Supplemental Material
Data S1.

PRISMA NMA Checklist of Items to Include When Reporting A Systematic Review Involving a Network Meta-analysis.

| Section/Topic | Item # | Checklist Item                                                                                                                                                                                                 | Reported on Page #         |
|---------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| **TITLE**     |        |                                                                                                                                                                                                             |                            |
| Title         | 1      | Identify the report as a systematic review incorporating a network meta-analysis (or related form of meta-analysis).                                                                                      | Title Page (Page 1)        |
| **ABSTRACT**  |        |                                                                                                                                                                                                             |                            |
| Structured summary | 2      | Provide a structured summary including, as applicable: **Background:** main objectives **Methods:** data sources; study eligibility criteria, participants, and interventions; study appraisal; and synthesis methods, such as network meta-analysis. **Results:** number of studies and participants identified; summary estimates with corresponding confidence/credible intervals; treatment rankings may also be discussed. Authors may choose to summarize pairwise comparisons against a chosen treatment included in their analyses for brevity. **Discussion/Conclusions:** limitations; conclusions and implications of findings. **Other:** primary source of funding; systematic review registration number. | Page 3                     |
| **INTRODUCTION** |        |                                                                                                                                                                                                             |                            |
| Rationale     | 3      | Describe the rationale for the review in the context of what is already known, including mention of why a network meta-analysis has been conducted.                                                             | Page 5                     |
| Objectives    | 4      | Provide an explicit statement of questions being addressed, with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).                                                                 | Page 5                     |
| **METHODS**   |        |                                                                                                                                                                                                             |                            |
| Protocol and registration | 5      | Indicate whether a review protocol exists and if and where it can be accessed (e.g., Web address); and, if available, provide registration information, including registration number. | N/A                        |
| 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. Clearly describe eligible treatments included in the treatment network, and note whether any have been clustered or merged into the same node (with justification). | Pages 6-7                  |
| 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.                                               | Page 5-6                   |
| Search  | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | Supplemental Table 1 |
|---------|----|-------------------------------------------------------------------------------------------------------------------|---------------------|
| 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). | Pages 5-7 Supplemental Figure 1 |
| 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. | Page 5-7 |
| Data items  | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | Page 5-7 |
| Geometry of the network  | S1 | Describe methods used to explore the geometry of the treatment network under study and potential biases related to it. This should include how the evidence base has been graphically summarized for presentation, and what characteristics were compiled and used to describe the evidence base to readers. | Page 5-7 |
| Risk of bias within 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. | Page 5 Supplemental Figure 3 and 4 |
| Summary measures  | 13 | State the principal summary measures (e.g., risk ratio, difference in means). Also describe the use of additional summary measures assessed, such as treatment rankings and surface under the cumulative ranking curve (SUCRA) values, as well as modified approaches used to present summary findings from meta-analyses. | Page 5-6 |
| Planned methods of analysis  | 14 | Describe the methods of handling data and combining results of studies for each network meta-analysis. This should include, but not be limited to:   - Handling of multi-arm trials;   - Selection of variance structure;   - Selection of prior distributions in Bayesian analyses; and   - Assessment of model fit. | Page 5-7 |
| Assessment of Inconsistency  | S2 | Describe the statistical methods used to evaluate the agreement of direct and indirect evidence in the treatment network(s) studied. Describe efforts taken to address its presence when found. | Page 5-7 Supplemental Table 5 |
| 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). | Page 5-7 |
| Additional analyses  | 16 | Describe methods of additional analyses if done, indicating which were pre-specified. This may include, but not be limited to, the following:   - Sensitivity or subgroup analyses;   - Meta-regression analyses;   - Alternative formulations of the treatment network; and   - Use of alternative prior distributions for Bayesian analyses (if applicable). | Page 5-7 |
### RESULTS†

