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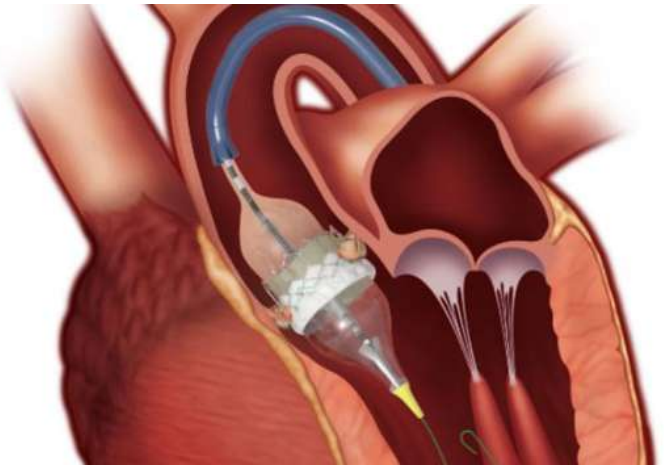
6th Azerbaijan Interventional Cardiology Meeting

December 14, 2024 / 11.00 - 11.30

How important is the choice of contrast media when performing a TAVI procedure? The role of isosmolar contrast media



Dr. Aleksi Surmava
Radiologist
Medical Director
GE HealthCare Pharmaceutical diagnostics
Russia, CIS, Middle East & Africa

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Acute kidney injury (AKI) after transcatheter aortic valve implantation (TAVI) is frequent

- In 2012, the Valve Academic Research Consortium (VARC - 2) standardized the timing for AKI diagnosis, **extending it to 7 days following a TAVI procedure** .
- Despite such definition has become more unified across trials, the reported prevalence based on VARC is still heterogeneous and ranges from ***4.6% to 35.1%***

European Journal of Cardio-Thoracic Surgery 42 (2012) 545–560
doi:10.1093/ejcts/ezs533 Advance Access publication 1 October 2012

ORIGINAL ARTICLE

Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-2 consensus document[†]

Arie Pieter Kappetein*, Stuart J. Head, Philippe Généreux, Nicolo Piazza, Nicolas M. van Mieghem, Eugene H. Blackstone, Thomas G. Brott, David J. Cohen, Donald E. Cutlip, Gerrit-Anne van Es, Rebecca T. Hahn, Ajay J. Kirtane, Mitchell W. Krucoff, Susheel Kodali, Michael J. Mack, Roxana Mehran, Josep Rodés-Cabau, Pascal Vranckx, John G. Webb, Stephan Windecker, Patrick W. Serruys and Martin B. Leon

VARC - 2

VARC - 3

AKI after TAVI is associated with adverse outcomes and mortality

A meta-analysis including 5971 patients treated with TAVI

has shown that patients with AKI had a significant increase of <u>early and 1- year</u>:

- all-cause and cardiovascular ***mortality***
- myocardial ***infarction***
- life threatening ***bleedings***
- need for transfusions and ***dialysis***

Meta-Analysis > Catheter Cardiovasc Interv. 2015 Sep;86(3):518-27. doi: 10.1002/ccd.25867. Epub 2015 Feb 17.

Impact of postoperative acute kidney injury on clinical outcomes after transcatheter aortic valve implantation: A meta-analysis of 5,971 patients

Giuseppe Gargiulo [1], Anna Sannino [1], Davide Capodanno [2,3], Cinzia Perrino [1], Piera Capranzano [2,3], Marco Barbanti [2], Eugenio Stabile [1], Bruno Trimarco [1], Corrado Tamburino [2,3], Giovanni Esposito [1]

Eur Heart J Suppl. 2020 Mar 29;22(Suppl E):E148–E152. doi: 10.1093/eurheartj/suaa061

Transcatheter aortic valve implantation: how to decrease post-operative complications

Claudia Ina Tamburino [1,2], Marco Barbanti [1], Corrado Tamburino [1,2]

AKI after TAVI: Contrast Media role

- In spite of its potential to induce acute tubular necrosis, to date the exact role played by the toxicity of CM in the pathogenesis of AKI is **not well described**.

