

Critical Review Form

Meta-analysis

Acute coronary angiography in patients resuscitated from out-of-hospital cardiac arrest--a systematic review and meta-analysis. Resuscitation. 2012 Dec;83(12):1427-33.

Objectives: To determine if “In patients with ROSC following OHCA (P), does acute CAG [coronary angiography] with coronary intervention (I), compared to conventional treatment (C), improve survival (O)?” (p. 1428).

Methods: This systematic review and meta-analysis was performed according to Meta-analysis in Observational Studies in Epidemiology ([MOOSE](#)) and Preferred Reporting Items For Systematic reviews and Meta-Analysis ([PRISMA](#)) guidelines. A literature search of [PubMed](#) was performed on May 1st, 2012, with the search terms “Heart arrest” [Mesh] AND (“Coronary Angiography” [Mesh] OR “Angioplasty, Balloon, Coronary” [Mesh]). [Embase](#) search terms were: “exp heart arrest” AND (“exp angiocardiology” OR “exp transluminal coronary angioplasty”). [SveMed+](#) search terms were: “exp Heart-Arrest” AND (“exp Coronary-Angiography” OR “exp Angioplasty,-Transluminal, Percutaneous Coronary”). The records were screened by one author, and full text English articles with outcomes reported at hospital discharge 30 days, or 6 months for patients undergoing CAG were selected.

Levels of evidence (LOE) were assigned using the following criteria:

LOE 1: randomized controlled trials (RCTs) or meta-analyses of RCTs

LOE 2: non-randomized trials with concurrent controls

LOE 3: studies with retrospective controls

LOE 4: studies with no control group

LOE 5: studies not related to the specific population.

A total of 32 studies were identified and included in the review: 15 studies addressed CAG in patients with STEMI following return of spontaneous circulation (ROSC); 5 studies evaluated routine CAG performed on patients with ROSC following out of hospital cardiac arrest (OHCA) without an obvious noncardiac cause, regardless of rhythm or ECG findings; 10 studies assessed CAG performed on select patients with OHCA of mixed etiology. A meta-analysis of data from this last set of 10 studies comparing outcomes in patients with and without acute coronary angiography was performed using a random-effects model to calculate a pooled, unadjusted odds ratio (OR) for survival.

Guide	Question	Comments
I	<i>Are the results valid?</i>	
1.	Did the review explicitly address a sensible question?	Yes. The authors formulated a structured PICO question regarding the benefit of CAG in patients with ROSC following OHCA. They looked further at the effect in studies which included only patients with STEMI, those in which CAG was used systematically in all OHCA patients, and those in which CAG was only performed in select patients.
2.	Was the search for relevant studies detailed and exhaustive?	No. The authors performed a search of PubMed using a detailed search strategy. They did not, however, search other major databases (CINAHL, SCOPUS, googlescholar), peruse the bibliographies of relevant articles, or search relevant conference proceedings.
3.	Were the primary studies of high methodological quality?	No. All of the studies included were observational in nature, and only one was LOE 2 (used concurrent controls). The majority of the studies (22 of 32) were LOE 4 (no control group) and 9 were LOE 5 (not related to the specific population).
4.	Were the assessments of the included studies reproducible?	Yes. The authors used a leveling system previously reported by ILCOR, which is detailed and easily reproducible.
II.	<i>What are the results?</i>	
1.	What are the overall results of the study?	<p><u>STEMI (15 studies):</u></p> <ul style="list-style-type: none"> Survival ranged from 41%-92% <p><u>Systematic acute CAG (5 studies):</u></p> <ul style="list-style-type: none"> The prevalence of significant coronary artery disease ranged from 59%-71%. Angiographic signs of acute MI (recent occlusion or irregular lesions) ranged from 36-69%. The percent of patients with STEMI or presumed new LBBB ranged from 31-63%. <p><u>CAG in select patients (10 studies):</u></p> <ul style="list-style-type: none"> Use of CAG ranged from 14%-83%. The presence of shockable rhythms ranged from 39%-100%. The pooled unadjusted OR for survival with CAG was 2.78 (95% CI 1.89-4.10; I² = 74%; p < 0.001).
2.	How precise are the results?	See above.
3.	Were the results similar from study to study?	No. There was a great deal of heterogeneity both between each of the groups of studies, and within each group. There was a wide range of survival within the STEMI studies, a wide range of CAD prevalence and signs of

