Percutaneous Transluminal Coronary Angioplasty in the Young Patients – Siriraj Hospital's Experience

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Abstract

The aim of this study was to follow-up immediate and long term results of patients aged less than 40 years with CAD treated by PTCA. Primary end points were to record major coronary events, incidence and timing of restenosis and requirement of repeated revascularization after initial PTCA.

Data was collected retrospectively from records of patients aged less than 40 years who underwent PTCA from Jan 1996 to June 1998 in Her Majesty Cardiac Center, Siriraj Hospital. Patients were followed up and data was collected regarding recurrent angina, major coronary events and results of repeated coronary angiography and revascularization if available.

Out of 830 procedures performed for 325 patients, 30 patients (9%) were less than 40 years of age and comprised of 26males (87%) and 4 females (13%). Eighteen patients (60%) had more than one risk factor. The most important risk factor was smoking (60%) followed by dyslipidaemia (47%) and family history of coronary artery disease (20%). DM was strikingly uncommon. 14 patients had single vessel disease and 16 patients had multiple vessel disease. Initial stenosis was 87.5 ± 9.8 and residual stenosis was 17.8±10.8. PTCA failed for 5 lesions, overall success rate was 89 per cent. Stent was used for 12 lesions in 10 patients. There was no major complication during the procedure. Minor complications included non occlusive dissection in four cases and groin haematoma in three cases. The follow up ranged from 7-36 months with the median of 23 months. During follow up, there was no major cardiac event such as death, acute MI, congestive heart failure or cerebero-vascular accident. Eleven patients (37%) had sustained improvement without recurrent angina. Recurrent angina occurred in 19 patients (63%) after initial PTCA and second/third recurrent angina occurred in 5 patients. On repeated coronary angiography angiographic restenosis was seen in 10 patients (33%) after initial PTCA. Overall repeated revascularization was done twenty times for sixteen patients which included 4 CABGs and 16 PTCA.

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Twenty one patients (70%) showed sustained improvement after repeated PTCA and medications. Follow up results of PTCA in young patients showed sustained improvement but achieved at high rate of repeated revascularization.

Key word : PTCA, Young Patients

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The concept of angioplasty was first introduced by Dotter and Judkins in the year 1964. The technique was initially effective in dilating peripheral arteries and was associated with complications which limited its clinical application[1]. In 1974, Andreas Greuntzig modified the technique replacing the rigid dilator with a double lumen catheter and dilated arterial lesions in the iliac and femoral vessels[2]. The first Percutaneous Transluminal Coronary Angioplasty (PTCA) of coronary artery was later introduced in the year 1979[3].

Since then progressive improvement in technique and equipment have produced dramatic growth in PTCA transforming it into a major therapeutic modality that is used to benefit a large number of patients with ischaemic syndrome[4]. Success rate has increased from 67 per cent in the year 1981 to 96 per cent in 1991 and the need for emergency coronary bypass surgery (CABG) has been reduced from 21 per cent in 1981 to less than 1 per cent in 1991.

Three randomized control trials have compared PTCA with medical therapy, and all three studied patients with single-vessel coronary artery disease[5]. ACME Trial[6] compared the effects of PTCA on angina and exercise tolerance with medical therapy in 212 patients with chronic stable angina who had single vessel disease. At 6 months of follow-up patients in the PTCA group showed significant symptomatic benefit (64% *vs* 46%; $P<0.01$). These benefits appear to be more pronounced in patients with more severe baseline angina[6,7]. Patients in the PTCA group also had greater improvement in exercise duration and psychological well-being[8].

Three large randomized control trials done in the 1970s established a role for CABG in the treatment of multivessel coronary artery disease[9]. The Veterans Administration Cooperative Study (VACS), the European Coronary Surgery Study (ECSS) and the Coronary Artery Surgery Study (CASS) compared CABG's results with medical therapy in the treatment of multi-vessel coronary artery disease[10,11]. Patients with the highest risk as defined by severity of angina and ischaemia, extent of coronary artery disease and presence of left ventricular dysfunction, had the greatest benefit in terms of survival when they were treated with surgical intervention[12]. The trials comparing CABG with medical therapy have established a role for revascularization in the treatment of multi-vessel coronary artery disease. However, the preferred method of revascularization remains controversial and is a major issue in 1990s.

