

## SUPPLEMENTAL MATERIAL

Intraventricular thrombolysis in intracerebral hemorrhage requiring ventriculostomy: a decade-long real-world experience

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TABLE I. Discharge outcomes and inpatient complications among specified sub-groups

	No IVT %	IVT %	IVT vs No IVT		IVT vs No IVT	
			Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
<b>Survival beyond 48 hrs [Total N=31,573, no IVT=30,455 (96.5%), IVT=1,118 (3.5%)]</b>						
Inpatient mortality	36.9	31.4	0.784 (0.615-0.999)	<b>0.049</b>	0.743 (0.577-0.957)	<b>0.021</b>
Favorable discharge*	25.0	28.5	1.193 (0.895-1.592)	0.228	1.259 (0.932-1.701)	0.133
Unfavorable discharge†	58.2	53.4	0.823 (0.633-1.070)	0.144	0.711 (0.535-0.944)	<b>0.018</b>
Bacterial meningitis	3.2	2.1	0.631 (0.249-1.599)	0.327	0.505 (0.194-1.311)	0.160
Ventricular shunting	8.5	11.2	1.372 (0.959-1.963)	0.082	1.304 (0.890-1.911)	0.173
Gastrointestinal bleeding	1.8	1.3	0.709 (0.255-1.975)	0.508	0.595 (0.204-1.740)	0.343
Tracheostomy	2.5	2.9	1.160 (0.504-2.668)	0.726	1.382 (0.585-3.263)	0.460
Gastrostomy	28.1	33.8	1.306 (0.981-1.738)	0.067	1.203 (0.910-1.590)	0.194
<b>High ICH case volume hospitals<sup>§</sup> [Total N=23,516, no IVT=22,599 (96.1%), IVT=917 (3.9%)]</b>						
Inpatient mortality	41.2	32.2	0.676 (0.521-0.878)	<b>0.003</b>	0.670 (0.505-0.889)	<b>0.006</b>
Favorable discharge*	23.7	30.2	1.390 (1.019-1.896)	<b>0.037</b>	1.497 (1.075-2.086)	<b>0.017</b>
Unfavorable discharge†	60.7	52.8	0.725 (0.544-0.967)	<b>0.028</b>	0.610 (0.446-0.835)	<b>0.002</b>
Bacterial meningitis	3.1	2.5	0.810 (0.317-2.066)	0.657	0.701 (0.264-1.864)	0.476
Ventricular shunting	8.4	10.8	1.328 (0.888-1.985)	0.165	1.254 (0.823-1.912)	0.293
Gastrointestinal bleeding	1.7	1.6	0.926 (0.326-2.631)	0.885	0.815 (0.264-2.513)	0.721
Tracheostomy	2.0	3.5	1.798 (0.757-4.271)	0.177	1.755 (0.743-4.150)	0.200
Gastrostomy	26.1	34.5	1.491 (1.081-2.058)	<b>0.015</b>	1.336 (0.974-1.831)	0.072
<b>Obstructive hydrocephalus [Total N=20,990, no IVT=20,189 (96.2%), IVT=801 (3.8%)]</b>						
Inpatient mortality	39.4	27.5	0.581 (0.433-0.780)	<b>&lt;0.001</b>	0.587 (0.429-0.803)	<b>0.001</b>
Favorable discharge*	24.5	27.1	1.145 (0.815-1.610)	0.435	1.113 (0.771-1.607)	0.568
Unfavorable discharge†	59.5	54.3	0.809 (0.605-1.082)	0.152	0.735 (0.521-1.039)	0.081
Bacterial meningitis	3.3	2.9	0.859 (0.338-2.183)	0.749	0.698 (0.261-1.867)	0.474
Ventricular shunting	11.2	13.2	1.203 (0.791-1.830)	0.386	1.124 (0.716-1.766)	0.611
Gastrointestinal bleeding	1.7	1.2	0.720 (0.208-2.493)	0.602	0.544 (0.146-2.022)	0.363
Tracheostomy	2.2	3.4	1.548 (0.603-3.971)	0.359	1.794 (0.664-4.847)	0.249
Gastrostomy	26.0	37.4	1.697 (1.211-2.379)	<b>0.002</b>	1.681 (1.179-2.396)	<b>0.004</b>
<b>Mechanical ventilation &gt;96hrs [Total N=15,435, no IVT=14,773 (95.7%), IVT=662 (4.3%)]</b>						
Inpatient mortality	38.7	33.8	0.809 (0.576-1.136)	0.219	0.753 (0.523-1.084)	0.127
Favorable discharge*	19.0	20.6	1.108 (0.717-1.712)	0.643	1.131 (0.699-1.832)	0.616
Unfavorable discharge†	61.7	60.6	0.955 (0.691-1.320)	0.781	0.842 (0.588-1.204)	0.345
Bacterial meningitis	3.6	2.0	0.535 (0.137-2.097)	0.362	0.480 (0.116-1.992)	0.312
Ventricular shunting	8.7	14.4	1.764 (1.149-2.709)	<b>0.009</b>	1.630 (1.031-2.578)	<b>0.037</b>
Gastrointestinal bleeding	2.3	2.2	0.964 (0.343-2.706)	0.944	0.850 (0.279-2.586)	0.774
Tracheostomy	4.3	4.9	1.159 (0.493-2.726)	0.735	1.556 (0.642-3.775)	0.328
Gastrostomy	41.5	52.9	1.584 (1.149-2.185)	<b>0.005</b>	1.684 (1.188-2.386)	<b>0.003</b>
<b>Transferred in from another hospital [Total N=6,074, no IVT=5,763 (94.9%), IVT=311 (5.1%)]</b>						
Inpatient mortality	39.1	30.2	0.675 (0.417-1.094)	0.108	0.727 (0.439-1.204)	0.215
Favorable discharge*	26.5	40.0	1.850 (1.080-3.170)	<b>0.023</b>	2.159 (1.190-3.918)	<b>0.011</b>
Unfavorable discharge†	58.1	45.8	0.611 (0.368-1.014)	0.055	0.493 (0.270-0.901)	<b>0.022</b>
Bacterial meningitis	3.4	0.0	N/A <sup>‡</sup>	0.174	N/A <sup>‡</sup>	0.143
Ventricular shunting	9.1	11.9	1.345 (0.717-2.521)	0.353	1.146 (0.558-2.353)	0.711
Gastrointestinal bleeding	1.6	1.6	1.002 (0.173-5.811)	0.998	0.661 (0.116-3.765)	0.641
Tracheostomy	2.1	6.9	3.493 (1.047-11.650)	<b>0.030</b>	2.055 (0.456-9.258)	0.348
Gastrostomy	25.7	32.1	1.368 (0.794-2.355)	0.256	0.958 (0.596-1.542)	0.861

