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Frequency and outcome of in-hospital resuscitation outside the ICU-setting

A 2 year observational study from Switzerland

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Summary

Background: Guidelines on performing cardiopulmonary resuscitation and its research have been published. Only few data concerning in-hospital resuscitation are available from Switzerland. The aim of our study was to evaluate the frequency and outcome of cardiopulmonary arrests in our hospital and to look for ways of improving our resuscitation management.

Methods: The prospective study was performed in the Kantonsspital Liestal, a primary care hospital with 360 beds, where about 24'300 in-patients were treated during the 2 year observation period. Only in-hospital resuscitations outside the ICU were included and recorded according to the Utstein criteria.

Results: Within a 24 months period, 61 emergency calls were registered. 25 patients needed cardiopulmonary resuscitation. Initial cardiac rhythms were available for all subjects: 8 patients had asystole, 7 ventricular fibrillation and 10 pulseless electrical activity. 12 of 25 resuscitated patients had a return of spontaneous circulation, 7 lived longer than 24 hours and 6 patients (24%) survived to hospital discharge, 4 of them in a very good or good neurological condition. After 12 months 3 patients (12%) were living independently at home, 2 patients had to be treated in a nursing home and 1 patient had died.

Conclusions: Our data correspond to survival rates in larger studies from abroad but are limited by the number of patients investigated. Improvements are necessary in documentation of resuscitation efforts. Rapid defibrillation must be further stressed. The implementation of a multicentre study is suggested because quality control and further improvement of in-hospital resuscitation are needed in Switzerland.

Key words: in-hospital; resuscitation; Switzerland; basic life support; ACLS

Background

International and nationally accepted guidelines for cardiopulmonary resuscitation by basic life support (BLS) and advanced cardiac life support (ACLS) have been published [1, 2]. Criteria for conducting research on in-hospital resuscitations have been proposed [3]. Data from resuscitated in-patients are available from different countries but only few data exist from Switzerland [4–9].

Aims of the study

The aims of the study were to evaluate frequency and outcome of cardiopulmonary arrests in non-intensive care units in our hospital and to look for possibilities for improving our resuscitation management.

Methods

Setting

The study was performed in the Kantonsspital Liestal, Baselland, Switzerland, a hospital with 361 acute beds including an interdisciplinary intensive care unit (ICU) with 10 beds. The hospital has a do-not-attempt-resuscitation (DNAR) policy and the DNAR decision is made by the physicians in charge considering the will of the patient. The hospital does not perform coronary angiographies,

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does not include a paediatric ward, and does not serve as major trauma centre. 11'944 inpatients were treated in the year 2001 and 12'374 inpatients in the year 2002. Only resuscitations outside the ICU and outside the operating rooms were included in the study. Resuscitations that were started outside hospital were excluded.

Resuscitation management and training

When a patient collapsed on the ward the staff had to dial an emergency telephone-number, whereupon a resuscitation team was alerted by pagers. A resuscitation team consisted of an physician, an anaesthesist and a surgeon who were all on-call. The team leader was the physician, who had two to four years of clinical experience and who was working in the ICU. All internists had had organised resuscitation training within the hospital but didn't have to be ACLS approved. The anaesthesist was responsible for the airway management. On weekdays during the day the team was supported by their medical superiors. In case of a cardiac arrest the team ran from their workplace to the scene, where BLS performed by nurses was supplemented with ACLS. Oxygen and bag-valve masks were available on the wards, medications and a defibrillator with an external pacer modality (Lifepak® 10, Medtronic Physio-Control) were brought to the scene by a nurse from the ICU. Automated external defibrillators (AED) were not available and nurses on the wards were not allowed to defibrillate. The team documented resuscitation efforts according to the Utstein criteria. Information about the patients' progress in hospital were obtained from the charts. 12 months later those who had survived to hospital discharge, or their general physicians were contacted by telephone.

Results

Alarms and initial rhythms

From September 1st 2000 to September 1st 2002, 61 emergency calls were registered. 36 calls were due to patients who neither needed ventilation nor chest compressions. These emergency calls were classified as false arrests. This group included visitors, nurses and patients who collapsed due to orthostatic dysregulation, hyperventilation, hypoglycaemia or cerebral seizures and also included patients with signs of death (such as corpse rigidity or post-mortem lividity) in whom no resuscitation efforts were started. 25 calls were because of patients who had to be resuscitated by ventilation and chest compression. Patient characteristics are shown in table 1. Initial rhythms were available from all these subjects: 7 patients had ventricular fibrillation (VF), 8 patients had asystole and 10 had pulseless electrical activity (PEA). In a 90 year old patient resuscitation efforts were started despite a DNAR-order. As soon as the mistake was realised efforts were stopped.

