

Effect of hyperdynamic LVEF on ICU outcomes

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Abstract

Objective To study the effect of hyperdynamic left ventricular function on ICU outcomes.

Keywords: Intensive Care Unit, Hyperdynamic

1. Background

In a recent meta-analysis review by Huang et al. (2013) [1] the authors attempted to answer the question whether ventricular depression or dilation is associated with lower mortality rates. A total of 62 studies were reviewed and 14 included in the analysis. The meta-analysis failed to find any evidence to support the view that the survivors from severe sepsis or septic shock had lower ejection fractions. This study aims to further explore this research question using the MIMIC-II clinical database from the Beth Israel Deaconess Medical Center in Boston, MA [2].

2. Materials and Methods

The cohort used in this study is shown in Figure 1. The consisted of all adults admitted to the ICU with echo reports. A subset analysis considers the patients who satisfy for the Angus criteria [3]. All statistical analysis was performed using Matlab version 2013a (Mathworks). Baseline comparisons were performed using χ^2 tests for equal proportion with results reported as numbers, percentages, and 95% confidence intervals. Continuously normally distributed variables were compared using t -tests and reported as means with 95% confidence intervals, while non-normally distributed data were compared using Wilcoxon rank sum tests and reported as medians and interquartile range (IQR).

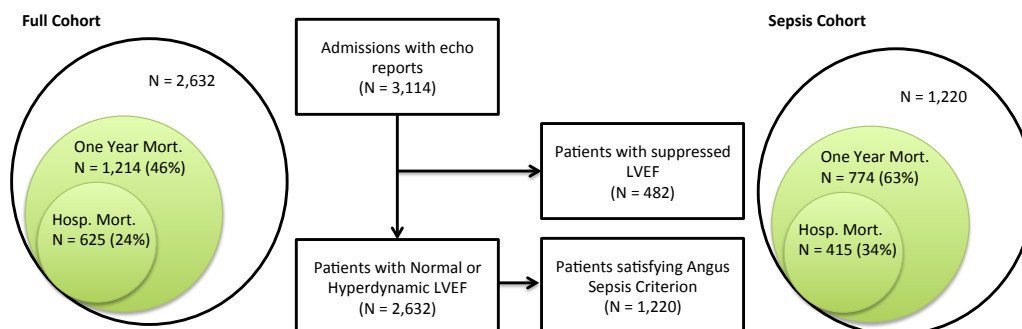


Table 1: Proportional characteristics of study patients (n = 2631).

	Normal (n=2372 , 90%)		Hyperdynamic (n=259, 10%)		P value
Male	1159	(49)	98	(38)	< 0.001
Service type:					
MICU	1233	(52)	138	(53)	0.691
CCU	364	(15)	28	(11)	0.052
SICU	572	(24)	69	(27)	0.369
CSRU	188	(8)	23	(9)	0.591
Primary outcomes:					
Twenty-eight day mortality	458	(19)	79	(31)	< 0.001
One-year mortality	892	(38)	129	(50)	< 0.001
ICU Mortality	296	(12)	60	(23)	< 0.001
Hospital Mortality	433	(18)	80	(31)	< 0.001
Treatments:					
RRT	363	(15)	55	(21)	0.013
Vasopressor	1062	(45)	139	(54)	0.006
Ventilated	1453	(61)	186	(72)	< 0.001

- [3] D. C. Angus, W. T. Linde-Zwirble, J. Lidicker, G. Clermont, J. Carcillo,
M. R. Pinsky, Epidemiology of severe sepsis in the united states: analysis
of incidence, outcome, and associated costs of care, Critical care medicine
29 (2001) 1303–1310.

Table 2: Continuous characteristics of study patients (n = 2631).

