How to Manage the LSA

When to Revascularise and When Not?

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Disclosures

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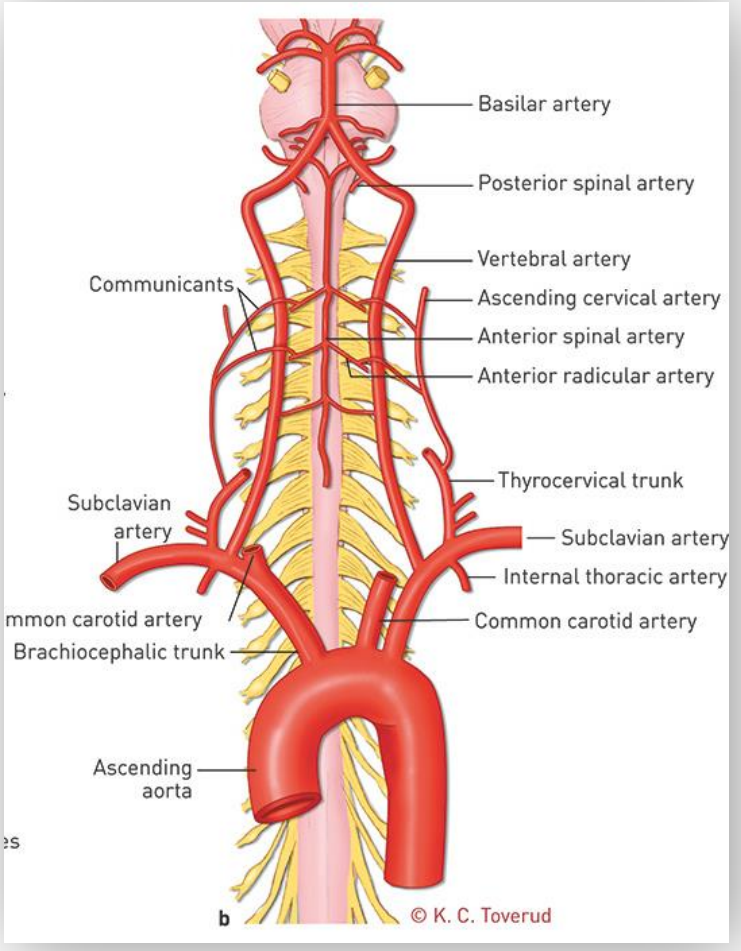
Management of LSA – Revascularise or Not ??

- **40% TEVR involve landing in Zone 2**
  - **Absolute indications(arm ischaemia / LIMA)**
  - **Relative indications (SCI and stroke)**
- **Balance of risks (intervention *vs.* complications)**



Spinal Cord Ischaemia and TEVR

- Pathogenesis incompletely understood
- Heterogenous presentation / aetiology
  - TAA > TAD
- Longer coverage increases risk (OR 1.2 / device)
- LSA revascularisation in extensive aortic coverage

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2012;19:37–43 37

◆ CLINICAL INVESTIGATION

Mechanisms of Symptomatic Spinal Cord Ischemia After TEVAR: Insights From the European Registry of Endovascular Aortic Repair Complications (EuREC)

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Purpose: To test the hypothesis that simultaneous closure of at least 2 independent vascular territories supplying the spinal cord and/or prolonged hypotension may be associated with symptomatic spinal cord ischemia (SCI) after thoracic endovascular aortic repair (TEVAR).

Methods: A pattern matching algorithm was used to develop a risk model for symptomatic SCI using a prospective 63-patient single-center cohort to test the positive predictive value (PPV) of prolonged intraoperative hypotension and/or simultaneous closure of at least 2 of 4 the vascular territories supplying the spinal cord (left subclavian, intercostal, lumbar, and hypogastric arteries). This risk model was then applied to data extracted from the

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Available at www.jevt.org

- **Single center model – validated EuREC**
- **4 aortic "segments" (LSA, thoracic aorta, abdominal aorta, hypogastric)**
- **SCI: coverage > 1 aortic segment**
- **"these results further emphasize the need to preserve the left subclavian artery during TEVAR"**

Spinal Cord Ischaemia and TEVR

- LSA revascularisation in extensive aortic coverage
- Adjunctive measures equally important
- Manipulation of MAP
- Spinal drainage
- Medication (BP, clopidogrel)

