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Serum lactate as predictor of in-hospital death in respiratory failure due to coronavirus disease 2019



Serum lactate as predictor of in-hospital death of Covid-19-pneumonia

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Introduction

- Early detection of patients with severe COVID-19 is essential for delivering personalized patient care
- Arterial lactate is widely and rapidly available as a measurement in different settings
- Few studies confirmed a positive association between hyperlactatemia or lactate clearance and mortality in patients with Covid19 in ICU

Aim:

To investigate the prognostic role of elevated lactate levels and their kinetics in patients **outside ICU** with acute respiratory failure related to COVID-19-pneumonia.



Methods

Retrospective registry from the
Covid-19 Unit, Internal and
Cardiovascular Medicine, Perugia
(107)

Prospective cohort from the
Department of Medicine, Azienda
ospedaliera-universitaria Pisana
(276)

Adult patients from two COVID-19 cohorts (383 patients tot)

Methods:

Inclusion criteria:

- Diagnosis of Covid-19 confirmed by real time-PCR testing
- Pneumonia detected by imaging techniques (chest x-ray, CT, LUS)
- New-onset respiratory failure

Exclusion criteria:

- The absence of serum lactate value on the first day of admission (177 patients)
- Pregnancy

STUDY OUTCOME: in-hospital death at 30 days

Statistical Analysis:

- **Lactate level on the first day of admission** was studied at the values of ≥ 2 mmol/l and ≥ 4 mmol/l
- **Delta-lactate (Δ Lac) at 24 hours** was calculated in 89 patients

Results:

206 patients included
in the study

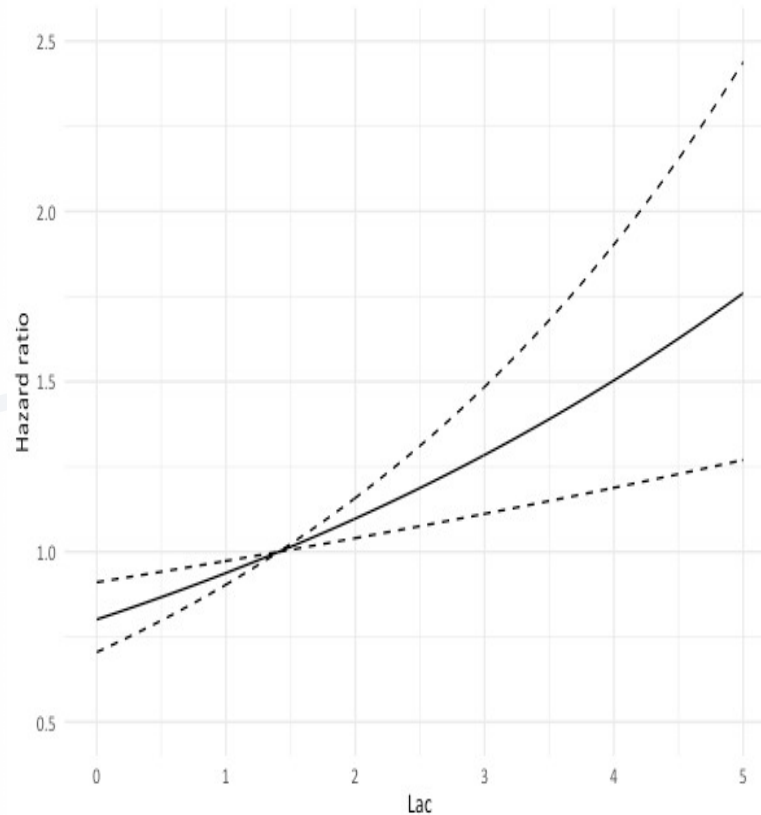
In-hospital death at 30
days occurred in 57
patients

Table 1. Main characteristics or measures of study patients at admission according to in-hospital death at 30 days