| Section                                      | Recommended Action                                                                                     | Page   |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------|--------|
| Study selection                              | 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. | Page 6 Supplemental Figure 1 |
| Presentation of network structure            | Provide a network graph of the included studies to enable visualization of the geometry of the treatment network. | Figure 1 |
| Summary of network geometry                  | Provide a brief overview of characteristics of the treatment network. This may include commentary on the abundance of trials and randomized patients for the different interventions and pairwise comparisons in the network, gaps of evidence in the treatment network, and potential biases reflected by the network structure. | Page 8 |
| Study characteristics                        | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | Page 8 Supplemental Table 2 and 3 |
| Risk of bias within studies                  | Present data on risk of bias of each study and, if available, any outcome level assessment.            | Supplemental Figure 3 and 4 |
| Results of individual studies                | For all outcomes considered (benefits or harms), present, for each study: 1) simple summary data for each intervention group, and 2) effect estimates and confidence intervals. *Modified approaches may be needed to deal with information from larger networks.* | Supplemental Tables 2 and 3 |
| Synthesis of results                         | Present results of each meta-analysis done, including confidence/credible intervals. *In larger networks, authors may focus on comparisons versus a particular comparator (e.g., placebo or standard care), with full findings presented in an appendix. League tables and forest plots may be considered to summarize pairwise comparisons. If additional summary measures were explored (such as treatment rankings), these should also be presented.* | Page 8-10 Figure 2, Supplemental Table 4 and Supplemental Figure 4 |
| Exploration for inconsistency               | Describe results from investigations of inconsistency. This may include such information as measures of model fit to compare consistency and inconsistency models, *P* values from statistical tests, or summary of inconsistency estimates from different parts of the treatment network. | Page 8-9 Supplemental Table 5 |
| Risk of bias across studies                  | Present results of any assessment of risk of bias across studies for the evidence base being studied.  | Supplemental Figures 3 and 4 |
| Results of additional analyses               | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression analyses, alternative network geometries studied, alternative choice of prior distributions for Bayesian analyses, and so forth). | Page 10-11 |

### DISCUSSION

| Section                                      | Recommended Action                                                                                     | Pages   |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------|---------|
| Summary of evidence                          | 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). | Pages 12-15 Tables 1-2 |
| 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). Comment on the validity of the assumptions, such as transitivity and consistency. Comment on any concerns regarding network geometry (e.g., avoidance of certain comparisons). | Page 15 |
|---|---|---|---|
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | Pages 16 |
| **FUNDING** | | | |
| 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. This should also include information regarding whether funding has been received from manufacturers of treatments in the network and/or whether some of the authors are content experts with professional conflicts of interest that could affect use of treatments in the network. | Page 1 |

PICOS = population, intervention, comparators, outcomes, study design.
### Table S1. Search strategies.

| Query for Embase |
|------------------|
| #1 'contrast induced acute kidney injury'/exp |
| #2 'contrast induced nephropathy' |
| #3 ‘CIN’ |
| #4 ‘CI-AKI’ |
| #5 contrast AND acute AND renal AND failure |
| #6 contrast AND nephropathy |
| #7 #1 OR #2 OR #3 OR #4 OR #5 |
| #8 Hydration |
| #9 Fluid AND administration |
| #10 Volume AND expansion |
| #11 Intravenous AND sodium AND bicarbonate |
| #12 Saline AND infusion |
| #13 #8 OR #9 OR #10 OR #11 OR #12 |
| #14 Cardiac AND catheterization |
| #15 Coronary AND angiography |
| #16 Coronary AND intervention |
| #17 Percutaneous AND coronary AND intervention |
| #18 PCI |
| #19 Percutaneous AND transluminal AND coronary AND angioplasty |
| #20 PTCA |
| #21 #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 |
| #22 #7 AND #13 AND #21 |

| Query for MEDLINE |
|-------------------|
| ((contrast-induced acute kidney injury OR contrast-induced nephropathy OR CIN OR CI-AKI OR contrast acute renal failure OR contrast nephropathy) AND (hydration OR fluid administration OR volume expansion OR intravenous sodium bicarbonate OR saline infusion)) AND (cardiac catheterization OR coronary angiography OR coronary intervention OR percutaneous coronary intervention OR PCI OR percutaneous transluminal coronary angioplasty OR PTCA) |

