

Supplemental Table 1: Studies included in the systematic review.

Title	Author	Year	Journal	Study Design	# of Patients	# of Aneurysms
Treatment of intracranial aneurysms by functional reconstruction of the parent artery: the Budapest experience with the pipeline embolization device.	Szikora et al.	2010	American Journal of Neuroradiology	Prospective	18	19
Early postmarket results after treatment of intracranial aneurysms with the pipeline embolization device: A US multicenter experience	Kan et al.	2012	Neurosurgery	Prospective	56	58
Volume changes of extremely large and giant intracranial aneurysms after treatment with flow diverter stents	Carneiro et al.	2014	Neuroradiology	Retrospective	8	8
A novel flow-diverting device (Tubridge) for the treatment of 28 large or giant intracranial aneurysms: A single-center experience	Zhou et al.	2014	American Journal of Neuroradiology	Prospective	28	28
Endovascular treatment of unruptured aneurysms of cavernous and ophthalmic segment of internal carotid artery with flow diverter device Pipeline	Jevsek et al.	2016	Radiology and Oncology	Retrospective	15	15
Pipeline for uncoilable or failed aneurysms: 3-year follow-up result	Becske et al.	2017	Journal of Neurosurgery	Prospective	108 enrolled (107 treated)	109
Usefulness of the pipeline embolic device for large and giant carotid cavernous aneurysms	Miyachi et al.	2017	Neurointervention	Retrospective	24	24
The second-generation eCLIPs Endovascular Clip System: initial experience	Chiu et al.	2018	Journal of Neurosurgery	Retrospective	33	25*
Short-term efficacy of pipeline embolization device for treating complex intracranial aneurysms	ReXiaTi et al.	2018	Bio-Medical Materials and Engineering	Retrospective	29	32

*Chiu et al. 2018 had fewer aneurysms than patients because the authors only characterized the 25 successfully treated patients who had 25 aneurysms.

Supplemental Table 2: Patient and aneurysm characteristics.

Patients	318
Female	228/267 (85.4%)
Mean Age	57.7 (267*)
Total number of aneurysms	318
Giant (≥ 25 mm max. diameter)	58/310 (18.7%)
Paraophthalmic	51/299 (17.1%)
Vertebrobasilar circulation	35/318 (11.0%)
Saccular	128/141 (90.8%)
Fusiform	11/141 (7.8%)
Wide-necked (≥ 4 mm or dome:neck ratio ≤ 2)	168/171 (98.2%)
Unruptured	306/318 (95.0%)
Ruptured	12/318 (3.8%)
Asymptomatic	99/285 (34.7%)
Symptomatic	186/285 (65.3%)

*Of the 267 patients that had their ages known .

Supplemental Table 3: Flow diverter and endovascular procedure characteristics.

Type of flow diverter	PED: 262/318 (82.4%) SILK: 3/318 (0.94%) Tubridge: 28/318 (8.8%) eCLIP: 25/318 (7.9%)
Flow diverters alone	213/286 (74.5%)
Flow diverters with coils	72/286 (25.2%)
Flow diverters with additional treatment other than coils	Prior WEB: 1/286 (0.35%)* Prior surgical clip: 1/286 (0.35%)
Successful deployment/treatment	FDs deployed: 220/227 (96.9%) Patients treated: 180/216 (83.3%) <i>Post-balloon reconstruction</i> FDs deployed: 226/227 (99.6%) Patients treated: 183/216 (86.1%)
Side branches covered	104 FDs covered 89 side branches <ul style="list-style-type: none"> ○ Ophthalmic: 59 ○ AComA: 1 ○ PComA: 16 ○ Anterior choroidal: 4 ○ PICA: 5 ○ AICA: 1 ○ Meningohypophyseal: 2 ○ Frontal: 1

*WEB: Woven EndoBridge Aneurysm Embolization system

AComA: Anterior communicating artery

AICA: Anterior inferior cerebellar artery

PComA: Posterior communicating artery

PED: Pipeline embolization device

PICA: Posterior inferior cerebellar artery

Supplemental Table 4: Complications from flow diverter treatment.

Complications (including death)	<p>Total: 96/318 (30.2%)</p> <ul style="list-style-type: none"> ○ Mortality: 14/318 <ul style="list-style-type: none"> ▪ Procedure-related 11/318 (3.5%) ○ Hemorrhagic complications: 34/318 (10.7%) ○ Ischemic complications: 20/318 (6.3%)
Perioperative (≤30 days post-procedure) deaths and hemorrhagic/ ischemic complications	<p>Total deaths: 7</p> <ul style="list-style-type: none"> ○ Aneurysm rupture: 6 ○ ICH unrelated to aneurysm ruptures: 1 <p>Hemorrhagic complications: 12</p> <ul style="list-style-type: none"> ○ Aneurysm rupture: 7 (6 fatal) ○ ICH unrelated to rupture: 5 (1 fatal; 2 permanent deficits) <p>Ischemic complications: 18</p> <ul style="list-style-type: none"> ○ TIA: 11 ○ Ischemic stroke: 5 (2 permanent deficits) ○ Retinal artery occlusion: 1 (1 permanent deficits) ○ In-stent thrombosis: 1
Delayed (>30 days post-procedure) deaths and hemorrhagic/ ischemic complications	<p>Total deaths: 7</p> <ul style="list-style-type: none"> ○ Aneurysm rupture: 2 ○ Worsening aneurysm mass effect: 1 ○ Rapid neurological deterioration: 1 ○ Unrelated to procedure: 3 <p>Hemorrhagic complications: 2</p> <ul style="list-style-type: none"> ○ Aneurysm rupture: 2 (2 fatal) <p>Ischemic complications: 2</p> <ul style="list-style-type: none"> ○ In-stent thrombosis: 2

Supplemental Table 5: Follow-up imaging findings.

