

The relationship between blood lactate changes and mortality for patients admitted to the Intensive Care Unit at Karolinska University Hospital - Huddinge.

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Introduction:

Hyperlactatemia in critically ill patients and particularly those in shock, has been interpreted as a marker of oxygen debt. Monitoring blood lactate levels is the most widely used method of evaluating global tissue dysoxia. Lactate can be measured in whole blood or plasma and concentration above 2mmol/L are considered abnormal. Elevated blood lactate and especially inability to clear it has been associated with increased mortality. Here we like to investigate if the changes in lactate levels in our mixed ICU are related to outcome.

Methods:

All lactate values registered in Clini Soft for 2011 were obtained in a database. From this the patients who were admitted to ICU with high blood lactate level (≥ 3 mmol/L) and/or patients who developed high blood lactate levels within 24 hours after admission to ICU were selected (Figure 1).

Patients included were subdivided in to four groups:

A: achieve normal blood lactate (≤ 2 mmol/L) within 24 hours in the ICU.

B: achieve normal blood lactate within 72 hours in the ICU.

C: achieve normal blood lactate after more than 72 hours in the ICU.

D: never achieve normal blood lactate in the ICU.

The four groups were compared for differences in age, sex, lactate, APACHE II, dose of Adrenalin and Noradrenalin administration, ICU and post ICU mortality (up to 12 months), need for dialysis, diagnosis, length of hospital stay in both ICU and hospital.

Logistic regression analysis with NCSS 2007 was used to test for relationships.

Results:

Mortality during ICU care was significantly higher, the longer it took to reach lactate ≤ 2 mmol/L. If the patients well survive ICU care no significant mortality difference related to how fast lactate normalized was observed (Table 1 and Fig 2).

Persistent high lactate level is a strong predictor of death in ICU but not after ICU. For the univariate logistic regression analysis, the odds of ICU mortality is greater for groups B and C+D compared with group A (Table 2). For the stepwise analysis, the effect was significant for the two factors separately (APACHE II: $p < 0.00001$, lactate group $p = 0.00086$) showing the independent prediction of lactate changes. The odds of death for the stepwise regression in group B is 1.76 (0.60 to 5.20, $p = 0.30$) compared with group A, while for the corresponding group C + D the OR is 5.85 (2, 23 to 15.4, $p = 0.0003$). The relation between lactate changes, APACHEII and mortality is illustrated in Fig 3.

Conclusion:

The longer it took to reach lactate ≤ 2 mmol/L, ICU mortality became significantly higher. Persistent high lactate is a strong predictor for death in the ICU and increases the predicted death rate in addition to APACHE II taken on admission. This confirms findings from previous studies in other ICUs.

	A (n=113)	B (n=43)	C + D (n=59)
Age (y)	58±20	64±16	57±19
Gender (m/f)	65/48	20/23	34/25
APACHE II	24±8	29±10	31±10
LOS ICU (D)	3 (1-42)	6 (2-30)	2 (1-41)
LOS HOS (D)	14 (1-125)	12 (1-102)	10 (1-41)
ICU Mortality number(%)	13/113 (12)	12/43 (28)	33/59* (56)
Post ICU mortality number(%)	29/100 (29)	14/31 (45)	10/26 (38)
CRRT (%)	10	30	37
Ad.(mg/ICU stay)	0 (0-37)	0 (0-29)	0 (0-15)
Norad. (mg/ICU stay)	3 (0-130)	18 (0-140)	6 (0-1576)
Diagnosis :			
Respiratory	20/113	5/43	4/59
Other causes	15/113	2/43	10/59
Bleeding	7/113	2/43	6/59
Circulation	15/113	7/43	5/59
CNS	14/113	0/43	4/59
Liver	21/113	5/43	11/59
Sepsis	21/113	22/43	19/59

Table 1. Patients characteristics. Values are given as mean \pm SD or median (range). *: significantly different between groups.

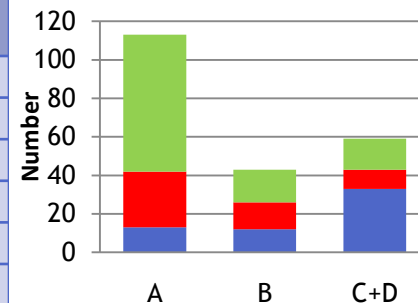


Figure 2. Mortality in ICU (blue), post ICU (red) and survival (green) in groups A, B and C+D.

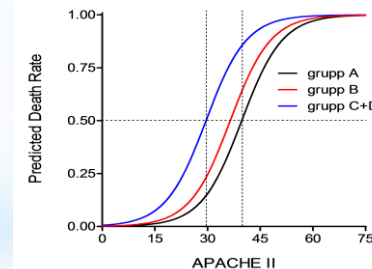


Figure 3. Relation mortality to APACHE II score for the three different groups (A, B and C+D). Group C+D significantly different from group A ($p=0.0003$)

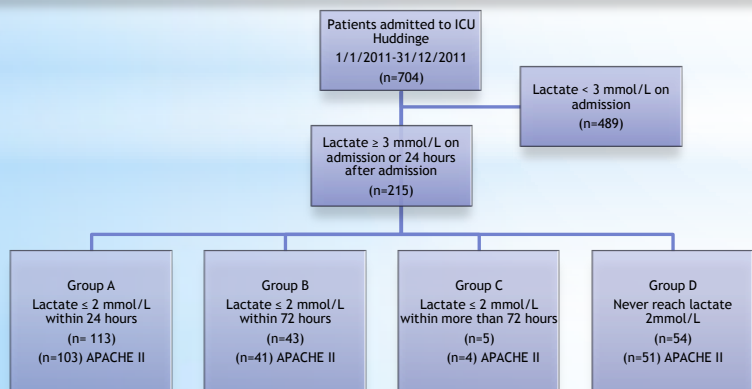


Figure 1. Consort diagram (for the final analysis groups C and D were joined in one group).

	Mortality in ICU n=215 OR compared with "A" (95% CI)	p	Mortality after ICU n=157 OR compared with "A" (95% CI)	p
Group B	2.97 (1.23-7.19)	0,015	2.02 (0.88-4.62)	0,10
Group C+D	9.76 (4.51-21.2)	<0,001	1.53 (0.62-3.76)	0,35

Table 2. Mortality in the ICU and within 12 months after ICU discharge. Values are presented as Odds ratio (OR) with 95% confidence interval (CI) compared to group A.