When Should The Left Subclavian Artery Be Preserved?

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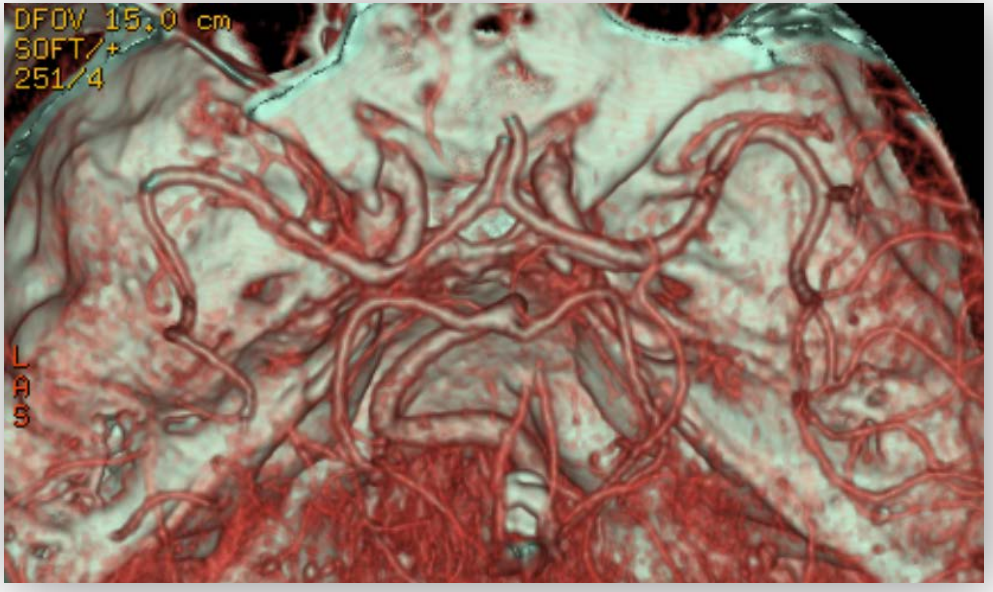
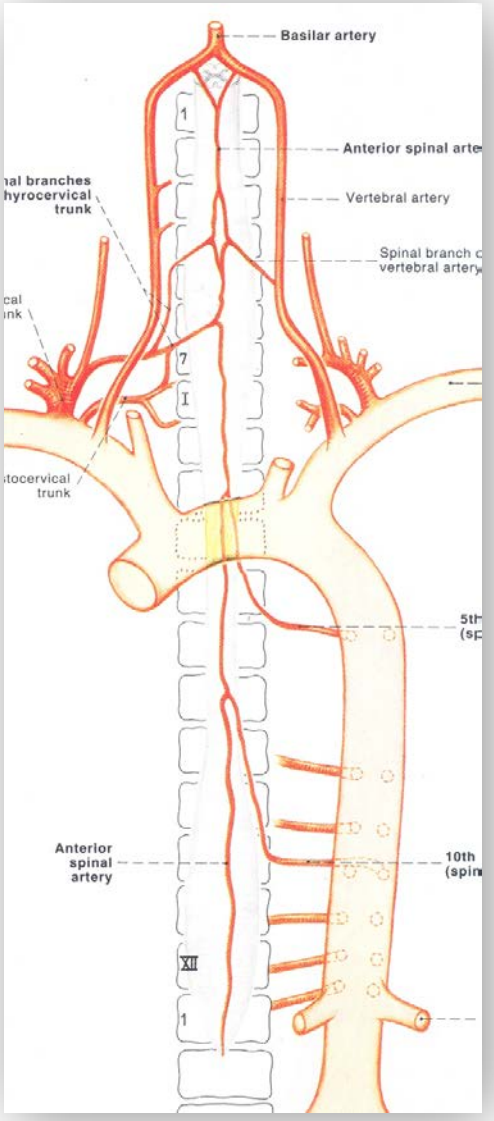
Is The LSCA Important?