LSA Coverage – Key Questions Stroke

- **Stroke rate proximal landing zone 2:**

LSA covered vs covered and revascularized

- **Sub group analysis to define patients who derive benefit**

- **Understand what LSA revascularization is preventing**

MOTHER Registry

From the Society for Vascular Surgery

Management of the left subclavian artery and neurologic complications after thoracic endovascular aortic repair

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Objective: Thoracic endovascular aortic repair (TEVAR) of various pathologies has been associated with periinterventional neurologic complication rates of up to 15%. The objective of this study was to determine the influence of the management of the left subclavian artery (LSA) on neurologic complications and to define subgroups that might benefit from LSA revascularization.

Methods: The Medtronic Thoracic Endovascular Registry (MOTHER; Medtronic, Santa Rosa, Calif), consists of data from five sponsored trials and one institutional series incorporating 1010 patients undergoing TEVAR from 2002 to 2010. Perioperative stroke and spinal cord injury (SCI) rates were described according to the management of the LSA and presenting pathology. Multivariate analysis was performed to determine factors associated with perioperative neurologic complications.

Results: Of 1002 patients included in the analysis, stroke occurred in 48 (4.8%), and SCI developed in 42 (4.2%) ≤30 days of surgery. The stroke rate was 2.2% in patients with no coverage of the LSA vs 9.1% with coverage alone and 5.1% in patients who underwent LSA revascularization before coverage ($P < .001$). This relationship was strongest in the aneurysm group. Coverage of the LSA without revascularization was independently associated with stroke (odds ratio [OR], 3.5; 95% confidence interval [CI], 1.7-7.1), specifically in the posterior territory (OR, 11.7; 95% CI, 2.5-54.6), as was previous cerebrovascular accident (OR, 7.1; 95% CI, 2.2-23.1; $P = .001$), whereas a covered LSA was not associated with an increased risk of SCI.

Conclusions: Coverage of the LSA without revascularization is an important modifiable risk factor for stroke in patients undergoing TEVAR for a thoracic aortic aneurysm. Prior revascularization appears to protect against posterior circulation territory stroke. (J Vasc Surg 2014;60:1491-8.)

Endovascular surgery is now the treatment of choice for much of the pathology of the descending thoracic aorta. The early mortality benefits observed compared with open surgical repair are clear, but further refinement of some elements of the operative technique is required to reduce the incidence of serious morbidity.[1,2]

Coverage of the left subclavian artery (LSA) is often necessary to establish an adequate landing zone in patients undergoing thoracic endovascular aortic repair (TEVAR. Not revascularizing the LSA was previously considered safe, but as further data have emerged, there have been concerns that reduction of flow through the left vertebral artery may increase the risk of postoperative stroke and spinal cord ischemia.[3-6] Guidelines for practice have been recommended by the Society for Vascular Surgery (SVS), but it has been acknowledged that these were based on poor-quality literature.[7]

An adequately powered study is required to define whether coverage of the LSA confers an additional risk of neurologic complication. Defining any subgroups of patients who would derive benefit from selective LSA revascularization is important from a clinical perspective. This report from the Medtronic Thoracic Endovascular Registry (MOTHER; Medtronic, Santa Rosa, Calif) database describes how the management of the LSA may influence neurologic events after TEVAR and gives some insight into the etiology of these complications.

METHODS

Trials. The MOTHER registry contains the data from five prospective trials combined with institutional data from one center, St George's Vascular Institute (SGVI). The

