Same-day transfer of patients with unstable angina and non-ST segment elevation myocardial infarction back to their referring hospital after angioplasty

Doan Hoa Do MD, Karl Dalery MD, André Gervais MD, Richard Harvey MD, Serge Lepage MD, Andrée Maltais BScN, Michel Nguyen MD

DH Do, K Dalery, A Gervais, et al. Same-day transfer of patients with unstable angina and non-ST segment elevation myocardial infarction back to their referring hospital after angioplasty. *Can J Cardiol* 2006;22(5):405-409.

BACKGROUND: Recent evidence has shown the advantages of an early invasive strategy for patients with high-risk unstable angina (UA) and non-ST segment elevation myocardial infarction (NSTEMI). However, the number of beds available for postangioplasty monitoring limits the use of this approach at the Centre hospitalier universitaire de Sherbrooke (Fleurimont, Quebec).

OBJECTIVES: To study the safety of a protocol allowing the same-day return of patients with UA or NSTEMI to their referring hospital after angioplasty at the Centre hospitalier universitaire de Sherbrooke.

METHODS: From June 2001 to June 2003, of the 532 patients with UA and NSTEMI who underwent percutaneous coronary intervention with planned same-day transfer back to their referring hospital, 419 consecutive patients who were eligible to return the same day were prospectively followed for 24 h.

RESULTS: Stents were used in 94.7% of patients and platelet glycoprotein IIb/IIIa receptor antagonists were used in 34.8% of patients. For 85% of patients, the femoral artery was used as the access route for percutaneous coronary intervention. The mean time that patients stayed in the hospital after angioplasty before returning to their referring centres was 4.4 h. No deaths, life-threatening arrhythmias or urgent revascularizations were reported during the 24 h postangioplasty follow-up period, but one patient had a major bleeding complication. During the study period, the mean angioplasty waiting time decreased from 5.7 days to 2.1 days.

CONCLUSIONS: The protocol evaluated in the present article is safe. It frees more beds, thus reducing the waiting list and allowing patients with high-risk acute coronary syndromes without ST segment elevation from community hospitals to benefit from the advantages of an early invasive strategy.

Key Words: Angina; Angioplasty; Community hospital; Discharge; Myocardial infarction; Stents

Evidence from the literature recommends an early invasive strategy for patients with high-risk unstable angina (UA) and non-ST segment elevation myocardial infarction (NSTEMI) (1,2). However, the application of this strategy for patients from community hospitals has been limited by the availability of tertiary care facilities and long waiting lists. For example, the mean coronary angiography waiting time at Centre hospitalier universitaire de Sherbrooke

Protocole de retour, le jour même, de patients souffrant d'angine de poitrine instable ou d'un infarctus du myocarde sans sus-décalage du segment ST à l'hôpital d'origine après une angioplastie

CONTEXTE : Des études récentes ont montré les bienfaits d'une stratégie d'interventions effractives précoces chez les patients souffrant d'angine de poitrine instable (API) à haut risque ou d'un infarctus du myocarde (IM) sans sus-décalage du segment ST. Toutefois, le nombre de lits disponibles pour la surveillance des patients après une angioplastie limite le recours à cette stratégie au Centre hospitalier universitaire de Sherbrooke (Fleurimont [Québec]).

OBJECTIF : L'étude visait à évaluer l'innocuité d'un protocole de retour, le jour même, de patients souffrant d'API ou d'un IM sans sus-décalage du segment ST à l'hôpital d'origine après une angioplastie pratiquée au Centre hospitalier universitaire de Sherbrooke.

MÉTHODE : De juin 2001 à juin 2003, 532 patients souffrant d'API ou d'un IM sans sus-décalage du segment ST ont subi une intervention coronarienne percutanée, suivie d'un retour planifié à l'hôpital d'origine le jour même; sur ce nombre, 419 patients consécutifs, répondant aux critères de sélection, ont été suivis de façon prospective sur 24 h.