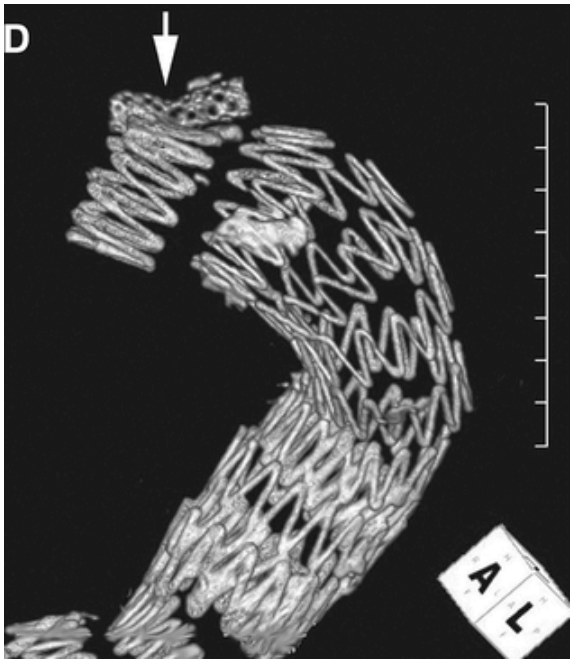


Sequelae of LSCA Coverage

- Arm ischaemia
- Subclavian Steal
- Paraplegia
- Stroke

Options

- Options for Preservation of the LSCA
  - Branched/fenestrated grafts
  - Chimney solutions
  - Carotid subclavian bypass
- Bypass
  - Routine
  - Selective
  - Only if symptomatic



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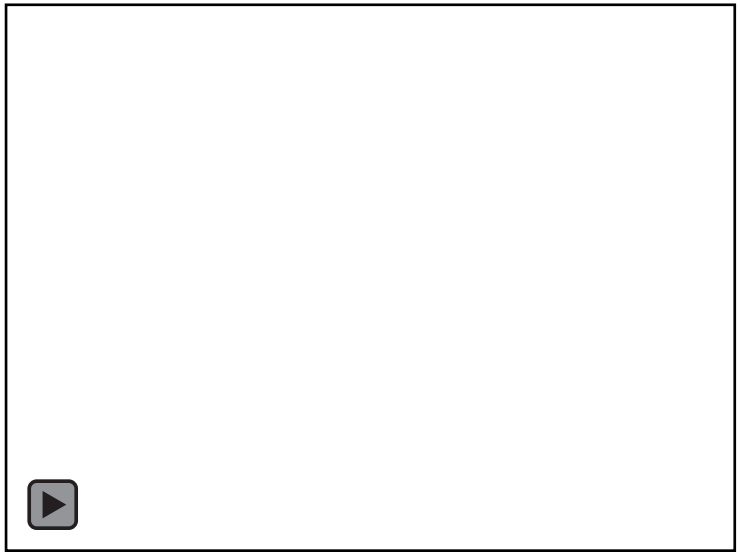

From the Society for Vascular Surgery

Left subclavian artery coverage during thoracic endovascular aortic repair and risk of perioperative stroke or death

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Introduction: Left subclavian artery (LSA) coverage during thoracic endovascular aortic repair (TEVAR) is often necessary due to anatomic factors and is performed in to up to 40% of procedures. Despite the frequency of LSA coverage during TEVAR, reported associations with risk of periprocedural stroke or death are inconsistent in reported literature.

LSA coverage was associated with increased 30-day risk of stroke (odds ratio [OR], 2.17)

Deaconess Medical Center, Boston[c]; and the Department of Epidemiology, Rollins School of Public Health, Emory University, Atlanta.[d]

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periprocedural stroke or death are inconsistent in reported literature. Sample size limitations, heterogeneity in patient selection criteria, and individualized device utilization patterns make generalization of findings related to the clinical impact of LSA coverage from single-center retrospective and industry-sponsored prospective studies challenging. The role of left subclavian revascularization during TEVAR likewise remains controversial. A 2009 consensus statement from the Society of Vascular Surgery described quality of existing evidence to guide performance of subclavian revascularization in patients undergoing TEVAR as "very low."[3] This same conclusion was also reached by the authors of a recent meta-analysis examining morbidity and mortality effects of LSA coverage during TEVAR, who suggested that improvement of the evidence base will require expansion of multicenter collaborative efforts to obtain sufficient numbers of patients and events necessary for more powerful analyses.[5]

