

Management of the False Lumen in Chronic Aortic Dissection

Saturday 29th September 2018

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Disclosures

Speaker Name: **Andrew Holden**

- No relevant disclosures

Consequences of Chronic Aortic Dissection

- It has long been known that there is significant mortality associated with chronic aortic dissection
- Most of the late mortality is aorta related

A Prospective Study of Medically Treated Acute Type B Aortic Dissection

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Objective: To study prospectively aneurysm formation, need of surgery, incidence of rupture and mortality in patients with conservatively treated acute type B aortic dissection.

Methods: All patients referred to us with acute type B aortic dissection between January 1990 and December 2000 were included in this prospective treatment and follow-up study. Patients referred not to be in need of acute surgical repair were included after aggressive antihypertensive treatment. The following criteria included close blood pressure control, clinic visits with physical examinations, chest x-ray and spiral CT or MRI at 3 and 6 months and annually thereafter.

Results: Seventy patients were followed for a mean 379 months (range 22–278). The actuarial survival rate was 87% at 3 years and 49% at 10 years. Eighty-five percent remained free from dissection-related death at 3 years and 45% at 10 years. Ten percent (10%) developed aneurysm in one of the distal aorta. Three of these 10 patients died from aortic rupture and 2 underwent elective surgical repair. Of the 56 patients without aneurysm, we had seen rupture and one died suddenly for aortic aneurysm, the patient was treated with endovascular stent-graft. Five patients contained a new type A aortic dissection which in all but one case died. In 26 patients the initial dissection was categorized as untreated aneurysm. Twelve of these patients had, in addition to the aneurysm, a new type B aortic dissection. The latter was found to be a predictor of aortic event (dissection-related death, rupture, new type A aortic dissection, aneurysm formation during follow-up), as was an initial diameter of ≥ 4.6 cm at first CT-scan during the acute phase.

Conclusions: Conservatively treated acute type B aortic dissection has a low incidence of aneurysm formation and rupture during the chronic phase. These results must be matched or improved upon before endovascular stent-grafting or early aortic surgical repair can be regarded as the primary treatment of choice.

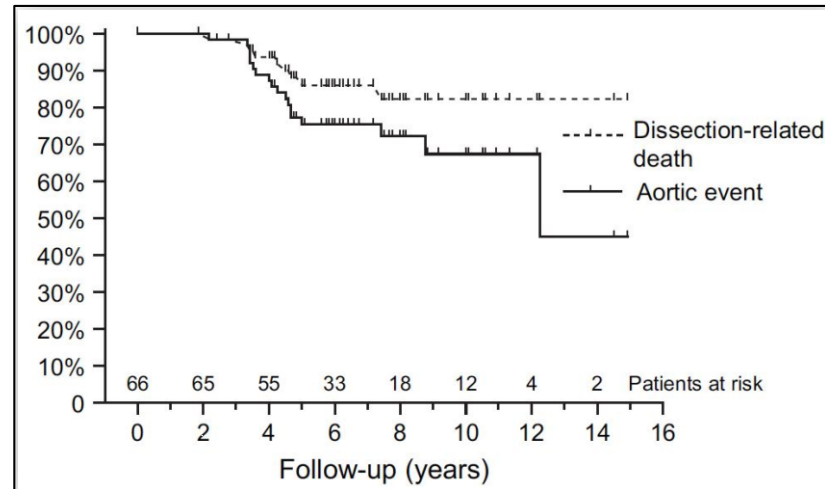
Keywords: Aortic dissection; Antihypertensive treatment; Prospective follow-up; Type B aortic dissection.

Introduction

Patients referred for acute type B aortic dissection and deemed not to be in need of acute aortic repair were included in this prospective study initiated in 1990. The patients were managed during the acute phase according to the non-surgical approach based on aggressive antihypertensive treatment described by Wheat and coworkers already in 1965.¹ The aim of our study was to follow these non-operated patients treated according to a protocol based on antihypertensive medication and to investigate aneurysm formation, need of surgery, incidence of rupture and mortality during the chronic phase.

Retrospective studies have reported aneurysm development, rupture and need of surgical repair in more than a third of patients with chronic type B aortic dissection,²⁻⁵ as well as a poor long-term prognosis.^{6,7} Endovascular stent-graft placement has evolved over the last decade and has been used as an alternative or in addition to surgery for the treatment of complications of acute type B dissection.^{8,9} It has even been suggested to use stent-graft placement for all patients with acute type B aortic dissection. By closing the false lumen the stent-graft is thought to promote healing and prevent aneurysm formation.¹⁰⁻¹²

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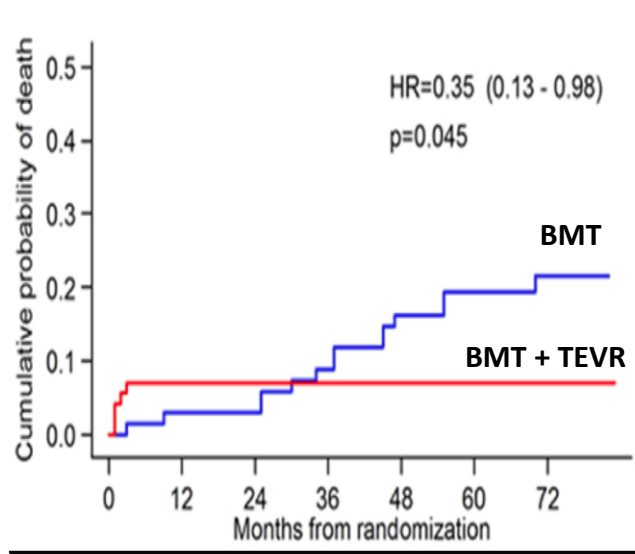
Eur J Vasc Endovasc Surg 2006;32:349-355-166

Consequences of Chronic Aortic Dissection

- This bleak outlook has not improved with time
- Durham et al¹ followed medically managed TBAD patients for a median of 4.3 +/- 3.5 years
- 29.2% subsequently underwent aorta related intervention
- 38.3% died
- Intervention free survival @ 6 years was 41%
- Commonest indication for intervention was aneurysmal dilatation

Durham et al, J Vasc Surg 2015;61 (5):1192-9

INSTEAD Trial (Extended Follow Up)



