



# Migration patterns of modern stent grafts: implications for EVAR planning and follow up

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**May 9-11 2019**

**Larissa Imperial Hotel  
Larissa, GREECE**

<http://www.live2019.gr>

Organized by:



**Institute of Vascular  
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In collaboration with:



Hellenic Society of Vascular and Endovascular Surgery



Stony Brook University Medical Center, New York, USA



International Symposium on Endovascular Therapeutics



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## Disclosures

Speaker name: Colin Bicknell.

**I have the following potential conflicts of interest to report:**

Consulting – Medtronic, Bolton Medical, Orzone

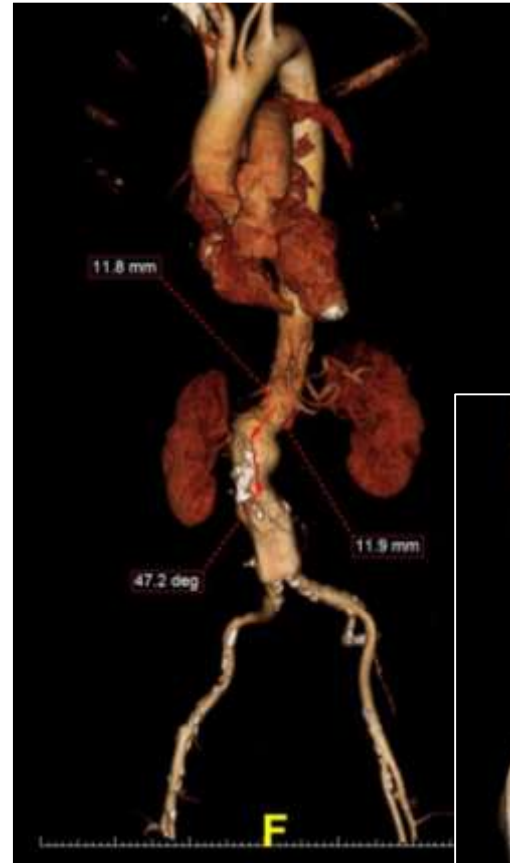
Institutional level funding, Orzone





# GRAFT MIGRATION

- Patient anatomy
  - Inadequate landing zone
  - Sizing, after rupture
- Remodeling and forces on the graft
- Disease progression and neck dilatation



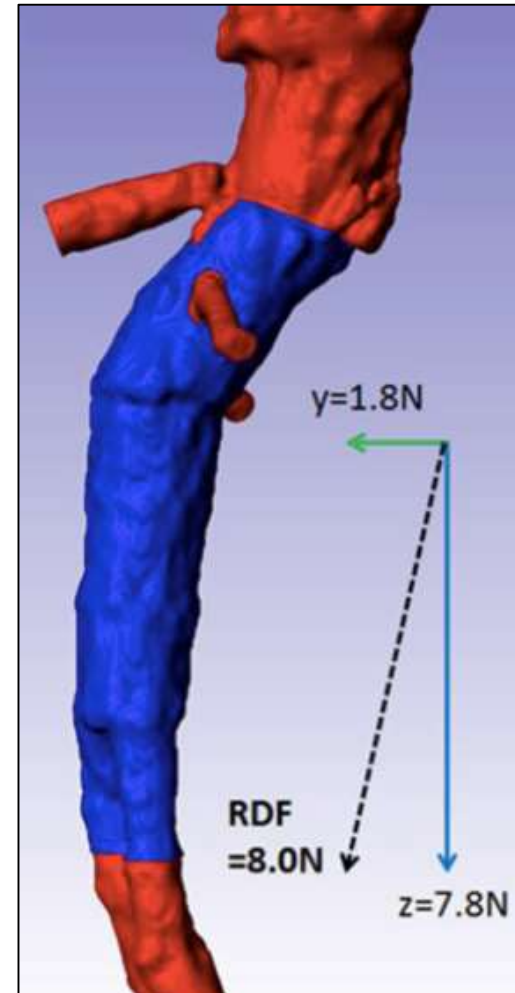
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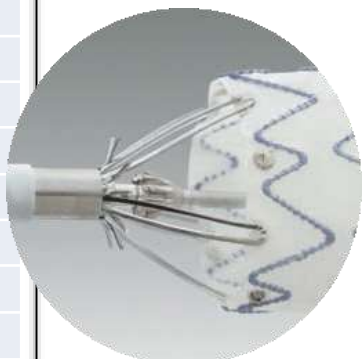
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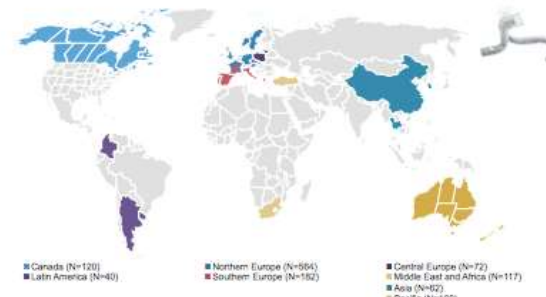


