ABDOMINAL AORTIC ANEURYSM

The Diagnosis and Non-Surgical Treatment Options

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INTRODUCTION

The aorta is the main blood vessel that carries oxygen-filled blood from the heart to the rest of the body. It extends from the chest to the abdomen, where it branches (bifurcates) 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 abdominal aortic aneurysm (AAA). (Fig 1)

An aneurysm is a bulge or balloon that forms in the wall of a blood vessel. An aneurysm is most commonly a result of an accumulation of fatty deposits on the vessel wall, but may also relate to heredity, trauma or other disease states that weakens the vessel wall. Although an aneurysm can occur in any artery of the body, it is most common in the abdominal aorta and the iliac arteries.

While the aorta’s diameter normally ranges from 2 -3 cm (1 ½ inches), an aneurysm can cause it to grow to several times its normal size. Over time, if the AAA continues to grow, the aorta’s wall can become thin and lose its 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 or even send blood clots down the legs to the feet.
Unfortunately, in most cases, patients have no signs or symptoms of an AAA. During your routine physician examination I may notice or feel a throbbing tender mass in the middle or lower part of your abdomen. If there are symptoms, the pain can be in the abdomen, back or chest. Some patients feel the aneurysm as a pulsating or throbbing mass in their abdomen.

Although an AAA can be discovered during a routine physical examination being done by your physician, most often, however, an aneurysm is found during a medical test such as a CT scan or ultrasound. (CT scan: Fig 2)

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, I may recommend periodic checks which could include a physical exam and possibly a CT scan or ultrasound.

TREATMENT OF ABDOMINAL AORTIC ANEURYSM

When an aneurysm is small, I recommend periodic checkups to monitor it. If an aneurysm is larger, or is rapidly growing, it has more risk of bursting or even be the cause of blood clots in the legs! There are two types of interventional treatment for AAA:

- Open Surgical Repair
- Endovascular Repair
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. (3D reconstruction of AAA: Fig 3)

WHAT IS AN OPEN SURGICAL PROCEDURE?

In this approach, surgery is performed to repair the section of the aorta that has an aneurysm. To reach the aneurysm, the surgeon makes a cut through the abdomen or the side of the patient. He repairs the aorta by replacing the aneurysm section with a fabric tube called a “graft” which 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 surgical procedure is performed under general anesthesia and takes about three to four hours to complete. (Surgical Anatomy: Fig 4)
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 10 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 procedure, open surgical repair has a risk of complications. (Ruptured AAA: Fig 5)
WHAT IS AN ENDOVASCULAR REPAIR (EVAR)?

“Endovascular” means “inside or within a blood vessel”. I will implant this graft which has a covered material so as to prevent blood from leaking into the aneurysm once it is properly placed in the body. I will gain access to the large aorta (site of the AAA) via means of using both groin arteries (Femoral arteries) with a percutaneous technique.

This involves entering the anesthetized femoral arteries with a needle. A small surgical incision in this area is made by me to allow safe passage of the STENT-GRAFT into its place. Local Novocain is used in almost every EVAR. General anesthesia will only be used in extremely unusual circumstances. Thus no respirator or Tube in the windpipe is necessary! The repair of these arteries is done by surgical closure of these holes by me with pristine antimicrobial sutures and solutions. In the rare event that the arterial access sites do not close adequately, a standby surgeon who is picked by me for your specific care will then suture these holes closed.

Before the procedure I will look at pictures of your aorta (CT scan and angiography). From these pictures, I can choose the appropriate type graft as well as the correct size for each part of the AAA Endovascular Graft so that it will fit your blood vessels. (Actual CT scan of an AAAA: Fig 6)

Using fluoroscopy (X-rays) for visual guidance, the delivery catheter is advanced through the large vessel in your thigh (iliac vessel) to the aneurysm site in your abdomen.
A stent-graft (fabric tube) is inserted into the arteries and positioned inside the aorta which seals off the aneurysm from the circulation. The graft makes a new path through which the blood flows. (STENT-GRAFT in EVAR: Fig 7) 8

