Serum Lactate and Outcome in Critically Ill Elderly Admitted To Icu

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ABSTRACT *Background: elderly patients need for admission to ICU is increasing. With advancing age and associated comorbidities critically ill elderly patients have substantial mortality. The early recognition of patients at high risk of mortality is needed to plan care in advance and to control healthcare costs. Aim: To find out the relation between serum lactate and outcome in critically ill elderly admitted to ICU. Study design: A prospective study. Participants: Ninety elderly patients aged 60 years and above. Method: This study was performed in Geriatric ICU at Ain Shams University Hospitals including patients admitted for 24 hours or more. On admission each patient was subjected to clinical assessment including detailed medical history, in addition to laboratory investigations including serum lactate on admission, after six hours and lactate clearance was calculated, also APACHE II score was calculated. Results: The current study showed that the prevalence of hyperlactatemia on admission to ICU was 61 %, the rate of mortality among the study participants was 43%, and lactate clearance after six hours had higher sensitivity and specificity to predict ICU mortality in elderly than initial serum lactate on admission. Conclusions: In the current study we conclude that lactate clearance is the most important predictor of mortality in elderly admitted to ICU.*

Introduction:

The elderly population is expanding in Egypt, like other countries, There were more than four million persons aged 60 and over representing 6.9% of the total population in 2006. The expected percentage of older people may reach 10.9% in 2026 (1). This rapid rise in the elderly population worldwide is paralleled by increase in utilization of health care resources (2). Moreover, elderly will need ICU admission more frequently and their management will be more challenging. Being old is associated with increased mortality in critically ill patients (3). However, age alone is not a strong predictor for mortality. There is evidence suggesting that acute physiological impairment and associated comorbidities were predictors of mortality after adjustment of age (4, 5). The current study was designed to study relation between serum lactate and outcome in critically ill elderly admitted to ICU. Persistent elevation of lactate has been shown to be associated with poor outcome, such that a decrease in lactate (or lactate clearance) during resuscitation is an independent predictor for improved mortality (6). The early recognition of patients at high risk of mortality is needed to plan care in advance and to control healthcare costs.

Patients and methods:
Study design:

A prospective single center study was conducted to assess effect of serum lactate on mortality in critically ill elderly admitted to ICU. Ninety consecutively admitted patients were included in the study. All patients were 60 years and over. Patients with ICU stay of less than 24 hours were excluded. The patients were divided into survival group (those who were discharged from the ICU after improvement) and non-survival group (those who died in the ICU). The study was carried out in the ICU of the Geriatrics and Gerontology Department at Ain Shams University Hospital in Cairo Egypt.

Laboratory assessment: Laboratory findings including complete blood count, bleeding profile, kidney function test, liver function test, albumin, arterial blood gases, serum lactate level on admission and after six hours. Laboratory measures were all performed in Ain Shams University Central Laboratories.

Ethics

The study protocol was reviewed and approved by the Research Review Board of the Geriatrics and Gerontology Department and ethical committee of Faculty of medicine, Ain Shams University.

Statistical methods:

The collected data were coded, tabulated, revised and statistical analyzed using SPSS program (version 16). Quantitative variables were presented in the form of means and standard deviation. Qualitative variables were presented in form of frequency tables (number and percent). Comparison between qualitative variables was done using Chi square test. Correlation coefficient was also done to find linear relation between different variables using Spearsman's correlation co-efficient. P-values <0.05 were considered significant for all tests (roc curve,multi variant?)

Results:

The demographic data of our study population showed that the mean age was 68.5±7.4 years, 42 male and 48 female, 25 smokers and 65 non-smokers. Study of effect of age on outcome in critically ill elderly showed that no statistically significant effect of age on outcome (P> 0.05) **table 1.**

The prevalence of hyperlactatemia (admission lactate >2 mEq/l) was 61 %. Mortality rate among studied sample was 43.3%.The sensitivity and specificity of initial serum lactate levels (cutoff, 2 mmol/L) to predict ICU mortality were 61.5% and 39.2%, respectively, with a positive predictive value of 43.6 and a negative predictive value of 57.1. Lactate clearance after six hours which had higher sensitivity and specificity to predict ICU mortality which were 87.1% and 58.8%, respectively, with a positive predictive value of 61.8 and a negative predictive value of 85.7.

Serum lactate level after six hours has higher mortality prediction than lactate level on admission **table 2.**

Study of relation between Lactate clearance and outcome in critically ill elderly showed that there was statistically significant effect of Lactate clearance on outcome (P< 0.05) **table 3.**

Discussion:
The goal of the current study was to assess effect of serum lactate on mortality in critically ill elderly admitted to ICU. The results of this study showed that age was not a predictor of mortality in elderly patient admitted in ICU. This finding agrees with Belayachi *et al* in a study on elderly subjects admitted in a Moroccan ICU which could not find an association of age with mortality (7).

