Chapter 4

RESULTS

Between November 1995 to February 1997, Forty-six cases of patients who had undergone successful PTCA were enrolled in our study. The characteristics of the patient population were shown in table 6.

Table 6 Characteristics of patient population

Total number of patients	46	
Age (yr)	61.3±19.0	(range 42-79)
Gender m/f (%)	29/17	(63% / 37%)
Risk factors		
Hypercholesterolemia	65 %	(30/46)
Hypertension	46 %	(21/46)
Diabetes mellitus	41 %	(21/46)
Old age (>65 Years)	41 %	(19/46)
Cigarette smoking	17 %	(8/46)
Previous MI	30.4 %	(16/46)
Anteroseptal wall	15.2 %	(7/46)
Anterior wall	6.5 %	(3/46)
Inferior wall	6.5 %	(3/46)
Lateral wall	2.1 %	(1/46)
Left ventriular hypertrophy	6.5 %	(3/46)
Atrial fibrillation	4.3 %	(2/46)
Previous PTCA	20.0 %	(11/54)
Previous CABG	1.8 %	(1/54)
Antianginal drug		
Calcium blocker	24.0 %	(11/46)
Beta-blocker	57.0 %	(26/46)
Nitrates	83.0 %	(38/46)
Anginal chest pain before PTCA	85.0 %	(46/54)

I 17366665

Most of the patients were male(63%). Hypercholesterolemia, hypertension and diabetes mellitus were the frequent risk factors in our study. Thirty percent of patients had previous MI before. Some patients (20%) had performed PTCA. Almost all were receiving antianginal medications and still had chest pain before PTCA 85.0 %

Table 7 and 8 show the findings of exercise treadmill test and MIBI scan before PTCA procedures. Seventy-three percent of patients had positive EST by developing anginal pain during exercise or having abnormal ECG changes, whereas ninety-six percents of patients had myocardial ischemia from MIBI scan. Therefore, most of the patients still had evidence of myocardial ischemia before PTCA was performed.

Table 7 Exercise Performance

Total number of patients with pre EST	69.0 %	(37/54)
Exercise duration (minutes)	7.0±2.0	(range 4.1-12.2)
Maximal heart rate (% of target HR)	87.8±16.8	(range 56-130)
Chest pain during exercise	21.6 %	(8/37)
Positive by abnormal ECG alone	51.0 %	(19/37)
Positive by abnormal ECG and Symptoms anginal pain	19.0 %	(7/37)
Positive by symptom anginal pain alone	3.0 %	(1/37)
Negative EST	11.0 %	(4/37)
Inadequate or Uninterpreted	16.0 %	(6/37)

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table 8 Results of MIBI scan before PTCA procedure

Total number of patients with pre MIBI scan	50 %	(27/54)
Myocardial ischemia	96 %	(26/27)
Fix defect or Old MI	7 %	(2/27)
Regional wall motion abnormality	22 %	(6/27)
Apical wall		3/27
Anterior wall		2/27
Anteroseptal wall		2/27
Inferior wall		1/27
Inferoseptal wall		1/27
LV ejection fraction	60.5±9.0	(range 40-78)

Most of the patients had evidence of myocardial ischemia before PTCA procedures, such as symptomatic anginal chest pain, abnormal exercise stress test and MIBI scan which showed reversible myocardial filling defect.

Table 9 shows coronary angiographic findings before PTCA. Most of the patients had single vessel disease; nevertheless, we had forty-six percent of multi-vessel disease.

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table 9 Coronary angiography

Single vessel disease	54 %	(29/54)
Double vessel disease	33 %	(18/54)
Triple vessel disease	13 %	(7/54)
Coronary artery lesions		
Left anterior descending	76 %	(64/84)
Left circumflex artery	48 %	(40/84)
ight coronary artery	35 %	(30/84)
Percent stenosis of vessels	86.2 ±12.0 %	(range 50-100)
Regional wall motion abnormality	24.0 %	(11/45)
Apical wall		6/45
Anterior wall		5/45
Septal wall		3/45
Inferior wall		2/45
Lateral wall		1/45
Posterior wall		1/45
LV ejection fraction	62.5 ±14.8%	(range 30-91)

Percutaneous transluminal coronary angioplasty (PTCA)

Fifty-four PTCA procedures were performed in our forty-six patients. Initial successful rate was 100 %, all residual stenosis less than 30 % and most of the patients(94 %, 51/54) had not chest pain after PTCA. The other patients seldom had chest pain but the symptom was relieved by routine medical antianginal drugs and pain eventually disappeared after the follow-up. The detail of PTCA procedures is shown in table 10.

