Identification, Prevalence, and Outcome of Complex Percutaneous Coronary Intervention (C-PCI)—A Single Center Experience

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Abstract

Introduction: Despite the shift in PCI application, the underlying criteria of complex PCI and its impact on clinical outcomes remain unexplained. **Methods:** Single-center retrospective observational study of complex PCI characteristics and 1-year outcome. Complex PCI was defined as any of the following: three-vessel disease, bifurcation lesion, left main disease, and moderate to severe calcification by angiography and CTO. **Results:** The study cohort includes 551 patients who had PCI over a two-month period. 101 (20%) of all patients fulfilled the criteria for complex PCI: 20% have 3VD, 33% have LM disease, 38% have bifurcation, 43% have severe Calcification and 35% have CTO. Combined MACE was more common in C-PCI (40% vs 12.4% <0.001), all individual components were more common in C-PCI (Repeated Revascularization 7.9%Vs 3.7%, P 0.071), Rehospitalization for ACS (1.9% vs 2.2%, p 0.8), Recurrent Angina (9% vs 8%, p 0.071), and HF (7% vs 3.7%, p 0.161). **Conclusion:** Complex PCI is prevalent in everyday practice (20% of total patients) across all clinical presentations, age groups, and gender. The consequence is dismal.

Subject Areas

Cardiology

1. Introduction

Percutaneous coronary intervention (PCI) has evolved rapidly over the last 40 years and is now a safe and effective therapeutic option for individuals worldwide suffering from coronary artery disease (CAD).

Initially, PCI was performed on relatively young and stable patients who received a single intracoronary stent; however, with the introduction of drugeluting stents (DES), as well as advancements in implantation techniques and adjunct pharmacological therapy, patients with more comorbidities and/or more complex lesions are now treated with PCI [1]. Despite this shift in PCI's applicability, the underlying causes and influence of PCI complexity on clinical outcomes remain unknown.

2. Aim of the Study

Evaluation of clinical outcomes of complex PCI cases in a high-volume center PCI in Egypt.

3. Method

This study was conducted at the National Heart Institute (NHI) and included 551 patients who had PCI over the period from 1/1/2021 to 30/3/2021. Complex PCI (C-PCI) was defined as any of three-vessel disease, bifurcation lesion, left main disease, and moderate to severe calcification by angiography and CTO. Combined MACE includes Mortality, repeated revascularization, and rehospitalization for ACS. Follow-up was scheduled 2 weeks after discharge and by phone calls every 3 months for 12 months.

Categorical data are reported as frequency and percentages. Continuous variables are presented as mean ± SD and compared using the 2-sample t-test. All tests were two-tailed, and $p < 0.05$ was considered significant.

4. Results

A total of 551 PCI procedures were performed. The mean age of the studied patients was 54 ± 10 years. There was a male predominance (72.8%). About two-thirds had hypertension (59.6%), and half were diabetics (50.6%). About half of the patients (48.8%) were smokers.

A total of 101 patients (18.3%) fulfilled the criteria for complex PCI: 20% have 3VD, and 33% have LM disease. 38% has bifurcation, 35% has CTO. 43% has severe calcification.

Complex PCI was more likely to be older (54 ± 10 years vs 57 ± 8 years) and more likely to be males (79%). Female patients were underrepresented in both

groups; 21% of complex PCI and 28% of noncomplex PCI.

Complex PCI patients were more likely to be hypertensive (68% vs 57% P 0.047), to have Diabetes (61% vs 48, p 0.017), to be Smokers 25% vs 27, p 0.46), and to have a History of IHD (14% vs 8%, p 0.049).

C-PCI were more likely to be presented with SIHD than non-C-PCI (73% vs 56% 0.002), while ACS presentation was more common in the non-C-PCI group (17% vs 36%, p 0.012)

Coronary anatomy was significantly different between both groups; Single vessel disease (SVD) was 80% non-C-PCI vs 57% of C-PCI (p < 0.001). LAD disease was predominant in both groups (75% vs 62% 0.012)

On average, follow-up was 1.3 years; 25 (24%) of C-PCI group patients died, and 9 of them presented with ACS. All of them had LM disease, and 16 had 3VD. No patient died from the non-C-PCI.

Combined MACE were more common in C-PCI (40% vs 12.4% <0.001), all individual components were more common in C-PCI (Repeated Revascularization 7.9% Vs 3.7%, P 0.071), Rehospitalization for ACS (1.9% vs 2.2%, p 0.8), Recurrent Angina (9% vs 8%, p 0.071), and HF (7% vs 3.7%, p 0.161).

Table 1 and Figures 1-5 show the patient characteristics, coronary anatomy and outcomes in Non-Complex and Complex PCI.

