**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

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| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Bader, 2004[7](#_ENREF_7) | Arm1: Saline infusion before and after procedure  Arm2: Saline infusion during procedure | eGFR ≥50%  At 48 hours  Arm1: 1/19 (5.3)  Arm2: 3/20 (20)  All arms p=0.605 | Diabetes  At 48 hours  Arm1: 0/6 (0)  Arm2: 1/4 (25)  No Diabetes  At 48 hours  Arm1: 1/13 (7.7)  Arm2: 2/16 (12.5) | NR | Time point: NR  Arm1: 0/19 (0)  Arm2: 0/20 (0)  p=NR | NR | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Brar, 2014[9](#_ENREF_9) | Arm1: IV Normal Saline  Arm2: LVEDP-guided IV hydration | SrCr ≥25%  At 1-4 days  Arm1: 27/172 (15.7)  Arm2: 23/178 (6.7)  RR: 0.43 (95% CI: 0.22-0.82)  p=0.008  SrCr ≥ 0.5 mg/dl  At 1-4 days  Arm1: 11/172 (6.4)  Arm2: 5/178 (2.8)  RR: 0.44 (95% CI: 0.16-0.1.24)  p=0.11  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 28/172 (16.3)  Arm2: 12/178 (6.7)  0.41 (95% CI: 0.22-0.79)  p=0.005 | No Diabetes  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 8/82 (9.8)  Arm2: 1/87 (1.1)  RR: 0.12 (95% CI: 0.02-0.92)  p=NR  Diabetes  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 20/90 (22.2)  Arm2: 11/91 (12.1)  RR: 0.54 (95% CI: 0.28-1.07)  p=NR  Male  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 11/101 (10.9)  Arm2: 4/116 (3.9)  RR: 0.32(95% CI: 0.10-0.96)  p=NR  Female  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 17/71 (23.9)  Arm2: 8/62 (12.9)  RR: 0.54 (95% CI: 0.25-1.16)  p=NR | At 30 days  Arm1: 3/200 (1.5)  Arm2: 0/196 (0)  p=0.25  At 6 months  Arm1: 8/200 (4)  Arm2: 1/196 (0.5)  p=0.037 | At 30 days  Arm1: 3/200 (1.5)  Arm2: 1/196 (0.5)  p=0.62  At 6 months  Arm1: 4/200 (2)  Arm2: 1/196 (0.5)  p=0.37 | NR | At 30 days  Arm1: 4/200 (2)  Arm2: 1/196 (0.5)  p=0.37  At 6 months  Arm1: 13/200 (6.5)  Arm2: 4/196 (2)  p=0.29 |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