Several randomized control studies comparing PTCA with CABG have recently been completed. In patients with chronic stable angina and multi-vessel disease, there were 6 major trials and 2 meta-analyses[13]. These were – RITA Trial[14], ERACI Trial[15], GABI Trial[16], EAST Trial[17], CABRI Trial[18] and BARI Trial[19] which together enrolled almost 4800 patients and showed no differences in mortality or in the combined end point of death and nonfatal myocardial infarction between patients treated with PTCA and those treated with CABG[14-19]. However, analysis of 353 treated diabetic patients in the BARI trial[19] showed the 5-year survival rate was significantly better in the CABG group than in the PTCA group (81% *vs* 65.6%). All these results have showed

that both methods of revascularization improved exercise tolerance, and angina-free exercise duration and reduced clinical angina[20]. However, the meta-analysis showed that second revascularization was more likely to be required in the first year following PTCA when compared to CABG (34% *vs* 3.3%)[20]. Thus the major remaining problem with the PTCA technique is the presence of recurrent angina within the initial 6 months from restenosis and the requirement of repeated revascularization.

The mean age of the study population group in most of these studies was 55-60 years. There are few studies to prove the efficacy of PTCA in young patients aged less than 40years. There is a paucity of data regarding incidence of chest pain, exercise tolerance and restenosis after PTCA in this age group which may be different from an older population. The aim of this study is to follow-up immediate and long term results of patients aged less than 40years with coronary artery disease who were treated by PTCA.

The primary end points of the study were:

- Major coronary events after PTCA which include fatal or non fatal myocardial infarction and unstable angina pectoris.
- Incidence and timing of clinical and angiographic restenosis and the requirement for repeated revascularization.

The secondary end points were :

- Evaluate risk factors and clinical presentations of coronary artery disease in the young population aged less than 40 yrs.
- Angiographic results.

We also compared the functional class before and after PTCA at the most recent follow-up visit.

MATERIAL AND METHOD

Data was collected retrospectively from the records of patients aged less than 40 years who underwent PTCA from Jan 1996 till June 1998 in Siriraj Hospital. Risk factors, clinical presentations, functional class before and after PTCA, indications for angioplasty, angiographic findings and complications during and after PTCA were recorded. Patients were called up for follow up and data was collected regarding incidence of chest pain, exercise tolerance, major coronary events and the number of hospitalization.

The exercise stress test using Bruce's Protocol was able to be done in fifteen patients. The results of repeated coronary angiography and PTCA were recorded.

RESULT

During 1996 – 1998, 830 PTCA procedures were performed for 325 patients. There were 228 males (70%) and 97 females (30%). There were thirty patients (9%) aged less than 40 years, out of which twenty six patients (87%) were male and four patients (13%) were female. Only six patients were aged less than 35 years.

Risk factors: Eighteen patients (60%) had more than one risk factor out of which twelve patients (40%) had two risk factors and six patients (20%) had three risk factors. Only two patients (15%) had no risk factors.

Table 1. Initial and residual coronary artery stenosis after PTCA.

	Single vessel (n = 14)	Multiple vessel (n = 16)
Percentage of Patients	47%	53%
Average initial stenosis	88 ± 4.1%	87.9 ± 11.6%
Average residual stenosis	13.7 ± 8.3%	16.8 ± 12%

Table 2. Follow-up outcome after PTCA.

Mean follow - up	22.1 ± 9.3months
Event free, improved	11 (37%) patients
Death, MI, CVA	0 patients
Recurrent angina	19 (63%) patients
Medical therapy, improved	5 (17%) patients
Angiographic restenosis	10 (33%) patients
New lesions	4 (14%) patients
Repeat PTCA	12 (40%) patients
Second/third recurrence	5 (17%) patients
CABG	4 (13%) patients
Sustained improvement after repeated PTCA or medical therapy	21 (70%) patients

Table 3. Comparison of results of EST, pre- and post-PTCA.

	Before PTCA	After PTCA
Number of patients.	11	15
Positive results.	8	4
Mets achieved.	4.8 ± 2.1	9.3 ± 1.9

The most important risk factor identified was smoking which was seen in eighteen patients followed by dyslipidaemia in thirteen patients, hypertension in six patients and family history of coronary artery disease in five patients. Only one patient had type II Diabetes Mellitus. One patient had chronic renal failure.