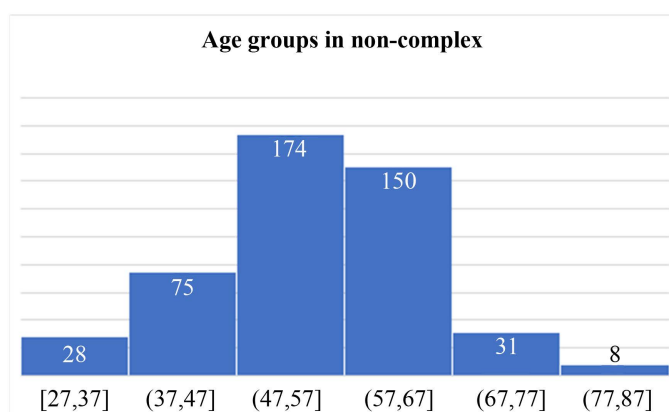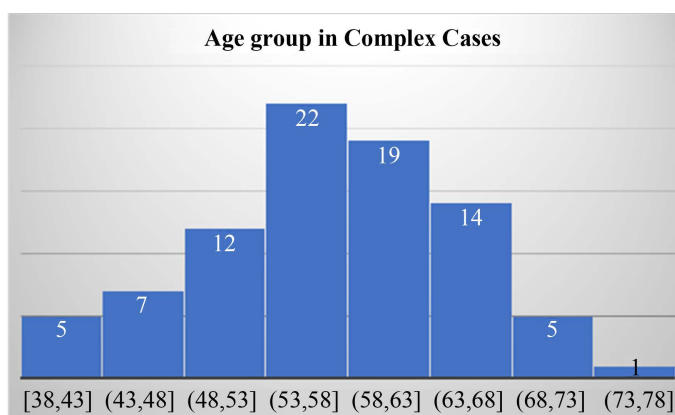Figure 1. Age groups in non-complex.
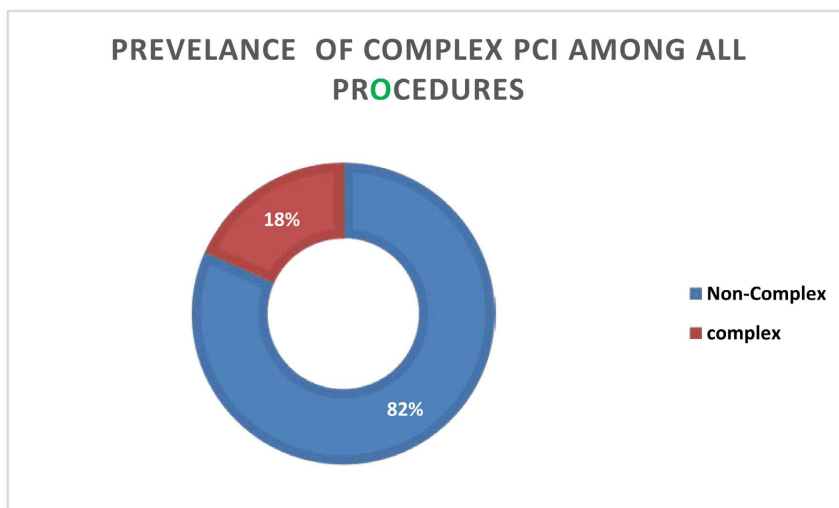

Figure 2. Age groups in complex cases.

Figure 3. Prevelance of complex PCI among all procedures.
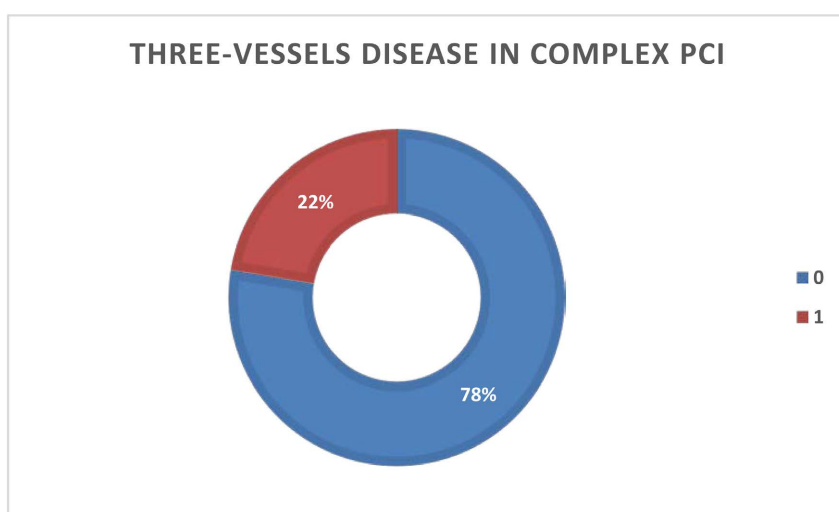

