

Supplemental Material

**Use of Statins and Outcomes in Intracerebral Hemorrhage
Patients**

Online Supplementary Table I: Characteristics and outcomes of studies comparing statin and non-statin users in ICH patients

Study	Country	Statin users			Non-statin users		Comparison	Mortality Time	Other Outcomes	
		Prior [†]	Continued [‡]	New	None	Stopped [*]			Variable	Time
Tapia-Perez et al. ¹	Mexico	63	45	NA	260	18	Continued statins versus Stopped statins	30 d/3 m/1y ^a	GOS/NIHSS	DC/6 m ^a
Priglinger et al. ²	International	204	NA	NA	2980	NA	Prior statins versus No statins	3 m	mRS	3 m
Gioia et al. ³	Canada	14	NA	NA	59	NA	Prior statins versus No statins	NA	PE ^β HE NIHSS/GCS	24 h
Pan et al. ⁴	China	NA	220	NA	2998	NA	Inpatient statins versus no statins	3 m/1 y ^a	mRS	3 m/1 y ^a
Flint et al. ⁵	USA	1160	769	425	1896	391	Inpatient statins versus no statins Continued statins versus stopped statins	30 d ^a	DC to home/rehab	DC ^a
Falcone et al. ⁶	USA	42	NA	NA	97	NA	Prior statins versus No statins	NA	HV ^a	NA
Winkler ⁷	USA	125	75	65	236	50	Any statins versus no statins	1 year ^a	Modified Barthel Index	1 year ^a
Tapia-Perez et al. ⁸	Mexico	29	29	0	149	0	Continued statins versus no statins	DC/3 m 6 m ^a	NIHSS	DC
Mustanoja et al. ⁹	Finland	187	NA	NA	777	NA	Prior statins versus No statins	DC/3 m/1 y	mRS/ DC to home/rehab	DC
King et al. ¹⁰	Singapore	292	NA	NA	1089	NA	Prior statins versus No statins	1 m	NA	NA
Dowlatshahi et al. ¹¹	Canada	537	379	237	1692	158	Prior statins versus No statins Continued statins versus stopped statins	DC/1m/6 m ^a	mRS	DC
Romero et al. ¹²	Brazil	20	NA	NA	63	NA	Prior statins versus No statins	3 m	GOS	3 m
Miura et al. ¹³	Japan	56	NA	NA	325	NA	Prior statins versus No statins	NA	HV/mRS	1 m ^β
Biffi et al. ¹⁴	USA	238	209	19	442	29	Prior statins versus No statins	3 m ^a	mRS	3 m ^a
Ricard et al. ¹⁵	Canada	71	NA	NA	232	NA	Prior statins versus No statins	DC	HV/HE ^β	NA
Gomis et al. ¹⁶	Spain	34	NA	NA	235	NA	Prior statins versus No statins	3 m	mRS	3 m ^a
Eichel et al. ¹⁷	Israel	101	NA	NA	298	NA	Prior statins versus No statins	3 m	mRS/NIHSS HV ^a	3 m
Tapia-Perez et al. ¹⁸	Mexico	NA	NA	18	57	NA	Inpatient statin versus no statins	DC ^a	NIHSS	DC ^a
Leker et al. ¹⁹	Israel	89	89	NA	223	NA	Prior statins versus No statins	DC ^a	DC to home/rehab	DC ^a
Agmazov et al. ²⁰	Russia	NA	NA	11	12	NA	Inpatient statin versus no statins	NA	mRS	1 m ^a
Naval et al. ²¹	USA	32	NA	NA	93	NA	Prior statins versus No statins	1 m	mRS/GOS/PE	DC ^a

FitzMaurice et al. ²²	USA	149	NA	NA	480	NA	Prior statins versus No statins	3 m	GOS	3 m
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†Prior, Prehospital use of statins; ‡Continued, Pre-and in-hospital use of statins; *Stopped, withdrawal of statins during hospital admission; α , Worse in non-statin group; β , Worse in Statin group;