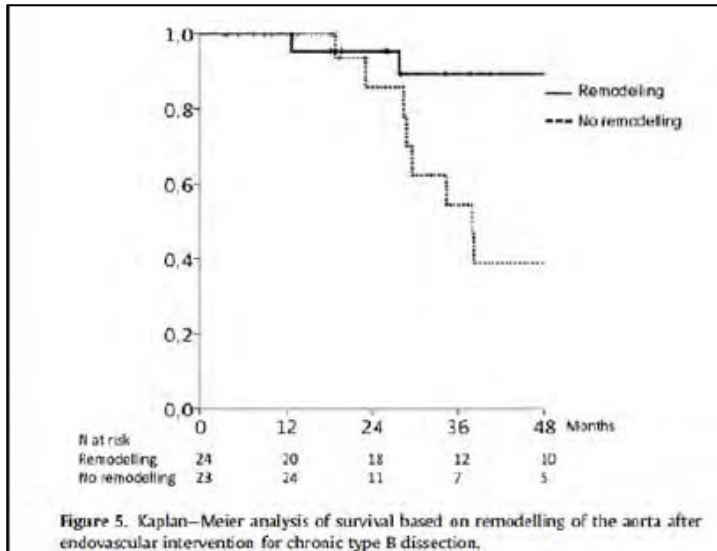
Aortic related death

Nienaber C et al, Circ Cardiovasc Int 2013;6:407

Late Deaths (>12 months)

BMT	BMT + TEVR
7 aortic rupture	No deaths
4 sudden death	
1 Type A dissection	

False Lumen Thrombosis and Aortic Remodelling in Chronic Aortic Dissection



Predictors of Outcome after Endovascular Repair for Chronic Type B Dissection
K. Mani^{a,d,*}, R.E. Clough^{a,b}, O.T.A. Lyons^{a,c}, R.E. Bell^a, T.W. Carrell^{a,b}, H.A. Zayed^a, M. Waltham^{a,c}, P.R. Taylor^{a,b}

FL thrombosis and aortic remodelling is a major predictor of survival in chronic aortic dissection

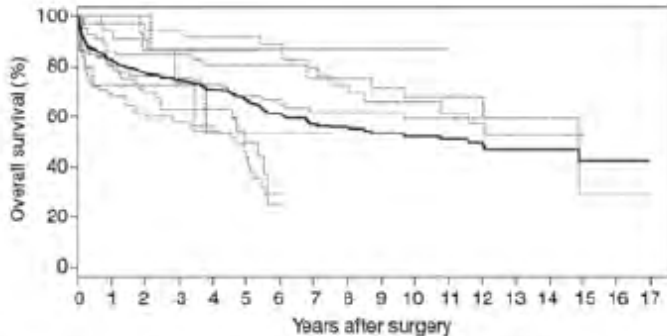
Mani et al Eur J Vasc Endovasc Surg 2012;43:386-91

Open Surgery for Chronic TBAD

Systematic Review

Open surgical repair for chronic type B aortic dissection: a systematic review

David H. Tian¹, Ramesh P. De Silva¹, Tom Wang¹, Tristan D. Yan^{1,2}

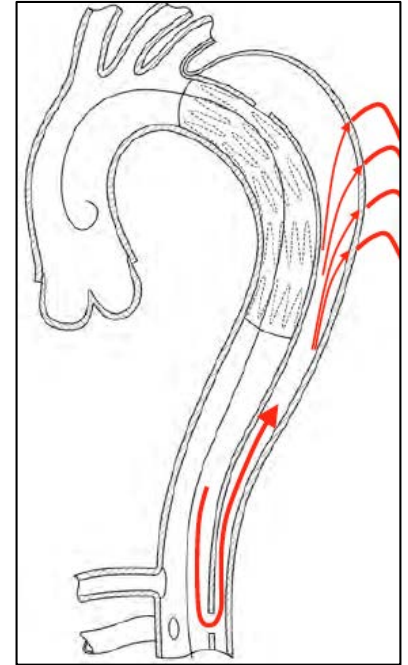


- 30 day mortality 11%
- Stroke 6%, SCI 5%
- 3 year survival 74%, 10 year survival 50%

Challenge of Excluding the False Lumen in Chronic Aortic Dissection

- Chronic dissection (> 3 months) is associated with a non-compliant intimal flap, multiple fenestrations in the intimal flap and aortic branch artery communication with the false lumen
- This makes false lumen thrombosis and subsequent aortic remodelling difficult to achieve with conventional thoracic EVAR devices

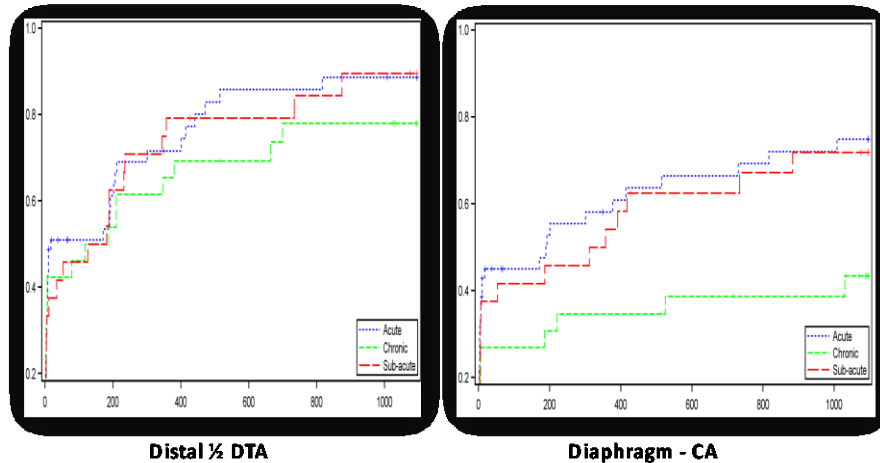
Images courtesy Tilo Kölbel



Challenge of Excluding the False Lumen in Chronic Aortic Dissection

The VIRTUE Registry of Type B Thoracic Dissections – Study Design and Early Results

False lumen thrombosis



- Acute, sub-acute and chronic AD treated with TEVR
- 24 patients had chronic dissection (> 92 days)

Eur J Vasc Endovasc Surg 2011;41:159-166

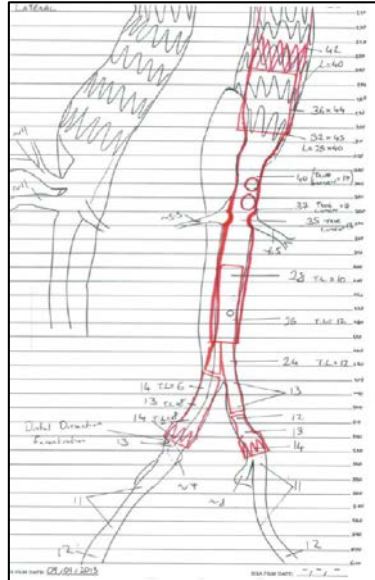
Methods to Manage the False Lumen in Chronic Aortic Dissection

- False lumen embolization associated with TEVR
- Complete endovascular repair with thoraco-abdominal fenestrated / branched endografts

