ORIGINAL RESEARCH

# A Single-Center Study Using IVUS to Guide Rotational Atherectomy for Chronic Renal Disease's Calcified Coronary Artery

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**Objective:** To assess the effectiveness and safety of an IVUS-guided rotational atherectomy (RA) percutaneous coronary intervention (PCI) in chronic renal patients with complex coronary calcification who are at risk for contrast-related acute kidney injury (AKI).

**Methods:** From October 2018 to October 2021, 48 patients with chronic renal disease who were receiving PCI with RA at the General Hospital of NingXia Medical University were informed for data collection for this research. They were randomly assigned to the IVUS-guided RA group and the Standard RA group, which did not use IVUS. According to a clinical expert consensus document on rotational atherectomy in China, both PCI procedures were performed. The intravascular ultrasound (IVUS) results from the study group were used to describe the morphology of the lesion and to guide the selection of burrs, balloons, and stents. IVUS and angiography were used to evaluate the outcome in the end. IVUS-guided RA PCI and Standard RA PCI groups' effects and results were contrasted.

**Results:** There were no appreciable differences in the clinical baseline characteristics between the IVUS-guided RA PCI group and the Standard RA PCI group. The average estimated glomerular filtration rate (eGFR) of two groups was $(81.42 \pm 20.22$ vs $82.34 \pm 22.19)$ mL/min/1.73 m$^2$. Most of them (45.8% vs 54.2%) was in stage 60–90 mL/min/1.73m$^2$. When compared to the standard RA PCI group, RA in IVUS-Guided group was more performed electively (87.5% vs 58.3%; p = 0.02). The IVUS-guided RA PCI group was associated with shorter fluoroscopy time $(20.6 \pm 8.4$ vs $36 \pm 22$; p<0.01) and less contrast amount $(32 \pm 16$ vs $184 \pm 116$mL; p<0.01) than Standard-RA group. Five patients in the Standard RA PCI group developed contrast-induced nephropathy, which was 5 times than the IVUS-guided RA PCI group (20.8% VS 4.1%; p=0.19).

**Conclusion:** In chronic renal patients with complex coronary calcification, an IVUS-guided RA PCI technique is effective and safe. It can also lower the volume of contrast and perhaps the incidence of contrast-related AKI.

**Keywords:** rotational atherectomy, chronic renal disease, contrast-associated acute kidney injury, intravascular ultrasound

## Introduction

Atherosclerosis and the calcification of the coronary arteries have both been found to progress more quickly in individuals with chronic kidney disease (CKD).[1] Since its introduction more than 20 years ago, the rotational atherectomy (RA) technique has become increasingly popular for the treatment of severely calcified coronary lesions.[2–4] The technically challenging procedure known as percutaneous coronary intervention (PCI) of severely calcified coronary lesions is typically linked with a high contrast volume consumption, which raises the risk of contrast-related acute renal injury.[5]

The increased utilization of intravascular ultrasonography has contributed to the rise in the incidence of RA (IVUS).[6–8] IVUS-guided rotational atherectomy (RA) percutaneous coronary intervention (PCI) in patients with complex coronary calcification who already had CKD is supported by a smaller number of studies.[9–11]

In order to evaluate the efficacy and safety of the procedure, the purpose of this research is to compare IVUS-guided RA PCI with standard-RA PCI in patients with CKD who have complicated calcified coronary lesions and a serious potential for contrast-related AKI.

## Methods
### Patient Selection
The data for this study came from a collection of 48 chronic renal patients who underwent PCI with RA at the General Hospital of NingXia Medical University between the months of October 2018 and October 2021. They were randomly split up into two groups after being separated. The first group consisted of 24 patients and was treated with standard RA without IVUS. The second group consisted of 24 patients and was treated with IVUS-guided RA. Both PCI procedures were carried out in accordance with the clinical expert consensus document on atherectomy rotational in China.[12] Mild, moderate, severe, or kidney failure (according to the Kidney Disease: Improving Global Outcomes guideline, these stages are referred to as G2-G5). According to the modification of diet in renal disease equation, patients who had an estimated glomerular filtration rate (eGFR) of less than 90 mL/min/1.73m$^2$ were all considered to be at a high risk for contrast-related acute kidney injury (AKI), or a previous history of acute kidney injury caused by contrast (AKI), which is defined as an increase in serum creatinine of 0.5 mg/dl or 25% over baseline that occurs between 48 and 72 hours after being exposed to iodinated contrast media).[13–15]

