

PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY IN TOTAL OCCLUSIONS : SUCCESS RATE, COMPLICATIONS, AND LONG TERM FOLLOW-UP

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SUMMARY

Purpose : This study analyses the results of coronary angioplasty performed in our institute in order to determine the procedural success, complications, and long term outcome of percutaneous transluminal coronary angioplasty (PTCA) in totally occluded coronary arteries. **Methods :** 40 patients with total occlusions aging 3 days to 14 weeks had undergone PTCA between January 1993, June 1994. All had angina pectoris. A movable guide wire dilation system and Magnum guide wire were used. **Results :** Overall initial PTCA success rate was 67.5% and depended on the duration of the occlusion (100% within the first week, 60 % within 1-12 weeks, 40% within 12-14 weeks). No patient died; one patient needed emergency bypass operation. Follow-up at 6 months was available for all the patients in whom PTCA was successful: 80 % experienced no angina; in the remaining 20% who complained of angina, the exercise ECG was found to be negative. Long term patency rate was 37.93 % with a 62.07 % of restenosis and 13.79 % of reocclusion rate. **Conclusion :** Coronary angioplasty of totally occluded vessels has a high rate of primary success with a low incidence of complications and a high rate of restenoses.

Key Words: Total Occlusion, PTCA.

INTRODUCTION

The first experience of PTCA in chronic total occlusions was the one performed by Gruentzig to patients whose coronary arteries had silently occluded while waiting for angioplasty planned on a nontotal lesion. The primary success rate was 62 % (1) . Patients with short and recent total occlusions and acute occlusions during impending MI (2) were the next. A fresh and soft thrombus in the above mentioned cases is an easy obstacle to pass through, compared to chronic total occlusions.

In chronic total occlusions, the recanalization equipment should be passed through the thrombus

and its texture is crucial for the success or failure of PTCA. The extent of fibrosis of the most recent thrombus is the decisive factor in determining the chance of successful balloon recanalization. The older and the more fibrosed a clot, the smaller the chance to cross it safely.

Attempts to recanalize chronic total occlusions are hampered by low success and high recurrence rates. On the other hand, serious complications are rare, although they do occur. The success rates in the literature range from 42 to 72 % (3-9) .

The duration of occlusion emerges as a key factor for success in most studies (4, 6-12) . The

most rapid decline in the chance of success occurs within the first 4 weeks after the occlusion (13). Case selection plays an even more important role in old occlusions, and only angiographically ideal occlusions (short straight segment in a large vessel) with a sound clinical indication should be tackled if they date back more than a few months. Further adverse factors are the absence of a stump or tapered segment as an entry port (5,12), bridging collaterals (which testify to the age of occlusion) (12), and occlusions in by pass grafts (14).

Success rate of PTCA is higher in functional stenosis compared to chronic total occlusion. This rate is known to increase with;

- duration of the occlusion <12 weeks (<1 week success rate is higher)
- functional vs anatomic occlusion
- length of the occluded segment <15mm
- collateral circulation (absence of bridging collaterals)
- vessel stump
- use of new instruments or technique.

The goal of this study was to evaluate the procedural success, complication rate, and long term results of angioplasty of total occlusions in our invasive cardiology unit.

PATIENTS AND METHODS

Definitions

Total occlusion was defined as 100% luminal diameter narrowing with TIMI (Thrombolysis in Myocardial Infarction Trial) grade 0 antegrade flow.

The angioplasty was considered a procedural success if the percent diameter stenosis of the first dilated total occlusion was reduced to less than 50% and antegrade flow showed normal runoff. Clinical success required procedural success and the absence of in hospital complications of myocardial infarction, coronary surgery, or death. Restenosis was defined as a greater than 50% diameter stenosis at follow up angiogram of the first dilated total occlusion. Reocclusion was defined as recurrent total occlusion of the first dilated total occlusion.

Patient population

This study comprised all patients with total

occlusion undergoing coronary angioplasty at Gazi University Medical School, Ankara, Turkey, between January 1993 and June 1994. Patients having had a prior revascularization procedure (angioplasty or coronary artery by-pass graft) or myocardial infarction within 3 days of angioplasty were excluded. There were 40 patients in the study group. 5 (all male) of the patients had PTCA within the first week, 30 (24 males, 6 females) within 12 weeks, and the remainder 5 (4 males, 1 female) after 12 weeks' time (Table 1).