LB2. Left Subclavian Artery Coverage during TEVAR Does Not Mandate Revascularization

Thomas Maldonado [1], David Dexter [1], Caron Rockman [1], Frank Veith [1], Mark Adelman [1], Neal Cayne [1], Frank Arko [2], Hernan Bertoni [3], Sharif Ellozy [4], William Jordan [5], Ronald Fairman [6], Joseph Bavaria [6], Charles Schwartz [1], Edward Woo [6]
[1] *Department of Surgery NYU Langone Medical Center, New York, NY;* [2] *Department of Surgery University of Texas Southwestern, Dallas, TX;* [3] *Departments of Interventional Radiology and Cardiovascular Surgery, University … York, NY;* [5] *Departm… of Pennsyl…*

No difference in stroke rate in patients with LSA covered vs. LSA covered and revascularised

OBJECT… …ubclavian Artery) … …nce."1 Our study a… …ts underg…

METHO… … Patient demogr… … recorded. Outcom… …was perform… …d with revascu…

RESULT… revascu… …, 5.3% p=.001) … …=.005) were sig… …vs. 5.4 p=.01), CA… …%F p=0.5) were significant predictors of CVA. Subgroup analysis showed no significant difference in outcome measures between Groups B and C (SCI (7.5% vs. 4.1% p=0.3), CVA (6.1% vs. 6.4%, p=0.9)). While female gender was predictive of CVA in all TEVAR patients, in subset analysis this was only true in female patients who underwent LSA revascularization (Group A: 5.6%M, 8.4%F p=.16; Group B: 6.6%M, 5.3%F p=0.9; Group C: 2.8%M, 11.9%F p=0.03). CVA and SCI rates were not significantly different between groups with regard to urgency, indications, and preoperative spinal drainage.

CONCLUSIONS: LSA coverage during TEVAR does not appear to confer an increased risk of SCI or CVA and thus should not mandate LSA revascularization. Selective LSA revascularization results in similar outcomes to the other cohorts studied and does not appear to be protective. Of note, LSA revascularization in females carries an increased risk of CVA and should be reserved for select cases.

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Review

How to manage the left subclavian artery during endovascular stenting of the thoracic aorta☆

Syed M. Rehman [a], Joshua A. Vecht [b], Ryan Perera [a], Rozh Jalil [a], Srdjan Saso [b], Jon R. Anderson [c], Ludwig Karl von Segesser [d], Thanos Athanasiou [a,b,*]

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Summary

We performed a systematic review of the literature to establish whether revascularisation of the left subclavian territory is necessary when this artery is covered by a stent. We retrieved data from 99 studies incorporating 4906 patients. Incidences of left-arm ischaemia (0.0% vs 9.2%, $p = 0.002$) and stroke (4.7% vs 7.2%, $p < 0.001$) were significantly less following revascularisation, although mortality (10.5% vs 3.4%, $p = 0.032$) and endoleak incidence (25.8% vs 12.6%, $p = 0.008$) were increased. No significant differences in spinal-cord ischaemia were seen. Revascularisation may reduce downstream ischaemic complications but can cause significant risk. Indications must be carefully considered on an individual patient basis.

Keywords: Anatomy; Aorta; Thoracic; Aortic surgery; Endovascular; Stents

1. Introduction

Thoracic aortic pathology has traditionally been treated by open surgery. The development of thoracic endovascular aortic repair (TEVAR) has introduced an attractive alternative with reported reduced morbidity and perioperative mortality [1]. Advantages such as negating the need for thoracotomy and aortic cross-clamping must be tempered by consideration of the complications. Management and, especially, stenting of the aortic arch present a specific challenge in view of the head-and-neck vessel origins because a key factor in the successful deployment of a stent is the provision of a suitable proximal landing zone (LZ), which should be at least 15–20 mm [2,3].

