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# Guide Extension Catheter-assisted Interventions - A Single-Centre Experience

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## ABSTRACT

**Objective:** To evaluate the technical and procedural success and safety of guide extension catheter-assisted percutaneous coronary intervention (PCI) in challenging and complex coronary lesions.

**Methods:** A physician-initiated, observational study conducted at a tertiary care centre in India between July 2021 and July 2022. The patients who underwent guide extension catheter-assisted PCI with the indication of facilitating stent delivery and deployment were consecutively enrolled in the study. Complete medical records including history, demographics and clinical characteristics, and angiographic data of patients who underwent guide extension catheter-assisted PCI were reviewed and noted.

**Results:** Total 19 patients were included in the study of which 18 underwent guide extension catheter-assisted PCI, and one patient internal carotid artery angioplasty. The mean of patients was 62.74±10.38 years ranging from 42 years to 82 years. Total 9 (47.3%) patients were presented with chronic stable angina, 8 (42.1%) with unstable angina and only one patient represented acute myocardial infarction. The right coronary artery (RCA) was the most common target vessel involved in 63.2%. Total 31.6% lesions were distally located, 57.9% were heavily calcified, and 10.5% lesions were chronic totally occluded. A 100% procedural success was noted with the use of guide extension catheter. No case of stent disruption, vessel dissection or ventricular arrythmias and in-hospital death or myocardial infarction were noted during hospital-stay. Only one case of small access site hematoma was reported.

**Conclusion:** The study concluded that the use of guide extension catheter facilitates easy advancement of stents or other devices through tortuous, heavily calcified, distal, bifurcations and CTOs coronary as well as carotid lesions. However, larger studies on wide range of patient population are required to validate our findings.

***Keywords:*** percutaneous coronary intervention, coronary artery, carotid artery, guide catheters

## INTRODUCTION

Over the past 20 years, percutaneous coronary intervention (PCI) technique and devices have radically evolved, allowing interventional cardiologists to treat anatomically challenging diffuse, tortuous, calcified lesions and chronic total occlusions (CTOs) with ease. In these types of complex lesions, stent delivery may be challenging despite of sufficient lesion preparation and use of novel devices.[1,2] Moreover, in the past couple of years, the adoption of the transradial approach for PCI has risen exponentially, which has made complex PCI even more challenging due inadequate guiding support while maneuvering a stent or other accessories through a complex lesion. Among many causes of procedural failure, failure to deliver equipment (stent/balloon/ thrombosuction device/rotablation catheter/ coils etc.) is frequent [1,3]. Poor back-up force, poor axial alignment (increased friction between stiff stent and vascular wall), and increased tortuosity of the target vessel are the major causes of equipment delivery failure. As a result of these, the need of alternative strategies for strengthening guide catheter support has emerged.

To enhance guide support, several approaches have been devised, including passive approach (larger guide dimensions and switching to Amplatzer left (AL) over Judkins) and active approach (deep intubation in combination with either buddy wires and/or an anchor balloon, use of balloon/microcatheter, and guide catheter extension).[4] Among all, use of guide extension catheter system is crucial in complex PCI procedures involving heavy calcification, tortuous lesions, aberrant coronary arteries, severe proximal obstructions, graft interventions, and CTOs.[5] Additionally, guide extension catheter also helps in rotablation procedures, retrieval of foreign objects from the coronaries or arterial system, distal drug/device delivery, distal artery stenting, and intravascular coronary imaging. In the aforementioned complex lesions, guide extension catheter is frequently employed to increase backup support and guide catheter alignment for stent delivery with reported success rate of about 90%.[3] Therefore, in the present study, we assess the technical and procedural success and safety of guide extension catheter in challenging and complex PCI and carotid intervention cases.

## METHODS

### Study design and patients

This was a physician-initiated, observational study conducted at a tertiary care centre in India. Between July 2021 and July 2022, the patients who underwent guide extension catheter-assisted PCI with the indication of facilitating stent delivery and deployment were consecutively enrolled in the study. The study protocol was approved by the institutional ethics committee and the written informed consent was obtained from all the patients for the procedure and for anonymous use of data.

