Initial Success Rate and Complications of Elective PTCA in 5064 Patients

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From October 1981 to May 1990, 7000 elective percutaneous transluminal coronary angioplasties (PTCA) were performed at the Kokura Memorial Hospital, of which 5064 were analyzed using our computer system. The primary success rate of PTCA was 85%, in 1 vessel disease 88%, in 2 vessel disease 85%, and in 3 vessel disease 79%. Complications of PTCA were as follows: myocardial infarction, 2.1%; emergency CABG, 0.5%; death, 0.6%. We analyzed predictive factors for in-hospital death or emergency CABG. Five significant factors are significantly related: cerebral vascular accident, chronic renal failure, jeopardized collateral, abrupt closure, and dilatation of the left anterior descending artery.

SINCE Gruentzig's success in dilating stenosed coronary arteries in humans in 1977, percutaneous transluminal coronary angioplasty (PTCA) has become popular world-wide and presently stands alongside aorto-coronary (A-C) bypass surgery. Compared to A-C bypass surgery, however, PTCA has the advantage of being able to be performed in a short period of time, without open heart surgery. Nevertheless, since it is not done under cardiopulmonary support, it has the disadvantage of possible abrupt closure. This study considers those factors which contribute to major complications in PTCA.

SUBJECTS AND METHODS

Subjects consisted of 5064 cases of elective PTCA which were entered into the hospital's computer out of 7000 cases of PTCA performed between October 1981 and March 1990. Patients' ages ranged from 30 to 89 years, with a mean of 62.1 years. There were 3887 males, and 1177 females.

Key words:

PTCA
In-hospital mortality
Abrupt closure
Emergency CABG
Procedure related or less related complication

The first 100 PTCAs were conducted via the brachial approach. In the remaining cases, the femoral approach was used except under special circumstance. Dextran 500cc was given one hour prior to PTCA at a rate of 100cc/h. An intra-arterial infusion of 10,000 units of heparin and an intracoronary infusion of 5 mg of isosorbide dinitrate were also given.

The contrast medium used for the first 3000 cases was 76% urografin, and that for the remaining cases was iopamiron. After PTCA, the sheath was normally removed the next morning and the patient discharged from the hospital the following day. Medication used was Ca antagonists, long acting nitrates, aspirin, and dipyridamole. For patients in serious condition, an intra aortic balloon pumping (IABP) was used before PTCA.

RESULTS

Table I shows the success rate in 5064 cases of elective PTCA. It includes complications such as acute myocardial infarction (AMI), emergency coronary artery bypass grafting (CABG), and death. The number of elective CABG in the case of unsuccessful

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TABLE I SUCCESS RATE, MAJOR COMPLICATION, AND OUTCOME OF 5064 CASES WITH PTCA ON ELECTIVE CASES

	no.	Success rate	AMI	Emergent CABG	death	Elective CABG
1. Diseased vessel		%	%	%	%	%
1 VD	2318	88	1.4	0.5	0.4	0.5
2 VD	1591	85	2.4	0.4	0.6	2.8
3 VD	824	79	3.6	1.1	1.0	8.0
previous CABG	331	84	1.2	0.3	0.6	3.4
2. Procedure						
1 st	3386	83	2.6	0.7	0.7	3.3
2 nd	1172	88	0.9	0.1	0.4	1.2
3 rd ≤	506	92	1.0	0.2	0	1.7
	5064	85	2.1	0.5	0.6	2.7

1 VD: 1 vessel disease, 2VD: 2 vessel disease, 3 VD: 3 vessel disease, no.: number, AMI: acute myocardial infarction

TABLE II CAUSE OF DEATH IN ELECTIVE PTCA

less or not related		related	
GI bleeding	2	acute closure, shock	4
bleeding, VF	1	LMT	2
bleeding, ARF	1	others	2
intracranial bleeding	1	late abrupt closure	1
shower embolism	2	spasm of LMT and RCA	1
brain infarction	2	hemopericardium	1
pulmonary infarction	1	FWR after AMI	2
obstruction of LMT		after emergency CABG	4
during angiography	1		
VF after surgical repair			
of AV fistula	1		
pneumonia	2		
	14 (0.27%)		13 (0.25%)

GI: gastrointestinal, VF: ventricular fibrillation, ARF: acute renal failure, LMT: left main trunk, AV fistula: atrioventricular fistula, RCA: right coronary artery, FWR: free wall rupture, AMI: acute myocardial infarction

PTCA is also shown. The success rate in single vessel disease was 88%, in 2 vessel disease 85%, in 3 vessel disease 79%, and in previous CABG 84%.

