

SAFETY AND EFFICACY OF PTCA IN THE TREATMENT OF CORONARY TOTAL OCCLUSION

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SUMMARY

Background: In recent years several centers have published data suggesting that total coronary occlusion is not a rare finding. Further exploration and improvement of percutaneous technique aimed at the treatment of this potentially large group of patients therefore seems justifiable. A retrospective study was thus carried out to analyze the short-term results of PTCA attempts on coronary total occlusion. **Methods:** St Thomas' hospital London cardiac intervention database was used to retrieve 76 consecutive patients with total coronary occlusion who had undergone PTCA (82 procedures) during Jan 1992 to Oct 1995. Either conventional (20%), Kaltentbach (37%) or a Magnum (43%) wire was used to cross the total occlusions. **Results:** Sixty-five (86%) of these patients were males with mean age of 57 + 6. Of these procedures 47(57 %) were successful (Group A) while in 35(43%) the PTCA wire did not cross the total occlusions (Group B). Risk factors, prior myocardial infarction (MI), previous PTCA and anginal status were comparable in two groups. Incidence of target location was 24(51%), 8(17%) and 14(30%) in Group A as compared to 9(26%), 7(23%) and 16(46 %) in Group B for LAD, RCA and Cx respectively. The overall incidence of gross dissections was 4.8%. One patient from group B developed acute MI during the procedure and two died on the table. There were, however, no major complications (including Ac MI or death) amongst group A patients during hospitalization. None of the patients from either group required emergency CABG. **Conclusions:** PTCA is a reasonably safe procedure for the treatment of coronary total occlusions. All the three types of wires used were almost equally effective in crossing the occlusions. Treatment success was significantly related to the age and site of occlusion.

INTRODUCTION

In recent years several centers have published data on large series of patients with totally occluded coronary arteries. In one study [1] enrolling 3449 consecutive patients with coronary artery disease, 13 48 patients (39.1 %) had 1767 total occlusions of which 1024 occlusions were treated with medication, 578 by means of CABG and only 165 by balloon angioplasty (9.3%). These numbers suggest that total coronary occlusion is not a rare finding but at present only in a minority of cases does this lead to an angioplasty as the treatment of first choice. However there has to be an evidence of myocardial viability in the territory of the occluded vessel prior to the procedure.

The major limitations for a wider application of PTCA as a treatment of first choice in total coronary occlusions is due to the fact that even after careful

patient selection success rates do not exceed 60 % on average [2,31]. The variables which have been described as predictive of procedural success include lesion morphology, chronicity of occlusion, site of occlusion and the skill of the operator [4,5,6,7,81]. The most common reason for failure is inability of the operator to pass a guide wire through the coronary occlusion into the distal true lumen or sub-intimal tracking of the guide wire finding a path of least resistance. The underlying factors which have been found responsible for this failure are; absence of visible stump of the occlusion; presence of a bend or side branch at the site of occlusion [11] providing an undesirable path of least resistance; visible collaterals suggesting a long duration of occlusion and increased length of the occluded segment [9,10,11]. However, PTCA is a safe, successful and less expensive alternative to CABG. A retrospective study has thus been carried out to analyze the results of PTCA attempts on selected patients found to have coronary total occlusion.

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AIMS OF THE STUDY

The primary objective of this study is to determine the success of crossing total coronary occlusion by means of PTCA guide wire in patients who were candidates for revascularization. The secondary objectives are; to establish the safety and efficacy of the procedure after the initial crossing and angioplasty of the total occlusion and to probe the various factors and possible reasons of the procedural failure in the unsuccessful PTCA group.

METHODS AND PATIENTS POPULATION

The cardiac intervention database was used to retrieve 76 consecutive patients with total coronary occlusion who had undergone PTCA at St Thomas' hospital London, during Jan 1992 to Oct 1995. All of these patients were found to have angina and/or objective evidence of myocardial ischemia with proven total coronary occlusion (TIMI 0) on coronary angiography and were hence eligible for coronary revascularization. A written informed consent was obtained from each patient prior to the procedure.

ANGIOPLASTY PROCEDURE

A mechanical PTCA guide wire often started with conventional or Kaltentbach supported by 038 hollow wires or a Magnum wire was employed using the femoral approach. The following were the steps of the procedure:

- a. An 8F-guiding catheter providing good back-up support and co-axial alignment was used.
- b. A guide wire of choice was introduced towards the stump of the total occlusion in order to bring the tip of the wire into contact with the stump of the occlusion.
- c. Attempt was made to cross the occlusion with the guide wire.
- d. If the primary attempt was unsuccessful the guide wire of first choice was exchanged for wires with other characteristics.
- e. For debulking the lesions a rotational mechanical device (rotablator) or excimer laser coronary angioplasty (ELCA) was also employed in some of the cases.

