

# Aortic Structure and Classification

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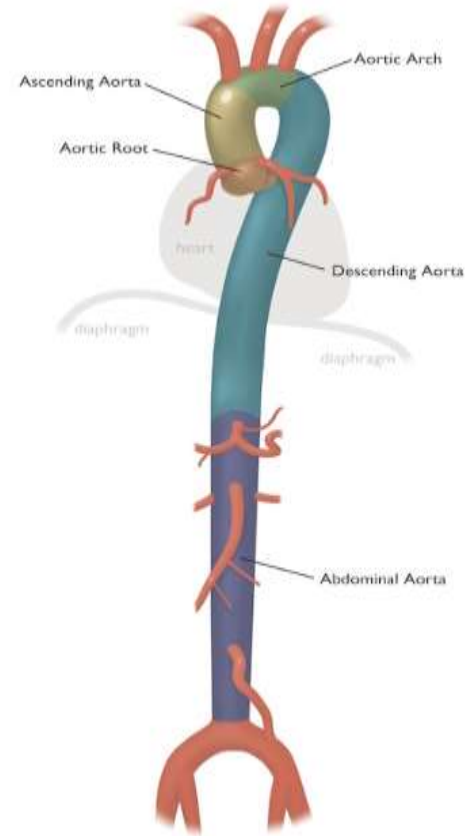
 **UTHealth Houston**  
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6th Annual  
**Houston Aortic Nursing Symposium**  
March 20, 2024 • 12:00 - 5:00 PM

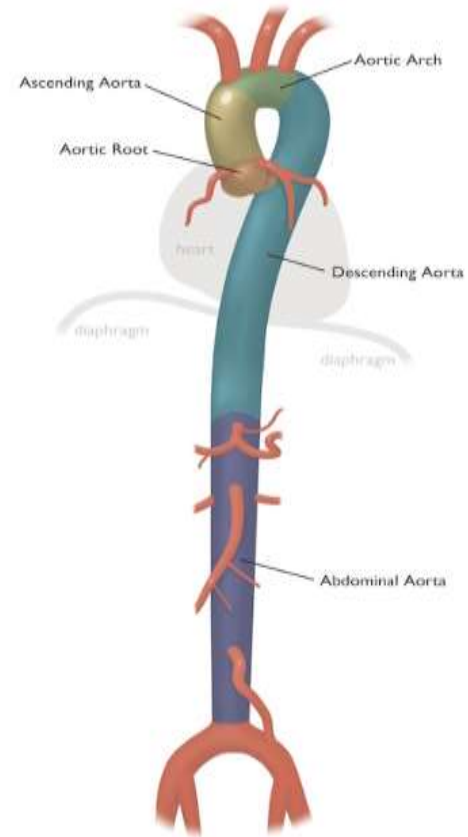
# Anatomy of the Aorta

**Aorta:** the main and largest artery in the body. The aorta carries oxygen rich blood to all parts of the body.



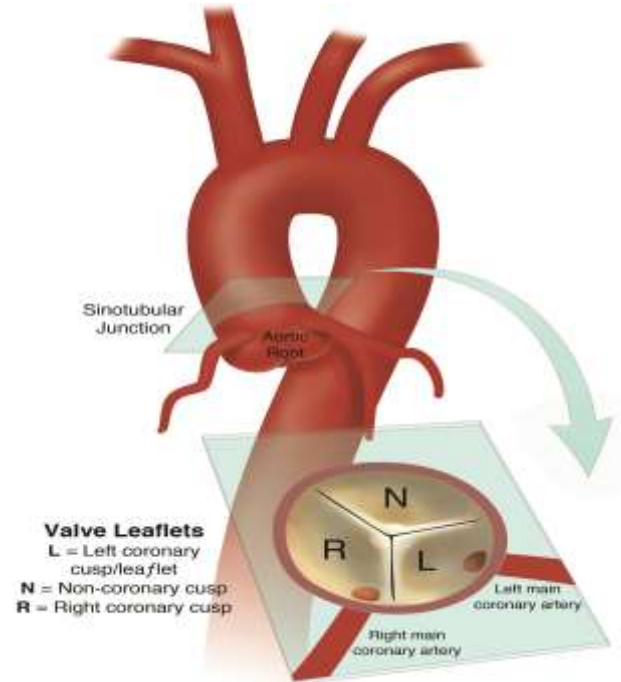
# Anatomy of the Aorta

- Begins at the left ventricle.
- Extends upward into the chest, curving towards the spine to form the aortic arch.
- Curves downward, through the diaphragm, and into the abdomen.
- Branches into the iliac arteries.
- The aorta is broken down into 5 parts to describe location: Aortic root, ascending aorta, aortic arch, descending/thoracic aorta, and abdominal.



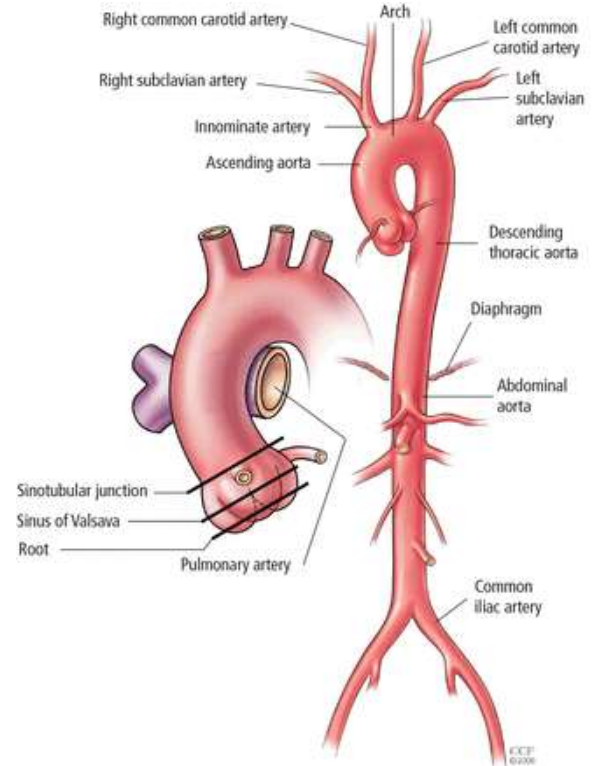
# Anatomy of the Aortic Root

- **Aortic root:** the point where the aorta attaches to the heart. The aortic valve sits at the root.
- **Aortic valve**
  - Allows blood to flow from the left ventricle to the rest of the body when its open.
  - Prevents blood from flowing backwards into the heart when its closed.
- **Right and left main coronary arteries** branch of the aortic root to provide blood to the heart.