Complete Endovascular Repair

- Complex, challenging procedures with endograft usually constrained by the true lumen
- Technical success 93.5%
- 30 day mortality 9.6%
- False lumen thrombosis 88%

Oikonomou et al, J Vasc Endovasc Surg 2014;48:641-8

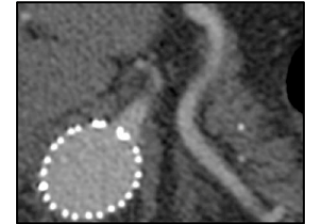
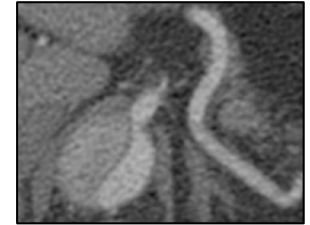


Images courtesy Stephan Haulon

PETTICOAT Technique

- **Provisional Extension To Induce Complete Attachment**
- Usually used in acute aortic dissection with uncovered stents to increase true lumen expansion and improve branch vessel perfusion
- Recent literature review showed TL expansion in all cases but variable alterations to FL size
- No evidence of short or mid-term survival benefit or positive remodelling of the false lumen

J Cardiovasc Surg 2017 Feb 9 [Epub ahead of print]



False Lumen Embolization

- Usually associated with TEVR to the level of the coeliac artery
- Achieves FL thrombosis in the thoracic aorta
- Does not restrict subsequent treatment strategies for the abdominal aorta (endovascular, open, hybrid)

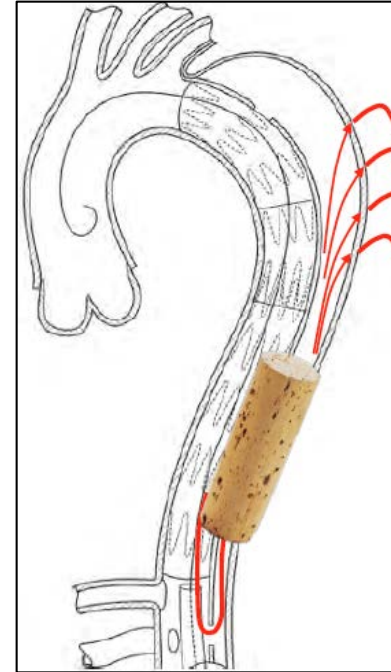


Image courtesy Tilo Kölbel

False Lumen Embolization

- Endotrash has been used in the false lumen for many years
- Reports have included the use of coils, plugs, glue, endograft components, IVC filters, detachable balloons

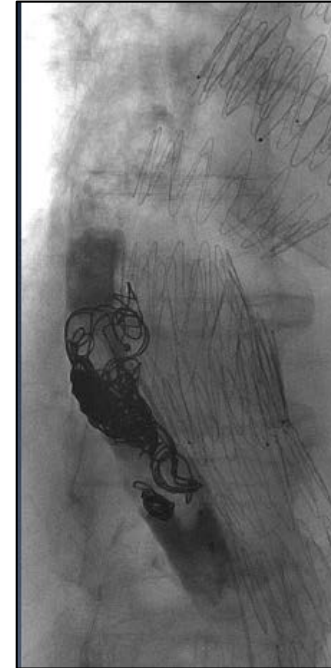
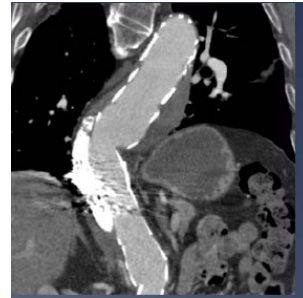


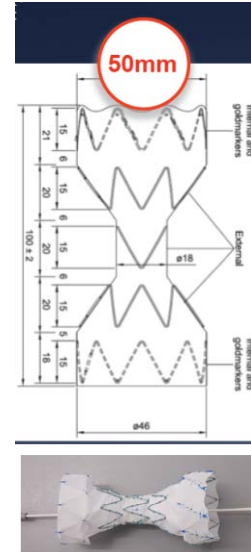
Image courtesy Tilo Kölbel

Candy Plug False Lumen Occlusion

- Device used to occlude a large calibre false lumen
- Central lumen of the device occluded with a large Amplatzer device or AUI occluder



22mm AUI Occluder



Candy Plug Sizing

True Lumen SG:

- Croissant-length
- No oversizing

FL candyplug:

- FL-diameter
- 10%-30% oversize
- 32-50mm



Candy Plug False Lumen Occlusion

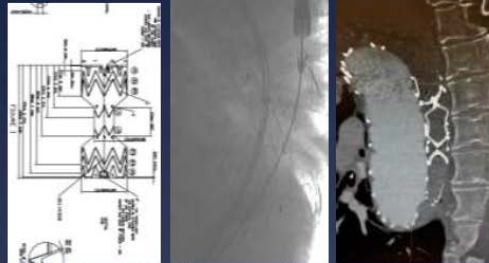
- Hamburg results 2013-2016
- 16 patients
- Technical success 100%
- Complete FL thrombosis @ 30 days 13/16
- Complete FL thrombosis @ 1 year 9/9 cases

Kölbel et al, J Endovasc Ther 2013;20:484-9



Other Candy Plug Devices

Bolton CMD-Candyplug



Courtesy of Dr. M Youssef, University of Mainz

Gore sm-Candyplug



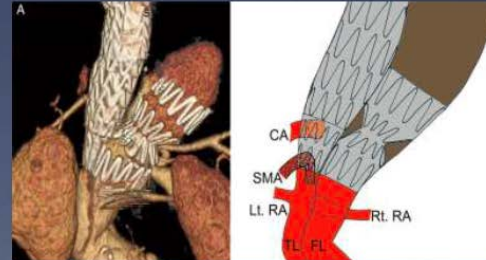
Ogawa et al. 2016; J Endovasc Ther 23:482-6