The success rate for initial PTCA was 83%, for second PTCA 88%, and for third or more PTCA 92%. The average success rate was 85%.

The incidence of AMI was 1.4% in single vessel disease, 2.4% in 2 vessel disease, and 3.6% in three vessel disease. In previous CABG cases the figure was 1.2%; in initial PTCA 2.6%, in second PTCA 0.9%, and in third or more PTCA 1.0%, with an average

of 2.1%. The necessity for emergency CABG was 0.5% in single vessel disease, 0.4% in 2 vessel disease, 1.0% in 3 vessel disease, and 0.3% in previous CABG. For initial PTCA, the figure was 0.7%, for second PTCA 0.1%, and for third or more PTCA 0.2%, an average of 0.5%.

Death occurred in 0.4% cases of single vessel disease, 0.6% of 2 vessel disease, 1.0% of 3 vessel disease and 0.6% of previous CABG cases. In terms of the number of procedures, death occurred in 0.7% of initial PTCA, and 0.4% of second PTCA. There were no deaths in cases of three or

TABLE III MULTIPLE REGRESSION ANALYSIS OF PREDICTING FACTOR OF IN-HOSPITAL DEATH OR EMERGENCY CABG (N=5064)

Variable	Standard partial regression coefficient	F value	T value	Standard error	
Gender (M>F)	-0.0211	2.3002	1.5166	0.0033	
>75 yrs (Yes<No)	0.0237	2.9194	1.7086	0.0054	
NPLMT (Yes<No)	0.0255	3.3528	1.8311	0.0132	
CVA (Yes<No)	0.0559	16.4309	4.0535	0.0099	$p<0.00$
CRF (Yes<No)	0.0955	47.1979	6.8701	0.0134	$p<0.00$
LVEF<40% (Yes<No)	0.0122	0.7327	0.8560	0.0070	
3 Vessel Disease (Yes<No)	0.0211	2.1324	1.4603	0.0039	
JCO (Yes<No)	0.0343	5.7946	2.4072	0.0063	$p<0.01$
Abrupt Closure (Yes<No)	0.1664	145.4821	12.0616	0.0058	$p<0.00$
LAD (Yes<No)	0.0456	10.8630	3.2959	0.0028	$p<0.00$
First Procedure (Yes<No)	0.0224	2.5701	1.6032	0.0030	
Hypertension (Yes<No)	-0.0128	0.8462	0.9199	0.0028	
Diabetes (Yes<No)	0.0087	0.3940	0.6277	0.0033	
Prior Myocardial infarction (Yes<No)	-0.0245	3.0425	1.7443	0.0028	
			34.0556	0.0432	

Variance Ratio 21.38621 ($p<0.01$)

NPLMT: non-protected left main trunk, CVA: cardiovascular accident, CRF: chronic renal failure, LVEF: left ventricular ejection fraction, JCO: jeopardized collateral, LAD: left anterior descending artery

more PTCA.

Table II shows whether or not the 27 deaths were directly related to PTCA in the first procedure (N=3739). 13 deaths (0.25%) were directly related to PTCA. Four deaths were due to acute closure and 4 followed emergency CABG. Out of deaths not directly related to PTCA, 5 were related to bleeding including 2 cases of gastrointestinal bleeding, 1 of ventricular fibrillation and acute renal failure from bleeding, and 1 of cerebral bleeding. There were also 2 cases of shower embolism and 4 cases of brain embolism. Altogether, there were 14 (0.27%) deaths which were not directly related to PTCA, approximately half of all the deaths which occurred.

Factors related to death or emergency CABG were analyzed using 14 variables (Table III). Variables found to be significant in death and emergency CABG were: dilatation of left anterior descending artery, jeopardized collateral, chronic renal failure, cerebral vascular accident and abrupt closure. Of these 5 variables, abrupt closure was the most significant. This was also studied using the multivariable analysis of 20 factors shown in Table IV. Injury through the guiding catheter, multiple abrupt clo-

sure, and jeopardized collateral were significant.

DISCUSSION

The success rate of PTCA is largely determined by the morphology of coronary artery stenosis. Although a success rate of 95% or more can be expected in single vessel disease with a proximal discrete, short lesion, this figure will be much lower if the single vessel disease includes a total occlusion. In multiple vessel disease, there are many total occlusions, leading to lower success rates. Our results were in concordance with those of a WHO task force report¹ of 85% success, and were lower than the success rates of other institutions. It is thought that this is due to the number of difficult cases dealt with at our institution.

