Iliac Artery Involvement Determines Optimal Therapy in Acute Uncomplicated Type B Aortic Dissection

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Disclosures

- Endospan: Consultant
- Gore: Consultant
- Medtronic: Speaker’s Bureau

Acute Uncomplicated Type B Aortic Dissection AUTBAD

- Optimal treatment is unknown

- OMT
  - In-Hospital Survival ∽95%
    - Fattori R et al. *JACC* 2013;61:1661-78
  - 5-year Intervention-Free Survival ≤50%
    - Lou X et al. *Ann Thorac Surg. 2018;105*(1):31-38.
    - Durham CA et al. *J Vasc Surg. 2015;* 61(5): 1192-1199

- TEVAR
  - Excellent Short-Term Results
    - Lou X et al. *Semin Thorac Cardiovasc Surg. 2023;35(2) 289-297.*
  - Balance Outcomes with Procedural Risks, Cost, Etc

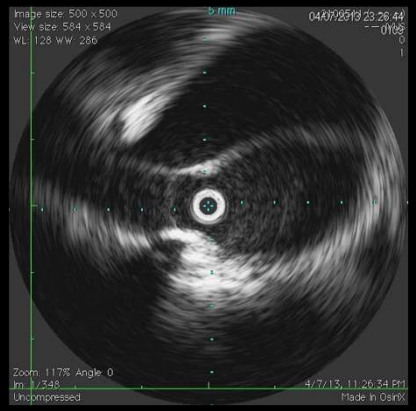
- Clinical Trials
  - IMPROVE-AD - USA
  - EARNEST - UK
  - SUNDAY - Scandinavia

Can We Predict OMT Failure in the Acute Phase?

TEVAR: Acute vs Chronic TBAD Dissection Flap Properties

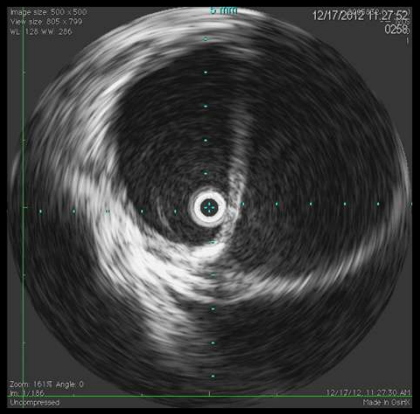
Acute TBAD

- Thin
- Compliant
- Mobile
- Less fenestrations



Chronic TBAD

- Thick
- Rigid
- Fixed
- More fenestrations



Anatomic Predictors of OMT Failure

- Aortic Diameter
  - Initial Aortic Diameter ≥ 40 mm is predictive of predictive of aortic enlargement ≥ 60 mm
  - Initial Aortic Diameter > 45 mm is predictive of aortic intervention or aortic-specific mortality

Marui A, et al. *Circulation* 1999;100:II-275-II-280.
Lou X, et al. *Ann Thorac Surg.* 2019;107: 493-8.

- False Lumen
  - Patent false lumen is an independent risk factor for increasing aortic diameter
  - Partially thrombosed false lumen is an independent predictor of mortality
  - False Lumen Diameter ≥ 22mm correlates with aneurysmal growth and mortality
  - Outflow
    - Viserals
    - Intercostals

Sueyoshi E, et al. *Circulation* 2004;110:II-256-II-261.
Tsai TTet al. *N Eng J Med* 2007;357:349-59.
Song JM et al. *J Am Coll Cardiol* 2007;50:799-804.
Sailer AM et al. *Circ Cardiovasc Imaging 2017;*.

- Primary Intimal Tear
  - PIT > 10mm is predictive of a rapid growth rate, dissection related events and mortality
  - PIT Location in Zone 3 is predictive of significant aortic growth compared to Zones 4&5

Evangelista A, et al. *Circulation* 2012;125:3133-3141.
Codner JA, et al. *J Vasc Surg.* 2019;69:692-700.

Anatomic Predictors of OMT Failure

- Review of 51 papers
- Consistent Evidence Across Studies
- Initial Aortic Size is Predictive of Adverse Events
- Complete FL Thrombosis is Protective

Current evidence in predictors of aortic growth and events in acute type B aortic dissection

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ABSTRACT

Objectives: Acute type B aortic dissection can have a stable course or evolve into aneurysm and subsequent adverse events. The aim of this systematic review was to analyze the morphologic predictors of an adverse course to establish their validity based on consistency of results.

Methods: Fifty-one studies were included in this review, reporting on aortic size, false lumen (FL) size, primary entry tear (ET) size and location, status of FL thrombosis, number of ETs, branch vessels involvement, and FL longitudinal extent.

Results: Some predictors showed good consistency, whereas others did not. Aortic size was the most investigated predictor. A larger diameter at presentation predicted worse outcomes, with few exceptions. Both FL size and size relative to true lumen size also predicted an adverse course, although a standardized measurement method was not used. Regarding primary ET size and location, evidence was sparse and somewhat conflicting. Although FL complete thrombosis was consistently associated with a more benign course, the role of partial thrombosis remained unclear and the concept of FL saccular formation might account for the inconsistency, but further evidence is needed. A higher number of re-entry tears was considered to be protective against false channel expansion, but results need to be confirmed. The predictive role of branch vessels involvement and FL longitudinal extent remain controversial.

Conclusions: Among several predictors of aortic growth and events in acute type B aortic dissection, controversial and even conflicting results have been described. Consistent evidence has been demonstrated only for two predictors: aortic size at presentation is associated with adverse events and total FL thrombosis has a protective role. (J Vasc Surg 2018;68:1925-35.)

Keywords: Aortic diameter; False lumen; Entry tear; prognosis; Computed tomography (CT); Complications

Spinelli D, et al J Vasc Surg 2018; 68:1925-33.

