

Current practice in out-of-hospital cardiac arrest management: a european heart rhythm association EP network survey

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Aims

The purpose of this EP wire is to examine clinical practice in the field of out-of-hospital cardiac arrest (OHCA) management, with special focus on in-hospital diagnostic and therapeutic strategies.

Methods and results

Fifty-three European centres, all members of the EHRA-EP Research network, completed the questions of the survey. A dedicated strategy for OHCA management is active in 85% of the centres. Shockable tachyarrhythmias such as initial OHCA rhythm are reported in >70% of the patients in 64% of the centres. In-hospital therapeutic hypothermia was applied in >50% of the patients in 53% of the centres and in <50% in 47% of the centres. In the year 2011 90% of the centres performed >10 primary percutaneous coronary angioplasties (PCI) in OHCA patients. The survival rate, when the initial documented rhythm was shockable, was >30% in 42% of the centres, and conversely, was significantly lower when asystole or pulseless electrical activity was the initial rhythm. A favourable neurological recovery was reported in >50% of the patients in 13 (26%) centres and in 21–50% of the patients in 21 (44%).

Conclusions

This EP wire survey demonstrates a favourable implementation in OHCA of an invasive management strategy, including coronary angiography/PCI and implantable cardioverter defibrillator therapy, while therapeutic hypothermia appears to be underused.

Keywords

EP wire • Cardiac arrest • Hypothermia • Coronary angiography • Percutaneous coronary angioplasty

Out-of-hospital cardiac arrest (OHCA) is defined as cessation of cardiac mechanical activity that is confirmed by the absence of signs of circulation and that occurs outside a hospital setting. The majority of such events have a cardiac aetiology and are associated with four documented electrocardiographic rhythms: pulseless ventricular tachycardia (VT), ventricular fibrillation (VF), pulseless electrical activity (PEA), and asystole.^{1,2} The leading cause of death among adults in the European countries and in the USA,^{3–5} is OHCA and the summary incidence estimates in Europe were 38

per 100 000 person years for all-rhythm OHCA and 17 per 100 000 person years for OHCA due to VT/VF.⁵ Survival rates vary widely across the European countries and the average estimates of survival were 10.7% for all-rhythm arrest and 21.2% for VT/VF arrest.⁵ In patients who initially achieve return of spontaneous circulation (ROSC) after OHCA, the morbidity and mortality are mostly due to the cerebral and cardiac dysfunction that are related to whole body ischaemia and development of post-cardiac arrest syndrome.⁶ Up-to-date management of OHCA patients includes pre-hospital immediate care and post-resuscitation in-hospital care.⁶

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Participation in the OHCA—EP wire enables EHRA to compare intervention modalities, local organizations, outcomes, and identifies opportunities to improve quality of care, and ascertain whether resuscitation and following care are provided according to evidence-based guidelines.

Results

Fifty-three European centres, all members of the EHRA-EP Research network, completed the questions of this survey.

Nine of the 53 (17%) participating centres have a referral area of <200 000 inhabitants, 22 (42%) between 200 and 500 000 inhabitants, 18 (34%) between 500 000 and one million inhabitants, and 8 (15%) more than one million inhabitants.

A dedicated management strategy for patients resuscitated from OHCA is present in 85% of the participating centres; a strategy that is coordinated by the Cardiology Department in 18 (34%) of the centres, by the Emergency Department in 6 (11%), and by the Anaesthesiology Department in 6 (11%). A shared strategy between these three departments is present in 13 (24%) centres.

Initial documented arrhythmias

Most patients of the participating centres had VF or pulseless VT as documented initial cardiac rhythm. In 19 (36%) centres, VT/VF was documented in >70% of the patients, while it was observed in 51–70% of the patients in 13 (25%), in 21–50% in 9 (17%) centres, and in <20% of patients in 2 (4%) centres. Asystole or PEA was less frequently observed. In 4 (8%) centres, it was documented in 51–70% of the patients, while it was observed in 21–50% of the patients in 17 (32%) centres, and in <20% of patients in 22 (42%) centres. Data regarding initial cardiac rhythm were not available for 10 (19%) centres (Figure 1).