Clinical presentations and indications of CAG: Twenty patients (67%) had a history of acute myocardial infarction. Indications for coronary angiography included : Post MI angina in nine patients, complicated MI in six patients (MI with heart failure in four patients and a survivor of sudden cardiac arrest in two patients) and positive exercise stress test (EST) at low work load at four weeks post MI in five patients. Ten patients presented as progressive angina which was present at minimal exertion or at rest.

Angiographic results: Fourteen patients (47%) had single vessel disease and sixteen patients (53%) had multiple vessel disease (two patients with triple vessel disease and fourteen patients with double vessel disease). Initial stenosis was 87.5+9.8 and residual stenosis after PTCA was 17.8+10.8. Stent was used for twelve lesions in ten patients.

In the group of single vessel disease patients, the left anterior descending artery (LAD) was involved in twelve patients and in two patients the right coronary artery was involved. Total coronary artery occlusion was seen in four patients. There was failure to pass wire in one patient as the lesion was heavily calcified and totally occluded. The success rate was 92 per cent.

In the group of multiple vessel disease patients, initial stenosis ranged from 85 per cent - 100 per cent with an average of 87 per cent. Lesions of LAD and branches were seen in twelve patients, lesions of right coronary artery (RCA) in nine patients and lesions of left circumflex artery in five patients. Total coronary artery occlusion was seen in five lesions. Generally one vessel was revascularized at a time except in four patients. Residual stenosis ranged from 0-40 per cent with the average of 17 per cent. PTCA was not successful for four lesions. Success rate was 85 per cent.

There were no major complications during the procedures. There was no procedure related mortality, no incidence of acute MI or requirment of emergency CABG. Minor complications included dissection in four cases without reduction of antegrade flow. All patients were discharged without complications within 2-3 days.

Follow up: Followed-up ranged from 7 – 36 months with the median of 23 months. During follow-up there was no major event such as death, acute MI, congestive heart failure or cerebrovascular accident. Eleven patients (37%) had sustained improvement and were event free with no clinical recurrence. Recurrent or worsening angina occurred in nineteen patients (63%).

The duration for recurrent angina ranged from 1– 15 months with the average of five months. Fifteen patients had angina within the first 6 months, three patients within 12 months and one patient at 15 months after initial PTCA. There were two hospital admissions during the third and ninth month after initial PTCA. Both patients were diagnosed as unstable angina at the time of admission.

Chest pain was more common in patients with multiple vessel disease, as seen in twelve patients compared with seven patients of single vessel disease. Five patients out of ten patients with stent had recurrent chest pain in comparison with fourteen out of twenty patients without stent.

Overall repeated revascularization was done twenty times for sixteen patients which included four CABGs and sixteen PTCA during the follow-up period of two years. Stents were used in seven patients, five on initial PTCA and two on repeated revascularization. CABG in one patient was done after failed PTCA, in two patients after initial PTCA and in one patient after the third recurrent angina. Twenty patients (70%) showed sustained improvement after repeated PTCA and without CABG, the return of minimal symptoms in six patients and four patients remained asymptomatic after CABG.

A follow-up treadmill exercise stress test (EST) was done in fifteen patients after PTCA had been done for at least six months. EST was positive in four patients and METs achieved ranged from 3.3 to 13 with the average of 9.3 METs. Thirteen out of fifteen patients achieved more than 8 METs (Table 3). In nine patients EST was done before PTCA and the METs achieved ranged from 2 to 8 with the average of 6.3. The other six patients were in clinical functional class II-III.

DISCUSSION

Despite the relatively low frequency of myocardial infarction and coronary artery disease in the young population[20] the potential for death and long term disability at young age make this entity

an important clinical problem. In this study the number of patients was small, 7.3 per cent of the total patients undergoing PTCA during the same period, which is due to lower incidence of coronary artery disease in young patients (8% of total population) as seen in previous studies[21].

