Effect of hyperdynamic LVEF on ICU outcomes

Joseph Parnessa, Thomas Brennan, Marco Pimentel, Leo Celi

Cambridge MA, United States

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. Materials and 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).

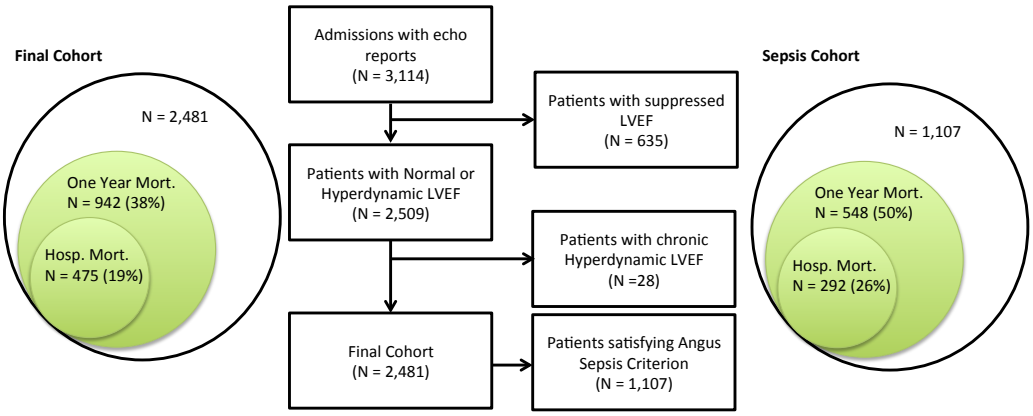

Figure 1: Patient record selection. Using the MIMIC II database we identified 2,481 patients that had a echo report.

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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[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.

	NLVEF (N=2237)	**HDEF** (N=244)
	N (%) or median (IQR)	
Age	65.78 (25.32)	68.54 (23.48)
Gender (Male)	1110 (49.62)	101 (41.39)*
SAPS-I	15.00 (7.00)	17.00 (7.00)*
Care Unit		
CCU	351 (14.15)	33 (1.33)
CSRU	175 (7.05)	25 (1.01)
MICU	1170 (47.16)	119 (4.80)
SICU	541 (21.81)	67 (2.70)
Labs		
Max WBC	13.60 (8.80)	15.30 (9.35)*
WBC	11.05 (6.60)	11.80 (7.65)*
Max lactate	2.20 (2.30)	2.60 (2.92)*
Lactate	1.70 (1.25)	1.90 (1.36)*
Max creatinine	1.10 (1.10)	1.20 (1.20)
Creatinine	1.00 (0.90)	1.00 (0.92)
Co-morbidities		
Diabetes	567 (25.35)	67 (27.46)
Alcohol abuse	123 (5.50)	12 (4.92)
Arrhythmias	640 (28.61)	64 (26.23)
Valvular disease	294 (13.14)	37 (15.16)
Hypertension	771 (34.47)	108 (44.26)*
Renal failure	231 (10.33)	22 (9.02)
Chronic pulmonary	516 (23.07)	55 (22.54)
Liver disease	159 (7.11)	26 (10.66)
Cancer	93 (4.16)	15 (6.15)
Psychosis	79 (3.53)	9 (3.69)
Depression	116 (5.19)	14 (5.74)
CHF	739 (33.04)	101 (41.39)*
Treatments		
RRT	319 (14.26)	45 (18.44)
Vasopressor	995 (44.48)	135 (55.33)*
Ventilated	1365 (61.02)	173 (70.90)*
Fluids in 3-days (ml)	7675.80 (8998.60)	9088.46 (10902.17)*
Echo time (days)	0.98 (2.15)	1.06 (2.95)

