Retrospective Study of the Survival of Patients who Underwent Cardiopulmonary Resuscitation in an Intensive Care Unit

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Objective *- To evaluate clinical and evolutive characteristics of patients admitted in an intensive care unit after cardiopulmonary resuscitation, identifying prognostic survival factors.*

Methods - *A retrospective study of 136 patients admitted between 1995 and 1999 to an intensive care unit, evaluating clinical conditions, mechanisms and causes of cardiopulmonary arrest, and their relation to hospital mortality.*

Results - *A 76% mortality rate independent of age and sex was observed. Asystole was the most frequent mechanism of death, and seen in isolation pulmonary arrest was the least frequent. Cardiac failure, need for mechanical ventilation, cirrhosis and previous stroke were clinically significant ($p<0.01$) death factors.*

Conclusion - *Prognostic factors supplement the doctor's decision as to whether or not a patient will benefit from cardiopulmonary resuscitation.*

Key words: cardiopulmonary resuscitation, cardiopulmonary arrest, intensive care unit

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Cardiopulmonary resuscitation is a therapeutic medical modality with both indications and counterindications [1,2]. Although frequently performed in the hospital, its efficacy has not been well established in this environment where many seriously ill patients are found who have multisystem afflictions and a poor prognosis. Inappropriate resuscitation measures may result in increased financial and emotional costs and little or no benefits to the patient.

Unsatisfactory results of cardiopulmonary resuscitation procedures have for the most part attributed to its indiscriminate use. Various individual factors interfere with recovery from cardiopulmonary arrest. Despite the fact that the prediction of an individual outcome of such resuscitation is of great medical, ethical, and socio-economic interest, doubts about the decision whether or not to resuscitate a given patient, as well as about the consequences of either attitude, persist [3]. This decision should not be made only at the moment of cardiopulmonary arrest, but should also take the previous medical condition of the patient into account [4]. Therefore, cardiopulmonary manouvers should be critically indicated for select patients, taking into consideration criteria that may be related to a better prognosis after therapy. The definition of these criteria is of relevance, rendering important knowledge about pre, trans and postarrest conditions of patients who undergo cardiopulmonary resuscitation.

It is the objective in the present work to evaluate clinical characteristics and evolution after cardiopulmonary resuscitation of patients confined to the intensive care unit of the Hospital de Clínicas de Porto Alegre. We identified factors that may influence their prognosis to a significant extent, thus stimulating reflection about the critical utilization of cardiopulmonary resuscitation.

Methods

The present work consists of a review of case histories of 136 patients admitted between January 1995 and Decem-

ber 1999 to the intensive care unit of the Hospital de Clínicas de Porto Alegre after successfully undergoing cardiopulmonary resuscitation manouvers. The Ethics and Research Commission of the hospital approved this study.

Patients were surveyed for sex, age, and mechanisms, causes and recurrence of cardiopulmonary arrest, and clinical conditions before and after the event as well as the incidence of mortality. Mechanisms of cardiopulmonary arrest were classified as ventricular fibrillation, pulseless ventricular tachycardia, pulseless electrical activity, asystole, or respiratory arrest without cardiac arrest. Causes were divided into acute myocardial infarct, cardiac ischemia or arrhythmia, respiratory insufficiency, hydroelectrolyte disturbances, hypotension, and others. Clinical conditions like arterial pressure, presence of pneumonia, sepsis, cancer, angina pectoris, acute myocardial infarction, congestive heart failure, stroke, coma, oliguria, elevated serum urea, (>100mg/dL) cirrhosis, use of mechanical ventilation and bedrest were evaluated.

Patients were evaluated regarding the major outcome, namely, hospital mortality. Secondary outcomes were mechanisms and causes of cardiorespiratory arrest. Statistical analysis was performed with the SPSS for Windows 10 program, using the Student *t* test for quantitative and the chi-square test for qualitative data, multiple logistic regression for risk factors, and prognosis and residue analysis for the mechanism of cardiopulmonary arrest. The level of significance adopted was α=0.05.

