

Influence of Chronic Complete Occlusion on Patients Who Underwent Percutaneous Coronary Intervention- A Retrospective and Cross-Sectional Study

Akram Ramadan Farag Elburki

Interventional Cardiologist, Department of Cardiac Care, Sevasadan Lifeline Super Speciality Hospital, MIDC Industrial Area, Miraj, Maharashtra - 416410 India.

ABSTRACT

Background: Percutaneous coronary intervention in chronic complete occlusion is a wide developing area and considered as frontier in interventional cardiology. But, how does complete occlusion influence the prognosis after percutaneous coronary intervention is still a dilemma. Some people have better prognosis and some may not. This mainly depends on the risk factors, underlying systemic conditions and complications during and after PCI.

Aim: Aim of research was to determine influence of chronic complete occlusion on patients who underwent percutaneous coronary intervention in the past.

Materials and methods: A total of 120 patients recruited from the outpatient department of Sevasadan Lifeline Superspeciality Hospital, Miraj, Maharashtra, India and data was collected from a period of 1-1-2018 to 31-3-2018. Influence of systemic diseases, risk factors, cardiac related parameters, angiographic characteristics of lesions were collected from patients and followed till 31-3-2020.

Results: The results in the present study emphasize that complications like target vessel occlusion (8% in complete occlusion), dissection risk (5%) and heart failure, were higher in patients with complete total occlusion which indicates higher risk of complications in this group. This suggests that patients with complete occlusion had higher risk as well as higher complications than patients with incomplete occlusion.

Conclusion: This study concludes that patients with chronic complete occlusion had more complications than patients with incomplete occlusion. It also concludes that all systemic

diseases like hypertension, diabetes are risk factors for patients with complete and incomplete occlusion undergoing PCI.

Key words: Chronic complete Coronary Occlusion, Incomplete occlusion, Percutaneous Coronary Intervention.

INTRODUCTION

Percutaneous coronary intervention (PCI) in chronic total occlusion (CTO) is expanding with new technology and higher predictive outcomes in medical research. Though PCI is considered as a standard procedure for treating complete and incomplete occlusions apart from CABG, many factors pre and post PCI influence the prognosis of the procedure. They may be either systemic factors (hypertension, diabetes, cerebrovascular disease etc.) or local factors (length of the occluded lesion, number of lesions, calcifications etc.) or during procedure events (dissections, heart failures, myocardial infarction etc). Therefore, before planning PCI procedure for occlusion patients either complete or incomplete, thorough past medical history, medications, habits, risk factors are to be collected to obtain a better prognosis.

Coronary chronic complete occlusions (CCOs) are defined as an occluded coronary segment with thrombolysis in myocardial infarction (TIMI) flow 0 for ≥ 3 months duration. [1] Approximately 18–33% of patients with

significant coronary disease on coronary angiography have at least one CCO. [2]

Chronic complete lesions are classified into four types according to

Abrupt Vessel Closure - AHA Task Force Definition, as modified by Ellis et al. [3,4]

They are:

Type A	<10mm, discrete, concentric readily accessible, <45 degree angle smooth contour, little or no calcification, less than totally occluded, not ostial, no major side branch involvement, absence of thrombus.
Type B1	One of the following characteristics: 10-20mm, eccentric, moderate tortuosity of proximal segment, irregular contour, presence of any thrombus grade, moderate or heavy calcification, total occlusion<3 months old, ostial lesion or bifurcation lesion requiring two guidewires
Type B2	Two or more of the following characteristics: 10-20mm, eccentric, moderate tortuosity or proximal segment, irregular contour, presence of any thrombus grade, moderate or heavy calcification, total occlusion<3 months old, ostial lesion or bifurcation lesion requiring two guidewires.
Type C	>20 mm diffuse, excessive tortuosity of proximal segment, total occlusion>3 months old and/or bridging collaterals inability to protect major side branches, degenerated vein graft with friable lesions.

The conventional procedure for CCO is coronary artery bypass graft surgery (CABG), but the preferred procedure for revascularization includes PCI which gives better prognosis to the patient. This is generally indicated when the patient had prior CABG or in specific isolated right coronary artery CCO. [5]

The other indications of PCI include atypical chest pain, stable angina, unstable angina, a positive stress test or non-ST elevation myocardial infarction (NSTEMI).