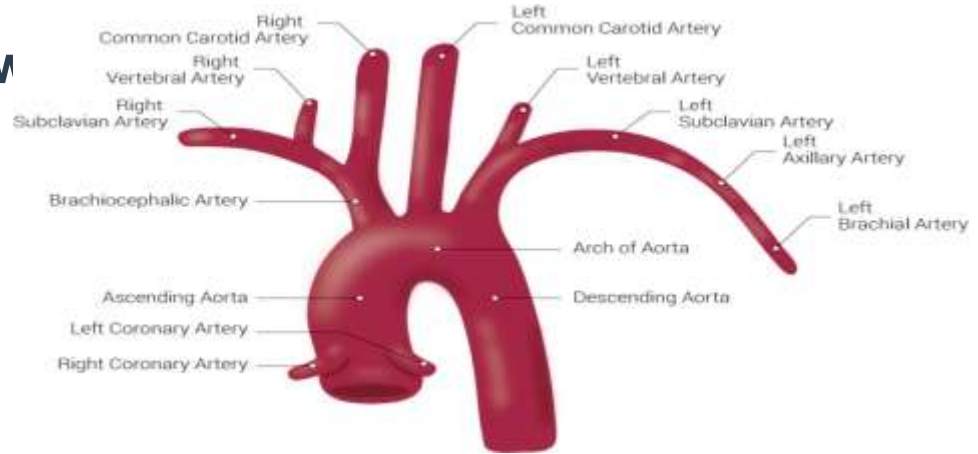
# Anatomy of the Ascending Aorta

- **Ascending aorta** begins at the sinotubular junction.
- Extends upward until it connects to the aortic arch.



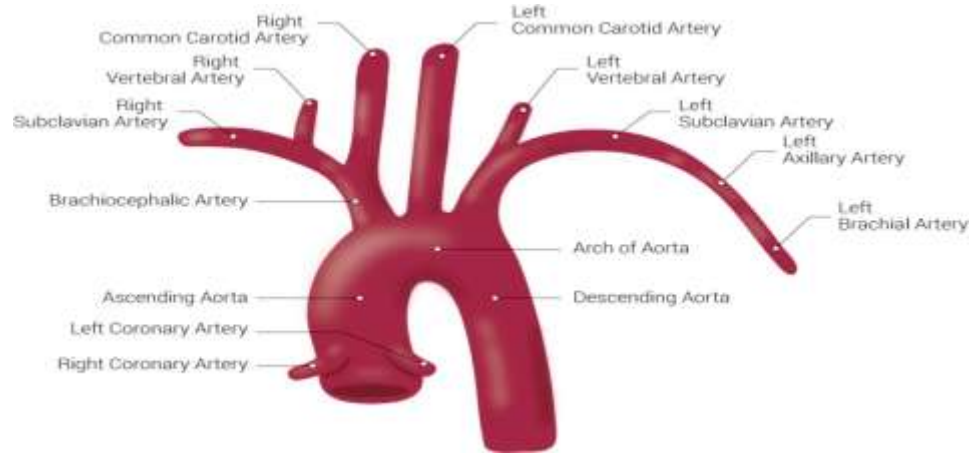
# Anatomy of the Aortic Arch

- The **aortic arch** connects the ascending to the descending and its branches provide blood flow to the head and upper extremities.
- The **brachiocephalic artery** or **inominate artery** gives branches to the right subclavian artery and right common carotid artery, supplying blood to the right arm and right side of the



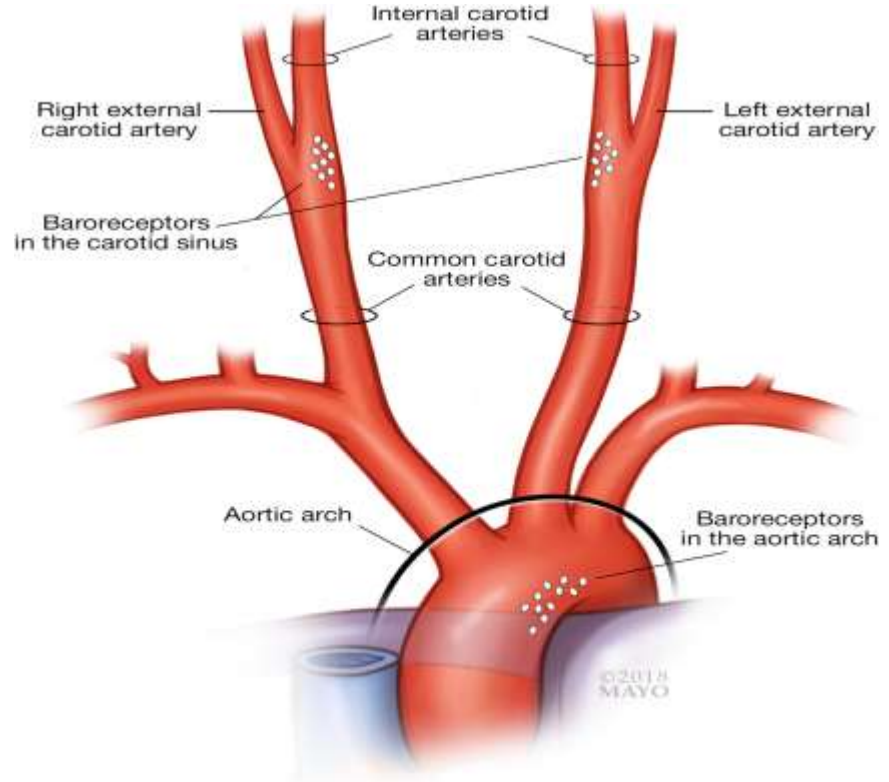
# Anatomy of the Aortic Arch

- The **left common carotid artery** gives blood to the left side of the brain.
- The **left subclavian artery** supplies blood to the left arm.



