Early ambulation of patients post-angiography with femoral puncture

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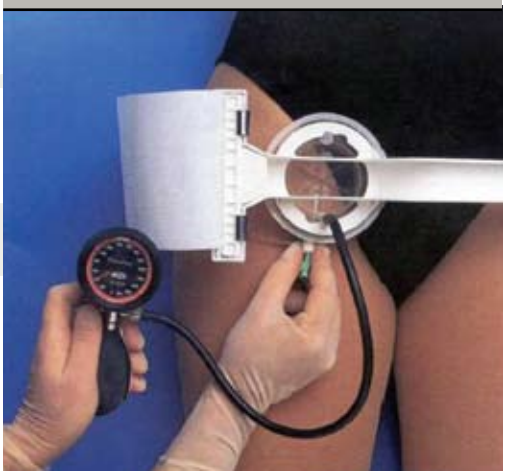
Research has shown that, following angiogram with femoral puncture, prolonged bed rest increases patient discomfort during recovery. This audit aimed to measure the effects of reducing the period of immobilisation from the local standard of four hours to only two hours. Almost 500 consecutive patients were selected for early ambulation at two hours post-angiogram. Overall, 86.8% of patients suffered no vascular complications. In addition to the beneficial effects on patient comfort, earlier ambulation will enable cardiology units to treat more patients, thereby maximising efficiency and income generation.

Introduction

Over 100,000 people die from coronary heart disease (CHD) every year in England; it is the country's biggest killer.[1] CHD can cause narrowing of the arteries, which can be treated effectively by invasive coronary angiography and revascularisation.[2] Angiography is crucial in determining suitability for percutaneous and/or surgical revascularisation.[3] Following angiography, haemostasis is usually achieved by manual or mechanical compression of the puncture site, followed by a period of bed rest in supine and upright positions. However, this period varies widely between institutions across the UK and internationally[4-6] and can be as much as 24 hours.

A systematic review of bed rest versus early mobilisation trials[7] found that outcomes worsened significantly for some procedures, including cardiac catheterisation. Research has shown that, following cardiac catheterisation, prolonged bed rest increased patient discomfort, limits the number of possible procedures and increases healthcare costs.[4,8] Reducing the period of immobilisation can diminish patients' overall pain and back pain, without causing delayed bleeding.[9] Gall *et al.*[4] concluded that early mobilisation at 90 minutes was shown to be feasible and safe for patients undergoing elective coronary angiography performed via the right femoral artery, with mechanical compression using the 'Femostop' device (RADI Medical Systems AB Uppsala, Sweden) (**figure 1**). Research has indicated that the time to achieve haemostasis is shorter with mechanical rather than manual compression.[8]

Figure 1. The Femostop device used for mechanical compression



Methods

The local protocol in St George's Healthcare NHS Trust (SGH) for patients undergoing angiography was four hours total bed rest time. This written protocol applied to all wards within the Cardiothoracic Clinical Directorate.

Our clinical objective was to achieve mobilisation of patients post-angiogram with femoral puncture at two hours. Our standard procedure for the audit was:

- 20 minutes mechanical compression using Femostop
- 25 minutes supine bed rest, including 15 minutes with Femostop in place at 0 mmHg
- 70 minutes sitting up in bed
- 5 minutes sitting on the edge of the bed.

Although the Gall *et al*. study[4] incorporated a 90-minute ambulation, we chose to audit a two-

hour ambulation. We considered that it would be beneficial to allow slightly more time for the staged recovery, including compression, thereby enabling clinicians to accurately assess the stability of the puncture site and reduce the risk of bleeding and haematoma. Extra manual or mechanical compression was provided if clinically indicated.

Our audit measured any extra elapsed time after two hours and before ambulation; and compared complication rates between factors such as gender, diabetes, blood pressure (BP), medications and body mass index (BMI). These comparisons were intended to reveal any potential barriers to early ambulation. According to the definitions recognised by the Department of Health,[10] BMI <18.5 kg/m^2 was classified as underweight; BMI between 18.5 and 24.9 kg/m^2 was classified as normal; BMI ≥25 kg/m^2 was classified as overweight; and BMI ≥30 kg/m^2 was classified as obese.