Patients with chronic total occlusion (CTO), acute coronary syndrome with ST-elevation, or cardiogenic shock were excluded from this study. The ethical committee of the General Hospital of Ningxia Medical University gave their stamp of approval to the collection and use of the data after receiving written consent from each patient (KYLL-2021-498). The principles outlined in the Declaration of Helsinki were adhered to throughout the course of the research.

## Procedure of IVUS-Guided RA PCI and Standard RA PCI
In order to reduce the risk of contrast-related acute kidney injury (AKI), PCI was performed as soon as possible after the diagnostic angiography in stable patients who had chronic coronary syndrome, and it was performed 48 hours later in stable patients who had non-ST-elevation acute coronary syndrome. Every single patient received the appropriate amount of hydration. Access through either the radial or the femoral artery was chosen by the operator depending on the peripheral vascular conditions. Systematic echocardiography was performed both before and after the PCI procedure in order to look for any pericardial effusion. After the decision to perform PCI was made, patients were given a loading dose of a P2Y12 inhibitor orally (either Clopidogrel 600 mg or Ticagrelor 180 mg), along with aspirin (300 mg). Intraprocedural anticoagulation was accomplished with a dose of unfractionated heparin that was set at 100 U/kg in order to maintain an active clotting time (ACT) that was greater than 250 seconds. During PCI, the previous angiography was shown as needed for procedural direction. On the basis of the prior diagnostic angiography without contrast injection, workhorse wire manipulation and guiding catheter placement were completed.

Before deciding whether to use a burr, balloon, or stent, the IVUS-guided RA PCI group performed a baseline IVUS to analyze the morphology of the lesion, as well as the distribution of calcium throughout the vessel. The length of the stent was determined by taking the distance between the two reference points into account. The use of small burrs (burrs measuring 1.25 or 1.5 mm) is recommended for IVUS lesions that cannot be crossed. The operator could choose either 1.25- or 1.5-mm burrs at their own discretion. After that, imaging data from the IVUS would be collected. During the IVUS pullback, the lesion limits were determined by comparing the IVUS data to the position of the catheter as seen on fluoroscopy. In the group that received IVUS guidance for RA PCI, contrast was only administered before and after the procedure. Baseline angiography was performed in different views showing the target lesion for the Standard RA PCI group. This was done to avoid foreshortening and overlap by visual estimation, which is why IVUS examination was not performed. Depending on the findings of the IVUS or previous angiographic procedures, RA was either performed as a planned strategy or as a bailout choice in situations involving lesions that could not be crossed or deleted. The micro-catheter was moved forward over the workhorse guide wire in order to make room for a wire exchange using the Rota Wire on both of them.

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The equipment known as RotaPro or Rotablator was utilized in the RA procedure (Boston Scientific Scimed Inc, USA). The size of the burr was determined in order to achieve a burr/vessel ratio of 0.5. And 140,000–200,000 revolutions per minute were within RA speed's capabilities. Continuous intracoronary infusion of heparin at a dose of 5000 IU was performed without the use of nitroglycerin or verapamil. During the atherectomy procedure, the patient's symptoms, as well as their heart rate, blood pressure, and ST-segment, were all carefully monitored. Ablation runs were restricted to 20 seconds, and a pecking action, which consisted of a slow push forward and a quick pullback movement of the burr, was the most frequently used technique for burr manipulation in RA. It was essential for effective RA to avoid making a floppy bend in the Rota Wires because doing so significantly increased the amount of friction force that existed between the burr and the Rota Wire. When using non-compliant balloons, balloon pre-dilation was performed with a 1:1 sizing target. The distal part of the treated segment was used as a reference to ensure that the balloon did not become oversized. Before the stent could be implanted, the balloon had to be expanded to its full capacity, and the lesion had to be properly prepared. It was recommended that the patient's balloon be downsized to reduce the risk of dissection in the event that additional pre-dilatation with a modified balloon (scoring/cutting/Lacrosse NSE) was required.