Table 10 Percutaneous transluminal coronary angioplasty procedures

Total number of PTCA procedures	54	
Total number of PTCA lesions	88	
Indication of PTCA		
Stable angina	44 %	(24/46)
Unstable angina	31 %	(17/46)
Post MI angina	11 %	(6/46)
Angiographic restenosis	7 %	(4/46)
Congestive heart failure	4 %	(2/46)
Acute MI (rescue)	2 %	(1/46)
Type of PTCA		
Elective case	74 %	(40/54)
Ad hoc case	24 %	(13/54)
Emergency (rescue)	2 %	(1/54)
One vessel PTCA	85 %	(46/54)
Two vessel PTCA	15 %	(8/54)
Vessels dilated		
Left anterior descending	63 %	(34/54)
Left circumflex artery	34%	(18/54)
Right coronary artery	19 %	(10/54)
Type of PTCA lesions		
Type A	9 %	(5/54)
Type B	30%	(16/54)
Type C	65 %	(35/54)
Additional interventional device		
Intracoronary stent	42 %	(23/54)
Microstent	22 %	(12/54)
Palmaz schatz	20 %	(11/54)
PTCRA	7 %	(4/54)

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table 10 Percutaneous transluminal coronary angioplasty procedures

Diameter reduction (%)	70.1±18.7	(range 20-100)
Residual stenosis after PTCA	16.1±13.0	(range 0-40)
Complications	26 %	(14/54)
Minimal dissection	22 %	(12/54)
Stent thrombus	2 %	(1/54)
Abrupt closure	2 %	(1/54)
Wire broken	2 %	(1/54)

The major indication of PTCA was stable angina which did not respond to medical treatment. Other indications include unstable angina, post MI angina and rescue PTCA after acute MI. In patients with angiographic restenosis in previous PTCA cases or CHF, although the patients had no clinical anginal pain except they showed evidence of some myocardial ischemia from MIBI scan. In our study, most of the lesions were type C (65%) which was complex and difficult to perform PTCA; therefore, we had quite a higher complication rate. Complications including minimal dissection (22%), stent thrombosis (2%), Abrupt closure (2%), and Wire broken (2%) were shown. Consequently, we had to use intracoronary stent for these compicated lesions. In case of stent thrombosis we used intracoronary urokinase for lysis clot, and the result was good and in case of abrupt closure, it subsided after administered intravenous heparin. Wire broken was removed by using double wire technique and caused no complication.

At week 3 and 4 after successful PTCA, the patients were evaluated the efficacy of PTCA by using MIBI scan. We found complete revascularization only 32 %(13/41) and partial revascularization 68 %(28/41), but most of the patients had not recurrence of anginal chest pain.

At month 3 and 6 after PTCA we followed up the detection of restenosis by using clinical anginal chest pain, EST, and MIBI scan. The results are shown in table 11,12.

Table 11 Clinical anginal chest pain and exercise stress test for detection restenosis after PTCA

Recurrent anginal chest pain	37 %	(20/54)
Exercise stress test		
All positive EST	45 %	(24/54)
Positive abnormal ECG only	35 %	(19/54)
Positive abnormal ECG and Symptoms	6 %	(3/54)
Positive symptoms only	4 %	(2/54)
Negative EST	39 %	(21/54)
Inadequate or Uninterprete	17 %	(9/54)
Exercise duration time	7.4±2.0	(range 3.2-11.5)
Percentage of maximal heart rate	87.4±12.8	(range 52-105)

Symptomatic anginal pain was only 37 %, whereas abnormal EST was detected higher(45%). Thirty-nine of the patients had negative EST and the results from seventeen percent of patients could not be interpreted. There was no significant changing of exercise performance between before and after PTCA procedures ($p>0.05$).