**Largest Contemporary EVAR Registry with single manufacturer's stent graft ENDURANT**

**1263** Patients

**30** Countries

**6** Continents



**Real world patients:**  
Limited inclusion/exclusion criteria

**Real world practice:**  
Limited procedural specifications  
- Standard follow-up

**>20 publications and > 100 presentations at major International/National conferences characterizing clinical outcomes and patients treated with ENDURANT**

| Description  | %        |
|--|----------|
| <b>Aneurysm Related Mortality†</b>                 | FF 97.8% |
| <b>Secondary Endovascular Procedure† (overall)</b> | FF 84.3% |
| <b>AAA Sac Diameter Stable or Decrease†</b>        | 89.4%    |
| <b>Type 1a Endoleaks‡</b>                          | 1.6%     |
| <b>Main Body Migration‡</b>                        | 0.3%     |

The impact of stent graft evolution on the results of endovascular abdominal aortic aneurysm repair. Tadros et al. J Vasc Surg 2014; 59(6):1518-27

MEDTRONIC ENGAGE Registry. 5 year outcomes.  
<https://www.medtronic.com/us-en/healthcare-professionals/products/cardiovascular/aortic-stent-grafts/endurantii/clinical-outcomes.html>

| Device and manufacturer             | Dates used  |
|-------------------------------------|-------------|
| <b>Era 1: Physician made</b>        |             |
| Juan Parodi                         | 11/92-01/95 |
| Michael Marin                       | 06/94-06/03 |
| <b>Era 2: Early industry</b>        |             |
| Endovascular Technologies (EVT)     | 06/94-05/96 |
| Boston Scientific (Vanguard)        | 08/97-03/00 |
| Guidant (Ancure)                    | 05/00-03/01 |
| Teramed (Ariba)                     | 07/00-08/00 |
| Cordis (Quantum LP)                 | 04/02-04/03 |
| Early Gore (Excluder)               | 05/98-06/03 |
| Early Medtronic (Talent)a           | 04/98-03/11 |
| Early AneuRx (AAAAdvantage)         | 11/99-06/03 |
| <b>Era 3: Intermediary industry</b> |             |
| Aptus Endovascular (Aptus)a         | 12/07-02/08 |
| Powerlink (Endologix)a              | 12/06-05/12 |
| Intermediary Gore (Excluder)        | 06/03-01/08 |
| Late Medtronic (Talent)a            | 04/98-03/11 |
| Late AneuRx (AAAAdvantage)a         | 06/03-10/10 |
| Early Cook (Zenith)                 | 12/03-01/08 |
| <b>Era 4: Modern industry</b>       |             |
| Late Cook (Zenith)                  | 01/08-02/12 |
| Medtronic (Endurant)                | 09/08-07/12 |
| Late Gore (Excluder)                | 01/08-07/12 |



