Journal of Clinical and Basic Cardiology

An Independent International Scientific Journal

Journal of Clinical and Basic Cardiology 2002; 5 (3), 233-235

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Indexed in
Chemical Abstracts
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Factors Influencing Outcome in Patients Admitted to a Medical Intensive Care Unit After Successful Cardiopulmonary Resuscitation

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Cardiopulmonary resuscitation is often unsuccessful or subsequently associated with a high mortality rate. We therefore desired to evaluate risk factors which could influence outcome. Out of 411 adult patients admitted to a medical intensive care unit (ICU) after cardiac arrest 52 % survived to be discharged from the ICU, and 33 % were discharged from hospital. Non-surviving patients included a high percentage of elderly persons (≥ 75 yrs), patients with coronary heart disease (38 % vs. 18 % and 77 % vs. 67 %, respectively), and patients with chronic diseases (6 = median vs. 4; $p < 0.001$). In addition, severe acute disease as estimated by the Acute Physiology Score and high plasma lactate levels on admission to the ICU had a negative influence on hospital mortality. *J Clin Basic Cardiol 2002; 5: 233–5.*

Key words: cardiopulmonary resuscitation, cardiac arrest, intensive care, coronary heart disease, elderly, APA score, lactate

The proportion of patients surviving cardiac arrest remains low (7–10 %) and the poor outcome varies with the type of arrest, delay in onset of life support and underlying disease [1, 2]. About 40 % of patients are admitted to an intensive care unit (ICU) after resuscitation [3]. However, hospital mortality for postcardiac arrest patients remains high (61–73 %) [4, 5]. Therefore, we whished to evaluate risk factors for in-hospital death after cardiopulmonary resuscitation.

Patients and Methods

Patients

We report the results obtained in 411 consecutive adult patients admitted to our medical intensive care unit (ICU) after cardiac arrest. The study was conducted over a six-year period from 1/1994 to 1/2000.

Risk Factors for Intra-Hospital Death

Age

Patients were classified as elderly if they were aged 75 years or older [6].

Diagnostic Category

Depending on the underlying acute disease responsible for admission to the ICU, patients were assigned to 10 subgroups: cardiovascular diseases, respiratory emergencies, gastrointestinal diseases, acute renal failure, metabolic disorders including poisoning, neurologic diseases, acute psychiatric conditions, organ failure resulting from haematologic diseases, non-operative trauma, and systemic diseases including sepsis, autoimmune disorders and metastatic cancer.

Plasma Lactate Levels

Plasma lactate levels were measured immediately after admission to the ICU with an enzymatic method [7].

Preexisting Health Status

Preexisting health status was quantified by the sum of chronic risk factors (hypertension, diabetes mellitus, hyperlipidaemia, obesity, smoking and alcoholism) and chronic organ diseases such as coronary heart disease (CHD), cardiomyopathy, chronic pulmonary disease, chronic renal failure, liver cirrhosis, malnutrition, immunosuppression, physical limitation as a result of stroke, rheumatoid arthritis, gallstone disease etc. Patients were classified as having CHD if they had a history of myocardial infarction and/or stable angina pectoris and/or signs of CHD in the electrocardiogram. In addition, CHD was diagnosed in patients admitted with acute coronary syndrome or acute myocardial infarction.

Severity of Illness

Severity of illness was estimated on the day of admission using the Acute Physiology Score (APS) [8]. APS is a part of the APACHE-III score (APACHE = Acute Physiology And Chronic Health Evaluation) where points are given for 16 physiologic variables (vital signs and laboratory abnormalities). Greater deviations from normal result in a higher score.

Statistical Analysis

The chi-square test was used to compare age groups and diagnostic categories. Distribution fitting of metric data was achieved with the Kolmogorov-Smirnov test. Since the data of age, plasma-lactate levels and APA scores were not normally distributed, they were summarized using the median and the interquartile range (25^{th} to 75^{th} percentile). Statistical comparison was done with the Kruskal-Wallis test. Differences at a level of $p < 0.05$ were considered to be significant.

Results

The clinical characteristics of the patients are summarized in Table 1. Mortality rate in the ICU was 48 % and in hospital 67 %. Survivors were significantly younger and their total number of chronic diseases was significantly lower. Cardiovascular diseases were predominant in the whole study population. Death, however, was not related to the diagnostic category responsible for cardiac arrest.

As shown in Figure 1, APA scores were higher in patients who did not survive during the hospital stay (93 median, 33 interquartile range vs. 67, 21; $p < 0.01$). The proportion of patients with coronary heart disease was high in all resusci-

Received: January 18^{th}, 2002; accepted: March 4^{th}, 2002.
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tated patients, but was significantly higher in patients who died. In this group the levels of plasma lactate were higher than those of the survivors.