	Normal (n=2372 , 90%)		Hyperdynamic (n=259, 10%)		P value
Age	65.3	(26.4-91.5)	69.0	(29.2-92.3)	0.046
Secondary outcomes:					
ICU Length of Stay	5.0	(0.9-44.1)	6.1	(1.0-39.8)	< 0.001
Hosp. Length of Stay	12.0	(2.0-63.9)	15.0	(3.0-81.0)	0.003
SOFA Scores:					
First	6.0	(0.0-16.0)	8.0	(1.0-18.0)	< 0.001
Day 1	7.0	(1.0-16.0)	8.0	(1.0-16.2)	0.003
Day 2	7.0	(0.0-16.0)	8.0	(0.0-16.0)	0.018
Day 3	6.0	(0.0-16.0)	7.0	(1.0-18.0)	0.012
SAPS-I Scores:					
First	15.0	(5.0-26.0)	17.0	(7.0-28.5)	< 0.001
Day 1	16.0	(6.0-26.0)	17.0	(8.0-26.0)	< 0.001
Day 2	14.0	(6.0-23.0)	15.0	(6.0-24.2)	0.008
Day 3	13.0	(5.0-22.0)	15.0	(5.9-24.2)	0.004
Lab Tests (first 3 days):					
Max lactate	2.2	(0.8-12.8)	2.5	(0.8-15.5)	0.017
Max wbc	13.8	(4.4-38.3)	15.3	(5.4-49.9)	< 0.001
Max createnin	1.1	(0.4-8.3)	1.3	(0.4-8.8)	0.031
Avg lactate	1.8	(0.8-7.3)	1.8	(0.8-9.7)	0.068
Avg wbc	11.1	(3.6-27.7)	11.8	(4.2-34.1)	0.005
Avg createnin	1.0	(0.4-6.8)	1.1	(0.3-7.4)	0.101
Elixhauser Points:					
Twenty-eight day mortality	4.0	(-6.0-18.0)	5.0	(-5.2-21.2)	0.093
One-year mortality	4.0	(-3.0-18.0)	6.0	(-3.0-23.0)	0.040
Two-year mortality	11.0	(-5.0-41.0)	14.0	(-3.1-50.0)	0.027
Treatments (first 3 days):					
Fluids in	41633.0	(1117.3-208548.9)	51984.2	(3264.9-201147.0)	< 0.001
Fluids out	5940.0	(371.6-21212.6)	6562.5	(420.4-23471.4)	0.078
Max pressor dose	2.5	(0.1-43.9)	3.0	(0.0-80.8)	0.202
Max pressor duration	2640.0	(30.0-46197.5)	5040.0	(203.5-40469.0)	0.002

Table 3: ICD9 Group and Elixhauser comorbidities of study patients (n = 2631).

	Normal (n=2372 , 90%)		Hyperdynamic (n=259, 10%)		P value
ICD9 Group:					
Cardiovascular	736	(31)	73	(28)	0.346
Respiratory	362	(15)	39	(15)	0.931
Cancer	433	(18)	57	(22)	0.141
Endocrine metabolic	42	(2)	3	(1)	0.470
Gastrointestinal	212	(9)	33	(13)	0.045
Genitourinary	65	(3)	7	(3)	0.972
Trauma	361	(15)	36	(14)	0.573
Treatment	0	(0)	0	(0)	NA
Elixhauser Comorbidity:					
Diabetes	626	(26)	70	(27)	0.826
CHF	813	(34)	111	(43)	0.006
Alcohol abuse	127	(5)	12	(5)	0.622
Arrhythmias	702	(30)	61	(24)	0.042
Valvular disease	331	(14)	42	(16)	0.322
Hypertension	825	(35)	116	(45)	0.001
Renal failure	278	(12)	31	(12)	0.906
Chronic pulmonary	569	(24)	60	(23)	0.768
Liver disease	179	(8)	24	(9)	0.325
Cancer	97	(4)	25	(10)	< 0.001
Psychosis	82	(3)	10	(4)	0.737
Depression	125	(5)	16	(6)	0.538

Table 4: Proportional characteristics of study patients (n = 1219).

	Normal (n=1082 , 89%)		Hyperdynamic (n=137, 11%)		P value
Male	547	(51)	57	(42)	0.048
Service type:					
MICU	723	(67)	81	(59)	0.073
CCU	106	(10)	9	(7)	0.223
SICU	185	(17)	35	(26)	0.015
CSRU	63	(6)	12	(9)	0.178
Primary outcomes:					
Twenty-eight day mortality	271	(25)	50	(36)	0.004
One-year mortality	530	(49)	83	(61)	0.011
ICU Mortality	193	(18)	45	(33)	< 0.001
Hospital Mortality	272	(25)	54	(39)	< 0.001
Treatments:					
RRT	276	(26)	47	(34)	0.028
Vasopressor	613	(57)	92	(67)	0.019
Ventilated	749	(69)	106	(77)	0.050

Table 5: Continuous characteristics of study patients (n = 1219).