After expansion of the stent graft, the delivery catheter is withdrawn and removed, leaving the stent graft within the vessel. Depending on the shape and size of your aneurysm, additional stent grafts may be placed to ensure that the aneurysm is completely excluded. X-rays and/or intravascular ultrasound imaging procedures are performed to allow me to verify that the stent graft is properly placed within the aneurysm. (STENT-GRAFT in EVAR: Fig 8)
The endovascular graft remains inside the aorta permanently through the use of metal prongs, or anchors as well and/or a tight fit (radial force) against the wall of the aorta. (STENT-GRAFT in EVAR: Fig 9)

Before the procedure is finished, I will use x-rays to confirm that the blood in the aorta flows through the graft, not through the aneurysm. I will then close up the area in each leg with a few stitches (Fig 10).

In 1 % of the cases, it will be necessary to have a surgeon perform this part of the procedure if the holes do not close with the percutaneous technique. There will always be a surgeon as stand by assigned to your particular case.

Endovascular repair typically takes ~3 hours to complete. This will result in less discomfort, a shorter hospital stay and faster recovery as compared to the open surgical technique. Patients will typically have a hospital stay of only one or less likely two nights!
They can usually return to normal activity within 1-2 weeks after the procedure. Patients will lose less blood and are less likely to need a blood transfusion while in the hospital. They are able to drink and eat sooner whereas their bowel function returned to normal sooner. They are able to walk sooner, and be discharged from the hospital sooner.

**Endovascular repair** also will require:

- **Routine CT scan or MRA at predetermined intervals**
- **Routine visits with me or your local physician.** In ~ 1-3% of patients, there is also a possibility that additional treatment or surgery may be required after the initial endovascular repair. This can occur if the body creates new blood vessels that continue to feed the original AAA so called **ENDOLEAK.** Though there are various forms of Endoleak, these are only treated if the aneurysm appears to be enlarging over time.

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**AM I A GOOD CANDIDATE FOR THIS PROCEDURE?**

Requirements should include:

- Be 18 years of age or older.
- Not be pregnant.
- Be sufficiently healthy to undergo a 2-4 hour implantation procedure.
- Be available to attend regularly scheduled office visits with me or your local physician following the procedure, including radiographic imaging studies to evaluate the status of the graft and aneurysm. Imaging studies may be required as often as every three months or as infrequently as every 12 months, depending on the status of your aneurysm and graft for up to 5 years after implantation.
Patients having very large aneurysms and/or aneurysms or vessels that are much more angled may not be good candidates for Endovascular treatment.

(STENT-GRAFT in EVAR: Fig 11) (Very Tortuous neck of an AAA: Fig 12)
WHAT GRAFTS ARE AVAILABLE

COOK ZENITH STENT-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. (Zenith stent-graft: Fig 13).

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 marks to help me see the device during placement. All of these materials have a long history of use in medical implants.
**MEDTRONIC ENDURANT STENT-GRAFT**

The Endurant Endovascular Graft is made up of two parts: a “**main body with one leg attached**” and a contralateral leg segment. The stent graft, which is woven polyester tub (graft) is covered by a tubular metal web (stent) and is sewn together at many points.

The **main body with leg attachment** is positioned in the **aorta**. The contralateral extension is positioned in the **iliac artery**. There is a fixed section where the graft attaches above the kidney arteries to prevent the graft from moving (migration). The graft thus extends from the aorta below the **renal arteries** (kidneys) into both **iliac arteries**. (Medtronic Endurant stent-graft: Fig 14).
**GORE EXCLUDER STENT-GRAFT**

The endovascular graft is a 2-piece, bifurcated graft that lines the aorta and extends from below the renal (kidneys) arteries into both iliac arteries. It is made up of an ePTFE (expanded polytetrafluoroethylene) covering with an outer metallic support structure known as a stent.

