

Flow Diversion for the Treatment of Posterior Circulation Aneurysms: An Evolving Concept

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Introduction

Flow diversion has been widely accepted for aneurysms in the anterior circulation but remains controversial for those in posterior circulation due to higher morbidity. We assessed the safety and efficacy of the Pipeline Embolization Device (PED) for the treatment of posterior circulation aneurysms.

Methods

Retrospective study. Patients with unruptured posterior circulation aneurysms treated with PED between 2011 and 2017 were included. Primary endpoints were procedure-related mortality rate and occurrence of neurological events during periprocedural period (within 30 days) and in delayed fashion (= 30 days). Secondary endpoints included rates of functional outcome, aneurysm occlusion, retreatment, and all-cause mortality. Sub-analyses, based on aneurysm morphology and number of PEDs, were performed.

Results

Thirty-two patients with 35 aneurysms (mean 8.3 ± 5.5 mm) were included. No procedure-related mortality occurred. Rates of major neurological events during periprocedural period and in delayed fashion were 3.1% (1/32) and 12.5% (4/32), respectively. Favorable outcomes (mRS 0-2) at discharge and last follow-up were 87.5% (28/32) and 83.3% (25/30), respectively. Complete aneurysm occlusion was achieved in 69.7% (23/33) and 3 aneurysms underwent retreatment. All-cause mortality rate was 6.3% (2/32). Overall, there was no difference in neurological complications between saccular and non-saccular aneurysms. Although not statistically significant, higher rates of major neurological events occurred when using multiple PEDs within periprocedural period and in delayed fashion (11.1% vs 0%; 33.3% vs 4.3%).

Conclusions

PED is a feasible option in selected patients for the treatment of posterior circulation aneurysms regardless of morphology, however, higher rates of neurological complications occur when using multiple devices.

Table 1. Endpoints comparison between saccular and non-saccular aneurysms.

	Saccular Aneurysms (n= 17)	Non-Saccular Aneurysms (n= 18)		Total
Baseline Characteristics				
Aneurysm size, (mm)				
Mean (min – max)	6.12 (4 – 10)	10.5 (1.5 – 28)		8.4 (1.5 – 28)
Angioplasty	5.9% (1/17)	16.7% (3/18)		11.4% (4/35)
Adjunctive Coiling	11.8% (2/17)	22.2% (4/18)		17.1% (6/35)
Multiple PED used (≥ 2) [*]	20% (3/15)	35.3% (6/17)		28.1% (9/32)
Primary Endpoints[†]				
	Saccular Aneurysms	Non-Saccular Aneurysms	P value	Total
Neurological complications within 30 days				
Minor	13.3% (2/15)	17.6% (3/17)	1	15.6% (5/32)
Major	0%	5.9% (1/16)	1	3.1% (1/32)
Delayed neurological complications (≥ 30 days)				
Minor	0%	0%	-	
Major	13.3% (2/15)	11.8% (2/17)	1	12.5% (4/32)
Secondary Endpoints[‡]				
Complete occlusion at last F/U	75% (12/16)	64.7% (11/17)	.71	69.7% (23/33)
Favorable outcome at discharge (mRS)				
0 - 2	86.7% (13/15)	88.2% (15/17)	1	87.5% (28/32)
Favorable outcome at last F/U (mRS)				
0 - 2	92.9% (13/14)	75% (12/16)	.33	83.3% (25/30)
Retreatment	12.5% (2/16)	5.9% (1/17)	.6	9.1% (3/33)
All-cause mortality	6.7% (1/15)	5.9% (1/17)	1	6.3% (2/32)

^{*} Denominator reflects the index procedure.

[†] Denominator reflects the number of patients.

[‡] Denominators in complete occlusion and retreatment are based on aneurysms treated in the index procedure whereas clinical outcomes and mortality rates are calculated based on number of patients.

F/U: follow-up; mRS: modified Rankin Scale; PED: Pipeline Embolization Device.

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Describe the importance of flow diversion in the treatment of posterior circulation aneurysms.
- 2) Discuss the importance of endovascular strategies for the treatment of posterior circulation aneurysms.
- 3) Identify the use of flow diverters as a feasible and valid alternative in select patients.

Table 2. Endpoints comparison between patients treated with single PED versus multiple PEDs.

	Single PED	Multiple PEDs (≥ 2)		Total
Baseline Characteristics				
Aneurysm size, (mm)				
Mean (min – max)	7.83 (2.3 – 28)	9.7 (1.5 – 18)		8.4 (1.5 – 28)
Aneurysm Morphology				
Saccular	52% (13/25)	40% (4/10)		48.6% (17/35)
Non-Saccular	48% (12/25)	60% (6/10)		51.4% (18/35)
Angioplasty	8% (2/25)	20% (2/10)		11.4% (4/35)
Adjunctive Coiling	12% (3/25)	30% (3/10)		17.1% (6/35)
Primary Endpoints[*]				
	Single PED	Multiple PEDs (≥ 2)	P value	Total
Neurological complications within 30 days				
Minor	8.7% (2/23)	33.3% (3/9)	.12	15.6% (5/32)
Major	0%	11.1% (1/9)	.28	3.1% (1/32)
Delayed neurological complications (≥ 30 days)				
Minor	0%	0%	-	
Major	4.3% (1/23)	33.3% (3/9)	.057	12.5% (4/32)
Secondary Endpoints[†]				
Complete occlusion at last F/U	66.7% (16/24)	77.8% (7/9)	.67	69.7% (23/33)
Favorable outcome at discharge (mRS)				
0 - 2	87% (20/23)	88.9% (8/9)	1	87.5% (28/32)
Favorable outcome at last F/U (mRS)				
0 - 2	95.5% (21/22)	50% (4/8)	.01	83.3% (25/30)
Retreatment	8.3% (2/24)	11.1% (1/9)	1	9.1% (3/33)
All-cause mortality	4.3% (1/23)	11.1% (1/9)	.49	6.3% (2/32)

^{*} Denominator reflects the number of patients.

[†] Denominators in complete occlusion and retreatment are based on aneurysms treated in the index procedure whereas clinical outcomes and mortality rates are calculated based on number of patients.

F/U: follow-up; mRS: modified Rankin Scale; PED: Pipeline Embolization Device.