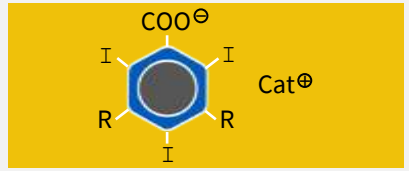
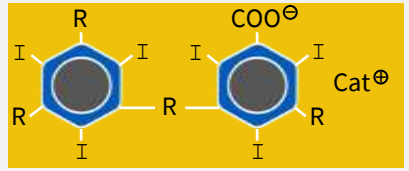
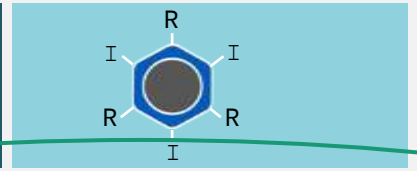
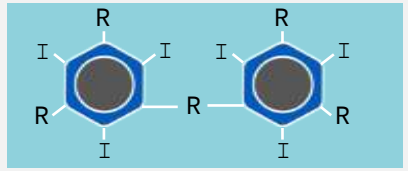
- The ratios of:
  - CM volume x serum creatinine (SCr)/body weight 2.7,
  - CM volume/creatinine clearance (CrCl) >3.7
  - CM volume/estimated glomerular filtration rate (eGFR) >3.9,

  could be considered **threshold values to predict the risk of CIN.**

- Tamburino et al. have recently suggested the **choice of a non-ionic and iso-osmolar contrast medium (IOCM)**

How did the structure of iodine-based CM evolve?

While the basic form of x-ray CM is an iodinated benzene ring, agents differ in the structure of their side chains[1,2]

			Molecule	Osmolality*[3]	Iodine/ molecule
Ionic	1950s HOCM	**Monomer** diatrizoate iothalamate metrizoate		High (5-8 times higher vs blood)	3/2
	1980s LOCM	**Dimer** ioxaglate		Low (2-3 times higher vs blood)	6/2
Non-ionic	1980s LOCM	**Monomer** iohexol iopamidol ioversol		Low (2-3 times higher vs blood)	3/1
	1990s IOCM	**Dimer** iodixanol		Equal to blood	6/1

- If a contrast molecule contains only one benzene ring it is called a monomer
- To deliver more iodine with each molecule of contrast, two benzene rings may be combined to produce a dimer
- However, only non-ionic dimers increase the number of iodine atoms per molecule (6/1) whereas ionic dimers dissociate in solution, resulting in two non-ionic monomers (6/2)

CM: contrast media
HOCM: high osmolar CM
IOCM: isosmolar CM
LOCM: 'low' osmolar CM

1. Jakobsen JA. Eur J Radiol 2007; 62(Suppl.): s14-25.
2. Aspelin P. Eur Radiol Suppl 2006; 16(Suppl.4): D22-27.

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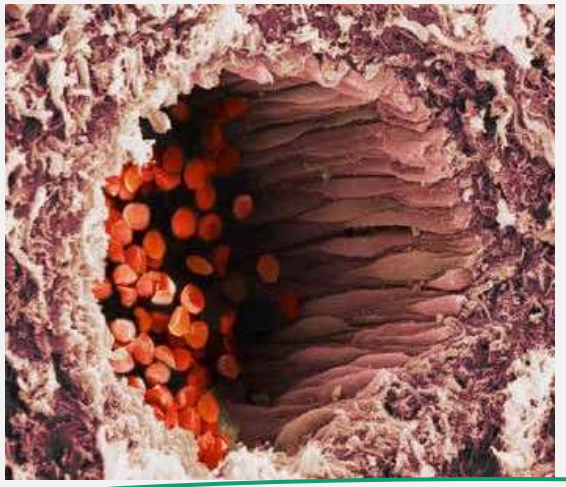
How does osmolality affect endothelial cells?

Another factor that may affect the microcirculation downstream of contrast injection is the impact of CM on capillary endothelial cells[1,2]



- Buckling of endothelial cells
- Narrowing of the free vascular lumen
- Potential to impede capillary blood flow
- **In addition, damage to endothelial cells may result in their loss of function[2]**

Isosmolar CM may help to minimise impact on endothelial cells[1-3]

Endothelial damage	*In vitro* results
Buckling of cells	Greater distortion with iomeprol, iopromide and ioxaglate than with isosmolar iodixanol[1,3]
Cell detachment	Greater cell loss with iomeprol than with isosmolar iodixanol[2]
Exposure of subendothelial matrix	More denuded areas with iomeprol and ioxaglate than with isosmolar iodixanol[2,3]

CM: contrast media

1. Franke RP *et al.* Microvasc Res 2008; 76(2): 110-13.
2. Franke RP *et al.* Clin Hemorheol Microcirc 2011; 48(1): 41-56.
3. Barstad RM *et al.* Acta Radiol 1996; 37(6): 954-61.

