

Supplementary information

**Title: Application of a simple scoring scale to predict prognosis of poor-grade
subarachnoid haemorrhage using intraventricular haemorrhage**

Authors: Shuto Fushimi, Taisuke Akimoto, Makoto Ohtake, Yu Iida, Shigeta Miyake, Ryosuke

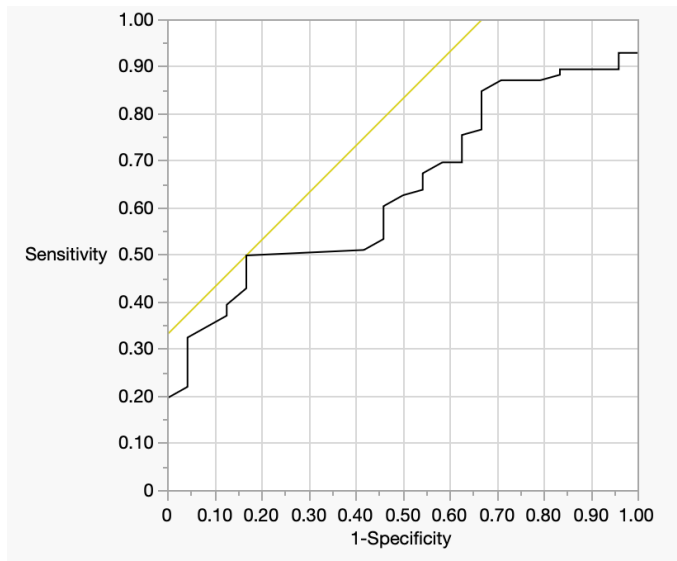
Suzuki, Satoshi Hori, Jun Suenaga, Yasunobu Nakai, Katsumi Sakata, Tetsuya Yamamoto

Supplemental Table S1: Baseline characteristics of study two

Variable	Overall (n=493)	mRS 0-2 (n=252)	mRS 3-6 (n=241)	Univariate analysis <i>P</i> Value	Multivariate analysis OR (95% CI) <i>P</i> value	
Mean age, y (SD)	62.8 ± 15.0	57.6 ± 12.8	68.2 ± 15.3	<0.0001	NA	NA
Male sex (%)	172 (34.9)	92 (36.5)	80 (33.2)	0.440		
Hypertension (%)	198 (40.2)	91 (36.1)	107 (44.4)	0.061		
Diabetes mellitus (%)	33 (6.7)	9 (3.6)	24 (10.0)	0.005	2.13 (1.29-3.67)	0.004
Dyslipidemia (%)	89 (18.1)	41 (16.3)	48 (19.9)	0.293		
Current smoke	94 (19.1)	65 (25.8)	29 (12.0)	0.0001	1.53 (1.13-2.09)	0.006
Af (%)	12 (2.4)	6 (2.4)	6 (2.5)	0.938		
Type 3 aortic arch	41 (8.3)	9 (3.6)	32 (13.3)	<0.0001	1.39 (1.11-2.24)	0.150
Bovine arch	14 (2.8)	3 (1.2)	11 (4.6)	0.024	2.04 (1.01-4.86)	0.062
Maximum aneurysm size, mm (SD)	6.2 ± 3.6	5.4 ± 2.7	6.9 ± 4.2	0.0002	1.10 (1.02-1.18) †	0.020
Dome neck ratio	1.5 ± 0.8	1.5 ± 0.7	1.5 ± 0.8	0.648		
Aneurysm location						
Acom (%)	115 (23.3)	59 (23.4)	56 (23.2)	0.963		
ACA (%)	27 (5.5)	12 (4.76)	15 (6.2)	0.476		
MCA (%)	36 (7.3)	21 (8.3)	15 (6.2)	0.368		
PCA (%)	17 (3.5)	7 (2.8)	10 (4.2)	0.404		
ICPC (%)	106 (21.5)	49 (19.4)	57 (23.7)	0.256		
ICA (%)	70 (14.2)	49 (19.4)	21 (8.7)	0.0006	1.32 (1.06-1.88)	0.107
Posterior circulation artery (%)	110 (22.3)	51 (20.2)	59 (24.5)	0.258		
WFNS				<0.0001	1.76 (1.50-2.09) †	<0.0001
I	145 (29.4)	119 (47.2)	26 (10.8)			
II	90 (18.3)	59 (23.4)	31 (12.9)			
III	62 (6.5)	16 (6.4)	16 (6.6)			
IV	90 (18.3)	30 (11.9)	60 (24.9)			
V	136 (27.6)	28 (11.1)	108 (44.8)			
Acute hydrocephalus	133 (27.0)	39 (15.5)	94 (39.0)	<0.0001	1.22 (1.10-1.63)	0.186
Fisher grade median (range)	3 (1-4)	3 (1-4)	3 (1-4)	<0.0001	1.18 (1.27-1.77) †	0.426
ICH (%)	79 (16.0)	28 (11.1)	51 (21.2)	0.002	1.23 (1.13-1.73)	0.224
IVH (%)	236 (47.9)	90 (35.7)	146 (60.6)	<0.0001		
Symptomatic spasm (%)	67 (13.6)	20 (7.9)	47 (19.5)	0.0002	1.56 (1.11-2.22)	0.011
Surgery for post-aSAH hydrocephalus (%)	107 (21.7)	30 (11.9)	77 (32.0)	<0.0001	1.55 (1.16-2.09)	0.003
Reruptured	10 (2.0)	2 (0.8)	8 (3.3)	0.047	1.58 (1.63-5.12)	0.390
Complication						
hemorrhagic	19 (3.9)	4 (1.6)	15 (6.2)	0.008	2.18 (1.15-4.46)	0.021
ischemic	115 (26.1)	52 (20.6)	63 (26.1)	0.148		
neural disorder	15 (3.0)	5 (2.0)	10 (4.2)	0.162		
IntraVentricular hemorrhAge score, median (range)	1 (0-5)	0 (0-4)	1 (0-5)	<0.0001	1.37 (1.10-1.70) †	0.005

