On-line Table 1: Search syntax

PubMed Search Accessed on November 17, 2018 (71 Articles)	EMBASE Search Accessed on November 17, 2018 (168 Articles)	Scopus Search Accessed on November 17, 2018 (371 Articles)
(((((small vessels(Title/Abstract) OR small arteries(Title/Abstract))) AND flow diversion(Title/Abstract)) AND (intracranial aneurysms(Title/Abstract) OR cerebral aneurysms(Title/Abstract)))) OR ((((intracranial aneurysms(Title/Abstract) OR cerebral aneurysms(Title/Abstract))) AND distal(Title/Abstract)) AND (flow diversion(Title/Abstract) OR flow diverter(Title/Abstract)))	'intracranial aneurysms':ab,ti AND 'flow diverter':ab,ti AND 'distal':ab,ti OR ('intracranial aneurysms':ab,ti AND 'flow diverter':ab,ti AND 'artery':ab,ti)	(intracranial AND aneurysms AND flow AND diversion AND distal) OR (TITLE-ABS-KEY (intracranial AND aneurysms AND small AND vessels AND flow AND diversion))

On-line Table 2: Summary of studies included in meta-analysis

Study Name	Design	No. of Aneurysms Treated by FD	Successful Stent Deployment	Overall Complete/Near-Complete Occlusion	Overall Rate of Treatment-Related Complications	Description of Complication	Antiplatelet Therapy (Loading Dose/Maintenance Dose)
Studies reporting MCA location							
Morais et al, 2017[42]	R	8	NA	NA	NA	M2 arterial narrowing ($n = 4$)	ASA 320 mg/day + CP 300 mg/day 1 day before/ASA 160 mg/day + CP 75 mg/day for 1 yr, then ASA 160 mg/day
Möhlenbruch et al, 2017[31]	P MC	18	18/18	9/16	3/18	3 Symptomatic arterial slow flow of covered M2	ASA 100–300 mg/day + CP 75 mg/day 5 days before /ASA 100 mg/day + CP 75 mg/day for 3–6 mo, then ASA 100 mg/day
Bhogal et al, 2017[29]	P MC	13	13/13	11/12	2/13	1 Acute in-stent thrombosis reversed with therapy + 1 ischemic basal ganglia lesion	ASA 100 mg/day + CP 75 mg/day/ASA 100 mg/day + CP 75 mg/day for 1 yr, then ASA 100 mg/day
Iosif et al, 2017[30]	P MC	63	63/63	39/40	5/58	3 Periprocedural and 1 delayed thromboembolism + 1 peri-aneurysmal inflammation	ASA 100 mg/day + CP 75 mg/day/ASA 100 mg/day + CP 75 mg/day
Bhogal et al, 2018[11]	R	15	15/15	11/14	2/15	1 Arterial dissection + 1 ischemic perforator lesion	ASA 100 mg/day + CP 75 mg/day 7 days before/ASA 100 mg/day + CP 75 mg/day for 2 mo, then ASA 100 mg/day
Topcuoglu et al, 2016[26]	R	29	29/29	20/27	5/28	1 Acute thrombosis of covered M2 + 2 M2 narrowing + 1 M2 occlusion + 1 aneurysm rupture + 1 ICH	ASA 300 mg/day + CP 75 mg/day 5–10 days before/ASA 300 mg/day + CP 75 mg/day for 6 mo, then ASA 100 mg/day
Lin et al, 2016[1]	R	20	19/20	17/19	2/20	1 Ischemic lesion + 1 in-stent delayed occlusion	ASA 300 mg/day + CP 75 mg/day 5 days before/NA
Briganti et al, 2016[12]	R	15	NA	12/15	4/14	4 Delayed thromboembolic events	ASA 150 mg/day + CP 75 mg/day 5 days before/ASA 100 mg/day + CP 75 mg/day for 1 yr, then ASA 100 mg/day
Caroff et al, 2016[13]	R	15	14/15	9/13	7/14	1 Acute transitory in-stent occlusion + 6 thromboembolic events	ASA 160 mg/day + CP 75 mg/day 7 days before/ASA 100 mg/day + CP 75 mg/day for 3 mo, then ASA 100 mg/day
Gawlitza et al, 2016[18]	R	12	12/12	4/12	6/12	1 Intraoperative perforation + 5 perforator strokes	ASA 100 mg/day + CP 75 mg/day 7 days before/ASA 100 mg/day + CP 75 mg/day for 4 mo, then ASA 100 mg/day
Yavuz et al, 2014[27]	R	25	23/25	21/25	3/21	1 SAH of unknown origin + 1 acute in-stent thrombosis resolved with therapy + 1 thromboembolism after CP discontinuation	ASA 160 mg/day + CP 75 mg/day 5 days before/ASA 100 mg/day + CP 75 mg/day for 6 mo, then ASA 100 mg/day
Saleme et al, 2014[4]	R	19	19/19	NA	NA	NA	NA
Zanaty et al, 2014[28]	R	10	10/10	8/9	3/10	1 Symptomatic occlusion of covered M2 + 2 thromboembolisms after CP discontinuation	ASA 81 mg/day + CP 75 mg/day 10 days before/ASA 81 mg/day + CP 75 mg/day for 6 mo, then ASA 81 mg/day
De Vries et al, 2013[17]	P	9	9/9	3/5	NA	NA	ASA 80 mg + CP 75 mg 5 days before/ASA 100 mg/day + CP 75 mg/day for 6 mo, then ASA 100 mg/day
Pistocchi et al, 2012[23]	R	8	8/8	3/5	2/8	1 Intraprocedural arterial perforation + 1 delayed in-stent thrombosis with permanent deficit	ASA 250 mg/day + CP 75 mg/day/ASA 250 mg/day + CP 75 mg/day for 6 mo
Lubicz et al, 2011[21]	R	7	7/7	7/8	NA	NA	ASA 300 mg + CP 300 mg 5 days before/ASA 160 mg/day + CP 75 mg/day for 6 mo
Studies reporting AcomA location							
Pistocchi et al, 2012[23]	R	16	16/16	12/14	1/16	Transient hemiparesis due to slow flow of covered A2	ASA 250 mg/day + CP 75 mg/day/ASA 250 mg/day + CP 75 mg/day for 6 mo
Toma et al, 2013[25]	R	7	7/7	NA	2/7	Acute in-stent thrombosis ($n = 2$)	ASA 300 mg/day + CP 75 mg/day 3 days before/ASA 300 mg/day + CP 75 mg/day for 3–6 mo, then ASA lifelong
Saleme et al, 2014[4]	R	9	9/9	9/9	NA	NA	NA
Gawlitza et al, 2016[18]	R	5	5/5	5/5	2/5	2 Ischemic lesions due to the coverage of Heubner artery	ASA 100 mg/day + CP 75 mg/day 7 days before/ASA 100 mg/day + CP 75 mg/day for 4 mo, then ASA 100 mg/day
Dabus et al, 2017[15]	R	13	13/13	11/13	2/13	1 Caudate infarct + 1 ICH	NA
Colby et al, 2017[14]	R	41	48/50	29/34	4/41	2 Acute in-stent thromboses + 2 ICHs	NA
Möhlenbruch et al, 2017[31]	P MC	11	11/11	6/9	0/11	NA	ASA 100–300 mg/day + CP 75 mg/day 5 days before /ASA 100 mg/day + CP 75 mg/day for 3–6 mo, then ASA 100 mg/day
Wakhloo et al, 2015[33]	P MC	12	NA	8/9	0/12	NA	ASA 81 mg/day + CP 75 mg/day 3 days before/ASA 81 mg/day + CP 75 mg/day for 3 mo, then ASA 81 mg/day
Lin et al, 2017[20]	R	10	10/10	NA	NA	NA	NA

