RISK OF CONTRAST INDUCED NEPHROPATHY IN PATIENTS UNDERGOING TREATMENT FOR ACUTE STROKE

Pooria Javadi, MD. Maryam Etesami, MD. Tanay Patel, MD. Kristine A. Blackham, MD.
Department of Diagnostic Radiology,
University Hospitals Case Medical Center,
Cleveland, OH, USA

Ed Exhibit # 127
Disclosure

The authors of this presentation have no financial disclosures.
Introduction & Background

- There is increasing use of endovascular therapy for the treatment of acute ischemic stroke (AIS), but the data regarding safety of use of contrast media during these procedures is limited.

- Previous studies have shown increased incidence of contrast induced nephropathy (CIN) in patients treated for acute coronary syndrome (ACS) who were treated by endovascular approach.

- Some studies have shown safety of contrast administration for noninvasive imaging in acute stroke patients.

- However, the data regarding CIN in patients with acute ischemic stroke who were treated by endovascular approach is sparse.
Purpose

1. Discuss the incidence and risk factors for CIN after the use of iodinated contrast media in a large number of acute ischemic stroke patients who underwent non-invasive imaging and endovascular treatment based on available literature.

2. Discuss the potential mechanisms for major differences in incidence of CIN in patients with AIS and ACS.
Methods

• A review of literature
  - Incidence and risk factors of CIN in patients receiving iodinated contrast for CT angiography or endovascular treatment in the setting of AIS
  - Comparison of the risk of CIN in AIS with the risk of CIN in patients receiving percutaneous intervention (PCI) for MI

• Results from our institute for the incidence and risk factors for CIN in patients receiving endovascular treatment for AIS in a four year span are included.
Discussion

CIN in percutaneous treatment of ACS

Myocardial Infarction → Percutaneous Intervention → 12-26% increased risk of CIN → High mortality when requiring hemodialysis

Risk Factors:
- Diabetes Mellitus
- Chronic Kidney Disease
- Amount of contrast used

Discussion

High mortality when requiring hemodialysis
CIN in stroke patients receiving CTA

• Previous studies have shown low incidence of CIN in acute stroke patients who underwent emergent multimodal CTA.

1. Josephson et al.:

- 1075 Acute stroke patients
- Underwent CT contrast studies
- 3.7% (40/1075) developed CIN (increased creatinine level > 0.5 mg/dl)

2. Hopyan et al.:

- 175 Acute stroke patients
- Underwent CT contrast studies
- 2.9% (5/175) developed CIN (increased creatinine level > 25% at <72 hours)
CIN in stroke patients receiving CTA & Endovascular treatment

3. Krol et al.:

481 patients received CTA

257 patients excluded (lack of follow up Cr. data)

3% (7/224) developed CIN (>25% increase in serum Cr from baseline)

36 patients underwent additional digital subtraction angiogram

None developed CIN
CIN in stroke patients receiving endovascular treatment

4. Loh et al:

99 Acute stroke patients

Underwent endovascular treatment (average volume of contrast = 189 ± 71 ml)

Average creatinine change was -4.6% at 48 hours postangiography

3 patients developed CIN

All 3 patients died as a result of stroke, but returned to baseline Cr level before death
Our institute data

- A retrospective chart review study

194 acute stroke patients (during 2006-2011)

44 patients received CTA

150 patients did not receive CTA

All underwent endovascular treatment (each ~150 ml of Optiray 320)
Contrast induced nephropathy (CIN) definition

- According to Acute Kidney Injury Network (AKIN) criteria:
  
i. Rapid time course (less than 48 hours)
  and
  
i. Reduction of kidney function
    ➢ Rise in serum Cr, defined by either:
      a. Absolute increase in serum creatinine of ≥0.3 mg/dl
      b. Percentage increase in serum creatinine of ≥50%
    ➢ Reduction in urine output, defined as <0.5 ml/kg/hr for more than 6 hours
### Demographics & Comorbidities

#### Table 1:

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Number of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>65 (17-89) years</td>
<td></td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>100</td>
<td>52</td>
</tr>
<tr>
<td><strong>Comorbidities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>132</td>
<td>67</td>
</tr>
<tr>
<td>Hypertension</td>
<td>167</td>
<td>85</td>
</tr>
</tbody>
</table>

- Baseline creatinine for 191 patients ranged between 0.4 – 2.7 mg/dl.
- Three patients on chronic hemodialysis had baseline Cr ranging between 5.3-6.1 mg/dl.
- Baseline Cr was ≤1.5 mg/dl in 84% (n= 163) and ≥ 1.5 mg/dl in 16% patients (n= 31) of all 191 patients.
Our institute results

194 acute stroke patients

44 patients received additional CTA

All underwent endovascular treatment

1.5% (3 patients) developed CIN

None developed CIN
• Out of 3 patients who developed CIN, one patient had known history of Chronic Renal Insufficiency (Cr > 1.5), but the other two had normal baseline Cr.
• Female gender and diabetes were not associated with higher risk of developing CIN.

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CT angiography</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Baseline Cr, mg/dl</td>
<td>0.5</td>
<td>2.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Nadir Cr, mg/dl</td>
<td>1.0</td>
<td>3.0</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 2: Characteristics for three patients who developed CIN
## CIN in endovascular treatment of AIS vs ACS

Incidence of contrast induced nephropathy (CIN) in endovascular treatment of:

<table>
<thead>
<tr>
<th></th>
<th>Acute Ischemic Stroke</th>
<th>Acute Coronary Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>1.5-3%</td>
<td>12-26%</td>
</tr>
</tbody>
</table>
Proposed reasons for differences in incidence of CIN in patients treated for AIS vs ACS

<table>
<thead>
<tr>
<th></th>
<th>Acute Ischemic Stoke</th>
<th>Acute Coronary Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atherosclerotic renal disease</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Acute kidney injury secondary to hemoconcentration¹</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Cardiogenic shock resulting in renal hypoperfusion²</td>
<td>Lower</td>
<td>Higher</td>
</tr>
</tbody>
</table>

¹ Acute Kidney injury secondary to hemoconcentration is more readily corrected by hydration than renal hypoperfusion due to cardiogenic shock.

² Sample sizes in AIS group are far smaller and factors such as IV hydration can not be controlled, hence testing hypothesis is difficult.
Conclusion

- Risk of developing CIN among acute stroke patients who undergo emergent CTA & endovascular intervention is low.

- Laboratory investigation should not delay and known renal insufficiency should not preclude intra-arterial treatment of stroke.

- A prospective randomized clinical trial is warranted to evaluate potential risk factors and long term effects of use of contrast and interval development of chronic kidney disease.
References

