Why Prophylactic CSF Drainage With eTAAA Repair is Not Benign: When to Used it and When Not?

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VEITH SYMPOSIUM

Faculty disclosures

G.S. Oderich

- **Consulting, research grants, scientific advisory board**
  WL Gore, Cook Medical Inc., GE Healthcare and Centerline Biomedical
- **Investigational use of devices**
  Cook Fenestrated and Branched Grafts
- **Special thank you**
  Research fellows: Lucas R. Kanamori MD, Bruno Schmid MD and Dora Babocs MD
  Research faculty: Ying Huang MD PhD
  Medical illustrations and graphics: David Factor and Chris Akers
  3D CTA Lab: Laura Ocasio MD and Thanila A. Macedo MD

2022 ACC/ AHA CLINICAL PRACTICE GUIDELINE

Recommendations for management of cerebrospinal fluid drainage (CSFD) during thoracoabdominal aortic aneurysm repair

CLASS 1A (VERY STRONG) — Benefit ≥ Risk

1. In patients undergoing **open TAAA repair** who are at high risk of SCI, CSF drainage is recommended to reduce the incidence of temporary SCI, permanent SCI, or both

CLASS 1B (STRONG) — Benefit ≥ Risk

2. In patients who experience **delayed SCI after either open or endovascular TAAA repair**, timely measures to optimize spinal cord perfusion and decrease intrathecal pressure are recommended

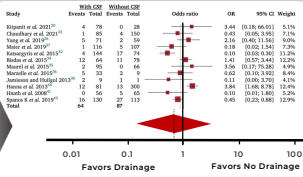
No recommendation for Routine use of Prophylactic CSFD during Fenestrated-Branched Endovascular TAAA Repair

American Heart Association.

Isselbacher E et al. Circulation and JACC 2022

Systematic review of the effect of CSF drainage on outcomes of endovascular TAA/TAAA repair

2,012 patients treated with or without prophylactic CSF drainage

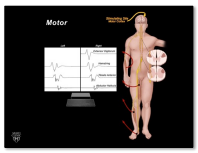


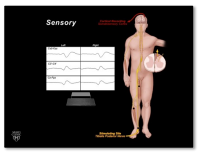
Incidence of spinal cord injury?

0.67 [0.23; 1.55]

Frankort J et al. Eur J Vasc Endovasc Surg 2021

Spinal cord injury preventive protocol





- Staged repair for Extent I-II TAAA
- Neuromonitoring
- **Routine CSF drainage**
- Permissive hypertension
- Early limb reperfusion
- TASP for persistent MEP changes

AMERICAN SURGICAL ASSOCIATION

141st VIRTUAL ANNUAL MEETING
APRIL 15-16, 2021

Mid-term outcomes of a prospective, non-randomized study to evaluate endovascular repair of complex aortic aneurysms using FB-EVAR

- 430 consecutive patients (70% TAAAs)
- Prophylactic CSFD used in 78%
- **Any SCI in 8%, paraplegia in 4% (permanent in 2%)**

Oderich G et al. Ann Surg 2021

CSF drainage practice changes

2007

All TAAAs (> 5cm supra-celiac coverage)
- Prophylactic CSFD
- Neuromonitoring
- Early reperfusion

CSF drainage practice changes

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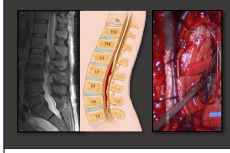
Hemorrhagic complications

2019

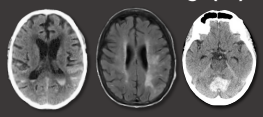
Hemorrhagic complications

Spine Hematoma (3%)



- **20%** of SCIs
- High index of suspicion (MRI)

Intracranial Hemorrhage (2%)