AKI after TAVI: Contrast Media role

Contents lists available at ScienceDirect

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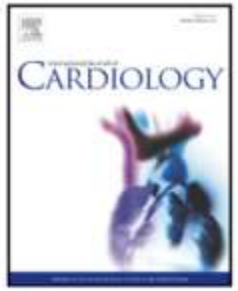


Impact of contrast medium osmolality on the risk of acute kidney injury after transcatheter aortic valve implantation: insights from the Magna Graecia TAVI registry☆

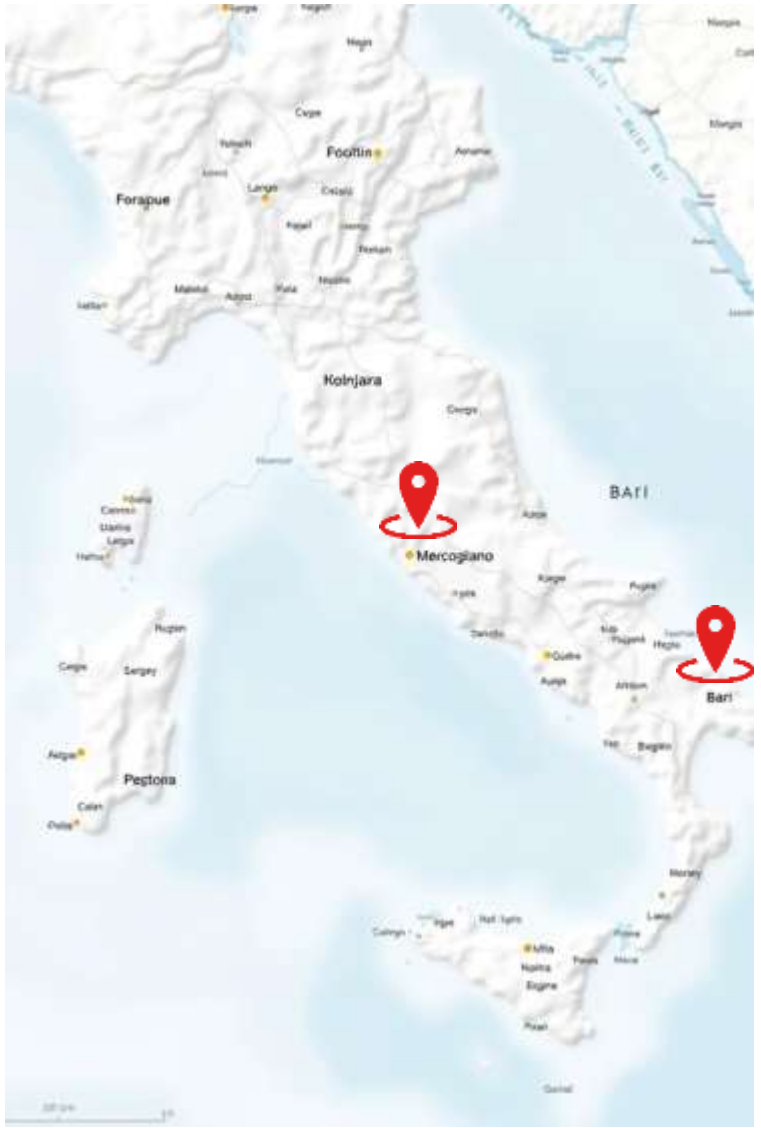
Fortunato Iacovelli [a,*], Antonio Pignatelli [b], Alessandro Cafaro [c], Eugenio Stabile [d], Luigi Salemme [e], Angelo Cioppa [e], Armando Pucciarelli [e], Francesco Spione [a], Francesco Loizzi [a], Emanuela De Cillis [f], Vincenzo Pestrichella [g], Alessandro Santo Bortone [f], Tullio Tesorio [e], Gaetano Contegiacomo [b]

Int J Cardiol. 2021 Apr 15:329:56-62. doi: 10.1016/j.ijcard.2020.12.049. Epub 2020 Dec 25.