Endovascular management in the vicinity of the left subclavian artery (LSA) origin may necessitate incursion of that boundary to create an adequate LZ. Stents have, therefore, been deployed partially or completely across the LSA origin. The LSA is not only the main source of perfusion of the left arm but also the origin of three important branches: the left internal mammary artery (LIMA), the vertebral artery and the costocervical trunk. The LIMA is the preferred donor conduit for coronary artery bypassing. The vertebral artery supplies the posterior part of the circle of Willis with the basilar artery and also contributes to spinal-cord perfusion via the anterior spinal and posterior spinal arteries. The costocervical trunk can also contribute to spinal-cord perfusion [3].

As a result, LSA coverage has been associated with downstream ischaemic complications such as left-arm ischaemia, spinal-cord ischaemia and stroke [2–4]. Myocardial ischaemia in patients with LIMA to coronary artery bypass graft (CABG) has also been reported. However, coverage of the LSA origin has also been shown to be complication-free with no downstream ischaemic consequences [3].

To prevent or to treat coverage complications, it is possible to revascularise the LSA territory, before or after TEVAR, respectively, usually by LSA to left-carotid-artery bypass or transposition [5]. The revascularisation itself is associated with mortality and morbidity such as nerve injury, graft infection, lymphatic leakage and stroke [6].

The optimal management of the LSA in the context of TEVAR, therefore, remains unclear and guidelines do not exist, especially with regard to the revascularisation requirement.

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E-mail addresses: t.athanasiou@imperial.ac.uk, tathan5253@aol.com (T. Athanasiou).

99 studies incorporating 4906 patients

LSA revacularisation decreased stroke (4.7% vs 7.2%) and arm ischaemia (0 vs 9%) BUT increased mortality (10.5% vs 3.4%) and endoleak (25.8% vs 12.6%)

CONTROVERSIES & UPDATES IN VASCULAR SURGERY
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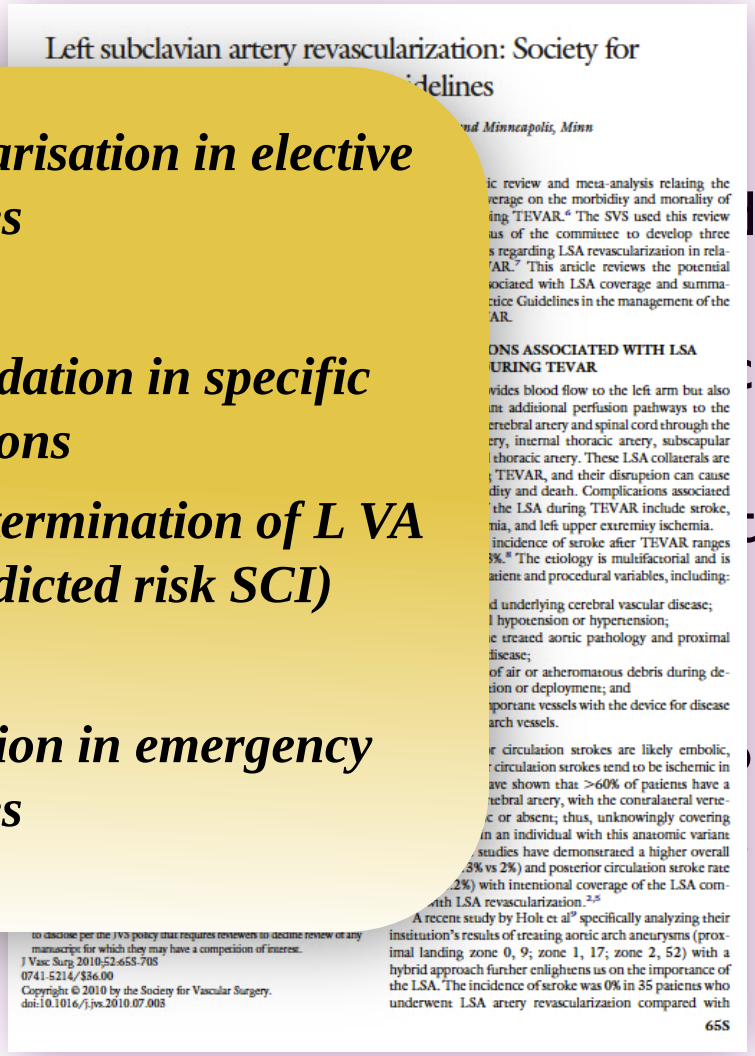
Recommendations: *Management of the L SCA*