Medtronic sm-Candyplug



Courtesy of Prof. I-Hui Wu, National Taiwan University

Gore/Cook sm-Candyplug



Furukawa et al. 2016; Interact Cardiovasc Thorac Surg

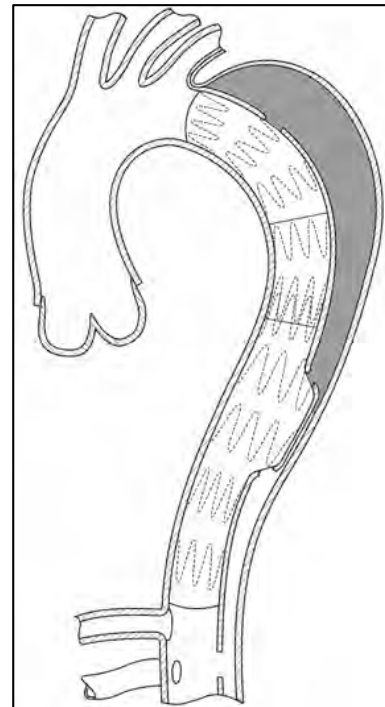
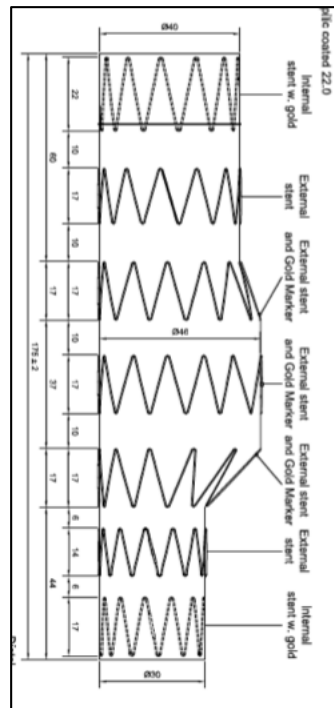
Image courtesy Tilo Kölbel

Knickerbocker Technique

- Customized graft component sized to the outer aortic diameter via a one sided graft bulge

Theoretical risks:

- Spinal cord ischemia
- False lumen rupture

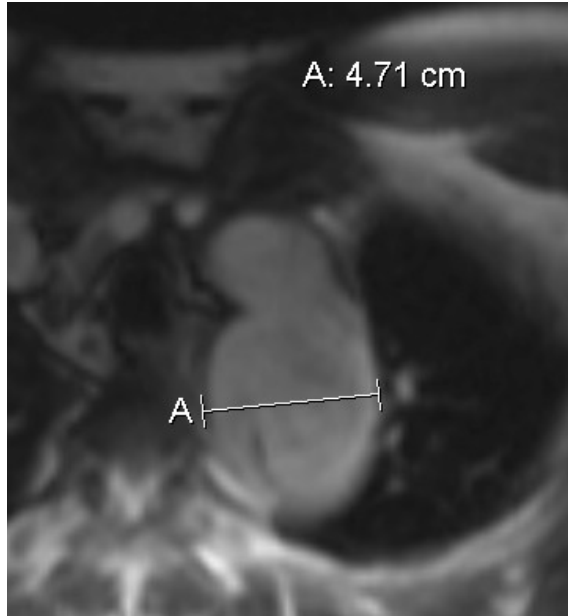


Knickerbocker Technique

- Experience includes Kölbel (Hamburg), Verzini (Perugia), van Rijswijk (Leiden), Wanhainen (Uppsala), Holden/Hill (Auckland)
- Hamburg results 2013-2016
- 15 patients
- Technical success 14/15 cases
- No complications, no SCI
- Complete FL thrombosis in all cases although 4 cases required additional embolization

Kölbel et al. 2014; J Endovasc Ther 21: 117-22

Knickerbocker – Auckland Experience



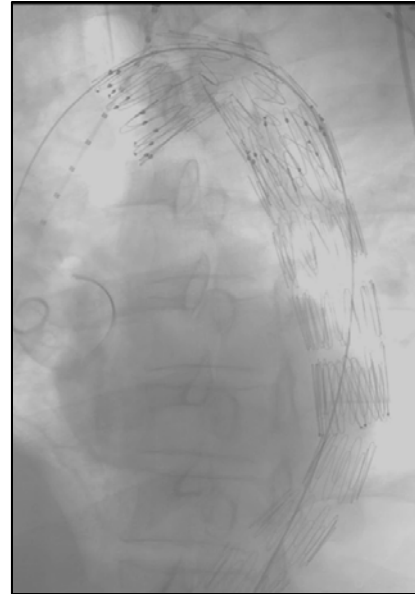
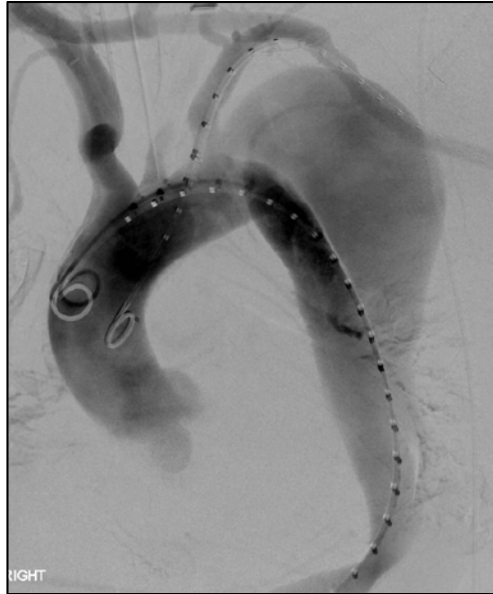
July 2010



