LEWIS KATZ SCHOOL OF MEDICINE

AI-Enabled Fractional Flow Reserve Derived From Coronary CT Angiography: Real-World Impact on Downstream Care and Clinical Outcomes

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Intro

- Coronary CT angiography (CCTA) is a first-line noninvasive test for suspected coronary artery disease.
- Anatomic stenosis on CCTA does not always reflect physiologically significant ischemia.
- AI-enabled fractional flow reserve derived from CCTA (FFR-CT) provides functional assessment without an invasive procedure.
- The real-world impact of adjunctive FFR-CT on downstream care and outcomes remains incompletely defined.

Study Aim

To evaluate whether adjunctive AI-enabled FFR-CT after CCTA was associated with differences in downstream invasive management and clinical outcomes compared with CCTA alone.

Methods

- FFR-CT defined as CPT 75580 within 7 days of CCTA Excluded patients with: Recent myocardial infarction, Angina, Prior coronary revascularization
- Performed 1:1 propensity score matching Balanced demographics and clinical covariates
- Groups were stratified by baseline renal function with normal as an eGFR ≥60 mL/min/1.73 m² and reduced function as an eGFR ≤59 mL/min/1.73 m²
- Outcomes assessed at 30 and 90 days included: Invasive coronary angiography, revascularization, myocardial infarction, acute kidney injury (AKI), and Bleeding (downstream clinically significant hemorrhage identified by diagnosis codes such as I97.62 or R58)
- All-cause mortality was assessed at 1-year

Figure 1

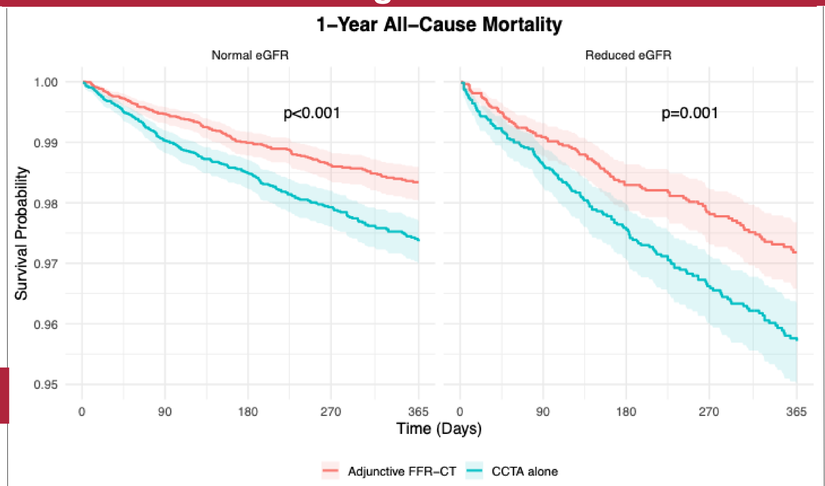

Figure 1: Kaplan–Meier survival through 1 year for patients undergoing CCTA with adjunctive FFR-CT versus CCTA alone, shown separately for normal and reduced-eGFR strata.

Figure 2

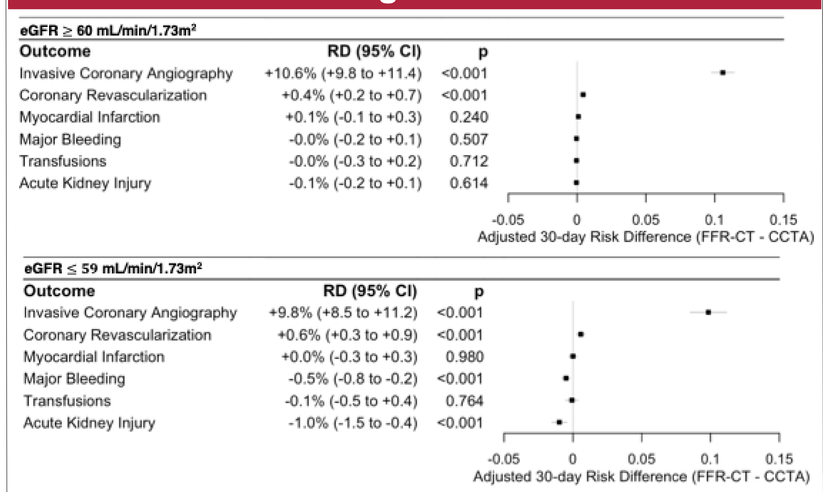

Figure 2: Risk differences adjusted and stratified by baseline eGFR 30-day for downstream utilization and safety outcomes comparing FFR-CT against CCTA alone.

Results

- A total of 403,874 eligible patients were identified. After matching and renal stratification, the normal-eGFR stratum included 13,559 patients per cohort and the reduced-eGFR stratum had 5,645 patients per cohort.
- For normal renal function, FFR-CT was associated with higher rates of invasive coronary angiography at both 30 days (RD 10.6%, p<0.001) and 90 days (RD 13.5%, p<0.001)
- Revascularization remained selective, with higher 30 and 90-day rates in for the FFR-CT cohorts (both p<0.001)
- At 30 days, there were no significant differences for myocardial infarction, AKI, or adverse bleeding outcomes (all p>0.05)
- Among patients with reduced renal function, FFR-CT was associated with lower short-term safety events for bleeding (RD −0.5%, p<0.001) and AKI (RD −1.0%, p<0.001)
- FFR-CT was associated with decreased all-cause mortality at 1-year in both renal-function strata: normal eGFR RD −0.6% (95% CI −0.9 to −0.3; p<0.001) and reduced eGFR RD −1.0% (95% CI −1.6 to −0.4; p=0.001)

Discussion

- FFR-CT was associated with altered downstream care pathways after CCTA. Use of FFR-CT was linked to more invasive angiography.
- Revascularization remained selective, suggesting improved physiologic triage rather than indiscriminate intervention.
- Safety outcomes were favorable, particularly in patients with reduced renal function. Lower AKI and bleeding in reduced-eGFR patients support a potential clinical benefit in higher-risk populations.
- Lower 1-year mortality across both renal-function strata reaffirms FFR-CT as an effective physiologic gatekeeper.
- Limitations of this study include its retrospective design and possible residual confounding.

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