\*Favorable discharge is defined as discharge to home/self-care or rehabilitation

†Unfavorable discharge is defined as discharge to skilled nursing facility, hospice or inpatient death

‡Unable to calculate odds ratio due to low number of cases in IVT group

§High case volume hospital defined as case volume quartile 3 or 4 (>47 ICH cases/year)

ICH = intracerebral hemorrhage, IVT = Intraventricular thrombolysis

TABLE II. Resource utilization measures

	No IVT Median (IQR)	IVT Median (IQR)	P value*
<b>All cases</b>			
Cost of care, USD**	42,052 (21,757-71,481)	58,770 (33,379-88,434)	<0.001
LOS, days	14 (6-25)	18 (10-26)	<0.001
Cost of care per day LOS, USD	3,198 (2,380-4,580)	3,309 (2,591-4,238)	0.285
<b>Withdrawal of care excluded</b>			
Cost of care, USD**	43,474 (22,757-73,266)	59,556 (34,469-88,434)	<0.001
LOS, days	15 (6-25)	18 (11-27)	<0.001
Cost of care per day LOS, USD	3,148 (2,344-4,464)	3,266 (2,520-4,230)	0.270

\* Mann-Whitney rank sum test, \*\*inflation-adjusted 2013 value  
 IVT=Intraventricular thrombolysis; LOS=length of stay

TABLE III. Resource utilization stratified by severity indicator (risk of mortality)