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Table 12 Result of MIBI scan for restenosis detection after PTCA

Frequently of number of MIBI scan		
At week 3 and 4	37 %	(19/54)
At month 3	33 %	(17/54)
At month 6	31 %	(16/54)
Restenosis evidence from MIBI	63 %	(34/54)
Left anterior descending	61 %	(33/54)
Left circumflex artery	11 %	(6/54)
Right coronary artery	6 %	(3/54)
New lesions evidence from MIBI	4 %	(2/54)
Fix defect	24 %	(13/54)
Anterior wall		8/13
Inferior wall		7/13
Anteroseptal wall		4/13
Inferolateral wall		4/13
Anterolateral wall		2/13
Regional wall motion abnormality	21 %	(10/47)
Apical wall		8/47
Anteroseptal wall		2/47
Anterior wall		3/47
Septal wall		4/47
Lateral wall		1/47
LV ejection fraction	59.7±12.2	(range 30.0-78.0)

From table 12 sixty-three percent of the patients had evidence of myocardial ischemia from MIBI scan during the follow-up of 6 month duration and four percent of patients had new lesions. Its detection rate was highest when compared with clinical anginal pain or abnormal EST.

Coronary angiography was repeated in all patients at the end of the study. Angiographic restenosis was 58 % per case and 51 % per lesions of PTCA. Most of the restenosis occurred during 3 to 6 months. Left anterior descending artery(LAD) had a higher rate of restenosis than left circumflex artery(LCX) and right coronary artery(RCA).

Three new lesions were detected-two lesions were LAD and one lesion was LCX. Coronary arteriographic findings at the end of the study are shown in table 13.

Table 13 Coronary arteriographic findings at the end of the study

Duration between PTCA and repeat CAG	6.1±2.7	(1.6-17)
Angiographic restenosis rate per case	58 %	(27/46)
Angiographic restenosis rate per lesions	51 %	(43/84)
Total percent of stenosis	56.2±35.9	(range 0-100)
Percent stenosis of restenosis group	88.5±11.0	(range 60-100)
Percent stenosis of no restenosis group	22.4±15.9	(range 0-45)
Vessels with restenosis		
Left anterior descending artery	62%	(21/34)
Left circumflex artery	50 %	(9/18)
Right coronary artery	50%	(5/10)
Number of new lesion	3	
Vessels with new lesion		
Left anterior descending artery	2	
Left circumflex artery	1	
Regional wall motion abnormality	19 %	(5/26)
Anterior wall		5/26
Apical wall		3/26
LV ejection fraction	56±14.8	(range 45.0-67.0)

Table 14 Comparision of sensitivity, specificity and accuracy of anginal chest pain, EST and MIBI scan for detection restenosis after PTCA by using CAG as a gold standard (n= 54)

	Sensitivity (%)	Specificity (%)	Accuracy (%)
Anginal chest pain	39.4	66.7	50.0
Exercise stress test	63.6	66.7	64.8
MIBI scan	84.8*	71.4	79.7*

*$p < 0.05$ versus EST and $p < 0.001$ versus anginal chest pain

The sensitivity, specificity and accuracy of Tc-9m MIBI scan for detection of restenosis were 84.8%, 71.4% and 79.7% respectively. When we compared them with anginal chest pain and EST, MIBI scan has the highest of all values predictors, with only sensitivity and accuracy that showed statistical significance ($p<0.05$). Although specificity of MIBI scan was also higher than anginal pain and EST, it had no significant difference ($p>0.05$).

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Figure 11 Sensitivity, specificity and accuracy of anginal chest pain and Tc-99m MIBI scan for detection of restenosis after PTCA

