

Percutaneous Transluminal Coronary Angioplasty (PTCA) and Stenting – Study of 100 Cases

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Summary:

This prospective ongoing study conducted in University Cardiac Center, BSMMU, Dhaka from July'2004 to April'2006. 100 patients (mean age 52.4±6.2 years) underwent Percutaneous Transluminal Coronary angioplasty and stenting (PTCA & stenting) were evaluated. This study was designed to evaluate the short term angiographic and clinical results of stentangioplasty during hospital stay. The study group of 100 patients consisted of 88 (88%) men and 12 (12%) women. About risk factors 36 (36%) had hypertension, 30 (30%) were smoker, 20 (20%) suffered from diabetes mellitus, 14 (14%) had family history of ischaemic heart disease. Average Left ventricular ejection fraction was 54.2±7. Target vessel PTCA were done on 130 vessels, intracoronary stent implanted in 124 vessels, direct stenting was done in 80 cases, failed PTCA were in 4 (4%)

Introduction:

Percutaneous coronary intervention (PCI) is widely used to relieve angina and ischaemia because it is effective in this role. Since the introduction of coronary balloon angioplasty into the clinical practice in 1977¹ improvement in equipment design and operator experience have permitted this procedure to be applied to the treatment of a broad spectrum of coronary artery disease (CAD). Advances in coronary

cases, and three patients had dissection. The native vessels had a mean reference diameter of 2.89 mm and their luminal diameter increased significantly after percutaneous coronary intervention (PCI). Thrombolysis in myocardial infarction (TIMI) flow analysis showed most of the patients had TIMI-1 flow (95,73%) before the procedure and maximum patients achieved TIMI-3 flow (91, 70%) after the procedure with significant clinical improvement. All the patients were discharged by one to three days of the procedure with improvement of their clinical condition. So PTCA and Stenting is a safe and effective technique with high procedural success rate and good short-term (hospital) clinical results in the native coronary artery lesions.

Key words: Coronary artery diseases; PTCA and stenting.

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based interventions, especially the use of bare-metal stents (BMS) and drug eluting stents (DES), have improved the efficacy and safety profile of percutaneous revascularization observed for patients undergoing PTCA. Coronary angioplasty (PTCA) as a primary method for establishing coronary patency in patients with acute myocardial infarction is the riding crest of a wave of enthusiasm that threaten to engulf us and carry us off into the uncritical adoption². Primary percutaneous coronary angioplasty (PTCA) has recently been advocated as the treatment of choice for patients with acute myocardial infarction³. Direct PTCA has been shown to have a high primary success rate (90%-99%) with few procedural complications and a low in-hospital mortality. It can establish TIMI grade III flow in upto 95% of patients within two hours of hospital admission⁴. Thrombolytic agents can not achieve this. Angioplasty has a more rapid action and greater success because it can dislodge and mechanically disrupt thrombus as well as reduce any residual coronary stenosis caused by atheroma. These actions reduce the risk of recurrent ischaemia, reocclusion and reinfarction⁴.

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With the combination of sophisticated equipment, experienced operators and modern drug therapy, PCI has evolved into an effective non-surgical modality of treatment. The efficacy of PTCA has recently improved by coronary stenting and adjunctive pharmacological therapy, such as aspirin^{5,6,7}, clopidogrel^{8,9} and glycoprotein IIb/IIIa receptor blocker¹⁰. The outcomes of PCI are measured in terms of success and complications and related to the mechanism of the employed procedure. The aim of the study was to evaluate the immediate (short-term) clinical and angiographic outcome following PTCA and stenting in patients with coronary artery disease (CAD).

Methods:

Study Patients

Between July' 2004 to October' 2006, 100 consecutive patients underwent PCI at University Cardiac Center (UCC), Banghabandhu Sheikh Mujib Medical University, Dhaka. The study group of patients consisted of 88 (88%) men and 12 (12%) women. With mean age of the patients was 52.4±6.2 years. (Table-01). Clinical inclusion criteria were symptomatic coronary artery disease with angina class I to IV and potential indication for coronary artery bypass surgery.

Stenting procedure

PTCA was done by technique as described by Gruentzig through femoral arterial approach according to modified seldinger technique. Outer diameter of guiding catheter was 7 to 8 French and 0.014 J steerable guidewire were used and dilatation was attempted using balloon catheter with 20-30 x 2-3 mm balloon size and balloon mounted stents were implanted at the target site. The balloon inflation pressure ranged from 4 to 14 atmosphere. Predilatation was performed using undersized, conventional angioplasty balloon before stenting.

Stenting was not performed in a vessel with a diameter 2.5 mm, if the lesion was longer than 40 mm, in case of extreme vessel tortuosity, if a large thrombus was visible at lesion site.

