

Percutaneous Coronary Intervention in Comorbid Patients with Diabetes Mellitus, Chronic Kidney Disease, and Liver Cirrhosis: Clinical Aspects, Strategy, and Recommendations

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Abstract

The combination of diabetes mellitus (DM), chronic kidney disease (CKD), and liver cirrhosis creates a high-risk setting for percutaneous coronary intervention (PCI). This article summarizes current literature and clinical experience, outlining preoperative assessment, interventional strategy, antithrombotic management, measures to reduce contrast-induced nephropathy (CIN), and post-procedural care algorithms. Practical recommendations are provided to support a multidisciplinary approach and decision-making within the Heart Team.

Keywords: PCI, diabetes mellitus, chronic kidney disease, liver cirrhosis, antithrombotic therapy, contrast-induced nephropathy, multidisciplinary approach.

Introduction

The growing number of patients with multiple comorbidities increases the frequency of clinical situations requiring decisions on revascularization. DM, CKD, and liver cirrhosis each independently worsen PCI outcomes; in combination, they necessitate an individualized approach to minimize both cardiac and non-cardiac complications.

Pathophysiological Features of Comorbidities

Diabetes Mellitus: Accelerated atherosclerosis, diffuse coronary artery disease, endothelial dysfunction, increased thrombogenicity, and impaired healing after stenting.

Chronic Kidney Disease: Reduced glomerular filtration rate (GFR) increases the risk of contrast-induced nephropathy (CIN), electrolyte imbalance, and a dual risk of thrombosis and bleeding. Dialysis patients have specific risks and outcome profiles.

Liver Cirrhosis: A combination of coagulopathy (reduced synthesis of clotting factors), thrombocytopenia, portal hypertension, and “rebalanced” hemostasis—leading to both increased bleeding and thrombosis risks; higher susceptibility to infections and drug toxicity.

Preoperative Assessment and Preparation

1. **Multidisciplinary evaluation:** cardiologist, interventional cardiologist, nephrologist, hepatologist, anesthesiologist, hematologist.
2. **Risk assessment:** GFR, creatinine, urea; glycated hemoglobin (HbA1c), glucose levels; coagulation profile (INR, APTT), platelet count, albumin, bilirubin; liver function scores (Child-Pugh, MELD); anemia and iron status.
3. **Optimization:** glycemic control (individual HbA1c targets), correction of anemia and thrombocytopenia if needed, coagulation factor replacement when indicated, discontinuation of nephrotoxic drugs.
4. **Access and contrast planning:** radial vs femoral access; contrast volume minimization; hydration strategy and potential dialysis planning.

Interventional Strategy

- **Access:** Radial access is preferred to reduce bleeding risk when anatomically feasible.
- **Revascularization strategy:** Individualized; in multivessel diabetic patients, consider CABG in cases of complex anatomy and low functional reserve. For PCI, use modern drug-eluting stents and optimize technique.
- **Contrast minimization:** Low-contrast protocols, pre- and post-procedural hydration (isotonic solutions), use of adjunct imaging (IVUS, OCT, FFR) when feasible with reduced contrast load, urine output monitoring.
- **Intraprocedural anticoagulation:** Standard weight-adjusted unfractionated heparin; bivalirudin may be considered in patients with high bleeding risk. Personalization is essential.

Antithrombotic Therapy After PCI

Balancing thrombosis and bleeding risk is critical:

- Dual antiplatelet therapy (DAPT: aspirin + P2Y12 inhibitor) remains standard, but duration and agent selection must be individualized.
- In high bleeding risk patients (cirrhosis, thrombocytopenia, elevated INR), shortened DAPT (e.g., 1–3 months) followed by monotherapy may be appropriate.
- Clopidogrel is often preferred over prasugrel/ticagrelor in cirrhotic patients due to bleeding profile, although its efficacy may be reduced in diabetics—requiring monitoring.
- Platelet function testing or genotyping may be helpful in selected cases.
- Consultation with hematology and hepatology is essential in significant hemostatic disorders.

Prevention and Management of CIN

• Hydration before and after PCI (0.9% NaCl 1–1.5 ml/kg/h for 6–12 hours, adjusted in heart failure).

- Minimize contrast volume; use iso- or low-osmolar contrast agents.
- Monitor creatinine at 24–72 hours post-procedure.
- Early nephrology involvement if renal function worsens.
- In dialysis patients, coordinate timing with dialysis sessions.

Postoperative Care

• Close monitoring for bleeding, hemoglobin levels, and platelet count.

• Strict glycemic control (insulin therapy if needed).

• Correction of coagulopathy and transfusion support when indicated.

• Infection prevention, early mobilization, cardiac rehabilitation, and management of heart failure.

• Follow-up plan: early visits (1–4 weeks), ECG/echocardiography and lab monitoring, long-term secondary prevention.

Outcomes and Prognosis

Evidence suggests increased perioperative and long-term mortality in patients with DM and CKD, while cirrhosis increases short-term risks of bleeding and infection. The choice of revascularization strategy (PCI vs CABG vs conservative treatment) should be based on coronary anatomy, cardiac function, comorbidity severity, and patient preferences.

Practical Decision-Making Algorithm

1. Assess coronary anatomy (coronary angiography) and symptom severity.
2. Conduct multidisciplinary Heart Team discussion.
3. Optimize metabolic and hematologic status before intervention if possible.
4. If PCI is chosen: plan radial access, minimize contrast, tailor anticoagulation and DAPT.
5. Establish a clear post-procedural monitoring and support plan for renal and hepatic function.

Limitations and Future Directions

There is a lack of large randomized trials specifically focused on patients with concurrent DM, CKD, and cirrhosis. Prospective studies are needed to define optimal DAPT duration, contrast minimization strategies, and peri-procedural management of coagulopathy.



Conclusion

PCI in patients with combined diabetes mellitus, chronic kidney disease, and liver cirrhosis is a complex clinical challenge requiring individualized planning and a multidisciplinary approach. Key principles include thorough preoperative assessment, minimization of contrast exposure, tailored antithrombotic therapy, and intensive post-procedural monitoring. Decisions regarding revascularization should be made within a Heart Team, including nephrologists and hepatologists.

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