Though the PCI procedure gives excellent outcomes, some of the chronic total coronary occlusion patients do not respond properly for varied reasons. This may be due to diversified etiology and risk factors within the patient leading to poor prognosis. Therefore, the aim of the study is to determine influence of chronic complete occlusion on patients who underwent percutaneous coronary intervention in the past.

MATERIALS AND METHODS

This is a retrospective and cross sectional study with a total of 120 patients recruited from the outpatient department of Sevasadan Lifeline Superspeciality Hospital, Miraj, Maharashtra, India and data was collected from a period of 1-1-2018 to 31-3-2018. Out of 120 patients, 75 patients were with incomplete coronary occlusion and 45 patients are with complete occlusion. All patients with complete and incomplete coronary occlusion (ICCO) with associated risk factors are included in the study

whereas patients who do not return to follow up or who expire during the study period are excluded. Follow up was carried out till 31/3/2020.

A detailed medical history and data on the associated risk factors, other systemic conditions, previous history of cerebrovascular accident, type of occluded lesion, intra and post operative complications was collected.

The following parameters additional to above mentioned parameters were also collected:

Cardiac related parameters like previous percutaneous intervention, prior myocardial infarction, Prior Coronary Artery Bypass Grafting (CABG), history of heart failure, intraoperative myocardial infarction, history of thrombolytics usage.

Angiographic characteristics of lesion like number of lesions per subject, length of the lesion, type of the lesion, vessels treated for lesions, its tortuousness, calcifications, ostial, in-stent restenosis.

Additional information on Pre PCI % Stenosis, Post PCI % Stenosis, Pre PCI TIMI-Flow, Post PCI TIMI-Flow, Dissection.

Major Adverse Cardiac Events like Myocardial Infarction (MI) n (%), FL n (%), Heart Failure (HF) n (%), Heart Block (HB) n (%), Death n (%), Target Vessel Revascularisation (TVR) n (%), Follow-up Restenosis n (%), Dissection risk n (%).

All the patients were followed up till 31-3-2020.

All the data are analyzed using suitable statistical analysis.

RESULTS

A total of 120 patients were recruited and distributed into patients with

occlusion (n=45) and without occlusion (n=75). Data from all patients who were recruited was collected thoroughly and the percentages of patients with the characteristics were noted.

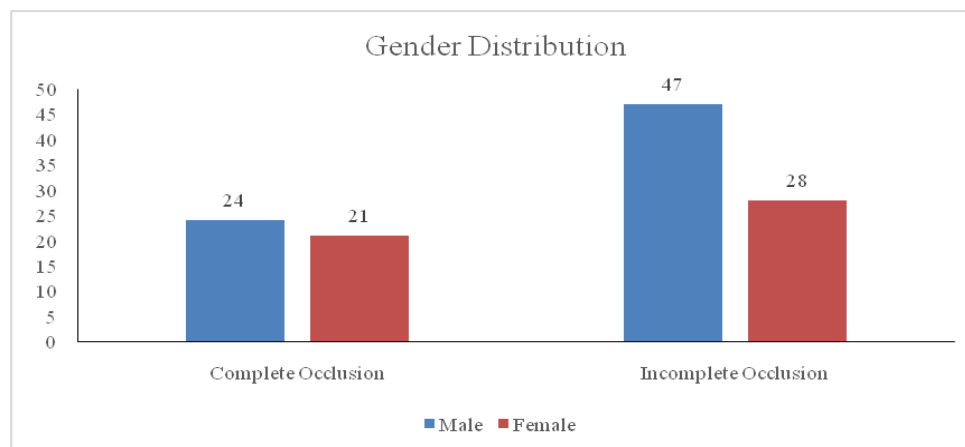


Figure 1: Gender Distribution

Figure 1 represents number of Males and Females distributed in patients with occlusion (M=24;F=21) and without occlusion (M=47, F=28). The graph clearly shows that males are at a higher number than females in the both the groups.