Immediate post-procedure	Complete occlusion: 8/93 (8.6%)
	<ul style="list-style-type: none"> FD alone: 1/34 (2.9%) FD with coils: 0/18 (0%)
3 months	Incomplete occlusion: 82/93 (88.2%) <ul style="list-style-type: none"> Neck remnant/RROC Class II/mRRC Class II: 10 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 58 Unspecified: 14
	No change: 3/92 (3.2%)
6 months	Complete occlusion: 13/20 (65%) <ul style="list-style-type: none"> Neck remnant/RROC Class II/mRRC Class II: 5 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 2
	Complete occlusion: 149/187 (79.7%) <ul style="list-style-type: none"> FD alone: 117/152 (77.0%) FD with coils: 10/10 (100%) Giant (all treated with FD alone): 5/6 (83.3%) Paraophthalmic: 8/8 (100%)
12 months	Incomplete occlusion: 35/187 (18.7%) <ul style="list-style-type: none"> Neck remnant/RROC Class II/mRRC Class II: 18 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 7 Unspecified: 10
	Cannot determine: 3/187 (1.6%)
14 months	Complete occlusion: 79/91 (86.8%) <ul style="list-style-type: none"> FD alone: 79/91 (86.8%)
	Incomplete occlusion: 12/91 (13.2%) <ul style="list-style-type: none"> Neck remnant/RROC Class II/mRRC Class II: 5 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 5 Unspecified: 2
36 months	Complete occlusion: 15/15 (100%) <ul style="list-style-type: none"> FD alone: 13/13 (100%) FD with coils: 1/1 (100%) Paraophthalmic: 8/8 (100%)
	Complete occlusion: 71/76 (93.4%) <ul style="list-style-type: none"> FD alone: 71/76 (93.4%)
Latest (Range: 3 to 48 months; mean 10.7 months)	Incomplete occlusion: 4/76 (5.3%) <ul style="list-style-type: none"> Neck remnant/RROC Class II/mRRC Class II: 2 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 2
	Cannot determine: 1/76 (1.3%)
Latest (Range: 3 to 48 months; mean 10.7 months)	Complete occlusion: 26/69 (37.7%) <ul style="list-style-type: none"> FD alone: 7/10 (70%) FD with coils: 12/23 (52.2%)
	Incomplete occlusion: 43/69 (62.3%) <ul style="list-style-type: none"> Incomplete unspecified: 16 Neck remnant/RROC Class II/mRRC Class II: 16 Residual aneurysm/RROC Class III/mRRC Class IIIa and IIIb: 6
Latest (Range: 3 to 48 months; mean 10.7 months)	Unchanged: 3/69 (4.3%)
	Increased: 2/69 (2.9%)

mRRC: Modified Raymond-Roy Classification
OKM: O'Kelly-Marotta Grading scale
RROC: Raymond-Roy Occlusion Classification

Supplemental Table 6: Follow-up clinical findings.

6 months	mRS ≤1: 118/125 (94.4%)
	No deficits: 12/84 (14.3%) Improved: 41/84 (48.8%) Unchanged: 18/84 (21.4%) Worsened: 13/84 (15.5%)
14 months	No deficits: 15/15 (100%) ○ FD alone: 13/13 (100%) ○ FD with coils: 1/1 (100%) ○ Paraophthalmic: 8/8 (100%)
36 months	mRS ≤1: 80/89 (89.9%) mRS 2: 2/89 (2.2%) mRS 3: 1/89 (1.1%) mRS 4: 2/89 (2.2%) mRS 6: 4/89 (4.5%)
Latest (Range: 3 to 48 months; mean 19.0 months)	No deficits: 13/28 (46.4%) Improved: 6/28 (21.4%) Unchanged: 9/28 (32.1%)

mRS: Modified Rankin Scale

Supplemental Figure 4: Risk of bias summary (right): review authors' judgements about each risk of bias item for each included study. Risk of bias graph (below): review authors' judgements about each risk of bias item presented as percentages across all included studies.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Becske et al 2017	⊖	⊖	⊖	⊕			
Carneiro et al 2014	⊖	⊖	⊖	⊖	⊖	⊖	
Chiu et al 2018	⊖	⊖	⊖	⊖	⊖	⊖	
Jevsek et al 2016	⊖	⊖	⊖	⊖	⊖	⊖	
Kan et al 2012	⊖	⊖	⊖	⊕	⊕		
Miyachi et al 2017	⊖	⊖	⊖	⊖	⊖	⊖	
ReXiaTi et al 2018	⊖	⊖	⊖	⊖	⊖	⊖	
Szikora et al 2010	⊖	⊖	⊖	⊖	⊖		
Zhou et al 2014	⊖	⊖	⊖	⊖	⊖		

