Safe and feasible immediate retransfer of patients to the referring hospital after acute coronary angiography and percutaneous coronary angioplasty for patients with acute coronary syndrome

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Abstract

Background: The challenge with fast track (FT) is to avoid compromising medical safety. We aimed to investigate whether patients with acute coronary syndrome could be safely retransferred to the referral hospital on the same day after coronary angiography and/or percutaneous coronary angioplasty (PCI).

Methods and results: A total of 399 consecutive patients were prospectively randomized: 206 to ordinary care (OC) and 193 to the FT group. Of these, 30% of patients were admitted for unstable angina pectoris and 70% for non-ST-segment elevation myocardial infarction. The FT patients were evaluated for possible same-day return after angiography and/or PCI. Crossover, acute, and 30-day major events were recorded. The radial approach was used in 91 and 87% in the OC and FT group, respectively. Of the FT patients, 95% were returned on the same day and nine crossover patients (4.7%) the next day or later. Major events occurred in nine patients (2.2%); five in the OC and four in the FT group. There were a total of five events within 24 hours. No events were observed during transportation and there were no early retransfers.

Conclusions: Immediate written reports and good communication with the referring hospital enabled thoroughly selected patients to be safely returned on the same day as angiography and/or PCI.

Keywords

Acute coronary syndrome, angioplasty, coronary angiography, fast track, immediate retransfer, percutaneous coronary intervention, referring hospital

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Introduction

Fast tracks (FT) are invading medical societies, as in modern society in general.¹ FT groups may be defined as the quickest, the most direct, and thus often the most economic way to reach goals – without compromising medical safety.² In 1994 Lyons wrote ‘In learning to manage with fewer beds, they have introduced policies of later and later admissions, and earlier and earlier discharge with eventually many more patients for surgical operations being treated as day patients.’²

While the number of patients needing immediate coronary angiography and percutaneous coronary angioplasty (PCI) is growing, the number of available beds and PCI

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centres may not increase accordingly. A possible solution to this discrepancy is to establish fast track lines for patients in need of angiography and/or PCI.

The aim of the present study was to investigate whether patients with acute coronary syndrome (ACS) could be safely retransferred to their local referral hospital on the same day that they arrived at the intervention centre for coronary angiography and/or PCI. Our hypothesis was that patients who were retransferred to the local referral hospital on the same day of the procedure would have no more complications compared to those who stayed overnight in the intervention centre.

Materials and methods

Consecutive patients with suspected ACS referred from hospitals within 200 km from the PCI centre were included before the angiography was performed. Patients younger than 18 years, with a known mental retardation, dementia, or harmful use of alcohol or drugs, with allergies or intolerance to acetylsalicylic acid and/or clopidogrel, who had previously participated in this study, and with acute ST-segment elevation myocardial infarction (STEMI) less than 72 hours previously were excluded.

Two patients were prospectively randomized each weekday in blocks of two. The first two arriving patients with suspected ACS who fulfilled the inclusion criteria were selected. After arrival to the emergency department, the patients gave their consent and the first patient was randomized either to the OC group or the FT group by opening a sealed envelope containing the randomization code. The subsequent patient was given the opposite treatment.

OC group patients were received in the emergency department as usual and transported to the cardiac department. After coronary angiography and/or intervention, they were returned to the medical ward for overnight stay and discharged the next day at the latest.

FT group patients were transferred directly to the angiographic intervention laboratory. The interventional cardiologist checked the medical records before the procedure, evaluated the feasibility and safety of retransfer to their local referring hospital, and afterwards wrote the report to go with the patient. The patient and the local hospital were formerly instructed from the PCI centre in how to handle bleeding from the puncture site. All together, 80% of the FT patients were returned by the referral hospital's own dedicated transport office or dedicated taxi. The rest of the FT patients were returned with the region's healthcare bus or ambulance.

Our PCI centre provides about 4500 coronary angiographic procedures yearly and 1800 PCI. About 1100 of these patients have suspected ACS. The radial artery is the preferred access site. Both femoral and radial approach is safe, but the radial access route has a lower rate of vascular complications.³ Acetylsalicylic acid and clopidogrel is

given to all patients before the PCI procedure if the patient is not already on the medication. GPIIb/IIIa is not routinely given to this group of patients, but administered at the discretion of the doctor performing the angiography. According to the study protocol, if PCI patients in the FT group were given GPIIb/IIIa, they were changed to overnight stay at the PCI centre.