	Normal (n=1082 , 89%)		Hyperdynamic (n=137, 11%)		P value
Age	65.9	(31.7-92.3)	66.7	(29.0-90.0)	0.973
Secondary outcomes:					
ICU Length of Stay	7.4	(1.1-52.3)	8.9	(1.5-46.5)	0.060
Hosp. Length of Stay	17.0	(3.0-71.9)	18.0	(3.0-106.2)	0.226
SOFA Scores:					
First	8.0	(1.0-17.0)	9.0	(2.0-19.0)	< 0.001
Day 1	8.0	(1.0-17.0)	9.0	(2.9-17.1)	0.105
Day 2	8.0	(1.0-17.0)	9.0	(1.0-19.1)	0.045
Day 3	7.0	(1.0-18.0)	9.0	(1.0-18.1)	0.010
SAPS-I Scores:					
First	16.0	(7.0-27.0)	18.0	(10.0-31.0)	< 0.001
Day 1	16.0	(7.0-27.0)	18.0	(10.0-26.1)	0.049
Day 2	15.0	(7.0-24.0)	16.0	(7.8-26.0)	0.025
Day 3	14.0	(6.0-22.1)	16.0	(7.9-25.0)	0.013
Lab Tests (first 3 days):					
Max lactate	2.4	(0.8-14.1)	2.8	(1.0-20.2)	0.002
Max wbc	15.1	(3.7-41.1)	17.1	(5.7-71.6)	0.002
Max createnin	1.7	(0.5-9.0)	1.8	(0.5-11.4)	0.334
Avg lactate	1.8	(0.8-7.9)	2.1	(0.9-10.8)	0.004
Avg wbc	11.8	(2.7-29.7)	13.6	(5.0-37.6)	0.004
Avg createnin	1.4	(0.4-7.6)	1.4	(0.4-9.6)	0.649
Elixhauser Points:					
Twenty-eight day mortality	6.0	(-4.0-19.0)	7.0	(-3.2-21.3)	0.327
One-year mortality	7.0	(-1.5-20.0)	8.0	(-1.0-24.1)	0.178
Two-year mortality	16.0	(-2.0-43.0)	17.0	(-1.1-53.1)	0.159
Treatments (first 3 days):					
Fluids in	50959.5	(2530.0-232789.6)	63560.9	(4924.9-204467.6)	0.003
Fluids out	6021.0	(404.5-23861.1)	6698.5	(512.3-22430.1)	0.183
Max pressor dose	3.0	(0.1-83.5)	4.4	(0.1-38.7)	0.104
Max pressor duration	3780.0	(30.0-57263.3)	5977.5	(241.0-43402.0)	0.095

Table 6: ICD9 Group and Elixhauser comorbidities of study patients (n = 1219).

	Normal (n=1082 , 89%)		Hyperdynamic (n=137, 11%)		P value
ICD9 Group:					
Cardiovascular	198	(18)	23	(17)	0.665
Respiratory	198	(18)	18	(13)	0.136
Cancer	300	(28)	44	(32)	0.282
Endocrine metabolic	21	(2)	2	(1)	0.697
Gastrointestinal	109	(10)	23	(17)	0.017
Genitourinary	54	(5)	5	(4)	0.491
Trauma	145	(13)	18	(13)	0.932
Treatment	0	(0)	0	(0)	NA
Elixhauser Comorbidity:					
Diabetes	349	(32)	44	(32)	0.974
CHF	513	(47)	69	(50)	0.514
Alcohol abuse	65	(6)	6	(4)	0.443
Arrhythmias	379	(35)	45	(33)	0.614
Valvular disease	182	(17)	18	(13)	0.273
Hypertension	351	(32)	57	(42)	0.032
Renal failure	204	(19)	25	(18)	0.864
Chronic pulmonary	287	(27)	35	(26)	0.807
Liver disease	133	(12)	22	(16)	0.213
Cancer	52	(5)	15	(11)	0.003
Psychosis	35	(3)	6	(4)	0.484
Depression	62	(6)	8	(6)	0.959