

Cardiac catheterisation by the Judkins technique as an outpatient procedure

K G Oldroyd, K V Phadke, R Phillips, P H M Carson, M Clarke, J A S Davis

Abstract

Objective—To assess the safety and cost benefit of left heart catheterisation by a modified Judkins technique performed as a day patient procedure.

Design—Review study of case notes of consecutive patients examined by the procedure over three years (January 1984 to December 1986).

Setting—Outpatient referrals in a regional cardiac centre within a district general hospital.

Patients—Nine hundred patients aged 18-76 (mean 54) selected at a previous clinic as suitable for the procedure.

Main results—Eight hundred and fifty patients (94.4%) were discharged home on the day of the procedure. Forty others (4.4%) could not be discharged owing to complications during or just after the procedure. Of these patients, two died (0.2%), six suffered a myocardial infarction (0.7%), and two had major vascular complications. The remaining 30 patients were admitted because of chest pain without infarction (10 cases), minor vascular incidents (six), haemorrhage at the puncture site (five), arrhythmia (four), pulmonary oedema (three), and contrast reaction (two). Ten patients were admitted for either urgent coronary artery bypass grafting or social reasons.

Conclusions—Cardiac catheterisation is safe as an outpatient procedure in most cases. Beds are spared and roughly £35 000 is saved for every 500 procedures performed.

Introduction

Left heart catheterisation is usually performed through a brachial arteriotomy (Sones's technique) or by percutaneous puncture of the femoral artery (Judkins's technique). We use a modification of the Judkins technique, puncturing the anterior wall of the femoral artery with a thin walled needle to permit the insertion of a short sheath through which catheter exchanges are made. In Britain left heart catheterisation is usually performed as an inpatient procedure with one or two overnight stays in hospital costing around £70 a night. In this paper we report a series of left heart catheterisations with the modified Judkins technique performed as outpatient procedures.

Patients and methods

We reviewed data on 1205 consecutive left heart catheterisations performed in this centre from January 1984 to December 1986. Two hundred and fifty four were inpatient investigations and a further 51 were by the Sones technique. The remaining 900 were outpatient procedures performed by the modified Judkins technique, and these patients form the study population. The male to female ratio was 4:1 and the patients had an age range of 18-76 years (mean 54). Tables I and II list the diagnoses recorded after catheterisation and the extent of coronary artery disease. Though most patients with recently unstable angina were investigated as inpatients, the study

population included some patients with this condition and also patients investigated early after myocardial infarction.

TABLE I—Diagnoses of study population

| | No | % |
|-------------------------------------|-----|-------|
| Coronary heart disease | 541 | 60.1 |
| Valvular heart disease | 153 | 17.0 |
| Valvular and coronary heart disease | 92 | 10.2 |
| Cardiomyopathy | 45 | 5.0 |
| Congenital heart disease | 7 | 0.8 |
| Normal | 62 | 6.9 |
| Total patients | 900 | 100.0 |

TABLE II—Extent of coronary artery disease

| | No | % |
|-----------------------|-----|-------|
| Left main stenosis | 56 | 6.2 |
| Three vessel disease | 341 | 37.9 |
| Two vessel disease | 198 | 22.0 |
| Single vessel disease | 145 | 16.1 |
| Normal | 160 | 17.8 |
| Total patients | 900 | 100.0 |

Catheterisation protocol—Patients who had been selected at a previous clinic were instructed to attend the department of cardiology in a fasting state 45 minutes before the procedure. Neither premedication nor systemic heparinisation was used. Other, regular medicines were taken as usual except for β blockers and verapamil; these were sometimes discontinued 48 hours before the procedure, according to the preference of the particular cardiologist. Patients taking anticoagulants were instructed to stop these from the day before catheterisation. Coagulation screens were not performed routinely, and 12 lead electrocardiograms were recorded only when there had been an important change in symptoms or an episode of prolonged chest pain since the last clinic visit. Catheter sheaths were used routinely with size 7 or 8 catheters. Non-ionic contrast media were used in all cases. At the end of the procedure haemostasis was secured and patients transferred to the day area of the cardiology ward, where they remained seated in a chair for a prescribed minimum of four hours. None occupied a bed during this period. Finally, they were examined by a doctor and if well discharged.