Table 1: Summary of patients Demographics

PARAMETER	PATIENTS WITH COMPLETE OCCLUSION (N=45)	PATIENTS WITH INCOMPLETE OCCLUSION (N=75)
Ejection Fraction (%)		
Mean (SD)	57.73 (11.10)	57.39 (12.23)
Hypertension n (%)		
Present	27 (60.00 %)	39 (52.00 %)
Absent	18 (40.00 %)	36 (48.00 %)
Diabetes Mellitus n (%)		
Present	28 (62.22 %)	40 (53.33 %)
Absent	17 (37.78 %)	35 (46.67 %)
Hyperlipidaemia n (%)		
Present	23 (51.11 %)	37 (49.33 %)
Absent	22 (48.89 %)	38 (50.67 %)
Cerebro Vascular Accident n (%)		
Present	10 (22.22 %)	15 (20.00 %)
Absent	35 (77.78 %)	60 (80.00 %)
Peripheral Artery Disease n (%)		
Present	12 (26.67 %)	20 (26.67 %)
Absent	33 (73.33 %)	55 (73.33 %)
Smoking Status n (%)		
Smoker	24 (53.33 %)	28 (37.33 %)
Non-Smoker	21 (46.67 %)	47 (62.67 %)

Table 1 represents the frequency of patients having Risk factors. Majority of patients with occlusion had a history of heart failure, prior myocardial infarction, previous PCI. The numbers of non smokers were more in patients without occlusion were more and accounted for 62.67% out of 75 patients. The mean ejection fraction in patients with occlusion was 57.53% which indicates that in majority of patients left ventricle is ejecting 57% of blood volume from the heart. Among the risk factors present, patients with complete occlusion and incomplete occlusion had hypertension and diabetes mellitus in higher frequency than other parameters.

Table 2: Summary statistics of Cardiac Related Parameters

PARAMETER	PATIENTS WITH COMPLETE OCCLUSION (N=45)	PATIENTS WITH INCOMPLETE OCCLUSION (N=75)
Previous Percutaneous Coronary Intervention (PCI) n (%)		
	12 (26.67 %)	11 (14.67 %)
Prior Myocardial Infarction (MI) n (%)		
	15 (33.33 %)	7 (9.33 %)
Prior Coronary Artery Bypass Grafting (CABG) n (%)		
	3 (6.67 %)	3 (4.00 %)
History of Heart Failure n (%)		
	11 (24.44 %)	22 (29.33 %)
Intra OP MI n (%)		
	4 (8.89 %)	3 (4.00 %)
Thrombolytics		
	7 (15.56 %)	5 (6.67 %)

Table 3: Summary statistics of Angiographic Characteristics of Lesions

PARAMETER	PATIENTS WITH COMPLETE OCCLUSION (N=45)	PATIENTS WITH INCOMPLETE OCCLUSION (N=75)
Total number of lesions in all subjects (n)	92	129
Number of Lesions per subject		
Mean (SD)	2.04 (0.80)	1.72 (0.74)
Length of Lesion (mm)		
Mean (SD)	21.91 (6.53)	22.81 (7.39)
Type of Lesion n (%)		
A	11 (11.96 %)	57 (44.53 %)
B1	12 (13.04 %)	27 (21.09 %)
B2	24 (26.09 %)	40 (31.25 %)
C	45 (48.91 %)	4 (3.13 %)
Vessels treated for Lesions n (%)		
D1	2 (2.17 %)	6 (4.65 %)
D2	1 (1.09 %)	1 (0.78 %)
LAD	41 (44.57 %)	53 (41.09 %)
LCX	19 (20.65 %)	17 (13.18 %)
LM	1 (1.09 %)	1 (0.78 %)
OM	1 (1.09 %)	0 (0.00 %)
OM1	3 (3.26 %)	5 (3.88 %)
OM2	2 (2.17 %)	4 (3.10 %)
RCA	22 (23.91 %)	37 (28.68 %)
PDA	0 (0.00 %)	2 (1.55 %)
RI	0 (0.00 %)	3 (2.33 %)
Tortuous n (%)		
RCA	8 (8.70 %)	7 (5.43 %)
LCX	4 (4.35 %)	3 (2.33 %)
OM	0 (0.00 %)	2 (1.55 %)
OM1	0 (0.00 %)	1 (0.78 %)
LAD	5 (5.43 %)	3 (2.33 %)
RI	0 (0.00 %)	2 (1.55 %)
Calcification n (%)		
LAD	30 (32.61 %)	21 (16.28 %)
LCX	11 (11.96 %)	5 (3.88 %)
RCA	15 (16.30 %)	16 (12.40 %)
OM1	1 (1.09 %)	0 (0.00 %)
LM	1 (1.09 %)	1 (0.78 %)
D1	0 (0.00 %)	1 (0.78 %)
Ostial		
D1	1 (1.09 %)	2 (1.55 %)
D2	1 (1.09 %)	1 (0.78 %)
OM	1 (1.09 %)	0 (0.00 %)
LCX	5 (5.43 %)	1 (0.78 %)
OM1	3 (3.26 %)	2 (1.55 %)
LAD	6 (6.52 %)	7 (5.43 %)
RCA	2 (2.17 %)	1 (0.78 %)
RI	0 (0.00 %)	1 (0.78 %)
In Stent Restenosis		
LAD	10 (10.87 %)	5 (3.88 %)
LM	1 (1.09 %)	0 (0.00 %)
RCA	1 (0.00 %)	2 (1.55 %)

