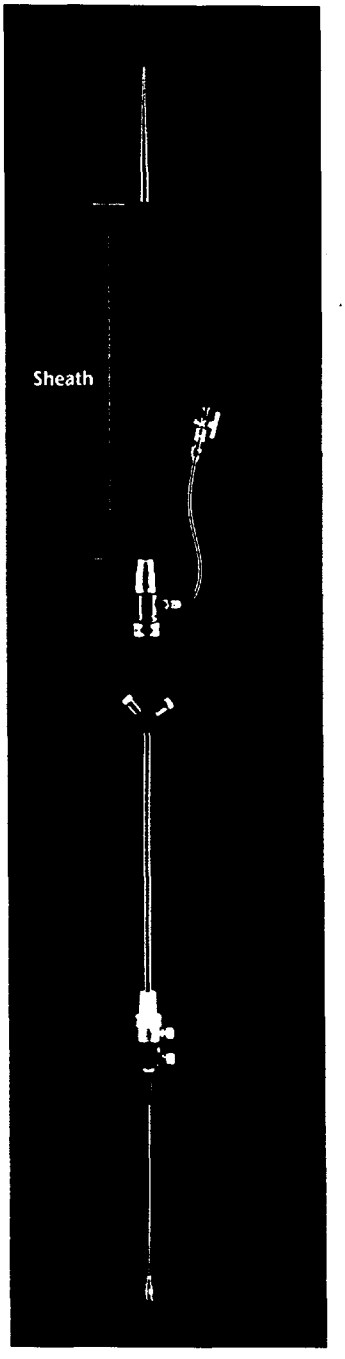
Before the procedure, your doctor looks at pictures of your **aorta** (**CT scan** and **angiography**). From these pictures, the doctor can choose the proper size for each part of the **Zenith® AAA Endovascular Graft** so that it will fit your blood vessels. During the procedure, the doctor uses X-rays to see the graft and position it correctly.

Before the graft is implanted, each of its three parts is contained in its own plastic tube (**sheath**) called the H&L-B One-Shot™ Introduction System. The plastic tubes are removed after the graft is put in place.

To place the graft, your doctor makes a small cut near each hip (near the crease between the abdomen and thigh) to get to the **femoral arteries** (blood vessels). Through these small cuts, each part of the graft is inserted separately into your bloodstream. The **main body** is positioned in the **aorta**. The legs extend from the **main body** into the **iliac arteries**. When each part of the graft is released from its tube, it opens up to fill and reinforce the blood vessels (**aorta, iliac arteries**). When both legs are connected to the **main body**, the graft "seals off" (excludes) the **aneurysm**.



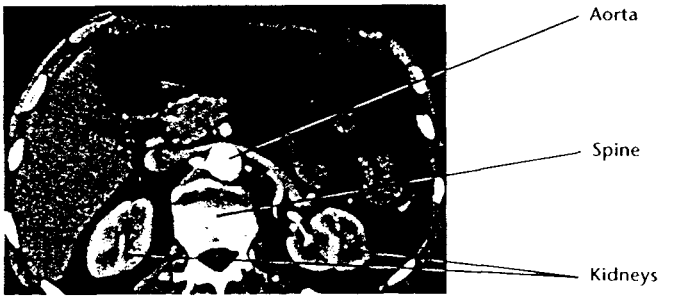
Before the procedure is finished, your doctor uses X-rays to confirm that the blood in the **aorta** flows through the graft, not through the **aneurysm**. Your doctor will then close up the cut in each leg with a few stitches.



After the Endovascular Procedure

Why is follow-up important?

If you receive a **Zenith® AAA Endovascular Graft**, it is very important that you have regularly scheduled follow-up appointments with your doctor because the long-term results of **endovascular repair** have not been established. It is possible for problems to occur that do not cause noticeable symptoms. Therefore, your doctor needs to look at pictures (X-ray, **CT scan**) of your **aneurysm** and graft on a regular basis. If a problem occurs, your doctor may recommend additional procedures.



Some problems that might occur are listed below:

- *Endoleak*
  An **endoleak** occurs when blood from the **aorta** continues to leak into the abdominal **aneurysm**. Most endoleaks do not require treatment. However, a small number require further treatment.

- *Graft movement*
  Because blood vessels can change over time with **aneurysm** disease, it is possible for a graft to shift position over time. Because graft movement cannot be felt, it is important to keep your routine follow-up visits with your doctor. Graft movement, if it occurs, can be seen with a **CT scan**.