Results

The population's mean age was of 60 years, and gender distribution was homogeneous: 67 men and 69 women. General intrahospital mortality was 75.7% (103 patients) without a significant difference regarding gender. No significant difference existed between the mean age of groups who died or survived (tab. I). Presumed causes of cardiorespiratory arrest were acute myocardial infarction, cardiac ischemia, or arrhythmia in 27 (20%), respiratory insufficiency in 27 (20%), hypotension in 24 (17%), and hydroelectrolyte or acid/base equilibrium disturbances in 10 (7%) patients; other causes including pulmonary embolism, intracerebral hemorrhage, stroke, intoxication, pacemaker dysfunction, neoplasm infiltration of the central nervous system were observed in 21 (15.4%), and unknown causes existed in 27 (20%) patients. No significant differences regarding causes of cardiorespiratory arrest were observed between survivors and nonsurvivors (tab. II).

The predominant mechanisms responsible for cardiorespiratory arrest were ventricular fibrillation and pulseless ventricular tachycardia, observed in 25 patients totalling 18.3% (13.1% and 5.1%, respectively). Asystole was observed in 21 (14.4%), respiratory arrest alone in 11.8%, and pulseless electrical activity in 11.1% of the patients. Based on a review of case histories, it was impossible to determine the mechanism of cardiopulmonary arrest in 59 (43.4%) patients. Upon comparison regarding the mechanism of cardiopulmonary arrest between survivors and nonsurvivors, a significantly higher mortality was observed in the asystole group (P=0.02) and a lower mortality (P=0.001) in the group with respiratory but not cardiac arrest. No significant differences existed between general mortality and groups exhibiting ventricular fibrillation, ventricular tachycardia, and pulseless electrical activity (tab. III). Among death risk factors of patients who underwent cardiopulmonary resuscitation, congestive heart failure, need for mechanical ventilation, recent stroke and hepatic cirrhosis increased such risk significantly (tab. IV). The recurrence of cardiopulmonary arrest that occurred in 27 (19.9%) patients was also strongly associated with a worse prognosis (RR=1.4; 95% CI=1.18-1.57).

Table I - Profile of patients who underwent cardiopulmonary resuscitation

Characteristic		Deaths	No deaths	p
Age (years)		61±16	57±18	0.31
Gender	Male	52 (77.3%)	15 (22.7%)	
	Female	51 (73.9%)	18 (26.1%)	0.69

Table II – Cause of cardiopulmonary arrest

Characteristic	Deaths Nº	Deaths %	No deaths Nº	No deaths %	p
Hydroeletrolyte and/or acid-base disturbance	9	90%	1	10%	0.45
AMI, arrhythmia, or myocardial ischemia	20	74.1%	7	25.9%	0.97
Hypotension	18	75%	6	25%	0.86
Respiratory insufficiency	19	70.4%	8	29.6%	0.63
Others [1]	18	85.7%	3	14.3%	0.38
Ignored	19	70.4%	8	29.6%	0.63
Total	103	75.7%	33	24.3%	-

AMI- acute myocardial infarct; others[1] - pulmonary embolism, intracerebral hemorrhage, ischemic vascular cerebral accident, intoxication, pacemaker dysfunction, neoplasm infiltration in the central nervous system.

Table III - Mechanism of cardiorespiratory arrest

Characteristic	Deaths Nº	Deaths %	No deaths Nº	No deaths %	p
VF and pulseless VT	17	68%	8	32%	0.61
Ventricular fibrillation	13	72.2%	5	27.8%	0.92
Pulseless VT	4	57.1%	3	42.9%	0.37
Asystole	20	95.2%	1	4.8%	0.02
Pulseless electrical activity	11	73.3%	4	27.7%	0.84
Respiratory arrest only	7	43.8%	9	56.2%	0.001
Ignored	48	81.4%	11	18.6%	0.19
Total	103	75.7%	33	24.3%	-

VF- ventricular fibrillation; VT- ventricular tachycardia.

