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Editorial

Need for speed in out-of-hospital cardiac arrest



Extensive efforts have been undertaken to improve survival in the very heterogeneous group of patients with out-of-hospital cardiac arrest (OHCA).¹ The chain of survival has been established, visualizing the important steps in resuscitation care.² Early recognition of collapse and immediate bystander basic life support (BLS) are key determinants of favourable neurological outcome, by minimizing no-flow time. High quality advanced life support (ALS) with early defibrillation and detection of reversible causes increase chances for a return of spontaneous circulation (ROSC) keeping low-flow time as short as possible.³

After achieving ROSC, patients are transferred to medical centres for post-resuscitation care.⁴ As advanced measures cannot be applied on scene, it seems plausible to minimize delay to hospital admission. Thus, the delay between collapse and hospital admission (prehospital time) includes no-flow time, low-flow time and transfer duration.

Minimizing time from collapse to ROSC (no-flow and low-flow time) is one of the cornerstones in the chain of survival, which is supported by abundant evidence.^{5,6} However, less is known about how duration of transfer impacts OHCA outcome. In patients with OHCA and STEMI, there is a strong correlation between prehospital time and outcome.⁷ The same is true for traumatic OHCA victims.^{8,9} For a majority of patients, those with other causes of OHCA, however, this correlation is not well established.

In this issue of *Resuscitation*, Adler and coworkers focus on an important group of patients with refractory OHCA (rOHCA),¹⁰ which was defined as persistent cardiac arrest after exclusion of reversible causes and continuous CPR for 10 min in case of non-shockable rhythm or persistent arrest after 3 defibrillation attempts in patients with initial shockable rhythm. They developed a fast-track algorithm for these patients aiming for a shorter prehospital time. This is a rational approach for rOHCA, because longer low-flow durations translate into poor outcome, while advanced diagnostic and therapeutic options are not available on scene.^{11,12} The intervention included a selection of rOHCA patients with lower risk (age below 75 years, witnessed cardiac arrest, no-flow time ≤ 5 min), on-scene ultrasound, direct communication between emergency personnel and intensive care specialists, a structured handover and direct transfer to catheterization laboratory when indicated. By applying these measures, prehospital time could be significantly reduced in the evaluated 40 patients from 79 ± 24 to 69 ± 18 min. For comparison, a cohort of 70 patients treated within the last 3 years was investigated. Favourable neurological outcome was more frequent in patients treated according to the fast-track algorithm 27.5% vs. 11.4% compared to standard care; mortality however was similar.

Although short-term survival was not improved, this is encouraging news and the described algorithm appears to be easily adopted. The fast-track algorithm did not affect no-flow- and low-flow times, but transfer duration. The likely explanation would be that implemented measures improved communication and organization, but did not alter the CPR algorithm itself.

It has to be noted that a recent meta-analysis suggested that transfer time had no impact on outcome after OHCA in a variety of OHCA studies.¹³ It may be intuitive that OHCA patients with respiratory failure may benefit from prehospital endotracheal intubation and immediate targeted temperature management, while transfer time may be more critical in patients with a cardiac cause of collapse. Moreover, ROSC can be achieved with high-quality ALS according to current guidelines, including early defibrillation and treatment of other reversible problems.¹⁴ High-quality resuscitation care requires time and resources and it has been shown that quality of CPR declines before and during transportation in patients with refractory cardiac arrest compared to patients without planned transfer.¹⁵ Therefore, identifying patients who would benefit from expedited transfer is crucial. On the contrary, the well-validated TOR rules (no ROSC, no shocks, no witnessed arrest) help identifying patients who should not be transported to hospital.¹⁶

Which patients benefit from shortened transfer times?

In OHCA patients with STEMI, every minute counts. A registry including more than 13 000 STEMI patients with and without OHCA, bypassing the emergency department and direct transfer to the catheterization laboratory resulted in an absolute reduction of 44.5 min in contact-to-balloon time.¹⁷ In other patients with suspected cardiac cause for arrest, this association is not as clear, although early causal treatment translates into better outcome in many other diseases. This could also be true for patients with NSTEMI, but this remains to be shown in a prospective interventional study applying expedited transportation. The contact-to-balloon time in OHCA patients without ST-segment elevation may have to be well below the median 2.3 h, which were recently achieved in the immediate coronary angiography group of the randomized COACT study.¹⁸

If no ROSC can be achieved, either termination of resuscitation efforts or VA-ECMO support (eCPR) should be considered. In patients with refractory cardiac arrest, mechanical compression devices seem to be as efficient as manual compression and can be used safely in the ambulance.¹⁹ In eCPR patients, a low-flow time correlates with

survival and transfer time is an important part of the low-flow time, if eCPR is initiated in the hospital and not on-scene.¹² This group of patients would most likely benefit from shortened transfer time.

Adler and co-workers demonstrated elegantly that prehospital time can be reduced remarkably by applying a fast-track algorithm. A more detailed analysis of ECMO parameters and characterization of survivors may help to understand, which patients benefit most of shorter transport times. However, this cannot be deduced from the current study, because only 22.7% of patients received ECMO therapy. From our point of view, patients with OHCA and STEMI or OHCA without ROSC may benefit most from reduced transport times.

Conflict of interest statement

The authors T. Wengenmayer and Dawid L. Staudacher declare that there is no conflict of interest.

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