NA, not available; m, month; y, year; GOS, Glasgow outcome score; GCS, Glasgow coma scale; mRS, Modified Rankin Scale; NIHSS, National Institute of Health Stroke Scale; HV, Admission hematoma volume; HE, Hematoma expansion; PE, Perihematoma Edema

Online Supplementary Table II: Comparison of patients who were enrolled versus who were not enrolled in ERICH

	Enrolled, N=3000	Not-Enrolled, N=373	p-value
Age, mean±SD	62.0±14.5	65.1±14.5	0.0001
Female Sex, <i>N</i> (%)	1235 (41.2)	152 (40.8)	0.9098
Race/Ethnicity			
• Black	1000 (33.3)	121 (32.4)	
• Hispanic	1000 (33.3)	72 (19.3)	
• White	1000 (33.3)	180 (48.3)	<0.0001
PMH			
• Hypertension	2407 (81.5)	287 (80.6)	0.6921
• Diabetes	830 (28.2)	92 (26.2)	0.4299
• Hypercholesterolemia	924 (33.0)	102 (29.4)	0.1725
• Anticoagulant Use	335 (11.2)	48 (12.9)	0.3285
• Alcohol Use	1137 (40.7)	96 (30.8)	0.0006
Inpatient Death	334 (11.1)	118 (31.6)	<0.0001*
Discharged to Hospice	97 (3.2)	18 (4.8)	
†Discharge to:			
• Home/Relative/Friend	851 (33.3)	75 (33.3)	
• Rehabilitation	1117(43.7)	93 (41.3)	
• SNF/Assisted Living	467 (18.3)	39 (17.3)	
• Hospital/Acute/Subacute Setting	121 (4.7)	18 (8.0)	0.1886

SD=Standard Deviation; SNF= Skilled Nursing Facility

* Represents comparison of 431 (14.4) enrolled vs. 136 (36.4) not enrolled.

† Inpatient deaths, discharges to hospice, and unknown discharge disposition (13 enrolled, and 12 not-enrolled) are not included in the comparison of discharge disposition. Percentages are based on the reduced denominators (2556 enrolled, and 225 not-enrolled).

Online Supplementary Table III: Detailed Comparison of Baseline Characteristics and Outcomes Between Statin Users and Non-Statin Users

