

Effect of hyperdynamic LVEF on ICU outcomes

Joseph Panessa, Thomas Brennan, Marco Pimentel, Mengling Feng, 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 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. 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).

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

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

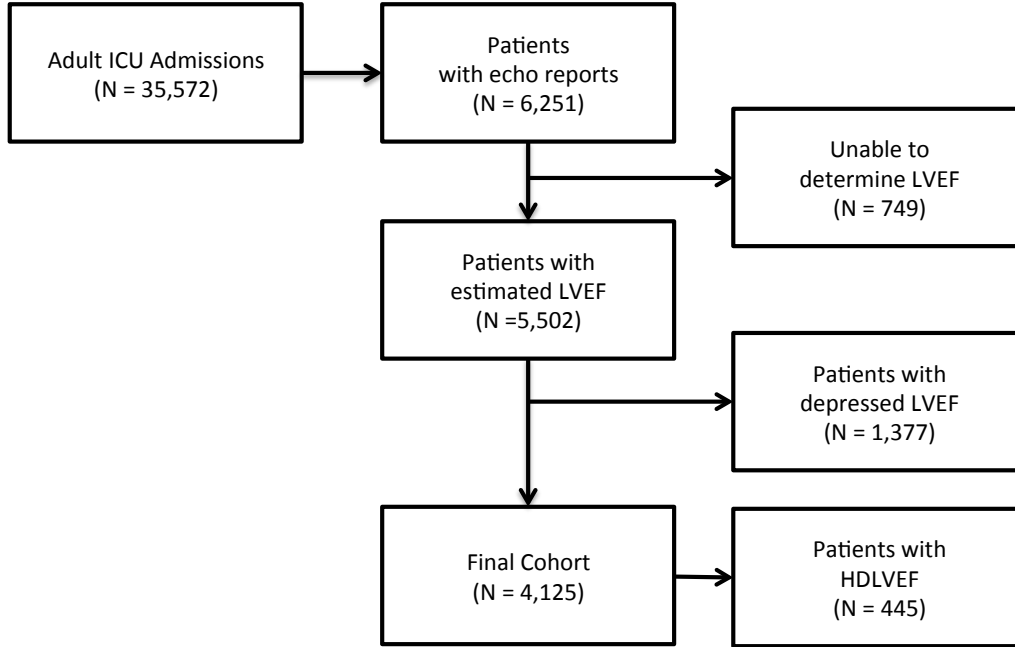


Figure 1: Patient record selection. Using the MIMIC II database we identified 2,481 patients that had a echo report.

30 3. Results

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

33 analysis for all patients with acute hyperdynamic EF. Significant values ($P <$
34 0.05) are shown in bold. Hyperdynamic patients are more likely to be female,
35 be admitted to MICU, SICU and ventilated. Hyperdynamic patients also
36 have higher risk of mortality, SOFA and SAPSI scores and stay longer in
37 ICU. Table ?? looks at potential confounders for the cohort: hyperdynamic
38 patients are more likely to have congestive heart failure, hypertension and
39 cancer.

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

45 References

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47 dilatation associated with lower mortality rate in adult severe sepsis and
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	NLVEF (N=3680)	HDLVEF (N=445)
	N (%) or median (IQR)	
Age	67.60 (24.15)	68.63 (22.65)*
Gender (Male)	1929 (52.55)	188 (42.34)*
SAPS-I	15.00 (8.00)	16.00 (7.00)*
Care Unit		
MICU	1975 (53.67)	268 (60.22)*
CSRU	809 (21.98)	66 (14.83)*
SICU	896 (24.35)	111 (24.94)*
Time to echo (days)	0.62 (3.22)	0.98 (4.37)*
Outcomes		
ICU LOS (days)	3.15 (5.64)	4.28 (11.47)*
HOSP LOS (days)	10.00 (13.00)	15.00 (19.00)*
Co-morbidities		
Diabetes	319 (71.69)	2747 (74.65)
Alcohol abuse	424 (95.28)	3488 (94.78)
Arrhythmias	323 (72.58)	2709 (73.61)
Valvular disease	377 (84.72)	3286 (89.29)*
Hypertension	252 (56.63)	2388 (64.89)*
Renal failure	395 (88.76)	3356 (91.20)
Chronic pulmonary	343 (77.08)	2900 (78.80)
Liver disease	404 (90.79)	3420 (92.93)
Cancer	413 (92.81)	3524 (95.76)*
Psychosis	426 (95.73)	3543 (96.28)
Depression	422 (94.83)	3472 (94.35)
CHF	275 (61.80)	2575 (69.97)*
Labs		
Max WBC	13.70 (8.40)	14.90 (10.10)*
WBC	11.25 (6.40)	11.60 (8.03)*
Max lactate	2.20 (2.20)	2.50 (2.65)*
Lactate	1.75 (1.30)	1.90 (1.40)*
Max creatinine	1.10 (1.00)	1.20 (1.20)*
Creatinine	1.00 (0.85)	1.00 (1.00)*
Treatments		
RRT	375 (84.27)	3295 (89.54)*
Vasopressor	229 (51.46)	2072 (56.30)
Ventilated	153 (34.38)	1464 (39.78)*
IVF first 24hr (ml)	3060.77 (5256.00)	2849.25 (5131.54)

Table 1: Characteristics of normal versus all HDLVEF patients

	NLVEF (N=3680)	HDLVEF (N=445)
	N (%) or median (IQR)	
Age	67.60 (24.15)	68.63 (22.65)*
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Table 2: Characteristics of normal versus all HDLVEF patients

	NLVEF (N=3680)	HDLVEF (N=445)
	N (%)	N (%)
Dobutamine	156 (96.89)	1065 (97.80)
Dopamine	146 (90.68)	991 (91.00)
Epinephrine	157 (97.52)	1085 (99.63)*
Vasopressin	151 (93.79)	1055 (96.88)
Levophed	124 (77.02)	889 (81.63)
Milrinone	155 (96.27)	1083 (99.45)*
Neosynephrine	126 (78.26)	928 (85.22)*

Table 3: Characteristics of normal versus all HDLVEF patients

	Odds-ratio (95% Confidence Interval)	P-value
Age	1.0021 (0.9973,1.0067)	0.4
Gender (Male)	0.9889 (0.8256,1.1849)	0.9
Elixhauser Score	1.0878 (1.0725,1.1035)	<0.001
SAPS-I	1.0658 (1.0457,1.0863)	<0.001
Vasopressor	1.3930 (1.1457,1.6947)	<0.001
HDLVEF	1.6782 (1.2993,2.1541)	<0.001

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

	Non-Septic (N=3372)	Septic (N=2130)
	N (%)	N (%)
Severly Supressed LVEF (<35%)	93 (4.37)	135 (4.00)*
Mildly Supressed LVEF (<55%)	457 (21.46)	692 (20.52)*
Normal LVEF (>55%)	1368 (64.23)	2312 (68.56)*
Hyperdynamic LVEF (>75%)	212 (9.95)	233 (6.91)*

Table 5: Left Ventricular Ejection Fraction Characteristics for septic patients

	Hazard ratio (95% Confidence Interval)	P-value
Age	1.0045 (1.0024,1.0065)	<0.001
Gender (Male)	1.0426 (0.9724,1.1179)	0.2
Elixhauser Score	1.0118 (1.0042,1.0194)	0.002
SAPS-I	0.9399 (0.8706,1.0147)	0.1
Vasopressor	1.1324 (1.0055,1.2752)	0.04
HDLVEF	1.0454 (1.0378,1.0530)	<0.001

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