March 2014

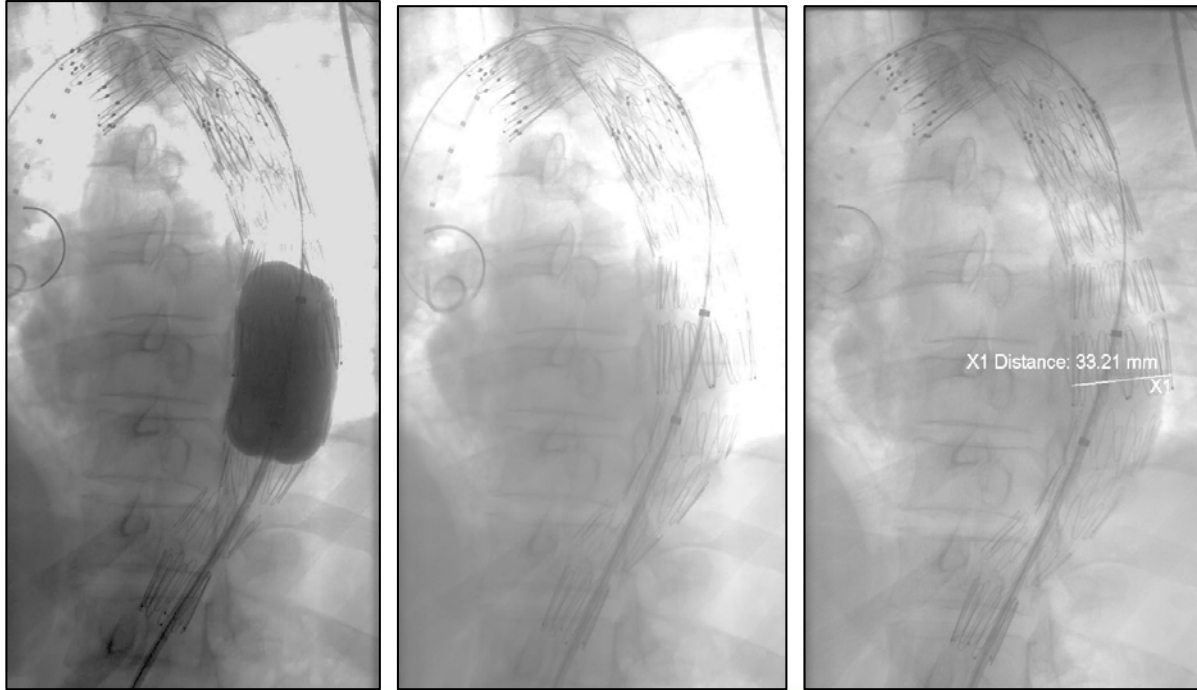
Knickerbocker – Auckland Experience

RCCA-LCCA-LScA debranch

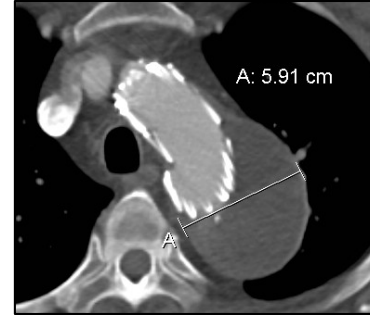
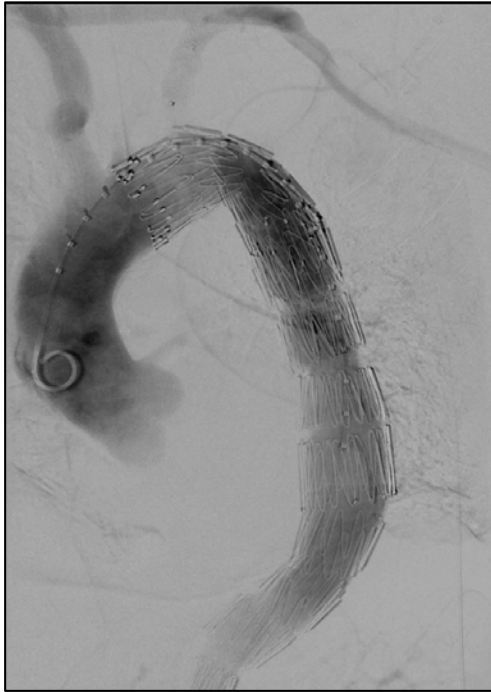


Knickerbocker – Auckland Experience

RCCA-LCCA-LScA debranch



Knickerbocker – Auckland Experience



6 months



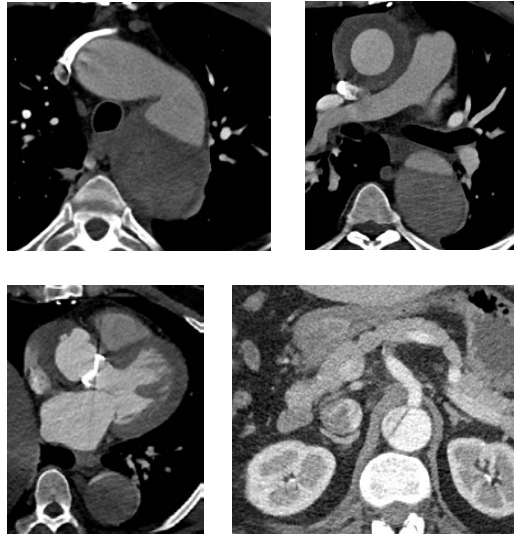
12 months

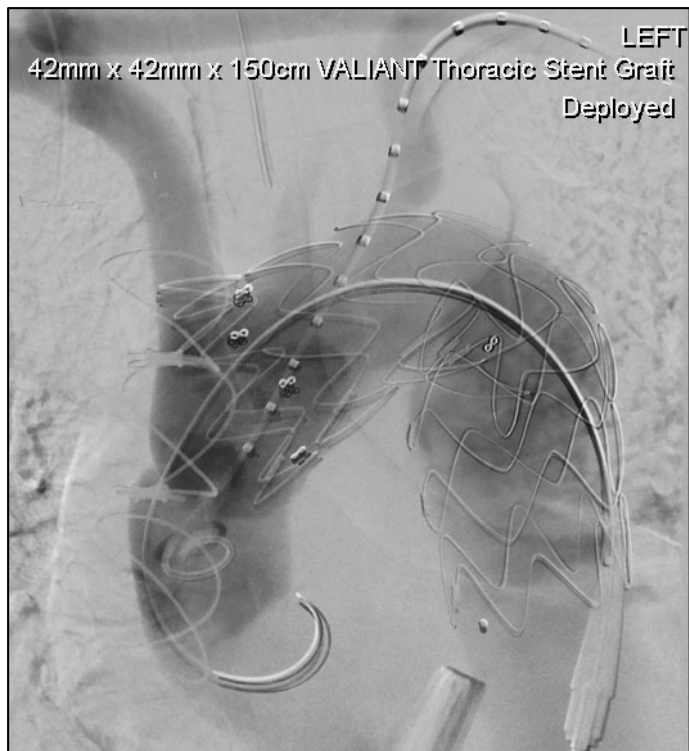
Knickerbocker – Auckland Experience

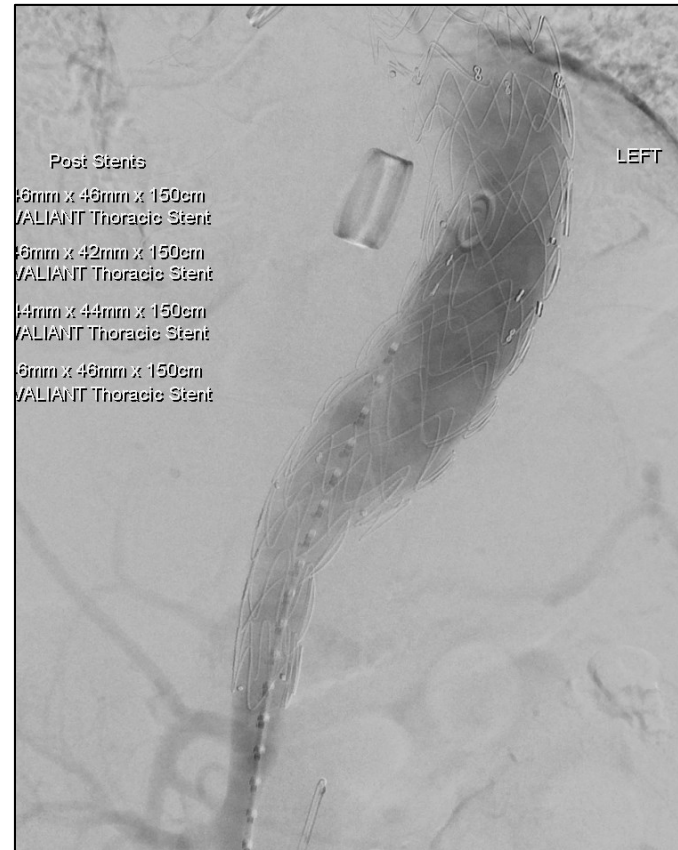
- Rather than a custom made Knickerbocker graft, we have performed a number of cases with conventional TEVR devices
- An endograft component is sized outer wall to outer wall in the distal descending thoracic aorta and post-dilated to exclude the false lumen
- The post-dilated segment needs to be at least 1 and preferably 2 stent elements above the distal landing zone to avoid acute coarctation