Table 2: represents the number of people with cardiac related parameters. The above table shows more patients with complete coronary occlusion had myocardial infarction in the past. A total of 23 patients had undergone prior PCI, and 7 patients had intra-operative MI which suggests that risk of complications was common during the PCI procedure. 15% of patients with CCO were under thrombolytics and only 6 % with incomplete occlusion were using thrombolytics.

Similarly, history of heart failure was common in both groups, representing both complete and incomplete occlusion can lead to adverse cardiac events.

Table 3: represents the angiographic characteristics of lesion. In the above table, on an average, patients with CCO had a minimum of 2 lesions per subject and patients without complete occlusion had 1.75 lesions per subject. C type lesions were common in patients with CCO and A type lesions are common in patients with incomplete lesions. LAD vessels were treated mostly in both the groups which suggest that LAD (left anterior descending artery) vessels were more prone for occlusions and then followed by RCA (right coronary artery). Similarly, calcification's and tortuosity are common in the same vessels as mentioned above i.e., LAD and RCA. In-stent restenosis was done mostly in LAD vessels which states that LAD are more prone for stenosis.

Table 4: Summary statistics of Results of Performed PCI

PARAMETER	PATIENTS WITH COMPLETE OCCLUSION (N=45)	PATIENTS WITH INCOMPLETE OCCLUSION (N=75)
Pre PCI % Stenosis		
n	92	128
Mean (SD)	94.55 (7.01)	86.55 (7.15)
Post PCI % Stenosis		
n	92	128
Mean (SD)	26.67 (21.97)	16.92 (13.46)
Pre PCI TIMI-Flow n (%)		
0	50 (54.35 %)	1 (0.78 %)
1	15 (16.30 %)	22 (17.97 %)
2	19 (20.65 %)	57 (44.53 %)
3	8 (8.70 %)	48 (37.50 %)
Post PCI TIMI-Flow n (%)		
0	6 (6.52 %)	1 (0.78 %)
1	2 (2.17 %)	2 (1.56 %)
2	31 (33.70 %)	18 (14.06 %)
3	53 (57.61 %)	107 (83.59 %)
Dissection n (%)		
B	2 (2.17 %)	2 (1.56 %)
C	2 (2.17 %)	2 (1.56 %)
D	0 (0.00 %)	1 (0.78 %)
E	1 (1.09 %)	0 (0.00 %)

Table 1: Summarizes the statistics of Results of Performed PCI. It depicts the stenosis frequency and flow frequency pre and post PCI. Highest frequency is associated in patients with incomplete occlusion. Pre TIMI flow was 0 for majority of patients which depicts that antegrade blood flow beyond coronary occlusion was absent leading to decrease in blood supply to distal bed. Post PCI TIMI flow was 3 in majority of patients which states that the flow is normal and it is filling the distal coronary bed properly. This suggests that PCI improved the blood supply and decreased the occlusion percentage in both the groups.