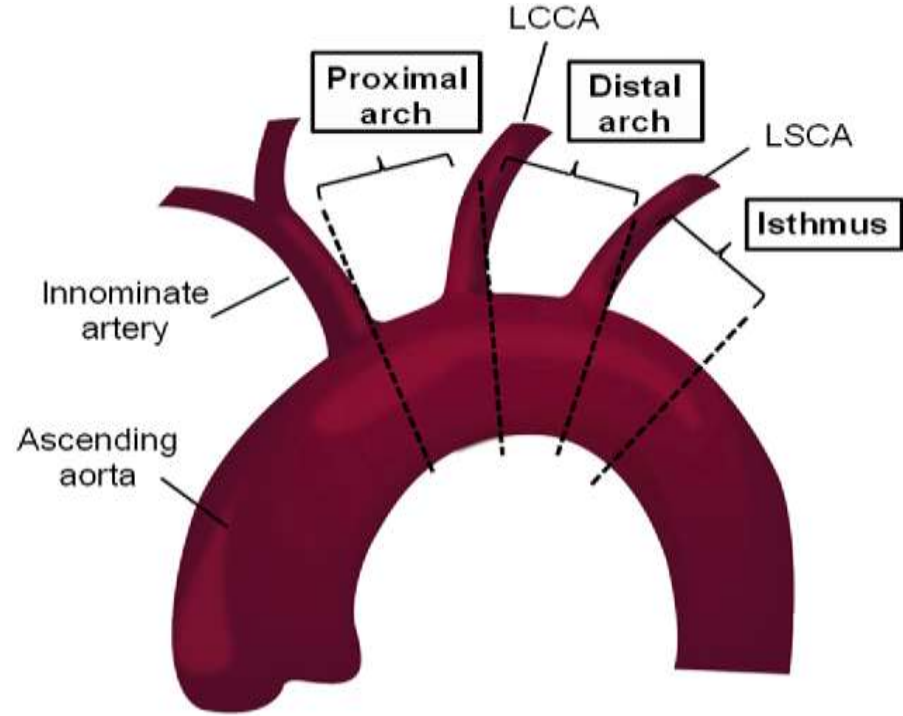
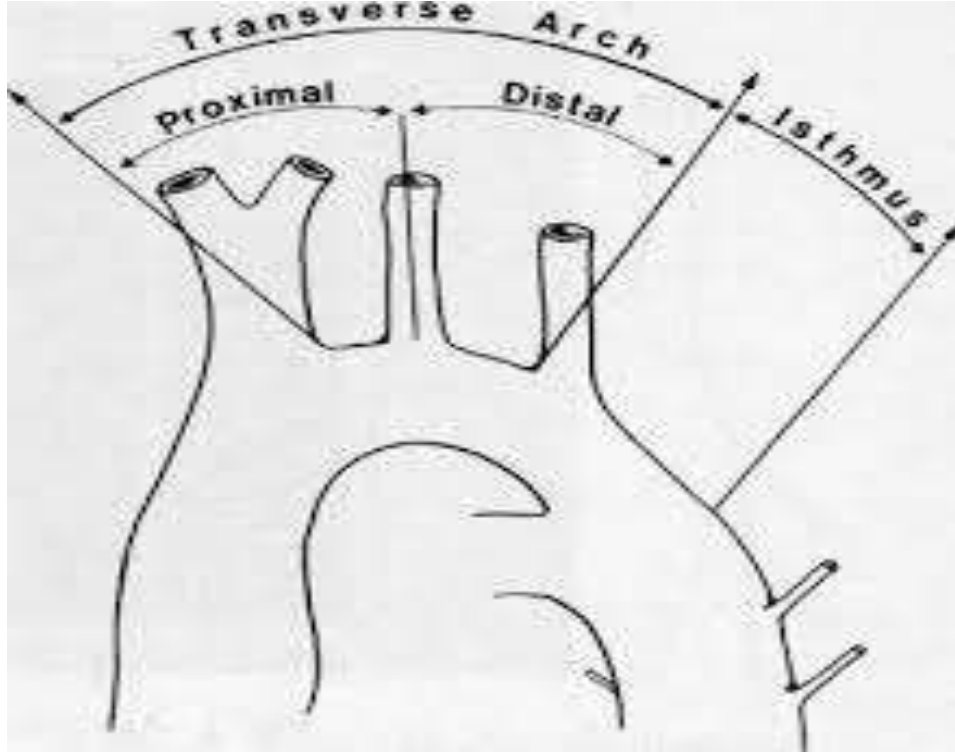
# Anatomy of the Aortic Arch

- The aortic arch contains baroreceptors that help to maintain blood pressure homeostasis by responding to stretching of the aortic wall.
- The arch also has chemoreceptors (aortic bodies) that monitor blood composition, specifically CO<sub>2</sub> and O<sub>2</sub>.

