

## **Supplementary Appendix**

### **Early Coronary Angiography & Survival after Out-of-hospital Cardiac Arrest:**

#### **A Systematic Review & Meta-analysis**

Rohan Khera MD\*, Sheena CarlLee MD\*, Amy Blevins MALS, Marin Schweizer PhD,

Saket Girotra MD, SM

\*Dr. Rohan Khera and Dr. Sheena CarlLee contributed `equally to the manuscript

## SEARCH STRATEGIES

**Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to Present** (Run on March 13, 2015, 2546 citations retrieved. Rerun on January 18, 2017, 2856 citations retrieved.)

1. exp Heart Arrest/
2. exp Death, Sudden, Cardiac/
3. ((cardiac or heart or cardiopulmonary) adj3 arrest\*).tw.
4. (Asystole\* or Sudden cardiac death).tw
5. 1 or 2 or 3 or 4
6. exp Coronary Angiography/ or exp Cardiac Catheterization/ or exp Percutaneous Coronary Intervention/ or exp Angioplasty, Balloon, Coronary/
7. (Coronary adj2 (dilation or angioplasty or angiograph\*)).tw.
8. ((Cardiac or heart) adj2 Catheterization\*).tw.
9. Percutaneous Coronary Intervention\*.tw
10. Percutaneous Coronary Revascularization\*.tw.
11. ((Coronary or rotational) adj2 Atherectom\*).tw.
12. 6 or 7 or 8 or 9 or 10 or 11
13. 5 and 12
14. limit 13 to animals
15. limit 13 to humans
16. 14 and 15
17. 14 not 16
18. 13 not 17

**CINAHL** (Run on March 13, 2015, 531 citations retrieved. Rerun on January 18, 2017, 705 citations retrieved.)

1. (MH "Heart Arrest+")
2. (MH "Death, Sudden, Cardiac")
3. (cardiac or heart or cardiopulmonary) N2 arrest\*
4. "Sudden cardiac death\*" OR asystole\*
5. S1 OR S2 OR S3 OR S4
6. (MH "Coronary Angiography")
7. (MH "Heart Catheterization+")
8. (MH "Angioplasty, Balloon+")
9. Coronary N2 (dilation OR angioplasty OR angiograph\*)
10. (Cardiac OR heart) N2 Catheterization\*
11. "Percutaneous Coronary Intervention\*"
12. "Percutaneous Coronary Revascularization\*"
13. (Coronary OR rotational) N2 Atherectom\*
14. S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13
15. S5 AND S14

**Embase** (Run on March 13, 2015, 4641 citations retrieved. Rerun on January 18, 2017, 6288 citations retrieved.)

1. 'heart arrest'/exp

2. (cardiac or heart or cardiopulmonary) NEAR/2 arrest\*
3. "Sudden cardiac death" OR "Sudden cardiac deaths" OR asystole\*
4. 1 OR 2 OR 3
5. 'angiocardiography'/exp
6. 'heart catheterization'/exp
7. 'percutaneous coronary intervention'/exp
8. Coronary NEAR/2 (dilation OR angioplasty OR angiograph\*)
9. (Cardiac OR heart) NEAR/2 Catheterization\*
10. "Percutaneous Coronary Intervention" OR "Percutaneous Coronary Interventions"
11. "Percutaneous Coronary Revascularization" OR "Percutaneous Coronary Revascularizations"
12. (Coronary OR rotational) NEAR/2 Atherectom\*
13. 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12
14. 4 AND 13

**Cochrane** (Run on March 17, 2015, CDSR 0, DARE 3, CENTRAL 123. Rerun on January 18, 2017, CDSR 0, DARE 4, CENTRAL 159.)

1. MeSH descriptor: [Heart Arrest] explode all trees
2. MeSH descriptor: [Death, Sudden, Cardiac] explode all trees
3. (cardiac or heart or cardiopulmonary) near/3 arrest\*:ti,ab,kw (Word variations have been searched)
4. Asystole\* or "Sudden cardiac death\*":ti,ab,kw (Word variations have been searched)
5. #1 or #2 or #3 or #4
6. MeSH descriptor: [Coronary Angiography] explode all trees
7. MeSH descriptor: [Cardiac Catheterization] explode all trees
8. MeSH descriptor: [Percutaneous Coronary Intervention] explode all trees
9. MeSH descriptor: [Angioplasty, Balloon, Coronary] explode all trees
10. Coronary near/2 (dilation or angioplasty or angiograph\*):ti,ab,kw (Word variations have been searched)
11. (Cardiac or heart) near/2 Catheterization\*:ti,ab,kw (Word variations have been searched)
12. "Percutaneous Coronary Intervention\*":ti,ab,kw (Word variations have been searched)
13. "Percutaneous Coronary Revascularization\*":ti,ab,kw (Word variations have been searched)
14. (Coronary or rotational) near/2 Atherectom\*:ti,ab,kw (Word variations have been searched)
15. #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14
16. #5 and #15