	Characteristic/ measure	Total (N=206)	Alive (N=149)	Dead (N=57)	p- value
Demographics	Age, years (IQR)		66 (53-76)	81 (74-86)	<0.001
	Female, n (%)	69 (33.5%)	51 (34.2%)	18 (31.6%)	0.719
Arterial blood gas analysis	Lac, median (IQR) mmol/l	1.1 (0.9-1.5)	1.0 (0.8-1.3)	1.3 (1.0-2.1)	<0.001
	Range min-max	0.0 - 13.2	0.0 - 2.7	0.8 - 13.2	
	Mean \pm SD	1.4 (1.3)			
	Lac \geq 2, n (%)	30 (14.6%)	13 (8.7%)	17 (29.8%)	<0.001
	Lac \geq 4, n (%)	6 (2.9%)	0 (0.0%)	6 (10.5%)	<0.001
	pH, median (IQR)	7.46 (7.43-7.49)	7.46 (7.43-7.49)	7.46 (7.41-7.49)	0.254
	Range min-max	7.22 - 7.68	7.31 - 7.68	7.22 - 7.60	
	Mean \pm SD	7.46 (0.06)	7.47 (0.05)	7.45 (0.07)	
	PaO ₂ , median (IQR) mmHg	66.0 (54.0-80.0)	69.0 (55.7-81.5)	59.0 (47.0-72.0)	0.002
	Range min-max	24.0 - 225.0	31.0 - 225.0	24.0 - 190.0	
	Mean \pm SD	72.3 (31.9)	75.4 (32.4)	64.5 (29.2)	
Comorbidities	Cancer, n (%) *	27 (13.1%)	17 (11.4%)	10 (17.5%)	0.243
	Systemic arterial hypertension, n (%) *		73 (49.0%)	39 (68.4%)	0.012
	Congestive heart failure, n (%) *	18 (8.7%)	10 (6.7%)	8 (14.0%)	0.096
	Chronic obstructive pulmonary disease, n (%) *	18 (8.7%)	8 (5.4%)	10 (17.5%)	0.006
	Chronic kidney disease, n (%) *	19 (9.2%)	8 (5.4%)	11 (19.3%)	0.002
	Chronic liver disease, n (%) *	9 (4.4%)	3 (2.0%)	6 (10.5%)	0.007
	Diabetes mellitus, n (%) *	43 (20.9%)	29 (19.5%)	14 (24.6%)	0.421
	Obesity, n (%) *	32 (20.5%)	29 (25.2%)	3 (7.3%)	0.015
	Respiratory support	Non-invasive ventilation, n (%)	67 (45.0%)	30 (52.6%)	0.324
Respiratory indexes	P/F, mmHg (IQR)	261.0 (190.4- 319.0)	266.8 (214.0- 333.0)	201.8 (134.7- 267.3)	<0.001
	P/F, n (%)				<0.001
	- <100		5 (3.4%)		
	- 100-200	43 (21.1%)	26 (17.6%)	17 (30.4%)	
	- 200-300	83 (40.7%)	62 (41.9%)	21 (37.5%)	
	- >300		55 (37.2%)	7 (12.5%)	
	sPFP, mmHg (IQR)	208.1 (135.0- 274.0)	223.7 (154.5- 289.0)	157.5 (88.3-216.9)	<0.001
	RI (IQR)	4.4 (3.4-5.6)	4.9 (3.8-6.0)	3.4 (2.5-3.9)	<0.001
	ROX (IQR)	15.6 (6.5-25.1)	20.9 (9.1-27.9)	6.3 (4.1-13.0)	<0.001

Results:

Figure 2. Risk of death at 30 days associated with arterial lactate level at admission.



Results:

Lactate ≥ 2 mmol/l and ≥ 4 mmol/l were independent predictors of 30-days in-hospital-death

Δ -Lac was not independently associated with in-hospital death at 30 day

Table 2. Risk factor for in-hospital death at 30 days (Cox proportional hazard model - multivariate)

Variable	HR	95% CI	p-value
Lactate ≥ 2 mmol/l	2.49	1.27-4.89	
pH < 7.35	0.70	0.22-2.21	0.5434
P/F	0.99	0.99-0.99	0.0077
Age	1.05	1.03-1.08	< 0.001
Chronic obstructive pulmonary disease	3.28	1.59-6.76	0.0012
Chronic kidney disease	2.44	1.20-4.95	0.0135
Variable	HR	95% CI	p-value
Lactate ≥ 4 mmol/l	8.14	2.06-32.12	
pH < 7.35	0.32	0.07-1.44	0.1364
P/F	0.99	0.99-0.99	0.0109
Age	1.05	1.03-1.08	< 0.001
Chronic obstructive pulmonary disease	2.85	1.38-5.87	0.0046
Chronic kidney disease	2.20	1.09-4.45	0.0275
Variable	HR	95% CI	p-value
Δ Lac ≥ 0	1.47	0.49-4.43	<u>0.4974</u>
pH < 7.35	0.59	0.11-3.11	0.5342
P/F	0.99	0.99-0.99	0.0134
Age	1.05	1.00-1.10	0.0332
Chronic obstructive pulmonary disease	3.12	0.69-14.23	0.1412
Chronic kidney disease	3.16	0.66-15.15	0.1494

HR: hazard ratio; CI: confidence interval; P/F: P/F ratio.

Conclusions:

- In **non-intubated patients**, hyperlactatemia on the first day was confirmed as an independent predictor of in-hospital death, regardless of age, comorbidities, and acidemia (PPV 56,7%, NPV 77.3%)
- Δ -lactate has only a positive non-significant association with adverse event

Grazie per l'attenzione!