Cardiac surgery and acute kidney injury: retrospective study

Department of Cardiovascular and Thoracic Surgery
University Hospital of Liège, Belgium

MG LAGNY¹, F BLAFFART¹, JO DEFRAIGNE², AF DONNEAU³, L ROEDIGER⁴, JM KRZESINSKI⁵

1. ECCP, Department of Cardiovascular and Thoracic Surgery, CHU Lg.
2. MD, PhD, Chief Department of Cardiovascular and Thoracic Surgery, CHU Lg.
3. Medical Informatics and Biostatistics, Public Health, University of Liège.
4. MD, PhD, Department of Anesthesiology, CHU Lg.
5. MD, PhD, Chief Department of Nephrology-Dialysis, CHU Lg.
Acute Kidney Injury (AKI) in the setting of cardiac surgery

**INTRODUCTION:**

- Severe postoperative complication
- Increase rate of mortality, morbidity and length of stay in intensive care unit (ICU)
- Occurrence: 5% to 42%

---


AIM OF THE STUDY:

... Occurrence by type of cardiac surgery?

... Length of stay in ICU and in Hospital?

... Mortality?
MATERIAL AND METHODS:

Retrospective study: 1 year adult surgery

Inclusion criteria

- Off-pump coronary artery bypass surgery (Off-PUMP CABG)
- On-pump coronary artery bypass surgery (On-PUMP CABG)
- Aortic valve replacement (AVR)
- Aortic valve replacement combined with CABG (AVR+CABG)
- Mitral valve repair or replacement (MVR)
MATERIAL AND METHODS:

Retrospective study: 1 year adult surgery

Exclusion criteria

- Mitral valve + CABG
- Aorta surgery
- Redo procedure
- Other combined surgery (eg: + TEA carotid)
- Double valve surgery
- Heart transplant
- Preoperative renal replacement therapy (RRT)
## RIFLE classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Blood criteria</th>
<th>Urine criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td>× 1.5 serum creatinin or GFR ↓ 25%</td>
<td>&lt; 0.5 mL/kg × 6h00</td>
</tr>
<tr>
<td>Injury</td>
<td>× 2 serum creatinin or GFR ↓ 50%</td>
<td>&lt; 0.5 mL/kg × 12h00</td>
</tr>
<tr>
<td>Failure</td>
<td>× 3 serum creatinin or GFR ↓ 75%</td>
<td>&lt; 0.3 mL/kg × 24h00</td>
</tr>
<tr>
<td></td>
<td>OR ≥ 4 mg/dL with ↑0.5mg/dL</td>
<td>OR anuria × 12h00</td>
</tr>
</tbody>
</table>

| Loss                      | Complete loss of kidney function > 4 weeks          |                                     |
| End-stage kidney disease  | ESKD > 3 months                                     |                                     |

GFR= Glomerular Filtration Rate

RESULTS:

N= 598 cases (100.0%)

Excluded cases
n= 164 (27.4%)

Included cases
n= 434 (72.6%)
Type of surgery  n= 434 (100%)

- On-PUMP CABG: 182 (42%)
- AVR: 104 (24%)
- AVR+CABG: 46 (11%)
- MVR: 58 (13%)
- Off-PUMP CABG: 44 (10%)

M-G LAGNY ECCP CHU de Liège
Postoperative renal status

n= 434 (100%)

- NO AKI
  n=221
  51%

- AKI
  n=213
  49%
Postoperative renal status

AKI
213
49%

Injury
n=108
51%

Risk
n=79
37%

Failure
n=26
12%

n=213 (100%)
Postoperative renal status

- AKI: 213 (49%)
- Injury: 108 (51%)
- Risk: 79 (37%)

- Failure: 26 (12%)
- RRT = 8 (4%)

Total: 213 (100%)
Postoperative AKI: Failure

M-G LAGNY ECCP CHU de Liège

$p<0.0001$
### Risk of AKI

#### Off-PUMP CABG vs On-PUMP CABG

<table>
<thead>
<tr>
<th></th>
<th>Off-PUMP CABG n=58</th>
<th>On-PUMP CABG n=182</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AKI, n (%)</strong></td>
<td>21 (36.0)</td>
<td>80 (44.0)</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Failure, n (%)</strong></td>
<td>2 (3.00)</td>
<td>10 (5.00)</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>EuroSCORE 1 Log</strong></td>
<td>2.72 (1.5 - 5.1)</td>
<td>3.05 (1.9 - 6.7)</td>
<td>0.083</td>
</tr>
<tr>
<td><strong>MI preop (&lt;3 months), n (%)</strong></td>
<td>4 (6.90)</td>
<td>39 (21.4)</td>
<td>0.032</td>
</tr>
<tr>
<td><strong>CABG (&gt;2 vs ≤ 2), n (%)</strong></td>
<td>21 (36.2)</td>
<td>134 (73.6)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>ICU stay (days)</strong></td>
<td>2.0 (2.0 - 3.0)</td>
<td>2.0 (2 – 4)</td>
<td>0.012</td>
</tr>
<tr>
<td><strong>Hospital stay (days)</strong></td>
<td>11.5 (10 – 15)</td>
<td>12.0 (10 – 18)</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Hospital mortality, n (%)</strong></td>
<td>0 (0.00)</td>
<td>4 (2.20)</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Data are expressed as M (IQR)
# AKI:
Length of stay
Mortality