Recommend revascularisation in elective cases

Stronger recommendation in specific situations

(LIMA, absent R VA, termination of L VA in PICA, high predicted risk SCI)

Individualised decision in emergency cases



Left subclavian artery revascularization: Society for
delines

nd Minneapolis, Minn

ic review and meta-analysis relating the
verage on the morbidity and mortality of
ing TEVAR.[6] The SVS used this review
us of the committee to develop three
s regarding LSA revascularization in rela-
AR.[7] This article reviews the potential
ociated with LSA coverage and summa-
ctice Guidelines in the management of the
AR.

**ONS ASSOCIATED WITH LSA
URING TEVAR**

vides blood flow to the left arm but also
nt additional perfusion pathways to the
erebral artery and spinal cord through the
ery, internal thoracic artery, subscapular
thoracic artery. These LSA collaterals are
; TEVAR, and their disruption can cause
dity and death. Complications associated
the LSA during TEVAR include stroke,
nia, and left upper extremity ischemia.
incidence of stroke after TEVAR ranges
3%.[8] The etiology is multifactorial and is
atient and procedural variables, including:

d underlying cerebral vascular disease;
l hypotension or hypertension;
e treated aortic pathology and proximal
disease;
of air or atheromatous debris during de-
tion or deployment; and
portant vessels with the device for disease
arch vessels.

r circulation strokes are likely embolic,
circulation strokes tend to be ischemic in
ave shown that >60% of patients have a
ebral artery, with the contralateral verte-
c or absent; thus, unknowingly covering
n an individual with this anatomic variant
studies have demonstrated a higher overall
.3% vs 2%) and posterior circulation stroke rate
.2%) with intentional coverage of the LSA com-
ith LSA revascularization.[2,5]
A recent study by Holt et al[9] specifically analyzing their
institution's results of treating aortic arch aneurysms (prox-
imal landing zone 0, 9; zone 1, 17; zone 2, 52) with a
hybrid approach further enlightens us on the importance of
the LSA. The incidence of stroke was 0% in 35 patients who
underwent LSA artery revascularization compared with

to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a competition of interest.

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lence equivocal

e of risk / benefit

o decrease stroke and SCI

mplications of revascularisation

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What Does This Mean in Practice?

- Selected cohort studies show revascularisation is associated with reduced stroke rate
- But possible association with increased mortality and endoleak
- Need to define sub groups who will benefit most (and least) from revascularisation

Medtronic Endovascular Thoracic Registry (MOTHER)

	N=1010	Years	Indication
Valor	359	2003-11	TAA : Talent
Valor II	160	2006-14	TAA: Valiant
Instead	68	2002-7	Chronic type B dissection: Talent
Captivia	100	2010-13	All indications: Valiant
Virtue	100	2006-12	Acute and chronic type B dissection: Valiant
SGVI	217	1999-2010	All indications: Talent / Valiant

MOTHER: *30 day outcomes*

Elective	TAA (n- 625)	B-CD (n-179)	B-AD (n-0)
Death (%)	33 (5%)	6 (3%)	-
Stroke (%)	34 (5%)	3 (2%)	-
SCI (%)	30 (5%)	6 (3%)	-

MOTHER: *30 day outcomes*

Elective	TAA (n- 625)	B-CD (n-179)	B-AD (n-0)
Death (%)	33 (5%)	6 (3%)	-
Stroke (%)	34 (5%)	3 (2%)	-
SCI (%)	30 (5%)	6 (3%)	-

Non-Elective	TAA (n- 38)	B-CD (n-15)	B-AD (n-114)
Death (%)	7 (18%)	2 (13%)	13 (11%)
Stroke (%)	2 (5%)	1 (7%)	7 (6%)
SCI (%)	4 (11%)	0 (0%)	2 (2%)

Multivariate Analysis for SCI

Covariate	P-value	OR	CI
Female gender	0.047	2.1	1.0-4.6
Tobacco use	0.034	3.2	1.1-9.5
Previous CVA	0.056	2.3	1-5.2
Emergency admission	0.014	4.4	1.4-14.4
Number of devices	0.000	1.2*	1.1-2.1