After the lesion was prepared, an IVUS was carried out once more in order to reassess its boundaries and decide whether it should be combined with a myocardial bridge in order to circumvent vascular dissection. After the stent was implanted, IVUS was performed to check for mal-apposition, under-expansion, and edge dissection in the stent, as well as to make sure that the lesion was completely covered. In order to monitor coronary flow and observe any complications such as distal embolization, perforation, or hematoma, the final outcome was evaluated angiographically by minimum dosage contrast injection following PCI and with satisfactory findings from IVUS. This was done in order to determine the ultimate outcome.

## Study Endpoints

Angiographic success was measured by TIMI 3 flow with less than 30% of residual stenosis after the treatment. To determine feasibility and safety, it was necessary to rule out intraprocedural and in-hospital issues such slow/no-flow, coronary perforation, pericardial effusion, peri-procedural death, cardiac arrest, and target vessel revascularization. After PCI, the absence of contrast-related AKI was used to assess the procedure's success. Following PCI, we clinically examined the patients to evaluate renal function and cardiovascular events.

## Statistical Methods

An overview of quantitative variables is provided by their median or mean (inter-quartile range [IQR]). Counts and percentages are used to summarize category variables. Independent variables included age, gender, diabetes mellitus, baseline GFR, and the overall length of stented arteries. There was no calibration. There were a total of 26 patients matched. The Student's *t*-test was used to compare continuously regularly distributed continuous variables, while the Mann–Whitney *U*-test was used for continuously non-normally distributed data. The chi-squared and Fisher's exact tests were used where needed to compare categorical variables. A two-sided 0.05 p value was used to establish statistical significance. Version 24.0 of the propensity score plug-in (version 1) for IBM SPSS, was used to conduct the PSM. Utilizing Stata SE 14, the remaining statistical analysis was carried out (StataCorp LP, Texas, USA).

# Results

## Baseline Clinical Characteristics

Forty-eight patients were included at General Hospital of NingXia Medical University with chronic renal disease who were undergoing PCI with RA from October 2018 to October 2021. Twenty-four patients were divided into the IVUS-guided RA PCI group. The study's participants had an average age of 72.3 ± 7.1 years, and 80.9% of them were male. The mean BMI of the IVUS-guided RA PCI Group was 26.9 ± 4.8. Hypertension was presented in 95.8% patients and 58.3% of the cases involved type 2 diabetes mellitus. Moreover, 79.2% of the patients had dyslipidemia and 80.9% of them had a history of smoking. The average ejection fraction was 41 ± 13%, PCI was performed in 19/24 (79.2%) patients diagnosed chronic coronary syndrome. The creatinine was 163[129–348] μmol/l. The mean eGFR was 81.42 ±