| Query for Cochrane CENTRAL |
|-----------------------------|
| #1 (contrast induced acute kidney injury):ti,ab,kw OR (contrast induced nephropathy):ti,ab,kw OR (CIN):ti,ab,kw OR (CI-AKI):ti,ab,kw OR (contrast acute renal failure):ti,ab,kw OR (contrast nephropathy):ti,ab,kw |
| #2 (hydration):ti,ab,kw OR (fluid administration):ti,ab,kw OR (volume expansion):ti,ab,kw OR (intravenous sodium bicarbonate):ti,ab,kw OR (saline infusion):ti,ab,kw |
| #3 (cardiac catheterization):ti,ab,kw OR (coronary angiography):ti,ab,kw OR (coronary intervention):ti,ab,kw OR (percutaneous coronary intervention):ti,ab,kw OR (PCI):ti,ab,kw OR (percutaneous transluminal coronary angioplasty):ti,ab,kw OR (PTCA):ti,ab,kw |
| #4 #1 AND #2 AND #3 |
Table S2. Description of the hydration protocols in the included studies.

| Author, Year (Ref) | Protocol | Description | Total hydration per group (mL) |
|--------------------|----------|-------------|-------------------------------|
| Briguori et al, 2011 (18) | UFR | 250 mL of i.v. saline in 30 min as “priming” (reduced to 150 mL if LVEF ≤ 30% on transthoracic echocardiography). After priming, a bolus of furosemide 0.25 mg/kg was administered i.v. to achieve a urine output of ≥300 mL/h. The procedure was initiated after achieving the target urine flow rate (mean 58±13 min). Subsequent hydration with saline was matched automatically to urine flow output using the RenalGuard system. Hydration was maintained for 4 hours after the end of the procedure. | 2312 [1928-2999] |
| Fixed | 3 mL/kg per hour of 154 mEq/L of NaHCO3 in dextrose for 1 hour. Subsequent hydration was maintained at 1 mL/kg per hour during the procedure and 6 hours thereafter. | 1438 [1390-1487] |
| Marenzi et al, 2012 (19) | UFR | 250 mL of i.v. saline in 30 min as “priming”. After priming, a bolus of furosemide 0.50 mg/kg was administered i.v. to achieve a urine output of ≥300 mL/h. The procedure was initiated after achieving the target urine flow rate (mean 48±16 min). Subsequent hydration with saline was matched automatically to urine flow output using the RenalGuard system. At the end of the procedure, a second dose of 0.20 mg/kg of i.v. furosemide was allowed if intraprocedural urine flow did not reach the target. Hydration was maintained for 4 hours after the end of the procedure. | 3995±1401 |
| Fixed | 1 mL/kg per hour of isotonic saline (0.5 mL/kg per hour if LVEF ≤ 40%) from 12 hours before to 12 hours after the procedure | 1742±290 |
| Brar et al, 2014 (20) | LVEDP | Initial bolus of normal saline 3 mL/kg in one hour. Subsequent infusion rate was set on the basis of LVEDP: if <13 mmHg infusion rate was set to 5 mL/kg per hour, 13 – 18 mmHg infusion rate was set to 3 mL/kg per hour, if >18 mmHg infusion rate was set to 1.5 mL/kg per hour. Hydration was continued during the procedure and for 4 hours thereafter. | 1727±583 |
| Fixed | Initial bolus of normal saline 3 mL/kg in one hour. Subsequent fluid rate was set to 1.5 mL/kg per hour and was maintained throughout the procedure and 4 hours thereafter. | 812±142 |
| UFR | 250 mL of i.v. saline in 30 min as “priming”. After priming, a bolus of furosemide 0.50 mg/kg was administered i.v. to achieve a urine output of ≥300 mL/h. The procedure was initiated after achieving the target urine flow rate (mean 48±16 min). Subsequent hydration with saline was matched automatically to urine flow output using the RenalGuard system. Hydration was maintained for 4 hours after the end of the procedure. | 4033±1405 |
| Study | Flow Rate and Hydration Regimen |
|-------|--------------------------------|
| Usmani et al, 2016 (21) | Flow rate. Subsequent hydration with saline was matched automatically to urine flow output using the RenalGuard system. Additional furosemide boli were allowed at physician discretion to maintain target urine flow. Hydration was maintained for 4 hours after the end of the procedure. |
| Fixed | 1000 mL 12 hours before the procedure at a flow rate adjusted for LVEF: 20 – 40 mL/h if LVEF <30%, 80 – 120 mL/h if LVEF 30 – 50%; 200 mL/h if LVEF >50%. Subsequent hydration was carried out with 1.4% sodium bicarbonate at 3 mL/kg per hour per 1 hour before the procedure. During and after the procedure, hydration was continued with 1.4% sodium bicarbonate at 1 mL/kg per hour. Hydration was terminated after 6 hours. |
| Qian et al, 2016 (22) | CVP Hydration with normal saline was initiated 6 hours before and finished 12 hours after the procedure. Patients with a CVP <6 cmH\(_2\)O received normal saline at a rate of 3 mL/kg per hour, if CVP was 6 – 12 cmH\(_2\)O received normal saline at a rate of 1.5 mL/kg per hour, and if CVP was ≥13 cmH\(_2\)O the rate was set at 1 mL/kg per hour. Subsequent infusion rate was dynamically adjusted according to CVP variation. |
| Fixed | Hydration with normal saline was initiated 6 hours before and finished 12 hours after the procedure and maintained for 1.5 mL/kg per hour. |
| 1827±497 | |
| Maioli et al, 2018 (23) | BIVA Patients’ hydration status was evaluated before inclusion in all patients using BIVA, and only patients with low volume status were included. In the experimental group, isotonic saline at 2 mL/kg per hour for 12 hours before and after the procedure. Infusion rate was halved if LVEF ≤40%. |
| Fixed | Patients’ hydration status was evaluated before inclusion in all patients using BIVA, and only patients with low volume status were included. Isotonic saline at 1 mL/kg per hour for 12 hours before and after the procedure. Infusion rate was halved if LVEF ≤40%. |
| 3216 (2522–3600) | |
| Marashizadeh et al, 2019 (24) | LVDEP Normal saline at 1 mL/kg per hour procedure (0.5 mL/kg per hour if LVEF ≤40%) was administered for 12 hours before contrast administration and during the procedure. Hydration was subsequently adjusted for 4 hours after the procedure according to LVDEP: 5 mL/kg per hour if LVDEP ≤13 mmHg, 3 mL/kg per hour if LVDEP 13 – 18 mmHg and 1.5 mL/kg per hour if LVDEP ≥ 18 mmHg. |
| Fixed | Normal saline at 1 mL/kg per hour (0.5 mL/kg per hour if LVEF ≤40%) was administered from 12 hours before to 4 hours after the procedure. |
| Not reported | |

