Table SI. Detailed clinical information of the participants.

ID	Disease	Age, years	Sex	Taken medicines	Antibiotics for the operation	Clinical presentation	Duration until surgery from the last clinical presentation	Subtype of MMD	Aneurysm location/size	Epileptic origin
1	MMD	64	F	Cilostazol 100 mg/day, atorvastatin 10 mg/day	Cefazolin 1 g	ICH	2 months	One side	-	-
2	MMD	47	F	Aspirin 100 mg/day, Lansoprazole 15 mg/day, Atorvastatin Calcium Hydrate 10 mg/day, Tsumura Goreisan 2.5g/day, Bepotastine Besilate 10 mg/day	Cefazolin 1 g	IF	8 months	Bilateral	-	-
3	MMD	48	F	Amlodipine Besilate 5 mg/day	Cefazolin 1 g	ICH	6 months	Bilateral	-	-
4	MMD	49	F	Aspirin 100 mg/day	Cefazolin 1 g	TIA	9 months	Bilateral	-	-
5	MMD	59	F	Cilostazol 100 mg/day, Esomeprazole Magnesium Hydrate 20 mg/day	Cefazolin 1 g	IF	11 months	Bilateral	-	-
6	MMD	50	F	Cilostazol 100 mg/day, Olopatadine Hydrochloride 5 mg/day	Cefazolin 1 g	TIA	1 month	Bilateral	-	-
7	MMD	45	F	Aspirin 100 mg/day, Lansoprazole 15 mg/day, Clopidogrel Sulfate 75 mg/day, Pitavastatin Calcium Hydrate 2 mg/day	Cefazolin 1 g	IF	1 year and 1 month	Bilateral	-	-
8	MMD	48	F	Aspirin 100 mg/day, Lansoprazole 15 mg/day, Celecoxib 100 mg/day	Cefazolin 1g	TIA	3 months	Bilateral	-	-

9	MMD	51	M	Aspirin 100 mg, Etizolam 0.5 mg/day, Olmesartan Medoxomil 10 mg/day, Azelnidipine 8 mg/day	Cefazolin 1 g	TIA	1 month	Bilateral	-	-
10	MMD	53	F	Aspirin 100 mg/day, Lansoprazole 15 mg/day	Cefazolin 1 g	TIA	7 months	Bilateral	-	-
11	MMD	43	F	Aspirin 100 mg, /day Lansoprazole 15 mg/day, Telmisartan 40 mg/day	Cefazolin 1 g	TIA	1 year and 2 months	Bilateral	-	-
12	MMD	34	F	Aspirin 100 mg/day	Cefazolin 1 g	TIA	5 months	Bilateral	-	-
13	MMD	29	F	Levetiracetam 1000 mg/day, Phenytoin 300 mg/day, Sodium Ferrous Citrate 100 mg/day	Cefazolin 1 g	ICH	7 months	Bilateral	-	-
14	MMD	32	M	Aspirin 100 mg/day, Lansoprazole 15 mg/day	Cefazolin 1 g	TIA	Several days	Bilateral	-	-
15	MMD	7	F	No	Cefazolin 1 g	TIA	Several days	Bilateral	-	-
16	MMD	27	M	Aspirin 100 mg/day, Esomeprazole Magnesium Hydrate 20 mg/day	Cefazolin 1 g	TIA	8 months	Bilateral	-	-
17	MMD	5	M	Aspirin 30 mg/day	Cefazolin 0.3g	IF	3 months	Bilateral	-	-
18	MMD	39	M	No	Cefazolin 1 g	TIA	7 months	Bilateral	-	-
19	MMD	11	M	Cilostazol 150 mg/day	Cefazolin 0.5g	TIA	2 months	Bilateral	-	-
20	MMD	46	F	Sodium Ferrous Citrate 50 mg/day, Olopatadine Hydrochloride 10 mg/day	Cefazolin 1 g	TIA	2 months	Bilateral	-	-
21	MMD	35	F	Pregabalin 225 mg/day, Amitriptyline Hydrochloride 35 mg/day, Desloratadine 5 mg/day	Cefazolin 1 g	TIA	8 months	Bilateral	-	-