# HAVE WE REALLY ABOLISHED MIGRATION?...

## CLINICAL PRACTICE







# HAVE WE REALLY ABOLISHED MIGRATION?...

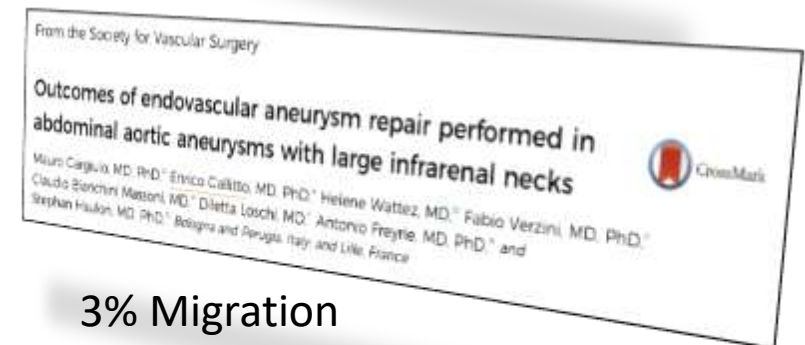
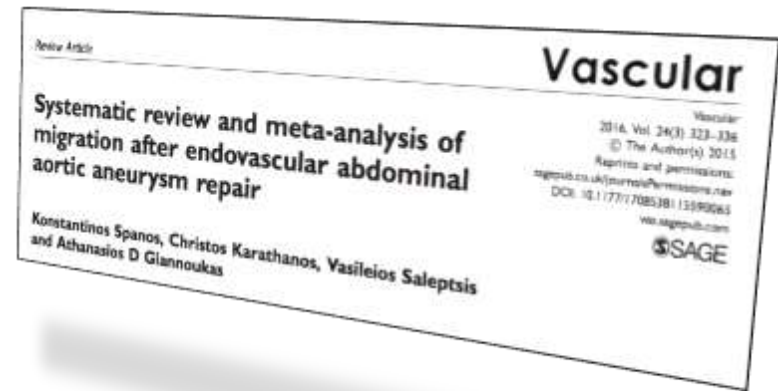
## CLINICAL STUDIES PUBLISHED

From 2000 to 2014, 22 retrospective studies. Stent-graft migration after EVAR 8.6% with older generation stent grafts

Stent-graft migration consists of an insidious and underestimated threat.

**Few published studies examining migration rates in newest generation stent grafts**

**Only available data uses 10mm cut off for migration as a binary outcome measure**



3% Migration  
Current gen grafts



# QUESTIONS

DO CURRENT GENERATION STENT GRAFTS  
MIGRATE?

WHAT PATTERNS OF MIGRATION OCCUR?

IS IT TIME DEPENDENT, WHICH MAY BE  
IMPORTANT FOR FOLLOW UP?

WHAT CAN THIS TEACH US?





## Screening

300 EVARs

- 140 unsuitable for analysis
- 12 FEVAR's, 5 prox cuff ext, 3 died within a year,

60 returned to referring hospital (no follow up)

160 cases

- Screened using Greenberg method before in-depth analysis

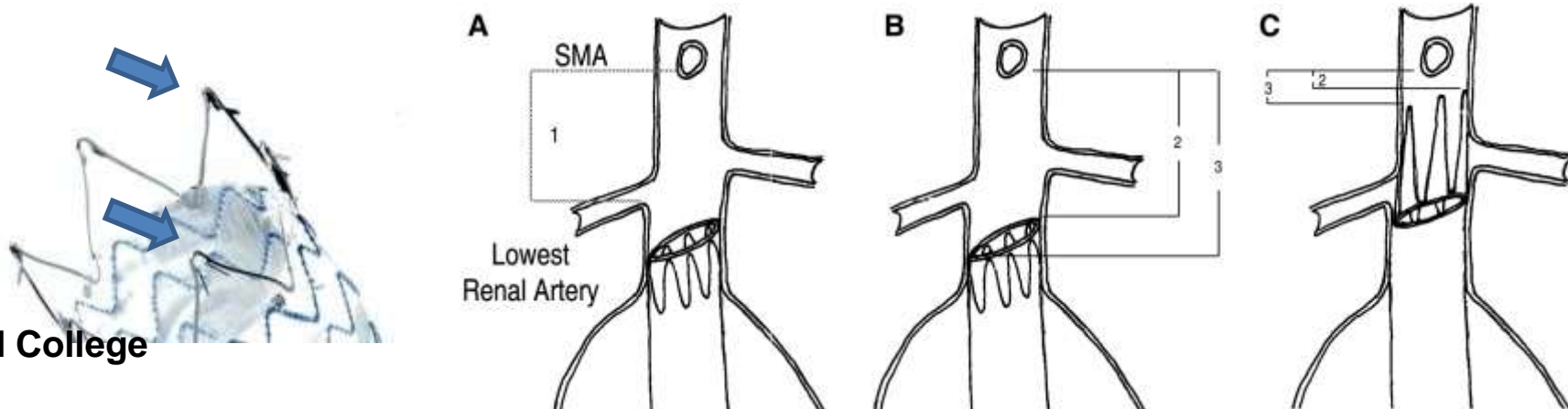
22 migrators.  
 (13%)