Our primary endpoints were the possible major events of cerebral insults, myocardial infarction, major bleeding, and death. Myocardial infarction was defined by clinical presentation⁴ with prolonged chest pain and ECG changes and confirmed by analysis of troponin and creatine kinase (CK) MB isoenzyme. Systematic measurement of troponin after the angiographic and/or PCI procedure was not performed. Bleeding was categorized into five groups according to the division of the Bleeding Academic Research Consortium.⁵ We defined major bleeding within types 3–5, which is: type 3a, overt bleeding plus haemoglobin drop of 3–5 g/dl (provided haemoglobin drop is related to bleed); type 3b, overt bleeding plus haemoglobin drop of 5 g/dl (provided haemoglobin drop is related to bleed); type 3c, intracranial haemorrhage (does not include microbleeds or haemorrhagic transformation, does include intraspinal); type 4, coronary artery bypass graft-related bleeding; and type 5, fatal bleeding. Major events were recorded from medical records at the PCI centre and the local hospital within 24 hours and 30 days after inclusion. Deaths were recorded from the national death registry. The secondary endpoint was the number of same-day successfully retransferred patients to the referral hospital.

The Regional Committee for Medical Research Ethics approved the study and informed consent was obtained from all participants. One of the authors (OJ) was the project leader and the responsible cardiologist. The study was financed by the hospital and completed during normal working hours. We had no external financial funding.

The statistical power was calculated according to an expected reduction in length of stay at the PCI centre in the FT group. According to pre-study recordings, we assumed that the average length of stay in the ordinary care group was 3.0 days, with standard deviation of 1 day. When comparing OC group with FT group, we wanted to use a two-sided Mann–Whitney test with 5% confidence interval. If the study should have at least 80% probability of detecting a 10% clinically significant difference in length of stay between the groups, at least 195 patients should be included in each. In the study protocol, we planned to include 200 patients in both groups: a total of 400 patients.

The results from the two groups were compared with chi-squared test using 95% confidence intervals.

Results

A total of 407 patients gave their written consent to participate in the study. Five patients withdrew their

Table 1. Baseline characteristics.

	Ordinary care (n=206)	Fast track (n=193)	p-value
Age (years, range)	64 (39 – 89)	65 (38 – 91)	0.36
Male	141 (68)	133 (69)	0.92
Current smoker	52 (25)	45 (23)	0.65
Treated hypertension	117 (57)	107 (55)	0.78
Treated diabetes	45 (22)	37 (19)	0.50
Previous stroke	14 (6.8)	9 (4.7)	0.36
Previous MI	48 (23)	50 (26)	0.54
GFR <60 ml/min/1.73m ²	42 (20)	41 (21)	0.83
Indication for admittance			
UAP	62 (30)	57 (30)	0.90
NSTEMI	144 (70)	136 (70)	0.90

Values are n (%) unless otherwise stated.

GFR, glomerular filtration rate; NSTEMI, non-ST-segment elevation myocardial infarction; UAP, unstable angina pectoris.

Table 2. Procedure and angiographic findings.

	Ordinary care (n=206)	Fast track (n=193)	p-value
Transradial access	187 (91)	167 (87)	0.18
Angiographic findings			
No significant stenosis	59 (29)	63 (33)	0.38
1-vessel disease	66 (32)	51 (26)	0.21
2-vessel disease	43 (21)	47 (25)	0.40
3-vessel disease	38 (18)	32 (16)	0.62
Intervention			
CABG	21 (10)	12 (6) ^a	0.14
PCI	94 (46)	78 (40)	0.29
C-lesion	10 (5)	14 (7)	0.31
Left main stem	0	0	
Bifurcation	20	16	0.62
Graft	1	4	0.15

Values are n (%).

^aOne patient underwent both PCI and CABG within 30 days.

CABG, coronary artery bypass graft; PCI, percutaneous coronary angioplasty.

Table 3. Fast track patients changed to overnight stay in hospital.

