Coronary angiography and percutaneous coronary intervention after out-of-hospital cardiac arrest: major leaps towards improved survival?

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Provenance: This is an invited Editorial commissioned by the Section Editor Lei Huang (Cardiac Centre of Tianjin Third-Central Hospital, Tianjin, China). *Comment on:* Patel N, Patel NJ, Macon CJ, *et al.* Trends and Outcomes of Coronary Angiography and Percutaneous Coronary Intervention After Out-of-Hospital Cardiac Arrest Associated With Ventricular Fibrillation or Pulseless Ventricular Tachycardia. JAMA Cardiol 2016;1:890-9.

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Out-of-hospital cardiac arrest (OHCA) is a leading cause of death in developed countries. Both resuscitation care and intensive care management for patients after OHCA has notably improved over the years. Recently, Patel et al. published data of more than 400,000 patients with ventricular tachycardia or ventricular fibrillation (VT/VF) OHCA from the Nationwide Inpatient Sample (NIS) database. The study reports on trends of the application of coronary angiography (CAG) and percutaneous coronary intervention (PCI), as well as outcome after OHCA (1). Evidence that CAG may reduce mortality in OHCA patients with and without ST-segment elevation (STE) myocardial infarction (STEMI) was obtained in several previous observational studies (2-12). Based on these studies the current guidelines recommend emergent CAG in OHCA patients with suspected cardiac ethology of arrest and STE on ECG (class of recommendation I, level of evidence B). Also it is stated that an early invasive approach is reasonable in survivors of cardiac arrest with a suspected acute coronary syndrome without STE (class of recommendation IIa, level of evidence B) (13). Similar results have now been reported from the NIS database, containing 407,974 VT/VF OHCA incidents reported all over the United States from January 1, 2000 through December 31, 2012 (1). The NIS database covers 97% of the US population. For the whole cohort a substantial increase in the use of CAG (from 27.2% to 43.9%) and PCI (from 9.5% to 24.1%, both P<0.001) was observed from 2000 to 2012. Most

importantly, survival to hospital discharge increased in the overall VT/VF OHCA-population (46.9% to 60.1%, P<0.001). Looking specifically at patients with STE, CAG use increased from 53.7% to 87.2% and PCI use from 29.7% to 77.3% (both P<0.001). In patients without STE, CAG use increased from 19.3% to 33.9% and PCI use from 3.5% to 11.8% (both P<0.001). These trends correlated to an improved survival to discharge both in patients with STE (59.2% to 74.3%) and without STE (43.3% to 56.8%, both P<0.001). Highest rates of survival to discharge were observed in patients who underwent CAG, irrespective of subsequent PCI (CAG vs. conservative, 77.3% and 38.9%; OR, 6.26; 95% CI, 5.93-6.61 and for PCI; OR, 5.99; 95% CI, 5.62-6.93; all P<0.001, respectively). Although these are correlative associations, these data suggest that targeted coronary intervention is beneficial, i.e. saves lives and results in improved health quality following OHCA.

It is not surprising that in OHCA patients with STEMI survival improves with increased use of CAG and subsequently PCI, as primary PCI was shown to be associated with improved outcomes in these patients before (14). This is in line with the improved patency rates of the-infarct-related artery and increased rates of survival following PCI use in STEMI patients without OHCA (15). Interestingly, the odds ratio (OR) for survival to discharge associated with CAG in patients without STE was exceedingly high, even higher as compared to patients with STE (OR, 7.02; 95% CI, 6.60–7.46 vs. OR, 3.71; 95% CI, 3.27–4.22; P<0.001).

This would imply that patients without STE benefit most from CAG and PCI if indicated, even in the absence of an acutely obstructed coronary artery. In a series in which consecutive post–cardiac arrest patients with suspected cardiovascular cause underwent CAG, a coronary artery lesion amenable to emergency treatment was found in about 60% of patients without STE (16). Therefore a large part of the total VT/VF OHCA population may benefit from CAG and PCI if indicated. In the acute setting after OHCA it can be difficult to distinguish high risk from low risk patients because information regarding cardiac risk factors and symptoms are largely lacking in this often unconscious patient group. Considerations for selecting patients may include factors such as hemodynamic or electrical instability as well as known comorbidities (17).

Patel and colleagues showed an increasing trend of survival to discharge from 2000 to 2012 in the overall VT/VF OHCA population, in patients with and without CAG use (74.0% to 79.6% and 36.9% to 44.8%, P<0.001, respectively). This implies that overall cardiac arrest care has improved over time, not only regarding coronary intervention. Strikingly, CAG itself was associated with higher rates of survival to discharge, even when no subsequent PCI was performed. This remarkable result may have been caused by a combination of selection bias, survival bias and higher intensity of care. Selection bias can occur when selecting patients with a presumed better prognosis for (early) CAG. This is also reflected in the baseline characteristics showing higher comorbidity and risk factors in the group without CAG. Survival bias could have contributed to the results because the most severely ill patients are likely to not (in time) receive CAG, having a lower chance of survival. Previously, early CAG was associated with a higher intensity of care such as a higher anticoagulation and mechanical support use. This may also occur in further care and monitoring (18). In addition to the trends in coronary intervention and survival, more information regarding the treatment of VT/VF OHCA patients will be essential for further evaluation of the total postresuscitation care. Patel's study did not describe in how many cases CAG displayed an acute coronary occlusion or significant stable vessel disease. It would be worthwhile to distinguish how frequently PCI would be indicated on basis of this. Furthermore, in their study no information about the timing of CAG and subsequent PCI was available. The role of early CAG and PCI in VT/VF OHCA patients without STE remains unsure.

As current guidelines are followed, the expectation (and hope)

is that the increasing trend in the use of CAG and PCI will continue, similarly for survival. It will be necessary to look into all aspects of diagnosis and care to obtain sustained improvement in outcome of OHCA patients. A strong correlation between the application of CAG and PCI after VT/VF OHCA and improved patient outcome is suggestive and promising, but causal relationship requires prospective randomized trials and mechanistic studies. Currently, several randomized controlled trials are ongoing, addressing this issue in the population of patients with VT/VF OHCA without STE (19-24).

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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