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MANAGEMENT OF PATIENTS WITH CKD STAGE 3B AND CKD STAGE 4 IN PREPARATION FOR CORONARY ANGIOGRAPHY OR PCI

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Introduction: Chronic kidney disease (CKD) stages 3b–4 (eGFR <45 mL/min/1.73 m²) significantly complicate the management of patients with ischemic heart disease (IHD), increasing the risk of contrast-induced nephropathy (CIN), bleeding complications, cardiovascular events, and in-hospital mortality. At the same time, there is a high need for invasive assessment of the coronary vasculature and performance of percutaneous coronary interventions (PCI) in this patient population.

The aim of this article is to summarize the key principles of preparation and management of patients with CKD stages 3B–4 who are scheduled for coronary angiography (CAG) and PCI, with an emphasis on minimizing renal and hemorrhagic risks.

1. Baseline Risk Assessment and Stratification

1.1. Determination of CKD Stage

- Estimation of eGFR (CKD-EPI, MDRD) is mandatory before planned coronary angiography (CAG) or percutaneous coronary intervention (PCI).
- CKD stage 3B corresponds to eGFR 30–44 mL/min/1.73 m²;

CKD stage 4 corresponds to eGFR 15–29 mL/min/1.73 m².

- It is essential to assess serum creatinine dynamics, the presence of proteinuria, and any history of acute kidney injury (AKI) episodes.

1.2. Additional Risk Factors for CIN and Adverse Outcomes

- advanced age, type 2 diabetes mellitus, arterial hypertension;
- heart failure (especially reduced left ventricular ejection fraction), hypotension;
- anemia, hypovolemia, use of nephrotoxic agents and RAAS inhibitors;
- multivessel coronary artery disease and anticipated contrast volume.

Existing contrast-induced nephropathy (CIN) risk scores (e.g., Mehran score) are recommended for quantitative assessment of post-procedural AKI risk.

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2. Medication Adjustment Prior to the Procedure

2.1. Nephrotoxic Drugs

Where possible, 24–48 hours before elective CAG/PCI:

- discontinue NSAIDs and COX-2 inhibitors;
- in high CIN risk patients with stable hemodynamics, consider temporary withdrawal of ACE inhibitors/ARBs and high-dose diuretics (especially in the presence of hypotension or hypovolemia);
- avoid combinations of nephrotoxic antibiotics and repeated contrast studies in a short time frame.

2.2. Antihyperglycemic Therapy

- **Metformin:** in patients with eGFR <45 mL/min/1.73 m², current guidelines recommend temporary discontinuation 24–48 hours before and after contrast exposure due to the risk of lactic acidosis in case of AKI;
- **SGLT2 inhibitors:** reduced efficacy at eGFR <30 mL/min/1.73 m²; in many cases, temporary discontinuation on the day of the procedure is advised.

2.3. Antithrombotic Therapy

- Antiplatelet therapy (aspirin, P2Y12 inhibitors) should be continued according to standard indications, with consideration of increased bleeding risk in advanced CKD;
- anticoagulant dosing (UFH, LMWH, fondaparinux, bivalirudin) must be strictly adjusted according to renal function. LMWH requires dose modification, while unfractionated heparin is preferred in severe CKD with aPTT monitoring.

3. Prevention of Contrast-Induced Nephropathy

3.1. Hydration

The cornerstone of prevention:

- isotonic saline (0.9% NaCl) at 1–1.5 mL/kg/h for 3–12 hours before and 6–12 hours after the procedure in patients without volume overload;
- in heart failure patients, infusion rate should be individualized and monitored (CVP, clinical status, lung ultrasound);
- oral hydration is not equivalent but may be used as an adjunct.

3.2. Contrast Media

- use low- or iso-osmolar contrast agents;

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- minimize total contrast volume (generally ≤3–4 mL/kg or ≤1–1.5 × eGFR in high-risk CKD);
- avoid repeated contrast exposure within 48–72 hours.

3.3. Pharmacologic Prophylaxis

- the benefit of N-acetylcysteine remains controversial; it may be considered as an adjunct but not a substitute for hydration;
- routine use of other agents (theophylline, dopamine, "renoprotectors") is not recommended.

4. Technical Aspects of CAG and PCI in CKD Stage 3B–4

4.1. Access and Technique

- radial access is preferred due to lower bleeding risk; femoral access may be used with meticulous hemostasis when necessary;
- "as few as possible contrast" strategy should be applied, relying on operator experience and pre-existing imaging;
- in complex multivessel disease, revascularization strategy (PCI vs CABG) should be determined by a Heart Team, considering CKD stage and overall prognosis.

4.2. Stent Selection and Revascularization Strategy

- modern drug-eluting stents (DES) are widely used in CKD patients;
- duration of dual antiplatelet therapy (DAPT) may be shortened in high bleeding risk patients;
- in patients with high ARC-HBR or HAS-BLED scores, abbreviated DAPT (1–3 months) followed by single antiplatelet therapy may be considered according to current guidelines.

5. Post-PCI Management: Monitoring and Therapy Adjustment

5.1. Laboratory Monitoring

- serum creatinine and eGFR: baseline, at 24–48 hours, and at 72 hours in high-risk patients;
- electrolytes, glucose, hemoglobin, coagulation profile as clinically indicated;
- CIN is defined as an increase in creatinine ≥44 μmol/L or ≥25% from baseline within 48–72 hours after contrast exposure.

5.2. Drug Therapy Adjustment

- in case of AKI/CIN: discontinue or adjust nephrotoxic and renally excreted drugs (NSAIDs, some antibiotics, metformin, MRAs, etc.);
- reassess anticoagulant and antiarrhythmic dosing based on updated renal function;
- ACE inhibitors/ARBs, diuretics, and other agents should be reintroduced after stabilization of renal and hemodynamic status.

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5.3. Complication Monitoring

- early detection of volume overload and heart failure (dyspnea, edema, lung ultrasound, echocardiography);
- bleeding surveillance (access site, gastrointestinal, intracranial signs, hemoglobin monitoring);
- adjustment of antithrombotic therapy if necessary (shortened TAT, transition to DAPT or monotherapy).

6. Cardiologist–Nephrologist Collaboration

- multidisciplinary management is essential for patients with CKD stages 3B–4 undergoing CAG/PCI;
- pre-procedural agreement on hydration strategy, AKI management plan, and medication adjustments is required;
- in CKD stage 4 and borderline eGFR (~15 mL/min/1.73 m²), the potential need for temporary dialysis in case of severe CIN/AKI should be considered.

Conclusion

Management of patients with CKD stages 3B–4 undergoing coronary angiography and PCI requires comprehensive risk assessment, careful preparation, and close multidisciplinary collaboration. Key elements include accurate stratification of renal and bleeding risk, optimization of pharmacotherapy before intervention, adequate hydration with minimization of contrast volume, careful selection of antithrombotic strategies, and intensive post-procedural monitoring. Adherence to these principles reduces the incidence of contrast-induced nephropathy, bleeding, and other complications while preserving the proven benefits of invasive coronary strategies in high cardiovascular risk patients.

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