Study Objectives

- Identify Demographic and Anatomic Predictors of OMT Failure

- To Characterize the Role of OMT vs Surgery (TEVAR/Open) in AUTBAD

GOAL: To provide data for a patient-specific risk stratification model:

1) Identifies patients who will benefit from TEVAR in the acute phase

2) Identify patients who will be appropriately treated with OMT alone

Methods

- EMORY and YALE Aortic Databases queried from 1995-2025
  - 293 patients
- Inclusion Criteria
  - Acute (<14 days) Uncomplicated Type B Dissection
  - Initial Treatment: Optimal Medical Therapy
  - Initial Diagnostic CTA Images available for analysis
  - Cause of Death Known
- Exclusion Criteria
  - Malperfusion or Rupture
  - Initial treatment: Open or endovascular aortic repair
  - Initial CTA unavailable
  - Cause of Death Unknown

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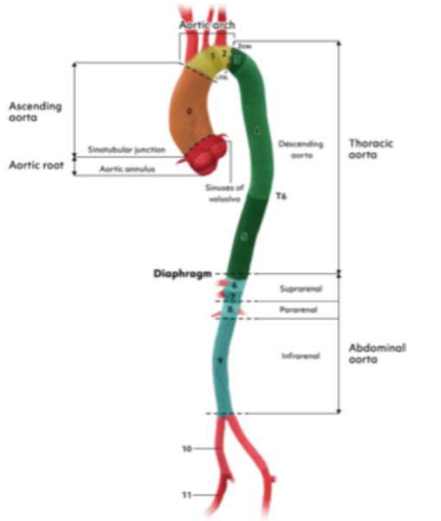
Variables Examined

- Demographics
- Outcomes
  - Mortality
    - Overall
    - Aortic-related
  - Aortic Interventions
    - Open
    - Endovascular
  - Aortic Event
    - Open or Endovascular Intervention
    - Aortic Related Death
- Long-term F/U data
  - Clinical research nurses
  - Chart review, telephone calls, internet searches

- Anatomic Variables
  - PIT Location
  - Extent of Dissection
  - Max Thoracic and ABD Diameters
  - FL Status
  - TL/FL Branch Origin



Results

- 293 Patients

- Aortic Events (n=153)
  - 52% patients required an aortic intervention or suffered an aortic-related death
    - Open or Endovascular aortic intervention (n=131)
      - Open DTAA/TAAA n=71
      - TEVAR n= 60
    - Aortic-related death (n=22)
    - Occurred at a median of 107 [IQR 18, 909] days from diagnosis

- OMT (n=140)
  - 48% managed with OMT with median follow-up of 1826 [IQR 494, 3156] days

RESULTS

Demographic and Anatomic Predictors

Demographics

	All Patients N=293	Continued OMT N=140	Aortic Event N=153	P-value
Median time to follow up or event (days) -- median [IQR]	556 [58,1933]	1826 [494,3156]	107 [18,909]	<0.001
Age (years) – mean (SD)	58.5 (13.1)	59.9 (13.0)	57.3 (13.2)	0.095
Male sex – no. (%)	189 (64.5)	93 (66.4)	96 (62.8)	0.510
Race – no. (%) •- White •- Black •- Asian •- Native American •- More than one race	 122 (43.1) 158 (55.8) 2 (0.7) 1 (0.4) 0	 52 (38.8) 80 (59.7) 2 (1.5) 0 0	 70 (47.0) 78 (52.4) 0 1 (0.7) 0	0.179
Connective tissue disease – no. (%)	14 (4.8)	4 (2.9)	10 (6.5)	0.140
Hypertension – no. (%)	268 (91.5)	125 (89.3)	143 (93.5)	0.201
Congestive heart failure – no. (%)	27 (9.2)	17 (12.1)	10 (6.5)	0.097
Myocardial infarction – no. (%)	7 (2.4)	5 (3.6)	2 (1.3)	0.205
Cerebrovascular accident – no. (%)	23 (7.9)	15 (10.7)	8 (5.2)	0.081
Family history – no. (%)	10 (3.4)	3 (2.1)	7 (4.6)	0.252
Cocaine use – no. (%)	12 (4.2)	6 (4.4)	6 (4.0)	0.862

PIT Location and Extent of Dissection

	All Patients N=293	Continued OMT N=140	Aortic Event N=153	P-value
Location of primary intimal tear				0.302
•- Zone 3	238 (88.5)	105 (86.8)	133 (89.9)	
•- Zone 4	12 (4.5)	4 (3.3)	8 (5.4)	
•- Zone 5	15 (5.6)	8 (6.6)	7 (4.73)	
•- Zone 6	1 (0.4)	1 (0.8)	0	
•- Zone 7	0	0	0	
•- Zone 8	0	0	0	
•- Zone 9	2 (0.7)	2 (1.7)	0	
•- Zone 10	1 (0.4)	1 (0.8)	0	
Distal extent of dissection				0.056
•- Zone 4	3 (1.1)	3 (2.2)	0	
•- Zone 5	21 (7.5)	11 (8.2)	10 (6.8)	
•- Zone 6	24 (8.5)	11 (8.2)	13 (8.8)	
•- Zone 7	17 (6.0)	10 (7.4)	7 (4.8)	
•- Zone 8	25 (8.9)	8 (5.9)	17 (11.6)	
•- Zone 9	39 (13.8)	13 (9.6)	26 (17.7)	
•- Zone 10	93 (33.0)	43 (31.9)	50 (34.0)	
•- Zone 11	60 (21.3)	36 (26.7)	24 (16.3)	