Not reported
| Briguori et al, 2020 (25) |
|--------------------------|
| **UFR**                 |
| 250 mL of i.v. saline in 30 min as “priming” (reduced to 150 mL if LVEF≤30% or average E/e’ >14 on transthoracic echocardiography). After priming, a bolus of furosemide 0.25 mg/kg was administered i.v. to achieve a urine output of ≥300 mL/h. The procedure was initiated upon obtainment of the target urine flow rate (mean 55±30 min). Subsequent hydration with saline was matched automatically to urine flow output using the RenalGuard system. Additional furosemide bolus of 0.25 mg/kg were administered 30’ apart if urine flow rate dropped below 300 mL/h. Hydration was maintained for 4 hours after the end of the procedure. |
| **LVEDP**                |
| Hydration with normal saline was initiated 1 hour before the procedure was titrated on the basis of non-invasive estimates of LVEDP based on echocardiographic average E/e’. Saline flow rate was adjusted to 5 mL/kg per hour if E/e’ <10, 3 mL/kg per hour if E/e’ 10 – 14 and 1.5 mL/kg per hour if E/e’ >14. Hydration rate was subsequently adjusted intraprocedurally according to invasive LVEDP: 5 mL/kg per hour if LVEDP was found to be low (<12 mmHg), 3 mL/kg per hour if LVEDP was intermediate (12 – 18 mmHg) or 1.5 mL/kg per hour if it was high (>18 mmHg). Hydration was continued for 4 hours after procedure. I.v. furosemide was allowed in case of pulmonary congestion of urine output <0.5 mL/kg per hour. |

|               | 2598±1349 |
|---------------|----------|
| UFR: Urine flow rate; LVEDP: left ventricular end diastolic pressure; CVP: central venous pressure; BIVA: bio-impedance vector analysis; LVEF: left ventricular ejection fraction; i.v.: intravenous. Total hydration data are reported as Mean±Standard Error or Median [Interquartile Range] as appropriate. |
Table S3. Characteristics of the included studies.