- ***Aneurysm** growth or **rupture***

  Symptoms of **aneurysm** growth are not always present. When symptoms are present, the most common are:

  pain in the legs, back, chest, or abdomen,
  numbness in the legs, back, chest, or abdomen,
  weakness in the legs, back, chest, or abdomen.

  Symptoms of **aneurysm rupture** include:

  dizziness, fainting, rapid heartbeat, or sudden weakness.

- *Limb **occlusion***

  Symptoms of limb **occlusion** include:

  leg or hip pain during walking,
  leg discoloration, or
  leg coolness.

If you experience any of the symptoms listed above, call your doctor immediately.

What follow-up should I expect?

Recommended follow-up includes check-ups at:

- 1 month,
- 6 months,
- 12 months, and
- yearly thereafter.

Follow-up exams usually include routine blood tests, X-rays, a **CT scan**, and a physical exam.

These follow-up exams carry some minimal potential risk. However, the benefits of these tests clearly outweigh any potential risks. There is a rare risk of allergic reactions related to the **contrast** dye used in the **CT scan**. Talk with your doctor if you have any concerns regarding these exams. These exams should be considered a lifelong commitment to your health and well-being. They are necessary to evaluate your treatment and any changes over time. Your doctor may request additional evaluations based on findings at the follow-up visits.

What if I need magnetic resonance imaging (MRI)?

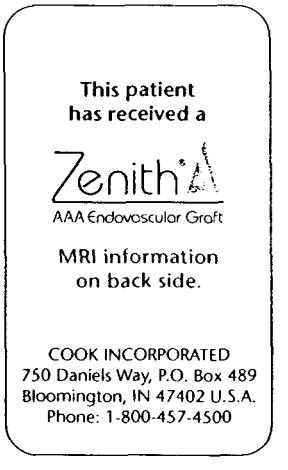
If you receive a **Zenith® AAA Endovascular Graft**, be sure to tell all of your health care providers that you have the graft. Show them your Patient I.D. Card. The card contains information related to MRI procedures for patients with this device. More information is available by referring to www.zenithstentgraft.com or by phoning our help line at 1-800-457-4500. Discuss potential risks and benefits of an MRI with your health care providers if you have any concerns about this diagnostic test.

What should I do with my Patient I.D. Card?

You will receive a **Zenith® AAA Endovascular Graft** Patient I.D. Card. The card provides valuable information concerning:

- Type of device implanted
- Date of implant
- Your doctors
- MRI information

Be sure to tell all of your health care providers that you have the graft and show them your Patient I.D. Card. You should keep your Patient I.D. Card available at all times.



86

Glossary

Abdominal Aortic Aneurysm (AAA) – a bulge that occurs in the part of the aorta that passes through the abdomen (stomach area). The bulge (enlarging and thinning) of the aorta is due to a weakening in the arterial wall.

Aorta – the main artery that carries blood from the heart to the rest of the body except the lungs.

Aneurysm – a bulge or "ballooning" (enlarging and thinning) of a weakened area of a blood vessel.

Angiography/Angiogram – an X-ray method that uses contrast (dye) injected into the bloodstream to see blood flow through blood vessels. This type of image is called an "angiogram."

Contrast (dye) – a liquid dye injected into the bloodstream to show blood vessels under X-ray or CT scan.

CT Scan – a series of computerized X-rays that form a picture of your aneurysm. Also known as a "CAT scan."

Endoleak – blood flow into the abdominal aortic aneurysm after placement of an endovascular graft.

Endovascular – inside or within a blood vessel.

Endovascular Graft – a graft placed inside a diseased vessel without the use of open surgical techniques. The graft makes a new path through which the blood flows.

Endovascular Repair – placement of an endovascular graft to seal off (exclude) an aneurysm. Instead of making a large incision in the abdomen, the doctor makes a small cut near each hip (near the crease between the abdomen and thigh) to get to the femoral arteries (blood vessels). Through these small cuts, a graft (fabric tube) is inserted through the femoral arteries. The graft makes a new path through which the blood flows.

Femoral Arteries – two blood vessels (one in each leg) that carry blood to the thigh region of each leg. Doctors can use the femoral arteries as a path to reach the iliac arteries and the aorta.

Iliac Arteries – the two large blood vessels that connect the lower end of the aorta to the femoral arteries in each leg.

