Critical Review Form
Therapy

Immediate percutaneous coronary intervention is associated with better survival after out-of-hospital cardiac arrest: insights from the PROCAT (Parisian Region Out of hospital Cardiac ArresT) registry. Circ Cardiovasc Interv. 2010 Jun 1;3(3):200-7.

Objectives: **To determine "whether a strategy that leads to an immediate revascularization can improve the outcome in patients admitted to the hospital after a cardiac arrest presumed to be of cardiac origin." (p. 201)**

Methods: **This was a retrospective chart review on data collected prospectively in the Parisian Region Out of hospital Cardiac ArresT (PROCAT) registry. In this system, patients with out-of-hospital cardiac arrest (OHCA) are resuscitated by an EMS team accompanied by at least one physician. Patients with return of spontaneous circulation (ROSC) without an obvious non-cardiac cause of arrest are transported to a tertiary care center where they are taken directly for cardiac catheterization and coronary angiography, with percutaneous coronary intervention (PCI) attempted for any unstable lesion. Any coronary obstruction resulting in > 50% luminal obstruction was considered significant, and PCI was considered successful if residual stenosis was < 50%. Mild hypothermia was instituted in all patients within 24 hours unless contraindicated.**

The patients were divided into those with ST-segment elevation (≥1 mm in 2 contiguous limb leads or ≥2 mm in the precordial leads) on ECG after ROSC, and those without ST-segment elevation. The primary outcome was survival to hospital discharge, and the secondary outcome was neurologically intact survival (CPC score of 1 or 2).

Between January 2003 and December 2008, 714 patients were admitted after OHCA, of whom 279 had an obvious non-cardiac etiology. The remaining 435 patients were included in the analysis. The median age was 59 years and 83% were male. ST-segment elevation was present 134 patients (31%), ST-segment depression was present in 127 patients (29%), a conduction disorder was present in 87 patients (20%), nonspecific changes were present and 40 patients (9%), and no abnormality was noted in 47 patients (11%). Delays between collapse and BLS and between BLS and ROSC were longer in patients with ST-segment elevation ($p = 0.008$ and $p = 0.06$ respectively). Overall survival was 39%, 94% of these with good neurologic outcomes.

Guide		Comments
I.	**Are the results valid?**	
A.	**Did experimental and control groups begin the study with a similar prognosis (answer the questions posed below)?**	
1.	Were patients randomized?	No. This was a retrospective observational trial on data collected prospectively. Comparison is made between those who underwent successful PCI and those who did not; these two groups are dependent upon the findings of coronary angiography, and hence could not be randomized.
2.	Was randomization concealed (blinded)?	No. As stated, the groups were not randomized.
3.	Were patients analyzed in the groups to which they were randomized?	Yes. While patients were not randomized, they were analyzed according to whether or not they underwent successful PCI.
4.	Were patients in the treatment and control groups similar with respect to known prognostic factors?	Uncertain. The authors do not provide data for the groups based on performance of PCI. Patients without ST-elevation, compared to those with ST-elevation, had longer delays between collapse and basic life support (BLS) (55% vs. 41% with delay $\geq$ 5 min, $p = 0.008$) and between BLS and ROSC (51% vs. 40% with delays > 15 min, $p = 0.06$), and had a trend towards increased rates of therapeutic hypothermia (88% vs. 82%, $p = 0.09$). These two groups were similar with respect to gender, age, underlying comorbidities, location of arrest, and initial arrest rhythm. Those with ST-elevation had higher levels of troponin than those without ST-elevation ($p < 0.001$).
B.	**Did experimental and control groups retain a similar prognosis after the study started (answer the questions posed below)?**	
1.	Were patients aware of group allocation?	No. All patients were comatose, and hence unaware of group allocation. Performance bias would be unlikely to affect the outcomes.
2.	Were clinicians aware of group allocation?	Yes. Clinicians were aware of coronary angiography findings and interventions, and hence aware of whether or not PCI was performed and successful.
3.	Were outcome assessors aware of group allocation?	Yes. There is no mention of blinding of outcome assessors.