Variables	Statin users				Non-statin users	P value
	Total	Prior	Continued	New		
N	1093	268	423	402	1364	
Age (years) mean±SD	N=1093 65.1±13.6	N=268 70.4±12.5	N=423 68.2±12.7	N=402 58.4±12.5	N=1364 60.3±15.0	<.0001
Gender	N=1093	N=268	N=423	N=402	N=1364	
Male	659 (60.3%)	158 (59.0%)	247 (58.4%)	254 (63.2%)	776 (56.9%)	0.0892
Female	434 (39.7%)	110 (41.0%)	176 (41.6%)	148 (36.8%)	588 (43.1%)	
Race/ethnicity	N=1093	N=268	N=423	N=402	N=1364	<.0001
Black	318 (29.1%)	73 (27.2%)	101 (23.9%)	144 (35.8%)	480 (35.2%)	
Hispanic	358 (32.8%)	74 (27.6%)	107 (25.3%)	177 (44.0%)	481 (35.3%)	
White	417 (38.2%)	121 (45.1%)	215 (50.8%)	81 (20.1%)	403 (29.5%)	
History of ischemic stroke	N=1093 197 (18.0%)	N=268 67 (25.0%)	N=423 81 (19.1%)	N=402 49 (12.2%)	N=1364 117 (8.6%)	<.0001
History of Diabetes	N=1093 429 (39.2%)	N=268 126 (47.0%)	N=423 203 (48.0%)	N=402 100 (24.9%)	N=1362 293 (21.5%)	<.0001
History of Alzheimer disease	N=1093 22 (2.0%)	N=268 6 (2.2%)	N=423 13 (3.1%)	N=402 3 (0.7%)	N=1364 23 (1.7%)	0.5485
History of Dementia (non-Alzheimer)	N=1093 55 (5.0%)	N=268 30 (11.2%)	N=423 21 (5.0%)	N=402 4 (1.0%)	N=1364 52 (3.8%)	0.1410
History of hypertension	N=1092 994 (91.0%)	N=268 247 (92.2%)	N=423 401 (94.8%)	N=401 346 (86.3%)	N=1356 1090 (80.4%)	<.0001
History of high cholesterol	N=1086 757 (69.7%)	N=268 236 (88.1%)	N=422 395 (93.6%)	N=396 126 (31.8%)	N=1332 364 (27.3%)	<.0001
Prior use of antiplatelet therapy	N=1093 119 (10.9%)	N=268 49 (18.3%)	N=423 60 (14.2%)	N=402 10 (2.5%)	N=1364 37 (2.7%)	<.0001
Prior use of anticoagulants	N=1093 183 (16.7%)	N=268 61 (22.8%)	N=423 105 (24.8%)	N=402 17 (4.2%)	N=1364 114 (8.4%)	<.0001
Prior use of alcohol	N=1093	N=268	N=423	N=402	N=1364	<.0001
None/rare	711 (65.1%)	198 (73.9%)	287 (67.8%)	226 (56.2%)	768 (56.3%)	
Moderate	247 (22.6%)	52 (19.4%)	97 (22.9%)	98 (24.4%)	349 (25.6%)	
Intermediate	38 (3.5%)	8 (3.0%)	12 (2.8%)	18 (4.5%)	53 (3.9%)	
Frequent	86 (7.9%)	10 (3.7%)	22 (5.2%)	54 (13.4%)	152 (11.1%)	
Unknown	11 (1.0%)	0 (0.0%)	5 (1.2%)	6 (1.5%)	42 (3.1%)	
APOE genotype	N=1071	N=256	N=416	N=399	N=1335	0.2659
E2/E2	9 (0.8%)	0 (0.0%)	6 (1.4%)	3 (0.8%)	8 (0.6%)	
E2/E3	102 (9.5%)	31 (12.1%)	41 (9.9%)	30 (7.5%)	162 (12.1%)	
E2/E4	32 (3.0%)	11 (4.3%)	9 (2.2%)	12 (3.0%)	52 (3.9%)	
E3/E3	643 (60.0%)	135 (52.7%)	254 (61.1%)	254 (63.7%)	765 (57.3%)	
E3/E4	243 (22.7%)	70 (27.3%)	90 (21.6%)	83 (20.8%)	295 (22.1%)	
E4/E4	42 (3.9%)	9 (3.5%)	16 (3.8%)	17 (4.3%)	53 (4.0%)	
ICH category	N=1093	N=268	N=423	N=402	N=1364	0.0293
Lobar	366 (33.5%)	116 (43.3%)	162 (38.3%)	88 (21.9%)	407 (29.8%)	
Deep (Includes Primary IVH)	599 (54.8%)	119 (44.4%)	211 (49.9%)	269 (66.9%)	769 (56.4%)	
Brainstem	45 (4.1%)	11 (4.1%)	14 (3.3%)	20 (5.0%)	88 (6.5%)	