| Authors, Year (ref) | n  | Population included                                                                 | Definition of high AKI risk | Treatment arms | CI-AKI definition                                                                 | CI-AKI Rates        | Pulmonary edema rates |
|---------------------|----|---------------------------------------------------------------------------------------|-----------------------------|----------------|-----------------------------------------------------------------------------------|---------------------|-----------------------|
| Briguori et al, 2011 (18)* | 292 | Patients undergoing elective coronary angiography (38%), elective PCI (54%) or peripheral angiography/intervention (8%) with high AKI risk | eGFR (mMDRD) ≤30 ml/min 1.73 m² OR Mehran score ≥11 | UFR-guided hydration (n=146) vs fixed hydration (n=146) | Serum creatinine increase from baseline ≥0.3 mg/dL 48h after procedure or new need for dialysis | UFR: 16/146 Fixed: 30/146 | UFR: 3/146 Fixed: 1/146 |
| Marenzi et al, 2012 (19) | 170 | Elective or urgent coronary angiography (49%) or coronary angiography plus PCI (51%) in subjects at risk for AKI. Urgent procedures constituted 41% of total | eGFR (mMDRD) ≤60 ml/min 1.73 m² | UFR-guided hydration (n=87) vs fixed hydration (n=83) | Serum creatinine increase ≥25% or ≥0.5 mg/dL over baseline during the first 72h from procedure | UFR: 4/87 Fixed: 15/83 | UFR: 5/87 Fixed: 10/83 |
| Brar et al, 2014 (20) | 350 | Elective or urgent cardiac catheterization in subjects at high risk of AKI. PCI was performed in 28% of cases. 42% of patients presented with ACS | eGFR (mMDRD) ≤60 ml/min 1.73 m² and one or more of: diabetes mellitus, history of CHF, HTN, ≥75 years of age. | LVEDP-guided hydration (n=178) vs fixed hydration (n=172) | Serum creatinine increase ≥25% or ≥0.5 mg/dL over baseline obtained during post-procedural days 1-4 | LVEDP: 12/178 Fixed: 28/172 | LVEDP: 3/178 Fixed: 3/172 |
| Usmiani et al, 2016 (21) | 124 | Elective or urgent coronary angiography or PCI in subjects at high risk for AKI. PCI was performed in 47% of | eGFR (CKD-EPI) ≤60 ml/min 1.73 m² | UFR-guided hydration (n=59) vs fixed | Serum creatinine increase ≥0.3 mg/dL or ≥50% over baseline over 48h or 7 days post-procedure respectively | UFR: 4/59 Fixed: 16/65 | - |
cases. Urgent procedures represented 40% of cases.  

Qian et al, 2016 (22)  
| 264 | Elective or urgent coronary angiography or PCI performed in subjects at high risk for AKI and a clinical history of CHF. PCI was performed in 88% of cases. 81% of patients presented with ACS; STEMI were excluded. | eGFR (mMDRD) ≤60 ml/min 1.73 m² | CVP-guided hydration (n=132) vs Fixed hydration (n=132) | Serum creatinine increase ≥25% or ≥0,5 mg/dL over baseline during the first 72h after contrast administration | CVP: 21/132 Fixed: 39/132 | CVP: 5/132 Fixed: 4/132 |

Maioli et al, 2018 (23)  
| 296 | Elective coronary angiography or PCI in subjects with low body fluid volume as assessed per bio-impedance vector analysis. PCI was performed in 59% of cases. | Not applicable | BIVA-guided hydration (n=148) vs fixed hydration (n=148) | Serum Cystatine C increase ≥10% over baseline within 24h after contrast administration | BIVA: 17/148 Fixed: 33/148 | BIVA: 0/148 Fixed: 0/148 |