**Web of Science** (Run on March 17, 2015, 1355 citations retrieved. Rerun on January 18, 2017, 1729 citations retrieved.)

1. (cardiac or heart or cardiopulmonary) Near/3 arrest\*
2. Asystole\* or "Sudden cardiac death\*"
3. #1 OR #2
4. Coronary Near/2 (dilation or angioplasty\* or angiograph\*)

5. (Cardiac or heart) Near/2 Catheterization\*
6. "Percutaneous Coronary Intervention\*\*"
7. "Percutaneous Coronary Revascularization\*\*"
8. (Coronary or rotational) Near/2 Atherectomy\*
9. #4 OR #5 OR #6 OR #7 OR #8
10. #3 AND #9

### ClinicalTrials.gov

1. **Search Terms** = "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= Coronary dilation
  - a. 8 Results Rerun on January 19, 2017, 6 results
2. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "Coronary angioplasty"
  - a. 0 results Rerun on January 19, 2017, 0 results
3. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "Coronary angiography"
  - a. 6 Results. Rerun on January 19, 2017, 12 results.
4. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "Cardiac catheterization"
  - a. 4 results. Rerun on January 19, 2017, 5 results.
5. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "heart catheterization"
  - a. 4 results. Rerun on January 19, 2017, 5 results.
6. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "Percutaneous Coronary Intervention"
  - a. 11 results. Rerun on January 19, 2017, 16 results.
7. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "Percutaneous Coronary revascularization"
  - a. 11 results. Rerun on January 19, 2017, 16 results.
8. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= Coronary Atherectomy
  - a. 0 results. Rerun on January 19, 2017, 0 results.
9. **Search Terms**= "cardiac arrest" or "heart arrest" or "cardiopulmonary arrest" OR asystole OR "sudden cardiac death" **Interventions**= "rotational Atherectomy"
  - a. 0 results. Rerun on January 19, 2017, 0 results.

## **Supplemental Figure Legends**

**Supplemental Table 1** PRISMA checklist for Meta Analyses and Systematic Reviews

**Supplemental Table 2** MOOSE checklist for Meta Analyses and Systematic Reviews

**Figure 1** Forest plot of the association between early coronary angiography and survival in patients with out-of-hospital cardiac arrest stratified by methodologic rigor

**Supplemental Figure 2** Forest plot of the association between early coronary angiography and survival with favorable neurological outcome in patients with out-of-hospital cardiac arrest stratified by methodologic rigor.

**Supplemental Figure 3** Forest plot of the association between early coronary angiography and survival in studies stratified by initial rhythm

**Supplemental Figure 4** Forest plot of the association between early coronary angiography and survival with favorable neurological outcome in studies stratified by initial rhythm

**Supplemental Figure 5** Forest plot of the association between early coronary angiography and survival stratified by whether studies included or excluded patients with STEMI

**Supplemental Figure 6** Forest plot of the association between early coronary angiography and survival with favorable neurological outcome stratified by whether studies included or excluded patients with STEMI

**Supplemental Table 1** PRISMA checklist for Meta Analyses and Systematic Reviews

Section/topic	#	Checklist item	Report ed on page #
<b>TITLE</b>			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
<b>ABSTRACT</b>			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4,5
<b>METHODS</b>			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	--
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	8

Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	8
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	8
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	8,9
<b>RESULTS</b>			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	9
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	9
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	11
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	10,11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	10,11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	11
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	10,11
<b>DISCUSSION</b>			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13,14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
<b>FUNDING</b>			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14,15

*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).