**Table 1** Baseline Clinical Characteristics of the IVUS-Guided RA PCI Group and Standard-RA PCI Group

| | IVUS-Guided-RA Group (n=24 Patients) | Standard-RA Group (n=24 Patients) | P value |
|---|---|---|---|
| Age (years) | 72.3 ± 7.1 | 71.6 ± 7.7 | 0.74 |
| Males | 21 (80.9%) | 17 (64.4%) | 0.16 |
| BMI (kg/m$^2$) | 26.9 ± 4.8 | 26.4 ± 4.6 | 0.71 |
| Hypertention | 23 (95.8%) | 23 (95.8%) | 1.00 |
| Diabetes mellitus | 14 (58.3%) | 13 (54.2%) | 0.77 |
| Dyslipidemia | 19 (79.2%) | 18 (75.0%) | 0.73 |
| History of smoking | 21 (80.9%) | 20 (83.3%) | 0.68 |
| Previous CABG | 2 (8.3%) | 2 (8.3%) | 1.00 |
| Clinical presentation | | | 0.73 |
|   Chronic coronary syndrome | 19 (79.2%) | 18 (75.0%) | |
|   Acute coronary syndrome | 5 (20.8%) | 6 (25%) | |
| Number of coronary atery disease | | | 0.83 |
|   1 | 2 (8.3%) | 1 (4.2%) | |
|   2 | 5 (20.8%) | 5 (20.8%) | |
|   3 | 17 (70.8%) | 18 (75.0%) | |
| EF (%) | 43 ± 13 | 45 ± 12 | 0.58 |
| Creatinine (μmol/l) | 163[129–348] | 154[132–298] | 0.92 |
| Mean eGFR (mL/min/1.73m$^2$) | 81.42 ± 20.22 | 82.34 ± 22.19 | 0.88 |
| eGFR stage | | | 0.80 |
| eGFR 60–90 mL/min/1.73m$^2$ | 11 (45.8%) | 13 (54.2%) | |
| eGFR 30–59 mL/min/1.73m$^2$ | 5 (20.8%) | 6 (25%) | |
| eGFR 15–29 mL/min/1.73m$^2$ | 6 (25%) | 4 (16.7%) | |
| eGFR <15 mL/min/1.73m$^2$ | 2 (8.3%) | 1 (4.2%) | |
| History of CIN | 7 (29.2%) | 6 (25%) | 0.75 |

**Note**: Values are n (%), median [IQR] or mean ± SD.
**Abbreviations**: BMI, body mass index; CABG, coronary artery bypass graft; LVEF, left ventricular ejection fraction; eGFR, estimated glomerular filtration rate; CIN, contrast-induced nephropathy.

20.22mL/min/1.73 m$^2$, 45.8% of them was in eGFR stage 60–90 mL/min/1.73m$^2$. Seven patients (29.2%) had a history of contrast-related AKI. Similar results were obtained in the Standard-RA PCI group, and the differences were not statistically significant (P>0.05). The baseline clinical characteristics of the IVUS-guided RA group and Standard RA group with PCI are summarized in Table 1.

## Baseline Angiographic and RA PCI Procedural Characteristics

Table 2 shows the baseline angiographic and procedural features. The most frequently targeted vascular in both the IVUS-guided RA PCI group and the conventional RA PCI group was the left anterior descending artery (LAD) (50% vs 54.1%). The diameter stenosis in the two groups was nearly identical (88 8% vs 89 9%) during RA PCI under IVUS guidance. A bifurcation was present in 54.1% of the lesions, and the two-stent approach was used to treat 20.8% of them (2 culotte technique cases, 3 crush technique cases). And 61.5% employed a preliminary approach. In order to offer robust back-up support in the event of a significant tortuosity and calcification, a 7F guide catheter (87.5%) was placed during the PCI. In five cases, a Guidezilla extension catheter was employed (20.8%). Both the IVUS-guided RA group and the Standard-RA group made extensive use of radial access (83.3% vs 75%). Target RA PCI vascular prevalence, diameter stenosis, bifurcation lesion, bifurcation approach, epidural access, and guiding diameter did not differ significantly between the two groups.

The majority of experts in RA technique advocated a 1.5 mm burr size for the second group (56% vs 44.4%). Two burrs were treated instead of as many patients (4.2% vs 12.5%). Operators decided to perform elective RA in 94.4% of the patients in the IVUS-guided RA PCI group and 58.3% in the Standard RA PCI group (P0.05) based on IVUS or