4.	Was follow-up complete?	Yes. Follow-up information was obtained from data in the PROCAT registry, and purportedly this information was complete on all of the patients in the study.
II.	**What are the results (answer the questions posed below)?**	
1.	How large was the treatment effect?	Overall, of 435 patients undergoing immediate coronary angiography, 171 (39%) survived to discharge. Of these, 160 (94%) had a good neurologic outcome (96 with a CPC level 1 and 64 with a CPC level 2). Survival was significantly higher in patients undergoing successful PCI compared to those with no or failed PCI (51% vs. 31%, $p < 0.001$) with a RR of 1.62 (95% CI 1.29-2.04). Higher survival in patients with successful PCI was also seen when looking at both patients with ST-elevation (54% vs. 31%, $p < 0.001$) and those without ST-elevation (47% vs. 31%, $p < 0.001$). For those without ST-elevation, the RR was 1.51 (95% CI 1.12-2.05). In patients with ST-segment elevation, 128 (96%) had at least one significant coronary stenosis; in patients without ST-segment elevation 176 (58%), had at least one significant coronary stenosis; in the latter group, PCI was attempted in 92 patients and was successful in 78 (85%). **The positive predictive value of ST-elevation for significant coronary stenosis was 96%, and the negative predictive value was 42%.** **PCI was successfully performed in 78 of 300 patients (26%) without ST-elevation.**
2.	How precise was the estimate of the treatment effect?	See above.
III.	**How can I apply the results to patient care (answer the questions posed below)?**	
1.	Were the study patients similar to my patient?	Yes and no. This study was conducted using a database from Paris, France. In this French system, ambulances are staffed by one or two physicians. Partly as a result of this, based on data provided in other studies, CPR is not

		attempted in almost half of out of hospital cardiac arrest patients due to "late arrival" or the presence of a "severe preexisting condition." Overall prognosis in patients in patients with ROSC may therefore be higher in this population compared to ours.
2.	Were all clinically important outcomes considered?	Yes. The authors evaluated both survival to hospital discharge and neurologic function at discharge based on CPC scores. While some groups have recommended 90-day neurologic outcomes as better measure in cardiac arrest (Research Working Group of the American Heart Association Emergency Cardiovascular Care Committee) such outcomes are more difficult and more expensive to measure. The authors also do not report length of stay, ICU length of stay, or cost.
3.	Are the likely treatment benefits worth the potential harm and costs?	No. Among patients without STEMI, only 26% underwent successful percutaneous coronary intervention. Therefore 74% of these patients underwent unnecessary cardiac catheterization without benefit from the procedure. For the entire cohort, the finding that successful PCI resulted in improved survival (51% vs. 31%) would indicate that having a lesion amenable to intervention is beneficial to survivors of OHCA; unfortunately, this is NOT a modifiable factor. This does not indicate that routine cardiac catheterization is beneficial.

Limitations:

1. **This was a retrospective analysis of data collected prospectively.**

2. **The assessment did not include long-term neurologically intact survival, as previously recommended.**

3. **The intervention being assessed was successful PCI. This is not a modifiable intervention, and this study does not address the need to identify patients in whom PCI is likely to be successful.**

4. **Differences in clinical practice, such as more aggressive resuscitation of the elderly and moribund in the US and the routine use of cardiac catheterization in Paris, raise issues of external validity when applied to our patient population and practice setting.**

Bottom Line:

This retrospective analysis of data collected from the PROCAT registry demonstrated that early successful PCI in patients successfully resuscitated from OHCA is associated with increased survival (51% vs. 31%). This association persisted when analyzing only patients without STEMI (survival of 47% vs. 31%). However, the authors' conclusion, that "immediate PCI seems to offer survival benefit" (p. 206) fails to address one important concern: the difficulty in predicting successful PCI in non-STEMI patients prior to coronary angiography. A more accurate conclusion may be that if you are going to have a cardiac arrest, make sure you have a lesion amenable to PCI. Of note, only 26% of patients without ST-elevation underwent successful PCI, indicating that a significant proportion of such patients underwent unnecessary cardiac catheterization.