Statistics—Differences in complication rates among subgroups identified during the study were analysed by the χ^2 test with Yates's correction.

Results

Of the 900 outpatients investigated by left heart catheterisation, 850 (94.4%) recovered uneventfully and went home the same day. Ten patients (1.1%) were admitted electively after catheterisation, seven for urgent coronary artery bypass grafting and three because of unforeseen difficulties with transport or

Department of Cardiology,
City General Hospital,
Stoke on Trent ST4 6QG

K G Oldroyd, MRCP, registrar
K V Phadke, MRCP, registrar
R Phillips, MB, research
assistant

P H M Carson, FRCP,
consultant cardiologist
M Clarke, FRCP, consultant
cardiologist
J A S Davis, MRCP, consultant
cardiologist

Correspondence and
requests for reprints to:
Dr Davis.

Br Med J 1989;298:875-6

TABLE III—Complications of outpatient catheterisation

| | No | % |
|---|-----|-------|
| None (patient discharged same day) | 850 | 94.4 |
| Admission for coronary artery bypass grafting or social reasons | 10 | 1.1 |
| Death | 2 | 0.2 |
| Myocardial infarction | 6 | 0.7 |
| Chest pain without infarction | 10 | 1.1 |
| Vascular {Major | 2 | 0.2 |
| Minor | 6 | 0.7 |
| Haemorrhage at puncture site | 5 | 0.6 |
| Arrhythmias | 4 | 0.4 |
| Pulmonary oedema | 3 | 0.3 |
| Contrast reactions | 2 | 0.2 |
| Total patients | 900 | 100.0 |

home circumstances. Forty patients (4.4%) could not be discharged owing to complications related to the procedure (table III).

COMPLICATIONS

There were two deaths. Both were related to complications arising in the catheter laboratory during the procedure and both occurred in patients with severe triple vessel coronary artery disease and previous myocardial infarctions. Six patients sustained non-fatal myocardial infarction. Ten patients were admitted because of prolonged chest pain without subsequent evidence of infarction; eight of these were discharged the day after catheterisation. There were two major vascular complications. One patient sustained multiple emboli to the distal vessels of the right leg and eventually required an above knee amputation. A second patient, not taking anticoagulants, suffered a haemorrhagic cerebral infarction during the procedure, resulting in a homonymous hemianopia.

Minor vascular complications consisted of five episodes of probable dissection of the femoral artery or descending aorta, or both, none of which required surgical intervention, and one episode of transient diplopia. Five patients were admitted because of haemorrhage at the puncture site; in four cases this occurred early—that is, within the prescribed minimum observation period of four hours. One patient rebled six hours after catheterisation but was still in hospital at the time. This patient was receiving warfarin and had not discontinued it as instructed. Of these patients, one ultimately required repair of a false aneurysm of the femoral artery but the four others made an uneventful recovery without the need for either surgery or transfusion. Four patients had arrhythmias necessitating admission, one after ventricular fibrillation and three after profound bradycardia with hypotension. Three patients were admitted with pulmonary oedema and two with contrast reactions.

FACTORS INFLUENCING COMPLICATION RATE

In addition to patients with angiographic states (three vessel disease, left main stem disease, low ejection fraction) and clinical conditions (unstable angina, left ventricular failure, hypertension) usually associated with an increased risk of complications

TABLE IV—Factors influencing complication rate among the 900 patients

| | No studied | No admitted | Haemorrhage at puncture site | Vascular complication |
|-----------------------------|------------|-------------|------------------------------|-----------------------|
| Peripheral vascular disease | | | | |
| {Yes | 74 | 11* | 0 | 3* |
| {No | 826 | 29 | 5 | 5 |
| Warfarin | | | | |
| {Yes | 61 | 5 | 2* | 1 |
| {No | 839 | 35 | 3 | 7 |
| Catheter | | | | |
| {Size 7† | 584 | | 4 | 4 |
| {Size 8† | 316 | | 1 | 4 |

*p<0.05.