- 8 required re-intervention
- 1 not suitable for intervention
- 13 unreported migration – no intervention

*J Endovasc Ther.* 2004 Aug;11(4):353-63.

### Stent-graft migration: a reappraisal of analysis methods and proposed revised definition.

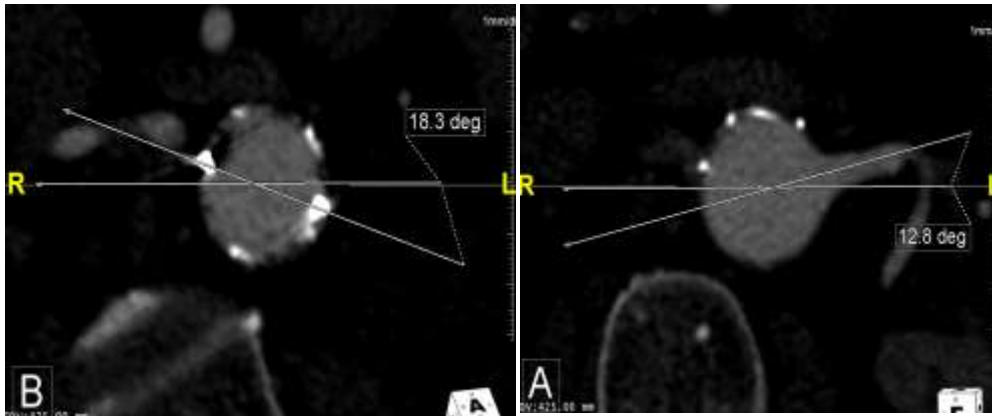
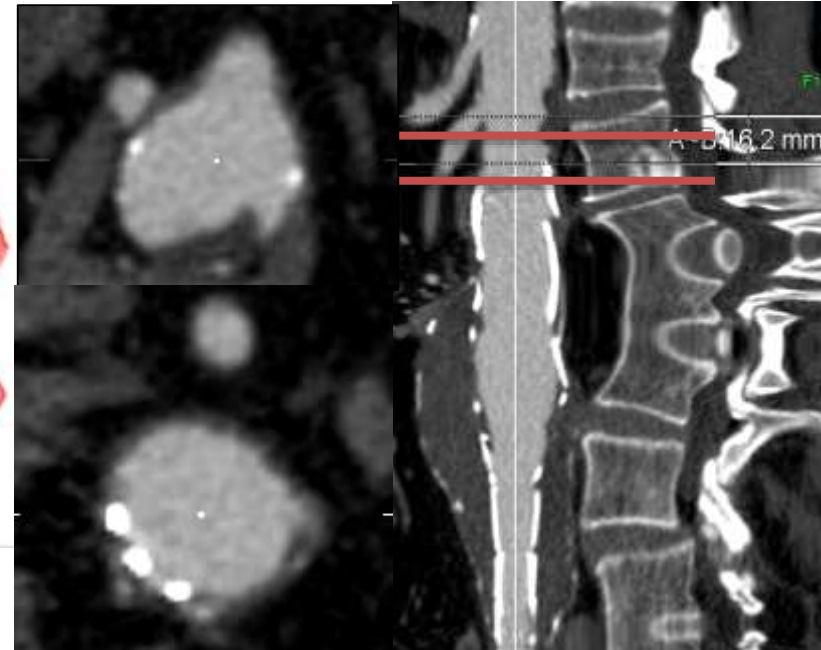
Greenberg RK<sup>1</sup>, Turc A, Haulon S, Srivastava SD, Sarac TP, O'Hara PJ, Lyden SP, Ouriel K.





