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 attemped 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 Deaconness Medical Center in Boston, MA [2].

2. Methods

We conducted a retrospective cohort study using the Multiparameter Intelligent Monitoring in Intensive Care II (MIMIC II) database. MIMIC II is a large open-access database, which includes data from electronic medical records of patients admitted to the ICUs at Beth Israel Deaconess Medical Center since 2001. The creation and use of the MIMIC database was approved by the institutional review boards of both Beth Israel Deaconess Medical Center and Massachusetts Institute of Technology (IRB protocol 2001-P-001699/3).

All adult patient records who underwent an echocardiograph in the database were screened for purposes of inclusion. Patients were excluded if their left-ventricular function was suppresed The cohort characteristics used in this study is shown in Figure 1. The study outcome was 28-day mortality among the entire patient cohort.

All statistical analysis was performed using R. Baseline comparisons were performed using Fisher tests for categorical variables with results reported as numbers and percentages. Continuously normally distributed variables were compared using t-tests and reported as median, while non-normally distributed data were compared using Mann-Whitney tests and reported as medians and interquartile range (IQR).

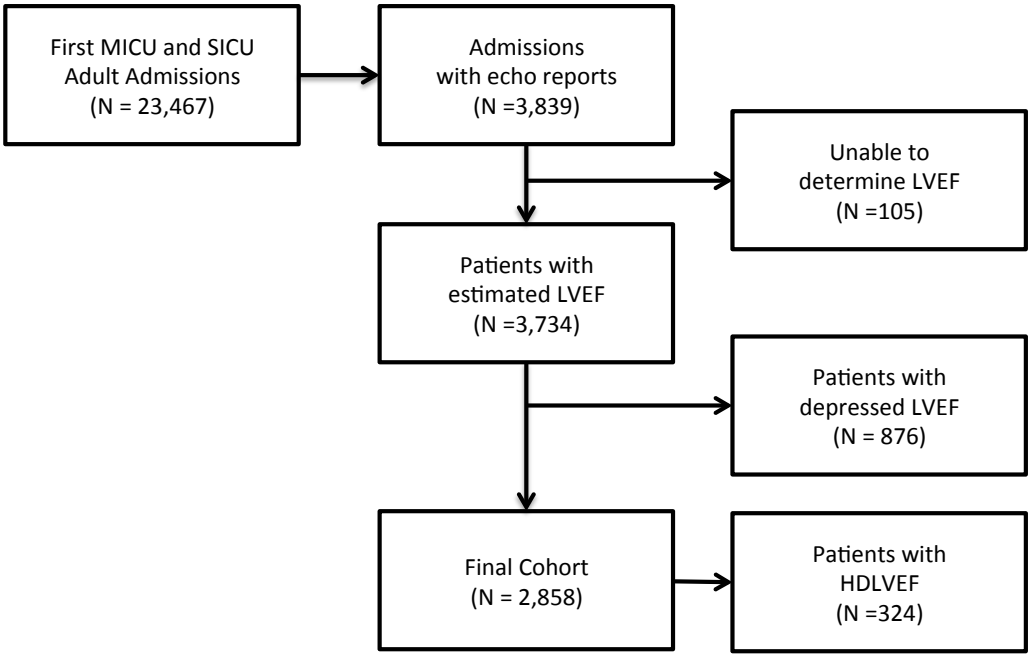

Figure 1: Patient record selection. Using the MIMIC II database we identified 2,481 patients that had a echo report.

3. Results

Table **??** highlights the results of the univariate analysis for all patients with hyperdynamic EF. Table **??** highlights the results of the univariate

analysis for all patients with acute hyperdynamic EF. Significant values ($P < 0.05$) are shown in bold. Hyperdynamic patients are more likely to be female, be admitted to MICU, SICU and ventilated. Hyperdynamic patients also have higher risk of mortality, SOFA and SAPSI scores and stay longer in ICU. Table **??** looks at potential confounders for the cohort: hyperdynamic patients are more liekly to have congestive heart failure, hypertension and cancer.

Table **??** highlights the results of the univariate analysis for all septic patients. Significant values ($P < 0.05$) are shown in bold. Hyperdynamic septic patients have a higher 28-day and ICU/hospital mortality are more likely to be administered more fluids. The confounder analysis in Table **??** is inconclusive.