†French gauge.

related to cardiac catheterisation,^{1,3} patients with peripheral vascular disease were also at increased risk (table IV). This subgroup included one of the deaths and the patient who required an amputation. The prior use of anticoagulants did not increase either the overall need for admission or the incidence of vascular complications but was associated with a slightly greater than expected number of haemorrhages at the puncture sites. Comparison between patients investigated using size 7 and size 8 French gauge catheters showed no excess incidence of either haemorrhage at the puncture site or vascular complications with the larger catheter.

FINANCIAL IMPLICATIONS

Using 1985 data from the Department of Health and Social Security⁴ and allowing for inflation, we calculate that a unit changing to outpatient left heart catheterisation from a previous policy of one overnight stay would save £70 per patient, or £35 000 for every 500 investigations performed. In this centre no additional space or staff were required for the change to outpatient catheterisation.

Discussion

Outpatient cardiac catheterisation was introduced in this centre in response to an ever increasing demand for the investigation coupled with a very limited number of available inpatient beds. A main advantage in this series was that over 90% of the patients were investigated uneventfully without ever occupying a hospital bed. Furthermore, we find that most patients prefer having their "test" done without having to be admitted.

Despite the safety of outpatient catheterisation by both Judkins's^{5,7} and Sones's techniques^{8,9} (reviewed by Kahn¹⁰), the practice has not been widely adopted. We have found no published report of outpatient catheterisation by the Judkins technique from a centre in Britain.

The mortality among our patients was comparable to that in other published outpatient series.^{5,9} None of the complications could directly be attributed to the catheterisation being performed as an outpatient procedure, and no complications occurred after the patients had been discharged from hospital. Extra caution is required in patients with unstable angina or poor left ventricular function and a higher complication rate is also likely in patients with peripheral vascular disease.

Our findings are further evidence that outpatient catheterisation by the Judkins technique is safe and applicable in most cases. Adoption of the policy would allow more efficient use of the limited funds and facilities available within the health service and possibly allow expansion of other services such as angioplasty and valvuloplasty.

- 1 Davis K, Kennedy JW, Kemp HG, Judkins MP, Gosselin AJ, Killip T. Complications of coronary arteriography from collaborative study of coronary artery surgery. *Circulation* 1979;59:1105-12.
- 2 Kennedy JW. Complications associated with cardiac catheterization and angiography. *Cathet Cardiovasc Diagn* 1982;8:5-11.
- 3 Kennedy JW, Baxley WA, Bunnell IL, et al. Mortality related to cardiac catheterization and angiography. *Cathet Cardiovasc Diagn* 1982;8:323-40.
- 4 Department of Health and Social Security Welsh Office. *Health service costing returns*. HMSO, 1985.
- 5 Mahrer PR, Eshoo N. Outpatient cardiac catheterization and coronary angiography. *Cathet Cardiovasc Diagn* 1981;7:355-60.
- 6 Mahrer PR, Young C, Magnusson PT. Efficacy and safety of outpatient cardiac catheterization. *Cathet Cardiovasc Diagn* 1987;13:304-8.
- 7 Klinke WP, Kubac G, Talibi T, Lee SJK. Safety of outpatient cardiac catheterizations. *Am J Cardiol* 1985;56:639-41.
- 8 Fierens E. Outpatient coronary arteriography. *Cathet Cardiovasc Diagn* 1984;10:27-32.
- 9 Murray NH, Rothman MT. Planned day case Sones technique cardiac catheterisation [Abstract]. *Br Heart J* 1986;55:515.
- 10 Kahn KL. The efficacy of ambulatory cardiac catheterization in the hospital and free-standing setting. *Am Heart J* 1986;111:152-67.

(Accepted 16 January 1989)