*** Per device used**

Multivariate Analysis for Stroke

Covariate	P-value	OR	CI
Female gender	0.024	2.4	1.1-5.3
Renal insufficiency	0.036	2.1	1.1-4
Previous CVA	0.013	2.9	1.3-6.5
Coverage of the LSA without revascularisation	0.002	3.3	1.6-7.2
Number of devices	0.000	1.2*	1.3-2.0

*** Per device used**

Multivariate Analysis for Stroke

Covariate	P-value	OR	CI
Female gender	0.024	2.4	1.1-5.3
Renal insufficiency	0.036	2.1	1.1-4
Previous CVA	0.013	2.9	1.3-6.5
Coverage of the LSA without revascularisation	0.002	3.3	1.6-7.2
Number of devices	0.000	1.2*	1.3-2.0

*** Per device used**

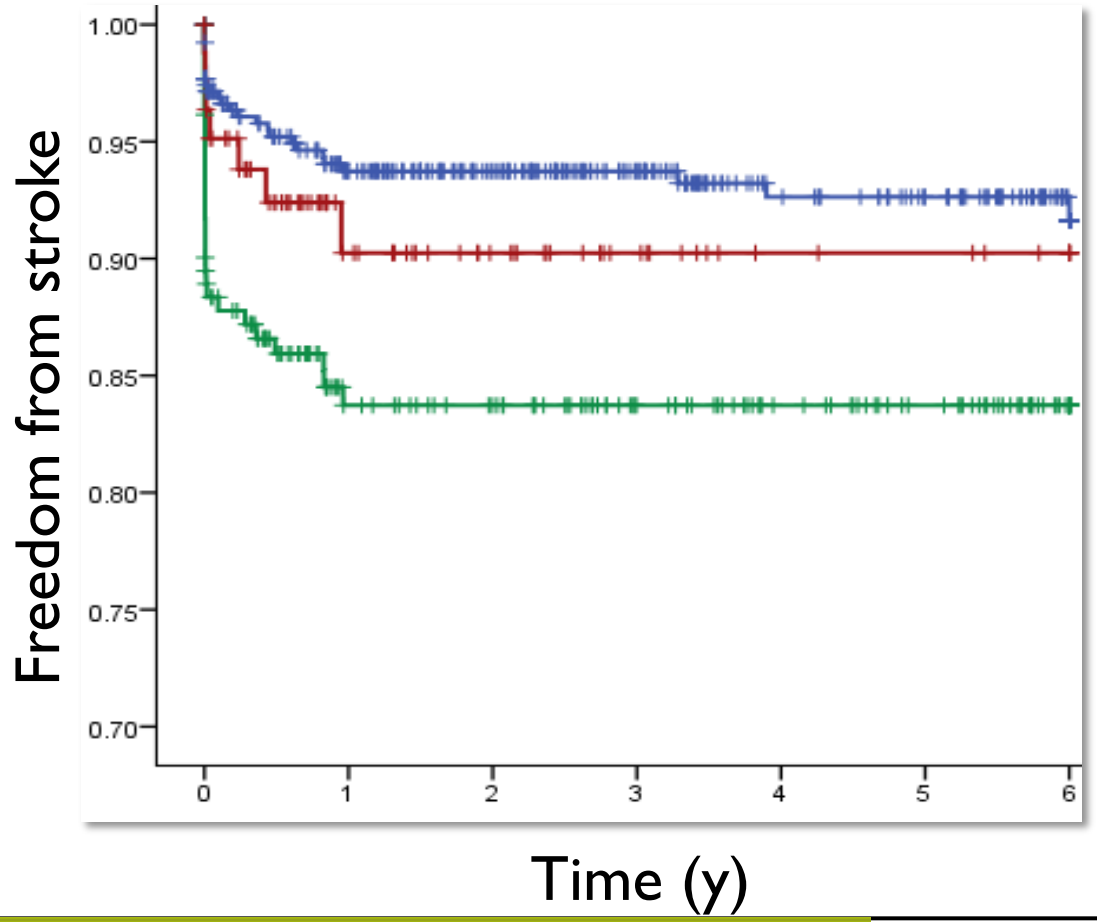
Major 30 day Outcomes and LSCA

	LSA uncovered	LSA Covered Not revasc	LSA Covered Revasc	p
Number	537	322	143	
Death (%)	31 (5.8)	22 (6.8)	10 (7)	0.769
Stroke (%)	12 (2.2)	29 (9)	7 (4.9)	0.000
SCI (%)	27 (5)	13 (4)	2 (1.4)	0.155