**Supplemental Table 2** MOOSE checklist for Meta Analyses and Systematic Reviews

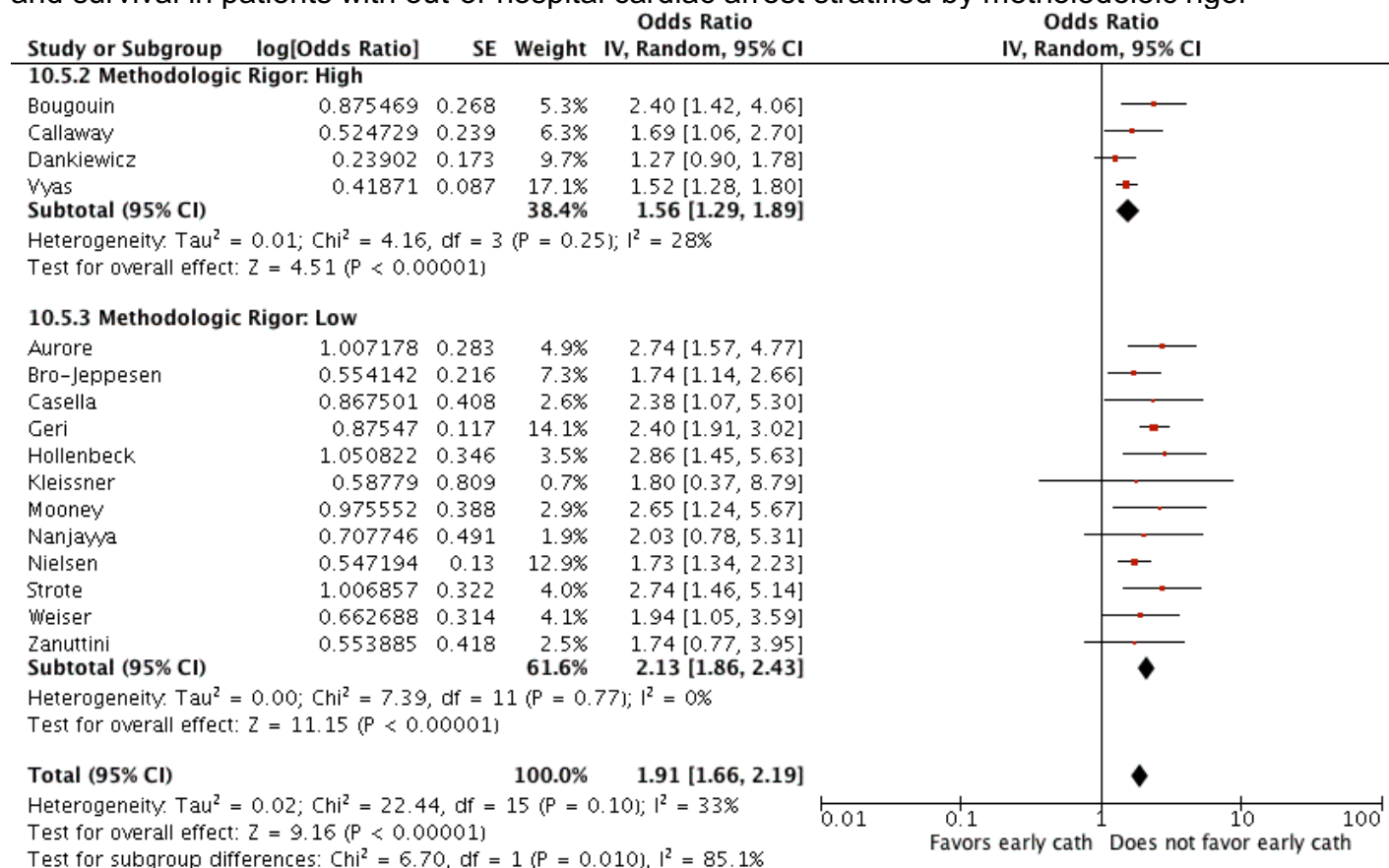
Item No	Recommendation	Reported on Page No
Reporting of background should include		
1	Problem definition	4
2	Hypothesis statement	5
3	Description of study outcome(s)	6
4	Type of exposure or intervention used	6-7
5	Type of study designs used	6
6	Study population	6
Reporting of search strategy should include		
7	Qualifications of searchers (eg, librarians and investigators)	5
8	Search strategy, including time period included in the synthesis and key words	5
9	Effort to include all available studies, including contact with authors	5
10	Databases and registries searched	5
11	Search software used, name and version, including special features used (eg, explosion)	5
12	Use of hand searching (eg, reference lists of obtained articles)	5
13	List of citations located and those excluded, including justification	5
14	Method of addressing articles published in languages other than English	n/a
15	Method of handling abstracts and unpublished studies	5
16	Description of any contact with authors	n/a
Reporting of methods should include		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	6
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	6-7
19	Documentation of how data were classified and coded (eg, multiple raters, blinding and interrater reliability)	7
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)	7-8
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	7
22	Assessment of heterogeneity	8
23	Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	7
24	Provision of appropriate tables and graphics	19-24
Reporting of results should include		
25	Graphic summarizing individual study estimates and overall estimate	25-29