PROCEDURAL SUCCESS

Treatment or procedural success was defined as reaching the true lumen distal to the occlusion angiographically documented by filling of the distal segment showing the tip of the wire in the true lumen.

CONCOMITANT MEDICATION

15,000 units IV Heparine was given during the procedure. IV Dextran was used as volume expander. IV Nitrates and Diamorphine were used to relieve angina as and when required.

RESULTS AND DISCUSSION

PATIENT'S CHARACTERISTICS:

Table 1 summarizes the baseline clinical characteristics of 76 patients with coronary total occlusion who had undergone procedures in this study. 65 (85.5%) of these patients were males with mean age of 57 yrs. The table also compares the clinical characteristics of these patients in whom coronary total occlusions were crossed (56.6%) and successfully dilated (Group A) with those (Group B) in whom the occlusions could not be crossed (43.4%). The results showed that history of risk factors, prior myocardial infarction (MI), previous PTCA and anginal status were comparable in two groups. However there were 3(6.9%) patients in group A who had a past history of coronary artery bypass graft surgery (CABG) as compared to 10(30.3%) such cases in group B.

TABLE 1
BASELINE PATIENTS' CHARACTERISTICS (N=76)

	Group A	Group B
Patients	43(56.6%)	33(43.4%)
Males	37(86.1%)	28(84.8%)
Females	6(13.9%)	5(15.2%)
Mean Age y	56+10	58+9
Risk factors:		
a. Family history	12(27.9%)	9(27.3%)
b. Smoking	15(34.9%)	16(48.5%)
c. Diabetes	5(11.6%)	3(9.1%)
d. Hypertension	11(25.6%)	5(15.2%)
e. Hyperlipidemia	11(25.6%)	9(27.3%)
Angina:		
a. Unstable	12(27.9%)	7(21.2%)
b. Stable	26(60.5%)	23(69.7%)
Previous MI	25(58.1%)	19(57.6%)
Prior CABG	3(6.9%)	10(30.3%)
Previous PTCA	7(16.3%)	5(15.2%)
Age of occlusion:		
< 3 month duration	11(25.6%)	2(6.1%)
> 3 month duration	32(74.4%)	31(93.9%)

Group A=successful PTCA group, group B=unsuccessful PTCA group

The number of recent occlusions (< three months duration) evidenced by history of myocardial infarction and/or angiographic proof was significantly higher in group A(25.6%) as compared to group B(6.1%) 1 %) as highlighted in fig 1. Age of occlusions greater than three months was evident in 32 patients (74.4%) in group A as compared to 31(93.9%) in group B.

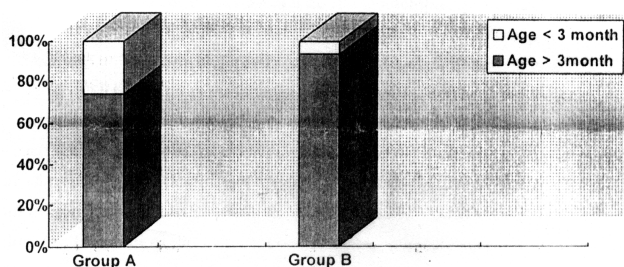


Figure No. 1

Comparison of Age of Coronary Occlusions in Treated Groups

Angiographic analysis and procedural outcome

A total of 82 PTCA procedures were attempted on 76 patients in this study. Of these procedures 47(57.3%) were successful (Group A) while in the remaining 35(42.7%) procedures the PTCA wire did not cross the total occlusions (Group B). Catheter reports and/or angiograms of all the procedures were reviewed for data analysis.

Table 2 summarizes the angiographic locations of the target occlusions.z

Table 2
Angiographic location of target occlusions
(n=82)

	Group A	Group B
Occlusions (n)	47(57.3%)	35(42.7%)
Localization:		
LAD	24(51.1%)	9(25.7%)
Cx	8(17%)	7(20%)
RCA	14(29.8%)	16(45.7%)
LAD graft		2(5.7%)
RCA graft	1(2.1%)	1(2.9%)

Group A=Successful PTCA procedures, Group B=Unsuccessful PTCA procedures, LAD=Left anterior descending, Cx=Circumflex, RCA=Right coronary artery.

The results showed a significant difference between the locations of occlusions in two groups. In 24(51.1%) of the successful procedures the target vessel was LAD as compared to only 9(25.7%) in case of group B. While on the other hand the target vessel was RCA in 14(29.8%) of the successful procedures as compared to 16(45.7%) in-group B.