Marashizadeh et al, 2019 (24)  
| 109 | Elective coronary angiography or PCI in subjects with chronic coronary syndromes and high risk of AKI. PCI was performed in 42% of cases. | eGFR (mMDRD) between 15-60 ml/min 1.73 m² | LVEDP-guided hydration (n=57) vs fixed hydration (n=52) | Serum creatinine increase ≥25% or ≥0,5 mg/dL over baseline during at 24h or 72h after contrast administration | LVEDP: 4/57 Fixed: 2/57 | LVEDP: 0/57 Fixed: 0/57 |

Briguori et al, 2020 (25)*  
| 702 | Patients undergoing elective coronary angiography (36%), elective PCI (61%) or peripheral angiography/PTA (3%) with high AKI risk. | eGFR (mMDRD) ≤45 ml/min 1.73 m² OR Mehran score ≥11 OR Gurm’s score >7% | UFR-guided hydration (n=351) vs LVEDP-guided hydration (n=351) | Serum creatinine increase ≥25% or ≥0,5 mg/dL over baseline obtained during post-procedural days 1-4 | UFR: 20/351 LVEDP: 35/351 | UFR: 1/351 LVEDP: 5/351 |
eGFR: estimated glomerular filtration rate; PCI: percutaneous coronary intervention; PTA: percutaneous transluminal angioplasty; AKI: acute kidney injury; CI-AKI: contrast induced acute kidney injury; PE: pulmonary edema; ACS: acute coronary syndrome; STEMI: ST-elevation myocardial infarction; mMDRD: modified Modification of Diet in Renal Disease formula(45); CKD-EPI: Chronic Kidney Disease Epidemiology Collaboration(46); UFR: Urine flow rate; LVEDP: left ventricular end diastolic pressure; CVP: central venous pressure; BIVA: bio-impedance vector analysis. Mehran’s and Gurm’s score: see (47) and (48), respectively

*Studies (18) and (25) were included in the analysis despite including patients undergoing peripheral angiography/intervention since >90% of the study population consisted of coronary angiography and PCI patients, therefore minimizing the risk of bias connected to heterogeneous procedures.
Table S4. League Table for contrast-induced acute kidney injury (upper panels) and pulmonary edema (lower panels) in the sensitivity analysis. Each cell contains an odds ratio (OR) for the comparison of treatment reported in the column vs treatment reported in the line. Grey cells contain treatment name.

|               | CI-AKI                        | Pulmonary Edema                |
|---------------|-------------------------------|--------------------------------|
| **UFR**       |                               |                                 |
| 0.32 (0.19,0.54) | Fixed Hydration               | 0.54 (0.17,1.79) Fixed Hydration |
| 0.58 (0.31,1.09) | LVEDP                         | 0.35 (0.08,1.51) LVEDP          |
| 0.71 (0.28,1.81) | 2.22 (1.03,4.79) CVP          | 0.43 (0.06,2.90) 0.79 (0.18,3.50) CVP |

CI-AKI: contrast induced acute kidney injury; UFR: urine flow rate; LVEDP: left ventricular end diastolic pressure; CVP: central venous pressure.
Table S5. Loop-specific inconsistency for contrast-induced acute kidney injury (CI-AKI – upper panel) and pulmonary edema (lower panel).

| Comparison | K | Prop | NMA | Direct | Indirect | RoR | z   | p   |
|------------|---|------|-----|--------|----------|-----|-----|-----|
| CI-AKI     |   |      |     |        |          |     |     |     |
| BIVA vs CVP | 0 | 0    | 1.00| .      | 1.00     | .   |     |     |
| BIVA vs Fixed | 1 | 1.00 | 0.4538| 0.4538| .        | .   |     |     |
| BIVA vs LVEDP | 0 | 0    | 0.8182| .    | 0.8182   | .   |     |     |
| BIVA vs UFR | 0 | 0    | 1.4230| .    | 1.4230   | .   |     |     |
| CVP vs Fixed | 1 | 1.00 | 0.4538| 0.4538| .        | .   |     |     |
| CVP vs LVEDP | 0 | 0    | 0.8182| .    | 0.8182   | .   |     |     |
| CVP vs UFR | 0 | 0    | 1.4230| .    | 1.4230   | .   |     |     |
| Fixed vs LVEDP | 2 | 0.61 | 1.8028| 1.9097| 1.6465   | 1.1599 | 0.22 | 0.8253 |
| Fixed vs UFR | 3 | 0.77 | 3.1355| 3.0302| 3.5147   | 0.8622 | -0.22 | 0.8253 |
| LVEDP vs UFR | 1 | 0.62 | 1.7392| 1.8404| 1.5867   | 1.1599 | 0.22 | 0.8253 |

