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Background

- Low cardiac output (CO) during cardiac surgery may contribute to renal hypoperfusion and AKI.
- It is challenging to associate intraoperative low CO to renal injury using serum creatinine (it is non-sensitive to injury and its increases are delayed by 24-48 hours after surgery).^{1,2}
- Radial arterial line analysis has become more accurate to continuously assess CO.
- We assessed the relationship between low CO (**Retia Medical**) and urinary neutrophil gelatinase-associated lipocalin (NGAL), a sensitive marker of renal tubular injury.^{3,4}

Methods

- We enrolled 30 patients with preserved left-ventricular ejection fraction undergoing coronary-artery bypass surgery
- Urine samples collected at baseline, after cardiopulmonary bypass, and at intensive care unit (ICU) arrival. Cardiac index (CI) was calculated from continuous arterial waveform analysis that generates CI every five seconds and value of ≤ 2 L/min/m² was used as the threshold for low CI. We used the Meso Scale discovery platform to assess NGAL.

Results (cont.)

- Mean age was 62.7 $\pm$ 8 and 28% female.
- On average, 210 $\pm$ 58 minutes of CI readings were available on each patient. Over 75000 CI measurements were analyzed.
- Mean low CI was 100.1 $\pm$ 73 minutes. **Figure 1** shows log2 NGAL at the three timepoints.
- Mean (SD) change from baseline to ICU arrival was (3.27 $\pm$ 3.89) pg/ml.
- In multivariable regression analysis adjusted for age, sex, and minutes MAP<65mmHg, each 10 minutes of CI <2 L/min/m² was associated with increased change in NGAL (beta 0.2; p=.078, **fig. 2**). There was minimal association between change in serum creatinine and low CI.

Results

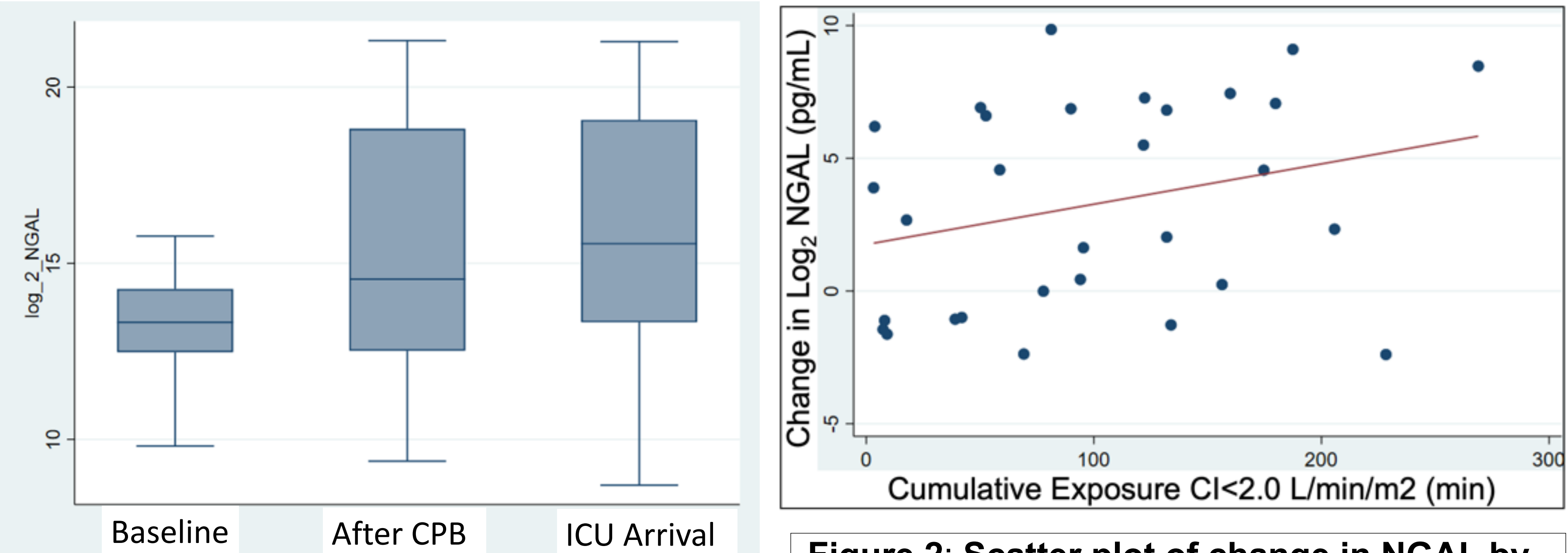


Figure 1: Box plots of log2 NGAL by time show increases from baseline and after cardiopulmonary bypass to ICU arrival.

Figure 2: Scatter plot of change in NGAL by cumulative low CI. Low CI is associated with change in NGAL (log2) from baseline to ICU arrival.

Conclusions

- Low CO during cardiac surgery appears to be associated with renal tubular injury and can be detected by urinary NGAL.
- This finding was independent of exposure to hypotension (minutes<MAP of 65 mmHg).
- Additional investigations of intraoperative hemodynamics and NGAL are warranted.

References

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3. Albert C, Albert A, Kube J, et al. Urinary biomarkers may provide prognostic information for subclinical acute kidney injury after cardiac surgery. The Journal of thoracic and cardiovascular surgery 2018;155(6). DOI: 10.1016/j.jtcvs.2017.12.056.
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MAIN FINDINGS:

- 1) **Low Cardiac Index was common** in 30 patients with preserved LV ejection fraction during coronary bypass surgery.
- 2) Each 10 minutes of CI <2 L/min/m² was associated with 0.2 increase log2GAL (**beta 0.2; p=.078**), adjusted for arterial hypotension.

