OUTPATIENT CORONARY ANGIOGRAPHY USING 7 FRENCH CATHETERS IN SINGAPORE

K H Mak, A T H Tan, K X Na, R M L Kam, P S S Koh

ABSTRACT

Purpose: Out-patient coronary angiogram (OCA) is commonly performed in many centres using 5 or 6 French (F) catheters. Though this small catheter may reduce bleeding complications, manipulatability and adequate vessel visualisation are problems which may increase procedure time. 7 or 8 F catheters have been used in Caucasians. We report our experience with OCA using 7 F catheters in an Asian centre.

Methods: Sixty-six patients with low procedural risk were consecutively recruited. They were pre-medicated with oral diazepam. Selective coronary angiogram (SCA) and left ventriculogram were performed via the femoral artery. Parenteral heparin was administered after the arterial puncture. After the procedure, haemostasis was secured by at least ten minutes of manual compression. The patients were immobilised for six hours and thereafter encouraged to walk for about an hour. The groin was inspected by a doctor before discharge and reviewed the following day.

Results: The age ranged from 27 to 73 years with a mean of 52.6. There were 48 men and 18 women. Seventeen patients had previous SCA or angioplasty. There was no significant coronary artery disease (CAD) in 26 patients (39.4%). Thirteen patients (19.7%) had minor CAD, 20 (30.3%) had single or double vessel and 7 (10.6%) had triple vessel disease. The mean procedural time was 16.6 ±7.3 minutes, ranging from 7 to 54. Seven (10.6%) of the patients had a small haematoma prior to discharge. None of the haematoma deteriorated at review. We did not find sex, age, history of diabetes mellitus or hypertension, height, weight, body mass index, use of anti-platelet agents, systolic blood pressure at and after the procedure and coronary artery anatomy to be associated with an increased risk of haematoma. The estimated cost savings for a non-subsidised patient was S$285 and for a subsidied patient was S$66.

Conclusion: We conclude that OCA using 7 F catheters is a safe and efficacious procedure in our patients.

Keywords: *cardiac catheterisation, coronary angiography, complications, haematoma*

SINGAPORE MED J 1995; Vol 36: 49-51

INTRODUCTION

Selective coronary angiogram (SCA) is the cornerstone in the evaluation of coronary artery disease (CAD). This is usually performed using a pre-formed catheter over a guide-wire inserted via a percutaneous femoral arterial puncture. The catheter engages the coronary artery orifice and radio-opaque contrast is injected to display the coronary arterial tree. These images are then captured on high quality cinefilm at multiple projections.

In Singapore, the procedure is usually performed on an in-patient basis. However, with increasing health care cost and the insatiable demand on hospital beds, out-patient SCA becomes a favourable alternative. Most centres use 5 or 6 French (F) catheters in out-patient SCA because of the lower incidence of vascular complications compared to larger catheters. The incidence of haematoma after 5 F cardiac catheterisation was 5%[1] while it was 8.5% with 7 or 8 F catheters[2]. However, Kohli et al[3] found that 7 F catheters were superior to 5 F ones in filling the coronary arterial tree. In addition, streaming of contrast occurred in only 20.7% for the 7 F compared to 88.5% for the 5 F catheters. Dislodgement was also more frequent with 5 F catheters, especially with power injection. Moreover, Klinke et al[4] reported 15 and 4 of their 26 patients had poor catheter torque control and unsatisfactory images respectively when 5 F catheters were used. On the other hand, Kern et al[1] found that 92% of their 263 patients completed their study using 5 F catheters alone.

With these problems associated with 5 F catheters, a study on early mobilisation using 7 F catheters was performed in our centre[5]. It showed that early mobilisation was not associated with an increased incidence of haematoma. Therefore, we proceed to evaluate the feasibility and safety of discharging patients home on the day of SCA with 7 F catheters.

Department of Cardiology
Singapore General Hospital
Outram Road
Singapore 0316

K H Mak, MRCP(UK)
Registrar

A T H Tan, FRACP
Head and Senior Consultant

K X Na, MD
Visiting Fellow

R M L Kam, MRCP(UK)
Registrar

P S S Koh, M Med (Int Med)
Consultant

Correspondence to: Dr K H Mak
Department of Cardiology
Tan Tock Seng Hospital
345 Jalan Tan Tock Seng
Singapore 1130

MATERIALS AND METHOD

Consecutive patients who underwent SCA and cardiac catheterisation and gave consent to be discharged on the same day of the procedure were entered into the study. Patients with any of the exclusion criteria were not included (Table I). The protocol has been approved by the Hospital Medical Committee. Laboratory tests including coagulation profile and platelet count were performed the day before SCA.