Aortic Size and False Lumen Status

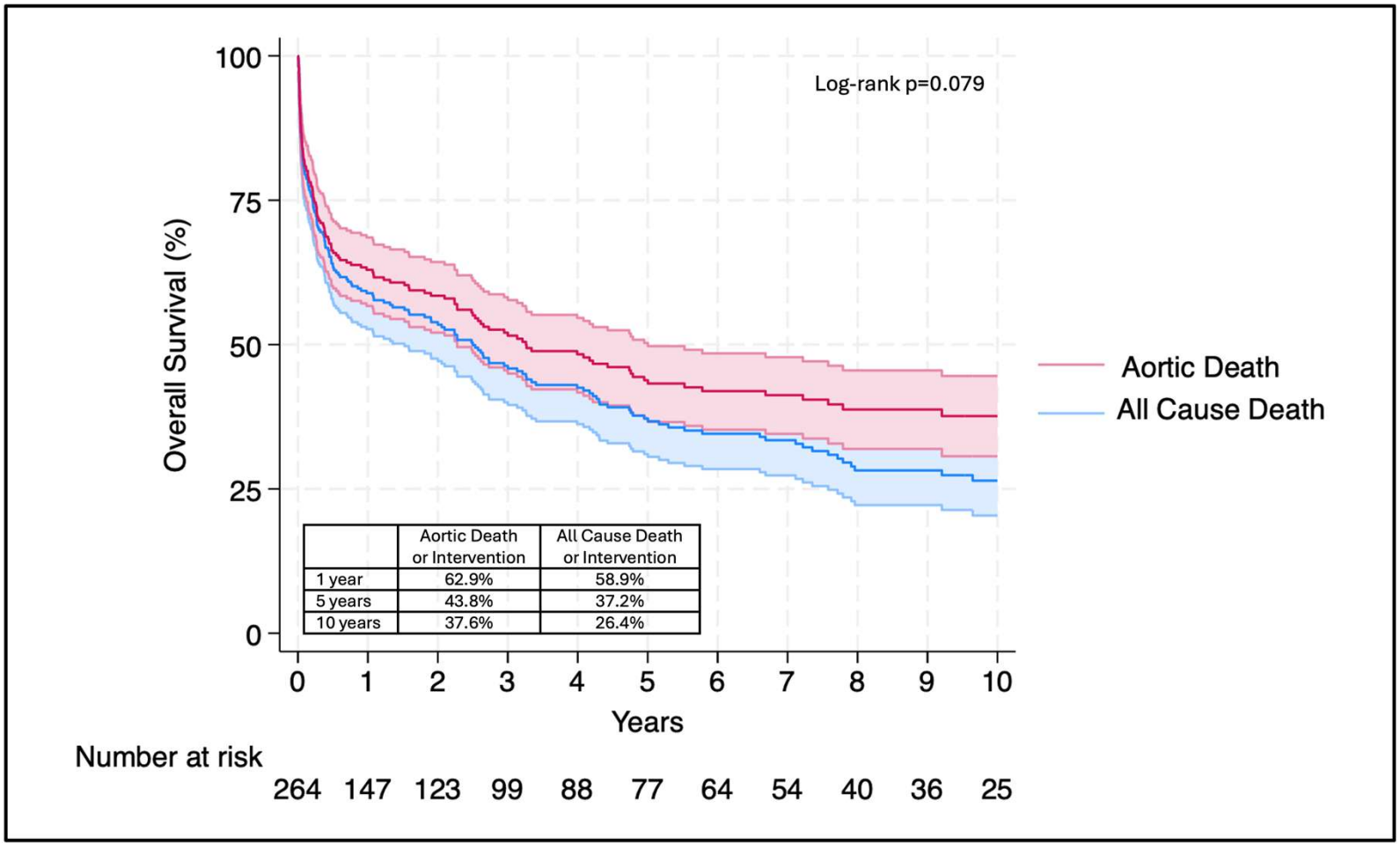
	All Patients N=293	Continued OMT N=140	Aortic Event N=153	P-value
Thoracic Diameter (cm)	4.0 [3.5,4.5]	3.8 [3.4, 4.5]	4.0 [3.7,4.6]	0.056
Abdominal Diameter (cm)	3.3 [2.9,3.8]	3.3 [2.9,3.7]	3.3 [3.0,4.0]	0.188
False lumen status •- Patent •- Partial thrombosis •- Complete thrombosis	 132 (47.7) 110 (39.7) 35 (12.6)	 68 (51.9) 53 (40.5) 10 (7.60)	 64 (43.8) 57 (39.0) 25 (17.1)	0.052

Branch Vessels: TL/FL Origin

	All Patients N=293	Continued OMT N=140	Aortic Event N=153	P-value
Celiac artery				0.763
•- True Lumen	120 (80.5)	60 (79.0)	60 (82.2)	
•- False Lumen	14 (9.4)	7 (9.2)	7 (9.6)	
•- Both	15 (10.1)	9 (11.8)	6 (8.2)	
Superior mesenteric artery				0.149
•- True Lumen	128 (85.9)	68 (89.5)	60 (82.2)	
•- False Lumen	7 (4.7)	1 (1.3)	6 (8.2)	
•- Both	14 (9.4)	7 (9.2)	7 (9.6)	
Inferior mesenteric artery				0.488
•- True Lumen	102 (72.9)	48 (69.6)	54 (76.1)	
•- False Lumen	34 (24.3)	18 (26.1)	16 (22.5)	
•- Both	4 (2.9)	3 (4.4)	1 (1.4)	
Right renal artery				0.626
•- True Lumen	102 (68.5)	54 (72.0)	48 (64.9)	
•- False Lumen	35 (23.5)	16 (21.3)	19 (25.7)	
•- Both	12 (8.1)	5 (6.7)	7 (9.5)	
Left renal artery				0.240
•- True Lumen	90 (60.8)	40 (54.1)	50 (67.6)	
•- False Lumen	43 (29.1)	25 (33.8)	18 (24.3)	
•- Both	15 (10.1)	9 (12.2)	6 (8.1)	
Right iliac artery				0.295
•- True Lumen	73 (59.4)	33 (55.9)	40 (62.5)	
•- False Lumen	7 (5.7)	2 (3.4)	5 (7.8)	
•- Both	43 (35.0)	24 (40.7)	19 (29.7)	
Left iliac artery				0.295
•- True Lumen	69 (56.1)	31 (52.5)	38 (59.4)	
•- False Lumen	7 (5.7)	1 (1.7)	6 (9.4)	
•- Both	47 (38.2)	27 (45.8)	20 (31.3)	

