Thoracic Aorta Measurements

Radiology Reference Guide

CT / MRI

Normal Diameters

Aneurysm Thresholds

Anatomy

Thoracic Aorta Segments

Five anatomically distinct zones — each measured at its widest point on a perpendicular double-oblique plane.

1

Aortic Annulus

AV valve plane

2

Sinuses of Valsalva

Aortic root

3

Ascending Aorta

Mid-tubular

4

Aortic Arch

Transverse arch

5

Descending Aorta

Mid + diaphragm

Measurement protocol: Double-oblique axial planes perpendicular to the vessel long axis. Report inner-edge-to-inner-edge (CT) or outer-edge-to-outer-edge (MRI). Specify imaging phase (end-diastolic preferred for ECG-gated).

Adult Diameter Reference Ranges

Based on large population CT studies. Values approximate mean ± 2 SD; adjust for body surface area when indicated.

Segment	Mean (mm)	Men ULN (mm)	Women ULN (mm)	Notes
Aortic Annulus	22–26	~ 27	~ 25	AV plane; critical for TAVR sizing
Sinuses of Valsalva	28–34	~ 37	~ 35	Root; trigger for Marfan monitoring
STJ / Prox. Ascending	29–34	~ 38	~ 36	Sinotubular junction
Mid-Ascending Aorta	32–36	~ 42	~ 39	Most common aneurysm location
Transverse Arch	26–29	~ 34	~ 32	Between innominate & L subclavian
Mid-Descending (T6)	23–27	~ 31	~ 29	Just below left PA
Descending at Diaphragm	23–26	~ 29	~ 27	T12 level; pre-abdominal aorta

ULN = Upper Limit of Normal (approx. mean + 2 SD). Sources: Framingham Heart Study CTs, MESA, AHA/ACC 2022 guidelines.

Visual Reference

Diameter Continuum by Segment

Aortic Annulus	**22–26 mm**
Sinuses of Valsalva	**28–34 mm**
Ascending Aorta (mid)	**32–36 mm**
Aortic Arch	**26–29 mm**
Mid-Descending Aorta	**23–27 mm**
Desc. Aorta at Diaphragm	**23–26 mm**

Size legend

- **Blue bars** = normal mean range
- **Amber** = dilation / ectasia
- **Red** = aneurysm threshold

Key principle

Diameter **decreases distally** — ascending > arch > descending. Ascending is always the widest normal segment (~34 mm mean). A descending aorta equal to the ascending suggests dilation.

Clinical Thresholds

Dilation → Aneurysm Thresholds

Ascending Aorta

Ć mm — Dilation
Above ULN but <50 mm

Ć mm — Aneurysm
Surgical threshold varies (45 mm bicuspid AV)

Descending Thoracic Aorta

0 mm — Dilation
Above normal range but <40 mm

0 mm — Aneurysm
Repair threshold ~55–60 mm or 1.5× normal

Aortic Root (Marfan)

Surgery at **≥45–50 mm**; at ≥40 mm if family history dissection or rapid growth (>3 mm/yr)

Bicuspid Aortic Valve

Lower threshold: surgery at **≥45 mm** ascending; earlier if additional risk factors present

Growth Rate

Concerning if **>3 mm/yr** for ascending; >5 mm/yr for descending — expedited surgery regardless of absolute size

Measurement Best Practices

Plane Selection

Always double-oblique reformats perpendicular to the vessel long axis. Axial slices alone overestimate diameter by ~4–8 mm in tortuous aortas.

MRI vs. CT

MRI measures outer-to-outer by convention; results ~2–3 mm mm larger than CT inner-lumen. When switching modalities, apply modalities, apply appropriate correction factor.

Inner vs. Outer Edge

CT (non-gated): inner-edge to inner-edge (lumen diameter). CT-angio: outer-wall to outer-wall includes wall thickness. Specify method in report for serial follow-up consistency.

Body Size Indexing

For small or large BSA patients, index to body surface area. Normal: root/ascending <2.1 cm/m²; descending <1.8 cm/m². Use Roman formula: BSA (m²) = √(Ht×Wt/3600).

ECG Gating

End-diastolic phase minimizes pulsation artifact. Non-gated CTs may overestimate ascending aorta by 2–4 mm. Document gating status.

Serial Follow-Up Rule

Always compare at same segment, same phase, same measurement method. Growth rate calculation requires minimum 6-month interval and ≥3 mm change to be considered true growth.

Surveillance

Follow-Up Intervals (AHA/ACC 2022)

Ascending <45 mm

5 years

CTA or MRA repeat if stable, no risk features

Ascending 45–49 mm

1–2 years

Annual imaging; consider surgery consultation

Ascending ≥50 mm

Surgery

Repair indicated; expedited for growth >3 mm/yr

Descending Surveillance

- <35 mm → 5-year follow-up
- 35–39 mm → Annual imaging
- ≥40 mm → Surgical consultation
- ≥55–60 mm → TEVAR indicated

Accelerate Surveillance If

- Bicuspid aortic valve (BAV)
- Connective tissue disorder (Marfan, Loeys-Dietz)
- Coarctation of aorta
- Family history of aortic dissection

Standardized Report Language

Normal

"The thoracic aorta is normal in caliber. The ascending aorta measures **[X] mm** in diameter (outer-to-outer, true axial perpendicular to vessel axis). The descending aorta measures **[X] mm** at the level of the diaphragm."

Mildly Dilated

ÀÌ ÒÕÑ ÑÒÕMRÒÕÕ ÕŅPOÑMŒÉÑÑÕÑÒÕŌŅ MÕØPMÖ ÑMŒÞØÕÕŅ **LÎ Ľ ÖÖ**ÆÖÒÕÑÕŘMNÕQÑ POÑ ÞŐŐÑØÓÕÕÒÒPŌŅŌÕØÖMÕĂŠ ÇČ Ö ÖÅBÍ Ö ÑQÒŇÑŌŃÑŌŅ ÑÒŒÉÑŃPÒÕŌBĪ ÑŃÖÖ Ö ÑŌÑŅÕÕÕŘRÆÞŐ FÌ Ė ÒŌ **ĈČęČÇ ÖÖŌPOŒ**BÀ

Always include: measurement method (inner/outer), imaging plane (double-oblique perpendicular), cardiac phase (gated vs. non-gated), and comparison to prior studies with interval change in mm.

Aneurysm

"Ascending thoracic aortic aneurysm measuring **[X] mm** (previously [X] mm on [date]), representing interval growth of [X] mm. No acute No acute dissection or intramural hematoma. **Clinical correlation and surgical consultation recommended.**"

Quick Reference Card

At-a-Glance Summary

Ascending ULN

mm

Men / 39 mm Women

Ascending Aneurysm

mm

45 mm if BAV/Marfan

Desc. Aneurysm

mm

TEVAR at ≥55–60 mm

Alarming Growth

mm/yr

Ascending; >5 mm/yr desc.

Root (Sinuses)

Normal: 28–34 mm | ULN ~37 mm

Index: <2.1 cm/m² BSA

Measurement Method

Double-oblique perp. to long axis

Specify inner vs. outer edge

Follow-Up Rule

Same segment, phase, method

Min. 6-month interval for Δ