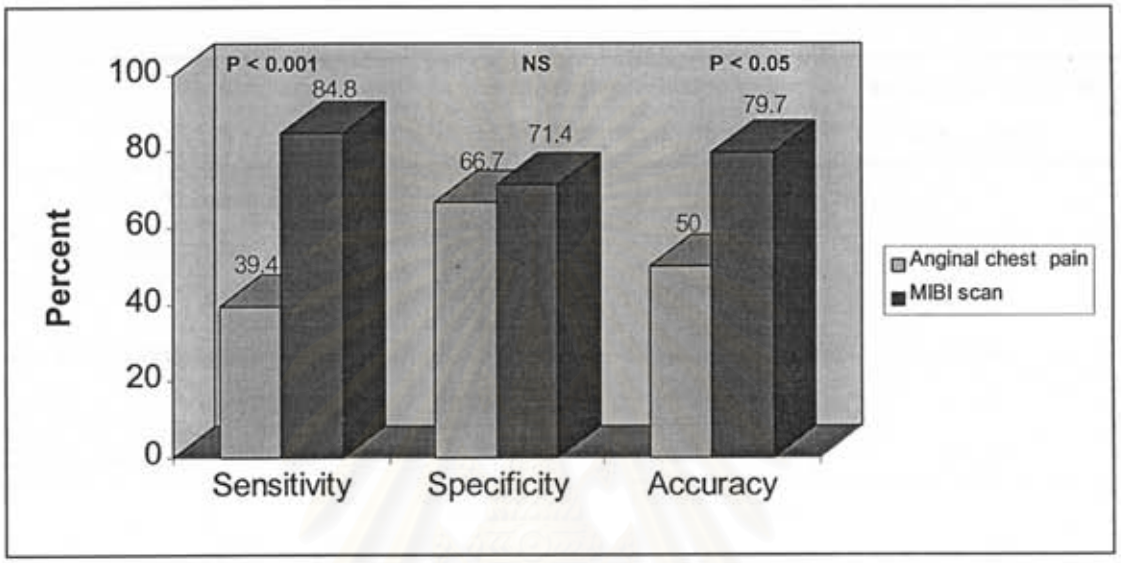

Figure12 Sensitivity, specificity and accuracy of exercise stress test and Tc-99m MIBI scan for detection of restenosis after PTCA

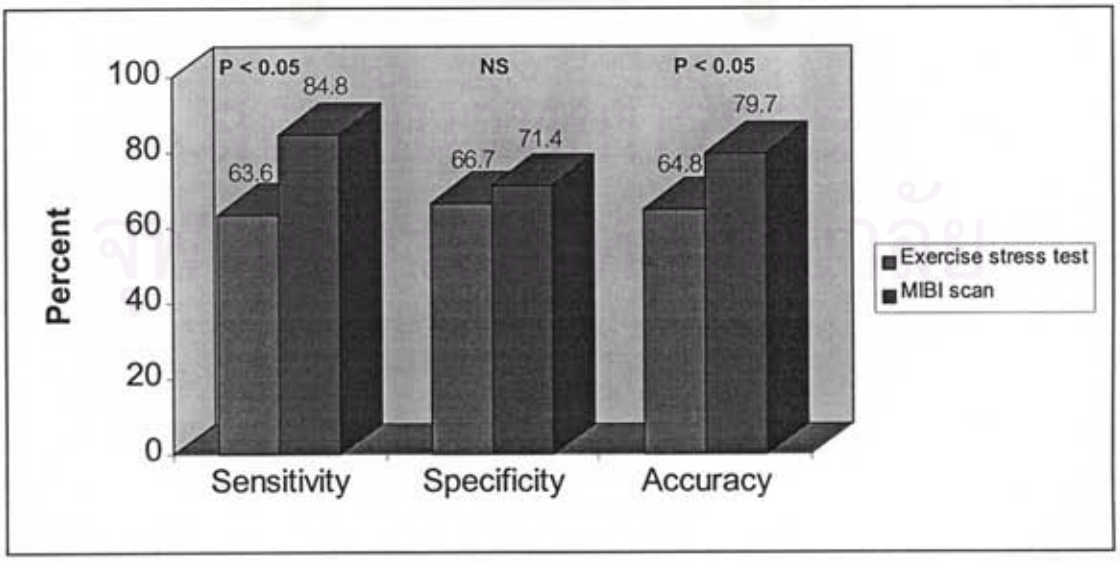

Table 15 Comparision of positive and negative predictive value of anginal chest pain, EST and MIBI scan for detection restenosis after PTCA by using CAG as a gold standard (n=54)

	Positive predictive value (%)	Negative predictive value (%)
Anginal chest pain	65.0	41.2
Exercise stress test	75.0	53.8
MIBI scan	82.4*	75.0*

*p <0.05 versus anginal pain and EST

Positive and negative predictive value of MIBI scan were 82.4%. and 75.0% respectively and also higher than anginal chest pain and EST with statistical significance (p <0.05).