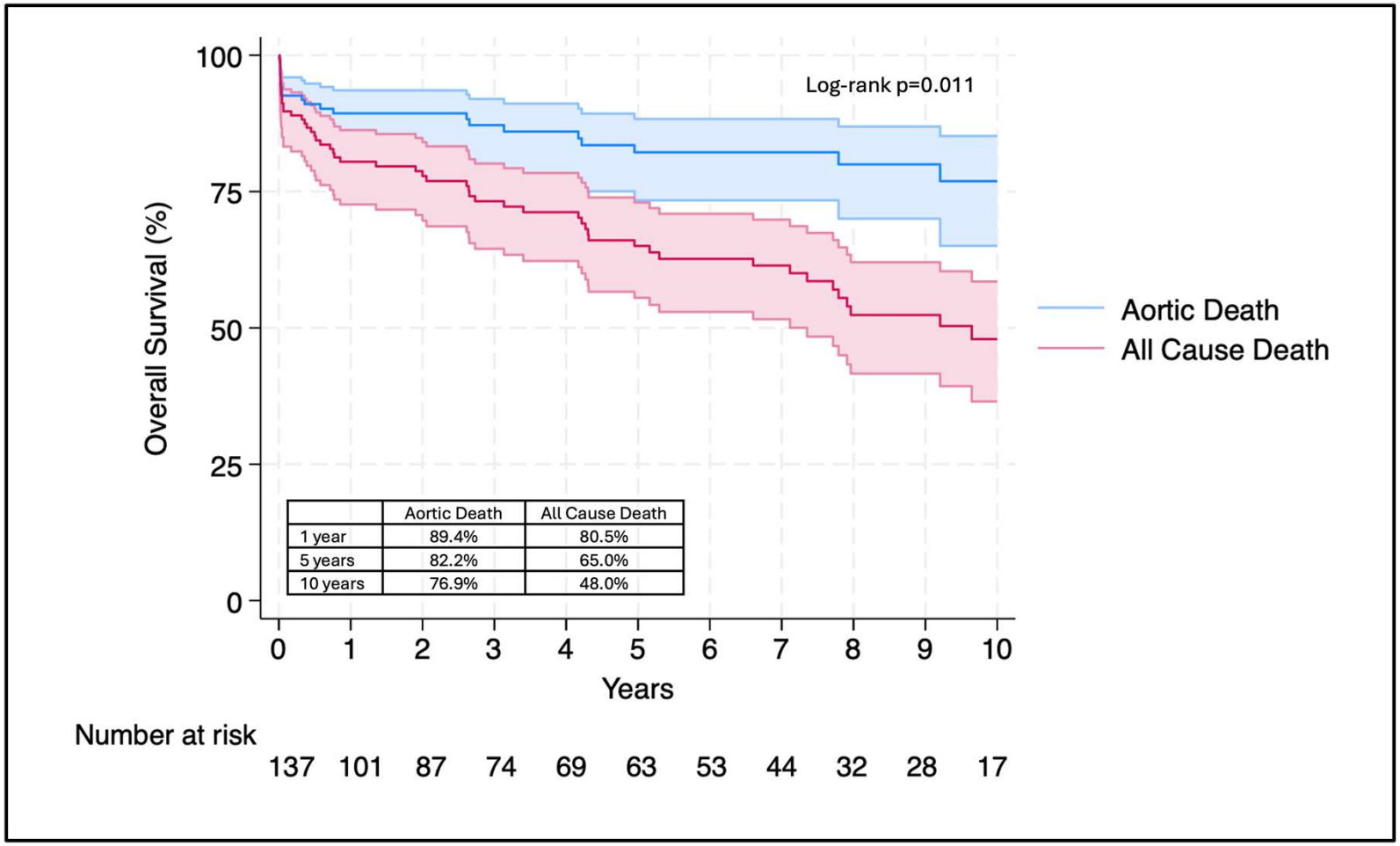
RESULTS
Survival and Aortic Intervention

Aortic Event-Free Survival



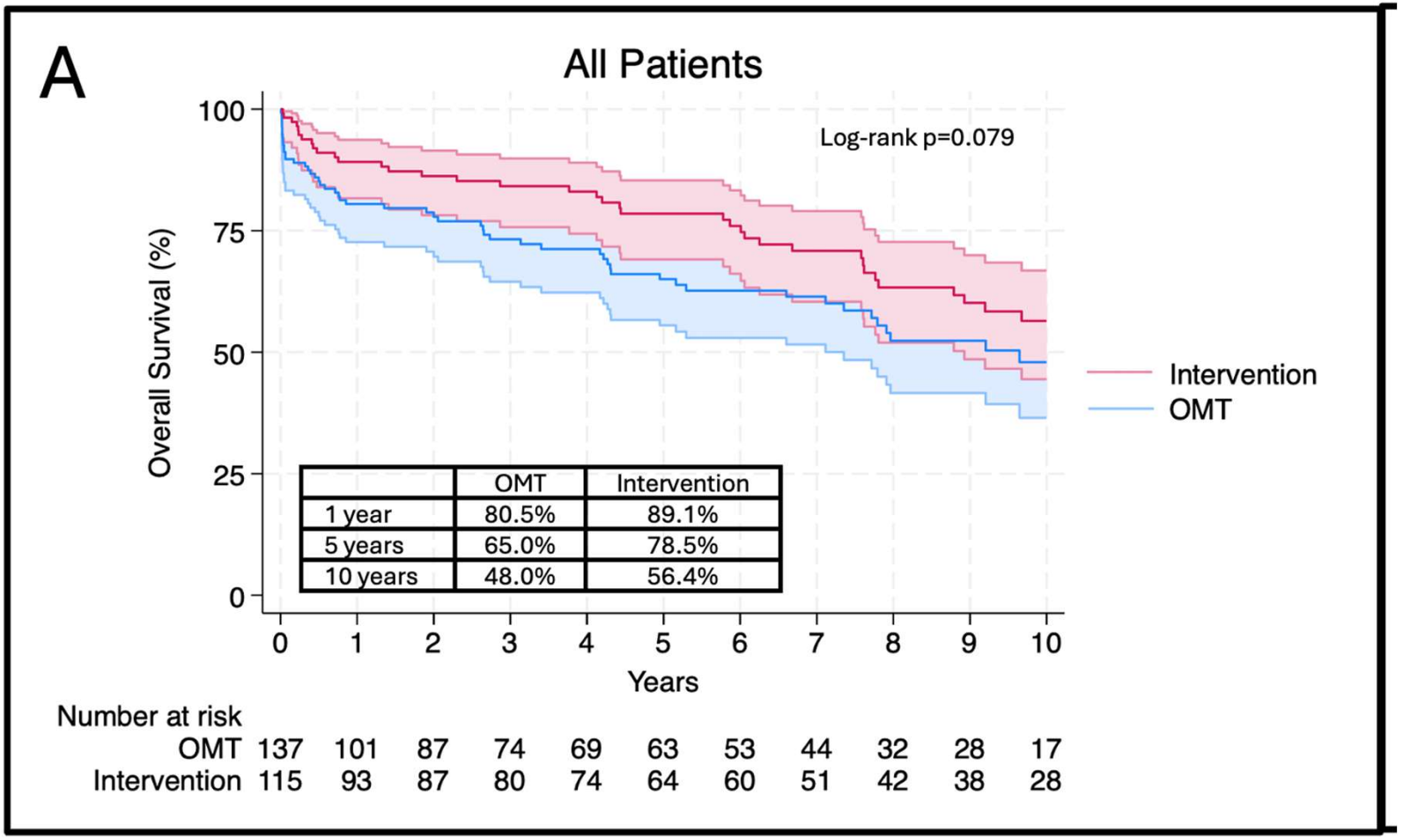
	Aortic Death or Intervention	All Cause Death or Intervention
1 year	62.9%	58.9%
5 years	43.8%	37.2%
10 years	37.6%	26.4%