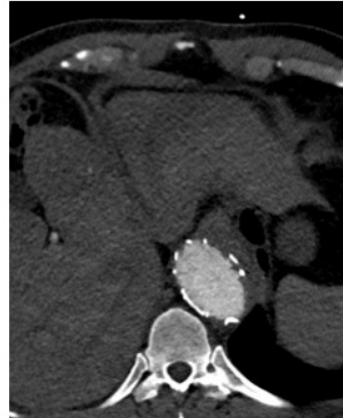
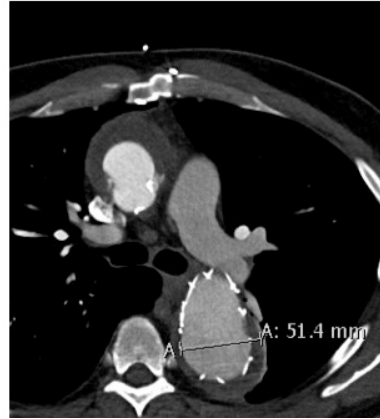
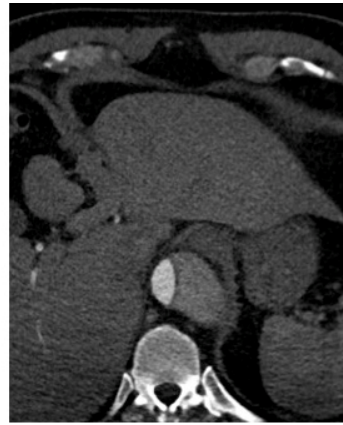
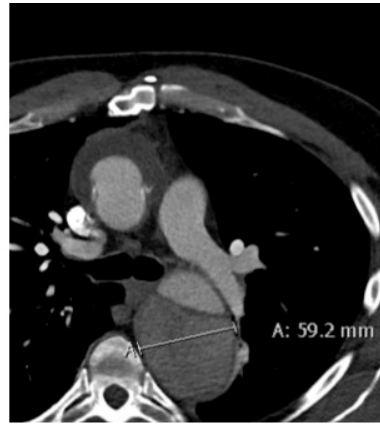
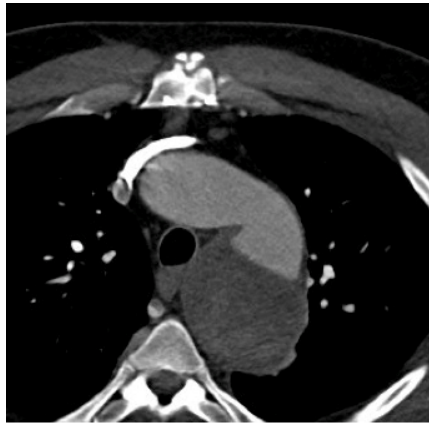
Knickerbocker – Auckland Experience

64 year old male, chronic TBAD, previous TAAD



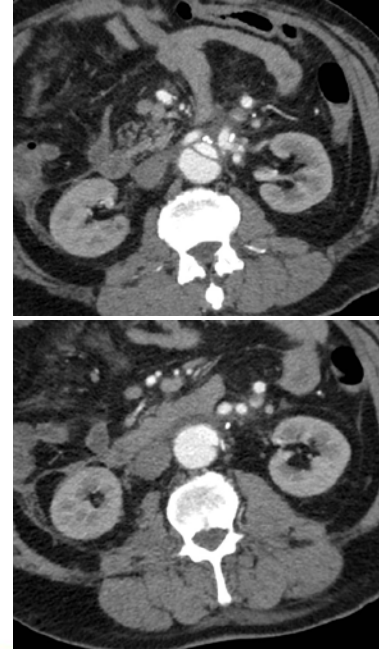
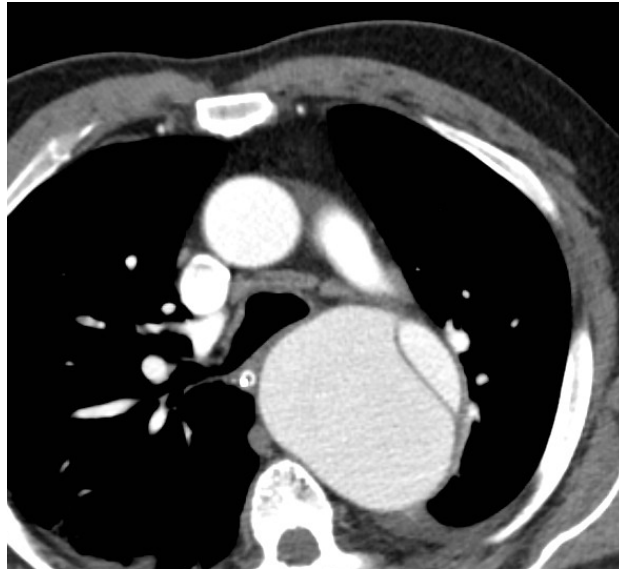






Knickerbocker – Auckland Experience

62 year male, chronic TBAD, open repair aorto-iliac arteries with ilio-visceral debranching