**Table 2** Angiographic and Procedural Characteristics of the IVUS-Guided RA Group and Standard-RA Group

| | IVUS-Guided-RA Group (n=24 Patients) | Standard-RA Group (n=24 Patients) | P value |
|---|---|---|---|
| Target RA PCI vessel | | | 0.99 |
| Left main | 1 (4.2%) | 0% | |
| Left anterior descending | 12 (50%) | 13 (54.1%) | |
| Left circumflex | 2 (8.2%) | 3 (12.5%) | |
| Right coronary artery | 9 (37.5%) | 8 (33.3%) | |
| Diameter stenosis (%) | 88 ± 8 | 89 ± 9 | 0.69 |
| Bifurcation lesion | 13 (54.1%) | 14 (58.3%) | 0.77 |
| Bifurcation technique | | | |
| Crush technique | 3 (23.1%) | 1 (4.2%) | 0.30 |
| Culotte technique | 2 (15.4%) | 0% | 0.49 |
| T and protrusion | 0% | 1 (4.2%) | 0.99 |
| Provisional | 8 (61.5%) | 12 (85.7%) | 0.24 |
| Procedural access | | | 0.48 |
| Radial artery access | 20 (83.3%) | 18 (75%) | |
| Femoral artery access | 4 (16.7%) | 6 (25%) | |
| Guiding diameter | | | 0.70 |
| 6 French | 3 (12.5%) | 5 (20.8%) | |
| 7 French | 21 (87.5%) | 19 (79.2%) | |
| Use of Guidezilla | 5 (20.8%) | 2 (8.3%) | 0.41 |
| Number of burrs | | | 0.60 |
| 1 burr | 23 (95.8%) | 21 (87.5%) | |
| ≥2 burrs | 1 (4.2%) | 3 (12.5%) | |
| Burr diameter | | | |
| 1.25 mm | 8 (32%) | 9 (33.3%) | 0.76 |
| 1.5 mm | 14 (56%) | 12 (44.4%) | 0.34 |
| 1.75 mm | 3 (12%) | 5 (18.5%) | 0.70 |
| 2 mm | 0% | 1 (3.7%) | 1.00 |
| Rotational speed (RPM) | 162,141 ± 4,245 | 164,862 ± 43,28 | 0.03 |
| Burr to artery ratio | 0.49 ± 0.08 | 0.48 ± 0.09 | 0.64 |
| Indication of RA | | | |
| Elective-RA | 21 (87.5%) | 14 (58.3%) | 0.02 |
| Bailout-RA | 3 (12.5%) | 10 (41.7%) | |
| **Balloon pre-dilatation** | | | |
| Max pre-dilation balloon size, mm | 3.04 ± 0.5 | 2.89 ± 0.40 | <0.01 |
| Max pre-dilation pressure, atm | 20 ± 3.7 | 17 ± 3.4 | <0.01 |
| **Stent implantation** | | | |
| Number of stents implanted | 2.1 ± 0.6 | 2.0 ± 0.6 | 0.57 |
| Mean stent diameter, mm | 3.16 ± 0.3 | 2.92 ± 0.4 | 0.02 |
| Total stent length (mm) | 61.8 ± 22.7 | 63.6 ± 20.4 | 0.77 |
| Max. stent diameter (mm) | 3.5± 0.5 | 3.2 ± 0.4 | 0.03 |
| Max. stent implantation pressure (atm) | 16 ± 2 | 14 ± 2 | <0.01 |
| **Balloon post-dilatation** | | | |
| Post-dilation balloon size, mm | 3.5 ± 0.5 | 3.2 ± 0.6 | 0.07 |
| Max. postdil. balloon pressure (atm) | 22.6 ± 2.7 | 20.7 ± 2.9 | 0.02 |

**Note**: Values are n (%), mean ± SD.
**Abbreviation**: RPM, rotations per minute.

angiographic results. The ratio of burrs to arteries in the two groups was nearly identical (0.49 0.08 vs 0.48 0.09). In contrast, the rotational speed (RPM) was different (162, 141 4, 245 vs 164, 862 43, 28bpm, P 0.05). There was no discernible difference in the number of stents implanted, the overall length of the stent, or the size of the post-dilation balloon (P > 0.05). The maximum pre-dilation balloon size (3.04 0.5 vs 2.89 0.40; p 0.01), the maximum pre-dilation