Overall Survival in OMT Patients

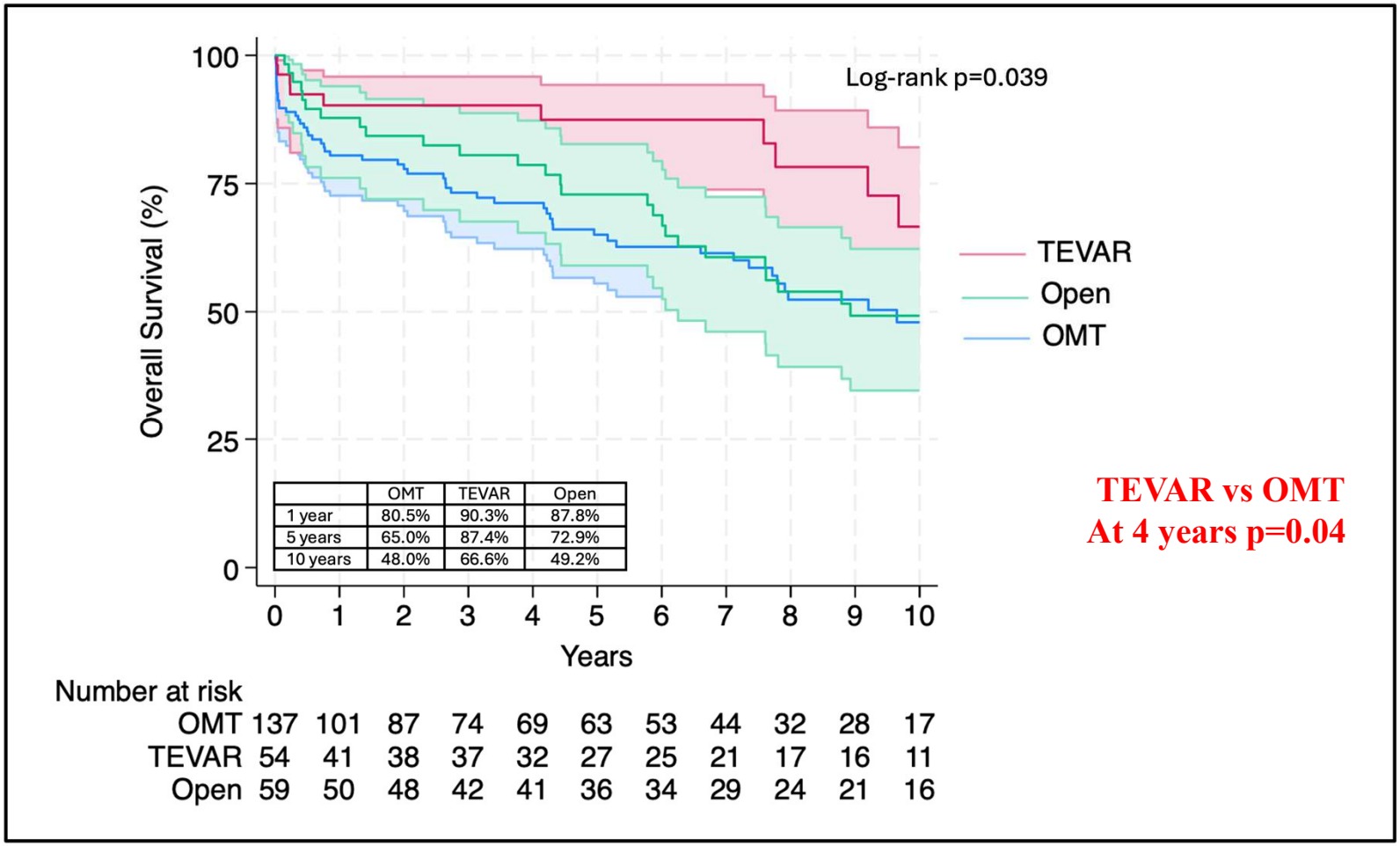


	Aortic Death	All Cause Death
1 year	89.4%	80.5%
5 years	82.2%	65.0%
10 years	76.9%	48.0%