	Age (years)	Diagnosis	1-, 2-, or 3-vessel disease	Comments
Male	65	NSTEMI	3	CABG during the same stay
Male	58	NSTEMI	3	CABG during the same stay
Male	55	NSTEMI	3	CABG during the same stay
Female	46	UAP	2	Prolonged chest pain after PCI and periprocedural MI
Male	78	NSTEMI	3	Considered CABG, but refused because of lack of viability in left ventricle
Male	82	NSTEMI	3	Unresolved lung cancer
Male	63	NSTEMI	2	Proximal LAD dissection during the PCI
Male	81	UAP	1	PCI late afternoon, overnight stay at the patient hotel
Male	65	NSTEMI	0	Angiography at late afternoon, overnight stay at the patient hotel

CABG, coronary artery bypass graft; LAD, left anterior descending artery; NSTEMI, non-ST-segment elevation myocardial infarction; UAP, unstable angina pectoris.

consent, and three patients were excluded either because of suspected STEMI or they did not undergo coronary angiography.

A total of 399 patients were included: 206 patients in the OC group and 193 patients in the FT group (Table 1). There were no significant differences between the groups,

Table 4. Major events.

	Ordinary care (n=206)	Fast track (n=193)
Before 24 hours		
Cerebral insult	0	0
Myocardial infarction	1	1
Major bleeding	1	1
Death ^a	1	1
No. of patients	3	2
Between 24 hours and 30 days		
Cerebral insult	0	0
Myocardial infarction	0	2
Major bleeding	1	0
Vascular noncardiac death ^b	1	0
No. of patients	2	2

^aBoth deaths were cardiac.

^bThe death was after 3 days.

regarding age, sex, or cardiovascular risk factors. Table 2 shows the angiographic findings and the interventional treatment. Note that most patients were accessed through the transradial approach. Also, note that 29 and 33% in the OC and FT groups, respectively, had no significant stenosis.

Nine patients in the FT group were changed to overnight stay in the hospital (Table 3). Thereby, 95% of the FT group patients were transferred back to the referral hospital the same day.

Major events occurred in nine patients: five within 24 hours and four within 1 month (Table 4). There was no difference between the groups. In the OC group, one died from heart failure and one died of undiscovered lung embolus. In the FT group, one patient died from fatal bleeding. Within 24 hours, two patients with UAP had procedure-related infarction, one in each group. Both had prolonged chest pain and an increase of troponin, three times the upper reference limit.

Two patients in the OC group had major bleeding complications and needed blood transfusions. Within 10 days, three patients had a new NSTEMI, two in the OC group and one in the FT group. Within 30 days, one patient in the OC group was readmitted to the PCI centre with cardiac tamponade, after which 300 ml blood was evacuated (categorized in BARC 3b hemipericard-tamponade).

Discussion

Previous studies have shown that patients with acute coronary syndromes may undergo coronary angiography and PCI and be re-transferred to the referral hospital after a few hours of observation. Vendrametto et al. reported in 2006⁶ of 102 consecutive ACS patients transferred to a PCI centre for urgent PCI: 88 patients (87.1%) were immediately re-transferred with no arrhythmic or haemorrhagic complications during the transport. Hoa Do et al. reported in 2006⁷

532 NSTEMI or UAP patients of whom 113 were excluded for logistical reasons, high-risk procedure, and other causes. They found it safe to return 419 patients (79%) to their local hospital located within a radius of 100 km the same day, even though the procedure was done with femoral punctures in 85% of the patients.

The number of safely returned patients in our study was higher than reported in previous publications. This may be related to the high number of patients with normal coronary arteries included, the preplanned selection for overnight stay, as well as the transfer facilities and distance to the referring hospital. Compared to the study of Hoa Do et al.,⁷ more patients in our study did not undergo PCI. The high sensitivity of troponin assays have increased the number of patients with suspected ACS, resulting in more patients with a negative angiography.⁸ This is a clinical challenge. Giving systematic feedback to the referring hospital may lower the number of normal angiographies over time. Testing of the possible differences in primary endpoints between the groups was not performed in our study. The total number of patients with endpoints was too low for further analysis.