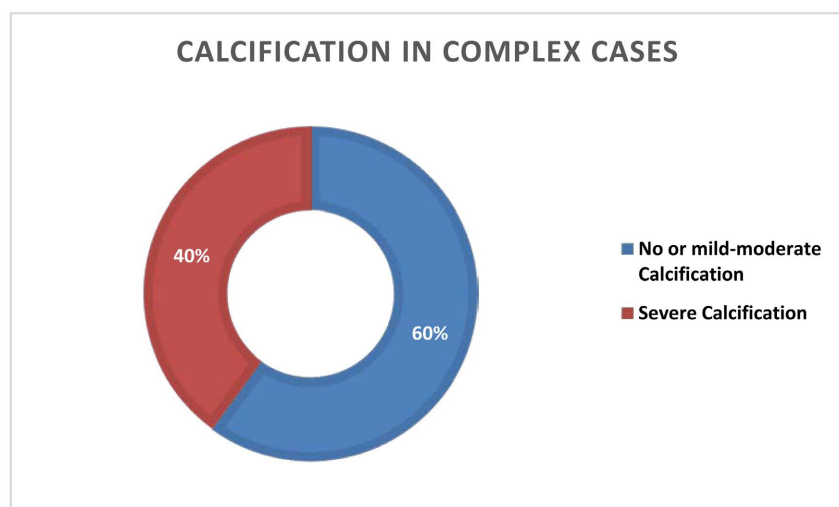**Figure 4.** Three-vessels disease in complex PCI.

Figure 5. Calcification in complex cases.

Table 1. Patient characteristics, coronary anatomy and outcomes in non-complex and complex PCI.

	Non-Complex PCI	%	Complex PCI	%	P-Value
Number	450/551	81.6%	101/551	18.3%	
Age	54.6 +/− 10.1		57.2 +/− 8.01		0.015
Female	128	28.4%	22	21%	0.175
HTN	259	57.5%	69	68.3%	0.047
DM	217	48.2%	62	61.3%	0.017
Smoking	223	49.5%	46	45.5%	0.467
Dyslipidemia	124	27.5%	26	25.7%	0.712
History of IHD	38	8.444%	15	14.8%	0.049
ACS on presentation	163	36.2%	18	17.8%	<0.001
Presentation as SIHD	255	56.6%	74	73.2%	0.002
Coronary anatomy					
LAD involvement	279	62.0%	76	75.2%	0.012
LCX	116	25.7%	42	41.5%	0.001
RCA	143	31.7%	41	40.5%	0.090
One-vessel disease	360	80.0%	58	57.4%	<0.001
Two-vessel disease	89	19.7%	22	21.7%	0.651
Three vessel disease	0	0	21	20.7%	NA
LM disease	0	0	33	32.6%	NA
Bif	0	0	38	37.6%	NA
CTO	0	0	36	36%	NA
Calcification	0	0	44	43.5%	NA
1-year outcome					
Recurrent angina	39	8.6%	10	9.9%	0.694
HF	17	3.7%	7	6.9%	0.161
Hospitalization due to ACS	10	2.2%	2	1.9%	0.881
Repeated Revascularization	17	3.7%	8	7.9%	0.071
Mortality	0	0	25	24.75%	NA
MACE	56	12.4%	41	40.59%	<0.001

5. Discussion

In the current study, 20% of all PCI cases observed over a two-month duration at a single tertiary center were considered C-PCI, which is comparable to similar findings in large registries [2]. To our knowledge, the current research represents the largest single-center C-PCI registry in Egypt.

The percentage of C-PCI in daily practice reflects more aggressive disease, rising age, and higher co-morbidities as well as more patients being offered PCI even in the presence of multivessel disease [3], LM disease [4], and severe calci-

fication.

The mortality was very high in C-PCI especially when LM disease is coupled with three-vessel disease and presentation as ACS. However, the mortality in those groups is more than what was reported in most of the published data [5]. Furthermore, a 1-year MACE of 40% in the C-PCI group driven by all individual components triggers an urgent need for further investigations and improvement of care [6].

Poor outcome in those cases is likely related to limited resources including low rate of Intravascular imaging, functional assessment, low availability of plaque modification tools (Cutting balloons, scoring balloons and IVL. atherectomy rarely used. only IABP is available and rarely used either in high-risk PCI of cardiogenic shock. Other MCS (Impella, ECMO, etc.) are not available.

6. Limitations

This study has several limitations. First, although all data were collected prospectively, we used a single-center observational design which has the inherent limitations associated with a non-randomized comparison. Second, there is no standard definition of C-PCI; we decided to focus selectively on several important domains of C-PCI: LM, CTO, multivessel or bifurcation intervention, and severe calcification.

7. Conclusions

Complex PCI is common in daily practice (20%) of total cases across the different scopes of clinical presentation and age groups with commonly overlapped criteria of complexity. The outcome is poor with MACE of 40% over 1 year.

Complex intervention became one of the challenges in daily practice in the context of expanding the horizon of PCI. Evaluation of center and operators' progression of skills should consider not only procedural outcomes but also intermediate and long-term ones.

Conflicts of Interest

The authors declare no conflicts of interest.

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