Overall Survival
OMT vs Aortic Intervention



Overall Survival
TEVAR vs Open vs OMT

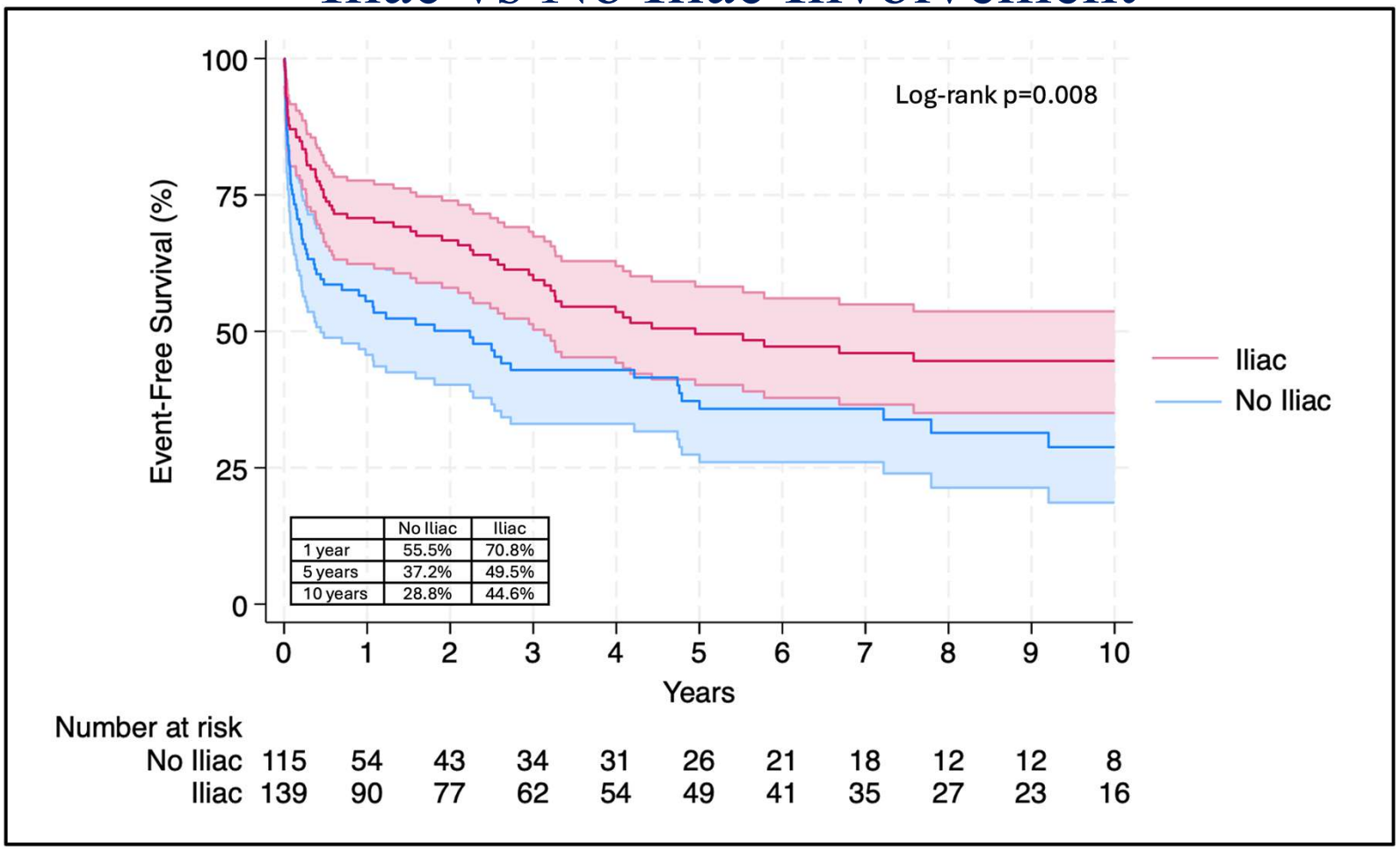


TEVAR vs OMT
At 4 years p=0.04

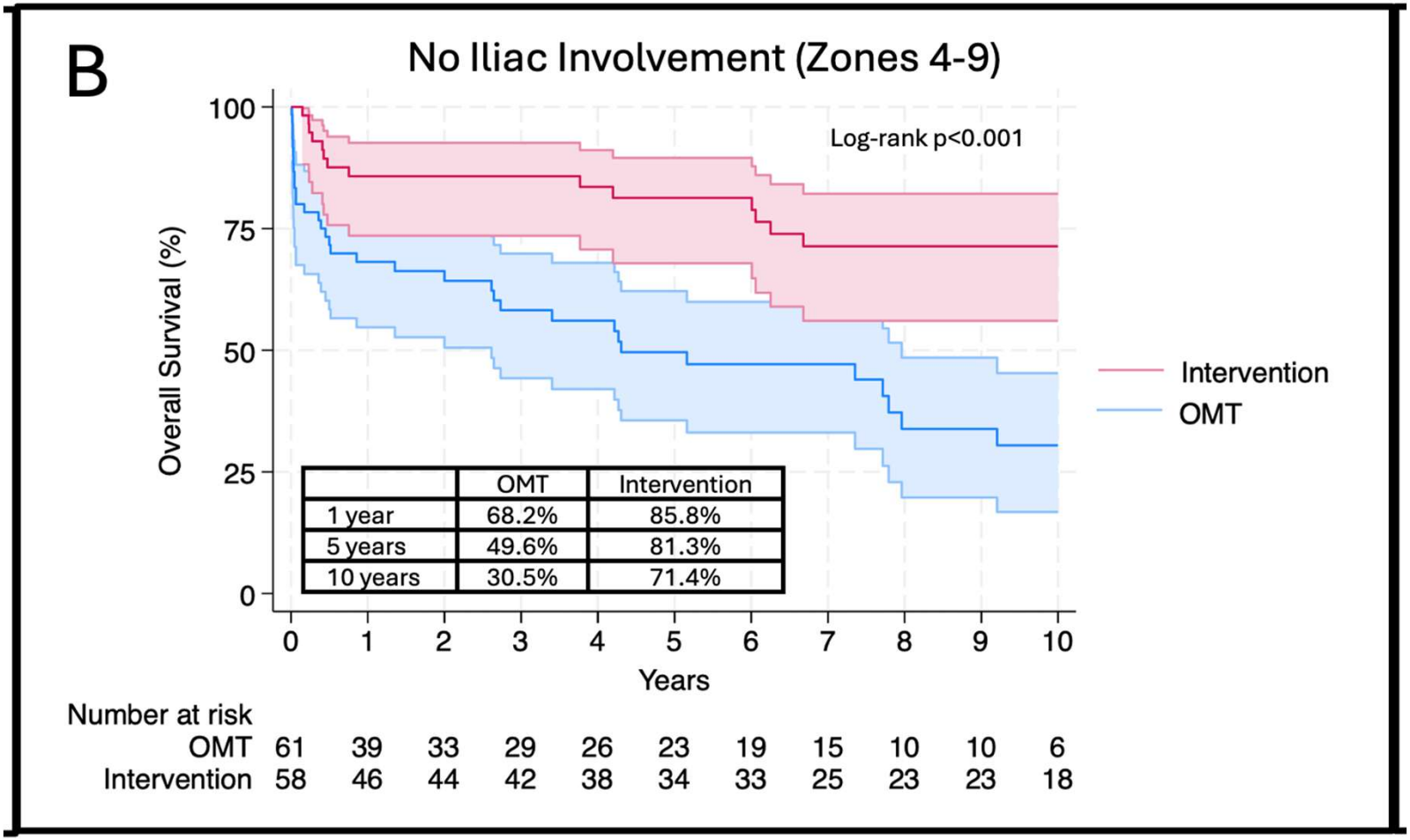
Competing Risk Regression Model Aortic Event vs Non-Aortic Death

	Hazard Ratio	95% CI	P-value
Age	0.99	0.98-1.00	0.14
Male sex	0.91	0.64-1.30	0.61
African American Race	0.63	0.44-0.90	0.01
Connective tissue disease	0.90	0.48-1.68	0.74
CHF, MI, CVA	0.68	0.40-1.15	0.15
Primary intimal tear in zone 3	1.12	0.69-1.84	0.64
Iliac artery involvement	0.69	0.48-0.99	0.049
Left renal artery involvement	1.42	0.91-2.21	0.12
Any vessels off false lumen	1.04	0.68-1.60	0.84
Era			
•- 1995-2005	Reference	Reference	Reference
•- 2006-2015	0.70	0.45-1.09	0.12
•- 2016-2025	1.25	0.74-2.12	0.40