After PCI, myocardial infarction defined from elevated CK-MB, has an expected incidence of 5–30%, although, most large interventional trials report rates of 5–10%.^{9–11} Enzyme-defined infarctions are often clinically ‘silent’.^{9,12,13} In our study we conducted no systematic measurement of troponin or CK-MB. Only symptomatic patients and suspected procedure-related events had the troponin evaluation. Therefore the number of procedure-related myocardial infarction, STEMI and NSTEMI in this study were low: 0.5% in the OC group and 1.6% in the FT group. After PCI, stent thrombosis customarily occurs days to weeks after stent implantation, but may have an earlier onset. With dual antiplatelet therapy and improvements in stent deployment techniques, stent thrombosis is now observed in approximately 1% of the patients.^{14–21} No stent thrombosis was

reported in our study. Observing the patients for 4 hours after the procedure, we expect that most acute occlusions will take place before discharge. Also the selection of patients who stay overnight may reduce the number of early returns from the local hospitals.

In contemporary large series and randomized trials, the reported prevalence of stroke ranges from less than 0.1 to 0.38%.^{22–27} Symptoms of stroke may occur in the angio suite and most of them within the 4 hours of observation. No cerebral insults occurred in this study, neither acutely nor within the 30 days of the study period. Patients having an acute stroke in near relation to the procedure may undergo immediate clot removal, but this is still controversial.

Bleeding complications, in particular from the puncture site, may prevent early discharge. Using a femoral approach, both haematoma and pseudoaneurysm may occur. Pseudoaneurysm has been reported in 0.5–6.3%,²⁸ although in most series the incidence is approximately 1%. If thorough imaging studies are performed on all patients, the prevalence can be expected to be significantly higher.^{29,30} The transfemoral access was used in 10% in the OC group and 13% in the FT group. A femoral closure device helps to reduce any puncture bleeding complications, may mobilize the patient more quickly and thereby allows for patient discharge sooner after femoral puncture. Other bleeding complications may occur, but these are expected to be taken care of at the local hospital. In most patients the radial access was successful. Using the radial approach in a majority of the patients has probably contributed to the low number of bleeding complications, but this cannot be concluded from our study because of the low number of femoral access.

Faster return on the day of the procedure to the referral hospital, after a short time of observation in the PCI centre, presents possible problems. It gives the PCI centre less opportunity to detect differential diagnostic diseases when the coronary arteries are normal. Using a fast track pathway when investigating patients with suspected ACS, one has to rely on the referring hospitals for broader investigations of other potential diseases before and especially after a normal angiography. In our study it is likely that two patients with valvular abnormalities in the FT group (1%) were not discovered during the short stay in our observation centre. Both were readmitted for operative valvular replacement. Complete clinical examination including echocardiography would have discovered the abnormality. This is clearly a drawback, but with the high pressure on capacity at the PCI centres for coronary angiography, one could discuss whether this is acceptable or an argument against rapid patient investigation loops.

Another possible problem with the fast track is the risk of delayed treatment. In our study, the numbers of PCI and coronary artery bypass graft treatments in FT group patients within 30 days were lower compared with ordinary care.

This may be a random finding. The decision for proceeding with PCI was normally taken immediately after the angiography for both the OC group and the FT group patients. There was only one patient in the FT group that had delayed valvular replacement within 6 months.

The primary limitation of this study is the single-centre design and possible bias from enthusiastic doctors. Also, the low number of patients and in particular the low number of complications makes it difficult to generalize the data. Our intention was to include the two first arrivals to the PCI centre every day, in order to successfully return the FT patient on the same day regardless of the transportation time and length. Unfortunately, the patients with the shortest transport distances arrived first. This resulted in nearly 75% of the patients being recruited within the Oslo region, with between 30 and 45 minutes travelling time. The other patients came from hospitals with travelling times of 1–4 hours.

As a result of the open design of the study, the FT patients were given priority to the angio suite for rapid return. Thereby, we have reinforced/increased the time difference in length of stay between the groups. However, we assume this difference to be small because the centre has four available angio suites. Only patients with acute myocardial infarctions or patients from the outpatient's clinic could cause delay for the angiography in the OC group.

In conclusion, fast track and return to the local hospital can be done safely with most patients with acute coronary syndrome, excluding acute myocardial infarction. Overnight stay may be decided after the angiography and a short stay in the observation area. Important requirements for same-day returns are thorough selection of patients, safe transfer, immediate written reports, and good communication with the local hospital.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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