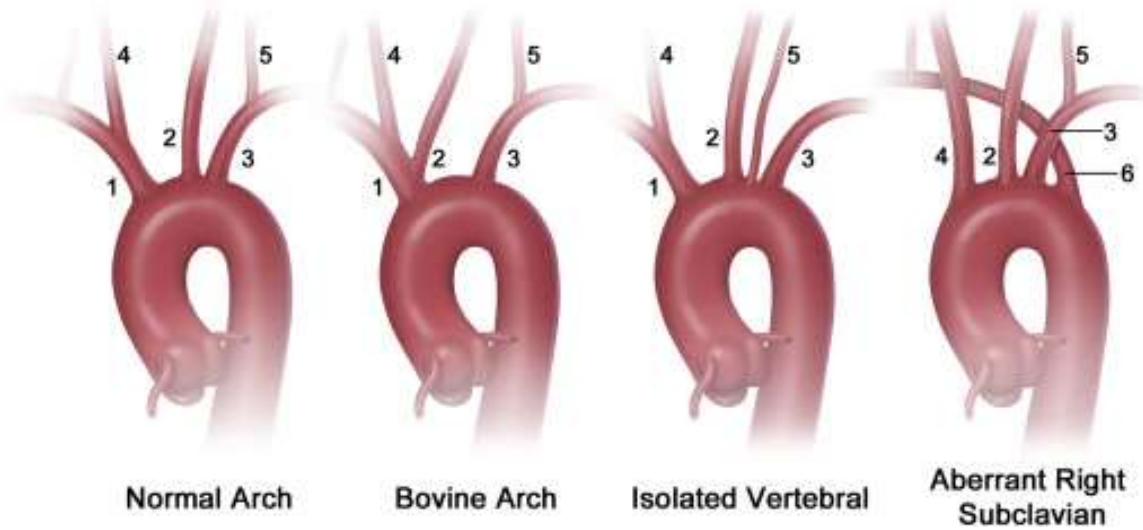




# Anatomy of the Aortic Arch

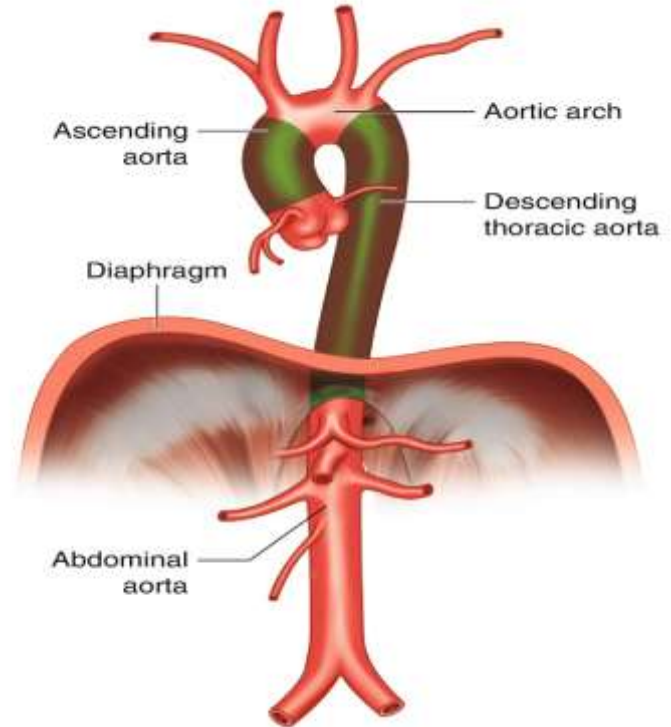


# Variations in the Aortic Arch

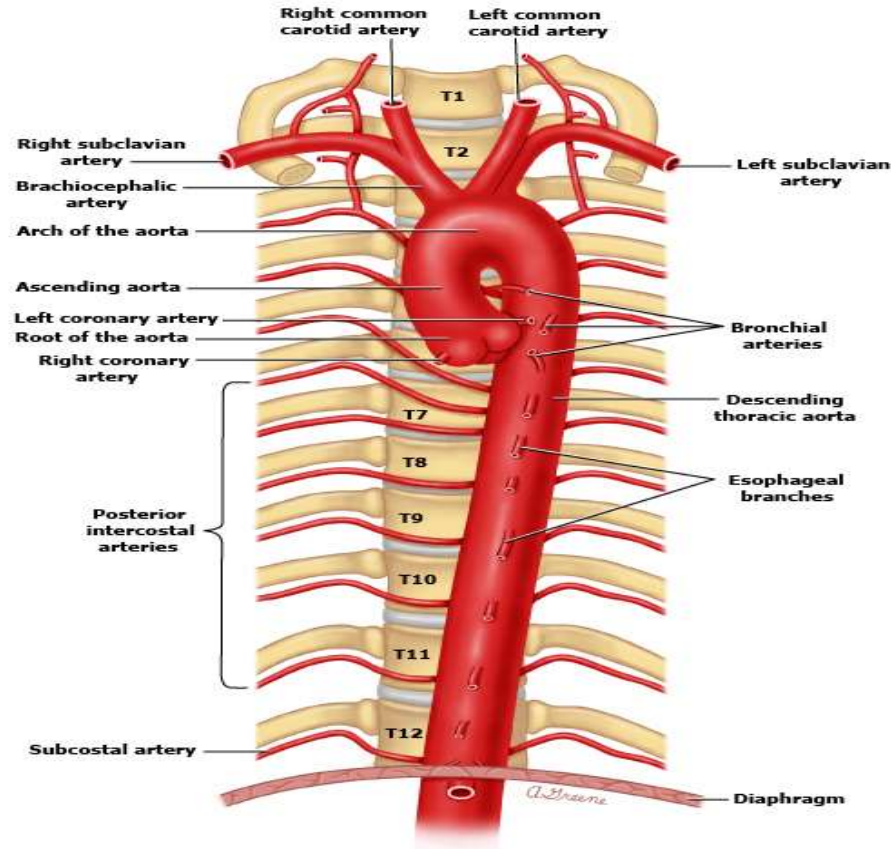


# Anatomy of the Descending Aorta

- The descending aorta begins at the end of the aortic arch and continues down into the abdomen.
- The thoracic portion of the descending aorta runs from the arch to the diaphragm.
- Provides blood to the chest wall and spinal cord.