## Migration:

- Using centerline technology (Terarecon<sup>®</sup>) – marker placed at the SMA and tracked caudally to each of the prongs
- Distance from the each of the prongs to SMA recorded with aortic diameter in every postoperative CT scan – and superimposed on patients own aortic phantom.



## Tilt:

- Change in angle from most proximal to most distal prong

## Rotation:

- Radio-opaque marker identified and angle measured to the center of the origin of lowest renal artery to determine rotation in serial scans

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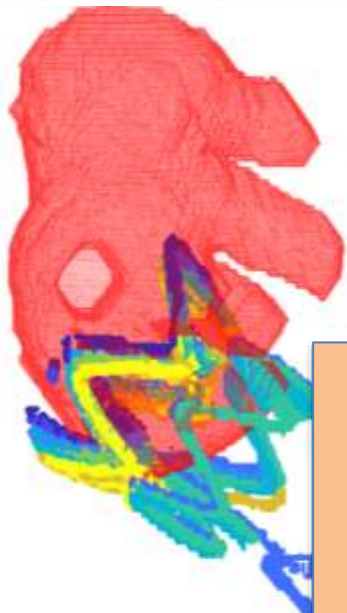


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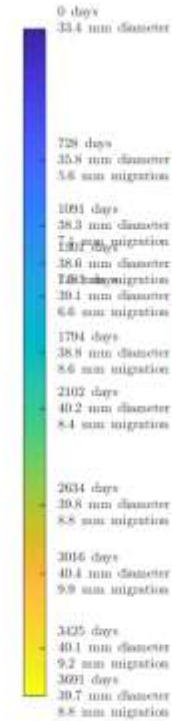
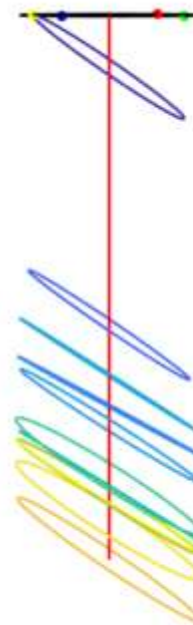
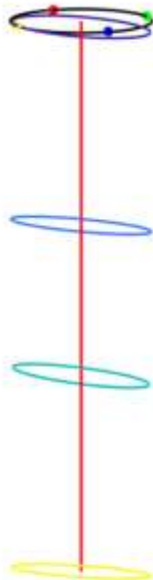
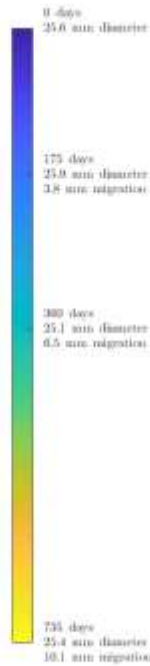
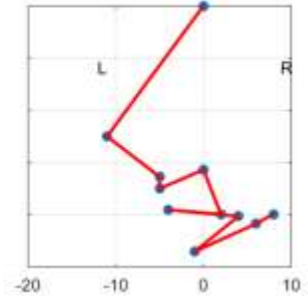
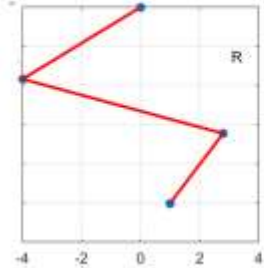
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|                                  | <b>Median</b> | <b>min</b> | <b>max</b> |
|----------------------------------|---------------|------------|------------|
| <b>follow-up (days)</b>          | 1283          | 519        | 3691       |
| <b>migration (max barb, mm)</b>  | 11.3          | 6.01       | 28.2       |
| <b>contact area loss (sq mm)</b> | 775.6         | 358.2      | 2477.4     |
| <b>rotation (deg)</b>            | 4.4           | 0          | 22.1       |
| <b>tilt (deg)</b>                | 14.7          | 2.1        | 34.5       |