Table 1. Characteristics of patients after cardiopulmonary resuscitation (CPR)

	CPR Patients total (n = 411)	Survivors (n = 151)	Not survived (n = 260)
Age (yrs)	70 (18)	64 (21)**	71 (16)**
Elderly (%)	32	18**	38**
Sex (% male/female)	59/41	62/38	58/42
Diagnostic category (n; %)			
Cardiovascular	300; 72	104; 76	196; 73
Respiratory	41; 9	16; 11	25; 9
Neurologic	27; 7	3; 2	24; 9
Metabolic	10; 3	5; 4	5; 2
Trauma	8, 2	2; 1.5	6; 2
Gastrointestinal	7; 2	3; 2	4; 1.5
Renal	7, 2	3; 2	4; 1.5
Systemic	7; 2	2; 1.5	5; 1.8
Haematologic	2; 0.5	–	2; 0.2
Psychiatric	2; 0.5	1; –	1; –
Chronic diseases (n)	5 (4)	4 (3)**	6 (4)**
Coronary disease (%)	72	67*	77*
Lactate (mmol/l)	7.2 (6.4)	5.3 (4)**	8 (6.2)**
Days of intensive care	4 (7)	4 (7)**	3 (7)**
in hospital	10 (19)	22 (19)**	5 (13)**

Not survived: death in hospital; intergroup differences are indicated by the same number of asterisks (**$p < 0.001$, *$p < 0.05$); percentages are given from column totals; data for age, lactate and days are given as median and (interquartile range).

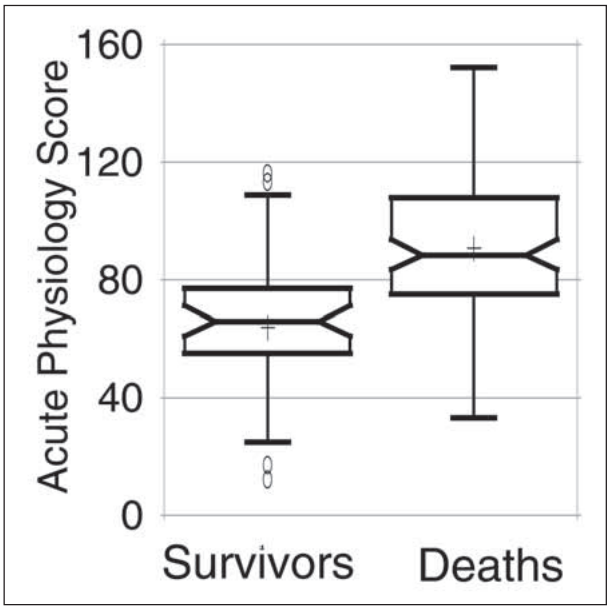

Figure 1. Acute Physiology Scores (APS) in patients after cardiac arrest (hospital survivors and deaths) are displayed by medians of box-and-whisker plots. The data were calculated on the day of admission to the intensive care unit. The plots divide data into 4 areas of equal frequency. The box encloses the middle 50 %. The median is drawn as a horizontal line inside the box (median notch). Two vertical lines extending from each end of the box represent data distribution from the first and third quartile to the smallest and largest data points within 1.5 interquartile ranges. Far outliers (data points more than 3 interquartile ranges below the first or above the third quartile) are displayed as circles. The location of sample means is indicated by asterisks.

Discussion

This study shows that advanced age, a high number of chronic diseases and the presence of coronary heart disease are risk factors for death in adult patients admitted to intensive care after successful cardiopulmonary resuscitation. In addition, severe deviations of physiologic parameters from normal and high plasma lactate levels contribute to a fatal outcome.

The high ICU and hospital mortality of the study patients is consistent with previous investigations [4, 5]. Nevertheless, it should be emphasized that after ICU discharge the proportion of deaths during hospitalization further increased by 19 %. This is a higher percentage when compared to the mortality of the whole patient population in ICUs (5–15 %) [9]. An explanation is that many of the resuscitated patients require a high level of nursing care after discharge from the ICU, mainly due to impaired neurologic control of swallowing and airway management. The staff of standard hospital wards may be overworked and often there are no intermediate-care facilities. In addition, triage procedures in ICUs and the decision not to resuscitate in futile patients may contribute to further deaths.