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On-line Table 2: Continued

Study Name	Design	No. of Aneurysms Treated by FD	Successful Stent Deployment	Overall Complete/Near-Complete Occlusion	Overall Rate of Treatment-Related Complications	Description of Complication	Antiplatelet Therapy (Loading Dose/Maintenance Dose)
Lin et al (aneurysms retreated) 2018[19]	R	6	5/6	5/6	0/6	NA	NA
Pierot et al, 2018[32]	P MC	9	9/9	NA	3/9	1 Thromboembolism + 1 acute in-stent occlusion + 1 intraprocedural perforation	NA
Rautio et al, 2018[24]	R	6	6/6	6/6	0/6	NA	ASA 100 mg/day + CP 75 mg/day 5 days before/ASA 160 mg/day + CP 75 mg/day for 6 mo, then ASA 160 mg/day for 12 mo
Studies reporting DACA location							
Möhlenbruch et al, 2017[31]	P MC	13	13/13	10/13	1/13	1 Symptom related to diminished flow of the covered branch	ASA 100–300 mg/day + CP 75 mg/day 5 days before /ASA 100 mg/day + CP 75 mg/day for 3–6 mo, then ASA 100 mg/day
De Macedo et al, 2018[16]	R	7	7/7	5/7	0/7	NA	ASA 81–325 mg/day + CP 75 mg/day 5 days before/ASA 100 mg/day + CP 75 mg/day for a minimum of 6 mo
Dabus et al, 2017[15]	R	6	6/6	3/6	0/6	NA	NA
Lin et al, 2016[1]	R	5	5/5	5/5	0/5	NA	ASA 300 mg/day + CP 75 mg/day 5 days before/NA
Nossek et al, 2017[22]	R	5	5/5	5/5	1/5	1 Asymptomatic occlusion of covered branch	ASA 325 mg/day + CP 75 mg/day 5 days before/ASA 300 mg/day + CP 75 mg/day for at least 3 mo
Cagnazzo et al, 2018[2]	R	17	17/17	13/17	3/17	1 Acute in-stent occlusion after discontinuation of AT + 1 subacute reversible in-stent occlusion + 1 thromboembolism	ASA 81 mg/day + CP 75 mg/day 5 days before/ASA 81 mg/day + CP 75 mg/day for 6 mo, then ASA 81 mg/day lifelong

