

Supplementary materials to: Loo LY, Liu Z, Chua ISY, et al. Additive value of non-invasive haemodynamic and fluid profiling in emergency department congestive cardiac failure patients.

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Table S1. Baseline demographics, medical history, chronic medications and outcome measures of patients enrolled. BMI: Body Mass Index, ED: Emergency Department, SD: Standard Deviation

Demographics	Values
Number	148
Age, years (Mean $\pm$ SD, Range)	72.9 $\pm$ 12.5, 38 – 97
BMI, kg/m² (Mean $\pm$ SD, Range)	26.1 $\pm$ 6.5, 15.1 - 47.9
Gender (n, %)	
Male	89 (60%)
Female	59 (40%)
Medical History (n, %)	
Hypertension	124 (84%)
Diabetes Mellitus	82 (55%)
Ischemic Heart Disease	74 (50%)
Chronic Kidney Disease	34 (23%)
Chronic Obstructive Pulmonary Disease	9 (6.1%)
Adrenal Insufficiency	1 (0.68%)
Immunocompromised state	1 (0.68%)
Malignancy	4 (2.7%)

None of the above	11 (7.4%)
Chronic medications (%)	
Angiotensin Converting Enzyme inhibitor	38 (26%)
Angiotensin Receptor Blocker	46 (31%)
Beta-blocker	107 (72%)
Calcium Channel Blocker	42 (28%)
Diuretic	77 (52%)
Other antihypertensives	7 (4.7%)
Digoxin	15 (10%)
None of the above	14 (9.5%)
Outcome Measures	
ED Length of Stay, minutes (Mean $\pm$ SD, Range)	449.5 $\pm$ 260.9, 108 - 1907
Disposition (n, %)	
Discharge from ED	1 (0.7%)
General Ward	131 (90%)
High Dependency	10 (6.8%)
Intensive Care Unit	6 (4.1%)
Hospital Length of Stay, days (Median [IQR], Range)	4 [3-7], 1 - 50
Death in 30 days (n, %)	8 (5.4%)
Unscheduled visit within 30 days (n, %)	37 (25%)

Table S2. Initial haemodynamic parameters for patients in congestive cardiac failure. CI: Cardiac Index, DBP: Diastolic Blood Pressure, HR: Heart Rate, MAP: Mean Arterial Pressure, SBP: Systolic Blood Pressure, SVI: Stroke Volume Index, TBW: Total Body Water, TPRI: Total Peripheral Resistance Index.

Hemodynamic Parameter	Value	Odds ratio for mortality (95% confidence interval, p-value)
SBP, mmHg (Mean $\pm$ SD, Range)	138.6 $\pm$ 26.5, 82 - 225	0.92-1.03 (p=0.300)
DBP, mmHg (Mean $\pm$ SD, Range)	75.0 $\pm$ 14.1, 45 - 126	0.87-1.08 (p=0.567)
MAP, mmHg (Mean $\pm$ SD, Range)	95.3 $\pm$ 16.5, 57 - 154	0.99-1.23 (p=0.068)
HR, beats/minute (Mean $\pm$ SD, Range) (NICaS reference range: 58-86)	88.4 $\pm$ 22.1, 45 - 139	0.93-1.15 (p=0.524)
CI, L/min/m² (Mean $\pm$ SD, Range) (NICaS reference range: 2.5-4.7)	3.3 $\pm$ 1.4, 1.2 - 11.8	0.027-6.58 (p=0.539)
SVI, mL/m² (Mean $\pm$ SD, Range) (NICaS reference range: 35-65)	37.6 $\pm$ 16.4, 13 - 145	0.82-1.37 (p=0.655)
TPRI, dynes sec/cm⁵/m² (Mean $\pm$ SD, Range) (NICaS reference range:1540-3000)	2687.8 $\pm$ 1123.0, 781 - 6537	0.998-1.00 (p=0.291)
TBW, % (Mean $\pm$ SD, Range) (NICaS reference range: 40-63)	58.0 $\pm$ 13.4, 31.1 - 92.4	1.375-36.642 (p=0.005)

Table S3. Comparison of parameters against outcomes. Where data was missing, the number of data points available is indicated next to the variable. CI: Cardiac Index, CRP: C-reactive protein, DBP: Diastolic Blood Pressure, EDLOS: Emergency Department Length Of Stay, FiO2: Fraction of inspired oxygen, GW: General Ward, HD: High Dependency, HR: Heart Rate, ICU: Intensive Care Unit, MAP: Mean Arterial Pressure, RR: Respiratory Rate, SBP: Systolic Blood Pressure, SVI: Stroke Volume Index, SpO2: Peripheral Oxygen Saturation, WBC: White Blood Cell count, TBW: Total Body Water, TPRI: Total Peripheral Resistance Index. Kruskal-wallis test for analysis of variances was done for disposition, Mann-Whitney U test was done for mortality status and independent samples t-test was done for ED reattendance.