ACA: anterior cerebral artery, Acom: anterior communicating artery, AF: atrial fibrillation, CI: confidence interval, CKD: chronic kidney disease, EVD: external ventricular drainage, ICA: internal carotid artery, ICPC: internal carotid artery-posterior communicating artery, ICH: intracerebral hemorrhage, IQR: interqartile range, IVH: intraventricular hemorrhage, MCA: middle cerebral artery, mRS: modified Rankin scale, OR: odds ratio, SD: standard deviation, WFNS: World Federation of Neurosurgical Societies

Supplemental Figure. 1



The receiver operating characteristic(ROC) curve analysis of age:

ROC analysis of age for unfavorable outcome (mRS3-6) was shown. The ideal cut-off value of age was 67, and the area under the curve (AUC), sensitivity, and specificity were 0.641, 0.500, and 0.834

Supplemental Table S2: Multivariate analysis for unfavorable outcome on study one

Variable	OR (95% CI)	<i>P</i> value
Age $\geq$ 65 y	1.64 (1.14-3.09)	0.123
Aneurysm size, mm	1.18 † (1.07-1.49)	0.160
WFNS grade V	1.04 (1.85-1.98)	0.914
ICH	2.68 (1.10-6.52)	0.030
IVH	2.15 (1.14-4.04)	0.018
Variable	OR (95% CI)	<i>P</i> value
Age $\geq$ 67 y	5.73 (2.12-27.3)	0.004
Aneurysm size, mm	1.17 † (1.11-1.64)	0.319
WFNS grade V	1.44 (1.50-3.29)	0.363
ICH	2.18 (1.12-6.50)	0.110
IVH	2.17 (1.08-4.70)	0.035

† : unit odds ratio, CI : confidence interval, ICH : intracerebral hemorrhage

IVH : intraventricular hemorrhage, OR : odds ratio, WFNS : World Federation of Neurosurgical Societies

Supplemental Table S3: Aneurysm location of study one and two

Aneurysm location	Study one (m=110)	Study two (n=493)	<i>P</i> value
Acom (%)	22 (20.0)	115 (23.3)	0.452
ACA (%)	3 (2.7)	27 (5.5)	0.231
MCA (%)	24 (21.8)	36 (7.3)	<0.0001
ICPC (%)	15 (13.6)	106 (21.5)	0.063
ICA (%)	5 (4.6)	70 (14.2)	0.006
Posterior circulation artery (%)	26 (23.6)	127 (25.8)	0.643