22	IA	62	F	Loxoprofen Sodium Hydrate 180 mg/day, Rebamipide 300 mg/day, Brotizolam 0.25 mg/day, Diazepam 2 mg/day	Cefazolin 1 g	No	-	-	ICA/27mm	-
23	IA	78	F	Etizolam 0.5 mg/day, Tandospirone Citrate 20 mg/day, Kallidinogenase 100 units/day, Magnesium Oxide 660 mg/day	Cefazolin 1 g	No	-	-	Covernous/28mm	-
24	IA	79	F	Aspirin 100 mg/day, Cilostazol 100 mg/day, Acetaminophen 1200 mg/day, Mecobalamin 1500 μg/day, Benidipine Hydrochloride 4 mg/day, Ezetimibe 10 mg/day, Rosuvastatin Calcium 5 mg/day, Candesartan Cilexetil 8 mg/day	Cefazolin 1 g	Oculomotor nerve palsy	1 month	-	Cavernous/26mm	-
25	IA	70	F	Valsartan 160 mg/day, Amlodipine Besilate 10 mg/day, Imidapril Hydrochloride 5 mg/day, Doxazosin Mesilate 2 mg/day, methotrexate 10 mg/week	Cefazolin 1 g	Oculomotor nerve palsy	Several days	-	Cavernous/20mm	-

26	IA	65	F	Clopidogrel Sulfate 75 mg/day, Atorvastatin Calcium Hydrate 10 mg/day, L-Carbocisteine 1500 mg, Mecobalamin 1500 μg/day, d-Chlorpheniramine Maleate 6 mg/day, Betamethasone 0.5mg/day, d-Chlorpheniramine Maleate 4 mg/day, Olopatadine Hydrochloride 20 mg/day	Cefazolin 1 g	Oculomotor nerve palsy, head ache	Several days	-	Cavernous/27mm	-
27	IA	71	F	Aspirin 100 mg/day, Esomeprazole Magnesium Hydrate 20 mg/day, Valsartan 80 mg/day, Amlodipine Besilate 5 mg/day, Suvorexant 15 mg/day	Cefazolin 1 g	No	-	-	ICA/21mm	-
28	EPI	56	M	Levetiracetam 2000 mg/day, Lamotrigine 300 mg/day, Perampanel Hydrate 4 mg/day, Pravastatin Sodium 20 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Temporal lobe
29	EPI	14	M	Lacosamide 300 mg/day, Clobazam 15 mg/day, Perampanel Hydrate 6 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Frontal lobe

30	EPI	20	M	Lacosamide 400 mg/day, Lamotrigine 200 mg/day, Carbamazepine 400 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Frontal lobe
31	EPI	43	F	Carbamazepine 300 mg/day, Atorvastatin Calcium Hydrate 5 mg/day, Fexofenadine Hydrochloride 120 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Temporal lobe
32	EPI	2	M	Levetiracetam 325 mg/day, Zonisamid 16 mg/day	Cefotaxime 0.5 g	Seizures	Several days	-	-	Frontal lobe
33	MMD	64	F	Atorvastatin 10 mg/day	Cefazolin 1 g	ICH	2 months	Bilateral	-	-
34	MMD	47	F	Aspirin 100 mg/day, atorvastatin 10 mg/day	Ceftriaxone 2 g	TIA	5 months	Bilateral	-	-
35	MMD	48	F	Amlodipine 5 mg/day	Ceftriaxone 2 g	ICH	6 months	Bilateral	-	-
36	MMD	49	F	Aspirin 100 mg/day	Cefazolin 1 g	TIA	6 months	Bilateral	-	-
37	MMD	59	F	Cilostazol 200 mg/day	Cefazolin 1 g	IF	11 months	Bilateral	-	-
38	MMD	50	F	Cilostazol 200 mg/day	Cefazolin 1 g	IF	8 months	Bilateral	-	-
39	MMD	45	F	Aspirin 100 mg/day, clopidogrel 75 mg/day	Clindamycin 600 mg	TIA	1 month	Bilateral	-	-
40	MMD	48	F	Aspirin 100 mg/day	Cefazolin 1 g	TIA	4 months	Bilateral	-	-
41	MMD	51	M	Aspirin 100 mg/day, olmesartan 20 mg/day, azelnidipine 16 mg/day, pitavastatin 2 mg/day	Cefazolin 1 g	TIA	2 months	Bilateral	-	-
42	MMD	53	F	Aspirin 100 mg/day	Cefazolin 1 g	TIA	4 months	Bilateral	-	-
43	MMD	43	F	Aspirin 100 mg/day, telmisartan 80 mg/day	Cefazolin 1 g	TIA	10 months	Bilateral	-	-
44	IA	62	F	No	Cefazolin 1 g	No	-	-	Supraclinoid/ 27 mm	-