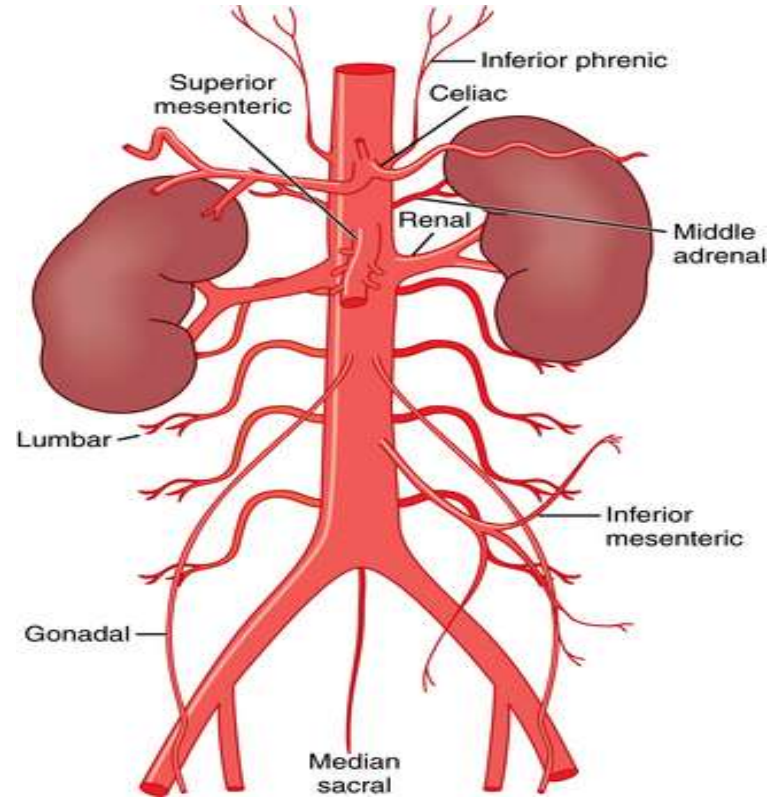


# Anatomy of the Descending Aorta



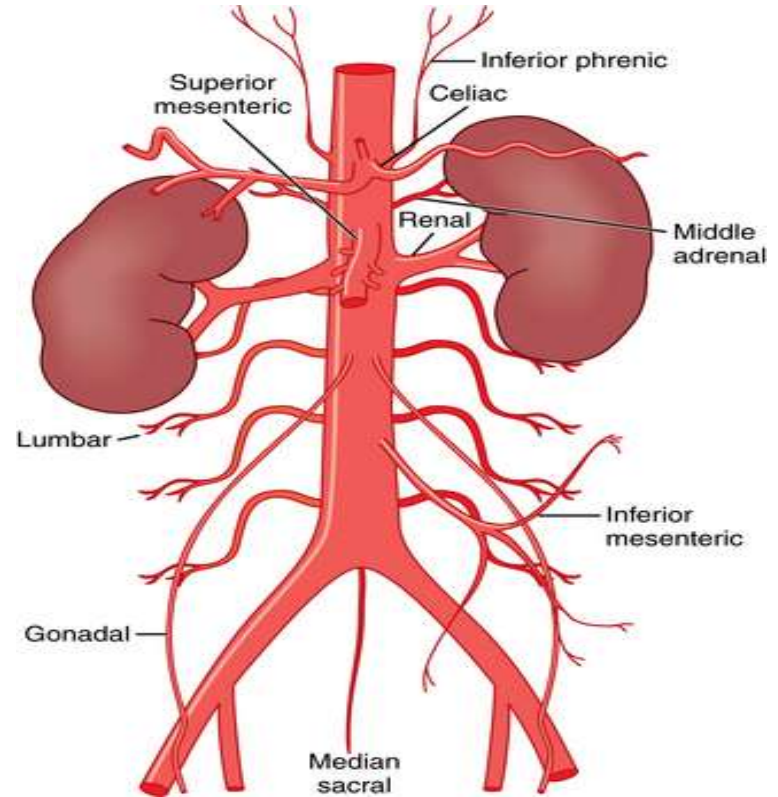
# Anatomy of the Abdominal Aorta

- **Abdominal aorta** runs from the diaphragm down and ends just above the pelvis, where it branches into the right and left iliac arteries.
- **Celiac artery**- supplies blood to the stomach, liver, and pancreas.
- **Superior mesenteric artery (SMA)**-supplies blood to the small intestine



# Anatomy of the Abdominal Aorta

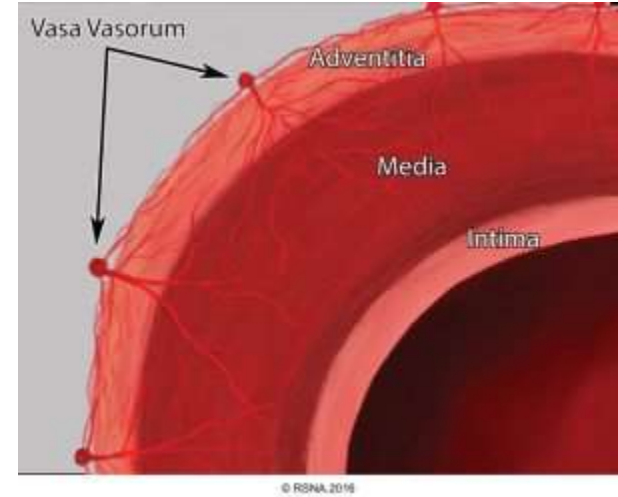
- **Inferior mesenteric artery (IMA)** - supplies blood to the large intestine.
- **Bilateral renal arteries** supplying blood to each kidney, its nearby adrenal gland, and ureter.
- **Iliac arteries** which supply blood to each leg and organs of the pelvis.



# Anatomy of the Aortic Wall

The aorta consists of 3 layers:

- The inner layer- tunica intima
- The middle layer- tunica media
- The outer layer- tunica adventitia





# Acute Aortic Syndromes

- **Aortic aneurysm:** a bulge or ballooning in the wall of the aorta.
- **Acute aortic dissection:** A separation of the layers of the aortic wall due to a tear in the intimal layer.