Item No	Recommendation	Reported on Page No
Reporting of discussion should include		
29	Quantitative assessment of bias (eg, publication bias)	11
30	Justification for exclusion (eg, exclusion of non-English language citations)	12
31	Assessment of quality of included studies	11,12
Reporting of conclusions should include		
32	Consideration of alternative explanations for observed results	12-14
33	Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	14
34	Guidelines for future research	14
35	Disclosure of funding source	14,15

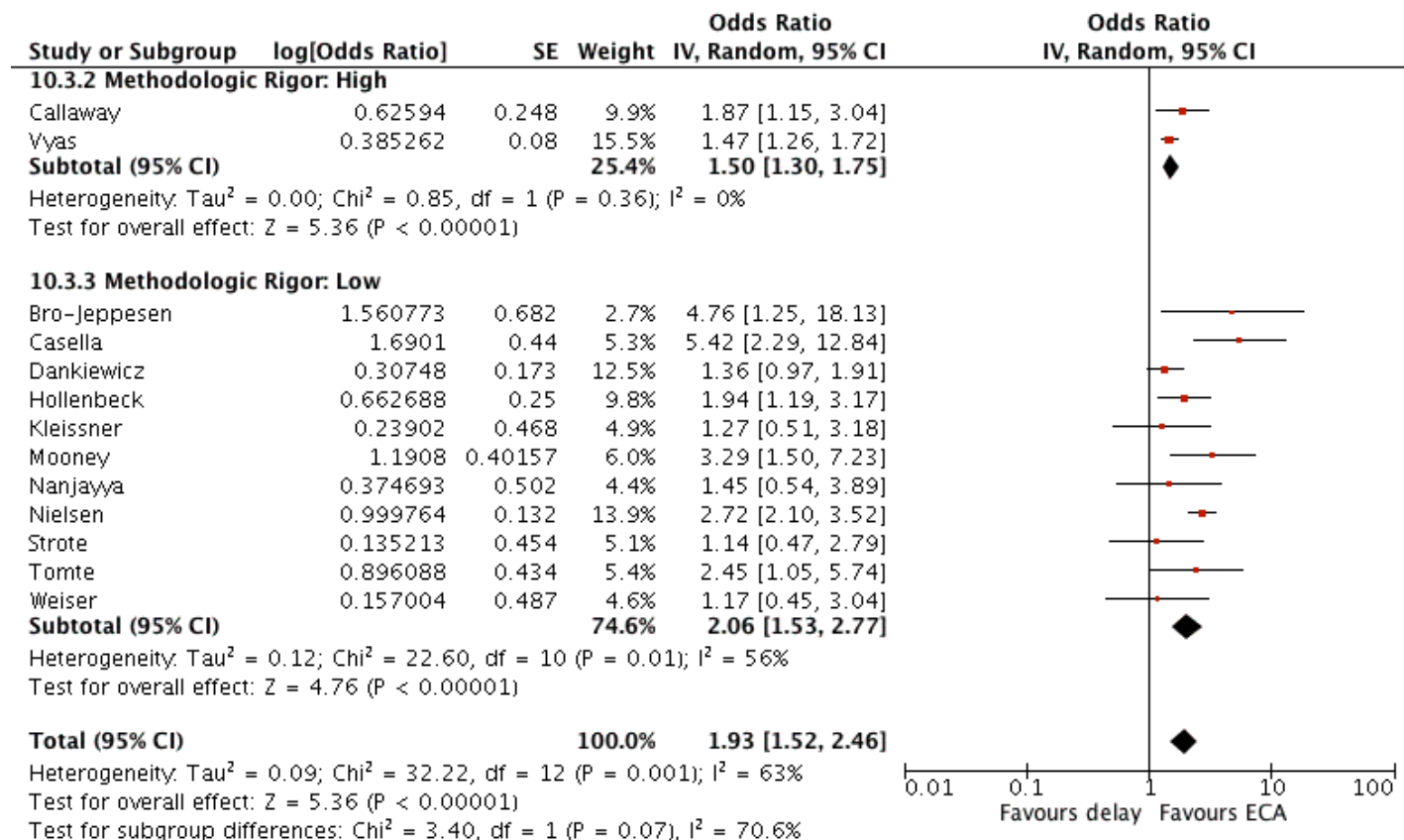
From: Stroup DF, Berlin JA, Morton SC, et al, for the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. Meta-analysis of Observational Studies in Epidemiology. A Proposal for Reporting. *JAMA*. 2000;283(15):2008-2012. doi: 10.1001/jama.283.15.2008.