RÉSULTATS : Il y a eu pose d'endoprothèses vasculaires chez 94,7 % des patients et administration d'antagonistes des récepteurs plaquettaires de la glycoprotéine IIb/IIIa chez 34,8 % des patients. Dans 85 % des cas, l'intervention coronarienne percutanée s'est faite par l'artère fémorale. Les patients ont passé en moyenne 4,4 h à l'hôpital après l'angioplastie avant de retourner à l'hôpital d'origine. Il n'y a pas eu de décès, d'arythmie potentiellement mortelle ou d'intervention urgente de revascularisation durant la période de suivi de 24 h après l'angioplastie; un patient a toutefois connu une complication hémorragique importante. Le temps d'attente moyen en vue d'une angioplastie, durant la période d'étude, est passé de 5,7 jours à 2,1 jours.

CONCLUSION : Le protocole évalué dans la présente étude s'est révélé sûr. Il permet de libérer des lits plus rapidement, ce qui réduit la liste d'attente et donne aux patients souffrant de syndromes coronariens aigus sans sus-décalage du segment ST et admis dans des hôpitaux communautaires la possibilité de profiter des bienfaits d'une stratégie d'interventions effractives précoces.

(CHUS), a tertiary care hospital in Fleurimont, Quebec, for patients with UA and NSTEMI from referring hospitals was 5.7 days in 2001.

The main factor limiting accessibility to CHUS was not the capacity of catheterization laboratories, which were reorganized to respond to higher demand, but rather the number of beds available for postangioplasty monitoring for at least 12 h to 24 h, as recommended (3).

Division of Cardiology, Centre hospitalier universitaire de Sherbrooke, Fleurimont, Québec

Correspondence and reprints: Dr Michel Nguyen, Division of Cardiology, Department of Medicine, Centre hospitalier universitaire de Sherbrooke, 3001, 12^e Avenue Nord, Fleurimont, Québec J1H 5N4. Telephone 819-346-1110, fax 819-564-5316, e-mail Michel.Nguyen@USherbrooke.ca
Received for publication October 26, 2004. Accepted September 12, 2005

Koch et al (4) performed elective percutaneous coronary intervention (PCI) on 1015 patients and demonstrated the safety of transferring more than 90% of them back to their referring hospital on the same day as the PCI. Banning et al (5) showed that same-day discharge following elective PCI in patients with stable angina was safely done for 487 patients. However, few data exist on the feasibility of the practice for patients with UA and NSTEMI, who are particularly more prone to abrupt vessel closure and acute thrombosis.

The present study evaluated the safety of a protocol allowing the same-day return of patients with UA and NSTEMI to their referring noninterventional hospital after PCI was performed at CHUS.

PATIENTS AND METHODS

Study population

From June 2001 to June 2003, 419 consecutive patients with UA and NSTEMI who were returned to their referring centre after undergoing PCI at the CHUS on the same day were prospectively studied.

CHUS serves eight referring community hospitals located within a 100 km radius. It has two catheterization laboratories and four interventional cardiologists. During the study period, approximately 5600 diagnostic coronary angiograms and 2400 PCIs were performed. Six beds equipped with cardiac monitoring devices were made available at the hospital exclusively for post-PCI monitoring.

Study protocol

The post-PCI care protocol was taught to the nursing staff and physicians of the eight referring centres. The nursing staff accompanying the patients during transfer possessed the required qualifications for critical care – in particular, knowledge concerning treatment of malignant arrhythmias and hemorrhagic complications. The use of drugs recommended in guidelines (2) for the treatment of UA and NSTEMI was encouraged in the community hospitals. To achieve that goal, lectures on the subject were given by interventional cardiologists from CHUS to physicians from the referring centres.