Technique for Procedure

All patients were pre-medicated with oral diazepam. The standard Seldinger and Judkins femoral artery techniques were used. A 7 F arterial sheath was placed initially in the femoral artery after infiltration with local anaesthesia and the removal of the arterial sheath. Parenteral heparin of 2,000 to 2,500 units were

Table I – Exclusion Criteria for Outpatient Coronary Angiogram

- age > 75 years
- severe peripheral vascular disease
- left main or severe triple vessel disease
- acute ischaemic syndromes
- renal impairment (serum creatinine > 200 µmol/l)
- uncontrolled hypertension (systolic blood pressure > 180 mmHg)
- congestive heart failure
- any major complications eg ventricular fibrillation

administered after arterial access. Judkins left and right, pig-tail and occasionally Amplatz catheters were used. Ionic or non-ionic contrast media were delivered to the coronary arterial tree by hand injection at room temperature. Multiple projections were imaged as determined by the attending cardiologist. Protamine sulphate was not given at the end of the procedure.

Post-procedure Protocol

After the procedure, haemostasis was secured by at least ten minutes of manual compression. A pressure bandage was then applied. Patients were advised to lie on their beds for the next five to six hours. During this period, the patients' general condition, vital signs and limb perfusion were closely monitored. Thereafter, the patients were encouraged to walk for about an hour. The groin was then inspected by a doctor. Instructions on how to detect and arrest bleeding at the puncture site were given to the patients and one of their relatives. Following this, the patients were discharged. They were also informed to call the ward should any problems occur in the night. The patients returned to the ward the following day and the groin was reviewed by a doctor.

RESULTS

Sixty-six patients were studied. The age ranged from 27 to 73 years with a mean of 52.6 (SD ± 9.6). There were 48 (72.7%) men and 18 (27.3%) women. Forty-nine (74.2%) of the patients were Chinese, 6 (9.1%) were Malay, 10 (15.2%) were Indian and one (1.5%) was a Caucasian. Of the 66 patients, 21 (31.8%) had diabetes mellitus, 35 (53.0%) were hypertensive, 15 (22.7%) were smokers and 31 (47.0%) had hyperlipidaemia. The mean height, weight and body mass index were 162.7 (SE ± 1.0) cm, 66.9 (SE ± 1.5) kg and 25.2 (± 0.4) kg/m^2 respectively.

Forty-seven (71.2%) of the patients were on anti-platelet agents. The majority of them were on aspirin. The rest were on ticlodipine. None of the patients had an abnormal platelet count or coagulation profile. The indications for the procedure are listed in Table II. All the patients had single femoral puncture and four patients (6.1%) also had femoral vein puncture for right heart study. Twenty patients had a past experience of SCA or angioplasty. The procedure time ranged from 7 to 54 minutes with a mean of 16.6 (±7.3). Systolic blood pressure (SBP) during the procedure was 90 to 180 mmHg and the mean was 135.8 (±21.1). After the procedure, at the ward, the SBP was 90 to 170 mmHg and the mean was 131.5 (±17.6). The results of the SCA are listed in Table III. Films were read by at least two observers on the same day. Luminal stenosis greater than 50% in a major epicardial vessel was considered to be significant.

Seven patients (10.6%) had small haematoma (< 3 cm) upon review prior to discharge. None of the haematomata increased in size when the groin was inspected the following day. No new haematoma was detected. We did not find sex, age, history of diabetes mellitus or hypertension, height, weight, body mass index, use of anti-platelet agents, systolic blood pressure at and after the procedure and coronary artery anatomy to be associated with an increased risk of haematoma. The student's t-test was used for continuous variables and either the chi-squared or Fischer's exact test was used for categorical variables. No patient needed to call the hospital back for any problems during the night that they were discharged. There was no mortality, cerebrovascular accident, angina, myocardial infarction or re-admission.

