

# Effect of chloride on ICU outcomes

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## Abstract

**Objective.** To study the characteristics of patients who exhibit different lactate dynamics.

*Keywords:* Intensive Care Unit, Lactate, Pulse Pressure

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## 1. Materials and Methods

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).

## 2. Results

Table 1: Characteristics of study patients (n = 3394).

	No. (%) [95% CI] of Patients						
	Lactate < 2 (n=2483 , 73%)			Lactate > 2 (n=911, 27%)		P value	
Gender	1468	(59)	[57-61]	520	(57)	[54-60]	0.285
Service type:							
MICU	623	(25)	[23-27]	324	(36)	[33-39]	< <b>0.001</b>
CCU	184	(7)	[6-9]	114	(13)	[11-15]	< <b>0.001</b>
SICU	1172	(47)	[45-49]	300	(33)	[30-36]	< <b>0.001</b>
CSRU	504	(20)	[19-22]	173	(19)	[17-22]	0.398
Vasopressors Used	1543	(62)	[60-64]	740	(81)	[79-84]	< <b>0.001</b>
Ventilation Used	2477	(100)	[99-100]	906	(99)	[99-100]	0.163
Sepsis (Martin Criteria)	638	(26)	[24-27]	385	(42)	[39-45]	< <b>0.001</b>
RRT	266	(11)	[10-12]	225	(25)	[22-28]	< <b>0.001</b>
Primary Outcome:							
Mortality ICU	322	(13)	[12-14]	429	(47)	[44-50]	< <b>0.001</b>
Mortality Hosp.	423	(17)	[16-19]	489	(54)	[50-57]	< <b>0.001</b>
Mortality 28-Day	418	(17)	[15-18]	480	(53)	[49-56]	< <b>0.001</b>
	<b>Median (Interquartile Range)</b>						
Age	65.3	(51.9-76.5)		65.7	(52.1-77.0)		0.483
ICU LoS	7.2	(4.0-13.9)		4.9	(2.3-12.0)		< <b>0.001</b>
SOFA	9.0	(7.0-12.0)		12.0	(9.0-15.0)		< <b>0.001</b>
SAPS-I	18.0	(15.0-21.0)		20.0	(17.0-24.0)		< <b>0.001</b>
Lactate, mmol/L:							
Mean	1.8	(1.3-2.4)		3.8	(2.6-6.0)		< <b>0.001</b>
Median	1.6	(1.2-2.2)		3.5	(2.5-5.9)		< <b>0.001</b>
Minimum	1.1	(0.9-1.3)		2.2	(1.8-3.2)		< <b>0.001</b>
Maximum	2.6	(1.7-4.1)		5.5	(3.5-9.9)		< <b>0.001</b>
Slope (-/day)	-0.5	(-1.3-0.1)		-0.2	(-1.6-1.0)		< <b>0.001</b>

Table 2: Data analysis of all study patients (n = 3394).