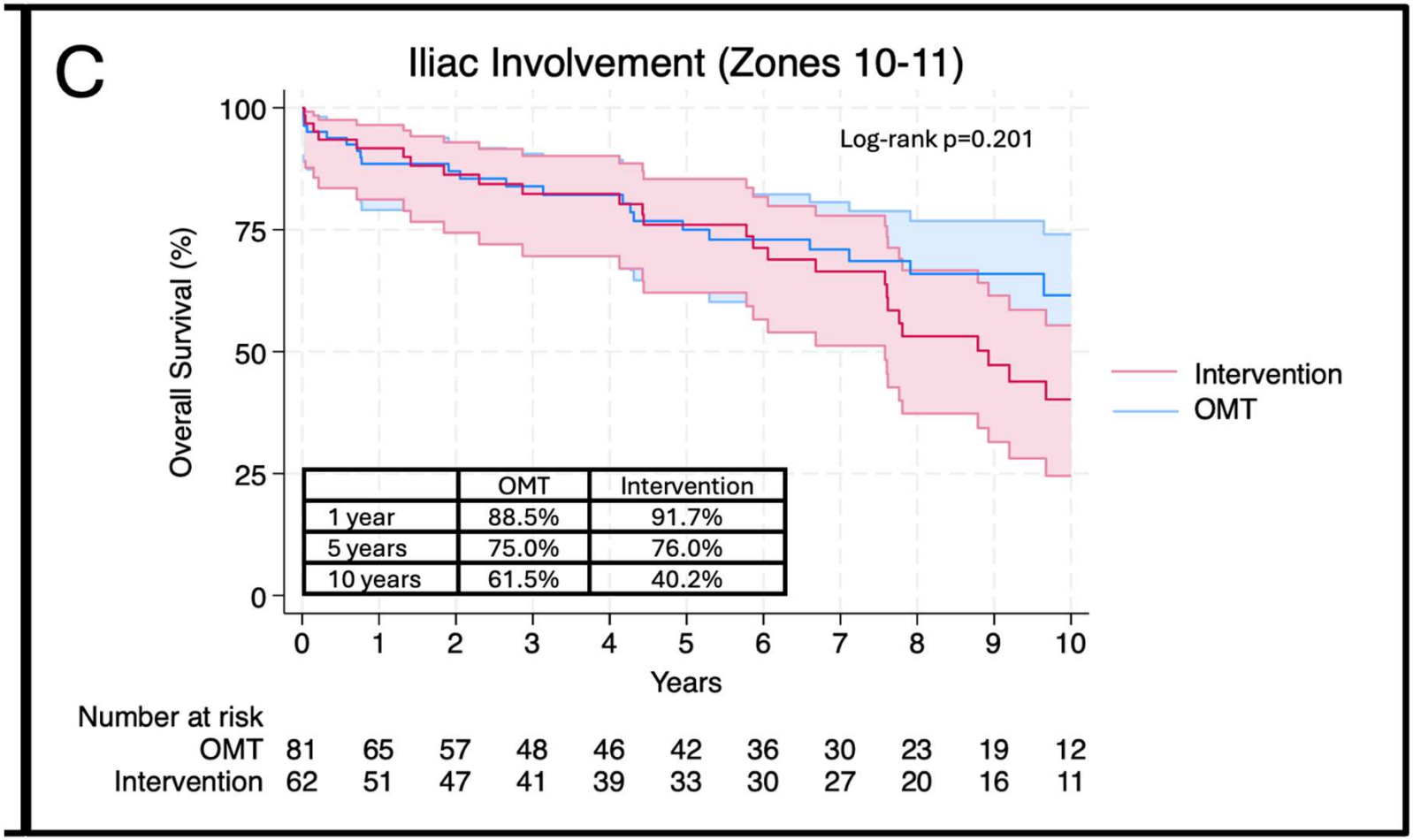
Aortic Event-Free Survival
Iliac vs No Iliac Involvement



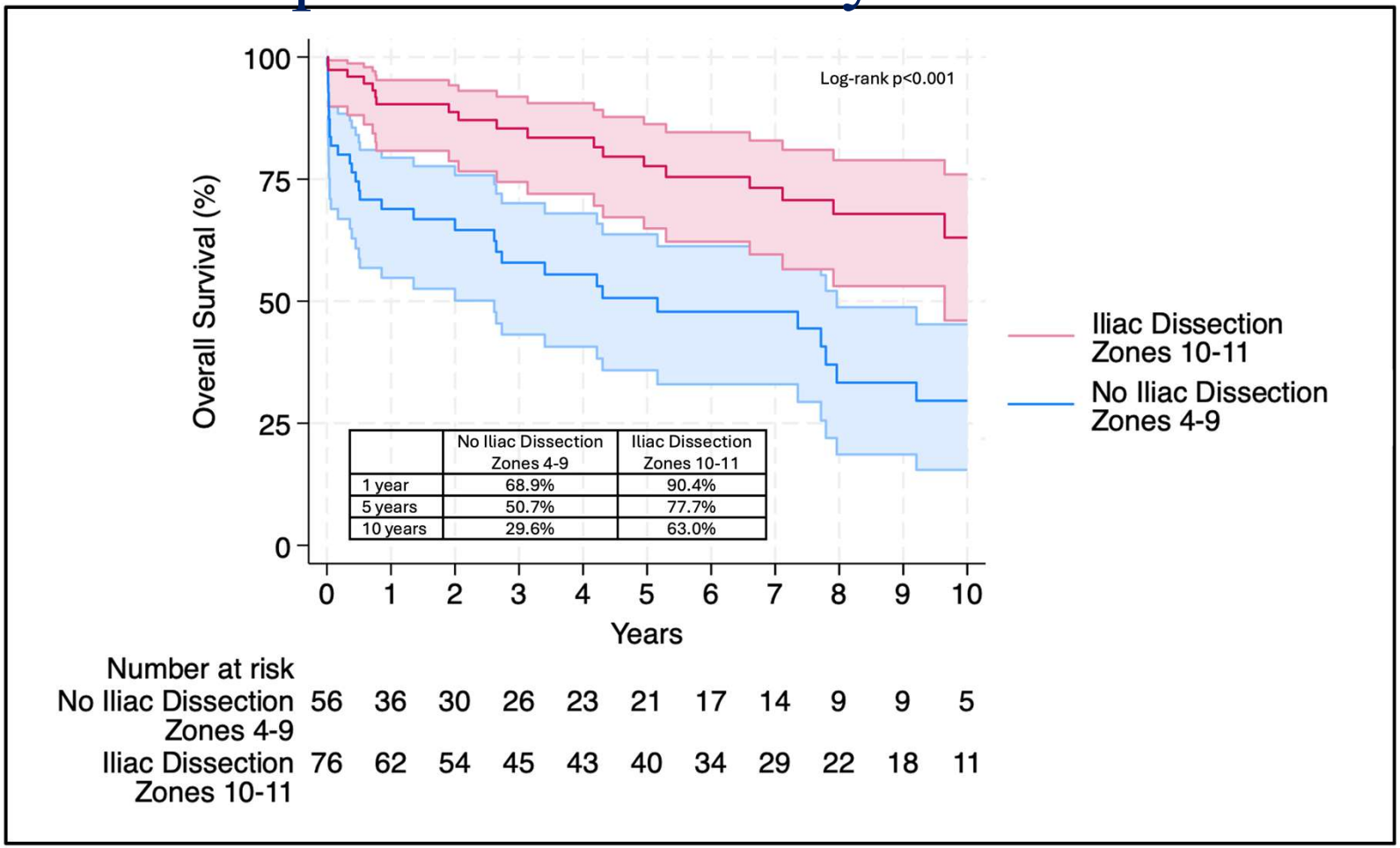
Overall Survival with No Iliac Involvement OMT vs Aortic Intervention



