Venous Stent Thrombosis:
Insights from the ABRE Trial

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Disclosures

Consultant: BD Bard, Boston Scientific, Cook, Cordis, Gore, Medtronic, Philips, Synervention,Veryn

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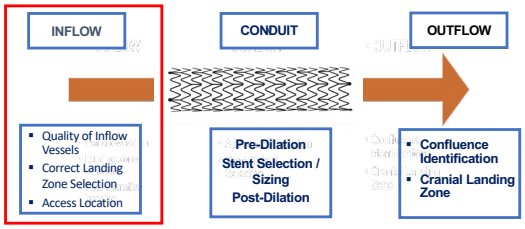
Success with (Venous) Stenting



+ ANTICOAGULATION DECISIONS

ABRE Study

Stent Thrombosis at 36 Months

	All Subjects	PTS	NIVL	aDVT
Stent Thrombosis (n)	12	10	1	1

ABRE Study

Disease/Procedure Characteristics

Baseline Demographic	All Subjects n=200	Stent Thrombosis at 36 Months Yes n=12	No n=188	*P* value
Age (years)	51.5 ± 15.9	43.2 ± 15.6	52.0 ± 15.8	0.043
Female	66.5 (133/200)	66.7 (8/12)	66.5 (125/188)	1.000
White	78.5 (157200)	75.0 (9/12)	78.7 (148/188)	0.723
BMI (kg/m²)	29.5 ± 7.1	28.4 ± 7.1	29.6 ± 7.1	0.508
Initial Clinical Presentation				
PTS	47.5 (95/200)	83.3 (10/12)	45.2 (85/188)	0.015
NIVL	36.0 (72/200)	8.3 (1/12)	37.8 (71/188)	0.059
aDVT	16.5 (33/200)	8.3 (1/12)	17.0 (32/188)	0.695
Previous history of VTE	52.0 (104/200)	83.3 (10/12)	50.0 (94/188)	0.035
Venous claudication	30.0 (60/200)	16.7 (2/12)	30.9 (58/188)	0.516
Known family history of DVT	22.0 (44/200)	8.3 (1/12)	22.9 (43/188)	0.470
Pulmonary embolism	17.0 (34/200)	50.0 (6/12)	14.9 (28/188)	0.007
Smoking (active)	12.0 (24/200)	0.0 (0/12)	12.8 (24/188)	0.367
Thrombophilia	11.5 (23/200)	25.0 (3/12)	10.6 (20/188)	0.146
Cancer (ongoing or remission)	11.0 (22/200)	8.3 (1/12)	11.2 (21/188)	1.000
IVC filter present	5.0 (10/200)	8.3 (1/12)	4.8 (9/188)	0.469

ABRE Study

Disease/Procedure Characteristics

More extensive disease

Imaging Core Lab Assessment Pre-Stenting	All Subjects n=200	Stent Thrombosis within 36 Months Yes n=12	No n=188	*P* value
Subjects with occluded lesions†	25.9 (51/197)	54.5 (6/11)	24.2 (45/186)	0.036
Lesion length (mm)†	112.4 ± 66.1 (184)	173.3 ± 56.2 (9)	109.3 ± 65.2 (175)	0.007

Procedural Characteristics	All Subjects n=200	Stent Thrombosis within 36 Months Yes	No	*P* value
Total stented length (mm)†	134.3 ± 58.0 (192)	184.5 ± 45.3 (11)	131.2 ± 57.4 (181)	0.003
Number of Abre stents implanted/subject	1.5 ± 0.6	2.2 ± 0.8 (12)	1.5 ± 0.6 (188)	0.002
Stented Vein Location‡				
Common iliac vein	96.0 (192/200)	100.0 (12/12)	95.7 (180/188)	1.000
External iliac vein	81.0 (162/200)	100.0 (12/12)	79.8 (150/188)	0.128
Common femoral vein	44.0 (88/200)	83.3 (10/12)	41.5 (78/188)	0.006