The incidence of complications is as important as the success rate. As PTCA does not use an artificial cardiopulmonary unit, it might be considered a very stable procedure, however, in some patients, the outcome is completely unpredictable. In our institution, the incidence of acute myocardial infarction was 2%, that of emergency CABG 0.5%, and of death 0.6%, lower than reports from

TABLE IV PREDICTING FACTOR OF DEATH OR EMERGENT CABG AFTER ABRUPT CLOSURE OF CORONARY ARTERY

— MULTIVARIATE ANALYSIS —

(N=308; pts with side branch occlusion or distal embolism were excluded)

Variables	standard correlation coefficient	T	P
Gender (M<F)	-0.0219	0.3454	
Age	0.0085	0.1555	
Diabetes Mellitus (Yes<No)	-0.0085	0.1425	
Hypertension (Yes<No)	0.0824	1.3890	
Poor LV (Yes<No)	0.0308	0.3836	
Episode of CVA (Yes<No)	0.0407	0.5592	
Renal dysfunction (Yes<No)	-0.0690	1.1143	
Previous MI (Yes<No)	0.0924	1.5471	
No. of procedure	-0.0173	0.2945	
Staged Procedure (Yes<No)	-0.0304	0.4731	
IABP (Yes<No)	0.0234	0.3667	
Guiding catheter (Yes<No)	-0.4585	3.2850	<0.01
Guide wire (Yes<No)	-0.3316	1.2935	
After dilatation (Yes<No)	-0.2305	0.8462	
Non-protected LMT stenosis (Yes<No)	0.0546	0.5641	
No. of diseased vessel	-0.0361	0.4900	
Dilatation of SVG (Yes<No)	-0.0670	1.0625	
Predilatational stenosis (%)	-0.0925	1.4437	
Multiple abrupt closure (Yes<No)	-0.1522	2.4440	<0.02
Jeopardized Collateral (Yes<No)	-0.1561	2.3993	<0.05
multiple correlation coefficient	0.5085		
F value	3.98		

Poor LV: poor left ventricular function, CVA: cardiovascular accident, MI: myocardial infarction,
No.: number, IABP: intraaortic balloon pumping, LMT: left main trunk, SVG: saphenous vein graft

other institution. It is thought that this is influenced somewhat by the type of case on which PTCA is performed. Examination of the variables in cases in which acute myocardial infarction occurred or where emergency CABG became necessary, shows that dilatation of the left anterior descending artery, abrupt closure, cerebrovascular accident and renal failure were the most influential factors. In general, factors contributing to death are female gender, collateral donor artery, the use of IABP, low blood pressure before and after the procedure, and multiple vessel disease. The greatest danger in PTCA is abrupt closure. When the factors contributing to this are analyzed, it is seen that significant factors are not so much we expected, left ventricular function, gender, age, non-protected left main trunk stenosis or number of diseased vessels, but there manipulation of the guide catheter, multiple abrupt closure and jeopardized collateral. In a

study of 4772 procedures by Ellis, abrupt closure occurred in 140 cases (2.9%)? Simpfordorfer³ reported abrupt closure occurred in 32 of 1500 cases (2%); Hollman⁴ 20 of 935 (2.1%), and Marquis⁵ 18 of 164 (11%), showing a very high frequency of abrupt closure. We had 308 cases of abrupt closure out of 5064 PTCA cases (0.6%). Thus the rate of abrupt closure in our hospital is lower than in the above reports. This is due to caution in the manipulation of the guide catheter, and in order to prevent multiple abrupt closures, if haziness or flap is seen after dilatation of the first vessel in multiple vessel disease, some time is spent before the second dilatation.

Cardiac death consequent to acute closure after coronary angioplasty occurred in only 13 of 294 cases having abrupt closure out of 8207 consecutive procedures performed since 1981 (0.16% cardiac mortality) reported by Ellis⁶ These results were much better than

our own (0.6%), but death occurred in 0.9% (27 deaths of 3079 cases) in NHLBI PTCA registry⁷.

Considering only the factors for death in PTCA, 13 cases were directly related to the procedures, and 14 were not. This suggests that when PTCA is performed, care should be taken not only in the procedure, but in observing the general condition of the patient and in checking for frequent bleeding etc., after PTCA, in order to prevent major complications.

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