Note:—R indicates retrospective study; P MC, prospective multicentric study; CP, clopidogrel; ASA, acetylsalicylic acid; NA, not available; ICH, intracranial hemorrhage.

On-line Table 3: Quality measure of included studies by the modified Newcastle-Ottawa quality assessment scale[a,b]

	Selection				Comparability		Outcome/Exposure			
Study Name	1)	2)	3)	4)	a) (Not tested)	b)	1)	2)	3)	Total
MCA location retrospective design (score 0–8)										
Morais et al, 2017[42]	*	*					*			3
Bhogal et al, 2017[29]	*	*				*	*		*	5
Topcuoglu et al, 2016[26]	*	*				*	*		*	5
Lin et al, 2016[1]	*	*				*	*		*	5
Briganti et al, 2016[12]	*	*				*	*		*	5
Caroff et al, 2016[13]	*	*				*	*		*	5
Gawlitza et al, 2016[18]	*	*				*	*		*	5
Yavuz et al, 2014[27]	*	*				*	*		*	5
Saleme et al, 2014[4]	*	*					*		*	4
Zanaty et al, 2014[28]	*	*				*	*		*	5
De Vries et al, 2013[17]	*	*					*		*	4
Pistocchi et al, 2012[23]	*	*				*	*		*	5
Lubicz et al, 2011[21]	*	*					*		*	4
MCA location prospective design (score 0–8)										
Möhlenbruch et al, 2017[31]	*		*	*		*	*	*	*	7
Bhogal et al, 2017[29]	*		*	*		*	*	*	*	7
Iosif et al, 2017[30]	*		*	*			*	*	*	6
AcomA location retrospective design (score 0–8)										
Pistocchi et al, 2012[23]	*	*				*	*		*	5
Toma et al, 2013[25]	*	*				*	*		*	5
Saleme et al, 2014[4]	*	*					*		*	4
Gawlitza et al, 2016[18]	*	*				*	*		*	5
Dabus et al, 2016[15]	*	*				*	*		*	5
Colby et al, 2017[14]	*	*				*	*		*	5
Lin et al, 2017[20]	*	*					*		*	4
Lin et al, (aneurysm retreatment) 2018[19]	*	*					*		*	4
Rautio et al, 2018[24]	*	*					*		*	4
AcomA location prospective design (score 0–8)										
Mohlenbruch et al, 2017[31]	*		*	*		*	*	*	*	7
Wakhloo et al, 2015[33]	*		*	*		*	*	*	*	7
Pierot et al, 2018[32]	*		*	*		*	*	*	*	7
DACA location retrospective design (score 0–8)										
De Macedo et al, 2018[16]	*	*				*	*		*	5
Dabus et al, 2017[15]	*	*				*	*		*	5
Lin et al, 2016[1]	*	*				*	*		*	5
Nossek et al, 2017[22]	*	*				*	*		*	5
Cagnazzo et al, 2018[2]	*	*				*	*		*	5
DACA location prospective design (score 0–8)										
Mohlenbruch et al, 2017[31]	*		*	*		*	*	*	*	7

[a] Newcastle-Ottawa quality-assessment scale for retrospective studies. Studies with ≥5 asterisks were considered high-quality.

