

# Improving Knowledge and Best Practices in Contrast-Induced Nephropathy



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This program has been developed solely for the purposes of describing the level of nurse practitioner (NP) knowledge and best practices regarding contrast-induced nephropathy, before and after participation in an online educational intervention with a one-month practice-change follow-up. The program is posted as a part of this project's educational intervention and is intended only for such use. The study has been approved for this purpose by the Chamberlain College of Nursing Institutional Review Board. Please find the link to return to the survey at the end of the slides.

# Objectives

By the conclusion of this presentation, participants will be able to:

- 1. Describe knowledge relating to assessment, treatment, and management of contrast-induced nephropathy
- 2. Discern best practices relating to assessment, treatment, and management of contrast-induced nephropathy
- 3. Identify potential for improved practice-change relating to assessment, treatment, and management of contrast-induced nephropathy

# Rationale

With the advent of contrast volume delivered during primary percutaneous coronary intervention, comes the development of contrast-induced nephropathy and mortality (Marenzi et al., 2009). Scientific evidence has further confirmed initial concerns with the growing incidence of contrast-induced acute kidney injury (Bartorelli & Marenzi, 2008; Stacul et al., 2011; Jorgensen, 2013). Selected preventive strategies for contrast-induced nephropathy have included haemodynamic-guided fluid administration (Brar et al., 2014), selected medication administration (Kelly et al., 2008), and sodium bicarbonate versus saline (Maioli et al., 2008). However, the need for provider education specific to best practices specific to contrast-induced nephropathy is further warranted (Jasuja et al., 2009; Reddan & Fishman, 2008).

# Contrast Induced Nephropathy (CIN)

- The goal of the following presentation is to provide participants with an overview of the following topics related to CIN:

Definition

Incidence

Risk Factors

Implications

Prevention

The Evidence

# CIN: A reversible form of acute kidney injury occurring after exposure to radio-contrast media

## Multiple accepted but controversial definitions

- $\uparrow$  Cr  $\geq$  25% from baseline within 72hrs
- $\uparrow$  Cr  $\geq$  25% from baseline at 2 or 4 days
- $\uparrow$  Cr  $\geq$  0.5 mg/dL 48hrs after contrast

## Incidence varies widely and is dependent on risk factors

- No to low risk patient; CIN risk  $<$ 1%
- High risk patient; CIN 10-20%

# Who is at risk?

## Comorbidities that increase the risk significantly

- Age >75yo
- Diabetes
- Chronic kidney disease
  - Defined as Serum creatinine >1.5mg/dl; GFR <60mL/min/1.73m<sup>2</sup>
- Heart failure
- Valve disease
- Dehydration
- Anemia (Hematocrit <39% for men, or <36% for women)
- Hypotension
- Low left ventricular end diastolic pressure (LVEDP)
- Sepsis
- Use of Intra-aortic balloon pump

# Who is at risk?

## Increased risk associated with concomitant use of nephrotoxic drugs

- ACE-I, aminoglycosides, vancomycin, diuretics, NSAIDS, metformin

## Procedural factors may increase the risk

- Intra-arterial administration of contrast
- Contrast volume / dose of contrast
- Type of contrast

## Certain procedures are considered high risk

- CT scan
- Coronary angiogram

# What Happens?

**Rise in Serum Creatinine starts 12-24 hours after contrast**

- Tends to be non-oliguric
- Recovery begins within 3-5 days

**Acute Tubular Necrosis (ATN) caused by**

- Renal vasoconstriction, medullary hypoxemia (mediated by alteration in NO/endothelin/adenosine)
- Direct cytotoxic effects of the contrast agent

**Unclear why ATN recovery occurs within a few days in CIN vs. 1-3 weeks in ATN due to other causes**

- It is possible that the degree of tubular necrosis is less and cells remain intact

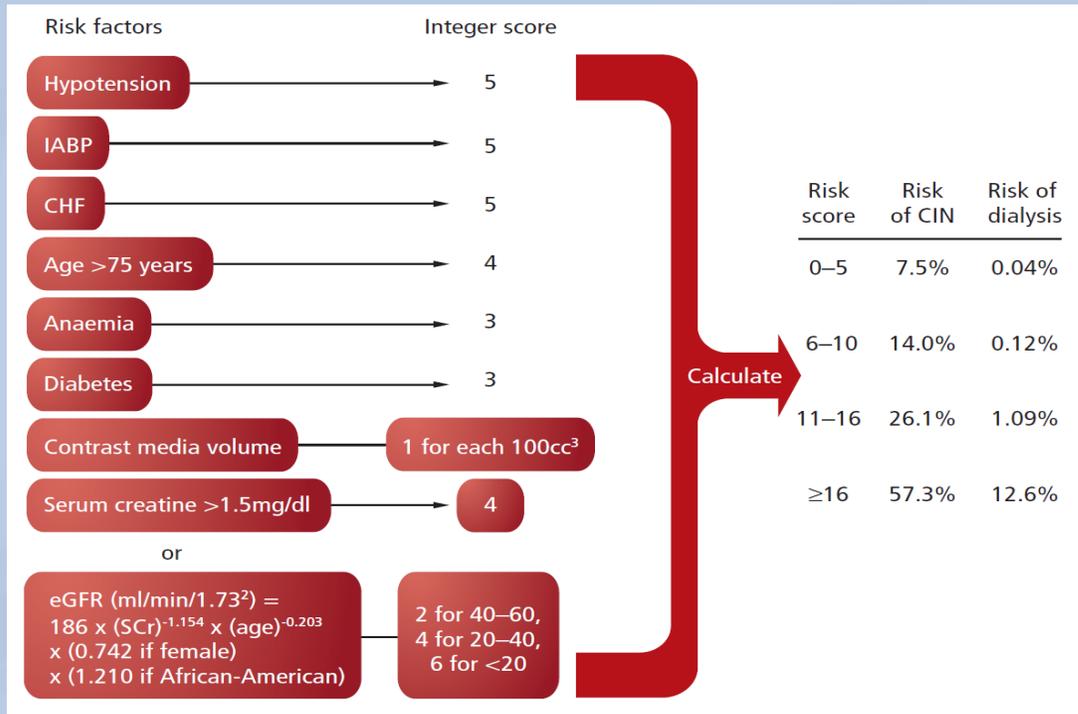
# Why do we care?