| Pulmonary Edema |   |      |     |        |          |     |     |     |
|-----------------|---|------|-----|--------|----------|-----|-----|-----|
| CVP vs Fixed    | 1 | 1.00 | 1.2586| 1.2586| .        | .   |     |     |
| CVP vs LVEDP    | 0 | 0    | 0.6963| .    | 0.6963   | .   |     |     |
| CVP vs UFR      | 0 | 0    | 2.0906| .    | 2.0906   | .   |     |     |
| Fixed vs LVEDP  | 1 | 0.65 | 0.5532| 1.0305| 0.1727   | 5.9650 | 0.95 | 0.3412 |
| Fixed vs UFR    | 2 | 0.83 | 1.6610| 1.2264| 7.3155   | 0.1676 | -0.95 | 0.3412 |
| LVEDP vs UFR    | 1 | 0.52 | 3.0024| 7.0993| 1.1902   | 5.9650 | 0.95 | 0.3412 |

CI-AKI: contrast induced acute kidney injury; UFR: urine flow rate; LVEDP: left ventricular end diastolic pressure; CVP: central venous pressure; k: number of studies providing direct evidence; Prop: direct evidence proportion; NMA: estimated treatment effect from the network meta analysis; direct: estimated treatment effect from direct evidence; indirect: estimated treatment effect from indirect evidence; RoR: ratio of ratios (direct vs indirect); z: z-value for disagreement test; p: p-value of disagreement test.
Table S6. Limitations of currently available tailored hydration strategies. The + sign whether the tailored hydration strategy possesses the characteristic mentioned in the heading. Red color indicates potential drawback, green color potential advantage

|       | Requires dedicated equipment | Requires invasive procedures for set up | Requires electrolytes monitoring | Requires delaying PCI | Provides multiple measures to fine-tune hydration |
|-------|------------------------------|----------------------------------------|---------------------------------|----------------------|-----------------------------------------------|
| UFR   | +                            | +                                      | +                               | +                    | +                                             |
| CVP   | -                            | +                                      | -                               | -                    | -                                             |
| BIVA  | +                            | -                                      | -                               | -                    | -                                             |
| LVDEP | -                            | -                                      | -                               | -                    | -                                             |

BIVA: bio-impedance vectorial analysis; UFR: urine flow rate; LVEDP: left ventricular end diastolic pressure; CVP: central venous pressure.
Figure S1. PRISMA diagram for study selection process.
Figure S2. Risk of bias assessment for the primary efficacy outcome (contrast-induced acute kidney injury) according to the Revised Cochrane Risk of Bias assessment tool (RoB 2). (6)
Figure S3. Risk of bias assessment for the primary safety outcome (acute pulmonary edema) according to the Revised Cochrane Risk of Bias assessment tool (RoB 2). (6)
Figure S4. Forest plots of direct and indirect estimates of effect size obtained through node-splitting, separate indirect from direct evidence (SIDE) method.

Panel A shows the estimates for CI-AKI, while panel B shows the results for pulmonary edema. CI-AKI, contrast induced acute kidney injury; LVEDP, left ventricular end diastolic pressure; UFR, urinary flow rate.
Figure S5. Comparison-adjusted funnel plots.

Panel A shows the comparison adjusted funnel plot for contrast induced acute kidney injury (CI-AKI), while panel B shows the plot for pulmonary edema. Considering that 0 pulmonary edema events were reported in the study by Maioli et al reporting on bioimpedance vector analysis guided hydration,(23) the strategy could not be included in funnel plot analysis for the latter outcome. On the right side of the plots, bias with respective 95% confidence intervals and p-values are reported. Bias were calculated as previously described.(7)