Cerebellum	83 (7.6%)	22 (8.2%)	36 (8.5%)	25 (6.2%)	100 (7.3%)	
Prestroke mRS	N=1088	N=265	N=422	N=401	N=1358	<.0001
0	707 (65.0%)	139 (52.5%)	260 (61.6%)	308 (76.8%)	1011 (74.4%)	
1	155 (14.2%)	42 (15.8%)	70 (16.6%)	43 (10.7%)	127 (9.4%)	
2	131 (12.0%)	44 (16.6%)	52 (12.3%)	35 (8.7%)	107 (7.9%)	
3	56 (5.1%)	24 (9.1%)	25 (5.9%)	7 (1.7%)	62 (4.6%)	
4	34 (3.1%)	14 (5.3%)	12 (2.8%)	8 (2.0%)	40 (2.9%)	
5	5 (0.5%)	2 (0.8%)	3 (0.7%)	0 (0.0%)	11 (0.8%)	
Admission GCS	N=1080	N=265	N=415	N=400	N=1348	<.0001
mean±SD	12.9±3.4	11.1±4.2	13.7±2.5	13.3±3.0	11.9±4.0	
median,IQR	15,12-15	13, 7-15	15, 14-15	15, 13-15	14, 9-15	
Onset to arrival in ED	N=1093	N=268	N=423	N=402	N=1364	0.5196
≤6hr	457 (41.8%)	115 (42.9%)	162 (38.3%)	180 (44.8%)	564 (41.3%)	
6-12hr	267 (24.4%)	85 (31.7%)	87 (20.6%)	95 (23.6%)	369 (27.1%)	
12-24hr	118 (10.8%)	25 (9.3%)	52 (12.3%)	41 (10.2%)	136 (10.0%)	
24-48hr	56 (5.1%)	7 (2.6%)	32 (7.6%)	17 (4.2%)	63 (4.6%)	
>48hr	84 (7.7%)	12 (4.5%)	46 (10.9%)	26 (6.5%)	86 (6.3%)	
unknown	111 (10.2%)	24 (9.0%)	44 (10.4%)	43 (10.7%)	146 (10.7%)	
Hematoma volume (CT imaging within 6 hrs of onset)	N=373	N=98	N=135	N=140	N=476	0.0765
mean±SD	20.2±26.7	39.2±39.6	13.7±15.8	13.3±15.3	21.2±24.0	
median,IQR	10.0, 4.0-25.4	25.5, 8.2-61.2	7.7, 2.6-18.3	8.8, 3.9-15.2	12.2, 4.9-27.8	
Hematoma volume (CT imaging within 6 hrs and with follow-up imaging 6hr to 5 days later)	N=294	N=72	N=109	N=113	N=334	
First CT						0.1383
mean±SD	17.7±21.7	31.7±32.2	14.4±16.7	12.1±11.8	19.1±21.9	
median,IQR	9.5, 4.0-23.0	20.2, 7.5-52.5	8.5, 3.0-18.3	8.3, 4.1-15.0	11.2, 4.9-25.8	
Subsequent CT						0.1708
mean±SD	21.8±27.1	37.3±39.9	19.0±22.4	14.7±14.6	22.7±24.5	
median,IQR	12.6, 4.5-27.8	19.3, 6.9-64.3	9.6, 3.5-27.8	9.5, 4.1-20.4	13.7, 5.3-32.4	
Difference in volume (CT2 vol < CT1 vol)	112 (38.1%)	31 (43.1%)	33 (30.3%)	48 (42.5%)	110 (32.9%)	0.0852
Growth <1 ml	74 (25.2%)	13 (18.1%)	34 (31.2%)	27 (23.9%)	71 (21.3%)	
1-3 ml	23 (7.8%)	5 (6.9%)	8 (7.3%)	10 (8.8%)	58 (17.4%)	
3-6 ml	20 (6.8%)	5 (6.9%)	7 (6.4%)	8 (7.1%)	24 (7.2%)	
6-9 ml	19 (6.5%)	5 (6.9%)	7 (6.4%)	7 (6.2%)	17 (5.1%)	
9-14 ml	16 (5.4%)	1 (1.4%)	9 (8.3%)	6 (5.3%)	24 (7.2%)	
14-19 ml	9 (3.1%)	2 (2.8%)	3 (2.8%)	4 (3.5%)	8 (2.4%)	
24-33 ml	10 (3.4%)	3 (4.2%)	5 (4.6%)	2 (1.8%)	13 (3.9%)	
33-44 ml	6 (2.0%)	3 (4.2%)	2 (1.8%)	1 (0.9%)	5 (1.5%)	
44-58 ml	2 (0.7%)	2 (2.8%)	0 (0.0%)	0 (0.0%)	3 (0.9%)	
≥58 ml	3 (1.0%)	2 (2.8%)	1 (0.9%)	0 (0.0%)	1 (0.3%)	
Presence of Microbleeds	N=431	N=62	N=175	N=194	N=451	0.6653
	225 (52.2%)	32 (51.6%)	73 (41.7%)	120 (61.9%)	242 (53.7%)	
Microbleed Location	N=338	N=48	N=123	N=167	N=350	0.5512
Lobar only	28 (8.3%)	6 (12.5%)	16 (13.0%)	6 (3.6%)	33 (9.4%)	
Non-Lobar only	56 (16.6%)	6 (12.5%)	10 (8.1%)	40 (24.0%)	45 (6.5%)	
Non-Lobar plus Lobar	93 (27.5%)	13 (27.1%)	24 (19.5%)	56 (33.5%)	103 (29.4%)	
Lipid panel on admission						
Total cholesterol	N=723	N=114	N=265	N=344	N=715	0.6881
mean±SD	174.3±49.7	157.4±46.6	154.7±43.0	195.1±47.2	173.4±41.8	
LDL	N=714	N=111	N=262	N=341	N=702	0.9061
mean±SD	101.3±41.5	84.6±39.6	85.4±36.1	119.0±38.9	99.7±36.5	
HDL	N=715	N=112	N=263	N=340	N=701	0.0034