## Implications of CIN

- Increases morbidity
- Increases mortality
- Increases hospital stay

## From: A simple risk score for prediction of contrast-induced nephropathy after percutaneous coronary intervention: Development and initial validation

J Am Coll Cardiol. 2004;44(7):1393-1399. doi:10.1016/j.jacc.2004.06.068



### Figure Legend:

Scheme to define CIN risk score. Anemia = baseline HCT value <39% for men and <36% for women; CHF = congestive heart failure class III/IV by New York Heart Association classification and/or history of pulmonary edema; eGFR = estimated glomerular filtration rate; hypotension = SBP <80 mm Hg for at least 1 h requiring inotropic support with medications or intra-aortic balloon pump (IABP) within 24 h periprocedurally.



### Figure Legend:

The prognostic significance of the proposed risk score for contrast-induced nephropathy extended to prediction of one-year mortality. (Red bars = development dataset; blue bars = validation dataset).

# Prevention Strategies

**Screen to identify risk factors, renal function, hydration and hemodynamic status**

- **Patient Education**

- Report signs and symptoms of renal impairment immediately (swelling, sudden weight gain, decrease u/o)
- Stress importance of with holding medications, fluid hydration, and follow up care
- Stress importance of informing health care providers of contrast dye exposure within 10 days
- Withhold nephrotoxic agents 48 hours prior to procedure to minimize injury to nephron and prevent accumulation of drug

# Prevention Strategies

- **Assessment of renal function daily during the hospital stay**
- **Monitor Intake and output, although it may not be reliable**
- **Assess for signs of hypovolemia**
  - **Hypotension, decreased U/O (<30cc/hr), concentrated urine, elevated serum blood urea nitrogen**
- **Controversial strategies and possibly without any benefit**
  - **Use of N-acetylcysteine, statins and antioxidants to preserve glomerular function**
  - **Ascorbic acid 3gm per day before the procedure and 2 gm daily after the procedure**

# Prevention Strategies

## Contrast optimization

- Risk is dose dependent
  - Implement modalities to decrease the dose of contrast administered
    - Use a biplane room for angiogram
    - Avoid ventriculogram or aortogram
- Type of contrast
  - Low osmolar, non-ionic contrast agents associated with lower risk (i.e. visipaque)

## Medications shown to not help

- Sodium bicarbonate, mannitol, diuretics, calcium channel blockers, fenoldopam, dopamine, theophylline, n-acetylcysteine

# Prevention Strategies

**Hydration is the only treatment recommended by ACC/AHA for prevention of CIN**

- **Isotonic saline (i.e. 0.9% Saline solution) is preferred**
- **Should be guided by clinical criteria**

**How does it help?**

- **Enhances blood flow to the nephron**
- **Decreases contact time of contrast within kidney**
- **Dilutes contrast**

# Suggested Pre-procedure Hydration for Prevention of CIN

**Standard treatment for patients with GFR  
<60 OR  
<90mL/min per 1.73m<sup>2</sup> in diabetic patients**

**\*NS is preferred but can be modified**

**\*Volume may be modified based on clinical status**

**\*Continue post procedure for up to 12 hours if clinically appropriate**

## **12 hours prior to the procedure**

- **Infuse 1mL/kg/hr**

**Modified for CHF or LV dysfunction**

- **LVEF <40% → 0.5mL/kg/hr**

## **If procedure is < 12 hours away**

- **1-2mL/kg/hr 2-6 hours prior to procedure**
- **3mL/kg 1 hour prior to procedure**
- **Emergent procedures IVF bolus 500-1000 mL**

# LVEDP guided hydration

- **POSEIDON trial**
  - Compared standard vs. LVEDP guided normal saline hydration in patients undergoing catheterization
  - Pre-procedure hydration was given at 3mL/kg/hr
  - LVEDP measured intra-procedurally, infusion rates were adjusted and hydration was continued x 4 hours post procedure
- **LVEDP guided hydration resulted in less CIN**

**LVEDP**

**RATE**

**<13**

**5mL/kg/hr**

**13-18**

**3mL/kg/hr**

**>18**

**1.5mL/kg/hr**

**Continued x 4 hours post procedure**

# Conclusions

- **While definitions, incidence and the choice of prevention strategies vary, the need for preventive measures is universal**
- **Risk of CIN should be calculated for each individual**
- **Adequate hydration is the best preventive measure and should be tailored to the individual based on:**
  - **Risk factors**
  - **Clinical presentation**
  - **Hemodynamic parameters**

# References

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<https://www.surveymonkey.com/s/SYGWWGD>