Table 3 shows data analysis of PTCA wires used in the attempted procedures. A conventional mechanical PTCA wire (usually 014) was used in 19 of Group A procedures but was effective in 16. Kaltenschbach supported by a hollow wire was employed in 16 of Group A procedures and was effective in 14. Where as Magnum wire was utilized in 18 of Group A procedures and was effective in 17. The number of attempts each with conventional, Kaltenschbach and Magnum wire in group B cases was 17, 18 and 18 respectively. These results suggest that in our study there was no significant difference between the efficacies of different PTCA wires used to cross the total occlusions. However of the 11 recent occlusions which were successfully opened up 7 were crossed by conventional wire, 2 by Magnum wire and 2 by Kaltenschbach where as of the 36 chronic occlusions 15 were crossed by Magnum wire 12 by Kaltenschbach and 9 by conventional wire. Hence Magnum wire was found more effective for chronic occlusions where as the conventional wire did better for recent ones.

Table 3
Data analysis of PTCA wires used in attempted procedures

Wire type	Group A		Group B	Efficacy
	Effective(n)	Ineffective(n)		
Conventional	16	3	17	44.4%
Kaltenschbach	14	2	18	41.2%
Magnum	17	1	18	47.2%

COMPLICATIONS

Table 4 outlines the short-term complications of the attempted procedures. Limited dissections (Covered by NHLBI classification type A-C) were observed in 16(34%) of the successful procedures (Group A) and 10(28.5%) in unsuccessful procedures (Group B), where as gross dissection (Covered by NHLBI type D-F) was seen in 1(2.1%) 1 %) of group A cases as

compared to 3 (8.6%) in-group B. The overall incidence of dissections caused by each of conventional, Kaltenbach and Magnum wire used in the attempted procedures was 6(20%), 11 (36.7%) and 13 (43.3 %) respectively as shown in Fig 2. The rates of dissections were highest with Magnum and lowest with conventional wire.

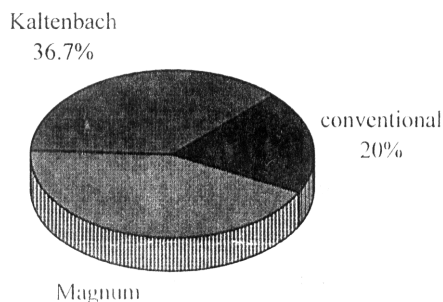


Figure No. 2

Incidence of Coronary Dissections Caused by Different PTCA Guide Wires

One patient from group B developed acute myocardial infarction (MI) during the procedure and two from the same group died on the table but they were already in cardiogenic shock and were brought for rescue angioplasty. There were, however, no major complications (including Ac MI or death) amongst group A patients during the procedure or hospitalization. None of the patients from either group required emergency CABG as a complication of the procedure.

Table 4
Complications of attempted procedures
(n=82)

	Group A(n=47)	Group B(n=35)
Limited dissection	12(25.5%)	8(22.8%)
Gross dissection	2(4.2%)	3(8.6%)
CABG	-	-
Acute MI	-	1(2.8%)
Death	-	2(5.7%)
In-hospital reocclusion	-	-

Group A=Successful PTCA group, Group B=Unsuccessful PTCA group, Limited dissection=NHLBI Classification type A-C, Gross dissection=NHLBI classification type D-F.

CONCLUSION

This study concludes that the success rates of PTCA in the treatment of total coronary occlusions are in the range of 57.3%, which are not different from other

studies [2&3]. An important factor responsible for treatment success has appeared to be the age of occlusion; the recent the occlusion the greater are the chances of success. In our study we observed that success rates are higher when the target occlusions are in LAD as compared to ones in Cx or RCA. The analysis of different PTCA guide wires used in the attempted procedures suggests that all the three types of wires i.e. conventional, Kaltenback or Magnum are almost equally effective in crossing the occlusions although the Magnum wire has been found more effective for chronic occlusions where as conventional wire for the recent ones. However the rates of dissections have been found comparatively higher with Magnum wire.

The study also reveals that PTCA is a reasonably safe procedure for the treatment of coronary total occlusions. The overall mortality rate of 2.4% in our study is not directly attributable to the procedures since all the two patients who died on the table were already in cardiogenic shock and were brought for rescue angioplasty. The incidence of gross dissections was 4.8% but all of these cases were manageable. Only one patient developed acute Myocardial Infarction, which was successfully treated and had uneventful recovery.

Attempts are in progress to improve the short and long term results in the treatment of total coronary occlusions by designing new techniques (18) and devices (39,40,43,45,47,48,50). A more careful selection criteria, use of excimer laser guide wire (51,52,19,20), ultrasound angioplasty (63,64,65) and stenting (37) under intravascular ultrasound monitoring (66,67) in cases of sub optimal PTCA results are the most promising steps towards improving the angiographic and clinical outcome. The results of these attempts at a larger scale are still under evaluation.

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