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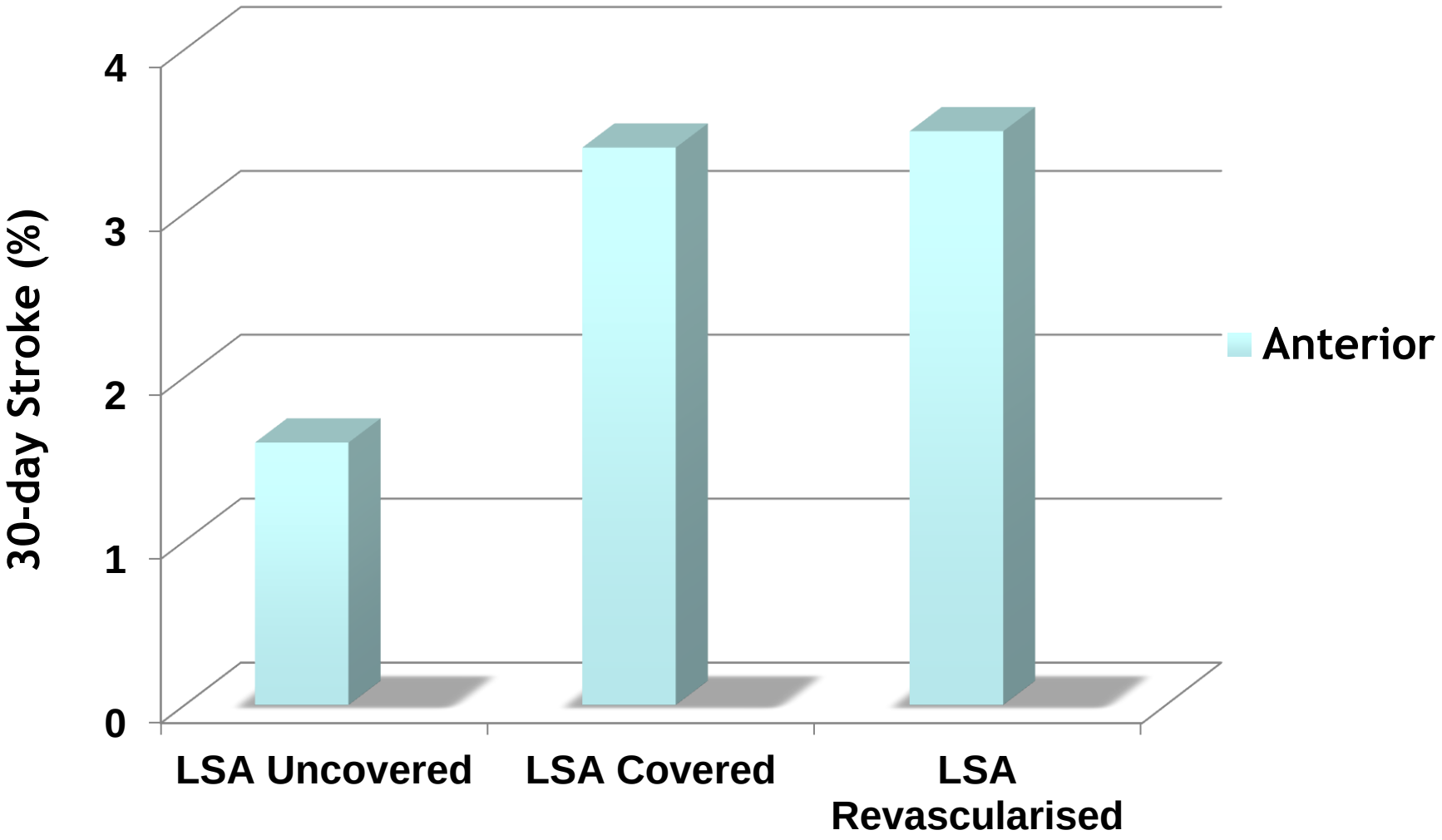
- **Registry of > 1000 TEVR**
- **Prospective data collection**
- **Adjudicated major adverse events (MAE)**
- **Long-term outcomes**
- **Sub-group analysis**

Analysis by Management of LSA

	Not Covered (n=537)	Covered Not revascularised (n=322)	Covered revascularised (n=143)	P - value
Death (%)	31 (5.8)	22 (6.8)	10 (7)	*0.769*
Stroke (%)	12 (2.2)	29 (9)	7 (4.9)	*0.000*
SCI (%)	7 (5)	13 (4)	2 (1.4)	*0.155*