There were 40 study patients: 33 men and 7 women aged 37 to 73 years (56±7). All had stable angina of effort and 15% were in NYHA class 3 or 4. All were treated with conventional antianginal drug therapy. There were clinical and electrocardiographic evidences of previous myocardial infarction in all. Multivessel coronary artery disease, defined as >50% diameter stenosis in more than one of the three epicardial coronary arteries or in major branches thereof, was present in 10 (25%) of 40 patients. Previous CABG had been undertaken in none of the patients.

The duration of occlusion ranged from 1 to 14 weeks (median 8). The target vessel was the left anterior descending coronary artery in 27 patients, followed by 10 RCA and 3 Cx artery lesions.

Angioplasty procedure

Percutaneous transluminal coronary angioplasty was performed by the femoral approach in all cases. In all 19 (47.5%) cases conventional movable 0.14 mm guide wire-dilation systems were used initially and lesions were passed through successfully via this approach. For the rest of the cases (21 patients) in which the above mentioned system was unsuccessful, the Sneider Meier Magnum system (15) was used and was successful in 11 (27.5%) cases. In the remaining 10 (25%) cases, the lesions cannot be passed through and the procedure was stopped.

Age (yrs)	56
Male sex (%)	82.5
Prior MI (%)	100
Type of case (%)	
One vessel disease	75
Multivessel	25

Table 1 : Patient characteristics.

Balloon and probing catheter were also used if required, to provide back-up. There was no correlation between the technique used and the age of the lesion.

Follow-up

Noninvasive follow-up (exercise ECG) was done routinely at first month. Angiographic follow-up was routinely recommended at 6 months, or earlier in the presence of symptoms. Clinical follow-up was obtained by trained personnel who made telephone contact with patients in the study. These personnel were instructed to determine the cause of death, especially whether death cardiovascular in nature, and diagnosing and grading angina pectoris. Patients were asked for the presence of symptoms, all hospitalizations subsequent to the index angioplasty, and repeat angioplasty or coronary surgery. All deaths were recorded and coded as cardiac or noncardiac when the information was available. Clinical follow-up was available in 100% of the cases.

RESULTS

Procedural outcome

The occlusion was passed through with both the 0.14 mm guide wire and balloon, and satisfactory dilatation was obtained in 29 of 40 occluded vessels with an overall procedural success rate of 72.5%. The success rate was 70.4% in left anterior descending coronary artery occlusion, 100% in circumflex coronary artery occlusion, and 70% in right coronary artery occlusion. However, in 4 cases, although post procedural patency was obtained, the residue was found to be >50%. In 1 patient with RCA lesion, the procedure was complicated by an intimal dissection and antegrade flow was not established. In 3 patients, although the guide wire had passed the lesion, PTCA was accepted unsuccessful with no recanalization in one, 10% recanalization in the second case, and 40% recanalization in the third one, all having 1-12 weeks age occlusion. When these 4 cases were excluded, the success rate becomes 62.9% for LAD, 100% for Cx, and 50% for RCA occlusions (Table 2).

Coronary artery dilated (%)	
Right	(10/40) 25
Left anterior descending	(27/40) 67.5
Left circumflex	(3/40) 7.5
Angiographic success (%)	(25/40) 62.5
Major complications (CABG)	(1/40) 2.5
Angiographic complications (%)	(2/40) 5
proximal vessel dissection	(1/40) 2.5
Transient acute occlusion	(1/40) 2.5

Table 2 : Dilatation site characteristics for arteries undergoing PTCA of total occlusions.

The success rate according to the lesion age is shown in the table 3 .

The procedure was unsuccessful (no improvement in flow from TIMI grade 0) in 15 procedures. An uncomplicated failure to cross the lesion with either a guide wire or a balloon occurred in 11 (27.5%). There was no significant difference between the three epicardial vessels in terms of uncomplicated procedure failures.

Intracoronary stent was applied to 3 patients, all with LAD lesions, because of ineffective recanalization.

In 1 patient who experienced angina pectoris and ST segment elevation in ECG after successful PTCA, perfusion balloon catheter was placed and then angiographic control showing no reocclusion was observed after 3 hours. Another patient with LAD total occlusion and acute left ventricular failure in spite of successful recanalization was given to emergency CABG because of the ongoing severe hemodynamic instability.

There was no in-hospital death in the group with procedural success. The remaining 25 patients were followed clinically for 6 months. 80% of the patients were asymptomatic at the end of the 6 months. The exercise ECG results were evaluated as negative for the remaining 20%. Patency rate at 6 months was evaluated via coronary angioplasty and was found to be 37.93% with a restenosis rate of 62.07% and complete reocclusion in 13.79%.