Selection

1) Is the case definition adequate?
   a) Yes, with independent validation*
   b) Yes, eg, record linkage or based on self-reports
   c) No description
2) Representativeness of the cases
   a) Consecutive or obviously representative series of cases*
   b) Potential for selection biases or not stated
3) Selection of controls
   a) Community controls*
   b) Hospital controls
   c) No description
4) Definition of controls
   a) No history of disease (end point)*
   b) No description of source

Comparability

1) Comparability of cases and controls on the basis of the design or analysis
   a) Study controls for (select the most important factor)*
   b) Study controls for any additional factor.* (these criteria could be modified to indicate specific control for a second important factor)

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On-line Table 3: Continued

Note =
Comparability (point a) was not tested because the design of the reported studies.
Comparability (point b) was tested comparing subgroups of analysis: One point was attributed if the study reported the analysis of the subgroups
Exposure
1) Ascertainment of exposure
   a) Secure record (eg, surgical records)*
   b) Structured interview where blind to case/control status*
   c) Interview not blinded to case/control status
   d) Written self-report or medical record only
   e) No description
2) Same method of ascertainment for cases and controls
   a) Yes*
   b) No
3) Nonresponse rate
   a) Less than 20%*
   b) Nonrespondents described
   c) Rate different and no designation.

[b] Newcastle-Ottawa quality-assessment scale for prospective studies. Studies with ≥5 asterisks were considered high-quality.

Selection
1) Representativeness of the exposed cohort
   a) Truly representative of the average (patients treated with braided stents) in the community*
   b) Somewhat representative of the average (patients treated with braided stents) in the community*
   c) Selected group of users, eg, nurses, volunteers
   d) No description of the derivation of the cohort
2) Selection of the nonexposed cohort
   a) Drawn from the same community as the exposed cohort*
   b) Drawn from a different source
   c) No description of the derivation of the nonexposed cohort
3) Ascertainment of exposure
   a) Secure record (eg, surgical records)*
   b) Structured interview*
   c) Written self-report
   d) No description
4) Demonstration that outcome of interest was not present at start of study
   a) Yes*
   b) No

Comparability
1) Comparability of cohorts on the basis of the design or analysis
   a) Study controls for _____ (select the most important factor)*
   b) Study controls for any additional factor* (these criteria could be modified to indicate specific control for a second important factor)

Note =
Comparability (point a) was not tested because of the design of the reported studies
Comparability (point b) was tested comparing subgroups of analysis: One point was attributed if the study reported the analysis of the subgroups (distal vs proximal location, anterior vs posterior circulation and so forth)

Outcome
1) Assessment of outcome
   a) Independent blind assessment*
   b) Record linkage*
   c) Self-report
   d) No description
2) Was follow-up long enough for outcomes to occur
(Adequate follow-up was considered a follow-up longer than the median follow-up time of the reported studies)
   a) Yes (select an adequate follow-up period for outcome of interest)*
   b) No
3) Adequacy of follow-up of cohorts
   a) Complete follow up: all subjects accounted for*
   b) Subjects lost to follow-up unlikely to introduce bias: small number lost (<20% of the original population) to follow-up or description provided of those lost*
   c) Follow-up rate (<80% of the original population) and no description of those lost
   d) No statement

On-line Table 4: Patient population and characteristics of distally located intracranial aneurysms treated with flow diversion

Variables	Raw Nos. (%)	No. of Articles	95% CI
Population characteristics			
Overall patients/aneurysms	484	27	
No. of MCA aneurysms	286	16	
No. of AcomA aneurysms	145	12	
No. of DACA aneurysms	53	6	
Mean/median age (general population) (yr)	54.5/55 (range, 18–82)	24	
Mean/median age (MCA population) (yr)	53/52 (range, 21–82)	12	
Mean/median age (AcomA population) (yr)	56/55 (range, 18–73)	7	
Mean/median age (DACA population) (yr)	57/58 (range, 20–81)	5	
Overall proportion of men	127/350 = 36%	20	31–41
Aneurysm characteristics			
Overall mean aneurysm size	6 mm (median, 5.7 mm; range, 2–21 mm)	24	
Mean MCA aneurysm size	7 mm (median, 6.5 mm; range, 3–21 mm)	11	
Mean AcomA aneurysm size	5.6 mm (median, 5 mm; range, 4–15 mm)	8	
Mean DACA aneurysm size	5.2 mm (median, 5.5 mm; range, 2–12 mm)	5	
Treatment characteristics			
Type of FD/total of FD used			
PED	284/457 = 62%		57–66
FRED	71/457 = 15.5%	24	12–19
Silk	48/457 = 10.5%		8–13
p64	31/457 = 7%		4–9
Surpass	23/457 = 5%		3–7
Radiologic Follow-up (mo)			
Mean	12 (range, 4–28)	27	
Median (IQR)	12.5 (10–12.5)		
Clinical follow-up (mo)			
Mean	13 (range, 6–30)	27	
Median (IQR)	12 (10–14)		