mean±SD	48.1±16.7	50.7±17.6	45.8±14.5	49.0±17.8	51.5±19.6	
Triglycerides mean±SD	N=730 124.8±80.7	N=119 110.1±80.2	N=265 124.1±101.5	N=346 137.1±112.2	N=732 113.6±72.7	0.0012
In-hospital death	N=1093 90 (8.2%)	N=268 90 (33.6%)	N=423 0 (0.0%)	N=402 0 (0.0%)	N=1364 232 (17.0%)	<.0001
3-month mortality	N=1093 191 (17.5%)	N=268 146 (54.5%)	N=423 29 (6.9%)	N=402 16 (4.0%)	N=1364 354 (26.0%)	<.0001
3-month Rankin	N=1093	N=268	N=423	N=402	N=1364	<.0001
0	43 (3.9%)	3 (1.1%)	25 (5.9%)	15 (3.7%)	65 (4.8%)	
1	174 (15.9%)	18 (6.7%)	72 (17.0%)	84 (20.9%)	207 (15.2%)	
2	187 (17.1%)	18 (6.7%)	74 (17.5%)	95 (23.6%)	209 (15.3%)	
3	178 (16.3%)	23 (8.6%)	82 (19.4%)	73 (18.2%)	191 (14.0%)	
4	230 (21.0%)	37 (13.8%)	106 (25.1%)	87 (21.6%)	233 (17.1%)	
5	90 (8.2%)	23 (8.6%)	35 (8.3%)	32 (8.0%)	105 (7.7%)	
6	191 (17.5%)	146 (54.5%)	29 (6.9%)	16 (4.0%)	354 (26.0%)	

Online Supplementary Table IV: Comparison of the cerebral microbleed location and statin use*

	Prior	Continued	New	P-value
Cerebral Microbleed	N=48	N=123	N=167	
Microbleed Present	25 (52.1%)	50 (40.7%)	102 (61.1%)	0.0027
Lobar only	6 (12.5%)	16 (13.0%)	6 (3.6%)	0.0083
Non-Lobar only	6 (12.5%)	10 (8.1%)	40 (24.0%)	0.0012
Non-Lobar plus Lobar	13 (27.1%)	24 (19.5%)	56 (33.5%)	0.0304

* Microbleed location subgroups counted among those with and without microbleeds

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