	< 24 hours	1-12 weeks	> 12 weeks
primary success (%)	(5/5) 100	(22/30) 73.3	(2/5) 40
PTCA success (%)	(5/5) 100	(18/30) 60	(2/5) 40

Table 3 : Success rate.

Recurrence is common after successful recanalization of total occlusions. Recurrence rates average 64%, ranging from 43-77% (16). Complete reocclusions of recanalized lesions occur only in an average of 17%, the remaining 46% being restenoses.

Angiograms were reviewed retrospectively to search for angiographic predictors of procedural success or failure. The features assessed were those other workers have found to be significant: length of occluded segment (> or < 1 cm), the presence or absence of a definite stump, and the presence or absence of side branches associated with the occlusion. In our patients, procedural success was associated with the presence of stump, absence of side branches, short occluded segments, and the experience of the operator.

Follow-up

Of the 25 patients discharged from the hospital after successful procedure, 80% was asymptomatic at 6 months and 1 patient underwent CABG.

DISCUSSION

Of the 40 patients with chronic total coronary occlusion, our primary success rate for reestablishing patency without significant residual stenosis was 62.5%. This result is in keeping with the initial success rates previously reported, ranging from 42 to 72% (3-9).

All large series (7,17) confirm that the main factor that determines the outcome of PTCA for occlusion is the duration of the occlusion. It probably corresponds to aging of the lesion, with progressive fibrosis replacing previous thrombus. Thus, older lesions are more difficult to cross with the guide wire. Holmes et al. reported that (17) occlusion duration of < 12 weeks had an acute success rate of 68% as compared to no success in the 5 patients with a duration of > 12 weeks. DiSciascio et al. (13) reported a 74% success rate when the occlusion duration was < 2 weeks and 55% when the duration was > 2 weeks. Kereiakes et al. (7) reported a 67% success rate when the duration was < 20 weeks and an 18% success rate when the duration was > 20 weeks. Melchior et al. (4) noted success rates of 69, 50, and, 11% for occlusion durations of < 1 month, 1 to 6 months, and > 6 months, respectively. LaVeau (10) et al. reported a 80% success with a duration of occlusion < 24 hours, 71% success rate when the duration was

between 1 day to 8 weeks and 69% success rate when the duration was > 8 weeks.

Our success rates with respect to the lesion age classified as <1 week, 1-12 weeks, and >12 weeks were 100%, 60%, and 40%, respectively.

Our results support other studies that demonstrate the limited nature of acute complications from PTCA of total coronary artery occlusions. All previous studies note a significantly lower morbidity rate when PTCA of total occlusions is compared to angioplasty of non-occluded coronary arteries. None of the previous studies report death during attempted angioplasty of totally occluded coronary artery. Only Safian et al. (18) reported cases requiring emergent CABG (secondary to side branch occlusion in 2 patients and to guidewire fracture in 1).

The current study is limited in several respects. It is a retrospective analysis of totally occluded coronary arteries referred to one center for PTCA. This clearly introduces a case selection bias in that only cases deemed appropriate for PTCA were included in the study. Additionally, the small number of patients in the current and other studies introduces the possibility of beta error, especially with subgroup analysis. With greater numbers, small differences in success frequency related to duration of coronary occlusion may show statistical significance. However, even with large numbers, the very low success rates for PTCA in long standing coronary occlusions noted from prior studies would be unlikely.

PTCA for total coronary occlusion should be considered as a separate entity. The initial success rate is lower than that for stenoses (19). However major complications are less frequent: Only one patient in this series required emergency CABG, and no MI occurred.

After a follow up of 6 months, 25 patients with an initially successful procedure had persistent subjective improvements of anginal symptoms and exercise stress test was negative in all of the cases.

In conclusion, recanalization of occluded coronary arteries has a lower initial success rate but also a lower complication rate than angioplasty for stenotic arteries. The success rate is strongly dependent on the duration of occlusion, and success rate is higher in the early cases. In our view, PTCA for occlusion older than 6 months should not be

attempted. In case of success, a favorable late angiographic result is only to be expected in about half of the patients, but long term relief of angina is provided in about 80 %. In case of recurrent symptoms, control angiography may be indicated, since about half of the recurrent lesions can be treated successfully by repeat PTCA.

We demonstrate that PTCA of totally occluded coronary arteries can be performed with a reasonable likelihood of acute success and a very low risk of major clinical complications.

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