Complete medical records including history, demographics and clinical characteristics, and angiographic data of patients who underwent guide extension catheter-assisted PCI and carotid intervention were reviewed and noted.

### Technical and procedural characteristics

The interventional procedure was performed as per routine clinical protocols via radial routes, using 6F guide catheters as a standard and 6 F guide extension catheter (Guidezilla, Boston Scientific,). After passing the BMW wire, the guide extension catheter was advanced in a monorail tech up to the tip of the distal end of the guide catheter and low-profile balloon 1.5 × 15 mm semi-compliant balloon was advanced into the coronary artery. On the shaft of the balloon, the guide extension catheter was advanced to the desirable depth into the coronary artery. The remaining procedure of balloon dilations and stent deployment was as per routine clinical protocols and guidelines, and the choice of interventional approaches, devices and techniques was left

at the operator's preference. During the procedure, all patients received a bolus dose of unfractionated heparin as per their bodyweight and was titrated during the procedure. All patients received aspirin and clopidogrel, prasugrel, or ticagrelor. Post-procedure, all the patients were advised to continue dual antiplatelet therapy for at least 12 months followed by aspirin for lifelong.

## STATISTICAL ANALYSIS

Continuous variables were presented as mean ± standard deviation. Discrete variables were presented as frequency (%). All data were analyzed using the Statistical Package for the Social Sciences software (IBM Corp., IL, USA).

## RESULTS

During the designated time duration of the study, total 18 patients underwent guide extension catheter-assisted PCI, and one patient underwent guide extension catheter-assisted internal carotid artery angioplasty at our center. The baseline demographic details of all 19 enrolled patients are outlined in Table 1. The mean of patients was 62.74±10.38 years ranging from 42 years to 82 years. Among all, total 13 (68.4%) patients had Type-2 diabetes mellitus, 8 (42.1%) had systemic hypertension, 6 (31.6%) had hyperlipidemia, 4 (21.1%) had family history of coronary artery disease, and 11 (57.9%) patients were smokers. Total 9 (47.3%) patients were presented with chronic stable angina, 8 (42.1%) with unstable angina and only one patient represented acute myocardial infarction.

**Table 1: Demographic details of the enrolled patients**

| | N=19 |
|---|---|
| Mean age, years (mean ± SD) | 62.74±10.38 |
| Gender | |
| Male | 11 (57.9%) |
| Female | 08 (42.1%) |
| Risk Factors | |
| Diabetes mellitus | 13 (68.4%) |
| Hypertension | 08 (42.1%) |
| Smokers | 11 (57.9%) |
| Hyperlipidemia | 06 (31.6%) |
| Family history of CAD | 04 (21.1%) |
| Clinical presentation | |
| Acute myocardial infarction | 01 (5.3%) |
| Unstable angina | 08 (42.1%) |
| Chronic stable angina | 09 (47.3%) |

The vessel and lesion characteristics of all the patients are depicted in Table 2. The right coronary artery (RCA) was the most common target vessel involved in 12 patients (63.2%). Out of the 19 lesions treated in 19 patients, 31.6% (6/19) were distally located, 57.9% (11/19) were heavily calcified, and 10.5% (2/19) lesions were chronic totally occluded (occluded for >3 months with visible collateral channels). A total of 21 drug-eluting stents were implanted to treat 19 lesions (18 coronary lesions and one internal carotid lesion).

**Table 2: Vessel and lesion characteristics**

| Vessel involved | |
|---|---|
| Right coronary artery | 12 (63.2%) |
| Left coronary artery | 06 (31.6%) |
| Internal carotid | 01 (5.3%) |
| Lesion characteristics | |
| Chronic total occlusion | 02 (10.5%) |
| Heavily calcified lesion | 11 (57.9%) |
| Tortious lesion | 05 (26.2%) |
| Bifurcation lesion | 01 (5.3%) |
| Distal lesion | 6 (31.6%) |

In the present study, 100% procedural success was noted with the use of guide extension catheter-assisted PCI despite of complex patient and lesion characteristics. No case of stent disruption, vessel dissection or ventricular arrythmias were noted after the procedure. Only one case of small access site hematoma was reported which was conservatively managed. Furthermore, no case of in-hospital death of myocardial infarction was noted during hospital stay (Refer Table 3).

