A Critical Look at Saccular Aortic Aneurysms:

1. Are They All *Ticking Time Bombs?*
2. *Diameter Measurements* – Include The Normal Aorta?
3. Do They *Rupture at a Smaller Diameter?*

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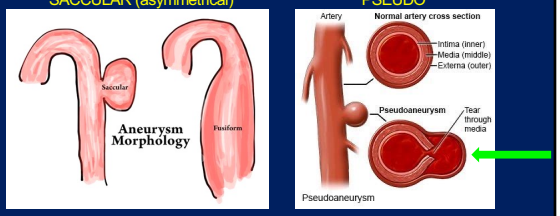
Potential COI: **NONE**

SACCULAR (asymmetrical) PSEUDO



Saccular Aneurysms are Most Frequent in the

- Descending thoracic aorta (20-30%)
- Abdominal Aorta (5%)
- Aortic Arch
- Ascending Aorta

DICTUM:

"SACCULAR AORTIC ANEURYSMS ARE PRONE TO RUPTURE, EVEN WHEN SMALL. *THEY SHOULD BE REPAIRED REGARDLESS OF SIZE"*

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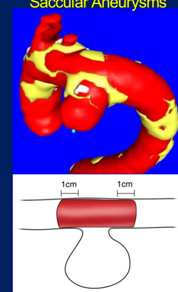
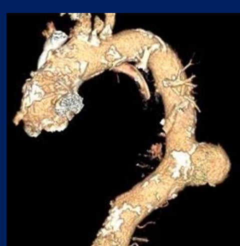
TRUE? WHAT'S THE EVIDENCE?

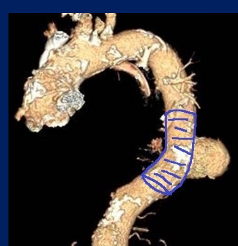
When compared with Fusiform, **Saccular Aneurysms:**

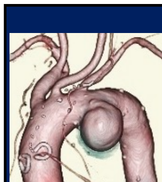
- More frequently underwent emergent/urgent repair and at smaller diameters.
- Had similar growth rates.
- Had similar TEVAR-outcomes BUT with a lower risk of spinal cord ischemia.

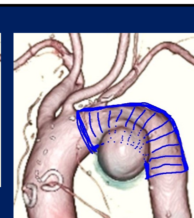
Saccular Aneurysms



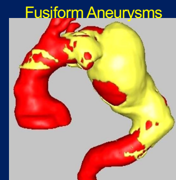


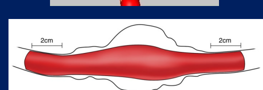


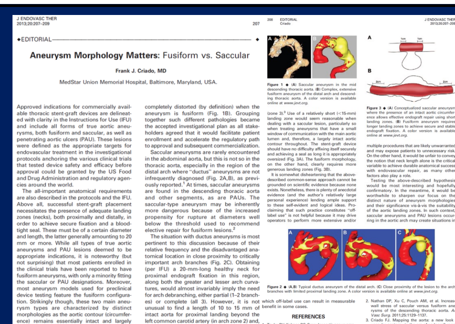




Fusiform Aneurysms







J ENDOVASC THER
2013;20:207–209 207

◆EDITORIAL

Aneurysm Morphology Matters: Fusiform vs. Saccular

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Approved indications for commercially available thoracic stent-graft devices are delineated with clarity in the Instructions for Use (IFU) and include all forms of true aortic aneurysms, both fusiform and saccular, as well as penetrating aortic ulcers (PAU). These lesions were defined as the appropriate targets for endovascular treatment in the investigational protocols anchoring the various clinical trials that tested device safety and efficacy before approval could be granted by the US Food and Drug Administration and regulatory agencies around the world.

The all-important anatomical requirements are also described in the protocols and the IFU. Above all, successful stent-graft placement necessitates the presence of adequate landing zones (necks), both proximally and distally, in order to achieve secure fixation and a blood-tight seal. These must be of a certain diameter and length, the latter generally amounting to 20 mm or more. While all types of true aortic aneurysms and PAU lesions deemed to be appropriate indications, it is noteworthy (but not surprising) that most patients enrolled in the clinical trials have been reported to have fusiform aneurysms, with only a minority fitting the saccular or PAU designations. Moreover, most aneurysm models used for preclinical device testing feature the fusiform configuration. Strikingly though, these two main aneurysm types are characterized by distinct morphologies as the aortic contour (circumference) remains essentially intact and largely uninvolved in saccular lesions (Fig. 1A), but it is completely distorted (by definition) when the aneurysm is fusiform (Fig. 1B). Grouping together such different pathologies became the accepted investigational plan as all stakeholders agreed that it would facilitate patient enrollment and accelerate the regulatory path to approval and subsequent commercialization.

Saccular aneurysms are rarely encountered in the abdominal aorta, but this is not so in the thoracic aorta, especially in the region of the distal arch where "ductus" aneurysms are not infrequently diagnosed (Fig. 2A,B), as previously reported.[1] At times, saccular aneurysms are found in the descending thoracic aorta and other segments, as are PAUs. The saccular-type aneurysm may be inherently more dangerous because of the increased propensity for rupture at diameters well below the threshold used to recommend elective repair for fusiform lesions.[2]

The situation with ductus aneurysms is most pertinent to this discussion because of their relative frequency and the disadvantaged anatomical location in close proximity to critically important arch branches (Fig. 2C). Obtaining (per IFU) a 20-mm-long healthy neck for proximal endograft fixation in this region, along both the greater and lesser arch curvatures, would almost invariably imply the need for arch debranching, either partial (1–2 branches) or complete (all 3). However, it is not unusual to find a length of 10 to 15 mm of intact aorta for proximal landing beyond the left common carotid artery (in arch zone 2) and, at times, even distal to the left subclavian artery

208 EDITORIAL
Criado

Figure 1 ◆ (A) Saccular aneurysm in the mid descending thoracic aorta. (B) Complex, extensive fusiform aneurysm of the distal arch and descending thoracic aorta. A color version is available online at www.jevt.org.