Study population

This multicentric observational study:

- Policlinico University Hospital of Bari
- “Santa Maria” Clinic of Bari
- “Montevergine” Clinic of Mercogliano



Contrast Media Used

The choice of the type of CM to be used for the procedure was institution- and physician dependent; the CM were:

IOCM group (n = 370)

- iodixanol (Visipaque)

LOCM group (n = 327).

- iopromide (Ultravist)
- iobitridol (Xenetix)
- iohexol (Omnipaque)
- iomeprol (Iomeron)

The amount of CM was recorded during all TAVI procedures. According to the previous investigations, the CM volume x SCr/body weight, CM volume/CrCl and CM volume/eGFR ratios were used to evaluate the degree of CM dose in individual

AKI definition

AKI was defined as stage 1, 2 or 3 by AKI Network from the SCr- and urine output (UO)-based criteria

- stage 1: increase in SCr of 150–199% (1.5–1.99 × increase compared with baseline) or increase of ≥0.3 mg/dL (≥26.4 mmol/L) or UO < 0.5 mL/kg/h for >6 h but <12 h
- stage 2: increase in SCr of 200–299% (2.0–2.99 × increase compared with baseline) or UO < 0.5 mL/kg/h for > 12 h but < 24 h
- stage 3: increase in SCr of ≥300% (>3 × increase compared with baseline) or SCr of ≥4.0 mg/dL (≥354 mmol/L) with an acute increase of at least 0.5 mg/dL (44 mmol/L) or UO < 0.3 mL/kg/h >24 h or anuria for >12 h

Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury

Ravindra L Mehta ✉, John A Kellum, Sudhir V Shah, Bruce A Molitoris, Claudio Ronco, David G Warnock, Adeera Levin & the Acute Kidney Injury Network

AKI outcomes

- ***AKI patients exhibited higher bleedings***, ***transfusions*** and new-onset **atrial fibrillation (*AF*)** or ***flutter*** rates.

- Besides a ***longer*** hospital stay observed in AKI patients

- the occurrence of AKI was associated with a worse outcome: lower **early safety** and higher ***periprocedural*** and ***1-year mortality*** were observed in the AKI group.