ACA: anterior cerebral artery, Acom: anterior communicating artery, ICA: internal carotid artery, ICPC: internal carotid artery-posterior communicating artery, MCA: middle cerebral artery

Supplemental Table S4: Univariate and Multivariate Analysis for symptomatic spasm on study two

Variable	Overall (n=493)	Symptomatic spasm		Univariate analysis	Multivariate analysis	
		yes (n=67)	no (n=426)	P Value	OR (95% CI)	P value
Mean age, y (SD)	62.8 ± 15.0	65.0 ± 16.8	62.4 ± 14.7	0.217	NA	NA
Male sex (%)	172 (34.9)	16 (23.9)	156 (36.6)	0.042	1.34 (1.01-1.84)	0.063
Hypertension (%)	198 (40.2)	21 (31.3)	177 (41.6)	0.113		
Diabetes mellitus (%)	33 (6.7)	4 (6.0)	29 (6.8)	0.799		
Dyslipidemia (%)	89 (18.1)	8 (11.9)	81 (19.0)	0.162		
Current smoke	94 (19.1)	11 (16.4)	83 (19.5)	0.5530		
Af (%)	12 (2.4)	2 (3.0)	10 (2.4)	0.753		
Type 3 aortic arch	41 (8.3)	12 (17.9)	29 (6.8)	0.002	1.47 (1.01-2.12)	0.048
Bovine arch	14 (2.8)	2 (3.0)	12 (2.8)	0.939		
Maximum aneurysm size, mm (SD)	6.2 ± 3.6	6.3 ± 3.6	6.1 ± 3.6	0.8770		
Dome neck ratio	1.5 ± 0.8	1.5 ± 0.5	1.5 ± 0.8	0.390		
Aneurysm location						
Acom (%)	115 (23.3)	17 (25.4)	98 (23.0)	0.670		
ACA (%)	27 (5.5)	3 (4.5)	24 (5.6)	0.699		
MCA (%)	36 (7.3)	5 (7.5)	31 (7.3)	0.957		
PCA (%)	17 (3.5)	1 (1.5)	16 (3.8)	0.345		
ICPC (%)	106 (21.5)	17 (25.4)	89 (20.9)	0.407		
ICA (%)	70 (14.2)	9 (13.4)	61 (14.3)	0.8470		
Posterior circulation artery (%)	110 (22.3)	13 (19.4)	97 (22.8)	0.538		
WFNS				0.001	1.21 (1.01-1.45) †	0.040
I	145 (29.4)	8 (11.9)	137 (32.2)			
II	90 (18.3)	11 (16.4)	79 (18.5)			
III	62 (6.5)	8 (11.9)	24 (5.6)			
IV	90 (18.3)	21 (31.3)	69 (16.2)			
V	136 (27.6)	19 (28.4)	117 (27.5)			
Acute hydrocephalus	133 (27.0)	17 (25.4)	116 (27.2)	0.750		
Fisher grade median (range)	3 (1-4)	3 (1-4)	3 (1-4)	0.162		
ICH (%)	79 (16.0)	11 (16.4)	68 (16.0)	0.925		
IVH (%)	236 (47.9)	37 (55.2)	199 (46.7)	0.195		
Surgery for post-aSAH hydrocephalus (%)	107 (21.7)	16 (23.9)	91 (21.4)	0.642		
Reruptured	10 (2.0)	1 (1.5)	9 (2.1)	0.738		
Complication						
hemorrhagic	19 (3.9)	3 (4.5)	16 (3.8)	0.775		
ischemic	115 (26.1)	20 (29.9)	95 (22.3)	0.174		
neural disorder	15 (3.0)	1 (1.5)	14 (3.3)	0.427		
IntraVentricular hemorrhAge score, median (range)	1 (0-5)	0 (0-5)	1 (0-5)	0.030	1.10 (1.12-1.34) †	0.370