Transcribed from the original paper within the NEUROSURGERY® Editorial Office, Atlanta, GA, United States. August 2012.

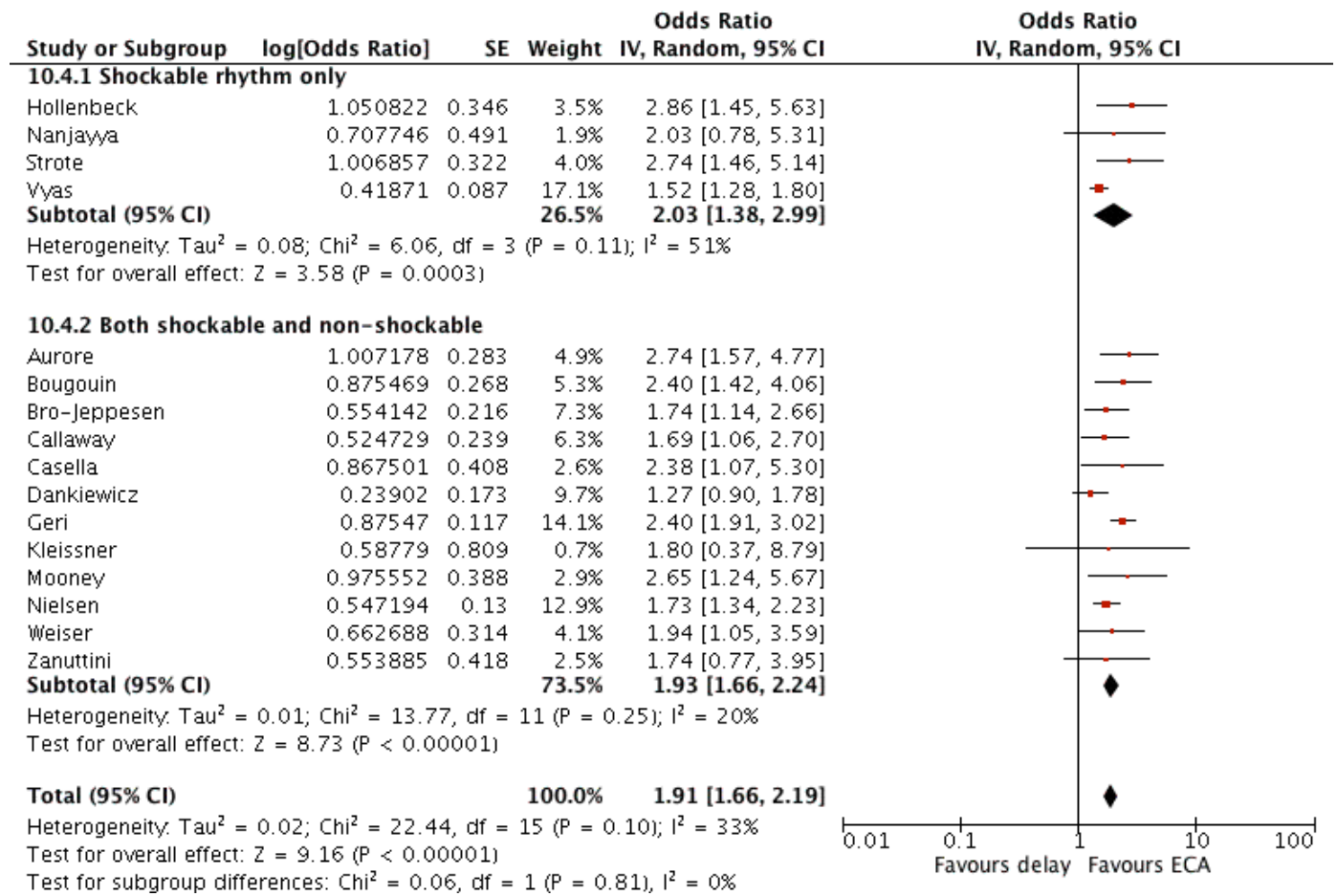
**Supplemental Figure 1** Forest plot of the association between early coronary angiography and survival in patients with out-of-hospital cardiac arrest stratified by methodologic rigor