**Table 3** Procedural and In-Hospital Outcome of the IVUS-Guided RA Group and Standard RA Group

| | IVUS-Guided-RA Group (n=24 Patients) | Standard-RA Group (n=24 Patients) | P value |
|---|---|---|---|
| Procedural duration (min) | 85 ± 31 | 79 ± 43 | 0.58 |
| Fluoroscopic time (min) | 20.6 ± 8.4 | 36 ± 22 | <0.01 |
| Dose area product (cGy/cm$^2$) | 1347 ±1044 | 1511± 1139 | 0.62 |
| Contrast amount (mL) | 32 ±16 | 184 ±116 | <0.01 |
| Angiographic success* | 100% | 100% | |
| RA PCI complications | | | |
| Slow flow/no flow | 1 (4.2%) | 1 (4.2%) | 1.00 |
| Perforation/rupture | 0% | 0% | |
| Pericardial effusion | 0% | 0% | |
| Stent thrombosis | 1 (4.2%) | 0% | |
| Dissection | 3 (12.5%) | 4 (16.7%) | 0.92 |
| Cardiac arrest | 0% | 1 (4.2%) | 0.87 |
| Mean eGFR 48h after PCI (mL/min/1.73 m$^2$) | 81.12 ± 20.74 | 76.84 ± 20.69 | 0.48 |
| Contrast-induced nephropath | 1 (4.1%) | 5 (20.8%) | 0.22 |
| Renal replacement therapy | 0% | 2 (8.3%) | 0.47 |
| In-hospital TVR | 0% | 0% | |
| In-hospital death | 0% | 0% | |

**Notes**: Values are n (%), mean ± SD or median. *Angiographic success was defined as TIMI 3 flow at the end of the procedure with <30% residual stenosis.
**Abbreviation**: TVR, target vessel revascularization.

pressure (20 3.7 vs 17 3.4; p 0.01), the mean stent diameter (3.16 0.3 vs 2.92 0.4; p = 0.02), the maximum stent diameter (3.5 0.5 vs Table 2 contains more details).

## Intravascular Imaging Finding

In the IVUS-guided RA PCI group, there were three IVUS acquisitions on average in each procedure. The IVUS catheter was unable to across the lesion in around 25% of the instances, and baseline IVUS lesion analysis was not accessible. The measurements of maximum calcium angle, proximal reference, distal reference, post-stent implantation, are showed in Table 3. The average stent expansion rate was (75 ± 8)%, 3(12.5%) patients got edge dissection. One patient (4.1%) had under-expansion and 3(12.5%) patients had mal-apposition.

## Procedural, Complications and In-hospital Outcome

In comparison to the Standard-RA group, the IVUS-guided RA PCI group had shorter fluoroscopy times (20.6 8.4 vs 36 22min; p 0.01) and less contrast (32 16 8.4 vs 184 116; p 0.01). Although there was no discernible distinction in the mean eGFR between the two groups following PCI. Contrast-induced nephropathy occurred in five patients in the Standard RA PCI group, which is 5 times more patients than in the IVUS-guided RA PCI group (20.8% VS 4.1%). Procedure length, dosage area product, RA PCI problems (slow flow/no flow, pericardial effusion, dissection, cardiac arrest), in-hospital TVR, and in-hospital death (P0.05) did not differ significantly from one another (see Table 3).

## Discussion

Cardiovascular disease is the leading cause of mortality and morbidity in CKD patients, especially those with complex calcified lesions.[15–17] They are so resistant to insufficient balloon dilatation or stent placement, and coronary highly calcified lesions can present a significant obstacle for PCI[18–20] additionally, stent thrombosis and in-stent restenosis may occur as a result of inadequate stent implantation.[21–23] Therefore, adequate stent expansion depends in particular on sufficient preparation of severely calcified lesions. RA is effective at modifying calcified plaques and enabling the stent deployment.[24–26]

Observational trials showed RA was safe and appropriate in terms of peri-procedural and in-hospital consequences in most patients.[27] Our research revealed that IVUS-guided RA PCI may be a useful strategy to prevent contrast-associated AKI. A shorter fluoroscopy duration and lower radiation dosage were linked with IVUS-guided RA PCI, which did not increase procedural time.