On-line Table 5: Factors related to aneurysm occlusion and treatment-related complications after flow diversion of distally located anterior circulation aneurysms

Variables	Complete/Near-Complete Occlusion (95% CI)	No. of Articles	*P* Value	Treatment-Related Complications (95% CI)	No. of Articles	*P* Value
Factors influencing occlusion and complication rate						
Aneurysm size	104/128 vs 35/44			14/94 vs 11/36		
Small vs large/giant[a]	(0.4–2.3) (I^2 = 0%)	12	.9	(0.1–1.1) (I^2 = 0%)	13	.04[b]
	OR = 1.02			OR = 0.4		
Mean aneurysm size	Complete occlusion 6 ± 4.6 mm	12		Complications	12	
	vs		.3	7 ± 4.3 mm		.06[b]
	Incomplete occlusion 6.5 ± 6.3 mm			vs		
				No complications		
				4.4 ± 4.5 mm		
Mean difference of age among completely occluded	54 vs 60 yr			58.5 vs 60		
vs	Mean difference = 6	11	.06[b]	Mean difference = 1.7	13	.09
Incompletely occluded aneurysms	(2.5–12.6) (I^2 = 82%)			(0.5–6.2) (I^2 = 0%)		
Flow-diverter + coils	47/59 vs 101/136			3/26 vs 12/64		
vs	(0.5–2.8) (I^2 = 0%)	10	.4	(0.2–9) (I^2 = 48%)	7	.5
Flow diverter alone	OR = 1.05			OR = 1.99		
Multiple flow diverters	33/37 vs 77/101			12/60 vs 16/122		
vs	(0.5–3.8) (I^2 = 0%)	15	.5	(0.7–3.7) (I^2 = 0%)	15	.2
Single flow diverter	OR = 1.4			OR = 1.6		
Fusiform/dissecting aneurysms	48/60 = 80%	6		8/47 = 14%	5	
	(72–90) (I^2 = 0%)			(4–23) (I^2 = 0%)		
vs	vs		.5	vs		.8
	186/244 = 76%	16		38/222 = 15%	14	
Saccular	(82–97) (I^2 = 0%)			(9–22) (I^2 = 47%)		

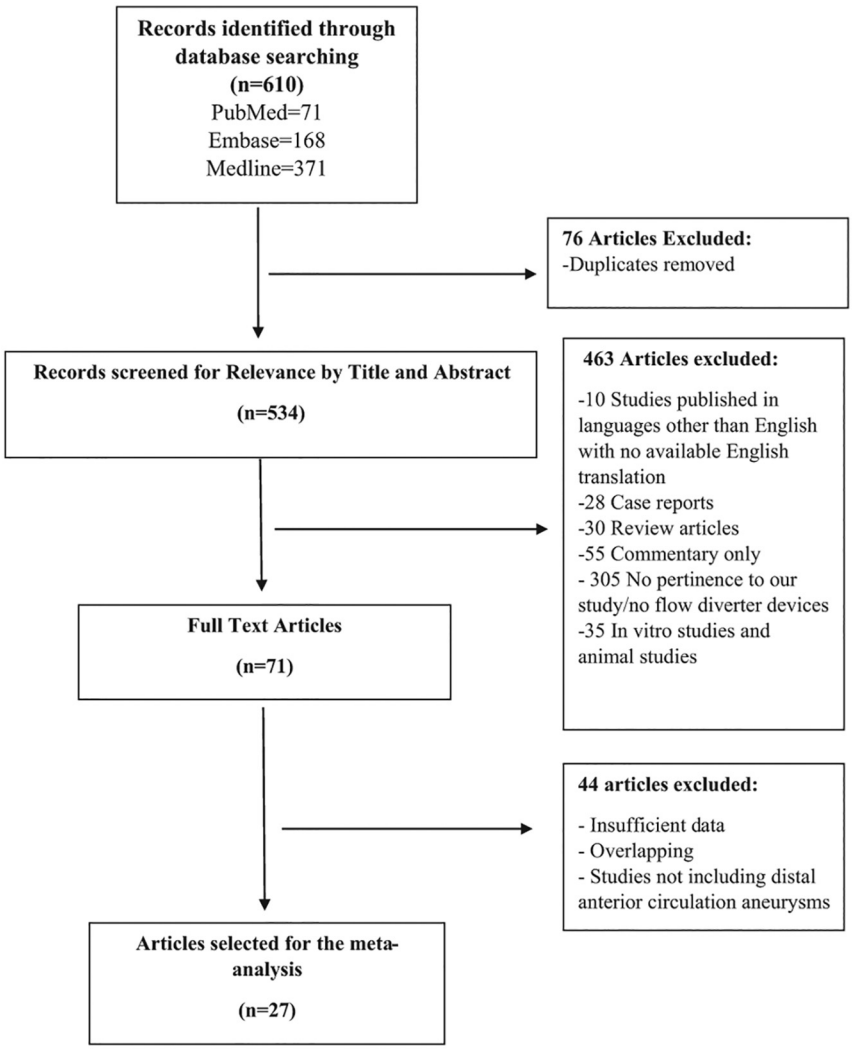
[a] Small aneurysms, ≤10 mm; large aneurysms, ≥10 mm; giant aneurysms, ≥25 mm; CI, confidence interval; I^2, heterogeneity.