We prospectively audited a sample of 499 consecutive patients who underwent coronary angiogram and recovered in a cardiothoracic speciality ward. An audit form was designed and inserted into each patient's folder. These forms were completed by cardiology nurses for each patient in the audit. Data fields collected included gender, medications, complications, co-morbidities, BMI and blood pressure. The data were entered into and analysed in Microsoft Excel®. Where data were obviously missing from cells, for example, if gender was not provided, only the total completed cells were used to calculate the percentages. Statistical analysis was performed using the Chi-squared or Fisher's Exact test. A probability value of $p<0.05$ was considered significant.

Exclusions

- Patients who received percutaneous coronary intervention (PCI) and subcutaneous heparin during angiography, where bleeding would normally be exacerbated.
- Patients with renal failure on dialysis, or with severe hypertension, causing complications of delay in sheath removal.

Results

The relevant characteristics of the 499 patients audited are shown in **table 1**. About 75% (n=360) of all patients were overweight (BMI ≥25 kg/m^2) and about one-third (n=163) were classified as obese (BMI ≥30 kg/m^2).

Vascular complications developed in 13.2% of patients (n=66); these comprised bleeding (n=31) and haematoma (n=35). An additional four patients experienced leg numbness and 43 (8.6%) exhibited some oozing from the puncture site but, for the purposes of this audit, these were not considered to be serious complications. **Table 2** shows the vascular complication rate among the various patient groups, according to their gender, medication, BMI, diabetic status and BP.

We were able to apply our standard procedure of early ambulation after two hours to 59.1% of the patients audited (**table 3**). Of the remaining cases, ambulation was delayed in 21.2% of cases because the patient required extra compression. In 19.6% of cases, ambulation was delayed for other reasons largely unrelated to the treatment or complications. These included: ward staff needing to care for other patients, insufficient staff on duty, patient asleep or local anaesthetic not worn off.

The mean time delay before ambulation among all 499 patients, over and above our two-hour standard, was 17 minutes. Only 42 patients (8.5%) experienced delays longer than 60 minutes and only four patients (0.8%) experienced delays longer than 120 minutes. Patients who were given extra manual or mechanical compression had longer mean delays (52 and 54 minutes, respectively). These results are extended in **table 4**. Almost all (98.2%; n=490) patients were discharged on the day of the procedure, with five patients having an overnight stay due to social reasons and four patients needing urgent revascularisation. However, this was warranted by the patients' arterial disease and was not due to a problem with the femoral access for angiography.

Table 1. Characteristics of patients audited (n=499)

	Percentage (number)		
Females	42.4% (n=211)		
Males	57.6% (n=287)		
BMI	28.3 mean	27.9 median	15.3 to 43 range
Patients with high BP (>140 mmHg systolic)	22.3% (n=106)		
On antiplatelets	78% (n=389)		
On anticoagulants (stopped 4/7)	6.2% (n=31)		
Diabetic	26.5% (n=132)		

Key: BMI = body mass index; BP = blood pressure

Table 2. Proportion of patients with vascular complications by patient group (average = 13.2%)

	Number	Percentage
Females	29/211	13.7%
Males	37/287	12.9%
On aspirin and clopidogrel	8/46	17.4%
On aspirin only	39/324	12%
On warfarin (see note*)	5/30	16.7%
Obese (BMI ≥30 kg/m^2)	16/163	9.8%
Overweight (BMI ≥25 kg/m^2)	47/360	13.1%
Normal weight (BMI 18.5 to 24.9 kg/m^2)	18/118	15.3%
Underweight (BMI <18.5 kg/m^2)	1/5	20%
Diabetic	13/132	9.8%
High BP (>140 mmHg systolic)	15/106	14.2%
Acceptable BP	48/370	13%

*Note: Normally on warfarin, but stopped 4 days before angiography and replaced with dalteparin subcutaneous injections twice daily
Key: BMI = body mass index; BP = blood pressure

Table 3. Procedure followed in patients (n=499)

	Percentage (number)	% with complications (number)
Standard	59.1% (n=295)	Zero
Extra manual compression	10.4% (n=52)	80.8% (n=42)
Extra Femostop compression	10.8% (n=54)	42.6% (n=23)
Other	19.6% (n=96)	1% (n=1)