	No IVT	IVT	P value*
3M™ APR-DRG risk of mortality subclass	Median (IQR)	Median (IQR)	
<b>All Cases</b>			
<b>Cost of care, USD**</b>			
Minor likelihood of dying	79,303 (53,526-10,4873)	108,210 (99,286-117,134)	0.162
Moderate	80,683 (58,666-113,907)	71,752 (55,944-102,359)	0.562
Major	38,335 (20,570-65,664)	53,540 (32,085-79,789)	<0.001
Extreme	43,342 (22,518-73,400)	58,910 (34,469-88,762)	<0.001
<b>LOS, days</b>			
Minor likelihood of dying	28 (18-36)	41 (37-45)	0.116
Moderate	28 (20-38)	25 (21-34)	0.468
Major	14 (6-23)	18 (11-26)	0.005
Extreme	13 (5-24)	17 (8-26)	0.002
<b>Cost of care per day LOS, USD</b>			
Minor likelihood of dying	2,734 (2,231-3,758)	2,686 (2,206-3,166)	0.689
Moderate	2,996 (2,320-3,694)	3,198 (2,237-3,755)	0.959
Major	2,993 (2,262-4,265)	3,048 (2,332-4,238)	0.928
Extreme	3,507 (2,559-5,070)	3,667 (3,014-4,448)	0.629
<b>Withdrawal of care excluded</b>			
<b>Cost of care, USD**</b>			
Minor likelihood of dying	81,822 (53,869-106,004)	108,210 (99,286-117,134)	0.166
Moderate	82,443 (58,633-115,089)	90,836 (67,156-110,528)	0.859
Major	39,681 (21,584-66,998)	53,991 (32,424-79,792)	0.001
Extreme	45,280 (23,845-75,420)	59,244 (34,561-88,682)	<0.001
<b>LOS, days</b>			
Minor likelihood of dying	29 (18-36)	41 (37-45)	0.119
Moderate	28 (20-39)	25 (21-41)	0.517
Major	15 (7-24)	19 (11-26)	0.005
Extreme	15 (6-25)	17 (9-26)	0.017
<b>Cost of care per day LOS, USD</b>			
Minor likelihood of dying	2,752 (2,269-3,758)	2,686 (2,206-3,166)	0.660
Moderate	2,996 (2,309-3,719)	3,264 (2,299-3,859)	0.647
Major	2,978 (2,242-4,246)	3,048 (2,336-4,230)	0.925
Extreme	3,428 (2,495-4,969)	3,649 (2,889-4,338)	0.504

\* Mann-Whitney rank sum test, \*\*inflation-adjusted 2013 value

APR-DRG=all patient refined diagnosis-related group; IVT=Intraventricular thrombolysis; LOS=length of stay

TABLE IV. 3M™ APR-DRG as a valid predictor of inpatient mortality in primary intracerebral hemorrhage requiring ventriculostomy, NIS 2002-2011

Predictor variable	Outcome: Inpatient mortality			
	Unadjusted OR (95% CI)	P value*	Adjusted OR (95% CI)	P value†
<b>3M™ APR-DRG risk of mortality subclass</b>				
Minor vs. extreme	0.143 (0.076-0.270)	<0.0001	0.116 (0.064-0.210)	<0.0001
Moderate vs. extreme	0.168 (0.117-0.241)	<0.0001	0.146 (0.103-0.207)	<0.0001
Major vs. extreme	0.561 (0.506-0.622)	<0.0001	0.560 (0.508-0.617)	<0.0001

\*Unadjusted logistic regression

†Logistic regression controlling for age, sex, race/ethnicity, inter-institutional transfer, hospital characteristics (location, teaching status, geographic region, bedsize and ICH case volume quartile), modified Charlson comorbidity index, coronary artery disease, diabetes mellitus, hypertension, atrial fibrillation, dyslipidemia, anemia, valvular disease, anticoagulation associated hemorrhage, thrombocytopenia, blood components transfusion, performance of cerebral angiography, craniectomy and craniotomy, prolonged mechanical ventilation, withdrawal of care status and intraventricular thrombolysis.

APR-DRG=all patient refined diagnosis-related group