Variable	GW (n=131) Median (1 st - 3 rd quartile)	HD (n=10)	ICU (n=6)	p- value	Death (n=8)	Survived (n=140)	p- value	Reattenda nce (n=37)	No reattendanc e (n=111)	p-value
Age	76 (65-78)	70 (59- 80.25)	80.5 (63.75- 88.5)	0.468	76 (73.25- 83)	75 (64-82)	0.353	77 (65-83)	70 (63.25- 78.75)	0.254
Weight	64 (54.45- 74.25)	64.5 (59.5- 76.88)	62 (53- 79.75)	0.801	55.65 (44.5- 57.88)	64.95 (55- 75.75)	0.005 *	64 (53.5- 74)	64 (56.25- 74.65)	0.846

Height (n=147)	1.6 (1.52- 1.66)	1.64 (1.55- 1.69)	1.62 (1.43- 1.68)	0.699	1.65 (1.63- 1.69)	1.6 (1.52- 1.66)	0.067	1.6 (1.52- 1.67)	1.6 (1.54- 1.66)	0.568
Temp	36.6 (36.2- 37.1)	36.3 (35.95- 37)	36.7 (36.3- 37.23)	0.430	36.1 (36.1- 36.7)	36.6 (36.2- 37.1)	0.146	36.7 (36.3- 37.1)	36.55 (36.13-37.1)	0.601
RR (n=144)	19 (18-20)	20 (19-26.5)	22.5 (19.5- 32)	0.017 *	20 (19.25- 20)	19 (18-20)	0.202	19 (18-22)	19 (18-20)	0.870
SpO2	98 (96-99)	98 (94.75- 100)	98.5 (95.75- 100)	0.697	97 (96-99)	98 (96-99)	0.287	98 (96-99)	98 (96-99)	0.864
FiO2	21 (21-21)	21 (21-21)	21 (21- 29.25)	0.003 *	21 (21-24)	21 (21-21)	0.007	21 (21-21)	21 (21-21)	0.386
Troponin T (n=142)	37 (25.25-60)	173 (64.5- 653.5)	107 (46.75- 695)	0.002 *	58 (20.75- 114)	40.5 (26- 81)	0.686	41 (26.5- 73)	35.5 (24.75- 110.75)	0.281
Lactate (n=32)	2 (1.4-2.7)	3.6 (3.35- 7.67)	2.05 (0.85- 4.6)	0.011 *	5.94	2.4 (1.5- 3.1)	0.116	2.4 (1.5- 3.98)	2 (1.4-3)	0.382

WBC	7.33 (5.85-9.85)	9.18 (8.18-11.6)	8.93 (6.72-12.7)	0.077	9.63 (6.55-12.72)	7.72 (5.91-9.9)	0.206	7.79 (6.02-9.88)	7.38 (5.46-10.03)	0.537
Procalcitonin (n=29)	0.25 (0.13-1.8)	0.32 (0.13-1.79)	NA	0.814	0.15 (0.08-0.19)	(0.32 (0.14-2.1)	0.209	0.2 (0.12-1.1)	0.32 (0.25-113.69)	0.380
CRP (n=28)	13.8 (4.5-46)	34 (3.97-62.7)	NA	0.861	5.65 (0.52-10.6)	16.35 (4.68-50.6)	0.181	11.55 (3.98-33.17)	37.65 (9.8-232.22)	0.415
SBP	139 (120-156)	131.5 (111.5-155.25)	134.5 (122-193.25)	0.704	143 (121-162)	137.5 (120-156)	0.715	140 (124-159)	128.5 (117-155.25)	0.100
DBP	72 (66.75-83)	74.5 (61-96.75)	68 (59.75-86.5)	0.756	77 (62.4-83.75)	72 (66-83)	0.792	73 (65-84)	70 (67-79)	0.209
HR	82 (69-105.25)	83.5 (71.75-83.5)	86.5 (62.75-95)	0.874	78.5 (61-92.75)	82 (69-104.5)	0.257	87 (69-107)	82 (66.75-105)	0.931

EDLOS	378.5 (270.25- 547.75)	304 (237.5- 434)	319 (231- 526.25)	0.452	498 (370.5- 792.25)	373 (255.25- 522)	0.086	374 (256- 762.2)	398.5 (245- 682.5)	0.292
MAP	95 (83-104)	97 (75.75- 115.25)	90.5 (82.5- 111.25)	0.979	97 (81.75- 101.75)	95 (83- 105.75)	0.953	95 (86- 106)	91 (79.75- 100.25)	0.061
CI	3.04 (2.3-3.8)	3.05 (2.55- 4.23)	2.95 (2.36- 3.97)	0.923	2.51 (1.8- 3.67)	3.07 (2.4- 3.80)	0.188	3.1 (2.5- 3.9)	2.5 (1.92- 3.4)	0.128
SVI	35 (28-44)	35.05 (26.75- 44.48)	35.2 (31.88- 41.25)	0.957	33.25 (24.25-41.5)	35 (28.18- 43.75)	0.440	36 (30-44)	32 (26-39)	0.337
TPRI	2461 (1885- 3304)	2420 (1739- 3060)	2589 (2320- 3042)	0.913	2696 (2175- 4724)	2507 (1881- 3240)	0.249	2461 (1885- 3190)	2745 (1916- 3750)	0.087
TBW	58 (47.9- 66.3)	57.05 (43.57- 76.55)	58.4 (55.33- 64.5)	0.885	73.9 (63.35- 76.5)	57.45 (47- 65.52)	0.002 *	57.8 (47.9- 65.3)	59.7 (47.68- 72.05)	0.514