## Off-PUMP CABG vs On-PUMP CABG

<table>
<thead>
<tr>
<th></th>
<th>Off-PUMP CABG n=21</th>
<th>On-PUMP CABG n=80</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICU stay</strong> (days)</td>
<td>2.0 (2 – 3)</td>
<td>2.0 (2 – 4)</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Hospital stay</strong> (days)</td>
<td>11.0 (9 – 13)</td>
<td>12 (10 – 18)</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>Hospital mortality, n (%)</strong></td>
<td>0 (0.00)</td>
<td>1 (1.25)</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Data are expressed as M (IQR)
Postoperative AKI

Off-PUMP CABG

On-PUMP CABG

MVR

AVR+CABG

AVR

p<0.0001

M-G LAGNY ECCP CHU de Liège
## Risk of AKI

### CPB procedures

#### Preoperative data

<table>
<thead>
<tr>
<th></th>
<th>Non AKI n=184</th>
<th>AKI n=192</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> (years)</td>
<td>66.0 (59 - 74)</td>
<td>72.0 (63 - 77)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>BMI</strong> (UI)</td>
<td>25.7 (23 - 28)</td>
<td>26.9 (24 - 30)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>GFR</strong> (mL/min)</td>
<td>82.0 (72 - 96)</td>
<td>70.5 (55 - 88)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Parsonnet Log</strong></td>
<td>5.76 (3 - 12)</td>
<td>8.41 (4 - 17)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>EuroSCORE I Log</strong></td>
<td>3.60 (2 - 6)</td>
<td>4.98 (2 - 9)</td>
<td>0.008</td>
</tr>
<tr>
<td><strong>CIN score</strong></td>
<td>4.27 (2 - 8)</td>
<td>6.44 (4 - 9)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>ARF score</strong></td>
<td>1.00 (0 - 2)</td>
<td>2.00 (1 - 3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are expressed as M (IQR)

CIN score: Contrast Induced Nephropathy (Mehran and all, JACC Vol.44 No.7, 2004 October 6, 2004:1393-9)

## Risk of AKI

### CPB procedures

#### Peroperative data

<table>
<thead>
<tr>
<th></th>
<th>Non AKI n=184</th>
<th>AKI n=192</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPB time (min)</td>
<td>85.0 (70 - 100)</td>
<td>89.0 (75 - 106)</td>
<td>0.048</td>
</tr>
<tr>
<td>Clamping time (min)</td>
<td>52.0 (39 - 64)</td>
<td>58.0 (43 - 74)</td>
<td>0.009</td>
</tr>
<tr>
<td>Nadir Hct ≤ 21%, n (%)</td>
<td>102 (55.4)</td>
<td>127 (66.5)</td>
<td>0.028</td>
</tr>
<tr>
<td>RBC transfusion, n (%)</td>
<td>30 (16.3)</td>
<td>50 (26.5)</td>
<td>0.017</td>
</tr>
<tr>
<td>UF, n (%)</td>
<td>21 (20.6)</td>
<td>11 (13.8)</td>
<td>0.22</td>
</tr>
<tr>
<td>UF, mL</td>
<td>1000 (1000-1600)</td>
<td>1300 (1000-2000)</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Data are expressed as M (IQR)
### POSTOPERATIVE DATA

**CPB procedures**

<table>
<thead>
<tr>
<th></th>
<th>Non AKI n=184</th>
<th>AKI n=192</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Blood Pressure (mmHg)</strong></td>
<td>85.0 (79 - 96)</td>
<td>92.0 (80 - 108)</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Serum creat (mg/dL)</strong></td>
<td>9.40 (7 - 11)</td>
<td>10.4 (8 - 12)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>ICU stay (days)</strong></td>
<td>2.0 (2 - 3)</td>
<td>3.0 (2 - 4)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Hospital stay (days)</strong></td>
<td>12.0 (10 - 16)</td>
<td>13.0 (10 - 19)</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Hospital mortality, n (%)</strong></td>
<td>5 (2.72)</td>
<td>8 (4.17)</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Data are expressed as M (IQR)
Probability of length of stay in ICU

Probability of length of stay (Kaplan-Meier) in intensive care unit by grade of gravity AKI.

$\text{Probability of length of stay.}$

$p < 0.0001$
CONCLUSIONS

- Limits
- RIFLE classification
- Large proportion of AKI
- Length of stay
- Great mortality with AKI FAILURE (RRT)
- High risk patients
- Prospective study
THANK YOU