Table II – Indications for Coronary Angiogram

Indication	Number (%)
Coronary artery disease	47 (71.2)
Post-myocardial infarction	15 (22.8)
Atrial septal defect	1 (1.5)
Cardiomyopathy	3 (4.5)

Table III – Results of Coronary Angiogram

Results	Number (%)
Normal	26 (39.4)
Minor disease	13 (19.7)
Single or double vessel disease	20 (30.3)
Triple vessel disease	7 (10.6)

DISCUSSION

SCA is not without risk. The overall mortality ranged from 0.02 to 0.2% and myocardial infarction rate ranged from 0.03 to 0.64%[6-16]. Other complications include stroke, arrhythmia, reaction to contrast and local arterial problems. In order to minimise risk in out-patient SCA, a list of stringent exclusion criteria was used.

Data from the Society for Cardiac Angiography[14,15] showed that mortality rates for patients with significant triple vessel disease (TVD) and left main disease (LMD) were 0.16 and 0.86% respectively. This was much higher than patients without LMD (0.056%). This finding was substantiated by the report for the Collaborative Study of Coronary Artery Surgery (CASS)[14]. They found the highest risk was associated with patients with TVD or LMD. Furthermore, they demonstrated that patients with ventricular ectopy, heart failure, hypertension and diminished ejection fraction were associated with higher mortality. In addition, the Society for Cardiac Angiography found that mortality was inversely related to the functional status of the patient[16]. Patients with New York Heart Association (NYHA) class I or II had a mortality of 0.02%. On the other hand, those with class III or IV had a mortality of 0.24%. Mortality was highest for patients in NYHA class IV (0.67%). Age also appeared to have an influence on mortality[16]. Patients above the age of 60 years have a mortality of 0.23% compared to the overall rate of 0.14%. With these information, we formulated the exclusion criteria (Table I).

The incidence of haematoma in patients mobilised 8 hours after femoral catheterisation with 7 or 8 F catheters was low[7,17]. Block et al[2] found that the incidence of haematoma was 12% for out-patients and 8.5% for in-patients. However, the difference was not statistically significant. Their patients were immobilised for six hours. In an earlier study from our centre[5], 273 patients were randomly assigned to two groups following femoral catheterisation using 7 F catheters. The group of patients who

were mobilised six hours later had a groin haematoma rate of 6.3% compared to 7.6% for the group of patients who were mobilised the following day. Therefore we decided to immobilise our patients for a period of about six hours following the procedure.

Patients without significant CAD made up 39.4% of our patients. This was higher than that reported by CASS (27%)[14], Society for Cardiac Angiography (20%)[15,16], Mahrer et al (16.3%)[18] and Fierens et al (16.5%)[19]. An earlier study from our centre reported it to be 30%[5]. We felt that our result was not surprisingly high because our patients were carefully chosen and with low risk. In addition, a number of our patients were evaluated for re-stenosis after coronary angioplasty. Those without re-stenosis would be reported as normal. Indeed, patients without significant CAD have a low procedural risk.

We found that the incidence of haematoma in our patients was 10.6%. All the haematomata were small, less than 3 cm in diameter. This was comparable to the data from Block et al[2], 12% for out-patients and the earlier study from our centre[5]. Unlike the patients in Block's series, protamine sulphate was not used to reverse the anticoagulation. In a preliminary study, Klinke et al[4] found that puncture site haematoma occurred in 18% and 19% for 5 F and 8 F catheters respectively. On the other hand, using only 5 F catheters, Kern et al[2] and Lominack et al[20] had a haematoma rate of 7% and 2% respectively. However, in a local study[21] using 5 F catheters, the haematoma rate was 23.3% (13.3% of the patients had haematoma less than 5 cm while 10.0% had haematoma greater than 5 cm). Therefore, the haematoma rate was acceptable. In addition, none of the haematoma increased in size the following day. No new haematoma developed too. No other complications developed in our patients.

The procedural time was relatively short with a mean of 16.6 minutes. Kern et al[1] reported a procedural time of 25.7 ± 13.1 minutes with a range from 16.6 to 30.3 with 5 F catheters. In their report, only left heart studies were performed. Therefore, if only the left heart was studied, our mean procedural time could have been shorter. This would also mean a lower radiation exposure time for medical, paramedical personnel and patients without the problems of a small catheter and with a low incidence of vascular complications.

Morevoer, out-patient SCA reduced the need for hospital beds and staff. This would also allow the patient to spend less time in an unfamiliar environment like the hospital. Though the exact cost for each patient was not computed, the patient would pay less in terms of ward charges and treatment fees. It was estimated that the non-subsidised and subsidised patient would, on average, pay S$285 and S$66 less respectively. This amounted to about 11% and 8% of the average in-patient bill respectively. This was comparable to another local centre[21], where the savings for a full-paying patient was S$376.60, and for a subsidised patient was S$76.40.