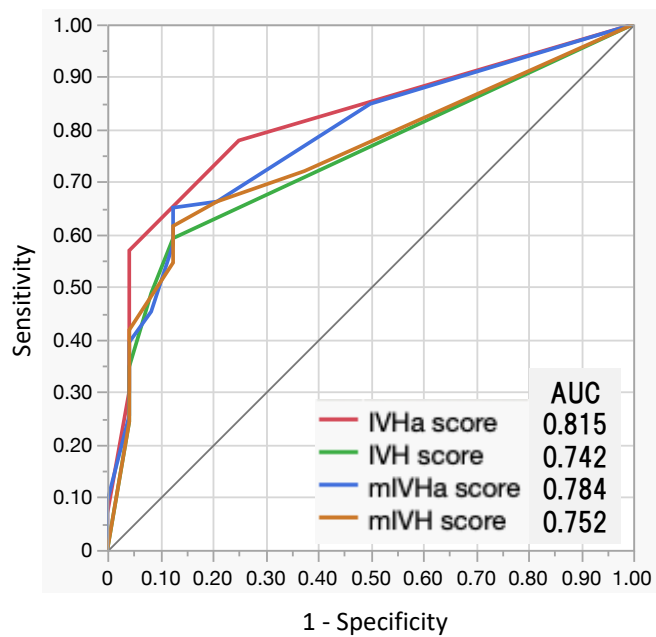
ACA: anterior cerebral artery, Acom: anterior communicating artery, AF: atrial fibrillation, CI: confidence interval, CKD: chronic kidney disease, EVD: external ventricular drainage, ICA: internal carotid artery, ICPC: internal carotid artery-posterior communicating artery, ICH: intracerebral hemorrhage, IQR: interqartile range, IVH: intraventricular hemorrhage, MCA: middle cerebral artery, mRS: modified Rankin scale, OR: odds ratio, SD: standard deviation, WFNS: World Federation of Neurosurgical Societies

Supplemental Tabel S5: Univariate and Multivariate Analysis in each ventricular hemorrhage for prognosis on study one

				Univariate analysis	Multivariate analysis	
Variable	Overall (n=110)	mRS 0-2 (n=24)	mRS 3-6 (n=86)	<i>P</i> Value	OR (95% CI)	<i>P</i> value
LVH (%)	57 (51.8)	4 (16.7)	53 (61.6)	<0.0001	2.97 (1.46-6.53)	0.004
3rd VH (%)	63 (57.3)	8 (33.3)	55 (64.0)	0.007	1.10 (2.24-2.66)	0.831
4th VH (%)	67 (60.9)	10 (41.7)	57 (66.3)	0.029	1.20 (1.90-2.74)	0.657
Variable	Overall (n=110)	mRS 0-2 (n=24)	mRS 3-6 (n=86)	<i>P</i> Value	OR (95% CI)	<i>P</i> value
Age, y (SD)	62.8 (±15.2)	58.3 (±11.4)	64.1 (±16.0)	0.036	1.04 † (1.00-1.09)	0.086
Aneurysm siz	7.1 (±4.3)	5.3 (±1.9)	7.7 (±4.7)	0.029	1.16 † (1.03-1.53)	0.205
ICH (%)	47 (42.7)	4 (16.7)	43 (50.0)	0.004	1.98 (1.19-5.68)	0.145
LVH (%)	57 (51.8)	4 (16.7)	53 (61.6)	<0.0001	2.91 (1.23-8.51)	0.025
3rd VH (%)	63 (57.3)	8 (33.3)	55 (64.0)	0.007	1.03 (2.99-3.15)	0.959
4th VH (%)	67 (60.9)	10 (41.7)	57 (66.3)	0.029	1.10 (2.69-3.15)	0.856

ICH: intracerebral hemorrhage, LVH: intra-lateral ventricular hemorrhage, 3rd VH: intra-3rd ventricular hemorrhage, 4th VH: intra-4th ventricular hemorrhage

Supplemental Figure. 2



Receiver operating characteristics curves for IntraVentricular hemorrhage + Age score (IVHa score; 0-5), IntraVentricular hemorrhage score (IVH score; 0-4), modified IntraVentricular hemorrhage + Age score (mIVHa score; 0-9), modified IntraVentricular hemorrhage score (IVH score; 0-8).

The 4-point scoring system has higher sensitivity and specificity than the 8-point scoring system with 1 point per compartment, as well as the 4-point scoring system adopted in this study. The AUC was higher when age was included (AUC = 0.815).