Table 5: Summary statistics of Major Adverse Cardiac Events

PARAMETER	PATIENTS WITH COMPLETE OCCLUSION (N=45)	PATIENTS WITH INCOMPLETE OCCLUSION (N=75)
Myocardial Infarction (MI) n (%)	3 (6.67 %)	4 (5.33 %)
FL n (%)	3 (6.67 %)	1 (1.33 %)
Heart Failure (HF) n (%)	3 (6.67 %)	2 (2.67 %)
Heart Block (HB) n (%)	0 (0.00 %)	1 (1.33 %)
Death n (%)	1 (2.22 %)	1 (1.33 %)
Target Vessel Revascularisation (TVR) n (%)	4 (8.89 %)	2 (2.67 %)
Follow-up Restenosis n (%)	4 (8.89 %)	4 (5.33 %)
Dissection risk n (%)	5 (11.11 %)	5 (6.67 %)

Table 2: The above table summarizes the major cardiac events which occurred after the PCI in patients with and without complete coronary occlusion. High percentage of adverse cardiac events was related with Dissection risk in patients with occlusion and target vessel revascularization with a frequency of 8.89%. In contrast to dissections, Target vessel revascularization was seen in 4 patients with CCO and 2 patients with ICCO. Follow up re-stenosis was present in 8% of patients with CCO and 5% in ICCO.

DISCUSSION

This is a retrospective and cross-sectional study which was attempted to study the association of complete and incomplete coronary occlusion in patients who underwent PCI procedure. This study also aimed to depict the frequency of systemic diseases associated risk factors for patients who underwent PCI.

This study showed males were more affected with coronary occlusion than women. In accordance with this study, a study by Chiha et al concluded that males are more affected than females. [6] In contrary to the present study, a review by Maas et al stated that women were mostly underestimated from coronary diseases and they are affected more than men. [7] Most of the patients in this study had hypertension as one of the systemic disease and this is in accordance with the study done by Saluveer et al in which he concluded that Hypertension is associated with higher mortality in patients with STEMI, NSTEMI/UA or stable angina who were treated with PCI. [8]

Diabetic patients were also higher in this study showing that diabetes is also one of the risk factors for complete or incomplete coronary occlusion. This is in accordance with a study done by Iglesias et al which also suggests that PCI is suitable and safe option than CABG for diabetic patients. [9] History of cerebrovascular disease and peripheral artery disease are

only seen in few of the patients recruited. As far as our knowledge, there are no such studies comparing the history of cerebrovascular disease and occlusion. In this study, smokers are more prone to coronary diseases than non-smokers. 7 patients were using thrombolytics and still had complete occlusion of the arteries and 5 patients had incomplete occlusion.

Cardiac related parameters were seen only in fewer patients and showed lesser correlation with coronary occlusion patients. Only 3 patients with complete occlusion and 3 patients with incomplete occlusion had undergone CABG. 12 patients with complete occlusion and 11 patients with incomplete occlusion have undergone previous PCI.

In view of angiographic characteristics of lesion, Type C lesion was more common in both complete and incomplete patients. According to AHA/ACC, type C lesions have high risk and emergency CABG rate is highest in patients with patent class C lesions. [10,11]

Tortuous lesions were more associated with right coronary artery in patients with complete occlusion. Ostial lesions and calcifications are more common with LAD. 26.67% of patients with complete occlusion and 16% with incomplete occlusion had Post PCI stenosis. Dissection type B and C were more observed in patients with both complete and incomplete occlusion. A study done by Tweet et al showed that PCI for spontaneous coronary artery dissection SCAD is associated with high rates of technical failure even in those presenting with preserved vessel flow and does not protect against target vessel revascularization or recurrent SCAD. [12]

Death occurred in one patient with complete occlusion and incomplete occlusion each after PCI and target level revascularization was done in 4 patients each in two groups (with complete and incomplete occlusion). This is in accordance with a meta-analysis done by Chacko et al

in 2020 in which they concluded that PCI prevents death, cardiac death, and MI in patients with unstable CAD. For patients with stable CAD, PCI shows no evidence of an effect on any of these outcomes. ^[13]

CONCLUSION

This study concludes that patients with complete occlusion had more complications than patients with incomplete occlusion. It also concludes that all systemic diseases like hypertension, diabetes are risk factors for patients with complete and incomplete occlusion undergoing PCI. The angiographic characteristics like number of lesion, type of lesion, tortuosity, calcifications also influence the outcome of the treatment. Some patients who had undergone prior CABG had poor prognosis and PCI was suggested for better outcomes.

This study also concludes that complications like target vessel occlusion, dissection risk and heart failure, were higher in patients with complete total occlusion which indicates higher risk of complications in this group. This suggests that patients with complete occlusion had higher risk as well as higher complications than patients with incomplete occlusion. Further studies with large sample size and longer follow up should be done to confirm the results of these studies. Also equal number of patients in both groups can magnify the details further.

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