Table 1: Characteristics of normal versus all HDEF patients

	NLVEF (N=2412)	**HDEF** (N=69)	
	N (%) or median (IQR)		*P*-value
Age	66.10 (25.23)	67.51 (22.60)	0.9628*
Gender (Male)	1184 (49.09)	27 (39.13)	0.113
SAPS-I	15.00 (7.00)	17.00 (8.00)	**0.0061***
Care Unit			**0.033***
CCU	371 (14.95)	13 (0.52)	
CSRU	188 (7.58)	12 (0.48)	
MICU	1258 (50.71)	31 (1.25)	
SICU	595 (23.98)	13 (0.52)	
Labs			
Max wbc	13.70 (8.90)	15.50 (9.00)	0.1899*
Wbc	11.10 (6.55)	11.40 (8.80)	0.2434*
Max lactate	2.20 (2.40)	2.60 (1.98)	0.2036*
Lactate	1.70 (1.30)	1.90 (1.19)	0.1693*
Max createnine	1.10 (1.10)	1.30 (1.30)	0.2286*
Createnine	1.00 (0.90)	1.05 (1.20)	0.4185*
Co-morbidities			
Diabetes	614 (25.46)	20 (28.99)	0.487
Alcohol abuse	134 (5.56)	1 (1.45)	0.179
Arrhythmias	675 (27.99)	29 (42.03)	**0.014***
Valvular disease	315 (13.06)	16 (23.19)	**0.020***
Hypertension	844 (34.99)	35 (50.72)	**0.010***
Renal failure	249 (10.32)	4 (5.80)	0.311
Chronic pulmonary	551 (22.84)	20 (28.99)	0.246
Liver disease	177 (7.34)	8 (11.59)	0.168
Cancer	103 (4.27)	5 (7.25)	0.223
Psychosis	86 (3.57)	2 (2.90)	1.000
Depression	126 (5.22)	4 (5.80)	0.782
Chf	805 (33.37)	35 (50.72)	**0.004***
Treatments			
Rrt	350 (14.51)	14 (20.29)	0.171
Vasopressor	1088 (45.11)	42 (60.87)	**0.010***
Ventilated	1492 (61.86)	46 (66.67)	0.453
Fluids in 3-days (ml)	7731.82 (9121.47)	8889.06 (14182.76)	**0.0143***
Echo time (days)	0.99 (2.17)	1.36 (3.01)	0.0629*

Table 2: Characteristics of normal versus acute HDEF patients

	NLVEF (N=2237) N (%)	**HDLVEF** (N=244) N (%)
Dobutamine	27 (2.15)	5 (3.33)
Dopamine	129 (10.30)	17 (11.33)
Epinephrine	8 (0.64)	5 (3.33)*****
Vasopressin	42 (3.35)	6 (4.00)
Levophed	220 (17.56)	34 (22.67)
Milrinone	7 (0.56)	4 (2.67)*****
Neosynephrine	187 (14.92)	26 (17.33)

Table 3: Characteristics of vasopressors treatment up to 24 hours before echocardiogram

	Odds-ratio (95% Confidence Interval)	**P-value**
Age	0.9992 (0.9933,1.0049)	0.7910
Gender (Male)	0.9672 (0.7810,1.1974)	0.7596
Elixhauser Score	1.0728 (1.0542,1.0919)	**<0.01***
SAPS-I	1.0737 (1.0509,1.0973)	**<0.01***
Vasopressor	1.8616 (1.4831,2.3408)	**<0.01***
HDEF	1.4743 (1.0642,2.0240)	**0.0178***

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

	Non-Septic (N=1374) N (%)	**Septic** (N=1107) N (%)
Normal EF	1254 (91.27)	983 (88.80)*****
HDEF	120 (8.73)	124 (11.20)*****
Acute HDEF	24 (1.75)	45 (4.07)*****

Table 5: Left Ventricular Ejection Fraction Characteristics for septic patients

	Hazard ratio (95% Confidence Interval)	**P-value**
Age	1.0068 (0.9905,0.9960)	**<0.01***
Gender (Male)	0.9948 (0.9180,1.1007)	0.9111
Elixhauser Score	1.0282 (0.9646,0.9806)	**<0.01***
SAPS-I	1.0153 (0.9756,0.9944)	**<0.01***
Vasopressor	1.0300 (0.8796,1.0716)	0.5571
HDEF	1.0363 (0.8216,1.1334)	0.6643

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