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Figure 13 Positive and negative predictive value of anginal chest pain and Tc-99m MIBI scan for detection of restenosis after PTCA

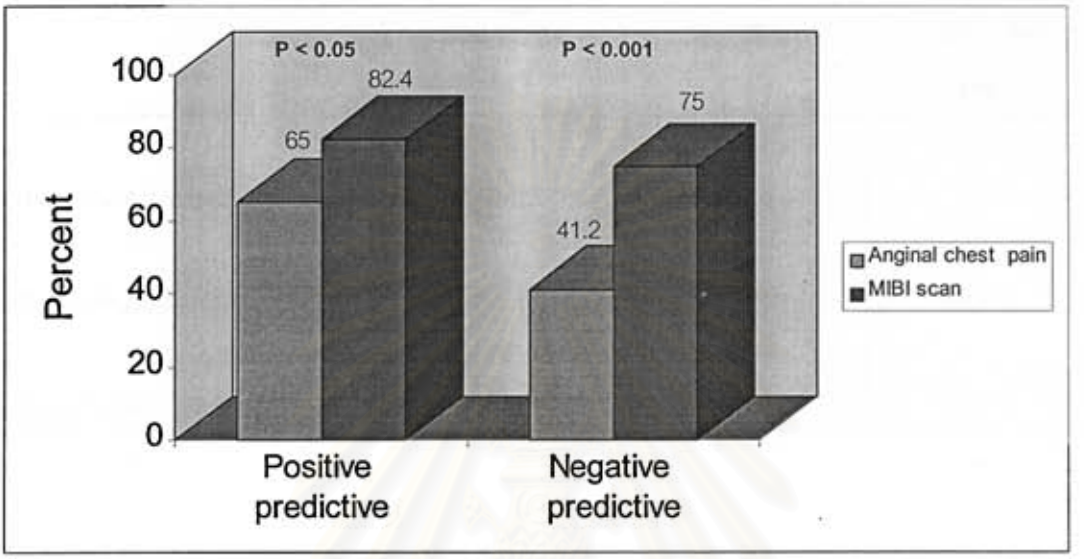

Figure 14 Positive and negative predictive value of exercise stress test and Tc-99m MIBI scan for detection of restenosis after PTCA

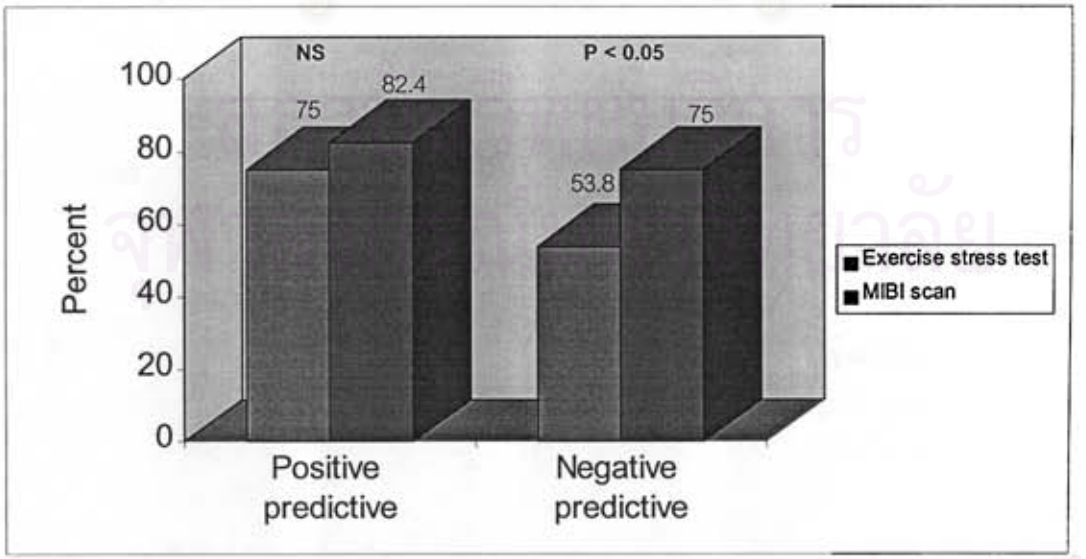

Table 16 Comparision of sensitivity, specificity, and accuracy of MIBI scan for detection of restenosis in individual vessels (n=84)

	Sensitivity (%)	Specificity (%)	Accuracy (%)
Left anterior descending	95.2*	60.6	74.0
Left circumflex artery	55.6	97.8*	90.8*
Right coronary artery	60.0	100.0*	95.3*