[b] Significant.

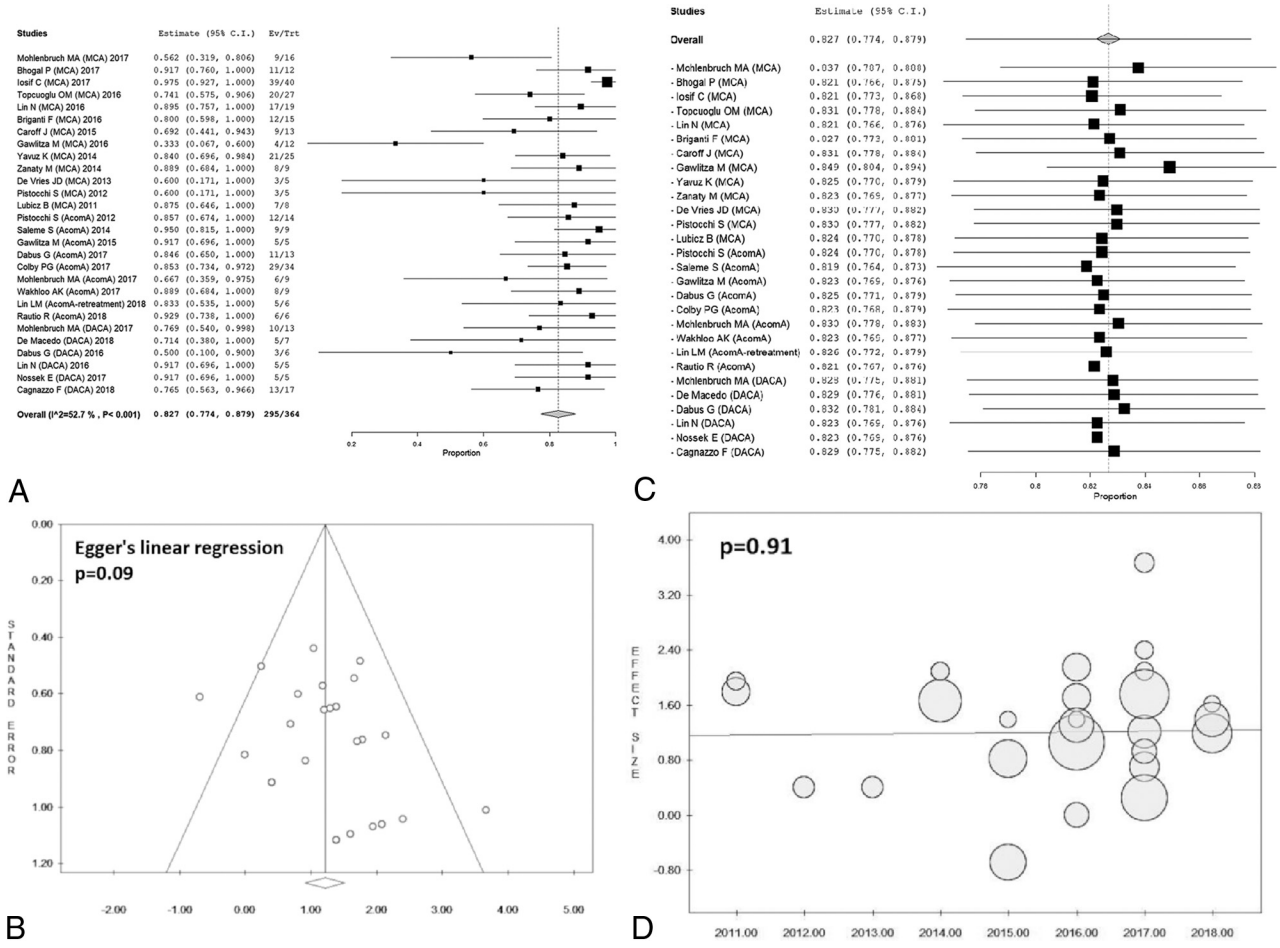
On-line Table 6: Outcome of covered vessels by flow-diverter stents used for the treatment of distally located anterior circulation aneurysms