**Table 3: Procedural success and in-hospital clinical outcomes**

| Procedural success, n (%) | 19 (100%) |
|---|---|
| Complications, n (%) | |
| Stent disruption or loss | 00 |
| Vessel dissection | 00 |
| Pressure damping | 00 |
| Ventricular arrythmia | 00 |
| Access site hematoma | 01 (5.3%) |
| In-hospital death | 00 |
| In-hospital myocardial infarction | 00 |

## DISCUSSION

Unsuccessful delivery of stent/other tools across a tortuous, heavily calcified, and complex coronary artery segment during PCI is often due to inadequate support from the guiding catheter. Additionally, the

widespread adoption of the transradial method for PCI in recent years has increased the demand for procedures that provide adequate guiding support. The use of a guide extension catheter is one method for enhancing guiding catheter support for stent delivery and deployment in complex lesion characteristics. Here, the current study demonstrated the safety and efficacy of the guide extension catheter as a crucial tool to provide extra support during complex coronary interventions.

Globally, at least seven guide extension catheter systems are available, but only three of them are commercially available in India [GuideLiner V3 Catheter (Teleflex, USA), Guidezilla II Guide Extension Catheter (Boston Scientific, USA), and Telescope Guide Extension Cathete] with limited use in small number of centers. [3] In the present study, we used the Guidezilla II Guide Extension Catheter for all the patient, and we reported a 100% procedural success rate. Similarly, a recent study reported 98.7% procedural success rate with the GuideLiner catheter to in 317 complex lesions. [1] The results of Twente registry also reported 93% success rate using ‘‘5-in-6’’ GL catheter for 70 complex coronary lesions.[6] Also, Kovacic et al. [7] reported 89% procedural success in 28 patients with complex coronary lesions. Even though we performed PCI using a transradial approach in our patients, guide extension catheters can also be employed in a transfemoral PCI procedures. A study by Luna M et al. [8] showed a 90% procedural success rate with transfemoral GuideLiner catheter-assisted PCI in 21 patients with complex coronary and bypass grafts lesions.

In our study, RCA was the most common target vessel which involved around 64% of patients. Similar observation was noted by De Man FH et al. [6] in which they found RCA as the target vessel in 70% of patients. This indicates a recent increase in the incidence of guide extension catheter-assisted PCI to RCA. In this study, the patients who underwent PCI with the aid of a guide extension catheter covered a wide spectrum of lesion complexity, including severely calcified lesions (57.9%), tortuous lesions (26.2%), bifurcations (5.3%), distal lesions (31.6%), and even CTOs (10.5%). Therefore, an upfront use of the guide extension catheter was implemented in each of our cases to aid the delivery of stents into these types of challenging cases. Until now, the use of guide extension catheter has reported only few common complications and some of them include stent destructions [9], air embolism [6], vessel wall dissection [10], and balloon damage. [11] However, despite this level of complexity, no adverse events were reported in our study during the hospital-stay. Only one case of access site hematoma was reported which was managed with conservative medical therapy. Apart for coronary intervention, use of guide extension catheter for carotid artery intervention and renal artery denervation have been reported in previous studies. [12] In this study, we have successfully used Guidezilla II guide extension catheter for internal carotid artery intervention.

**Study limitation**

The limitation of the present study includes: i) small sample size, ii) single-center experience, iii) lack of control arm which could have provided better clarity of the results, and ii) lack of short-term as well as long-term follow-up.

## CONCLUSION

In conclusion, we believe that the use of guide extension catheter facilitates the easy advancement of stents or other devices through tortuous, heavily calcified, distal, bifurcations and CTOs lesions. In our opinion, this technology is a valuable addition to the interventional skill set that will enable high procedural success rates in difficult coronary and carotid anatomy. However, larger prospectively studies are required to validate the current findings.

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**Conflict of Interest:** None

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**Ethical Approval:** Approved

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