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| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Brar, 2014[9](#_ENREF_9) (continued) | Arm1: IV Normal Saline  Arm2: LVEDP-guided IV hydration |  | NAC user  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 12/97 (17.9)  Arm2: 4/66 (6.1)  RR: 0.34 (95% CI: 0.11-1.0)  p=NR  NAC non-user  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 16/105 (15.2)  Arm2: 8/112 (7.1)  RR: 0.47 (95% CI: 0.21-1.05)  p=NR  Contrast >100ml  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 20/93 (21.5)  Arm2: 8/94 (8/5)  RR: 0.40 (95% CI: 0.18-0.85)  p=NR  Contrast <100ml  SrCr ≥25% or ≥ 0.5 mg/dl  At 1-4 days  Arm1: 8/79 (10.1)  Arm2: 4/84 (4.8)  RR: 0.47 (95% CI: 0.15-1.50)  p=NR |  |  |  |  |
| Chen, 2008[14](#_ENREF_14) | Arm1: Non hydration  Arm2: IV 0.45% saline  Arm3: Oral NAC + non hydration  Arm4: IV Saline 0.45% + Oral NAC | SrCr ≥ 0.5 mg/dl  At 48 hours  Arm1: 23/330 (6.97)  Arm2: 22/330 (6.67)  Arm3: 64/188 (34.04)  Arm4: 40/188 (21.28)  p<0.001 | NR | NR | NR | NR | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Cho, 2010[15](#_ENREF_15) | Arm1: IV Normal Saline  Arm2: IV NaHCO3  Arm3: Oral hydration  Arm4: Oral hydration + oral NaHCO3 | SrCr ≥25%  At 72 hours  Arm1: 6 (22.2)  Arm2: 2 (9.5)  Arm3: 2 (9.1)  Arm4: 1 (4.7)  Arm1 vs. Arm2  P=0.78  Arm1 vs. Arm3  P=0.62  Arm1 vs. Arm4  P=0.34  Arm2 vs. Arm3  P=0.84  Arm2 vs. Arm4  P=0.53  Arm3 vs. Arm4  P=0.66 | NR | NR | NR | Arm1: 4.2 (4.5  Arm2: 4.1 (4.0)  Arm3: 4.4 (6.5)  Arm4; 6.9 (9.4)  p=0.66 | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Koc, 2012[31](#_ENREF_31) | Arm1: Standard-dose IV Normal Saline  Arm2: IV NAC plus high-dose IV Normal Saline  Arm3: High-dose IV Normal Saline | SrCr ≥25%  At 48 hours  Arm1: 2 (2.5)  Arm2: 13 (16.3)  Arm3: 6 (10.0)  p=0.012 | Age >70  At 48 hours  Arm1: 0 (0)  Arm2: 6 (18.9)  Arm3: 3 (14.3)  P=0.14  LVEF <40  At 48 hours  Arm1: 1 (3.6)  Arm2: 1 (5.6)  Arm3: 2 (15.0)  P=0.50  Contrast dose >100ml  At 48 hours  Arm1: 2 (4.2)  Arm2: 9 (18.0)  Arm3: 4 (9.1)  P=0.07  Diabetes  At 48 hours  Arm1: 2 (6.7)  Arm2: 3 (14.3)  Arm3: 3 (12.5)  P=0.63  Baseline CrCl<50  At 48 hours  Arm1: 1 (4.8)  Arm2: 8 (33.3)  Arm3: 3 (30.0)  P=0.03 | NR | NR | NR | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac**  **events,**  **n/N (%)** |
| Kong, 2012 [32](#_ENREF_32) | Arm1: IV Normal Saline  Arm2: Pre and post oral hydration  Arm3: Post oral hydration | SrCr ≥25%  At 48-72 hours  Arm1: 2/40 (5)  Arm2: 3/40 (7.5)  Arm3: 2/40 (5)  p=0.86 | NR | In-hospital  At 4 days  Arm1: 0/40 (0)  Arm2: 0/40 (0)  Arm3: 0/40 (0)  p=NR | NR | NR | NR |
| Krasuski, 2003[35](#_ENREF_35) | Arm1: IV 0.45% Saline  Arm2: IV Normal Saline | SrCr >0.5mg/dl  At 48 hours  Arm1: 0/26 (0)  Arm2: 4/37 (11)  p=0.136 | CrCl <50ml/min  At 48 hours  Arm1: 0/17 (0)  Arm2: 3/20 (15)  p=0.234 | NR | Permanent dialysis  At 48 hours  Arm1: 0/26 (0)  Arm2: 2/37 (5.4)  p=0.503 | NR | NR |
| Lawlor, 2007[37](#_ENREF_37) | Arm1: IV Normal Saline + placebo  Arm2: IV Normal Saline + oral NAC  Arm3: Oral hydration + oral NAC | SrCr ≥25%  At 48 hours  Arm1: 2 (8.0)  Arm2: 2 (8.0)  Arm3: 2 (7.0)  p=0.99 | Baseline SrCr >200 µmol/L  At 48 hours  Arm1: 2(40.0)  Arm2: 1(20.0)  Arm3: 2 (33.0)  P=0.78 | NR | NR | NR | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac events,**  **n/N (%)** |
| Maioli, 2011[44](#_ENREF_44) | Arm1: No hydration  Arm2: Llate IV Normal Saline  Arm3: Early IV NaHCO3 | SrCr ≥25%  At 3 days  Arm1: 41/150 (27.3)  Arm2: 34/150 (22.7)  Arm3: 18/150 (12.0)  P=0.001 | SrCr ≥ 25%  High to very high CIN risk >11  At 3 days  Arm1: 18/52 (34.6)  Arm2: 14/46 (46)  Arm3: 11/45 (24.4)  P=0.28  eGFR <60  At 3 days  Arm1: 10/34 (29.4)  Arm2: 12/46 (26.1)  Arm3: 6/40 (15.0)  P=0.14  Age >75 years  At 3 days  Arm1: 11/29 (37.9)  Arm2: 15/36 (41.7)  Arm3: 8/38 (21.1)  P=0.12  Diabetes  At 3 days  Arm1: 10/34 (29.4)  Arm2: 11/31 (35.5)  Arm3: 5/31 (16.1)  P=0.24 | In-hospital  At 3 days  Arm1: 8/150 (5.3)  Arm2: 5/150 (3.3)  Arm3: 3/150 (2.0)  P=0.12 | Need for hemofiltration  At 3 days  Arm1: 1/150 (0.7)  Arm2: 1/150 (0.7)  Arm3: 2/150 (1.3)  P=0.54 | NR | Cardiogenic shock  At 3 days  Arm1: 8/150 (5.3)  Arm2: 9/150 (6.0)  Arm3: 6/150 (4.0)  P=0.6  Recurrent MI  At 3 days  Arm1: 5/150 (3.3)  Arm2: 6/150 (4.40)  Arm3: 2/150 (1.3)  P=0.30  Repeated urgent PCI  At 3 days  Arm1: 2/150 (1.3)  Arm2: 5/150 (3.3)  Arm3: 1/150 (0.7)  P=0.66  Stroke  At 3 days  Arm1: 2/150 (1.3)  Arm2: 2/150 (1.3)  Arm3: 1/150 (1.3)  P=1.0  MACE  At 3 days  Arm1: 15/150 (10)  Arm2: 19/150 (12.7)  Arm3: 11/150 (7.3)  P=0.44 |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac events,**  **n/N (%)** |
| Maioli, 2011[44](#_ENREF_44) (continued) |  |  | Anterior MI  At 3 days  Arm1: 22/65 (33.8)  Arm2: 16/63 (25.4)  Arm3: 12/61 (19.7)  P=0.07  LVEF <40%  At 3 days  Arm1: 24/61 (39.3)  Arm2: 20/58 (34.5)  Arm3: 12/56 (21.4)  P=0.04  Volume contrast to eGFR ratio >3.7  At 3 days  Arm1: 15/50 (30.0)  Arm2: 15/55 (27.3)  Arm3: 9/48 (18.8)  p=0.20 |  |  |  |  |
| Manari, 2014[45](#_ENREF_45) | Arm1: IV Normal Saline  Arm2: High-dose IV Normal Saline  Arm3: IV NaHCO3  Arm4: High-dose IV NaHCO3 | SrCr ≥ 25%  At 72 hours  Arm1: 29/151 (19.2)  Arm2: 27/145 (19)  Arm3: 24/145 (16.6)  Ar,4: 27/154 (17.5)  p=0.92  SrCr >0.5mg/dl  At 72 hours  Arm1: 7/151 (4.6)  Arm2: 8/142 (5.6)  Arm3: 5/145 (3.4)  Arm4: 3/154 (3.2)  p=0.51 | NR | NR | Time point NR  Arm1: 0/151 (0)  Arm2: 0/142 (0)  Arm3: 0/145 (0)  Arm4: 0/154 (0)  p=NR | NR | NR |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac events,**  **n/N (%)** |
| Marron, 2007[48](#_ENREF_48) | Arm1:IV Normal Saline  Arm2: IV 0.45% Saline | SrCr ≥ 25%  At 24 hours  Arm1: 5 (13.5)  Arm2: 4 (11.7)  p=NS  At 48 hours  Arm1: 3 (8.1)  Arm2: 1 (2.9)  p=NS | NR | NR | NR | NR | NR |
| Mueller, 2002[49](#_ENREF_49) | Arm1: IV Normal Saline  Arm2: IV 0.45% Saline + 5% glucose | SrCr >0.5mg/dl  At 48 hours  Arm1: 0/26 (0)  Arm2: 4/37 (11)  p=0.04 | StCr >0.5mg/dl  At 48 hours  Men  At 48 hours  Arm1: 4/507 (.8)  Arm2: 5/522 (1)  p=0.77  Women  At 48 hours  Arm1: 1/178 (.6)  Arm2: 9/176 (5.1)  p=0.01  Diabetes  At 48 hours  Arm1: 0/107 (0)  Arm2: 6/110 (5.5)  p=0.01  No diabetes  At 48 hours  Arm1: 5/578 (.9)  Arm2: 8/588 (1.4)  p=0.42 | NR | NR | Arm1: 4.8  Arm2: 4.8  p=0.87 | Major adverse cardiac event  At 30 days  Arm1: 14 (5.3)  Arm2: 17 (6.4)  p=0.59 |