Subarachnoid | Parenchymal | Cerebellar

- **Fatal in 1**

Karkkainen JOderich J et al. J Vasc Surg 2019

Spinal drain complications

Author (Senior)	Journal, Year	n	Major complication	Intra-cranial Hemorrhage	Spine Hematoma	Non-Functional
Karkkainen et al. (Oderich)	JVS 2019	240	10%	**2%**	**3%**	-
Alcaim et al. (Schanzer)	JVS 2019	100	16%	**3%**	**0%**	**16%**
Kitpanit et al. (Schneider)	JVS 2020	78	8%	**3.9%**	**2.6%**	-
Jonsson et al. (Uppsala)	JVS 2023	147	12%	**4.1%**	**3.4%**	**17%**
Leone et al. (Meta-analysis)	JVS 2024	1,079	10.5%	**2.8%**	**1.4%**	**11.4%**

CSF drainage practice changes

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Hemorrhagic complications

2019

CSF drainage practice changes

2007

All TAAAs (> 5cm supra-celiac coverage)
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Task Force

Vascular surgery
Cardiac surgery
CV anesthesia
Neurology
Neurosurgery

Hemorrhagic complications

2019

Recommendations

- CSF drain placement by experienced, dedicated (2-3) CV anesthesia team
- No prophylactic CSF drainage, except patients with:
  - Occluded collaterals
  - Prior spinal cord injury
  - Difficult spine anatomy
- Rescue drain team (24x7) within 1h of symptom presentation

CSF drainage practice changes

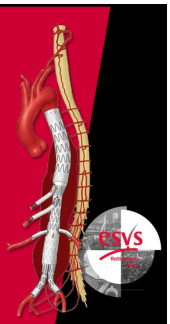
2024

	All patients n = 682	IDE Mayo n = 475	UTHealth n = 207	P Value
TAAA	477 (70)	318 (67)	173 (84)	<.001
Extent I to III	402 (59)	261 (55)	142 (69)	<.001
Prophylactic CSFD	97 (37)	69 (47)	28 (7)	<.001
30-day mortality	7 (1)	5 (1.1)	2 (1)	.80
Any SCI	39 (5.7)	27 (5.7)	12 (5.8)	.84
Permanent paraplegia	7 (1)	4 (0.8)	3 (1.4)	.26

Endovascular repair of Extent I-III TAAAs without prophylactic CSF drainage is safe with low rates of permanent paraplegia

Giulianna B. Marcondes MD[1], Emanuel R. Tenorio MD PhD[1], Nolan C. Cirillo-Penn MD[2], Bernardo Mendes MD[2], Donald. J. Adam MD[3], Carlos Timaran MD[4], Martin J. Austermann MD[5], Luca Bertoglio MD[6], Tomasz Jakimowicz MD[7], Michele Piazza MD[8], Maciej T. Juszczak MD[3], Bärbel Berekoven[5], Guilherme B. B. Lima MD[1] and Gustavo S. Oderich MD[1]

On Behalf of the Trans-Atlantic Aortic Research Consortium investigators



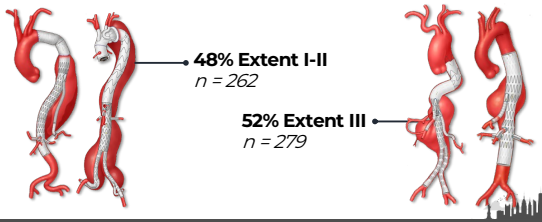
Annals of Surgery 2022

Aneurysm classification

541 patients

48% Extent I-II
n = 262

52% Extent III
n = 279



Marcondes G et al. Ann Surg 2023

30-day/ in-hospital outcomes

	Overall n = 541	Extent I-II n = 262	Extent III n = 279	P value
Mortality	15 (3)	5 (2)	10 (4)	0.2
Any major adverse event	70 (13)	42 (16)	28 (10)	**0.04**
Acute kidney injury	31 (6)	18 (7)	13 (5)	0.3
Any Spinal Cord Injury	**45 (8)**	**30 (12)**	**15 (5)**	**0.011**
Paraplegia	**22 (4)**	**15 (6)**	**7 (3)**	**0.06**
Respiratory failure	14 (3)	7 (3)	7 (3)	0.9
Myocardial infarction	10 (1.8)	4 (1.5)	6 (2)	0.8
Major stroke	9 (1.7)	7 (3)	2 (0.7)	0.1
Bowel ischemia w/ resection	2 (0.4)	0 (0)	2 (0.7)	0.5