	No. (%) [95% CI] of Patients Median (Interquartile Range)				
	Lactate < 2 (n=2483 , 73%)		Lactate > 2 (n=911, 27%)		P value
Systolic BP, mmHg:					
Mean	117.0	(107.1-129.7)	108.0	(99.5-119.1)	< <b>0.001</b>
Median	116.0	(106.0-129.0)	107.0	(98.5-118.9)	< <b>0.001</b>
Minimum	99.0	(91.0-110.5)	91.5	(83.0-102.0)	< <b>0.001</b>
Maximum	136.0	(122.5-152.0)	127.0	(115.0-142.0)	< <b>0.001</b>
Slope (-/day)	2.9	(-4.4-11.6)	0.1	(-11.2-9.3)	< <b>0.001</b>
Diastolic BP, mmHg:					
Mean	59.4	(53.7-66.0)	57.8	(52.3-65.5)	<b>0.001</b>
Median	59.0	(53.0-65.5)	57.5	(51.0-65.3)	<b>0.004</b>
Minimum	51.0	(46.0-57.0)	49.5	(44.0-56.0)	< <b>0.001</b>
Maximum	69.0	(61.0-78.0)	68.0	(60.0-77.5)	0.114
Slope (-/day)	0.2	(-3.8-4.2)	-0.1	(-6.3-5.0)	0.131
Pulse Pressure, mmHg:					
Mean	78.5	(72.2-86.4)	74.9	(68.8-82.8)	< <b>0.001</b>
Median	77.5	(71.0-85.8)	74.0	(68.0-82.0)	< <b>0.001</b>
Minimum	67.5	(62.0-74.5)	64.0	(58.0-71.0)	< <b>0.001</b>
Maximum	91.0	(82.0-103.0)	87.5	(78.6-99.0)	< <b>0.001</b>
Slope (-/day)	1.1	(-4.2-6.5)	-0.0	(-9.2-6.7)	< <b>0.001</b>
Mean Arterial Pressure, mmHg:					
Mean	57.6	(48.5-67.5)	50.1	(41.3-59.5)	< <b>0.001</b>
Median	57.0	(48.0-67.5)	49.8	(40.5-59.9)	< <b>0.001</b>
Minimum	45.0	(36.0-54.5)	38.0	(29.0-47.5)	< <b>0.001</b>
Maximum	71.0	(60.5-83.0)	64.0	(52.0-76.0)	< <b>0.001</b>
Slope (-/day)	2.9	(-2.7-9.3)	-0.2	(-9.0-7.2)	< <b>0.001</b>
Heart Rate, bpm:					
Mean	88.6	(79.5-99.4)	94.7	(84.3-108.4)	< <b>0.001</b>
Median	88.5	(78.5-99.5)	95.0	(83.3-109.0)	< <b>0.001</b>
Minimum	76.5	(67.5-86.5)	82.0	(71.0-93.9)	< <b>0.001</b>
Maximum	101.5	(90.0-115.0)	110.0	(95.3-125.0)	< <b>0.001</b>
Slope (-/day)	-1.7	(-8.6-4.6)	-1.2	(-11.1-8.0)	0.172
Cardiac Output:					
Mean	11835.9	(10292.3-13927.2)	12122.5	(10471.9-14237.5)	<b>0.006</b>
Median	11685.4	(10077.6-13650.8)	12073.2	(10322.6-14168.8)	< <b>0.001</b>
Minimum	9547.2	(8030.6-11164.4)	9758.0	(8107.7-11560.0)	0.098
Maximum	14620.0	(12391.7-17391.2)	15055.2	(12651.6-17759.5)	<b>0.009</b>
Slope (-/day)	-88.6	(-1340.1-1154.1)	-212.1	(-1930.4-1372.2)	0.153

Table 3: Characteristics of study patients with no vasopressors (n = 1111).

	No. (%) [95% CI] of Patients					
	Lactate < 2 (n=940 , 85%)		Lactate > 2 (n=171, 15%)		P value	
Gender	546	(58) [55-61]	103	(60) [53-67]	0.600	
Service type:						
MICU	211	(22) [20-25]	60	(35) [28-43]	< <b>0.001</b>	
CCU	26	(3) [2-4]	10	(6) [3-11]	0.036	
SICU	647	(69) [66-72]	94	(55) [47-62]	< <b>0.001</b>	
CSRU	56	(6) [5-8]	7	(4) [2-8]	0.332	
Vasopressors Used	0	(0) [0-1]	0	(0) [0-3]	NaN	
Ventilation Used	935	(99) [99-100]	171	(100) [97-100]	0.339	
Sepsis (Martin Criteria)	158	(17) [15-19]	38	(22) [17-29]	0.088	
RRT	79	(8) [7-10]	15	(9) [5-14]	0.874	
Primary Outcome:						
Mortality ICU	76	(8) [7-10]	38	(22) [17-29]	< <b>0.001</b>	
Mortality Hosp.	107	(11) [10-14]	52	(30) [24-38]	< <b>0.001</b>	
Mortality 28-Day	111	(12) [10-14]	54	(32) [25-39]	< <b>0.001</b>	
	Median (Interquartile Range)					
Age	59.5	(45.8-73.6)	58.7	(43.5-73.5)	0.812	
ICU LoS	6.5	(3.6-12.4)	4.9	(2.6-11.3)	<b>0.003</b>	
SOFA	8.0	(6.0-9.0)	8.0	(6.0-10.0)	0.021	
SAPS-I	17.0	(14.0-19.0)	16.0	(14.0-20.0)	0.627	
Lactate, mmol/L:						
Mean	1.5	(1.1-2.1)	2.8	(2.2-3.8)	< <b>0.001</b>	
Median	1.4	(1.1-1.9)	2.6	(2.1-3.7)	< <b>0.001</b>	
Minimum	1.0	(0.8-1.2)	2.0	(1.6-2.5)	< <b>0.001</b>	
Maximum	2.2	(1.5-3.4)	3.7	(2.7-5.7)	< <b>0.001</b>	
Slope (-/day)	-0.4	(-1.1-0.1)	-0.3	(-1.5-0.3)	0.022	