Table 1.

Characteristics of patients. This table shows age and gender of patients who underwent resuscitation efforts, and the time-period when these efforts were started.

	Survivors to hospital discharge n = 6	Non-survivors n = 19
Age: mean (range)	69 (68–78)	74 (42–90)
Gender: male	4 (67%)	14 (74%)
Time: 8 am to 7pm	3 (50%)	10 (53%)

Locations, causes for cardiac arrests and follow up:

11 resuscitation attempts took place on the general medicine wards. Two of these patients survived to hospital discharge and both initially had PEA. Both patients suffered from chronic obstructive lung disease. One of the two had an spontaneous tension pneumothorax that was decompressed immediately. The other patient had hypoxia and hypercapnia and her condition improved with ventilation. Another survivor to hospital discharge with initial PEA came from the urology ward where 2 patients needed ventilation and chest compression during the observation period. His PEA was due to severe sepsis. 4 patients were resuscitated in the emergency room where patients in general are under close observation. 2 of 4 initially had VF and both survived to hospital discharge. The other 2 had asystole. Only the patient who was suffering from acute pulmonary embolism survived asystole to hospital discharge. No survivor to hospital discharge came from the haemodialysis unit, general surgery- and orthopaedic surgery-units, where ventilation and chest compression were performed in 1, 6 and 1 patients, respectively.

Table 2.

Initial rhythms and follow up. This table shows the initial rhythms and follow up of patients who underwent resuscitation efforts.

Initial rhythm	Number of patients	Survival			Clinical diagnosis of survivors
		ROSC	>24 hours	to hospital discharge	
VF	7	4	2	2	Cardiomyopathy, myocardial infarction
Asystole	8	2	2	1	Pulmonary embolism
PEA	10	6	3	3	COPD (2u) Sepsis
Total	25 (100%)	12 (48%)	7 (28%)	6 (24%)	

VF = ventricular fibrillation, PEA = pulseless electrical activity, ROSC = return of spontaneous circulation, COPD = chronic obstructive pulmonary disease.

Table 3.

Suspected diagnoses and autopsy findings of non-survivors. This table lists the 12 patients who did not survive resuscitation efforts and who underwent autopsy. The first column shows the clinical diagnoses before autopsy and the second column shows the autopsy findings. In the patients marked with * a relevant new diagnosis could be identified by autopsy.

Patient	Clinical diagnoses	Diagnoses identified by autopsy
1 *	Suspicion of pulmonary embolism, history of elevated blood pressure	Acute myocarditis, MH, pulmonary oedema
2	Pulmonary embolism	Pulmonary embolism
3	Chronic CAD with heart failure	Chronic CAD
4	Endocarditis with heart failure, alcoholism	Endocarditis, liver cirrhosis
5*	Exacerbation of COPD, CAD with heart failure	Rupture of abdominal aortic aneurysm, pulmonary emphysema, CAD
6*	Sepsis with *Staphylococcus aureus*, chronic renal failure	Brain abscess with gram-positive cocci, MH, shrunken kidneys
7*	History of melanoma, suspicion of pulmonary metastasis	Systemic tuberculosis, MH, no metastasis
8	Chronic CAD, diabetes mellitus type 1, renal insufficiency	Chronic CAD and MH, liver cirrhosis
9*	Hypertensive cardiopathy	MH, lung embolism
10	Myocardial infarction	Myocardial infarction
11*	Ileus	Large bowel perforation
12	Dilative cardiomyopathy, pulmonary fibrosis	MH, pulmonary fibrosis

MH = myocardial hypertrophy, CAD = coronary artery disease, COPD = chronic obstructive pulmonary disease.

Outcome

12 of 25 patients (48%) had a return of spontaneous circulation (ROSC), 7 patients (28%) lived longer than 24 hours and 6 patients (24%) survived to hospital discharge (table 2). 4 patients left the hospital in a very good or good neurological condition with a cerebral performance category (CPC) of 1 or 2 according to the Utstein criteria [3]. Two patients had a CPC of 3, one was transferred to a nursing home and one to a rehabilitation centre. After 12 months 3 patients (12%) were independent at home, one patient had died and the 2 patients with an initial CPC of 3 were being treated in a nursing home. Of the 19 patients who died after resuscitation autopsy was performed in 12 cases (Table 3). Rib fractures were found at autopsy in 8 of 12 patients. Although the study was performed prospectively time intervals required by the Utstein criteria could only be recorded insufficiently by the resuscitation teams.

