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. 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 anlysis considers the patients who satisfy for the Angus crietria [3]. All statistical analysis was performed using Matlab version 2013a (Mathworks). Baseline comparisons were performed using chi^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).

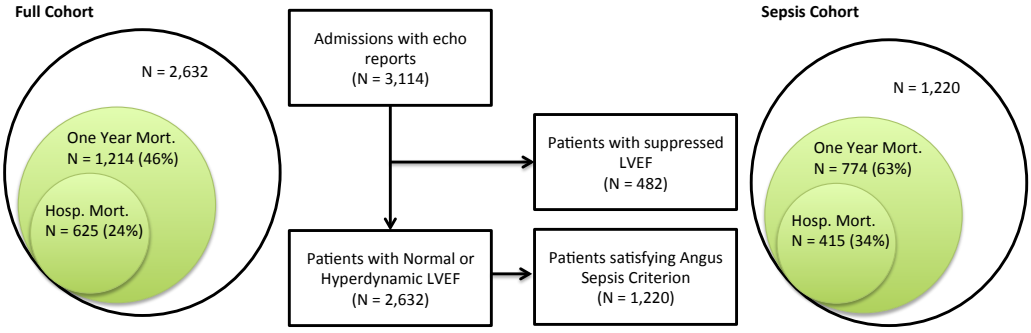

Figure 1: Patient record selection. Using the MIMIC II database we identified 2,632 patients that had a echo report.

3. Results

Table **??** highlights the results of the univariate analysis for all patients with echo reports. 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

[1] S. J. Huang, M. Nalos, A. S. McLean, Is early ventricular dysfunction or dilatation associated with lower mortality rate in adult severe sepsis and septic shock? a meta-analysis, Critical Care 17 (2013) R96.

[2] M. Saeed, M. Villarroel, A. T. Reisner, G. Clifford, L. Lehman, G. M. ody, T. Heldt, T. H. Kyaw, B. Moody, R. G. Mark, Multiparameter intelligent monitoring in intensive care II (MIMIC-II): A public-access intensive care unit database, Crit Care Med 39 (2011) 952–960.

	Normal EF (N=2387)	**Hyperdynamic EF** (N=271)
	N (%) or median (IQR)	
Age	65.56 (25.21)	68.25 (23.78)
Male	1174 (49.18)	108 (39.85)*
SAPS-I	15.00 (7.00)	17.00 (7.00)*
Care Unit		
CCU	370 (15.50)	36 (13.28)
CSRU	187 (7.83)	28 (10.33)
MICU	1262 (52.87)	135 (49.82)
SICU	568 (23.80)	72 (26.57)
Labs		
Max WBC	13.60 (8.90)	15.10 (9.90)*
WBC	11.00 (6.70)	11.50 (7.78)*
Max lactate	2.20 (2.40)	2.50 (3.05)
Lactate	1.70 (1.30)	1.90 (1.47)
Max creatinine	1.10 (1.20)	1.30 (1.38)
Creatinine	1.00 (1.00)	1.05 (1.10)
Treatments		
RRT	366 (15.33)	53 (19.56)
Vasopressor	1071 (44.87)	149 (54.98)*
Ventilated	1462 (61.25)	192 (70.85)*
Fluids in (ml)	7683.25 (8935.38)	9021.72 (10929.05)*
Fluids out (ml)	4455.00 (4323.00)	4652.00 (4792.00)

Table 1: Characteristics of normal versus hyperdynamic patients

[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.