Significantly Lower incidence of AKI with IOCM

F. Iacovelli, A. Pignatelli, A. Cafaro et al.

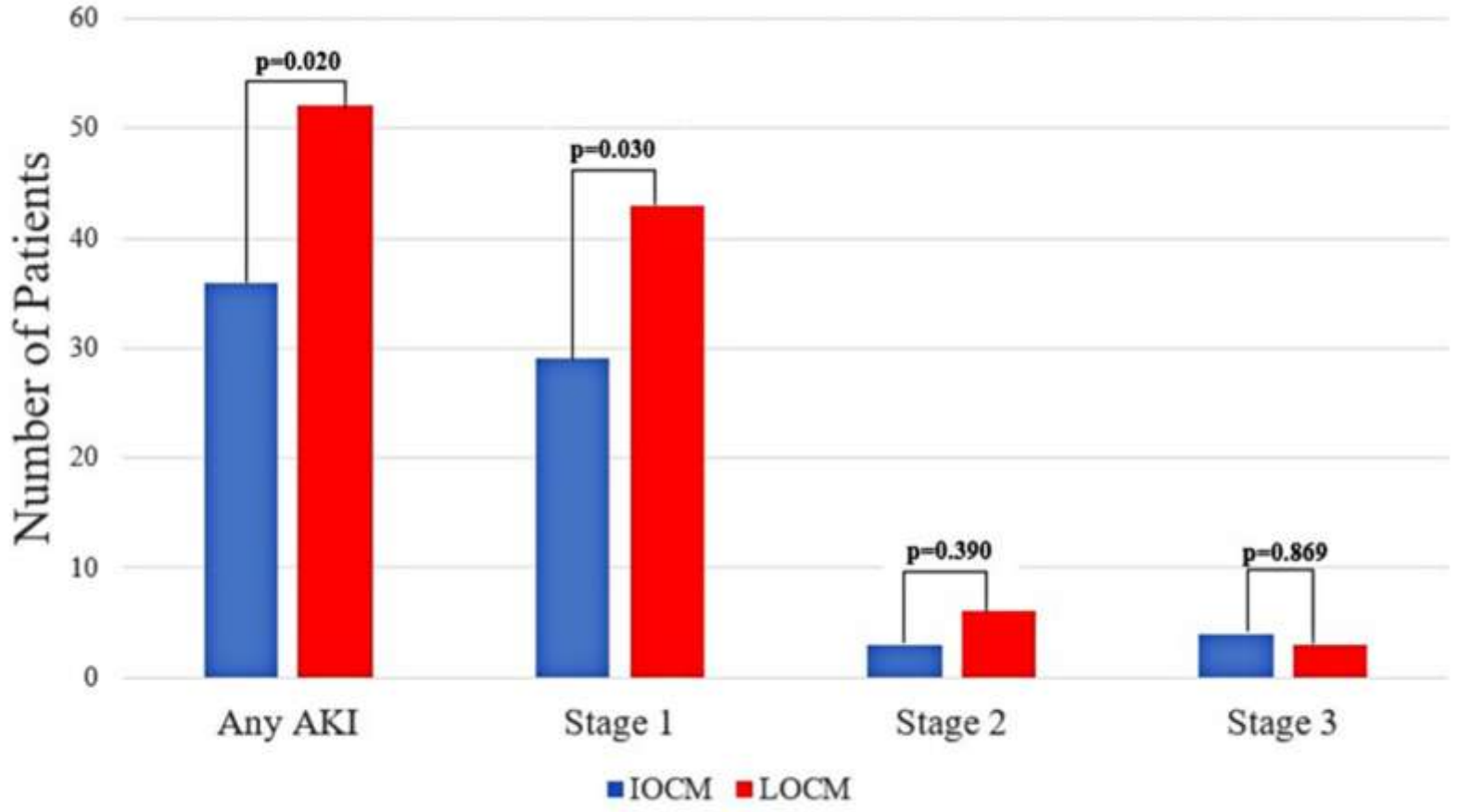
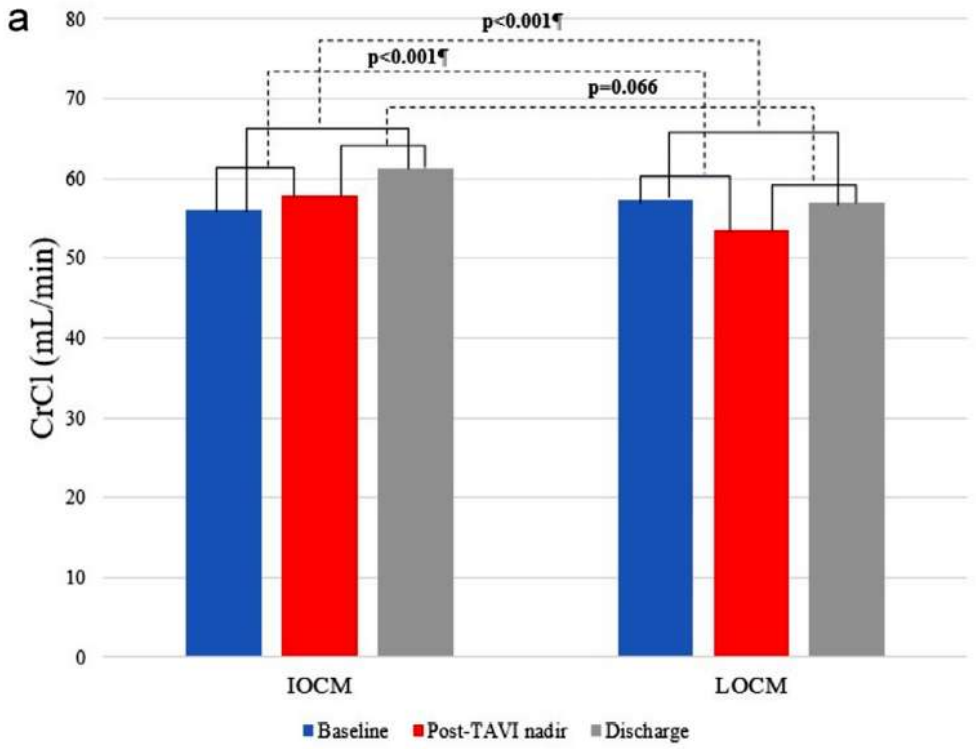
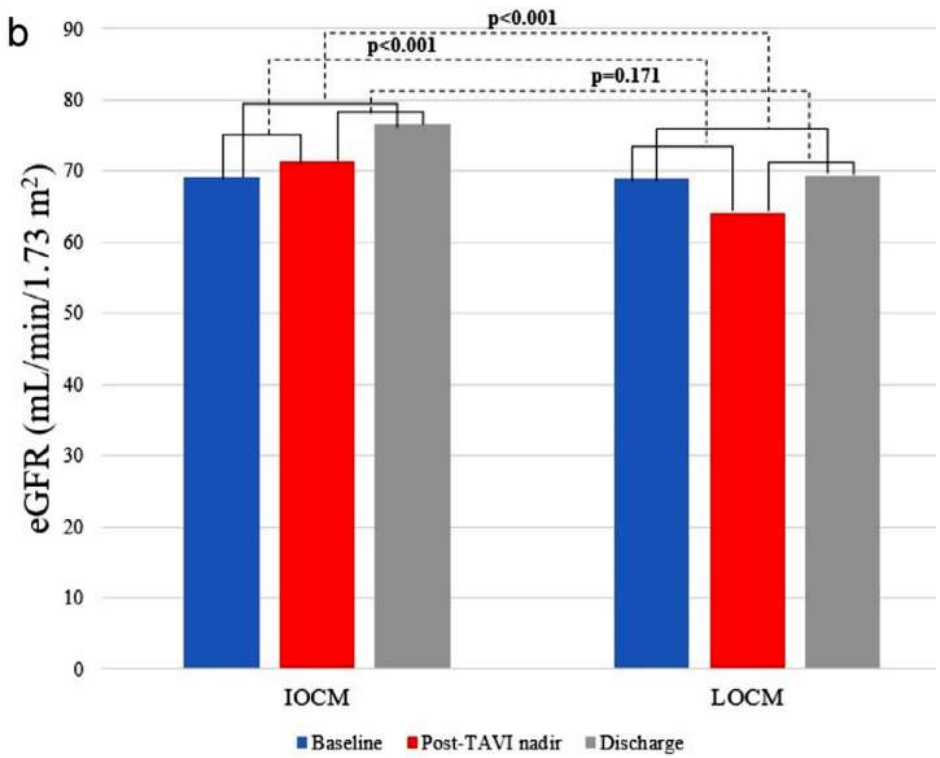