Implementation of therapeutic hypothermia

Pre-hospital therapeutic hypothermia after successful cardiopulmonary resuscitation (CPR), defined by sustained ROSC, is not used at all in the majority of the participating centres ($n = 35$, 66%). It is used rarely (>20–50% of patients) in four (7.5%) centres and very rarely (<20%) in eight (15%). Only eight (15%) centres use this strategy in >50% of the patients.

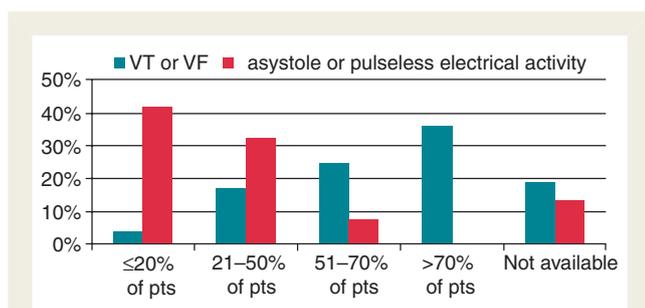


Figure 1 Initial cardiac rhythm in out-of-hospital cardiac arrest patients in 53 European centres in the year 2011.

Conversely, in-hospital therapeutic hypothermia for 12–24 h is frequently applied in most centres; 28 (53%) and 6 (11%) centres use this strategy in >50% and in 21–50% of the patients, respectively. Only 19 (36%) centres apply in-hospital therapeutic hypothermia in <20% of the patients.

Implementation of emergent coronary angiography

Most centres ($n = 49$, 93%) have the possibility to perform emergent coronary angiography after successful CPR (24 h and 7 out of 7 days in 45 centres, on day-time and 7 out of 7 days in 2 centres, on day-time and 5 out of 7 days in 2 centres). Only four (7%) centres do not offer this examination.

After successful CPR, OHCA patients of most participating centres are referred to emergent coronary angiography. In 31 (66%) and in 10 (19%) centres, emergent coronary angiography is performed in >70% and in 50–70% of the resuscitated patients, respectively. Emergent coronary angiography is less frequently performed (in <20% or in 21–50% of the resuscitated patients) in the remaining 12 centres.

In 35 (66%) centres, time from collapse to ROSC is not considered as a variable influencing the decision to perform coronary angiography. In 7 (9.5%) centres, coronary angiography was considered only if time from collapse to ROSC was <20 min; in the remaining 10 (19%) centres, it was performed even if time from collapse to ROSC was >20 min.

It is to be noted that, if the in-hospital management is coordinated by the Cardiology Department, the majority (81%) of participating centres performed emergent coronary angiography in >70% of the OHCA patients. On the contrary, if the hospital OHCA management is coordinated by other departments only 48.6% of them performed emergent coronary angiography in >70% of the patients. Finally, emergent coronary angiography was more frequently indicated (>70%) in the centres with large referral area: 19 (73%) out of 26 centres with >500 000 inhabitants area vs. 12 (44%) out of 27 <500 000 inhabitants area.

Results of coronary angiography and revascularization

Significant coronary artery disease (CAD), defined as coronary stenosis $\geq 50\%$ luminal diameter, was documented by coronary angiography in >75% and in 51–70% of the resuscitated patients in 14 (26%) and in 17 (32%) centres, respectively. Significant CAD was observed in <25% and in 26–50% of the patients in one (2%) and six (11%) centres, respectively. Data regarding the results of coronary angiography were not available for 15 (28%) centres.

During the year 2011, 13 (26%) centres were high-volume hubs in performing primary percutaneous coronary angioplasties (PCI) of resuscitated OHCA patients (>30 primary PCI per year); 32 (64%) centres were medium-volume centres (11–30 primary PCI per year), while 5 (10%) centres were low-volume centres (<10 primary PCI per year).

During the year 2011, 2 (4%) centres were high-volume hubs in coronary artery bypass grafting (CABG) of the resuscitated OHCA patients (>30 CABG per year); 9 (18%) centres

were medium-volume centres (11–30 CABG per year), while 39 (78%) centres were low-volume centres (<10 CABG per year).