Overall Survival with Iliac Involvement
OMT vs Aortic Intervention



Overall Survival with OMT
The Impact of Iliac Artery Involvement



	No Iliac Dissection Zones 4-9	Iliac Dissection Zones 10-11
1 year	68.9%	90.4%
5 years	50.7%	77.7%
10 years	29.6%	63.0%

Conclusions

- **Aortic Event-Free Survival with Initial OMT in AUTBAD is Dismal!!!!**
  - 5 years: 44%
  - 10 years: 38%

- TEVAR Provides A Survival Benefit ($p < 0.05$) vs OMT at 4 years

- Is there any role for OMT in AUTBAD?
  - **DEFINITELY YES!!**
  - Freedom from Aortic Related Mortality at 10 years: 77%

Conclusions

- AUTBAD's involving the Iliac arteries have improved survival compared to those ending proximal to the aorto-iliac bifurcation
- Aortic intervention improves survival compared to OMT for patients without iliac artery involvement
- There was no survival benefit from aortic intervention compared to OMT in patients with Iliac artery involvement
- Iliac artery involvement may represent a key determinant of the optimal therapy (OMT vs TEVAR) for patients with AUTBAD

Risk Stratification of Uncomplicated Type B Aortic Dissection Using Clinical and Engineering Analysis

NIH RO1HL 155537

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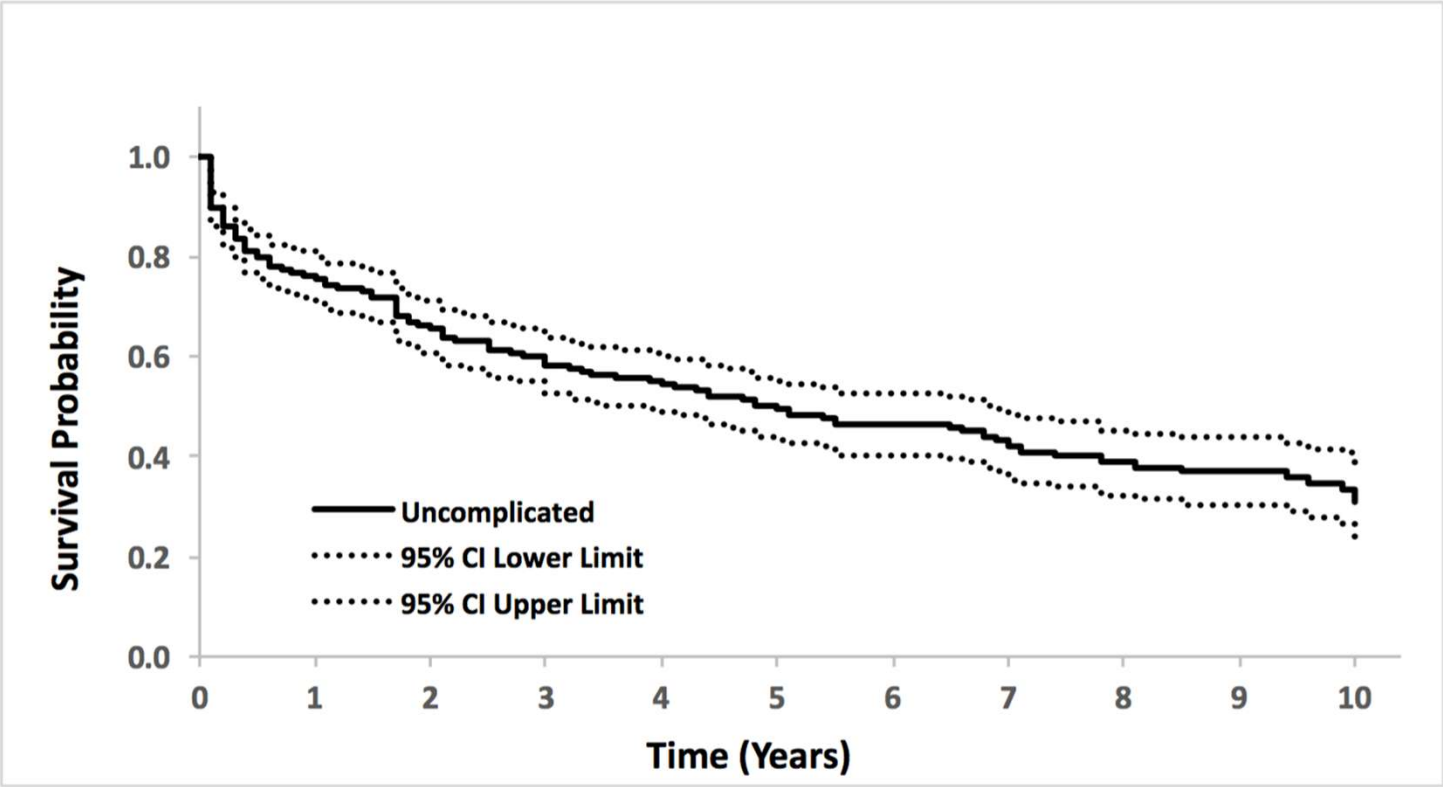
Kaplan-Meier Intervention-free Survival Curve
Uncomplicated aTBAD patients from time of presentation



	1 Year	3 Years	5 Years	8 Years	10 Years
Uncomplicated (N = 318)	75.4 (234)	58.4 (160)	49.4 (108)	38.9 (46)	30.9 (27)

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Lou et al. Ann Thorac Surg 2018

Acute Uncomplicated Type B Aortic Dissection (AUTBAD)

- < 14 days
- De Novo Type B with PIT distal to the LSA
- No Malperfusion or Rupture
- 60-70% of all Type B Dissections

Afifi RO et al. Circulation 2015;132:748-754.
Tsai TT et al. Eur J Vasc Endovasc Surg 2009; 37:149-159.

- Outcomes
  - Hospital Mortality: 6.4%
  - 5-yr Intervention-Free Survival ≤ 50%