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Simulation and education

Improvements in the quality of advanced life support and patient outcome after implementation of a standardized real-life post-resuscitation feedback system☆

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ABSTRACT

Background: Educational aspects in the training of advanced life support (ALS) represent a key role in critical care management of patients with out-of-hospital cardiac arrest (OHCA) and received special attention in guidelines of various international societies. While a positive association of feedback on ALS performance in training conditions is well established, data on the impact of a real-life post-resuscitation feedback on both ALS quality and outcome remain scarce and inconclusive. We aimed to elucidate the impact of a standardized post-resuscitation feedback on quality of ALS and improvements in patient outcome, in a real-life out-of-hospital setting.

Methods: We prospectively enrolled and analyzed 2209 patients presenting with OHCA receiving resuscitation attempts by the municipal emergency medical service (EMS) of Vienna over a two-year period. A standardized post-resuscitation feedback protocol was delivered to the respective EMS-team to elucidate its impact on the quality of ALS.

Results: We observed that both chest compression rates and ratios were in accordance to recommendations of recent guidelines. While interruptions of chest compressions longer than 30 s declined during the observation period (−6.5%) rates of the recommended chest compressions during defibrillator-charging periods increased (+8.9%). Since the percentage of ROSC and 30-day survival remained balanced, the frequencies of both survival until hospital discharge (+6.3%) and favorable neurological outcome (+16%) in survivors significantly increased during the observation period.

Conclusion: Improvements in the quality of advanced life support as well the patient outcome were observed after the implementation of a standardized post-resuscitation feedback protocol.

Introduction

Since 2010, the guidelines on adult advanced life support (ALS) of both the European Resuscitation Council (ERC) and the American Heart Association (AHA), have put a major focus on educational aspects on several levels [1–8]. While, facing a major need for an effective quality management in cardiac arrest among healthcare professionals, a large variety of teaching and feedback methods have already been investigated, ranging from a standard lecture followed by hands-on training, to real-time peri-intervention audio and/or visual feedback on chest compression [9–17]. Additionally, post-resuscitation video documentation during a combined instructor and team analysis of both individual and team performance proved to be a promising technique in delivering feedback [18,19].

Most recently Bleijenberg and co-workers showed that a post-resuscitation feedback after OHCA was associated with improvements in chest compression rate as well as chest com-

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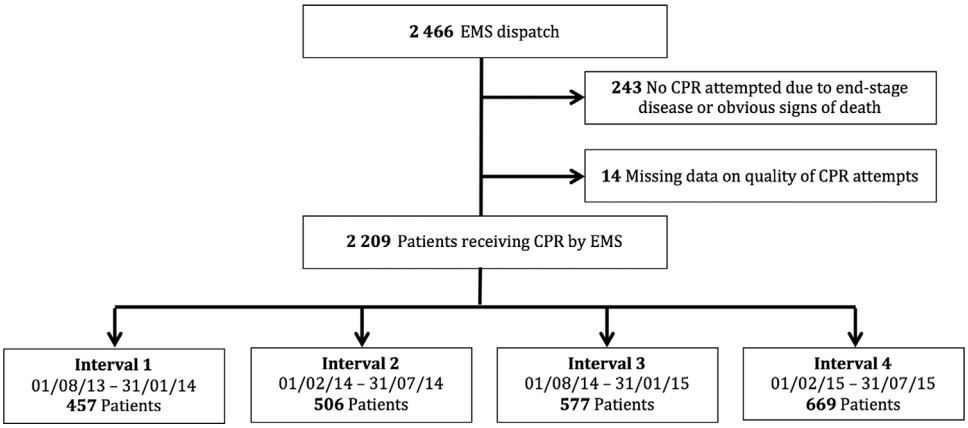

Fig. 1. Flow Diagram for Enrollment of Patients. After exclusion of patients not likely for enrollment, the total study population of 2209 individuals was stratified according to their date of CA into four predefined observation intervals equal of length as follows: Interval 1 (01.08.2013–31.01.2014), Interval 2 (01.02.2014–31.07.2014), Interval 3 (01.08.2014–31.01.2015) and Interval 4 (01.02.2015–31.07.2015).
CPR = Cardio Pulmonary Resuscitation; EMS = Emergency Medical Service.

pression ratio. Moreover, they observed a strong reduction in pauses during chest compressions but found no association with improvements in outcome [20]. Similarly, Lyon et al. demonstrated improvements in chest compression fraction, while the patient outcome remained unchanged [21]. Of note, Couper and Olasveengen et at. even reported negative data on performance evaluation after OHCA, showing no association with quality of care and outcome among their study population [22,23].