Table 4. Extra time before ambulation, after two-hour standard

	Mean (minutes)	Median (minutes)	Range (minutes)
Standard treatment (see note*)	0.3	zero	0–40
Extra manual compression	52	50	0–120
Extra Femostop compression	54	52	0–126
Delay due to care of other patients	19	14	0–77

*Note: Only four patients out of 295 with standard treatment (1.4%) experienced a delay, due to staffing constraints

Discussion

Overall, 13.2% of patients in our audit recorded vascular complications (n=66). Almost all of these were dealt with by applying extra compression (n=65) and ambulation was delayed for less than an hour on average. Only nine patients needed an overnight stay in hospital and five of these were for social, rather than clinical, reasons. Reported complication rates have been variable in previous studies: 1.4% by Gall *et al*.,[4] with ambulation after 90 minutes; and 19.2% by Pollard *et al*.,[5] with ambulation after 2.5 hours. This could be due to different criteria used for determining what constitutes a complication, for example, size of haematoma. Both studies concluded that early ambulation with manual or mechanical compression was safe.

Within our vascular complications, our haematoma rate was 7%. In comparison with other studies, Pollard *et al*.[5] reported haematoma in 12.8% of patients and Steffenino *et al*.[11] reported a haematoma rate of 4%. Steffenino *et al*. also opined that supervised resumption of ambulation three hours after uncomplicated cardiac studies was safe and feasible. Several studies reviewed by Reynolds[6] found no significant increase in complication rates associated with early walking following percutaneous transluminal coronary angioplasty.

Our vascular complication rate was slightly higher among females (13.7%) than males (12.6%), but this difference was not statistically significant (p=0.78). Conversely, other studies have found that the complication rate among females was significantly higher than among males, notably in Gall *et al*., where it was 4.38 times higher (p=0.01).

The proportion of patients with a BMI ≥25 kg/m^2 was 74.5%, very similar to the Gall *et al*. sample (72.8%). However, Gall *et al.* found that complications were more predominant in overweight patients, whereas our audit showed that complications became progressively less predominant as weight increased (20% in underweight patients; 15.3% in normal weight patients; 13.1% in overweight patients; and 9.8% in obese patients). This may be because the arterial pulse is deeper and less bounding in heavier patients. However, none of the differences between our BMI groups was statistically significant (p=0.32).

Our complication rates were higher in patients on aspirin and clopidogrel (17.4%) compared with those who were not (12.8%; p=0.38); and in patients with high BP (14.2%) compared with patients with normal BP (13%; p=0.75); but neither of these was statistically significant. Our complication rate was lower among diabetic patients (9.8%), compared with non-diabetics (14.4%), but again this difference was not significant (p=0.18).

These audit results indicate that early ambulation after two hours is safe for our patients, providing that they are adequately supervised during recovery and extra compression is performed, if and when required. Factors that could potentially increase complication rates, such as high BMI, did not have a significant adverse effect on the results. We propose to change the current local guidelines accordingly and disseminate the audit results within the cardiology service and ward staff. Adoption of the new guidelines should produce the benefits identified in other studies: reduced pain and discomfort for patients and increased bed capacity for the service, enabling us to treat more patients and generate more income for the service.

In recent years, the radial artery has replaced the femoral artery as the preferred access site for coronary procedures, because reported complications are negligible, mobilisation times are reduced and patients prefer it.[12] Therefore, radial access enables us to cope with the increasing number of day-case PCI procedures, coupled with pressures to reduce bed occupancy and hospital costs. Radial access is contraindicated in the 10–27% of patients with a negative Allen test, for testing the adequacy of the ulnar collateral supply, or in procedures that require >6 Fr guide catheters.

We acknowledge that this audit did not attempt to measure long-term morbidity and mortality, nor did it seek to compare the patient sample with a control group

Acknowledgement

We thank the ward sisters and nursing staff within cardiology, who worked so hard during this audit to gain invaluable data and for whom this work affects the most.

Conflict of interest

None declared.

Key messages

- Early ambulation after two hours following angiogram with femoral puncture was safe
- Complications were well managed with little adverse effect on times before ambulation and subsequent discharge
- Likely benefits include more comfort and less pain for patients; greater efficiency and better use of bed resources for the organisation

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