Fig. 1. AKI incidence based on CM osmolality. AKI = acute kidney injury; IOCM = iso-osmolar contrast medium; LOCM = low-osmolar contrast media.

Significant impact of IOCM on CrCl & eGFR





Within 48 h from IOCM administration, SCr even decreased and consequently mean CrCl and eGFR increased from baseline values; conversely for patients receiving LOCM, SCr increased and mean CrCl and eGFR reduced from baseline values: such differences were statistically significant for all ($p < 0.001$)

Contrast Media & 1 year mortality

- multivariable analysis, **LOCM usage was found to be an independent predictor of 1-year mortality**

- other independent predictors were baseline anemia

Lower incidence of AKI with ICOM

- AKI was significantly less frequent in the IOCM group than in the LOCM group in patients **younger than 85 years, without diabetes, anemia, coronary artery disease (CAD) history, severe renal impairment, chronic or persistent AF, moderately-to-severely depressed left ventricular ejection fraction (LVEF)**

Lower incidence of AKI with ICOM

- AKI incidence was significantly lower in the IOCM group than in the LOCM group in patients **undergoing TAVI through transfemoral route without orotracheal intubation, and in patients who received lower corrected amounts of CM and consequently with lower Mehran score**

Lower incidence of AKI with ICOM

- post-TAVI, the incidence of AKI among patients who **did not experienced any bleeding and transfusion, any vascular complication and with trivial-to-mild residual aortic regurgitation** was significantly lower for those ones receiving IOCM compared with that for patients receiving LOCM

Conclusion

- The use of **IOCM have a favorable impact** on renal function with respect to LOCM.
- LOCM administration is an independent predictor of both **AKI and 1-year mortality**.

In the wake of the current trend, TAVI will be indicated in less and less aged patients as well as increasingly poorer in comorbidities, and therefore with ever lower surgical risk.

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Thank you very much for your attention!

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Dr. Aleksi Surmava
Radiologist
Medical Director PDx
Russia, CIS, Middle East & Africa
Aleksi.Surmava@gehealthcare.com