While it seems intuitive that a post-resuscitation debrief or feedback intervention has a strong impact on quality of care and therefore patient outcome, recent data give the impression to be underpowered, possibly mirroring the reason for major discrepancies and non-significances among those trials. Therefore, the aim of this study was to elucidate the impact of a standardized post-resuscitation feedback system after cardiac arrest on quality of ALS and improvements in patient outcome, in a real-life out-of-hospital setting.

Methods

Study design and patient enrollment

A detailed protocol of the study design has already been described elsewhere [24]. In short, the current study was conducted as a prospective population-based observational trial as part of the Vienna Cardiac Arrest Registry (VICAR). Patients suffering OHCA (defined by unresponsiveness and signs of apnea), receiving ALS attempts by the local Municipal Emergency Medical Service (EMS) of Vienna, were included within the current analysis.

To reach the study goals, the study population was stratified in four subgroups according to observation intervals equal of length: “Observation Interval 1” (month 1–6; 01/08/13–31/01/14; n = 457); “Observation Interval 2” (month 7–12; 01/02/14–31/07/14; n = 506); “Observation Interval 3” (month 13–18; 01/08/14–31/01/15; n = 577); “Observation Interval 4” (month 19–24; 01/02/2015–31/07/2015; n = 669). (Fig. 1)

Data acquisition

Patient data were assessed via run reports and event documentation of both EMTs and pre-hospital emergency physicians at the time of CA. Information on CA-related risk factors and characteristics was collected by specially trained personnel and inserted into a predefined record abstraction form. Data acquisition was conducted in accordance to the recommended Utstein-Style criteria [25].

The current study was conducted with waiver of informed consent since enrolled patients were in CA and unable to consent and due to minimal risk for participation. The protocol conforms to the Declaration of Helsinki and was approved by the local ethics committee of the Medial University of Vienna, Austria (No.1221/2013).

The feedback protocol

The standardized post-resuscitation feedback protocol was implemented on August 1st 2013–in parallel the enrollment of patients was initiated.

The feedback protocol listed detailed information on quality of intra-arrest ALS performance and the respective ranges for optimal critical care, covering data on compression rate, compression ratio, ventilation rate, chest compression during defibrillator loading phase, total duration of hands-off intervals and measurement of end-tidal carbondioxide (etCO2). Additionally, to cover a baseline monitoring and diagnostic approach within the post-arrest period, the feedback protocol comprises post-arrest measurement of oxygen saturation (SpO2). The respective ranges were defined in accordance to established guidelines of the European Resuscitation Council and American Heart Association [1,2]. Moreover, a compression ratio of more than 75% was defined as lower cut-off in accordance to a consensus statement of the AHA [26].

Data on ALS performance was evaluated by trained personnel and physicians via the screening of transthoracic impedance measurements and vital parameters of recorded defibrillator-tracings using CODE-STAT Reviewer software package (Physio-Control, Redmond, WA, USA) and inserted into a standardized predefined feedback layout.

Additionally, the feedback protocol highlighted both good performance/guideline conformity (green) and poor performance (red). Since the assessment of SpO2 values refers to the post-arrest period, the missing measurement of SpO2 in individuals that did not reach any ROSC, was not marked as “wrong/missing” (red), but held in a neutral (gray) tone. Similar referral applies for the measurement of etCO2 values. In case of no advanced airway management, missing measurement was not marked as “wrong/missing” (red), but also held in a neutral (gray) tone. Moreover, the person responsible for case analysis had the possibility to summarize the overall impression on CPR performance, combined with potential suggestions for further improvements (Fig. 2).