Iliac Leg(s) – the parts of the graft that extend from the main body (in the aorta) to the iliac arteries.

Main Body – the part of the graft that is placed in the aorta.

MRI (Magnetic Resonance Imaging) – a way of creating detailed pictures of the body. The MRI scanner uses magnetic fields and radio waves to create the pictures.

Occlusion – blockage of a blood vessel.

Open Surgical Repair – a type of surgery performed to repair an aneurysm. To reach the aneurysm, a doctor makes a cut through the abdomen or the side of the patient. The doctor repairs the aorta by replacing the aneurysm section with a fabric tube called a "graft." The "graft" is sewn into place and acts as a replacement blood vessel.

Renal Arteries – two blood vessels attached to the aorta that carry blood to the kidneys.

Rupture – a tear in the blood vessel wall that causes serious internal bleeding.

Sheath – a long plastic tube that contains the Zenith® AAA Endovascular Graft. The sheath is advanced inside the blood vessel to the aneurysm site, and the graft is positioned in place.

Stents – metal parts of the endovascular graft that provide support and hold it in place.

Ultrasound – a way to create pictures of parts of the body using high frequency sound waves.

Zenith® AAA Endovascular Graft with the H&L-B One-Shot™ Introduction System – A device placed within an aneurysm to "seal off" the aneurysm. The graft is made of polyester graft material like that used in open surgical repair. Standard surgical suture is used to sew the graft material to a frame of stainless steel stents. These self-expanding stents provide support. The graft has three parts: a "main body" and two "legs." The main body is positioned in the aorta. The legs are positioned in the iliac arteries and connect to the main body. The graft thus extends from the aorta below the renal arteries (kidneys) into both iliac arteries. The Zenith® AAA Endovascular Graft is placed within the aneurysm using the H&L-B One-Shot™ Introduction System.

Where can I find more information?

Aneurysms

Background information on Abdominal Aortic Aneurysms

Vascular Web Patient Information www.vascularweb.org

VascularWeb is a World Wide Web (WWW) based global resource of information and services for individuals interested in improving vascular health worldwide. VascularWeb is sponsored and owned by the American Association for Vascular Surgery (AAVS) and the Society for Vascular Surgery (SVS), both non-profit organizations, and is governed by a Board of Directors and managed by an Editorial Board.

Interventional Therapy

Society of Interventional Radiology www.sirweb.org

The Society of Interventional Radiology (SIR) is a professional society for physicians who specialize in interventional or minimally-invasive procedures. SIR is a non-profit, national scientific organization deeply committed to its mission to improve health and quality of life through the practice of cardiovascular and interventional radiology.

U.S. National Library of Medicine www.medlineplus.gov

The National Library of Medicine (NLM) on the campus of the National Institutes of Health in Bethesda, Maryland is the world's largest medical library. The library collects materials in all areas of biomedicine and health care, as well as works on biomedical aspects of technology, the humanities, and the physical, life, and social sciences.

Product Information

Cook Incorporated www.zenithstentgraft.com

With international headquarters in Bloomington, Indiana, privately held Cook (www.cookgroup.com) is a leading designer, manufacturer and global distributor of minimally invasive medical device technologies for diagnostic and therapeutic procedures. Since its founding in 1963, Cook has created innovative technologies for stents and stent-grafts, catheters, wire guides, introducer needles and sheaths, embolization coils, medical biomaterials, vena cava filters, implanted cardiac lead extraction equipment and other minimally invasive medical devices.

U.S. Department of Health and Human Services
Food and Drug Administration www.fda.gov

A U.S. government agency intended to promote and protect the public health by helping safe and effective products reach the market in a timely way, and monitoring products for continued safety after they are in use.

Notes

If you have any questions about your abdominal aortic aneurysm or treatment, we encourage you to talk to your doctor. He or she should always be your primary source of information. Talk to your doctor about the details of this procedure and its impact on your health.

Use the space below to record your doctor's name and phone number. You may also want to write down any questions, take notes, or keep a record of your discussions with your doctor.

Patient name: _____

Date of graft placement: _____

Doctor name: _____

Hospital: _____

Doctor phone #: _____

[redacted]

COOK®

www.zenithstentgraft.com

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Phone: 812 339-2235, Toll Free: 800 457-4500
Toll Free FAX: 800 554-8335

Patient Guide

Treating your abdominal aortic aneurysm:

A patient's guide

Zenith®

AAA Endovascular Graft