References

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	NLVEF (N=2534)	**HDLVEF** (N=324)	P-value
	N (%) or median (IQR)		
Age	64.61 (27.22)	68.59 (22.84)	**0.03**
Gender (Male)	1238 (49.03)	134 (41.49)	**0.01**
SAPS-I	14.00 (7.00)	16.00 (7.00)	< **0.01**
Care Unit			0.9
MICU	1713 (67.60)	221 (68.21)	
SICU	821 (32.40)	103 (31.79)	
Time to echo (days)	1.09 (3.22)	0.92 (4.20)	0.4
Outcomes			
ICU LOS (days)	3.66 (7.03)	4.33 (11.86)	< **0.01**
HOSP LOS (days)	11.00 (14.00)	16.00 (19.00)	< **0.01**
Co-morbidities			
Diabetes	590 (23.28)	89 (27.47)	0.1
Alcohol abuse	153 (6.04)	19 (5.86)	1.0
Arrhythmias	700 (27.62)	82 (25.31)	0.4
Valvular disease	255 (10.06)	38 (11.73)	0.4
Hypertension	850 (33.54)	134 (41.36)	< **0.01**
Renal failure	213 (8.41)	29 (8.95)	0.8
Chronic pulmonary	536 (21.15)	68 (20.99)	1.0
Liver disease	198 (7.81)	32 (9.88)	0.2
Cancer	119 (4.70)	28 (8.64)	< **0.01**
Psychosis	115 (4.54)	15 (4.63)	0.9
Depression	148 (5.84)	12 (3.70)	0.1
CHF	840 (33.15)	127 (39.20)	**0.03**
Labs			
Max WBC	13.30 (8.90)	14.60 (10.28)	< **0.01**
wbc	11.00 (6.80)	11.53 (7.70)	**0.02**
Max lactate	2.10 (2.30)	2.60 (3.15)	< **0.01**
Lactate	1.70 (1.30)	1.90 (1.40)	< **0.01**
Max creatinine	1.10 (1.00)	1.20 (1.20)	**0.04**
Creatinine	0.90 (0.80)	1.00 (0.94)	0.1
Treatments			
RRT	288 (11.37)	50 (15.43)	**0.04**
Vasopressor	850 (33.54)	143 (44.14)	< **0.01**
Ventilated	1339 (52.84)	202 (62.35)	< **0.01**
IVF first 24hr (ml)	2206.63 (4566.65)	2500.00 (4930.78)	0.2

Table 1: Characteristics of normal versus all HDLVEF patients

	NLVEF (N=2534)	**HDLVEF** (N=324)	P-value
	N (%) or median (IQR)		
Age	64.61 (27.22)	68.59 (22.84)	**0.03**
Gender (Male)	1238 (49.03)	134 (41.49)	**0.01**
SAPS-I	14.00 (7.00)	16.00 (7.00)	$<$ **0.01**
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	NLVEF (N=2534)	**HDLVEF** (N=324)	P-value
	N (%) or median (IQR)		
Labs			
Max WBC	13.30 (8.90)	14.60 (10.28)	$<$ **0.01**
wbc	11.00 (6.80)	11.53 (7.70)	**0.02**
Max lactate	2.10 (2.30)	2.60 (3.15)	$<$ **0.01**
Lactate	1.70 (1.30)	1.90 (1.40)	$<$ **0.01**
Max creatinine	1.10 (1.00)	1.20 (1.20)	**0.04**
Creatinine	0.90 (0.80)	1.00 (0.94)	0.1
Treatments			
RRT	288 (11.37)	50 (15.43)	**0.04**
Vasopressor	850 (33.54)	143 (44.14)	$<$ **0.01**
Ventilated	1339 (52.84)	202 (62.35)	$<$ **0.01**
IVF first 24hr (ml)	2206.63 (4566.65)	2500.00 (4930.78)	0.2

Table 2: Characteristics of normal versus all HDLVEF patients

	NLVEF (N=2534) N (%)	**HDLVEF** (N=324) N (%)	*P*-value
Dobutamine	17 (1.93)	4 (3.31)	0.3
Dopamine	77 (8.75)	11 (9.09)	0.9
Vasopressin	24 (2.73)	7 (5.79)	0.1
Levophed	160 (18.18)	29 (23.97)	0.1
Milrinone	1 (0.11)	0 (0.00)	1.0
Neosynephrine	114 (12.95)	22 (18.18)	0.1

Table 3: Characteristics of normal versus all HDLVEF patients

	Odds-ratio (95% Confidence Interval)	*P*-value
Age	1.0059 (1.0008,1.0108)	**0.02**
Gender (Male)	1.0612 (0.8632,1.3045)	0.6
Elixhauser Score	1.0575 (1.0404,1.0750)	**<0.001**
SAPS-I	1.0873 (1.0642,1.1111)	**<0.001**
Vasopressor	1.8840 (1.5144,2.3439)	**<0.001**
HDLVEF	1.3744 (1.0232,1.8315)	**0.03**

Table 4: Multivariate logistic regression model predicting 28-day mortality for all patients

	Non-Septic (N=2140) N (%)	**Septic** (N=1594) N (%)	*P*-value
LVEF < 35%	88 (4.11)	73 (4.58)	< **0.01**
35% < LVEF < 55%	368 (17.20)	347 (21.77)	< **0.01**
NLVEF (>55%)	1510 (70.56)	1024 (64.24)	< **0.01**
HDLVEF (>75%)	174 (8.13)	150 (9.41)	< **0.01**

Table 5: Left Ventricular Ejection Fraction Characteristics for septic patients

	Hazard ratio (95% Confidence Interval)	**P-value**
Age	1.0058 (1.0034,1.0083)	<**0.001**
Gender (Male)	1.0650 (0.9784,1.1592)	0.1
Elixhauser Score	1.0178 (1.0086,1.0272)	<**0.001**
SAPS-I	1.0442 (0.9472,1.1511)	0.4
Vasopressor	1.0671 (0.9277,1.2274)	0.4
HDLVEF	1.0366 (1.0278,1.0455)	<**0.001**

Table 6: Multivariate Cox Hazard model predicting one-year mortality for all 28-day survivors