



# Imaging of Acute Aortic Syndrome (AAS)

SHORT ABSTRACT

PIET VANHOENACKER 

 ubiquity press

## DEFINITION

Acute aortic syndrome (AAS) is a term that encompasses a range of life-threatening aortic disorders, with similar presenting symptoms and requiring prompt diagnosis and treatment. AAS primarily includes:

1. Aortic dissection: This is the most common and best-known condition under the AAS umbrella. It involves a tear in the inner layer of the aorta, allowing blood to flow between the layers, forcing them apart. Based on the location, aortic dissections are further subdivided as:
  - \* Type A: involves the ascending aorta (and potentially the descending aorta). This type requires surgical treatment as it's more dangerous.
  - \* Type B: involves only the descending aorta. Depending on the characteristics, it might be managed with medications or interventions.

The Society of Thoracic Surgeons (STS) and the Society for Vascular Surgery (SVS) have developed a classification system for aortic dissections that builds upon the more commonly referenced Stanford (Type A and Type B) and DeBakey (Type I, II, and III) systems.

The STS/SVS classification system provides a more granular approach, taking into account more specific anatomical details, which may serve in guiding therapeutic decisions. The goal of this classification is to improve the clarity of communication among clinicians and guide therapeutic management more effectively.

2. Intramural hematoma (IMH): This condition is characterized by bleeding within the wall of the aorta without an intimal tear. The outcome and treatment might be similar to that of aortic dissection. IMH can progress to an overt aortic dissection or may resolve spontaneously.
3. Penetrating atherosclerotic ulcer (PAU): This involves an ulcer-like lesion penetrating the internal elastic lamina of the aorta. It is caused by atherosclerosis.

## DIAGNOSIS

Computed tomography (CT), especially CT-angiography (CTA), is the primary diagnostic modality for aortic dissection due to its wide availability, rapid image acquisition and multiplanar display, and high sensitivity and specificity.

### CORRESPONDING AUTHOR:

**Piet Vanhoenacker**

University Hospital Gent, BE

[piet@vanhoenacker.be](mailto:piet@vanhoenacker.be)

### KEYWORDS:

Aortic Dissection; Intramural Hematoma; Penetrating Atherosclerotic Ulcer

### TO CITE THIS ARTICLE:

Vanhoenacker P. Imaging of Acute Aortic Syndrome (AAS). *Journal of the Belgian Society of Radiology*. 2023; 107(1): 95, 1–3. DOI: <https://doi.org/10.5334/jbsr.3362>

A non-enhanced series may already be diagnostic. A reliable and specific sign in acute aortic dissection is the high attenuation crescent representing acute hemorrhage into the wall of the aorta and appears as an area of increased attenuation.

Contrast-enhanced ECG-triggered or ECG-gated CT contributes to synchronize the acquisition of images with specific phases of the cardiac cycle.

One of the main reasons for using ECG-triggered CT in imaging the aorta is to reduce motion artifacts, especially in the ascending aorta. Motion artifacts might obscure or mimic aortic pathology, potentially leading to misdiagnosis or non-diagnosis of conditions like aortic dissection.

CT signs of aortic dissection:

1. **Intimal Flap:** This is the most characteristic and definitive sign. It appears as a linear structure within the aortic lumen separating the true and false lumens.
2. **Differential Aortic Enhancement:** The true lumen typically enhances more than the false lumen, although this can be variable. Sometimes, the false lumen may appear thrombosed (not enhancing) due to stagnant flow.
3. **Differential Lumen Size:** The false lumen is typically larger than the true lumen, but this can also vary.
4. **“Beak” Sign:** A sharp acute angle formed at the site of origin of the dissection, often seen at the edges of the false lumen.
5. **“Cobweb” Sign:** Represents thin, linear structures in the false lumen caused by dissected media.
6. **Pleural Effusion:** Especially on the left side, which might suggest aortic rupture or leakage.
7. **Pericardial Effusion:** Indicates involvement of the pericardial sac, which might be a sign of an impending cardiac tamponade if the ascending aorta or aortic root is involved.
8. **Mediastinal Hematoma:** Indicates blood outside the aorta but within the mediastinal space.
9. **Expansion of the Aorta:** An increased aortic diameter compared to prior imaging or standard reference values can be a hint, especially in the absence of a clear intimal flap.
10. **Calcium Sign:** In patients with atherosclerosis, the intimal calcium might be seen displaced from the outer wall of the aorta, indicating the presence of an intimal flap.
11. **Branch Vessel Involvement:** Delayed or absent contrast enhancement in a branch of the aorta (like

the renal arteries) due to dynamic obstruction by the intimal flap.

12. **Signs of End-Organ Malperfusion:** Infarcts or lack of perfusion in organs (e.g., kidneys, spinal cord, brain) due to decreased blood flow from the dissection.
13. **Intramural Hematoma:** Represents hemorrhage within the aortic wall without a discernible intimal flap. It appears as a region of high attenuation (brightness) within the aortic wall.

## TREATMENT

Nowadays aortic dissections are treated with TEVAR (Thoracic EndoVascular Aortic Repair) or hybrid procedures. A hybrid aortic procedure combines elements of traditional open surgical repair with endovascular techniques. These procedures are typically utilized in situations where standard endovascular or open surgical approaches are not feasible or carry high risks. Hybrid procedures often arise from the challenges posed by complex anatomical situations, especially in the aortic arch or the thoracoabdominal aorta. Endovascular treatment of aortic arch pathologies can be challenging due to the presence of vital branch vessels (e.g., brachiocephalic trunk, left common carotid artery, and left subclavian artery). A hybrid thoracic approach might involve debranching of the aortic arch vessels followed by TEVAR. This may include bypassing the supra-aortic vessels to the carotid or axillary arteries or transpositioning them to create a landing zone for the stent-graft.


In summary, contrast-enhanced CT is generally the preferred technique for the assessment of acute aortic syndrome. Pitfalls and pearls are presented.

TEVAR has revolutionized the management of thoracic aortic pathologies by offering a less invasive alternative to traditional open surgery. Proper patient selection, meticulous procedural technique, and regular postoperative follow-up are crucial to ensure optimal outcomes, all being achieved by dedicated CT.

## COMPETING INTERESTS

The author has no competing interests to declare.

## AUTHOR AFFILIATIONS

**Piet Vanhoenacker**  [orcid.org/0000-0002-1913-2092](https://orcid.org/0000-0002-1913-2092)  
University Hospital Gent, BE

---

**TO CITE THIS ARTICLE:**

Vanhoenacker P. Imaging of Acute Aortic Syndrome (AAS). *Journal of the Belgian Society of Radiology*. 2023; 107(1): 95, 1–3. DOI: <https://doi.org/10.5334/jbsr.3362>

**Submitted:** 12 September 2023    **Accepted:** 14 September 2023    **Published:** 08 December 2023

**COPYRIGHT:**

© 2023 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

*Journal of the Belgian Society of Radiology* is a peer-reviewed open access journal published by Ubiquity Press.