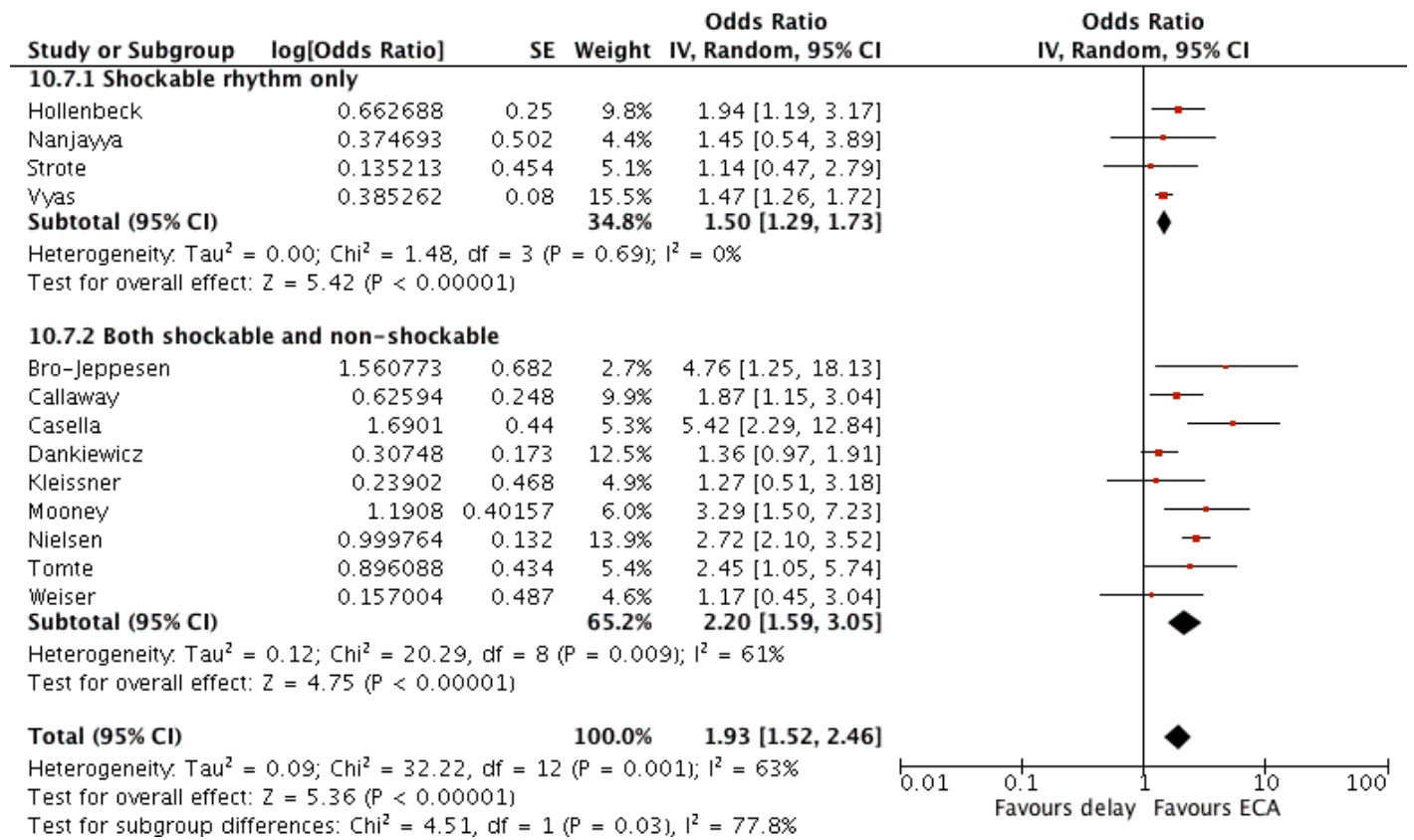
**Supplemental Figure 2** Forest plot of the association between early coronary angiography and survival with favorable neurological outcome in patients with out-of-hospital cardiac arrest stratified by methodologic rigor.