Variables	Results of Systematic Review and Meta-Analysis	No. of Articles	Statistic (95% CI) (I^2)
Angiographic outcomes and symptoms related to arterial flow changes			
Overall rate of vessel occlusion (late follow-up)	29/283 = 6.3%	22	(3.5–9.1) (I^2 = 4.2%)
Overall rate of arterial narrowing (late follow-up)	69/283 = 23.8%	22	(15.7–32) (I^2 = 80%)
Symptoms related to vessel occlusion	6/269 = 3.5%	21	(1.1–5) (I^2 = 0%)
Symptoms related to arterial narrowing/slow flow	6/245 = 3%	21	(1–4) (I^2 = 0%)
Angiographic outcome of covered vessels by location and device			
Rate of vessel occlusion (MCA location)	22/207 = 7.3%	14	(3.5–11) (I^2 = 15%)
Rate of vessel occlusion (ACA location)	7/76 = 5.5%	8	(1–11) (I^2 = 0%)
Rate of vessel occlusion (PED device)	11/124 = 7.7%	12	(3.2–12) (I^2 = 0%)
Rate of vessel occlusion (other devices)	9/61 = 7%	4	(3.5–10) (I^2 = 0%)

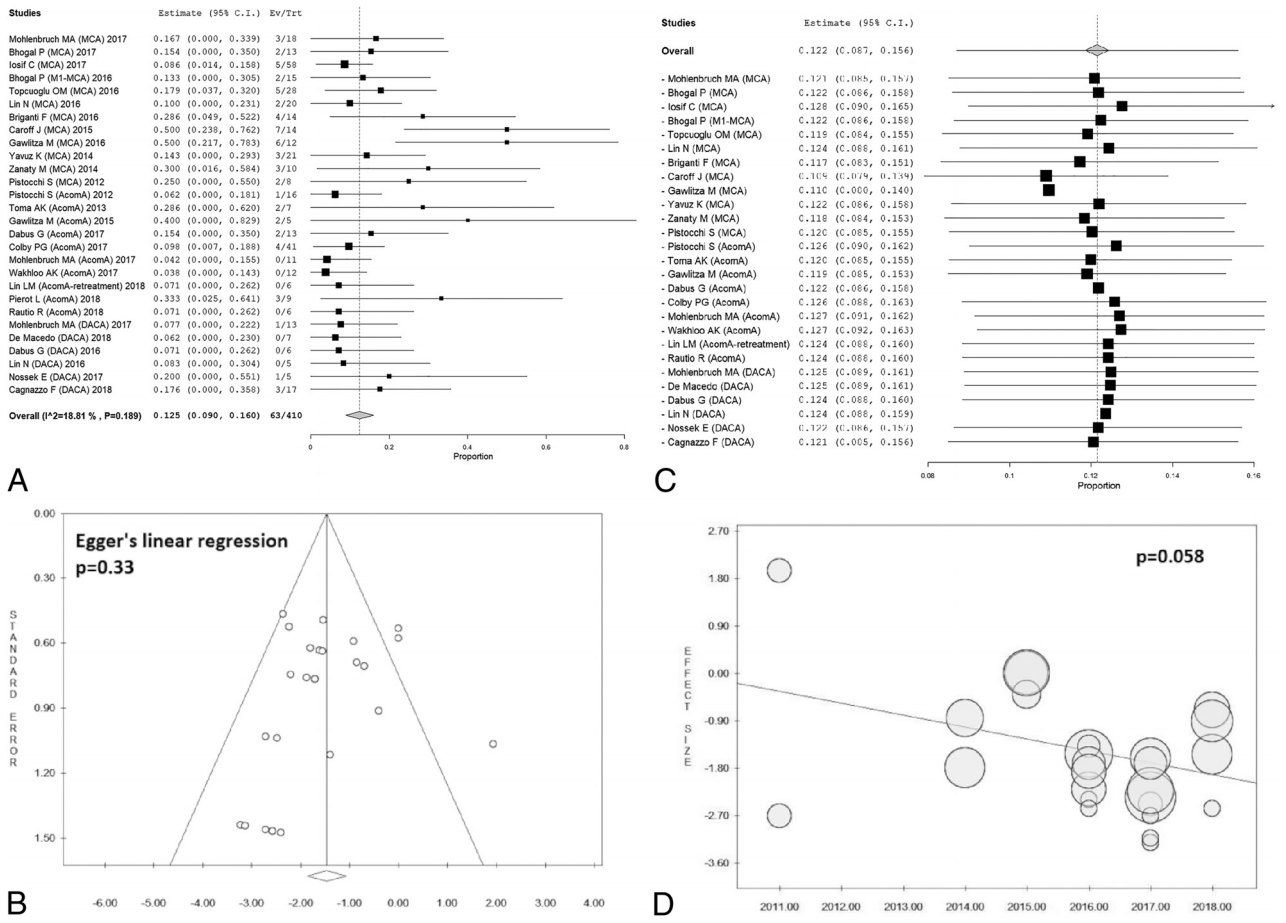
Note:—ACA indicates anterior cerebral artery.