Discussion

Within 24 months 25 patients needed to be resuscitated outside the ICU-setting in our hospital. This small number of investigated resuscitations is a limitation and has to be taken into account when interpreting the results. 6 of these 25 patients (24%) survived cardiac arrest to hospital discharge, 4 of them in a very good or good cerebral condition. After 12 months 3 patients (12%) were still independent and lived at home. Our success rates of in-hospital, out-of-ICU resuscitations lie within the success rates published in studies from different countries. They all reported survival rates to hospital discharge of 17% [6–9]. For the future we must aim for even higher success rates, like the ones published by Herlitz and co-workers [10]. They reported that 31% of their unmonitored patients survived cardiopulmonary arrest to hospital discharge. 79% of these patients had a witnessed arrest, their initial arrhythmia was ventricular fibrillation in 44% and the median time-interval between collapse and defibrillation was 5 minutes. The higher survival rate may be due to the higher percentage of initial ventricular fibrillation. And the higher percentage of ventricular fibrillation may result from shorter intervals between collapse and defibrillation compared to our study. Published data from AED-use in the Chicago airport demonstrated even more effective resuscitations with a 1-year survival rate of nearly 50% [11]. In this study all survivors had ventricular fibrillation as their first rhythm and they were all defibrillated within 7 minutes. We believe that this high survival rate can not be achieved in hospitalised patients outside the ICU. First, some arrests within non-monitored hospital-units occur without observation which delays defibrillation and makes it ineffective. Second, hospitalised patients have relevant co-morbidity and circulatory arrest may be a sign of a dying heart instead of a transient myocardial dysfunction. Nevertheless, rapid defibrillation is crucial and must be stressed. To optimise early defibrillation the use of AEDs must be considered for hospital units, that can not be reached rapidly by the resuscitation team. Some hospitals in Switzerland have already introduced this practice and are training their personnel accordingly.

Because our study is limited by the number of investigated resuscitations more information on in-hospital resuscitation from Switzerland could be collected by a prospective multicentre study.

Such a study could show differences in survival rates between hospitals depending on their size, their AED use or depending on the experience of the resuscitation teams. Our study shows that documentation of resuscitation efforts should have been more precise in order to allow more conclusions. Recording of time-intervals in particular, as required by the Utstein criteria must be stressed in a subsequent trial because this information may influence the future management of cardiac arrests and the training of the hospital personnel. We know from other studies that documenting time intervals is difficult [7]. Even when a person was added to the resuscitation team as a data recorder the time intervals during resuscitation were collected inaccurately or not at all [12]. Another finding from our study is that autopsy is still important for the quality control of our work. Another point is that we focused on patients in whom resuscitation efforts were started. In a future study investigators should also look at the false arrests. Published data suggest that there is a need for a wider appreciation of false arrests because patients with a false arrest seem to have a high morbidity and mortality [13].

We conclude that rapid defibrillation is crucial and precise documentation of time intervals is important. Future research on in-hospital resuscitation is needed in Switzerland for quality control of resuscitation efforts and its further improvements.

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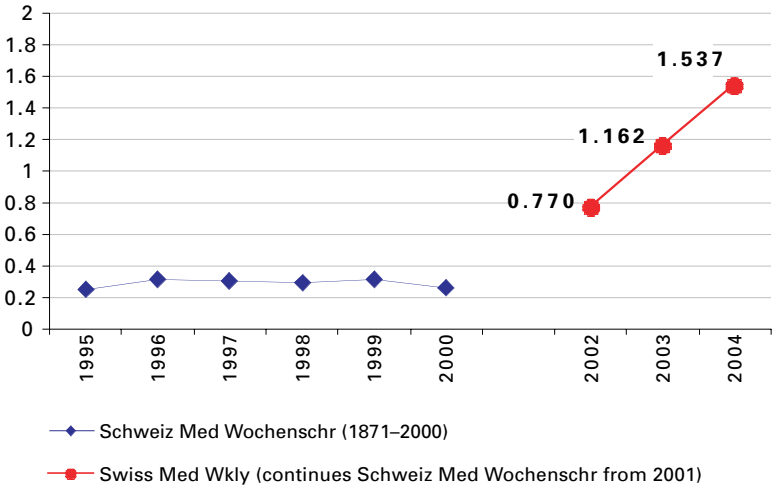

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