Risk factors: Only two patients (6.6%) were without risk factors similar to 7 per cent in a previous study[21]. This study highlights the importance of male sex, cigarette smoking, dyslipidaemia, hypertension and family history as risk factors for coronary artery disease in young patients. Eighty per cent of these patients were men which is consistent with the high incidence of coronary artery disease and myocardial infarction in young men (92% in young men, compared with 78% of middle aged men and 60% of elderly male patients.) (22) The other very important risk factor was smoking, seen in 60 per cent of patients consistent with the closer association of tobacco consumption with CAD in young patients (80%) compared with middle age (56%) and the elderly population (24%)[21,22]. Diabetes was distinctly unusual in these patients, consistent with the findings of others.

Clinical features: A history of angina pectoris was seen in only four patients (13%) which was quite similar to previous studies (23% of young patients compared to 40% of middle aged and 48% of the elderly population)[22]. Post MI heart failure was seen in only two patients (6.6%), comparable to a previous study in which congestive heart failure was seen in only 3 per cent of young patients compared with 10 per cent of middle aged and 21 per cent of the elderly population[22]. One year mortality and morbidity was low. These findings were consistent with previous studies[21].

Results of CAG and PTCA: Coronary artery lesions were less complicated: single vessel involved in fourteen patients; double vessels involved in fourteen patients and triple vessels in two patients. There was no case with the involvement of the left main coronary artery. The left anterior descending artery was most commonly involved followed by the right coronary artery. The right coronary artery was most commonly completely obstructed. These findings correlate with findings of less complex lesion and less involvement of left main coronary artery in young patients[23,24].

PTCA was successful in all patients except in one patient and there was no major complication during or after the procedure. Minor complication were seen in two patients.

Follow up: Patients were followed-up for an average of 22 months. During this period, clinical recurrence was seen in nineteen patients (63%) which is quite high compared with previous studies in which clinical recurrence was seen in 34 per cent of patients[25]. Patients with stents placed had lesser incidence of chest pain (40%) compared with patients without stents placed (80%). Chest pain was more common in patients with double vessel disease which may be due to incomplete revascularization because generally only one vessel was revascularized at a time. Repeated coronary angiography was done only in patients with clinical recurrence. Angiographic restenosis was seen in ten patients (33%) which is consistent with the rate of restenosis after PTCA. Overall, during the follow-up of two years, repeated revascularization was done twenty times for sixteen patients which included four CABGs and sixteen PTCAs. Sustained improvement was seen in twenty patients (70%) after repeated PTCA. EST after PTCA showed improvement in exercise duration with the achievment of an average 9.3 ± 1.9 METs.

Limitation of study :

1. Total number of the patients in the study was small which can be explained by lower incidence of coronary artery disease in the young patients.
2. Repeated angiographic studies were done only in symptomatic patients, therfore does not provide the information of restenosis in asypmtomatic patients.
3. The study was a descriptive non comparative study.

SUMMARY

Follow-up results of PTCA in the young patients showed sustained improvement and increase in exercise tolerance, but this is achieved at the expense of repeated revascularization.

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การขยายหลอดเลือดหัวใจตีบด้วยลูกโป่งในผู้ป่วยอายุน้อยในโรงพยาบาลศิริราช

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ได้รวบรวมผู้ป่วยอายุน้อยกว่า 40 ปีซึ่งได้รับการขยายหลอดเลือดหัวใจที่ตีบด้วยลูกโป่ง (PTCA) ตั้งแต่เดือนมกราคม 2539 – มิถุนายน 2541 ที่ศูนย์โรคหัวใจสมเด็จพระบรมราชินีนาถ โรงพยาบาลศิริราช และได้ทำการติดตามผู้ป่วยและเก็บรวบรวมข้อมูลเกี่ยวกับอาการเจ็บหน้าอก และ coronary event ต่างๆ รวมทั้งผลของการตรวจหลอดเลือดหัวใจและการขยายหลอดเลือดซ้ำ พบว่ามีผู้ป่วยจำนวน 325 ราย โดยมี procedure ทั้งหมด 830 procedures การติดตามผลการทำ PTCA ในผู้ป่วยอายุน้อยพบว่าได้ผลดี แต่ยังมีอัตราการขยายหลอดเลือดซ้ำค่อนข้างสูง

คำสำคัญ : การขยายหลอดเลือดหัวใจตีบด้วยลูกโป่ง, ผู้ป่วยอายุน้อย

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