In the current study there was no association between serum lactate and mortality in elderly admitted to ICU. This was supported by the study done by Kaplan and Kellumin their retrospective study, they mentioned that admission lactate could not discriminate survivors from non-survivors (2.3 mmol/L vs. 2.9 mmol/L, p=0.24) (8).How ever this finding disagree with the finding of the study done by Deven Juneja et al to evaluate the causes, incidence, and impact on outcome of admission hyperlactatemia in patients admitted to a general medical ICU, They found that admission hyperlactatemia was common and is associated with increased mortality, irrespective of presence of shock (9).

A systematic review by Kruse et al was published in Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2011to assess blood lactate as a predictor for in-hospital mortality among patients admitted acutely to hospital. They mentioned that most studies reviewed support single lactate measurements, assessed at admission to the hospital, as being useful in terms of predicting mortality (10).

The predictive value of a single lactate assessed at admission is, however, controversial, as several studies were not able to show a significant predictive value of admission lactate. Furthermore there is great heterogeneity between studies when defining, at what stage an admission lactate should be taken; some studies choosing the first patient contact, others when the patient is admitted to ICU. In the population admitted to ICU, close monitoring of all patients are mandatory, and it seems reasonable to perform serial lactate measurement on all patients (10).

The sensitivity and specificity of serum lactate levels (cutoff, 2 mmol/L) to predict ICU mortality were 61.5% and 39.2%, respectively, with a positive predictive value of 43.6 and a negative predictive value of 57.1. Lactate clearance after six hours had higher sensitivity and specificity to predict ICU mortality, which were 87.1% and 58.8%, respectively, with a positive predictive value of 61.8 and a negative predictive value of 85.7.

This agrees with the finding of Zhang and Xu in there systematic review and meta-analysis of diagnostic accuracy of lactate clearance in predicting mortality, they conclude that the overall sensitivity and specificity for lactate clearance to predict mortality were 0.75 (95% CI, 0.58-0.87) and 0.72 (95% CI, 0.61-0.80), respectively. The diagnostic performance improved slightly when meta-analysis was restricted to ICU patients, with sensitivity and specificity of 0.83 (95% CI, 0.67-0.92) and 0.67 (95% CI, 0.59-0.75), respectively (11).

Conclusions: In the current study we found that Measurement of initial serum lactate (on admission) has no significant statistical effect on outcome in elderly admitted in ICU in contrast to follow up serum lactate after six hours and lactate clearance.

Table 1: Base line characteristics of our study participants

ITEM		Statistics	
Age (years)		68.578±7.476*	
Sex	Male	42	46.67**
	Female	48	53.33**
Smoking	Smoker	25	27.78**
	non smoker	65	72.22**
Body mass index (BMI)		22.922±4.798*	
Glasgow Coma Scale (GCS)		10.544±3.336*	
Diabetes mellitus	Diabetic	45	50.00**
	not diabetic	45	50.00**
Hypertension	HTN	54	60.00**
	no HTN	36	40.00**
Ischemic heart disease (ISHD)	ISHD	28	31.11**
	no ISHD	62	68.89**
COPD	COPD	20	22.22**
	no COPD	70	77.78**
Liver Cirrhosis	Cirrhosis	12	13.33**
	no cirrhosis	78	86.67**
Renal impairment	Renal	38	42.22**
	not Renal	52	57.78**
Shock	Shock	9	10.00**
	no Shock	81	90.00**
Length of ICU stay		6.756±7.992*	
APACHE II score		19.067±7.424*	
Mortality	Survival	51	56.67**
	Non survival	39	43.33**

* Data are expressed as mean±SD for parametric data.
** Data are expressed as frequency and percentage data.

Table 2: Comparison between effect of serum lactate on admission (LACT1) and serum lactate after six hours (LACT2) on outcome in critically ill elderly.

		Survivals	Non Survivals	p.value
LACT1	Range	1.200-6.500	1.000-7.000	0.575
	mean±SD	2.649±1.097	2.518±1.094	
LACT2	Range	0.500-5.600	1.200-7.500	0.001
	mean±SD	2.214±1.041	3.115±1.280	

Comparison between effect of serum lactate on admission (LACT1)and serum lactate after six hours (LACT2) on outcome in critically ill elderly showed that no statistically significant effect of(LACT1) on outcome (P> 0.05) but there was statistically significant effect of (LACT2) on outcome (P< 0.05).

Table 3: Study of relation between Lactate clearance and outcome in critically ill.

Lactate clearance Survivals		OUTCOME		
		Non Survivals	Total	
Clearance	N (%)	30(58.82%)	5(12.82%)	35(38.89%)
No clearance	N (%)	21(41.18%)	34(87.18%)	55(61.11%)
Total	N	51	39	90
	%	100.00	100.00	100.00
Chi-square	X2	19.680		
	P-value	0.001		

Study of relation between Lactate clearance and outcome in critically ill elderly showed that there was statistically significant effect of Lactate clearance on outcome (P< 0.05).

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