Knickerbocker – Auckland Experience



Knickerbocker – Auckland Experience



Advances
Problems
Solutions

13TH ANNUAL SCIENTIFIC MEETING OF

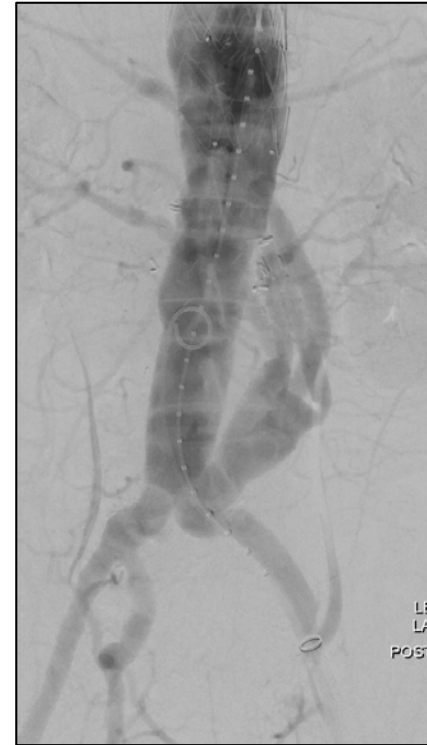
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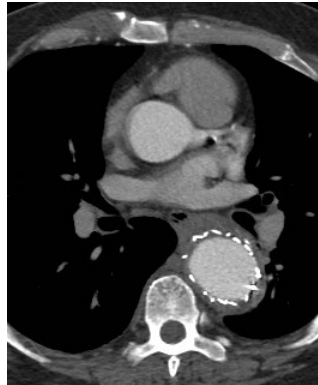
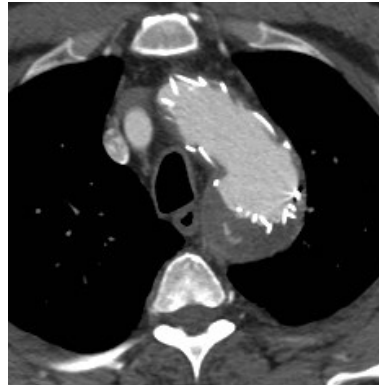
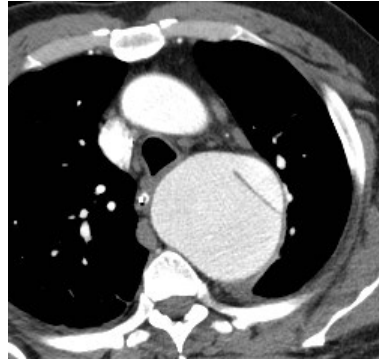
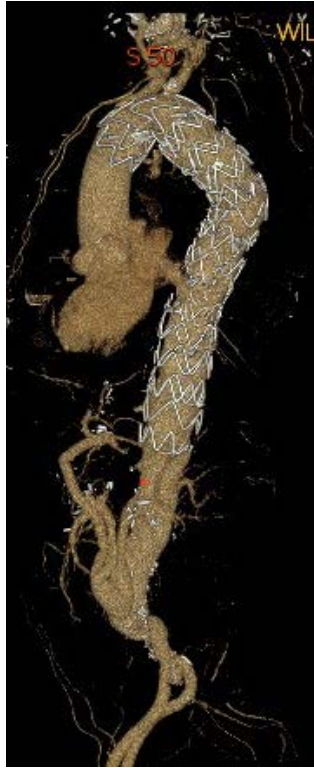


Joint Meeting of the
Interventional Radiology Society
of Australasia and the Vascular
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Knickerbocker – Auckland Experience

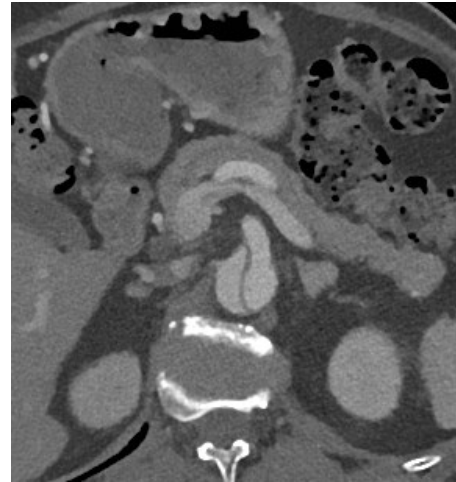
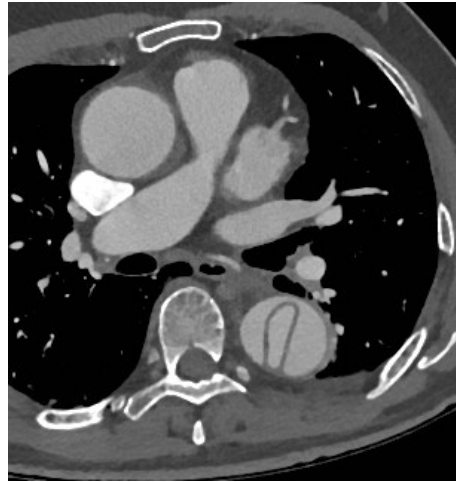


Knickerbocker – Auckland Experience



Knickerbocker – Auckland Experience

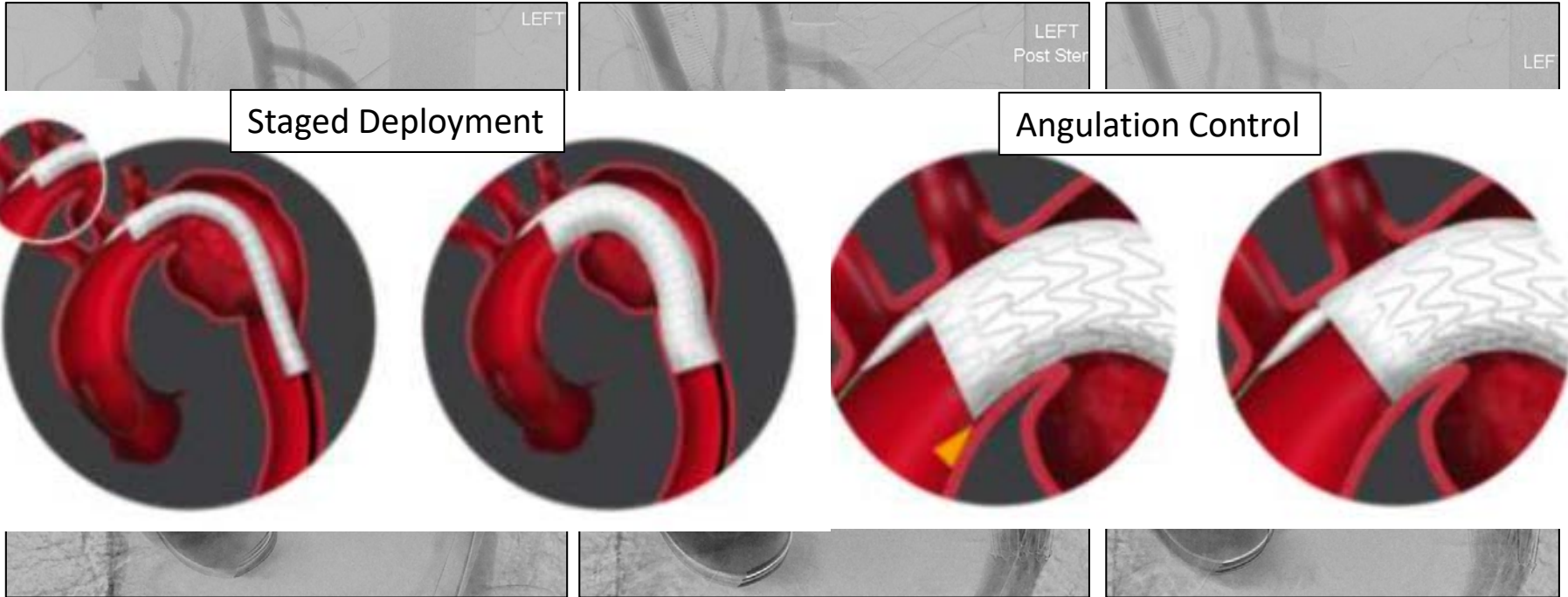
55 year female, chronic TBAD, progressive dilatation