ABRE Study

Factors Contributing to Stent Thrombosis

Case Study	Initial Clinical Presentation	Days to TLR	Duplex CFV	Duplex DFV	Duplex FV
1	NIVL	108	Patent	Patent	Patent
2	PTS	159	Non-occlusive disease	Partial occlusive disease	Non-occlusive disease
3	PTS	196	Non-occlusive disease	Partial Occlusive	Occluded
4	PTS	113	Non-occlusive disease	Patent	Patent
5	PTS	21	Occluded	Patent	Patent
6	PTS	5	Occluded	Partial Occlusive	Occluded
7	PTS	1	Occluded	Partial Occlusive	Occluded
8	PTS	355	Non-occlusive disease	Partial Occlusive	Occluded
9	PTS	559	Patent	Patent	Patent
10	aDVT	565	Occluded	Patent	Patent
11	PTS	742	Partial Occlusive	Partial Occlusive	Partial Occlusive
12	PTS	490	Partial Occlusive	Partial Occlusive	Partial Occlusive

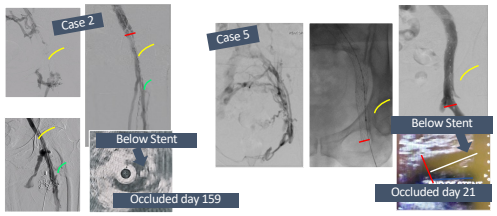
ABRE Study

Factors Contributing to Stent Thrombosis

Case Study	Indication for Intervention	Days to TLR	TECHNICAL ERRORS: INADEQUATE STENT INFLOW: Understenting: Missed Distal Disease (CFV)	TECHNICAL ERRORS: INADEQUATE STENT INFLOW: Inadequate Inflow (2 vessel inflow disease: Femoral/Profunda)	TECHNICAL ERRORS: Outflow	TECHNICAL ERRORS: Other Major Technical Errors	ANTICOAGULATION DECISIONS: Made by Physician	ANTICOAGULATION DECISIONS: Patient Noncompliance
1	NIVL	108	--	--	--	--	--	YES
2	PTS	159	YES	YES	--	--	--	--
3	PTS	196	--	YES	--	YES	YES	--
4	PTS	113	YES	--	--	--	--	YES
5	PTS	21	YES	--	--	--	--	--
6	PTS	5	--	YES	--	--	--	--
7	PTS	1	YES	YES	--	YES	--	--
8	PTS	355	--	YES	--	--	--	--
9	PTS	559	--	--	YES	YES	--	YES
10	aDVT	565	YES	--	--	--	--	YES
11	PTS	742	--	YES	--	--	--	--
12	PTS	490	YES	YES	--	--	YES	--

Technical Errors: Missed Distal Disease

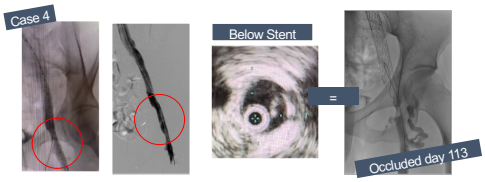
Distal Disease Remaining Between Stent Edge & Profunda



Technical Errors: Missed Distal Disease

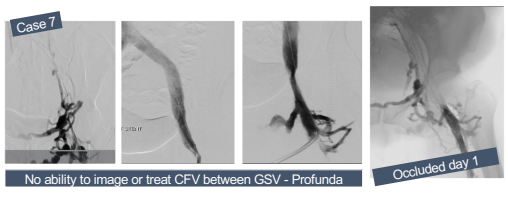
Distal Disease Remaining Between Stent Edge & Profunda

Patient was also noncompliant with AC



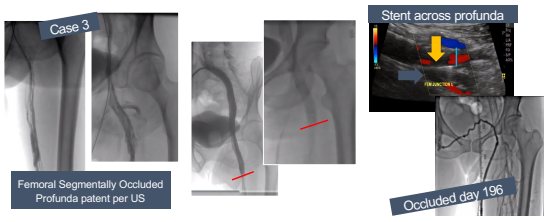
Technical Errors: Missed Distal Disease

Distal Disease Remaining Between Stent Edge & Profunda



Technical Errors: Inadequate Inflow Vessels

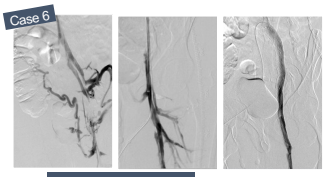
Stenting into the Femoral Vein + AC Stopped at 5 Months