		<p>acute MI in the systematic CAG studies, and a wide range in the use of CAG in studies where CAG was used on select patients.</p> <p>In the meta-analysis, use of CAG ranged from 14%-83%. For the pooled OR, the I^2 statistic was 74% (74% of the difference between studies could NOT be attributed to chance alone) with a p value < 0.001 (indicating a very low likelihood that the observed differences between studies was due to chance alone).</p>
III.	<i>Will the results help me in caring for my patients?</i>	
1.	How can I best interpret the results to apply them to the care of my patients?	<p>The results seem to indicate that the incidence of significant CAD (59%-71%) and acute coronary occlusion (36%-69%) is high in patients suffering OHCA, regardless of rhythm or ECG findings. This indicates that patients with ROSC after OHCA may benefit from acute coronary angiography to detect and intervene upon these lesions. Further research is needed to clarify particular subsets of patients at high risk of having acute coronary occlusion in whom CAG/PCI is beneficial.</p> <p>The results from the meta-analysis indicate a survival benefit among patients selected for acute CAG (unadjusted OR 2.78). This finding is difficult to interpret in light of 2 significant concerns:</p> <ol style="list-style-type: none"> 1) There was significant heterogeneity between these 10 studies ($I^2 = 74\%$; $p < 0.001$), and it may be unwise to combine such heterogeneous results into a single estimate of treatment effect. However, all 10 studies indicate that there is a treatment benefit, with the 95% confidence interval crossing 1.0 in only a single study. Therefore, despite the heterogeneity noted, the benefit of treatment appears to be consistent. 2) None of these studies was randomized, and it is quite likely that significant selection bias may have affected the results. Patients in whom further care was deemed futile, for example, would not be likely to undergo CAG. This meta-analysis was not able to control for the influence of other prognostic factors on survival.
2.	Were all patient important outcomes considered?	No. The authors were forced to rely on the outcomes provided in the individual studies. The meta-analysis was performed to assess survival to hospital discharge, and did not include neurologic function (i.e. CPC score) or long-

		term survival and neurologic function.
3.	Are the benefits worth the costs and potential risks?	Uncertain. While there is a clear benefit to coronary angiography in when applied to select patients, this analysis does not enlighten us as to which patients benefit. It is standard care to perform CAG in patients with STEMI following arrest, but it is unclear if there is benefit in other patients without STEMI. This current meta-analysis does not address this question, and identified no studies specifically addressing CAG in this subgroup.

Limitations:

1. **The search was limited to English language articles and did not include a search of the bibliographies of selected articles or of relevant conference proceedings.**
2. **The literature search was performed by only one author.**
3. **There was significant [heterogeneity](#) among studies included in the meta-analysis ($I^2 = 74\%$; $p < 0.001$) making the resulting odds ratio difficult to interpret.**
4. **The included studies were of overall poor methodological quality: no randomized controlled trials were identified; only one LOE 2 study was identified; the majority of the studies (22 of 32) were LOE 4 (no control group) and 9 were LOE 5 (not related to the specific population).**
5. **The outcome assessed in the meta-analysis was survival to hospital discharge, and did not take into account neurologic function (i.e. [CPC score](#)) or long-term outcomes.**

Bottom Line:

This systematic review demonstrated a prevalence of significant coronary artery disease ranging from 59%-71% when angiography was performed systematically in patients with ROSC following OHCA; angiographic signs of acute MI were present in 36-69% of these subjects. These findings suggest that coronary occlusion and acute MI are likely present in a significant proportion of patients resuscitated from OHCA, regardless of ECG findings. Select patients without STEMI following arrest may benefit from angiography, but the review was unable to elucidate a plan for selecting these patients. A meta-analysis of studies

involving the use of angiography in select patients revealed a pooled unadjusted OR for survival of 2.78 when angiography was performed. Unfortunately, this meta-analysis suffered from significant heterogeneity among studies, and the individual studies likely suffered from significant [selection bias](#). Further studies will need to prospectively evaluate the use of angiography in a pre-defined population of patients without STEMI in order to assess its efficacy in subsets of this population.