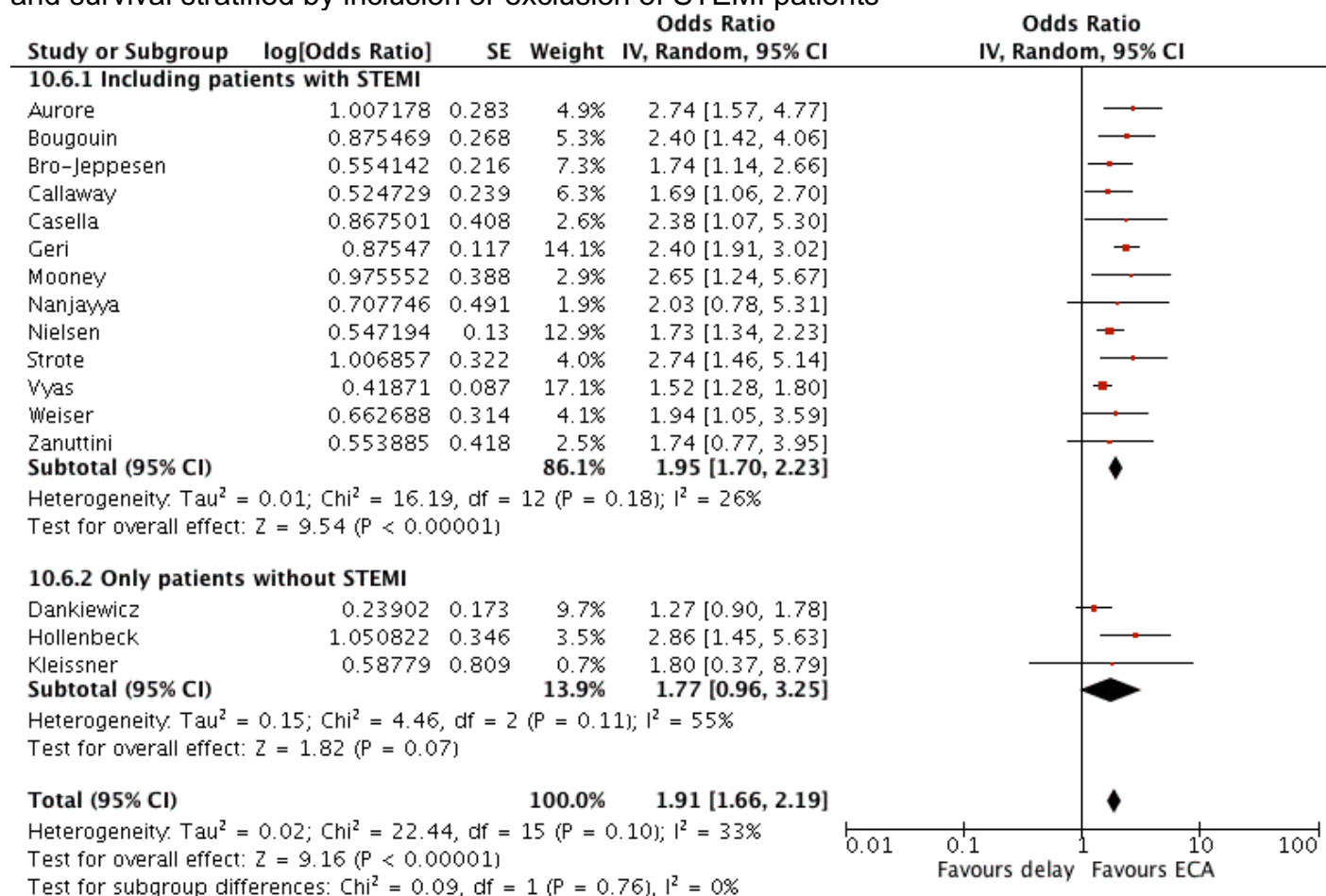
**Supplemental Figure 3** Forest plot of the association between early coronary angiography and survival in patients with shockable rhythm only versus all rhythms



**Supplemental Figure 4** Forest plot of the association between early coronary angiography and favorable neurologic outcome in patients with shockable rhythm only versus all rhythms



**Supplemental Figure 5: Forest plot of the association between early coronary angiography and survival stratified by inclusion or exclusion of STEMI patients**



**Supplemental Figure 6:** Forest plot of the association between early coronary angiography and favorable neurologic outcome stratified by the inclusion and exclusion of STEMI patients