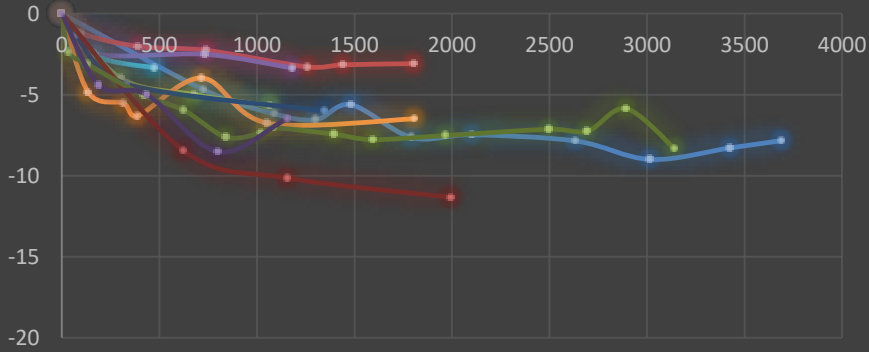
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# MIGRATION, TILT AND ROTATION

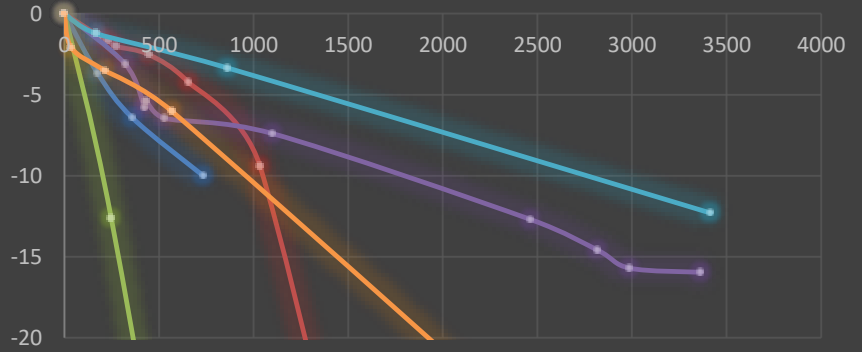




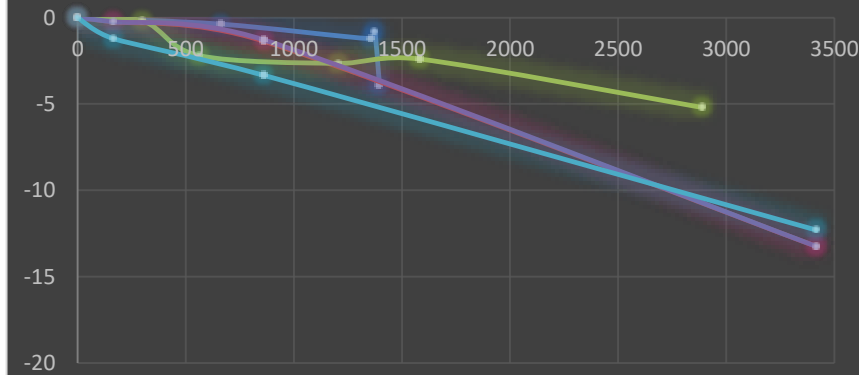
**Early Migrants (Settle)**



**Early Continuous**



**Late Migrants**





# CONCLUSIONS

## DO CURRENT GENERATION STENT GRAFTS MIGRATE AND WHAT PATTERNS EXIST?

- There is still evidence that migration occurs - if you look closely
- There is a loss of STABILITY in many cases - migration, tilt and rotation
- The question is whether this matters....

## IS IT TIME DEPENDENT, WHICH MAY BE IMPORTANT FOR FOLLOW UP AND WHAT CAN THIS TEACH US?

- There appear to be different patterns of migration over time
- If there is INSTABILITY on first post op CT scan, suggest further CT monitoring, if it settles should stay stable, if not will need to be treated
- If there is no INSTABILITY on first CT scan, then suggestions of reduced surveillance (if other criteria are met) are appropriate, but late imaging (?CT at 5yr) appears important





With many thanks to....

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