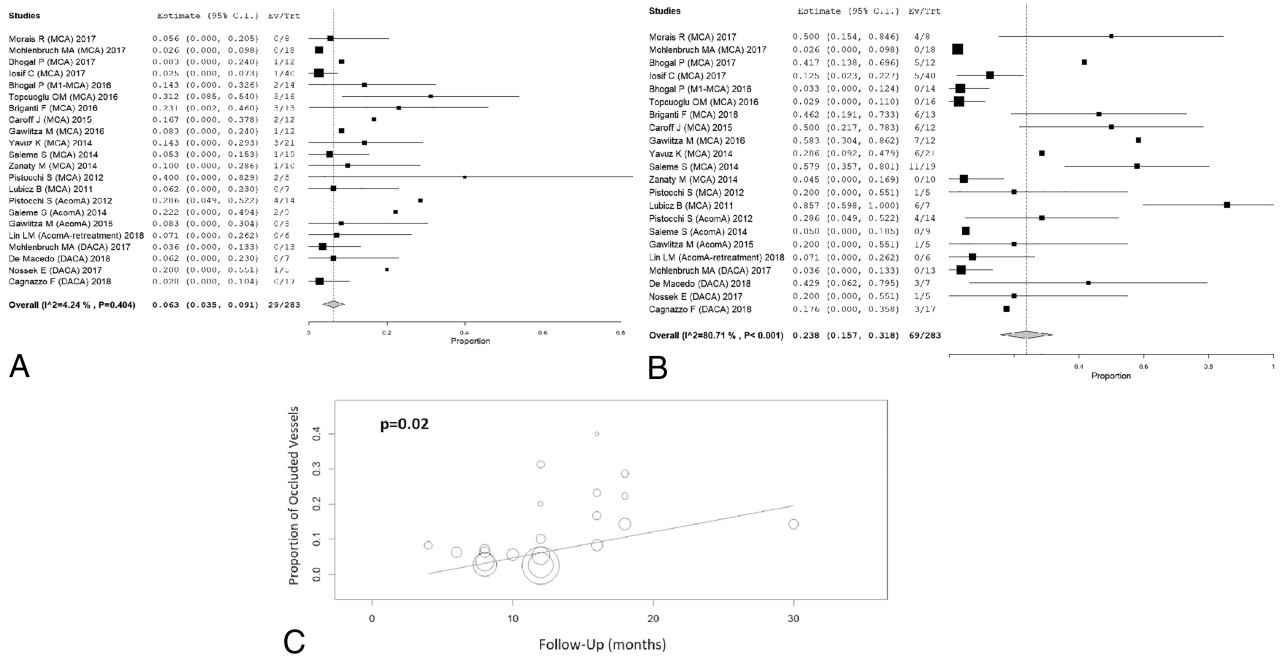
ON-LINE FIG 1. PRISMA diagram detailing the specifics of the systematic literature review.



ON-LINE FIG 2. Forest plot demonstrating the overall rate of aneurysm occlusion (*A*). The funnel plot (Egger linear regression) excludes publication bias (*B*). Sensitivity analysis shows that no individual study significantly influenced the reported outcome (*C*). Meta-regression shows a nonsignificant variation of the effect size (*D*).



ON-LINE FIG 3. Forest plot demonstrating the overall rate of treatment–related complications (*A*). The funnel plot (Egger linear regression) excludes publication bias (*B*). Sensitivity analysis shows that no individual study significantly influenced the reported outcome (*C*). Meta-regression shows a trend toward lower complications during the analyzed period (*D*).



ON-LINE FIG 4. Forest plot showing the rate of occlusion (*A*) and narrowing (*B*) of jailed arteries. Meta-regression demonstrates a significant association between jailed vessel occlusion and the length of the angiographic follow-up (*C*).