Marcondes G et al. Ann Surg 2023

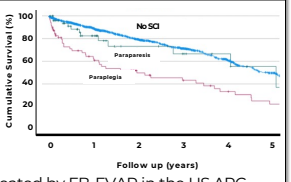
Rescue and neurological recovery

	Overall n = 541	Extent I-II n = 262	Extent III n = 279	P value
Rescue treatment	45 (8)	30 (12)	15 (5)	1
Permissive hypertension	45 (8)	30 (12)	15 (5)	1
Therapeutic CSFD	22 (4)	12 (5)	10 (4)	0.6
Symptom improvement	**33 (73)**	**23 (77)**	**10 (67)**	**0.5**
Permanent SCI	14 (3)	8 (3)	6 (2)	0.5
Paraparesis	2 (0.4)	0 (0)	2 (0.7)	0.5
Paraplegia	**12 (2)**	**8 (3)**	**4 (1.4)**	**0.3**
Any drain complication	7 (1.3)	4 (1.5)	3 (1.1)	0.7
Major drain complication	**2 (0.4)**	**2 (0.8)**	**0 (0)**	0.2

Marcondes G et al. Ann Surg 2023

ESVS 35th ANNUAL MEETING

28-29 September 2021 – Rotterdam, Netherlands



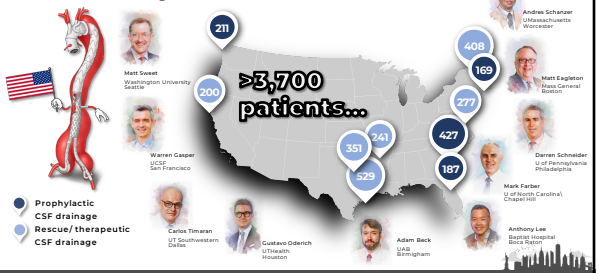
- 1,641 patients treated by FB-EVAR in the US ARC
- Patient **survival is similar among patients with no SCI and those with partial or reversible SCI**

Aucoin V (Beck A) et al. J Vasc Surg 2023

- **Pilot prospective randomized trial comparing prophylactic CSFD vs no drain (therapeutic rescue maneuver) for Extent I-IV TAAA**
- **10 patients on each arm**
- **Spinal hematoma requiring laminectomy in 1 patient**
- **Neurologic deficit 1/20 (5%)** in a patient in the prophylactic CSFD drainage arm due to hypotension on POD9 from GI bleeding

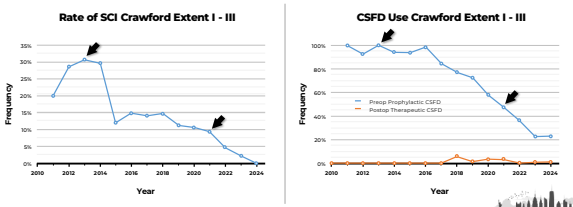
Blakeslee-Carter J et al. J Vasc Surg 2024

CSF Drain practice in U.S. ARC



KIRSO Annual Data Update, December 2023

Rate of SCI and Use of CSFD for Extent I-III TAAAs in the U.S. ARC



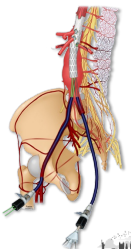
Rationale for avoiding prophylactic drains

1. ~90% of TAAA patients don't develop SCI without prophylactic drains – these patients are subjected to unnecessary risks of spinal drainage
2. If a prophylactic drain is used still ~10% of patients develop SCI
3. Not all drains work; in fact 16% don't!
4. ~70% of patients who develop SCI recover with rescue maneuvers including placement of a therapeutic drain

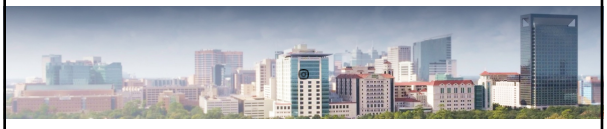
When to consider prophylactic CSF drainage

- Extent I-III TAAAs with:

  - Prior h/o spinal cord injury
  - Occlusion of collateral networks
  - Anticipated difficulty to place rescue drain
  - Inability to place rescue drains expeditiously



Thank You!



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