Outcome and implantable cardioverter defibrillator therapy

A high survival rate of the resuscitated OHCA patients was observed when VT/VF was the documented initial rhythm; the survival rate was >50% in 10 (21%) centres and between 31 and 50% in 10 (21%) centres, respectively. It was between 11 and 30% and <10% in 12 (25%) centres and 2 (4%) centres, respectively. Data regarding the survival rate of this group of patients were not available for 14 (29%) centres.

Conversely, survival rate of the resuscitated OHCA patients was lower when asystole or PEA were the documented initial rhythm; it was between 6 and 10%, 3–5% and <2% in 7 (15%), 16 (33%), and 9 (19%) centres, respectively. Data regarding the survival rate of this group of patients were not available for 16 (33%) centres.

A favourable neurological recovery was less frequently obtained. In only 13 (26%) centres, >50% of the patients could be discharged at home with preserved mental capacity. No major neurological impairment at discharge was observed in <20% and 21–50% of the patients in 14 (29%) and 21 (44%) centres, respectively.

During the year 2011, 10 (21%) centres were high-volume centres in implantable cardioverter defibrillator (ICD) implantation of resuscitated OHCA patients (>30 per year); 21 (44%) centres were medium-volume centres (11–30 per year), while 17 (35%) centres were low-volume centres (<10 per year).

Discussion

Out-of-hospital cardiac arrest is a common and very frequent lethal event in European and US countries, and important regional variations in the incidence and outcome have been described.^{3–5} Survival from OHCA has not significantly changed for almost three decades and the aggregate survival rate across different populations was between 6.7 and 8.4%.³ Survival to hospital discharge was more likely among the OHCA cases witnessed by a bystander, by emergency medical system operators, who received bystander CPR, or were found in shockable arrhythmias, or achieved persistent ROSC.^{3,7–9} Recent studies, however, have reported a significant increase in OHCA survival after implementation of the 2005 and 2010 guidelines for CPR and emergency cardiovascular care either in patients with shockable or non-shockable arrhythmias.^{10,11}

The main results of the present EP wire survey can be summarized as follows: (i) half of the participating centres have a referral area of >500 000 inhabitants; (ii) a dedicated strategy for OHCA management is active in the vast majority of centres; (iii) shockable arrhythmias (VT, VF) are more frequently reported as initial OHCA rhythm; (iv) pre-hospital therapeutic hypothermia was not performed in the majority of emergency medical organizations while in-hospital hypothermia was applied in a good proportion of cases; (v) most centres have the possibility to perform emergent coronary angiography without considering time from

collapse to ROSC as a variable influencing the decision to perform the procedure; (vi) significant CAD was documented in >50% of the patients in the centres with available data; (vii) 90% of the centres performed >10 primary PCI in the year 2011, while only 22% of the centres performed CABG on >10 patients per year after HCA; (viii) the survival rate, when the initial documented rhythm was shockable, was >30% in 42% of the centres, and conversely, was significantly lower when asystole or PEA was the initial rhythm; (ix) 65% of the centres implanted >10 ICDs per year in survivors of OHCA.

A more frequent use of therapeutic hypothermia and of an invasive management strategy including emergent coronary angiography and PCI, when indicated, have led to a significant improvement in survival of OHCA patients.^{8,12,13} The independent relation between primary PCI and in-hospital survival has also been recently demonstrated by the prospective PROCAT registry [odds ratio (OR) 2.06; 95% confidence interval (CI) 1.16–3.66; $P = 0.013$].¹⁴ Combining mild therapeutic hypothermia with emergent coronary angiography/PCI has been demonstrated to further improve outcome and neurological recovery.^{6,15} On the basis of the current guidelines the use of intracardiac defibrillator should be considered in patients without reversible causes or with persistent left ventricular dysfunction and with good neurological recovery.^{16–18}

Conclusion

This cardiac arrest EP wire survey demonstrates that most participating European centres, in accordance with recently published observations, implement an invasive management strategy, including coronary angiography/PCI and ICD therapy, while therapeutic hypothermia appears to be underused, especially in the pre-hospital phase.

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