# Acute Aortic Syndromes

- **Aortic intramural hematoma**: a hematoma confined within the medial layer of the aorta, without a detectable intimal tear.
- **Intimal tear** without a hematoma (uncommon)
- **Penetrating aortic ulcer**
- **Periaortic hematoma**: contained rupture

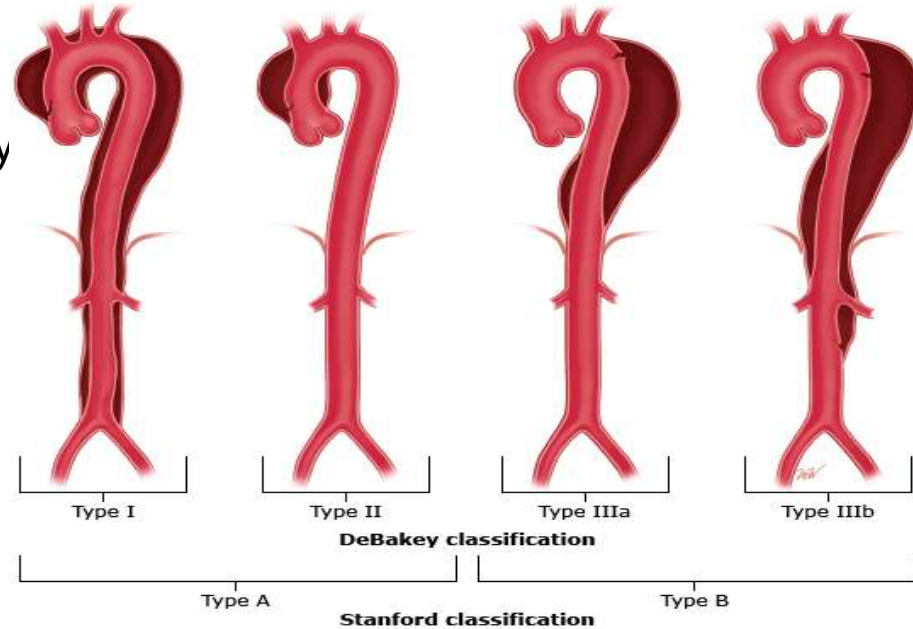


# Classifications of Acute Aortic Syndromes

In the Stanford classification:

Type A involves the ascending aorta and may progress to involve the arch and thoracoabdominal aorta.

Type B involves the descending thoracic or thoracoabdominal aorta distal to the left subclavian artery without involvement of ascending aorta.

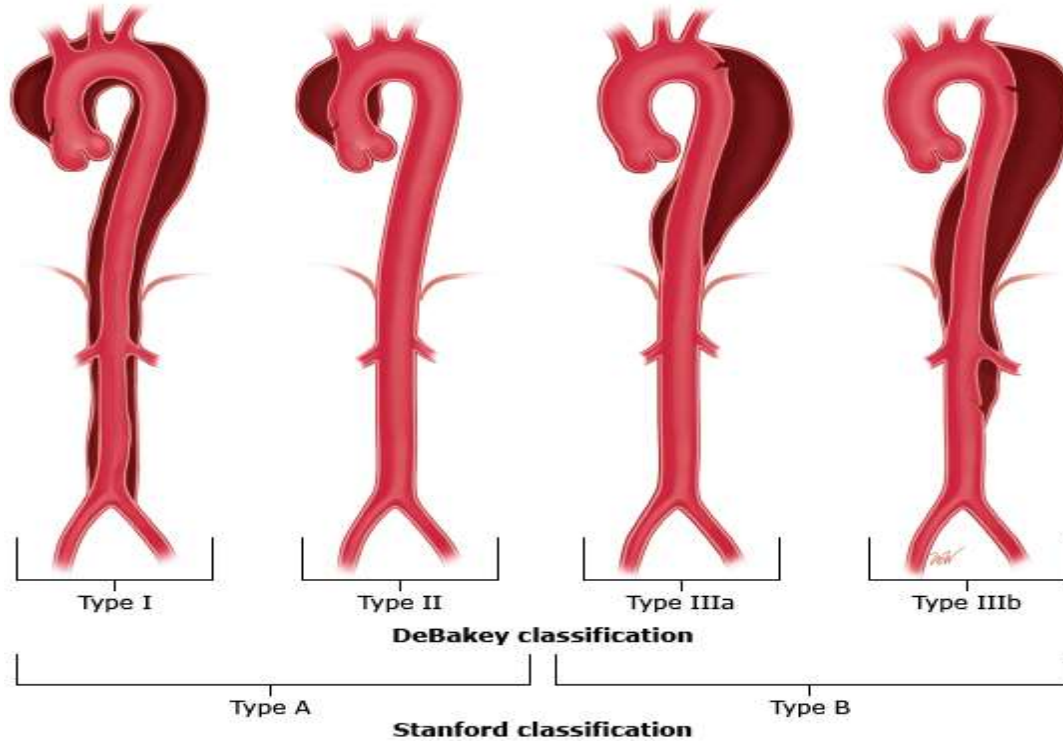


# Classifications of Acute Aortic Syndromes

In the DeBakey classification:

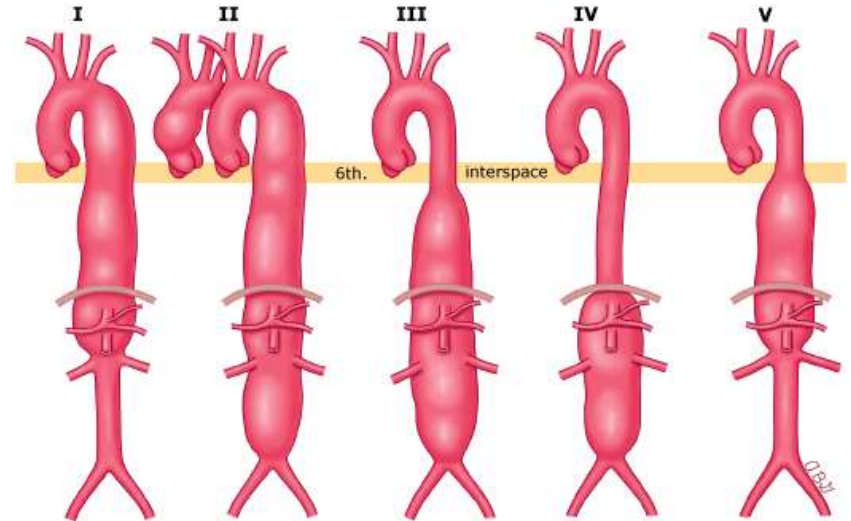
- Type I involves the ascending aorta, arch, and descending thoracic aorta and may progress to involve the abdominal aorta.
- Type II is confined to the ascending aorta.
- Type IIIa involves the descending thoracic aorta distal to the left subclavian artery and proximal to the celiac artery.
- Type IIIb dissection involves the thoracic and abdominal aorta distal to the left subclavian artery and distal to the celiac artery.

# Classifications of Acute Aortic Syndromes



# Classifications of Thoracoabdominal Aortic Aneurysms

- Due to the challenging nature of treatment and surgical repair of TAAAs, in 1986, Dr. Stanely Crawford described the first classification system for TAAA based on the anatomic extent.
- Dr. Hazim Safi later modified this system by adding to it.



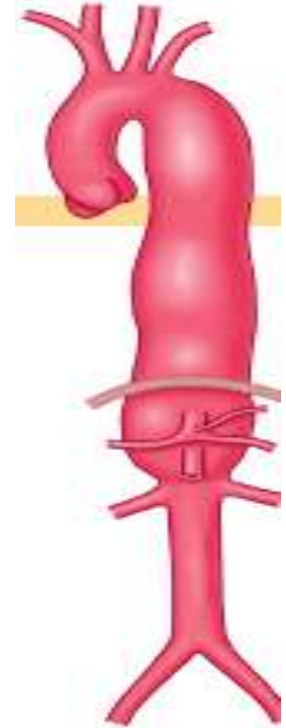
# Classifications of Thoracoabdominal Aortic Aneurysms



## Extent I TAAA:

arises from above the sixth intercostal space, usually near the left subclavian artery and extends to include the origins of the celiac axis and superior mesenteric arteries (SMA).

Although the renal arteries can be involved, the aneurysm or dissection does not extend into the infrarenal (below the renals) aortic segment.



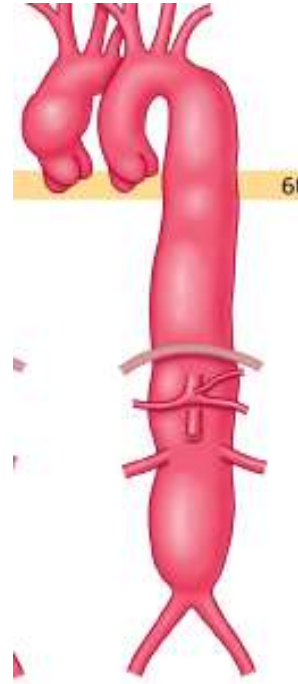
# Classifications of Thoracoabdominal Aortic Aneurysms



## Extent II TAAA:

Arises above the sixth intercostal space and may include the ascending aorta. It extends down to include the infrarenal aortic segment and often down to the aortic bifurcation (illiacs).

“Root to Toot”



# Classifications of Thoracoabdominal Aortic Aneurysms



## Extent III:

Arises in the distal half of the descending thoracic aorta, below the sixth intercostal space, and extends into the abdominal aorta.



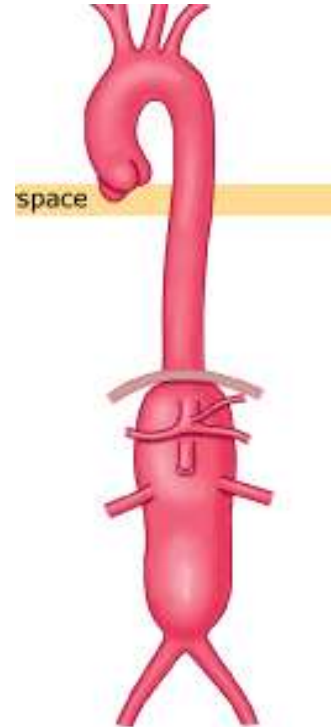


# Classifications of Thoracoabdominal Aortic Aneurysms



## Extent IV TAAA:

Generally involves the entire abdominal aorta from the level of the diaphragm to the aortic bifurcation.



# Classifications of Thoracoabdominal Aortic Aneurysms

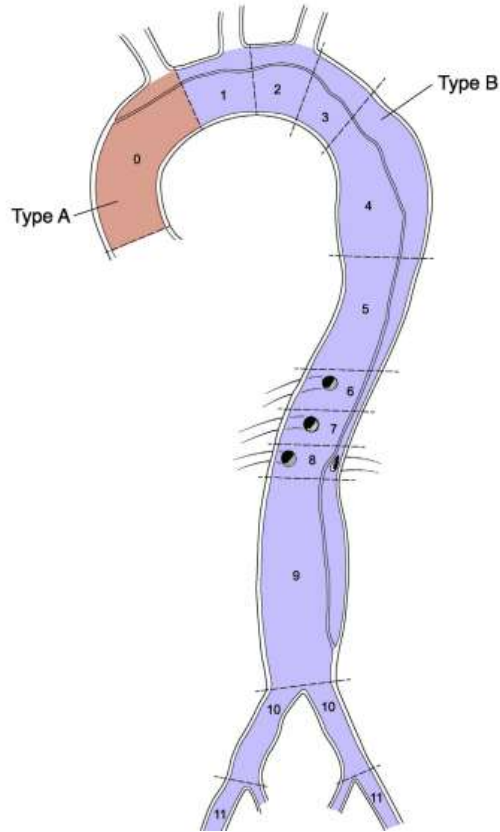


## Extent V TAAA:

Arises in the distal half of the descending thoracic aorta, below the sixth intercostal space, and extends into the abdominal aorta, but is limited to the visceral segment (suprarenal).