*p <0.05

When we sub-classified into individual vessels (table 15), sensitivity of LAD is dramatically increase (95.2%) with statistical difference, whereas specificity also drops. Conversely, LCX and RCA have significantly higher of specificity and accuracy than LAD

Figure15 Sensitivity, specificity and accuracy of Tc-99m MIBI scan for detection of restenosis in the individual vessel

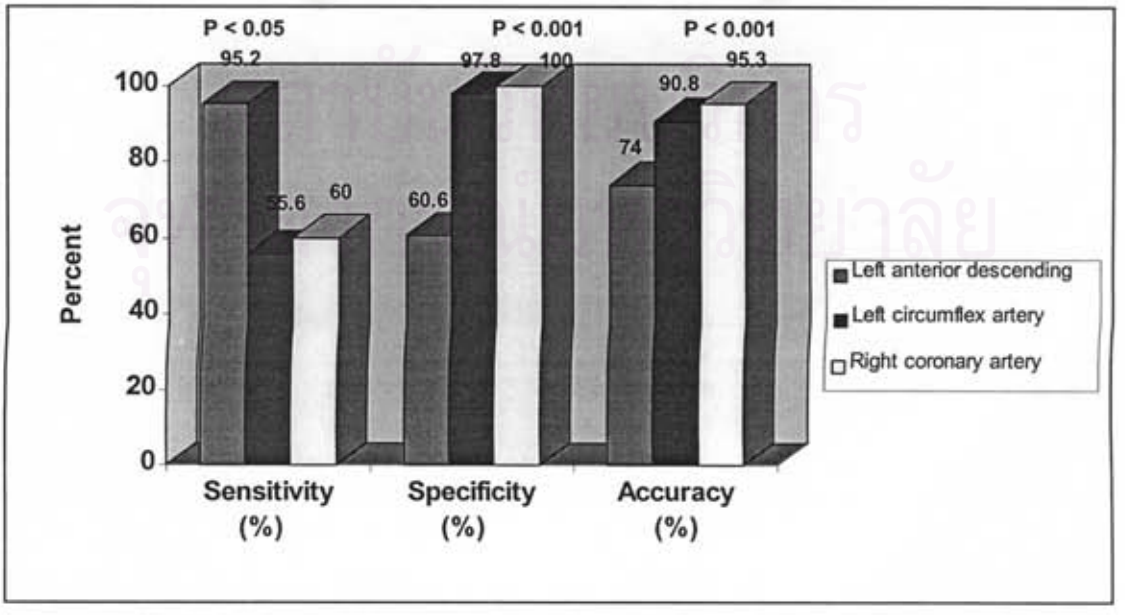

Table 17 Comparision of positive and negative predictive value of MIBI scan for detection of restenosis in individual vessels (n=84)

	Positive predictive value (%)	Negative predictive value (%)
Left anterior descending	60.6	95.2
Left circumflex artery	83.3	91.7
Right coronary artery	100.0*	96.1

*p<0.05 versus LAD, LCX

LCX and RCA have higher positive predictive value than LAD, whereas negative predictive value of LAD, LCX and RCA is quite similar and shows no statistical difference.

Figure 16 Positive and negative predictive value of Tc-99m MIBI scan for detection of restenosis in the individual vessel