	Normal EF (N=2387)	**Hyperdynamic EF** (N=271)
	N (%) or median (IQR)	
Sepsis	1092 (45.75)	140 (51.66)
Diabetes	632 (26.48)	79 (29.15)
Alcohol abuse	127 (5.32)	13 (4.80)
Arrhythmias	701 (29.37)	70 (25.83)
Valvular disease	332 (13.91)	44 (16.24)
Hypertension	833 (34.90)	118 (43.54)*****
Renal failure	282 (11.81)	31 (11.44)
Chronic pulmonary	567 (23.75)	63 (23.25)
Liver disease	177 (7.42)	27 (9.96)
Cancer	102 (4.27)	19 (7.01)
Psychosis	82 (3.44)	9 (3.32)
Depression	127 (5.32)	16 (5.90)
CHF	822 (34.44)	116 (42.80)*****

Table 2: Co-morbidities of normal versus hyperdynamic patients

	Normal EF (N=2387)	**Hyperdynamic EF** (N=271)	
	N (%) or median (IQR)		
ICU LOS	4.99 (9.34)	6.75 (17.07)	**0.004***
Hosp LOS	12.00 (16.00)	15.00 (21.00)	**0.004***
Mortality 28-Day	464 (19.44)	76 (28.04)	**0.001***
One-year MortalityY	903 (37.83)	127 (46.86)	**0.005***
ICU stay Mortality	300 (12.57)	59 (21.77)	**0.000***
Hospital Mortality	438 (18.35)	77 (28.41)	**0.000***

Table 3: Outcomes of normal versus hyperdynamic patients

	Normal EF (N=2571)	**Acute Hyperdynamic EF** (N=87)
	N (%) or median (IQR)	
Age	66.01 (25.12)	64.42 (24.39)
Male	1253 (48.74)	29 (33.33)*
SAPS-I	15.00 (7.00)	17.00 (7.00)*
Care Unit		
CCU	391 (15.21)	15 (17.24)
CSRU	202 (7.86)	13 (14.94)
MICU	1355 (52.70)	42 (48.28)
SICU	623 (24.23)	17 (19.54)
Labs		
Max WBC	13.70 (8.90)	14.70 (11.65)
WBC	11.10 (6.65)	10.90 (8.53)
Max lactate	2.20 (2.40)	2.50 (1.90)
Lactate	1.70 (1.30)	1.80 (1.25)
Max creatinine	1.10 (1.20)	1.30 (1.60)
Creatinine	1.00 (1.00)	1.05 (1.38)
Treatments		
RRT	400 (15.56)	19 (21.84)
Vasopressor	1170 (45.51)	50 (57.47)*
Ventilated	1596 (62.08)	58 (66.67)
Fluids in (ml)	7740.15 (9076.53)	8760.25 (13001.09)*
Fluids out (ml)	4479.00 (4347.25)	4550.00 (4484.00)

Table 4: Characteristics of normal versus acute hyperdynamic patients

	Normal EF (N=2571)	**Acute Hyperdynamic EF** (N=87)
	N (%) or median (IQR)	
Sepsis	1174 (45.66)	58 (66.67)*
Diabetes	681 (26.49)	30 (34.48)
Alcohol abuse	139 (5.41)	1 (1.15)
Arrhythmias	737 (28.67)	34 (39.08)*
Valvular disease	355 (13.81)	21 (24.14)*
Hypertension	909 (35.36)	42 (48.28)*
Renal failure	301 (11.71)	12 (13.79)
Chronic pulmonary	603 (23.45)	27 (31.03)
Liver disease	196 (7.62)	8 (9.20)
Cancer	113 (4.40)	8 (9.20)
Psychosis	89 (3.46)	2 (2.30)
Depression	138 (5.37)	5 (5.75)
CHF	893 (34.73)	45 (51.72)*

Table 5: Co-morbidities of normal versus acute hyperdynamic patients

	Normal EF (N=2571)	**Acute Hyperdynamic EF** (N=87)	
	N (%) or median (IQR)		
ICU LOS	5.06 (9.68)	8.05 (17.79)	**0.020***
Hospital LOS	12.00 (17.00)	19.00 (34.00)	**0.000***
Mortality 28-day	527 (20.50)	13 (14.94)	0.258
One-year Mortality	994 (38.66)	36 (41.38)	0.689
ICU stay Mortality	345 (13.42)	14 (16.09)	0.577
Hospital Mortality	498 (19.37)	17 (19.54)	1.000

Table 6: Outcomes of normal versus acute hyperdynamic patients