Medications, sheath removal and discharge

All patients received aspirin (75 mg daily) indefinitely and clopidogrel (75 mg daily) 72 hours

before the procedure up to six months to one year after procedure. Intravenous heparin 10,000 unit IV was given as bolus during procedure and APTT was monitored. Sheath was removed after 4-6 hours and uncomplicated patients were discharged on next day.

Outcome:

The outcome of PCI are measured in terms of success and complication and are related to the mechanism of the deployed devices as well as the clinical and anatomical patient-related factors. Complications can be divided into two categories;

Those common to all arterial catheterization procedures and

Those related to the specific technology used for the coronary procedure. With increased operator experience, new technology and adjunctive pharmacotherapy, the overall success and complication rate of angioplasty have improved.

Definitions of PCI Success:

The success of a PCI procedure may have the following components- angiographic success, procedural success and clinical success.

Angiographic success- A successful PCI produces substantial enlargement of the lumen at the target site. Previously definition was the achievement of a minimum stenosis diameter reduction to <50% in the presence of grade 3 TIMI flow¹¹. With the advent of advanced adjunct technology, including coronary stents, a minimum stenosis diameter reduction to <20% has been the benchmark of an optimal angiographic result.

Procedural success- A successful PCI should achieve angiographic success without in-hospital major clinical complications eg. death, myocardial infarction, emergency coronary artery bypass surgery during hospitalization^{11,12}.

Clinical success- clinically successful PCI includes anatomic and procedural success with relief of signs and or symptoms of myocardial ischemia after the patient recovers from the procedure^{13,14}.

Definitions of procedural complications. According to the 1998 coronary interventional document¹³

procedural complications are divided into six basic categories: death, MI, emergency CABG, stroke, vascular access site complications and contrast agent nephropathy.

Results:

In this study 36 (36%) patients had history of hypertension, 30 (30%) were smokers, 20 (20%) were diabetic, 14 (14%) had family history of ischaemic heart disease. Average left ventricular ejection fraction (LVEF) was 54.2 ± 7 (Table-I). Among these cases coronary vessel involved in 147 cases, target vessels were 130, PTCA was done in 124 and intracoronary stent deployed in 124 patients (Table-II).

Most of the patients in study presented as a case of post MI angina (38%) followed by stable angina pectoris (18%) (Table-I)

Single vessel disease was 60 (60%), double vessel disease was 33 (33%). triple vessel disease was 7 (7%). (Table-II). Majority of the patient had Type A Lesion 81 (62.3%). 93 (93%) patients had clinical success, 95 (95%) patient had angiographic and procedural success (Table-VI).

All the stent implantation procedures were successful except¹ five. In particular, there was one stent displacement. Intracoronary stent implanted in LAD 71 (57.3%), (Fig 1.a,b) LCX 24 (19.4%), RCA 16(12.9%) (Fig-2, a,b). Diagonal 10 (8.07%) and Marginal 3 (2.4%) (Table-03). Failed PTCA were in five cases due to tortuosity of vessels or total occlusion not crossed by PTCA wire or balloon. Bare metal stents (BMS) were deployed in most of the patient (71.8%) (Table-IV). with mean diameters (mm) 2.89 ± 0.2 and mean length of 14.68 ± 2 . TIMI Grade 03 flow was in 91 patients (70%) (Table -V). Three patients developed coronary artery dissection during the procedures who needed immediate intracoronary stent deployment. Stentangioplasty were successfully done in 12 patients with CTO and failed in 3 (three) patient due to failure in crossing guide wire. Three patients developed ischaemic pain and two patients developed heart failure and six patients developed major arrhythmias (Table-VII).

Table-I

Baseline characteristics of study population (n= 100)

Demography/other features	N (% SD)
Mean age (year)	52.4±6.2
Male	88 (88%)
Female	12 (12%)
Risk Factors	
Smoking	30 (30%)
Hypertension	36 (36%)
DM	20 (20%)
Dyslipidaemia	13 (13%)
Positive F. History	14 (14%)
Clinical Diagnosis	
Stable angina pectoris	28 (28%)
Unstable Angina	18 (18%)
AMI (Ant and Inf)	09 (09%)
Recent MI (Ant. Sept & Inf.)	07 (07%)
Post MI Angina.	38 (38%)
Anterior MI	24 (24%)
Inferior MI	08 (08%)
Combined	06 (06%)
Ejection fraction (mean)	54.20±7

Table-II

Angiographic diagnosis of study population (n =100)

Vessels	Total Number	Percentage (%)
Total diseased vessels	147	-
Total target vessel	130	-
Single vessel disease	60	60
Double vessel disease	33	33
Triple vessel disease	7	7

Table-III

Site of stent deployment in the target vessel (n = 124)

Site	Total number	Percentage (%)
LAD	71	57.3
LCX	24	19.4
RCA	16	12.9
Diagonal	10	8.07
Marginal	3	2.4