**Evidence Table I-21. Summary of the outcomes of studies comparing fluid strategies for the prevention of contrast-induced nephropathy and other outcomes**

**(continued)**

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| **Author, year** | **Comparison** | **Incidence of CIN, n/N (%)** | **Incidence of CIN: subgroups,**  **n/N (%)\*** | **Mortality**  **n/N (%)** | **Need for RRT,**  **n/N (%)** | **Length of hospital stay, mean days (SD)** | **Cardiac events,**  **n/N (%)** |
| Trivedi, 2003[63](#_ENREF_63) | Arm1: Oral hydration  Arm2: IV Normal Saline | SrCr >0.5mg/dl  At 48 hours  Arm1: 9/26 (34.6)  Arm2: 1/27 (3.7)  p=0.005 | NR | NR | Need for dialysis  At 48 hours  Arm1: 0/26 (0)  Arm2: 0/27 (0)  p=NR | NR | NR |

CIN=contrast induced nephropathy; CrCl=creatinine clearance; eGFR=estimated glomular filtration rate; IV=intravenous; LVEF=left ventricular ejection fraction; MACE=major adverse cardiac events; MI=myocardial infarction; Normal Saline=normal saline; NR=not reported; PCI=percutaneous coronary intervention; RRT=renal replacement therapy; SD=standard deviation; SrCr=serum creatinine

\* n/N refers to number of events divided by number at risk.