45	IA	78	F	No	Cefazolin 1 g	Oculomotor nerve palsy	5 months	-	Cavernous/ 30 mm	-
46	IA	79	F	Cilostazol 100 mg/day, candesartan 8 mg/day, benidipine 4 mg/day, rosuvastatine 5 mg/day, ezetimibe 10 mg/day	Cefmetazole 1 g	Oculomotor nerve palsy	6 months	-	Cavernous/ 25 mm	-
47	IA	70	F	Clopidogrel 75 mg/day, valsartan 160 mg/day, amlodipine 10 mg/day, imidapril 5 mg/day, doxazosin 2 mg/day, methotrexate 10 mg/week	Cefazolin 1 g	Oculomotor nerve palsy	7 months	-	Cavernous/ 20 mm	-
48	IA	65	F	Clopidogrel 75 mg/day, atorvastatin 10 mg/day	Cefazolin 1 g	No	-	-	Cavernous/ 26 mm	-
49	IA	71	F	Aspirin 100 mg/day, valsartan 160 mg/day, amlodipine 5 mg/day	Cefazolin 1 g	No	-	-	Supraclinoid/ 22 mm	-
50	EPI	56	M	Pravastatin 20 mg, levetiracetam 2000 mg/day, lamotrigine 300 mg/day, perampanel 4 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Temporal lobe
51	EPI	14	M	Lacosamide 300 mg/day, perampanel 6 mg/day, clobazam 15 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Frontal lobe
52	EPI	20	M	Lacosamide 300 mg/day, lamotrigine 200 mg/day, carbamazepine 400 mg/day	Cefazolin 1 g	Seizures	Several days	-	-	Frontal lobe

The information of participants was obtained from the datasets GSE189993 and GSE157628, which were from published studies (1,2). MMD, moyamoya disease; F, female; M, male; IA, intracranial aneurysm; EPI, epilepsy; ONP, ocular nerve palsy; ICH, intracerebral hemorrhage; IF, infarction; TIA, transient ischemic attack; ICA, internal carotid artery; MCA, middle cerebral artery.

Table SII. Clinical and demographic characteristics of MMD participants.

No. of Patients	Groups	Sex	Age, years	Hypertension	Diabetes	Coronary heart disease	Hyperlipidemia	Smoking history, years	Alcohol consumption, years	Duration of symptoms, months	Suzuki stage
P1	MMD	M	41	NO	NO	NO	NO	NO	NO	8	L5/R4
P2	MMD	F	39	NO	NO	NO	NO	NO	NO	6	L1/R3
P3	MMD	F	51	NO	NO	NO	NO	NO	NO	6	L3/R3
P4	HC	M	38	NO	NO	NO	NO	NO	NO	-	-
P5	HC	F	30	NO	NO	NO	NO	NO	NO	-	-
P6	HC	F	45	NO	NO	NO	NO	NO	NO	-	-

MMD, moyamoya disease; HC, healthy controls; F, female; M, male.

Table SIII. Correlation analysis between hub genes and endothelial migration-related genes.

Gene1	Gene2	Cor	P-value
OSBPL11	GIPC1	-0.613	$2.61x10^{-5}$
NEIL2	SOX18	-0.575	0.000105
NEIL2	LPXN	0.571	0.00012
MSMO1	STAT1	0.565	0.000147
WDR27	PIK3CA	0.55	0.000234
MSMO1	LGALS8	0.525	0.000507
MSMO1	CEL	-0.521	0.000561
MSMO1	PIK3CA	0.499	0.001058
OSBPL11	NR4A1	-0.498	0.001089
WDR27	LGALS8	0.487	0.001432
OSBPL11	PRSS3	-0.485	0.00152
OSBPL11	LPXN	0.484	0.001574
OSBPL11	CYP1B1	0.478	0.001816
WDR27	NR4A1	-0.476	0.001929
OSBPL11	CDH13	0.475	0.001939
OSBPL11	S100P	0.472	0.002119
MSMO1	VEGFA	-0.471	0.002148
NEIL2	PRKX	0.47	0.002226
WDR27	PRSS3	-0.467	0.002407
MSMO1	PXN	-0.465	0.002477
OSBPL11	S100A9	0.455	0.003185
WDR27	PLXND1	-0.448	0.003757
WDR27	CDH13	0.442	0.004329
OSBPL11	RAB13	0.441	0.004433
MSMO1	ID1	-0.434	0.005138
WDR27	CEL	-0.433	0.005208
MSMO1	PRSS3	-0.425	0.006212
OSBPL11	S100A12	0.417	0.007445
WDR27	S100A9	-0.412	0.008209
MSMO1	NOS3	-0.407	0.009206