(zone 3).[3] Use of a relatively short (<15-mm) landing zone would seem reasonable when dealing with a saccular lesion, particularly so when treating aneurysms that have a small window of communication with the main aortic lumen and, therefore, a largely intact aortic contour throughout. The stent-graft device should have no difficulty affixing itself securely and achieving a seal as long it is appropriately oversized (Fig. 3A). The fusiform morphology, on the other hand, clearly requires more generous landing zones (Fig. 3B).

It is somewhat disheartening that the above-described common-sense approach cannot be grounded on scientific evidence because none exists. Nonetheless, there is plenty of anecdotal evidence (and the author's relatively large personal experience) lending ample support to these self-evident and logical ideas. Proclaiming that such practice constitutes "off-label use" is not helpful because it may drive operators to perform more extensive and/or multiple procedures that are likely unwarranted and may expose patients to unnecessary risk. On the other hand, it would be unfair to convey the notion that neck length alone is the critical variable to achieve durable anatomical success with endovascular repair, as many other factors also play a role.

Testing the above-described hypothesis would be most interesting and hopefully confirmatory. In the meantime, it would be worthwhile to sharpen our focus on the distinct nature of aneurysm morphologies and their significance vis-à-vis the suitability of the aortic landing zones. In such context, saccular aneurysms and PAU lesions occurring in the aortic arch may create situations in which off-label use can result in measurable benefit in some cases.

Figure 2 ◆ (A,B) Typical ductus aneurysm of the distal arch. (C) Close proximity of the lesion to the arch branches with limited proximal landing zone. A color version is available online at www.jevt.org.

J ENDOVASC THER
2013;20:207–209

Figure 3 ◆ (A) Conceptualized saccular aneurysm where the presence of an intact aortic circumference allows effective endograft repair using short landing zones. (B) Fusiform aneurysm requires longer landing zones to achieve secure and stable endograft fixation. A color version is available online at www.jevt.org.

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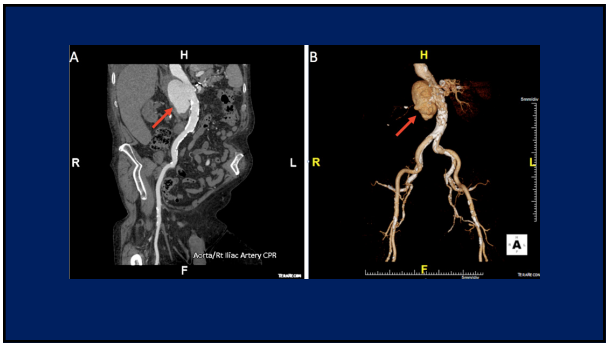

Increased Wall Stress of Saccular Versus Fusiform Aneurysms of the Descending Thoracic Aorta

Derek P. Nathan [1] · Chun Xu [1,2] · Alison M. Pouch [2] · ... · Ron M. Fairman [6] · Robert C. Gorman [2,5] · Benjamin M. Jackson [6] ... Show more

Affiliations & Notes Article Info

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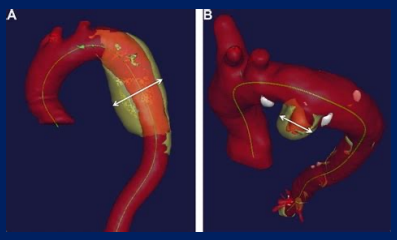
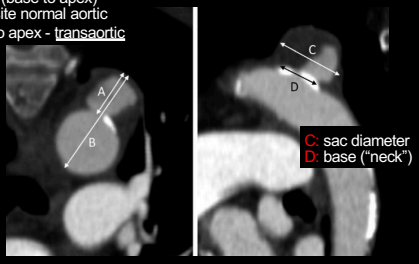
Morphology matters…



HOW TO MEASURE

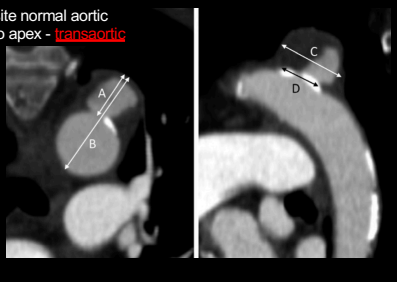
A: depth (base to apex)
B: opposite normal aortic wall to apex - transaortic



C: sac diameter
D: base ("neck")

HOW TO MEASURE

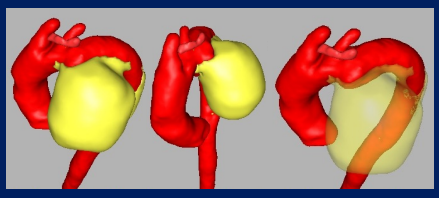
B: opposite normal aortic wall to apex - transaortic



- The better way is 3D volumetric measurement
- The best is ECG-gated CTA volumetric measurements

Moll: VEITH50 2023

Individual morphology and architecture probably most important as well, adding to the relative unpredictability of saccular aneurysm behavior



A Critical Look at Saccular Aortic Aneurysms:

1. Are They All *Ticking Time Bombs?* ***NO***
2. *Diameter Measurements* – Include The Normal Aorta? **YES – USE TRANSAORTIC DIAMETER**
3. Do They *Rupture at a Smaller Diameter?* ***YES***