The main body with leg attachment is positioned in the aorta. The contralateral extension is positioned in the iliac artery. The graft thus extends from the aorta below the renal arteries (kidneys) into both iliac arteries (Gore Excluder stent-graft Fig 15).
The graft itself is made of an ePTFE (expanded polytetrafluoroethylene) over a Nitinol framework skeleton. It is unique in that it has a Unibody-Bifurcated design for delivery from the main side with a large introducer and from the opposite leg with a very small introducing sheath. (Endologix stent-graft Fig 16).
TRIVASCULAR OVATION STENT-GRAFT

At 14F OD, the Ovation Prime Abdominal Stent Graft System is the lowest profile AAA endograft system, offering enhanced deliverability — even through narrow and tortuous anatomies. It has a tri-modular design with suprarenal stent fixation. The size has been decreased to use without a sheath for insertion.

Upon deployment, integrated polymer-filled sealing rings are expanded to exactly conform and seal to the patient’s unique anatomy, excluding the aneurysm.

(Trivascular stent-graft Fig 17).
AFTER THE ENDOVASCULAR PROCEDURE

Immediately afterwards, I may require you to lay flat for two to six hours to allow the leg wounds to begin healing. Patients have reported feeling discomfort for the first few days following the procedure in the groin areas as the anesthetic wears off. You may experience side effects such as swelling of the upper thigh, numbness of the legs, nausea, vomiting, leg pain or throbbing, malaise, lack of appetite, fever. You will be given appropriate medications to take home which will include antibiotics.

WHY FOLLOW-UP IS EXTREMELY IMPORTANT

It is possible for problems to occur that do not cause noticeable symptoms. Therefore, I need to look at pictures (x-rays, CT scan) of your aneurysm and graft on a regular basis. Though extremely rare, if a problem occurs, I may need to recommend additional procedures.

Some problems that might occur are listed below: Fig 18

- **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 (Migration)**
  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 me. Graft movement, if it occurs, can be seen with a CT scan.

- **Aneurysm growth or rupture**
  Symptoms of aneurysm growth are not always present. Symptoms may include pain, numbness or weakness in the legs.

- **Limb (leg artery) Occlusion**
  Symptoms of this invariably include leg or hip pain during walking, leg discoloration, or leg coolness.
Recommended follow-up may include check-ups or X-Ray testing at:
- 1-3 months,
- 6-12 months
- Yearly thereafter.

There is a rare risk of allergic reactions related to the contrast dye used in the CT scan. Talk with me if you have any concerns regarding these exams.

These exams should be considered a long-long commitment to your health and well-being. They are necessary to evaluate your treatment and any changes over time. I may request additional evaluations based on findings at the follow-up visit.

**PRECAUTIONS:**

- Aneurysm rupture in patients implanted with any of the Stent Graft Systems has occurred.
- Perforation and/or dissection of the vasculature are an inherent risk of any catheter-based procedure. These risks may be increased with the use of large-sized catheters such as the delivery catheter or introducer sheath.
- The results of the clinical studies indicate that women treated with these devices may have a higher morbidity or mortality rate as compared to their male counterparts due to the smaller nature of their native blood vessels.
- It is important to attend each follow-up evaluation visit because the information from these visits enables me to monitor the aneurysm and to determine whether additional treatment is advisable. If the follow-up recommendation is not followed, it is possible that I may not be adequately informed about your physical condition.

**THE DEVICE IMPLANTATION CARD**

You will receive an 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 stent and show them your Patient I.D. Card. *You should keep your Patient I.D. Card available at all times.*
WHEN TO CALL THE OFFICE
If you experience any of the following symptoms, contact my office immediately:
- Pain, numbness, coldness or weakness in your legs or buttocks
- Any unusual and persistent back, chest, abdominal or groin pain
- Dizziness, fainting, rapid heartbeat or sudden weakness

You should also call my office if you are required to reschedule your follow-up visit for any reason.

The risks and benefits of the endovascular graft and procedure which you may want to discuss with me include:
- Risks and differences between endovascular repair and open surgical repair
- Potential advantages of traditional open surgical repair.
- Potential advantages of endovascular repair.
- The possibility that additional endovascular treatment or surgery may be required after initial endovascular repair.

In addition to the risks and benefits of an endovascular repair, you should consider your commitment and compliance to postoperative follow-up as a necessary step to ensure continuing safe and effective long term results.