Since contrast-induced nephropathy is linked to an independent risk of peri-procedural mortality, acute myocardial infarction, hemorrhage, and RRT after PCI.[28–30] It is a significant issue in the management of patients with CKD. As a result, minimizing contrast use to reduce contrast-related AKI and attaining outstanding stent results to improve long-term outcomes are two therapy goals that should be pursued concurrently.

Prior research had established the viability and safety of minimal-contrast IVUS-guided rotational atherectomy in terms of the prevalence of peri-procedural and in-hospital problems. This could be successful in preventing contrast-related AKI.[5] In a cohort of 31 patients with severe CKD, Ali et al[31–33] showed that intravascular imaging guidance allowed for safe PCI with zero contrast. The later series, however, excluded individuals with significant calcification in tortuous vessels and only performed RA on two lesions. It also only included patients with CCS. Patients with advanced CKD were more likely to present with acute coronary syndrome than stable angina according to a prior case-control study.[34] Our study included 79.2% chronic coronary syndrome 20.8% acute coronary syndrome, which is more consistent in real world. Similar results could be found in Abd et al's trial.[5]

Previous research had shown that elective RA saves surgery time, radiation, and, most critically, contrast use when compared to bailout RA.[35,36] In our study, 87.5% patients in study group performed RA electively, not only basing on IVUS findings but also because some IVUS catheters failed to pass through the lesion. Additionally, we discovered that the IVUS catheter enables a detailed assessment of the lesion and side branch to decide whether a one- or two-stent strategy could improve the effect of procedural and clinical outcomes. There were no statistically significant differences in the occurrence of complications such as slow flow/no flow, perforation/rupture, pericardial effusion, and stent thrombosis of two groups.

Our study found that IVUS catheterization did not extend the operation or expose patients to a higher radiation dosage. This is due to the fact that calcified lesions make it more difficult for the balloon and stent to pass through them, and IVUS catheterization enables clinicians to choose the best balloon size, burr diameter, and stent size for PCI. All of these elements would aid in making the PCI process quicker and more precise. Because their doctors were concerned that they would develop contrast nephropathy, which had a negative effect on their clinical outcomes, some patients with coronary artery disease and chronic renal insufficiency even did not have PCI. Because the contrast was only utilised before and during coronary angiography, with an average dose of just 32 mL, we found that the risk of contrast-associated acute kidney damage (AKI) was exceedingly low in patients with chronic renal insufficiency having IVUS-guided RA PCI.

Some limitations exist in our research. First of all, it was a single-center study with a tiny sample size. Second, those who have persistent complete occlusions are excluded. Third, our investigation did not include any physiological evaluations like fractional flow reserves. Fourth, there may be a selection bias on bur size, one- or two-stent strategies due to the fact that different operators had different experiences using the RA approach. Therefore, larger prospective multicenter trials must be conducted in order to show the clinical value of IVUS-guided RA in chronic renal illness. However, our investigation showed that in high-risk CKD patients, low-contrast IVUS-guided PCI supported by RA is safe and feasible.

## Conclusion

An IVUS-guided RA PCI method in chronic renal patients with complex coronary calcification is efficient and safe, and can also reduce the contrast volume and possibly the rate of contrast-related AKI. In conclusion, this single-center study suggests that using IVUS to guide rotational atherectomy for calcified coronary artery lesions in patients with chronic renal disease may be a safe and effective approach. The use of IVUS allowed for more precise sizing of the rotational atherectomy burrs and identification of the extent of calcification, which may have contributed to improved procedural outcomes. However, the study's findings should be interpreted with caution, given its limitations, including the small

sample size, short-term follow-up, and lack of a control group. Further research is needed to confirm these findings and assess the long-term clinical outcomes of this approach.

## Abbreviations

PCI, percutaneous coronary intervention; AKI, acute kidney injury; CKD, chronic kidney disease; IVUS, intravascular ultrasound; RA, rotational atherectomy; TVR, target vessel revascularization.

## Informed Consent Statement

The participants were fully informed about the purpose of the study and written informed consent has been obtained from them to publish this paper.

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## Disclosure

The authors report no conflicts of interest in this work.

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