Major 30 day Outcomes and LSCA

	LSA uncovered	LSA Covered Not revasc	LSA Covered Revasc	p
Number	537	322	143	
Death (%)	31 (5.8)	22 (6.8)	10 (7)	0.769
Stroke (%)	12 (2.2)	29 (9)	7 (4.9)	0.000
SCI (%)	27 (5)	13 (4)	2 (1.4)	0.155

Mid Term Stroke: *TAAA and LSCA*



LSA Uncovered
Covered/revascularised
Covered

Stroke: p = 0.002

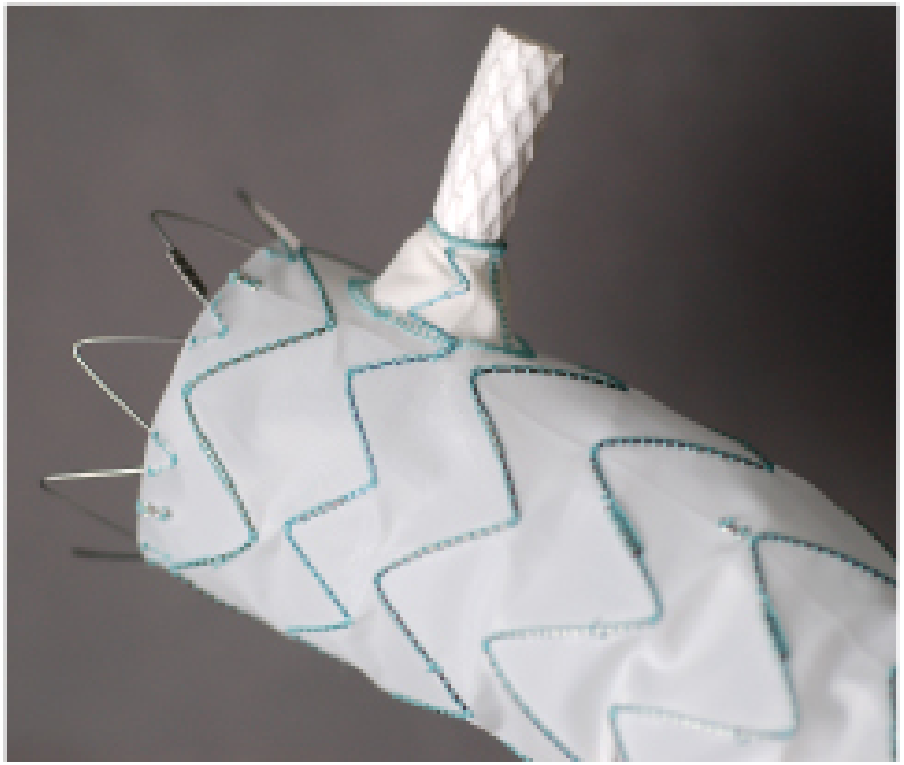
Summary: *Lessons from MOTHER*

- TAAA associated with higher risk of perioperative and long term stroke
- Relative protection from LSCA preservation is maintained
- Lesser benefit in terms of SCI
- Other risks relate to disease/presentation

Thoracic Branch Programme

Thoracic Branch Challenges

- Short seal zone
- Conformability
- Arch movement
- Durability
- May not mitigate embolic risk



Summary: *When Should the LSCA be Preserved?*

- Most elective cases (aneurysms>dissections)
- More important for stroke prevention than SCI
- Absolute indication: LIMA graft
- Dominant left vertebral
- Each case should be assessed individually on basis of overall net risk and benefit
- Branched grafts may shift that balance