Knickerbocker – Auckland Experience



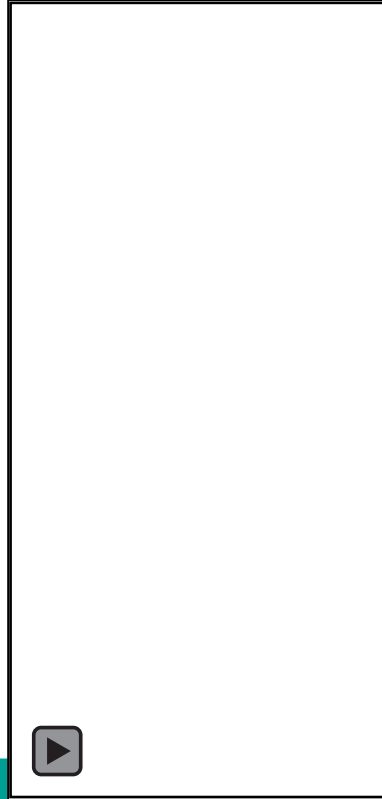
Knickerbocker – Auckland Experience



Knickerbocker – Auckland Experience

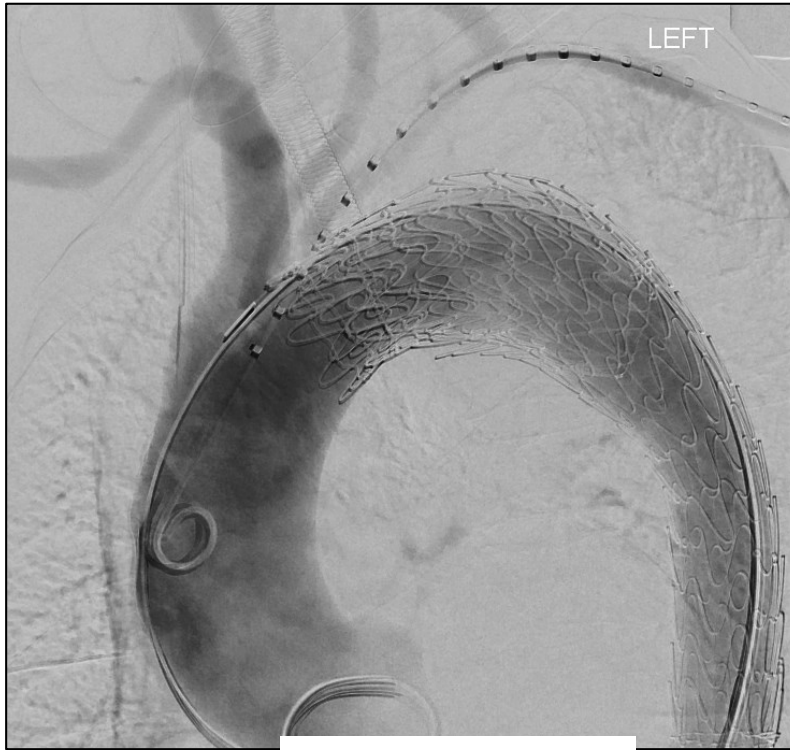


Knickerbocker – Auckland Experience



Need sheath support to prevent elongation and downward displacement

Knickerbocker – Auckland Experience

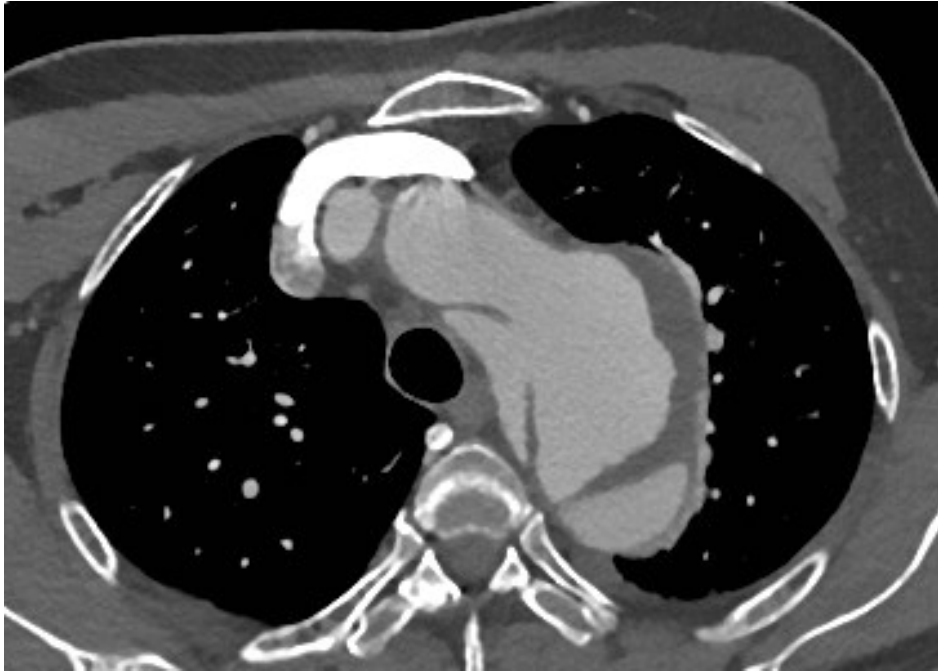


Pre-Knickerbocker



Post-Knickerbocker

Knickerbocker – Auckland Experience



CONCLUSIONS

- False lumen embolization and aortic remodelling is a strong predictor survival in chronic AD
- Complete endovascular repair with branch of fenestrated grafts may provide repair but the procedure is challenging and time - consuming
- Strategies to achieve FL embolization include the embolization with the Candy Plug device and the Knickerbocker technique
- The Knickerbocker Technique can be achieved with conventional endografts