Table 4: Data analysis of study patients with no vasopressors (n = 1111).

	No. (%) [95% CI] of Patients Median (Interquartile Range)				
	Lactate < 2 (n=940 , 85%)		Lactate > 2 (n=171, 15%)		P value
Systolic BP, mmHg:					
Mean	127.7	(116.5-138.5)	124.8	(113.0-138.9)	0.095
Median	127.0	(115.1-139.1)	124.3	(111.4-139.9)	0.200
Minimum	109.0	(98.0-121.0)	106.5	(95.0-118.5)	0.100
Maximum	147.0	(133.0-160.0)	141.5	(128.3-160.5)	0.076
Slope (-/day)	1.9	(-6.9-11.0)	-0.7	(-20.7-10.6)	<b>0.010</b>
Diastolic BP, mmHg:					
Mean	63.0	(56.5-69.8)	64.1	(56.4-72.3)	0.287
Median	62.5	(55.8-69.5)	63.5	(56.6-71.0)	0.229
Minimum	54.0	(48.0-60.5)	55.0	(48.0-62.4)	0.335
Maximum	73.0	(64.5-82.0)	72.0	(64.0-83.8)	0.719
Slope (-/day)	-0.0	(-4.4-4.5)	-0.3	(-9.2-4.4)	0.087
Pulse Pressure, mmHg:					
Mean	84.1	(77.8-92.1)	85.2	(75.4-94.6)	0.953
Median	83.5	(76.0-91.5)	83.5	(74.8-93.0)	0.786
Minimum	72.5	(65.0-80.0)	72.0	(65.0-79.5)	0.877
Maximum	97.5	(88.0-108.0)	95.0	(86.5-111.4)	0.714
Slope (-/day)	0.6	(-5.4-6.6)	-1.0	(-11.8-8.3)	0.066
Mean Arterial Pressure, mmHg:					
Mean	64.0	(54.1-73.6)	60.4	(49.4-69.5)	<b>0.004</b>
Median	63.0	(54.0-74.5)	60.0	(48.6-71.4)	<b>0.006</b>
Minimum	51.5	(42.0-61.0)	47.5	(37.6-58.0)	0.014
Maximum	77.0	(66.0-88.5)	73.0	(60.6-86.9)	<b>0.007</b>
Slope (-/day)	1.9	(-4.2-8.4)	-0.5	(-11.9-9.9)	0.013
Heart Rate, bpm:					
Mean	88.3	(78.5-100.2)	91.3	(80.2-107.0)	<b>0.009</b>
Median	88.4	(77.5-100.5)	90.8	(80.0-106.3)	<b>0.004</b>
Minimum	77.0	(67.5-88.0)	81.0	(71.5-95.8)	<b>&lt; 0.001</b>
Maximum	100.0	(88.0-114.0)	104.0	(89.1-120.9)	0.058
Slope (-/day)	-0.5	(-7.1-5.8)	0.5	(-11.3-9.1)	0.980
Cardiac Output:					
Mean	12696.4	(10710.0-14862.1)	13519.3	(10852.8-15894.9)	0.035
Median	12537.2	(10570.2-14804.0)	13209.0	(10899.9-15755.7)	0.016
Minimum	10119.3	(8554.8-12144.8)	10817.1	(8837.0-12862.3)	0.011
Maximum	15585.0	(13049.2-18371.9)	16181.0	(13105.4-19365.2)	0.164
Slope (-/day)	-11.3	(-1357.9-1324.8)	-235.9	(-2625.1-1488.7)	0.155