Patterson et al Circ 2013; 127;24-32

Effect of Management LSA – Anterior vs. Posterior Stroke



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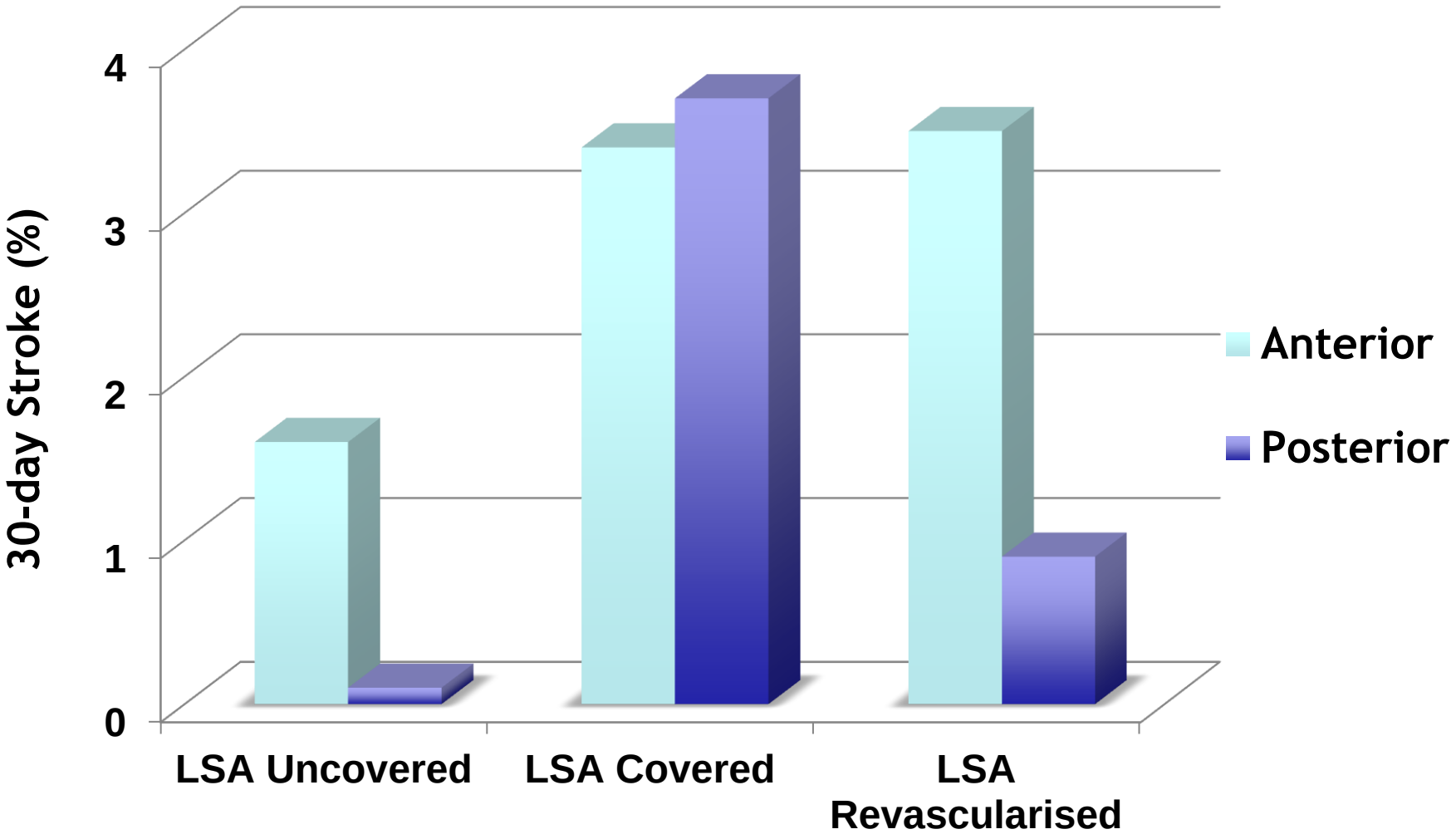
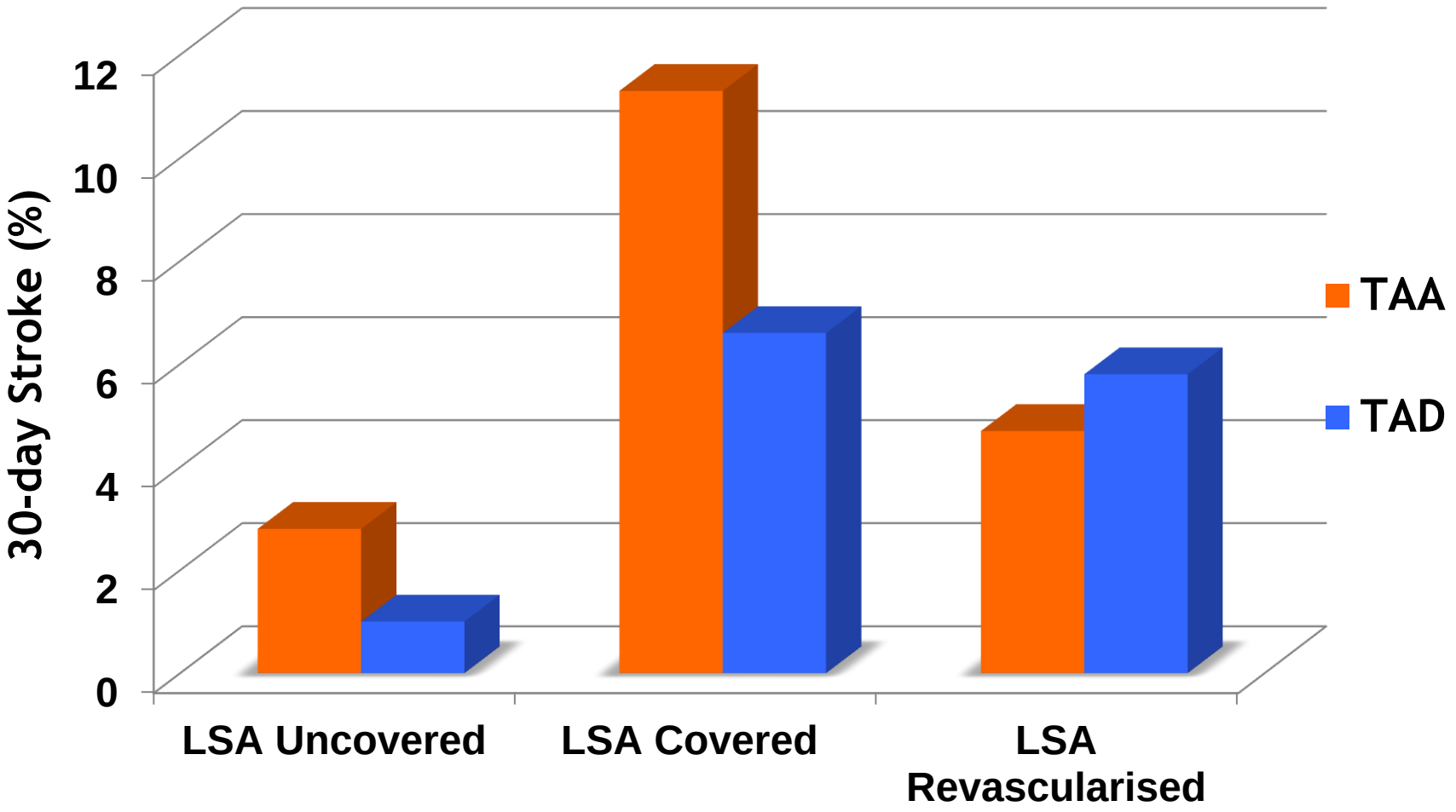
Effect of Management LSA – Anterior vs. Posterior Stroke



