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# The Visualization of Abdominal Aortic Aneurysms with the Aid of Computed Tomography

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## What are Abdominal Aortic Aneurysms? (AAA)

- The aorta is the largest blood vessel within the human body that extends from the thoracic to the abdominopelvic region.
- A normal sized aorta ranges from 2 to 3 cm.
- An abdominal aortic aneurysm is an enlarged bulge or swelling within the descending aorta; characteristically impacting males over the age of 65.
- An AAA can range in size between 4 cm to 8 cm. AAAs greater than 8 cm have the lowest chances for survival.
- If an AAA is not detected early and continues to grow, the risk for rupture increases.

(Karsy, Abou-Al-Shaar, & Guan, 2020)



Fig. 1 Coronal view of an AAA

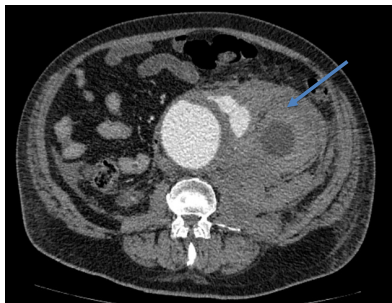


Fig. 2 Axial view of a ruptured AAA

## Causes of Abdominal Aortic Aneurysms (AAAs)

- Atherosclerosis: Hardening of the arteries
- Blood vessel diseases
- Hypertension: High blood pressure
- Infection within the aorta
- Trauma
- Family history of AAAs

(Mayo Clinic, 2022)

## Symptoms of Abdominal Aortic Aneurysms

- Back pain
- Pulsing sensation in or near the navel
- Abdominal pain
- Some cases of an AAA do not present symptoms

(Johns Hopkins Medicine, 2022)

## Complications of an Abdominal Aortic Aneurysm

- Rupture:** An eruption of an AAA that causes internal bleeding into the rest of the body. Specifically, into the abdominopelvic region which can be life-threatening.
- Aortic dissection:** A tear in the inner layer of the aortic wall. Most seen in the thoracic region, however, can occur within the abdominal region as well.
- Blood clots:** AAA's increase the chances of accumulation of blood clots surrounding the aneurysm. A breakage of a blood clot can potentially block the blood vessel. This can cause pain or blockages to other aspects of the body including the kidneys, legs, and other abdominal organs.

(Johns Hopkins Medicine, 2022) & (Mayo Clinic, 2022)

AAA size (cm)	Risk of rupture (%)
4-4.9	1-5
5-5.9	5-10
6-6.9	10-20
7-7.9	20-40
>8	30-50

Fig. 3 Data chart of AAA size in correlation to risk for rupture

## CT Angiography (CTA)

- CTA is performed in order to visualize and evaluate the blood vessels within the human body.
- The procedure uses contrast media which is injected intravenously to "highlight" blood vessels and tissues.
- CTA can be performed on multiple anatomical structures including the brain, neck, heart, chest, abdomen, pelvis, upper and lower extremities.
- CTA can be used for surgical planning which can evaluate location, size, and position in cases with aneurysm.
- Areas of interest that are best demonstrated include iliac arteries, lumbar vessels, aortic bifurcation, patency of arteries, descending aorta, and renal arteries.

(Karsy, Abou-Al-Shaar, & Guan, 2020) & (Radiological Society of North Americans, Inc., 2022)

## Case Study

- Age:** 74 years old
- Gender:** Female
- History:** Patient has had minor aneurysms. No information regarding family history.
- Symptoms:** Patient presented to the emergency room after falling due to dizziness. Patient's abdomen was distended and had severe abdominal pain.
- Diagnosis:** The patient was diagnosed with an abdominal aortic aneurysm measuring 13.7 cm.
- Outcome:** The aneurysm did rupture (seen in Fig. 3) and hemorrhage into the patient's abdomen resulting in fatality. (Geisinger Community Medical Center, 2022)



Fig. 4 Sagittal view of the case study demonstrates an AAA



Fig. 5 3-Dimension reconstruction of the case study

## Procedure: Endovascular Aneurysm Repair (EVAR)

- Highly preferred method for aneurysm repair; dependent on the results of CTA and patient's anatomy.
- The procedure obtains access through the femoral arteries and insertion of stent grafts over guidewires into the aorta at the site of the aneurysm in order to prevent possible rupture.
- EVAR is done under fluoroscopic guidance and may involve the use of contrast media.
- Post-operative CT scans are conducted in order to assess stent effectiveness. (Karsy, Abou-Al-Shaar, & Guan, 2020) & (Alberga, et al., 2022)

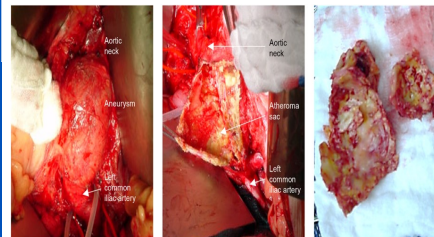


Fig. 6 Photographs demonstrating an AAA with thrombus and atheroma within the aneurysm

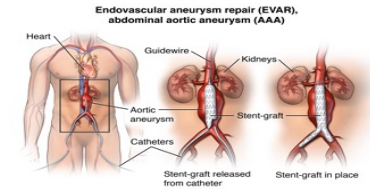


Fig. 7 Diagram shows EVAR repair on an AAA

## Advantages & Disadvantages

### Advantages

- EVAR is one of the least invasive vascular procedure options when treating AAAs.
- CT angiography scans are non-invasive and provide adequate visualization of blood vessels.
- CT scans provide extensive diagnostic information that can help aid in surgical planning, 3D reconstruction, and is faster compared to other modalities of medical imaging.
- CT scans can be vital in trauma situations especially for cases of AAA with high chances for rupture or post-rupture.
- EVAR has a lower perioperative mortality compared to open AAA Repair. (1.2 vs. 4.8%)

(Karsy, Abou-Al-Shaar, & Guan, 2020)

### Disadvantages

- EVAR have higher risks for late rupture. They have a 15% risk for leakage.
- EVAR leaks include proximal aortic leakage, back bleeding from inferior mesenteric arteries, and failure of the graft to remain separated.
- CT scans implement high doses of radiation.
- The iodinated contrast media used for CTAs could trigger a severe allergic reaction such as anaphylaxis. Additionally, contrast-induced nephrotoxicity can occur in those with renal dysfunction.

(Karsy, Abou-Al-Shaar, & Guan, 2020)

### Conclusion

CT angiography provides physicians visualization of the blood vessels including the aorta for cases of abdominal aortic aneurysms. CT in trauma situations is extremely reliable as it produces qualitative, diagnostic scans in a short period of time. Although there are risks associated to high radiation dosage and contrast reactions, the benefits outweigh the risks with CT angiography. Abdominal aortic aneurysms can be life-threatening if rupture were to occur, but with CT angiography, the increase for rupture is significantly decreased which could save a patient's life.