NEIL2	CYP1B1	0.392	0.012367
WDR27	CORO1B	0.389	0.013131
NEIL2	GIPC1	-0.388	0.0134
OSBPL11	PRKX	0.387	0.013689
MSMO1	S100A9	-0.382	0.014871
WDR27	PXN	-0.379	0.015771
WDR27	ABL1	0.379	0.016019
OSBPL11	MYH9	-0.377	0.016406
OSBPL11	CEL	-0.365	0.020543
MSMO1	NR4A1	-0.363	0.021365
OSBPL11	NELL1	-0.363	0.021406
NEIL2	NR4A1	-0.361	0.021995
NEIL2	STAT1	0.354	0.025071
WDR27	EGR3	-0.352	0.02576
OSBPL11	PIK3CA	0.351	0.026571
MSMO1	CORO1B	0.35	0.026677
WDR27	NOS3	-0.342	0.030879
NEIL2	CDH13	0.328	0.03853
NEIL2	EGR3	-0.327	0.039268
MSMO1	NELL1	-0.327	0.039584
OSBPL11	SOX18	-0.322	0.042822
NEIL2	TNFSF12	0.321	0.043481
NEIL2	NELL1	-0.318	0.045749
NEIL2	S100P	0.312	0.049789

Table SIV. Correlation analysis between hub genes and endothelial proliferation-related genes.

Gene1	Gene2	Cor	P-value
MSMO1	MSMO1	1	0
NEIL2	NEIL2	1	0
MSMO1	WDR27	0.737	$5.94x10^{-8}$
MSMO1	SEMA5A	0.582	$8.22x10^{-5}$
WDR27	DLG1	0.576	0.0001
MSMO1	ITGB1BP1	0.558	0.000185
OSBPL11	PROK2	0.543	0.000297
NEIL2	OSBPL11	0.537	0.000356
WDR27	SEMA5A	0.536	0.00036
MSMO1	DLG1	0.525	0.000504
NEIL2	PRKX	0.47	0.002226
MSMO1	THAP1	0.443	0.004224
WDR27	ITGB1BP1	0.441	0.004385
MSMO1	PROK1	-0.44	0.004454
OSBPL11	NRARP	-0.437	0.004784
MSMO1	NRARP	-0.432	0.005376
NEIL2	DLG1	0.401	0.010288
OSBPL11	PRKX	0.387	0.013689
WDR27	NRARP	-0.379	0.015998
NEIL2	ERN1	-0.369	0.01921
NEIL2	SEMA5A	0.367	0.019681
WDR27	THAP1	0.358	0.023407
OSBPL11	DLG1	0.346	0.02866
OSBPL11	SEMA5A	0.342	0.030595
OSBPL11	CD34	0.335	0.034355
MSMO1	HMOX1	-0.334	0.035032
NEIL2	NRARP	-0.329	0.038012
OSBPL11	ACVRL1	0.324	0.041326
OSBPL11	HMOX1	0.318	0.045491
NEIL2	PROK2	0.316	0.046806

References

(1) T. Mamiya, F. Kanamori, K. Yokoyama, A. Ota, S. Karnan, K. Uda, Y. Araki, S. Maesawa, K. Yoshikawa, and R. Saito, Long noncoding RNA profile of the intracranial artery in patients with moyamoya disease. J Neurosurg 138 (2023) 709-716.

(2) F. Kanamori, K. Yokoyama, A. Ota, K. Yoshikawa, S. Karnan, M. Maruwaka, K. Shimizu, S. Ota, K. Uda, Y. Araki, S. Okamoto, S. Maesawa, T. Wakabayashi, and A. Natsume, Transcriptome-wide analysis of intracranial artery in patients with moyamoya disease showing upregulation of immune response, and downregulation of oxidative phosphorylation and DNA repair. Neurosurg Focus 51 (2021) E3.