Table-IV*Characteristic of deployed stents in the target vessels (n = 124)*

Parameters	Total no	Percentage %
Types		
Bare metal	89	71.8
Drug coated	32	25.8
Drug eluting	3	2.4
Diameter		
2.5 mm	35	28.2
2.75 mm	26	21
3.00 mm	45	36.3
3.5 mm	15	12.1
4.0 mm	3	2.4
Mean diameter = 2.89 ± 2 (mm)		
Length (mm) :		
Range (0-10)	26	21
Range (10-19)	78	63
Range (20-29)	18	14.5
Range (30-39)	2	1.6
Meanlength = 14.68mm ± 2		

Table-V*TIMI flow of the target vessels (n= 130)*

Parameter (TIMI flow)	Before procedure Number (%)	After procedure Number (%)
Grade -0	10(8%)	6(4.6%)
Grade -1	95(73%)	0(0%)
Grade -2	25(19%)	33(25.4%)
Grade -3	0(0%)	91(70%)

Table-VI*Result of stentangioplasty of study population (n = 100)*

Results	Total number	Percentage %
Clinical success	93	93
Angiographic success	95	95
Procedural success	95	95

Table-VII*In-hospital clinical outcome of study population (n = 100).*

Parameters	Total number Patient	Percentage (%)
Dissection	3	3
Acute stent thrombosis	0	0
Acute MI	3	3
Acute LVF	5	5
Failed PTCA	4	4
Major arrhythmias (e.g. VT, VF)	6	6
Death	1	1

Discussion:

Based on our result, we believe that all types of PTCA and intracoronary stenting can play an important role in the treatment of symptomatic coronary artery diseases. Our in hospital mortality rate was one (%) comparing favorably with the results obtained in the previous angioplasty trials^{15,16,17}. The mean age of our study population was 52.4 ± 6.2 years, which is earlier age than other studies^{16, 18}.

Early recurrent ischaemia occurred in 4 (4%) patients in our series. Grines LC et al and Moreno R et al showed early recurrent ischaemia after PTCA in 5.1% and 6.5%, cases in their series^{15,18}, which are very close to our study and other studies in our country^{13,14}. Chest pain without changes on ECG just after PTCA occurred in cases which simulate the results of other study¹⁵.

Two patients had reappearance of symptoms within 1 month. Check angiogram of them were done which showed normal functioning of the stents. Thrombus containing lesions have been considered as contraindication for stentangioplasty. Stents were successfully deployed in two patients containing thrombus in LAD (Proximal) and LCX (distal) after treatment with low molecular weight heparin. Studies have shown that presence of angiographically visible thrombus as a risk factor for subsequent stent thrombosis¹⁶. However, other have represented coronary stenting as safe and effective therapy for thrombus containing lesion^{17,18}.

Elective stenting was done in most (80%) of patients. Similar elective stenting have also been reported by Moussa et al, Colombo et al²⁰ and Kimura et al²¹ (70%, 67% and 71% respectively). This study showed stenting as modality of treatment for suboptimal PTCA, acute vessel closure, dissection during PTCA and restenosis following PTCA similar to those reported as an indications for stenting by various authors^{14,22,23,27}. Hence unlike PTCA, this success of intracoronary stenting is not influenced by lesion morphology.

Recently developed drug eluting stents have reduced the incidence of restenosis drastically to 8 to 10%. Ten years follow up of initial Cohort of patients treated PTCA revealed 89.5% survival rate (95% with single vessel disease, 81% in-patients with multivessel disease²⁴). In patients undergoing with the 1985-1986 NELBL PTCA registry²⁵ a five year survival was 92.9% for double vessel disease and 86.5% for triple vessel disease. In patients with multivessel disease undergoing PTCA in BARI²⁶ 5 year survival was 86%. infarct free survival was 78.7%. Specifically 5 year survival was 84.7% with TVD, 87.6% with DVD (Double vessel disease).

Percutaneous intervention (PCI) of the chronic total occlusion (CTO) lesion present great challenge including reduced success rate, prolonged procedure time, large amount of contrast use, high occlusion rate, and costs. The goal of intervention in CTO is to penetrate the total occlusion and pass the wire in the true lumen of the distal vessel without causing stent angioplasty intimal dissection, Accordingly we have successfully done stentangioplasty in 12 patients with CTO and failed in three patient due to failure of passing the wire.

Limitation of the Study:

This is single center observational prospective study to assess the safety and short-term clinical and angiographic outcome of small number of patients. Further randomized trial may be needed for the better result.

Conclusion:

Percutaneous coronary intervention (PCI) have revolutionized the effective management of coronary artery disease and their symptoms. It has been

increasingly demonstrated to reduce the risk of adverse events in patients with acute coronary syndrome (ACS). Intracoronary stent implantation in coronary artery stenosis following PTCA is a valid strategy with good clinical and angiographic in-hospital results. This very study is an initial experience in a new center with small number of patients may serve as an impetus for future large scale study in home and abroad.

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