Table S4. Linear regression of haemodynamic parameters against co-morbidity or use of chronic medication. SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, MAP: Mean Arterial Pressure, HR: Heart Rate, CI: Cardiac Index, SVI: Stroke Volume Index, TPRI: Total Peripheral Resistance Index, TBW: Total Body Water

Co-morbidity or chronic medication	Linear regression coefficient on haemodynamic parameter (95% confidence interval, (p-value))							
	SBP	DBP	MAP	HR	CI	SVI	TPRI	TBW
No co-morbidities	-8.58-35.5 (p=0.229)	-6.83-17.0 (p=0.400)	-7.42-20.1 (p=0.363)	-15.1-21.9 (p=0.716)	-1.54-0.94 (p=0.630)	-18.3-10.1 (p=0.571)	-206-1714 (p=0.123)	-12.8-9.57 (p=0.774)
Hypertension	6.96-37.4 (p=0.005)	-5.97-10.4 (p=0.591)	-1.82-17.2 (p=0.112)	-16.1-9.33 (p=0.598)	-1.15-0.56 (p=0.494)	-12.3-7.27 (p=0.611)	107-1430 (p=0.023)	-11.5-3.93 (p=0.334)
Diabetes Mellitus	-12.4-5.67 (p=0.463)	-7.11-2.64 (p=0.367)	-9.24-2.04 (p=0.209)	-8.24-6.88 (p=0.859)	-0.35-0.67 (p=0.528)	-3.81-7.84 (p=0.495)	-362-422 (p=0.884)	-5.47-3.70 (p=0.703)
Ischemic Heart Disease	-14.9-2.86 (p=0.188)	-7.63-2.02 (p=0.252)	-9.85-1.31 (p=0.133)	-19.5- -4.60 (p=0.002)	-1.09- -0.09 (p=0.021)	-8.02-3.49 (p=0.438)	-107-670 (p=0.154)	-0.39-8.69 (p=0.073)
Chronic Kidney Disease	-6.10-15.0 (p=0.407)	-6.79-4.58 (p=0.702)	-6.01-7.14 (p=0.866)	-7.58-10.1 (p=0.782)	0.03-1.21 (p=0.039)	0.469-14.0 (p=0.036)	-805-112 (p=0.138)	-2.14-8.56 (p=0.238)
No chronic medications	1.88-39.9 (p=0.032)	0.703-21.2 (p=0.036)	2.25-26.1 (p=0.020)	-23.0-7.94 (p=0.338)	-0.66-1.48 (p=0.449)	-5.51-18.5 (p=0.286)	-708-988 (p=0.745)	-2.87-16.6 (p=0.165)
Angiotensin Converting Enzyme inhibitor	-15.7-5.56 (p=0.347)	-6.24-5.23 (p=0.861)	-8.04-5.34 (p=0.690)	-22.1- -4.78 (p=0.003)	-0.94-0.26 (p=0.260)	-5.20-8.27 (p=0.653)	-424-526 (p=0.831)	-5.08-5.85 (p=0.890)
Angiotensin Receptor Blocker	-12.8-7.66	-7.41-3.62	-8.70-4.19	-19.3- -2.65	-1.12-0.02	-8.01-4.95	-231-683	-4.79-5.73

	(p=0.619)	(p=0.498)	(p=0.490)	(p=0.01)	(p=0.059)	(p=0.641)	(p=0.329)	(p=0.859)
Beta-blocker	-12.8-9.90 (p=0.800)	-4.82-7.43 (p=0.673)	-6.65-7.65 (p=0.891)	-14.4-4.18 (p=0.280)	-0.71-0.56 (p=0.814)	-6.41-7.98 (p=0.829)	-350-665 (p=0.541)	-0.58-11.1 (p=0.077)
Calcium Channel Blocker	-1.05-18.4 (p=0.080)	-7.07-3.43 (p=0.495)	-5.60-6.66 (p=0.864)	-19.7- -3.80 (p=0.004)	-0.14-0.96 (p=0.144)	3.71-16.0 (p=0.002)	-511-359 (p=0.731)	-4.85-5.16 (p=0.952)
Diuretic	-7.70-10.4 (p=0.770)	-7.94-1.80 (p=0.215)	-8.02-3.35 (p=0.419)	-8.14-6.60 (p=0.836)	-0.51-0.50 (p=0.980)	-4.90-6.54 (p=0.777)	-521-286 (p=0.565)	-4.22-5.07 (p=0.856)
Digoxin	-27.9-0.23 (p=0.054)	-4.39-10.8 (p=0.407)	-12.1-5.6 (p=0.471)	-1.04-21.9 (p=0.075)	-0.56-1.01 (p=0.570)	-10.3-7.44 (p=0.747)	-884-370 (p=0.419)	-5.01-9.43 (p=0.546)