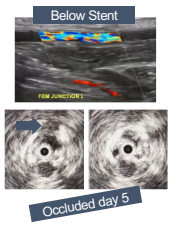
Technical Errors: Inadequate Inflow Vessels

Stenting Above Severely Obstructed Profunda & Femoral – No Inflow

Case 6



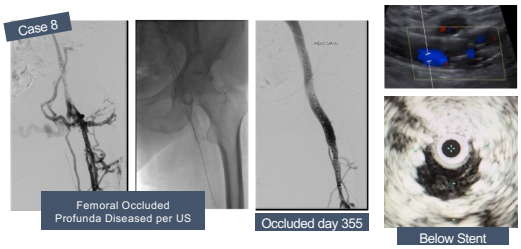
Femoral Occluded
Profunda Diseased per US



Technical Errors: Inadequate Inflow Vessels

Stenting Above Severely Obstructed Profunda & Femoral – No Inflow

Case 8



Femoral Occluded
Profunda Diseased per US

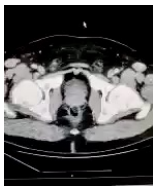
Occluded day 355

Below Stent

Technical Errors: Missed Outflow Disease

Stenting Below Unknown IVC Atresia

Case 9



Stent Below an Atresia

Anticoagulation
non-compliance

Anticoagulation Decisions: Patient Noncompliance

Case 1

Challenges with Patient Compliance
- Ceasing anticoagulation
- Marijuana use
- Long flight

Anticoagulation Decisions: Patient Noncompliance

= The ONLY venous stent thrombosis not related to poor inflow or poor outflow

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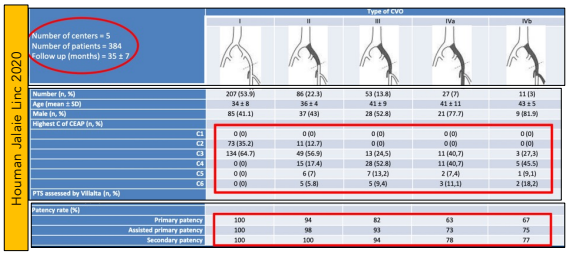

Failure classification	Etiology
Type 1, technical	
1a, No stent	Residual disease
1b, Missed inflow	Inadequate stenting of existing venous lesions; stent not extended distally
1c, Missed outflow	Inadequate stenting of existing venous lesions; stent not extended proximally
1d, Device failure: fracture (F), compression (C), or migration (M)	Stent failure can be subcategorized as F, C, or M
Type 2, flow	Scarring or occlusion of vessels not amenable to stenting—femoral, profunda, or popliteal vein
Type 3, hematologic	
3a, dose-related	Noncompliance or subtherapeutic anticoagulation
3b, non–dose-related	Thrombosis despite anticoagulation
Type 4, multifactorial	Mixed etiology

Category	No reintervention	Reintervention	*P* value
Technical	6/95 (6.30)	26/48 (54.2)	.0001
Hematologic	1/95 (1.10)	16/48 (33.3)	.0001
Flow	0/95 (0.0)	21/48 (43.8)	.0001
Multifactorial	0/95 (0.0)	13/48 (27.1)	.0001
Technical factors			
No stent	0/95 (0.0)	3/48 (6.3)	.0362
Inflow	3/95 (3.2)	13/48 (27.10)	.0001
Outflow	3/95 (3.2)	6/48 (12.5)	.0608
Device failure	0/95 (0.0)	4/48 (8.3)	.012

Stent Thrombosis Summary

- Stent thromboses in the ABRE Study were associated with:
- Post-thrombotic disease
- More extensive disease involving the CFV, inflow vessels, and outflow
- Significant 2 vessel inflow disease (profunda and femoral disease)
- Significant technical errors (CFV access & stenting into femoral)
- Cessation of anticoagulation in the presence of remaining inflow disease
- Noncompliance: stopping AC, marijuana use, inactivity

Thank you!!!

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