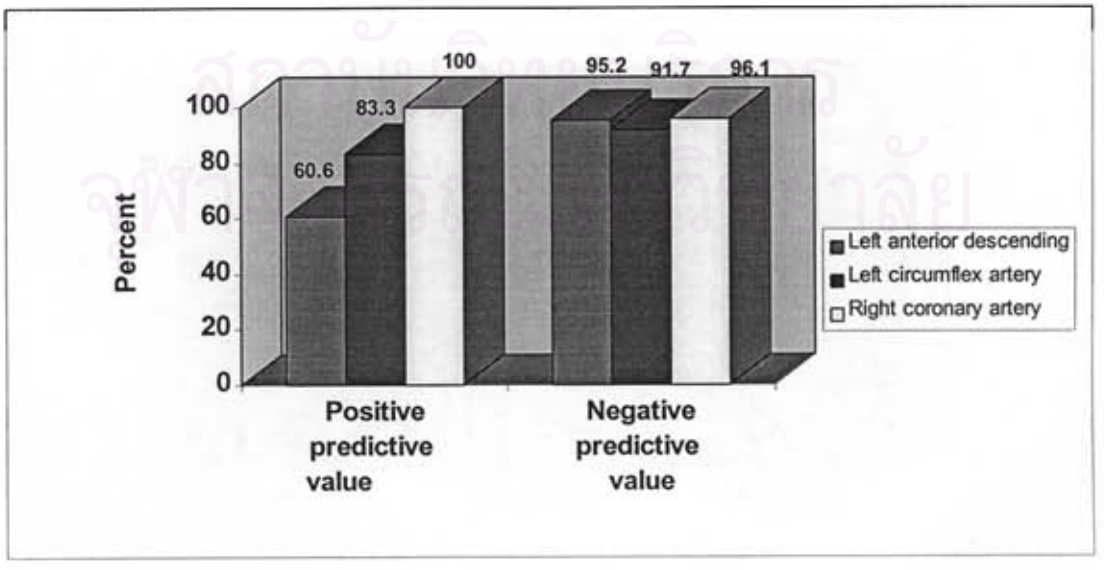

Table 18 Comparision of Sensitivity, specificity and accuracy of Tc-99m Sestamibi SPECT imaging for detection of restenosis in any type of coronary artery disease

Type of CAD	Sensitivity (%)	Specificity (%)	Accuracy (%)
SVD	76.5	63.6	71.4
DVD	91.7	66.7	83.3
TVD	100.0*	100.0**	100.0**

*p <0.05 versus SVD

**p< 0.05 versus SVD and DVD

Patients with multivessel disease (TVD,DVD) have higher sensitivity, specificity and accuracy than SVD.

Figure17 Sensitivity, specificity and accuracy of Tc-99m MIBI scan for detection of restenosis in any type of CAD

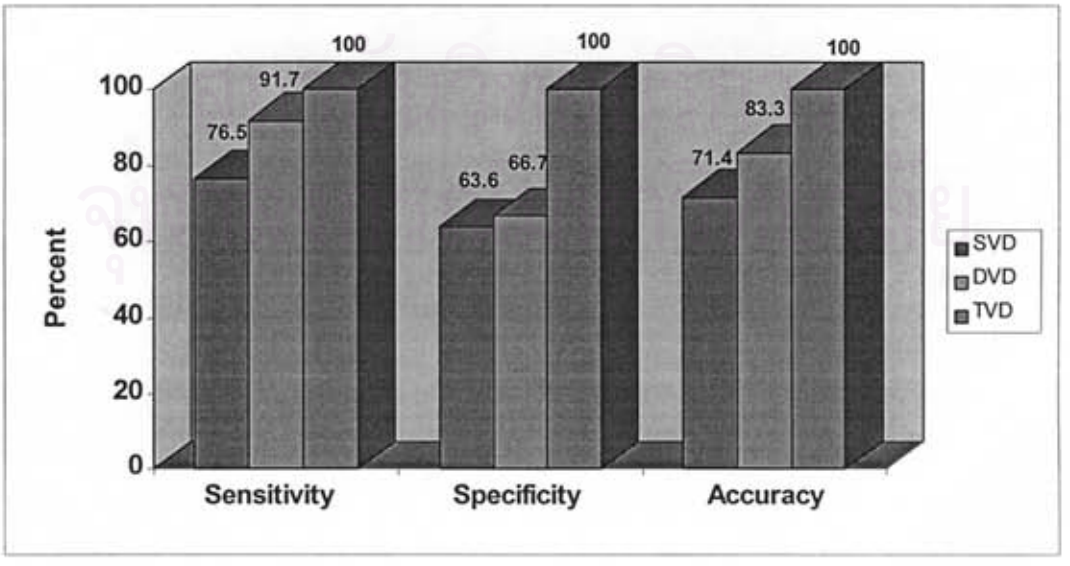

Table 19 Comparision of positive and negative predictive value of Tc-99m Sestamibi SPECT imaging for detection of restenosis in any type of coronary artery disease

Type of CAD	Positive predictive value (%)	Negative predictive value (%)
SVD	76.5	63.6
DVD	84.6	80.0
TVD	100.0*	100.0*

*p < 0.05 versus SVD and DVD

Positive and negative predictive value of patients with multivessel disease are higher than those of patients with single vessel disease.

Figure 18 Positive and negative predictive value of Tc-99m MIBI scan for detection of restenosis in any type of CAD