CONCLUSION

We conclude that out-patient SCA using 7 F catheters is a safe and efficacious procedure for our patients. It may also improve the use of the limited hospital facilities and bring about a reduction in medical cost.

REFERENCES

1. Kern MJ, Cohen M, Talley JD, Litvack F, Serota H, Aguirre F, et al. Early ambulation after 5 French diagnostic cardiac catheterisation. Results of a multicenter trial. J Am Coll Cardiol 1990; 15:1475-83.
2. Block PC, Ockene I, Goldberg RJ, Butterfly J, Block EH, Degon C, et al. A prospective randomized trial of outpatient versus inpatient cardiac catheterization. N Engl J Med 1988; 319:1251-5.
3. Kohli RS, Vetrovec GW, Lewis SA, Cole S. Study of the performance of 5 French and 7 French catheters in coronary angiogram: a functional comparison. Cathet Cardiovasc Diagn 1989; 18:131-5.
4. Klinke WP, Hui W, Kubac G, Talibi T. Comparison of 5 F and 7/8 F catheters for left heart catheterization and angiography. Am Fed Clin Res (western section) 1989; 37:95A (abstract).
5. Lau KW, Tan A, Koh TH, Koo CC, Quek S, Ng A, et al. Early ambulation following diagnostic 7 French cardiac catheterisation: a prospective randomised trial. Cathet Cardiovasc Diagn 1993; 28:34-8.
6. Adams DF, Fraser DB, Abrams HL. The complications of coronary arteriography. Circulation 1973; 48:609-18.
7. Davis K, Kennedy JW, Kemp HG Jr, Judkins MP, Gosselin AJ, Kilip T. Complications of coronary arteriography from the Collaborative Study of Coronary Artery Surgery (CASS). Circulation 1979; 59:1105-12.
8. Adams DF, Abrams HL. Complications of coronary arteriography: a follow-up report. Cardiovasc Radiol 1979; 2:89-96.
9. Nitter-Hauge S, Enge J. Complication rates of selective percutaneous transfemoral coronary arteriography: a review of 1094 consecutive examinations. Acta Med Scand 1976; 200:123-6.
10. Bourassa MG, Noble J. Complication rate of coronary arteriography: a review of 5,250 case studies by a percutaneous femoral technique. Circulation 1976; 53:106-14.
11. Green GS, McKinnon CM, Rosch J, Judkins MP. Complications of selective percutaneous transfemoral coronary arteriography and their prevention: a review of 445 consecutive examinations. Circulation 1972; 45:552-7.
12. Judkins MP, Gouder MP. Prevention of complications of coronary arteriography. Circulation 1974; 49:599-602.
13. Petch MC, Sutton R, Jefferson KE. Safety of coronary arteriography. Br Heart J 1973; 35:377-80.
14. Coronary Artery Surgery Study (CASS): a randomized trial of coronary artery bypass surgery: survival data. Circulation 1983; 68:939-50.
15. Kennedy JW. Complications associated with cardiac catheterization and angiography. Cathet Cardiovasc Diagn 1982; 8:5-11.
16. Kennedy JW, Baxley VA, Bunnel IL, Gensini GG, Messer JV, Mudd JG, et al. Mortality related to cardiac catheterization and angiography. Cathet Cardiovasc Diagn 1982; 8:323-40.
17. Johnson LW, Lozner EC, Johnson S, Krone R, Pichard AD, Vetrovec GW, et al. Coronary arteriography 1984-1987: a report of the Registry of the Society for Cardiac Angiography and Interventions. I. Results and complications. Cathet Cardiovasc Diagn 1989; 17:5-10.
18. Mahrer PR, Eshoo N. Outpatient cardiac catheterization and coronary angiography. Cathet Cardiovasc Diagn 1981; 7:355-60.
19. Fierens E. Outpatient coronary arteriography. Cathet Cardiovasc Diagn 1984; 10:27-32.
20. Lominack EK Jr, Lutz JF, Douglas JS Jr, King SB. Evaluation of 5 French catheters for outpatient arteriography. Circulation 1985; (Suppl III):454.
21. Ling LH, Choo M, Lim M, Lim YT, Soo CS, Kon K, et al. Outpatient cardiac catheterization with 5 French catheters: results of a pilot program in Singapore. The 10th Asian-Pacific Congress of Cardiology. Seoul, South Korea. 1991: 105.