# SVS/STS Classification

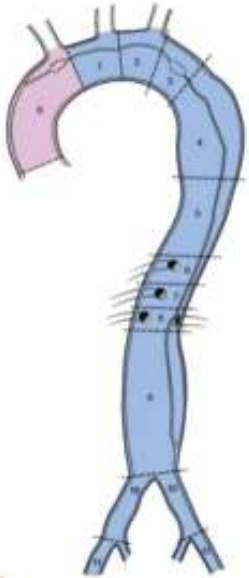


In March 2020, the Society for Vascular Surgery and the Society of Thoracic Surgeons published a revised classification scheme based on current data from the International Registry for Acute Aortic Dissection (IRAD), and utilizing expert opinions from a writing committee from both groups.

The opinion of the Writing Committee was that the Stanford and DeBakey classification schemes had limitations and did not include caveats for dissections that begin in the aortic arch.

Based on these limitations, the Writing Committee proposed a new classification system relevant to current treatments and more accurately describing aortic arch involvement.

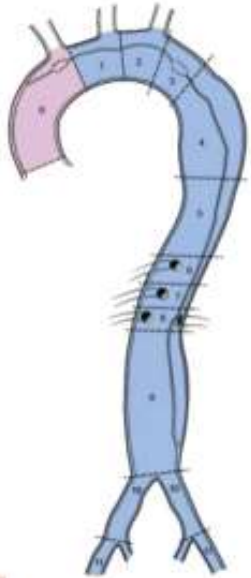
# SVS/STS Classification



Type	Proximal Extent	Distal Extent
<b>A<sub>D</sub></b> Entry tear: Zone 0	0	0
	1	1
	2	2
	3	3
<b>B<sub>FD</sub></b> Entry tear: ≥ Zone 1	4	4
	5	5
	6	6
	7	7
	8	8
<b>I<sub>D</sub></b> Unidentified entry tear involving Zone 0	9	9
	10	10
	11	11
	12	12

- The difference between Type A and Type B is based on entry tear location alone.
- In a Type A dissection, the entry tear originates only in Zone 0.
- The distal extent of a Type A is then simply designated by zone as a subscript.
- For example, a dissection entry tear is in Zone 0 and extends down to Zone 9. The dissection would be a **Type A<sub>9</sub>**.

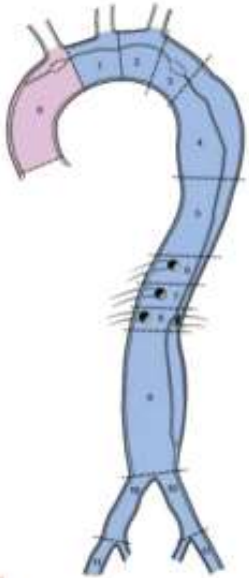
# SVS/STS Classification



Type	Proximal Extent	Distal Extant
$A_D$ Entry tear: Zone 0	0	0
	1	1
	2	2
	3	3
$B_{P,D}$ Entry tear: ≥ Zone 1	4	4
	5	5
	6	6
	7	7
	8	8
$I_D$ Unidentified entry tear involving Zone 0	9	9
	10	10
	11	11
	12	12

- Type B dissection includes any with an entry tear in zone 1 or beyond.
- Type B is further classified by two subscripts: **Type  $B_{P,D}$** .
- The subscript P describes the proximal zone involved, and the subscript D describes the distal zone of involvement.
- A Type B dissection with an entry tear in zone 1 and a distal involvement down to zone 7 would be classified as a **Type  $B_{1,7}$** .

# SVS/STS Classification



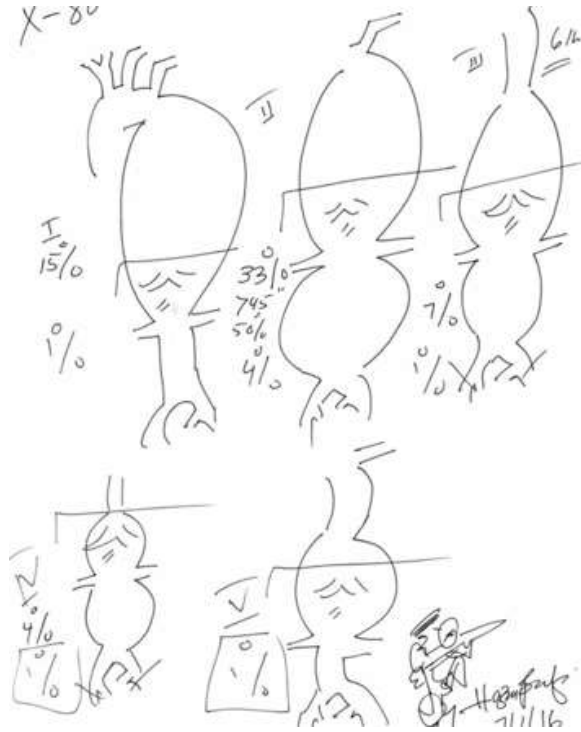
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<b>A<sub>D</sub></b> Entry tear: Zone 0	0	0
	1	1
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<b>B<sub>PD</sub></b> Entry tear: ≥ Zone 1	4	4
	5	5
	6	6
	7	7
	8	8
<b>I<sub>D</sub></b> Unidentified entry tear involving Zone 0	9	9
	10	10
	11	11
	12	12

- If the entry tear is not identifiable, the dissection will be classified as indeterminate with the designation **I**.
- These dissections will always involve zone 0 and will follow the same distal extent subscript as a Type A.
- An indeterminate dissection with distal involvement down to zone 8 would be classified as **I<sub>8</sub>**.

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# Questions?






# Thank You!



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