Table IV - Death risk factors in cardiopulmonary arrest patients

Factor	Deaths		No deaths		RR	p	CI 95%
	Nº	%	Nº	%			
SAP <100mmHg	34	33%	8	24.2%	1.07	0.52	0.85-1.35
Pneumonia	22	21.4%	6	18.2%	1.04	0.71	0.84-1.28
Ureia >100mg/dL	9	8.7%	2	6.1%	0.88	0.56	0.57-1.34
Cancer	24	23.3%	5	15.2%	1.15	0.24	0.9-1.46
Coma	14	13.6%	2	6.1%	0.95	0.7	0.73-1.23
Angina	6	5.8%	5	15.2%	0.95	0.87	0.52-1.72
AMI	7	6.8%	6	18.2%	0.66	0.11	0.4-1.1
CHF	21	20.4%	2	6.1%	1.51	<0.001	1.22-1.86
Oliguria	12	11.7%	4	12.1%	0.89	0.51	0.63-1.25
Sepsis	24	23.3%	4	12.1%	1.06	0.54	0.87-1.28
MV	17	16.5%	0	0%	1.38	<0.001	1.15-1.66
Stroke	15	14.6%	0	0%	1.28	0.003	1.08-1.52
Cirrhosis	6	5.8%	0	0%	1.55	<0.001	1.23-1.95

RR - risk relative; SAP - systolic arterial pressure; AMI - acute myocardial infarction; CHF - congestive heart failure; MV - mechanical ventilation.

Discussion

Cardiopulmonary resuscitation is frequently performed in stressful situations. Persons providing this treatment frequently fail to consider the possibility that the patient may have a cardiac disease in its final phase, taking into account only that cardiopulmonary arrest is an emergency situation. Roberts et al [5] concluded that doctors and nurses expect cardiopulmonary arrest patients to have a survival rate higher than they really do. In their study, doctors were shown to expect 24% of cardiopulmonary resuscitation procedures in adults and 41% in children to be efficient, while nurses expected survival indexes of 30% and 45% for adults and children, respectively. Laymen had an even higher level of expectation: a 52% cardiopulmonary arrest reversion rate was expected for adults and a 63% reversion rate for children. Several studies have shown hospital discharge rates following cardiopulmonary resuscitation to vary between 11 and 39%. In the present study, a 24.3% discharge ratio was observed.

Possible mortality risk factors reinforce a doctor's decision as to whether or not the patient will benefit from cardiopulmonary resuscitation. In agreement with the literature [3,7,8], the present study found the following statistically significant mortality risk factors: congestive heart failure, need for mechanical ventilation, previous stroke and cirrhosis. Some risk factors appearing as statistically significant in the literature, such as sepsis [7] and hypotension [3,9], were not characterized in the present study. Patient age is a controversial risk factor. No significant difference between the average age of the patients who died in the hospital and those who were discharged was found in this work. In agreement with the literature, previous data suggest that sex does not alter death rates after cardiopulmonary arrest [4]. Some risk factors described in the literature, such as the Glasgow coma scale, acute organ failure [10], diabetes mellitus [3], physiological scores including APACHE 2 [4,8], and duration of cardiopulmonary resuscitation [8,11,12], were not studied in the present work.

No cause with a statistically significant relation to mortality or patient survival was found (tab. II). These results differ from some data in the literature showing hypotension and acute myocardial infarction as causes of a worsened prognosis of cardiopulmonary arrest [9]. Further work will have to be performed to better evaluate these factors' influence on the prognosis of cardiopulmonary arrest patients.

It is important to point out the relationship between mortality and the mechanism of cardiorespiratory arrest. Only 2 statistically significant mechanisms were found: asystole associated with the worst prognosis and respiratory arrest without cardiac arrest associated with the best prognosis. Other studies had shown mortality reduction for ventricular fibrillation and tachycardia [9, 11-13], results not confirmed in the present study. This difference may have been due to the smaller number of patients having their cardiopulmonary arrest mechanism explained on the basis of the retrospective analysis of their case histories (57% of 136 patients).

Despite the great importance of patient prognosis, it must be mentioned that the decision whether to resuscitate cardiopulmonary arrest victims or not rests with the physician responsible for the case. He in turn may use literature data to aid him in the decision of whether or not to perform cardiopulmonary resuscitation manouvers.The prognostic scores studied do not substitute medical decision. In case of doubts about the most correct decision, the doctor should opt for cardiopulmonary resuscitation.

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