Effect of Management LSA – TAA and TAD



Logistic Regression Stroke (TAA)

Covariate	P-value	OR	Upper CI	Lower 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	<0.001	1.2*	1.3	2.0

Balance of Risk LSA Revascularisation

- Literature difficult to unpick
- Synchronous / staged procedures
- Hetrogenicity in pathology / presentation
- LSA revascularisation + TEVR – 9-10% stroke / 7% death
- Surgical component - 2% stroke / 1% mortality

Madenci et al J Vasc Surg 2013;57:1275-82

Scali et al J Vasc Surg 2013

Branch Grafts in the Arch – High Stroke Risk ??

- Cook Arch - 38 patients
- 6 technical failures
- Cerebrovascular Cx– 15.8%

Haulon et al JTCVS 2014; 148: 1709

Branch Grafts in the Arch – High Stroke Risk ??

- Cook Arch - 38 patients
- 6 technical failures
- Cerebrovascular Cx– 15.8%
- **Medtronic Mona LSA - 10 patients**
- **0 technical failures**
- **Non disabling strokes 3/10**

Haulon et al JTCVS 2014; 148: 1709

Arko, Roselli, Thompson 2014

Management LSA - Stroke

- Revasculsrise most cases - large amount of collateral territory to give up
- Thoracic aneurysms (cf. dissections)
- High clinical risk (female, renal failure, CVA, extensive TAA)
- Any suggestion of inadequate R VA