As in the general population of industrialized countries, the proportion of elderly patients requiring intensive care is increasing. They are more likely to have chronic diseases and poor prior health, diminishing physiolgical reserves and a predisposition for multiorgan failure [10]. Age and comorbidities have been shown to be independently related to mortality rate and recovery of neurologic function [11]. Unfortunately, physiological reserves cannot be measured directly and therefore information on risk factors and pre-admission health status had to be obtained from patient history. This was completed by ultrasound images of the heart and abdomen to confirm preexisting information or find additional diagnosis (eg, left ventricular hypertrophy or diminished kidney size) [12]. However, the mere total of risk factors and chronic diseases may be used as a rough measure of the ability to recover from acute illness. Further studies are necessary to evaluate an impact hierarchy of risk factors (from the strongest to the weakest) and comorbidities on physiological reserve.

Although the primary diagnosis of the patient is important for subsequent therapeutic management, we were not able to find an impact on hospital mortality in the subgroup of ICU patients after cardiac arrest. This may in part be due to a statistical problem. As Table 1 shows, there is a predominance of neurologic, sepsis, non-operative trauma and haematologic patients in the group of non-survivors, but patient numbers are too small to reach statistical significance. In contrast, the severity of the disease itself, as estimated by the APS score, influences outcome. These findings are supported by Bastos et al. [13], who have demonstrated that a severe impairment of consciousness after admission to the ICU is associated with a poor prognosis. These findings are supported by biochemistry: patients who did not survive to hospital discharge had significantly higher plasma lactate levels when compared to survivors. This reflects prolonged systemic hypoperfusion and tissue hypoxia until the onset of cardiopulmonary resuscitation [14].

Although death during hospitalization is the most immediate and readily discernible outcome, it is only a limited measure of the effectiveness of intensive care [26]. The objective in the ICU is not simply to keep the patient alive in the hospital. Quality of life after discharge must also be considered. Our study is limited by the fact that the quality of life after dismissal from hospital was not evaluated. An objective estimation of the patient's clinical course after hospitalization would be necessary to interpret outcomes after cardiac arrest.

References

1. Martens PR, Mullie A, Buylaert W, Calle P, van Hoeyweghen R and the Belgian Cerebral Resuscitation Study Group. Early prediction of non-survival for patients suffering cardiac arrest – a word of caution. Intensive Care Med 1992; 18: 11–4.
2. Niemann JT. Cardiopulmonary resuscitation. N Engl J Med 1992; 327: 1075–80.
3. Kudenchuk PJ, Cobb LA, Copass MK, Cummins RO, Doherty AM, Fahrenbruch CE, Hallstrom AP, Murray WA, Osulfka M, Walsh T. Amiodarone for resuscitation after out-of-hospital cardiac arrest due to ventricular fibrillation. N Engl J Med 1999; 341: 871–8.
4. Niskanen M, Kari A, Halonen P, the Finnish ICU Study Group. Five-year survival after intensive care – comparison of 12,180 patients with the general population. Crit Care Med 1996; 24: 1962–7.
5. Chen R, Bolton CF, Young GB. Prediction of outcome in patients with anoxic coma: a clinical and electrophysiologic study. Crit Care Med 1996; 24: 672–8.
6. Parrillo JE, Rush P. Guidelines for critical care and the elderly: the search continues. Crit Care Med 1997; 25: 1619–20.
7. Marbach EP, Weil MH. Rapid enzymatic measurement of blood lactate and pyruvate. Clin Chem 1967; 13: 314.
8. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, Sirio CA, Murphy DJ, Lotring T, Damiano A, Harrell FE. The APACHE-III prognostic system: Risk prediction of hospital mortality for critically ill hospitalized adults. Chest 1991; 100: 1619–36.
9. Wallis CB, Davies HT, Shearer AJ. Why do patients die on general wards after discharge from intensive care units ? Anaesthesia 1997: 9–14.
10. Tran DD, Groeneveld BJ, van der Meulen J, Manta JJ, Strack vom Schindel RJ, Thijs LG. Age, chronic disease, sepsis, organ system failure and mortality in a medical intensive care unit. Crit Care Med 1990; 18: 474–9.
11. Teres D, Brown RB, Lemeshow S. Predicting mortality of intensive care patients. The importance of coma. Crit Care Med 1982; 10: 86–95.
12. Hollerbach S, Schölmerich J. Ultrasonography in the intensive care medicine. Intensivmed 1992; 29: 348–58.
13. Bastos PG, Sun X, Wagner DP, Wu AW, Knaus WA. Glasgow coma scale score in the evaluation of outcome in the intensive care unit: findings from the acute physiology and chronic health evaluation III study. Crit Care Med 1993; 21: 1459–65.
14. Mizock BA, Falk JL. Lactic acidosis in critical illness. Crit Care Med 1992; 20: 80–93.
15. Thibault GE, Mulley AG, Barnett GO, Goldstein RL, Reder VA, Sherman EL, Skinner ER. Medical intensive care: indications, interventions and outcomes. N Engl J Med 1980; 302: 938–42.

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