A nurse accompanied each patient during the transfer from the referring centre to the hospital on the day of the scheduled PCI. On the same day, the patient underwent coronary angiography, followed by an ad hoc angioplasty, if suitable. The use of stents was highly encouraged for arteries larger than 2.75 mm to 3 mm or for smaller arteries with suboptimal results. Acetylsalicylic acid (325 mg) and heparin (intravenous unfractionated heparin or low molecular weight heparin) were previously administered to all patients. All patients were preloaded at the referring centre with clopidogrel 300 mg 12 h to 48 h before the procedure. Clopidogrel and acetylsalicylic acid were continued for at least four weeks following the PCI. A platelet glycoprotein (GP) IIb/IIIa receptor inhibitor was used at the discretion of the referring physician and interventional cardiologist. The infusion of GP IIb/IIIa was continued for 12 h following the PCI procedure.

All PCI procedures were performed with 6 French access sheaths via the femoral or the radial artery (depending on the preference of the interventional cardiologist). At the end of the PCI, a hemostatic closure device (Angio-Seal [St Jude Medical, USA] or Perclose [Abbott Laboratories, USA]) was immediately used on the access artery for all procedures performed using the femoral approach, followed by the application of a pressure bandage. If the closure device failed, then manual compression of the puncture site was performed.

Immediately following the PCI procedure, patients were observed under cardiac monitoring at CHUS for approximately 4 h to 6 h. After that period, if the interventional cardiologist judged it to be safe, then patients were returned back to their referring centre accompanied by their nurse in an ambulance. The main reasons precluding a patient's transfer were hemodynamic instability, abrupt vessel closure, complex coronary dissection, suboptimal angiographic result, vessel perforation, complex PCI, the need for emergency coronary artery bypass graft surgery, serious arrhythmia, serious bleeding complication, pulmonary edema, respiratory insufficiency, anaphylaxis, neurological event and logistical reasons.

Follow-up

All patients able to return to their hospital on the same day after PCI were observed in an intensive care unit for a minimum of 12 h. Serial measures of creatine kinase (CK) and CK-MB isoenzyme (every 8 h for 24 h or until discharge), creatinine, international normalized ratio and activated partial thromboplastin time, as well as complete blood cell count and electrocardiography, were performed by the referring hospital 12 h to 24 h following PCI. The follow-up was assured by a written survey and a telephone call 24 h post-PCI by a catheterization laboratory nurse to the nursing staff of the referring centre. Using these means, any complication during the ambulance transport or during the 24 h observation period was surveyed. An interventional cardiologist and the catheterization laboratory chief nurse could be contacted at any time by pager for any questions or problems.

The written and telephone questionnaires looked for the following complications: death, serious arrhythmia, severe myocardial ischemia requiring urgent repeated PCI or coronary artery bypass grafting surgery, myocardial infarction (MI) (defined as CK or CK-MB isoenzyme greater than three times the upper limit of normal or a recent increase in CK or CK-MB isoenzyme levels to 50% above the previous value after an initial peak), major bleeding event (defined as a decrease in the blood hemoglobin concentration of at least 50 g/L, the need for transfusion of two or more units of blood, the need for corrective surgery, or the occurrence of an intracranial or retroperitoneal hemorrhage or cardiac tamponade), neurological event, pulmonary edema and other complications.

Data collection

Patient demographics, lesion location, number of stents used, use of GP IIb/IIIa inhibitors, access artery and use of hemostatic closure devices were recorded in a catheterization laboratory database. Incidence of any of the above complications was documented with the help of the written and telephone surveys.

The impact of the protocol on the waiting time was calculated from a sample of patients from March 2001 to June 2001 (for the waiting time before applying the protocol) and from March 2003 to June 2003 (for the waiting time during the use of the protocol). Calculations of the mean, median and range in days were used for the comparison.

All patients gave informed consent and the protocol was approved by the institutional review committee.

RESULTS

During the study period, 797 patients were referred for urgent angiography following UA and NSTEMI. Of these 797 patients, 169 patients (21.2%) were treated medically, 74 patients (9.3%) required coronary artery bypass grafting surgery,

Figure 1) Study group and noneligible patients. NSTEMI Non-ST segment elevation myocardial infarction; PCI Percutaneous coronary intervention; UA Unstable angina

TABLE 1
Reasons for the exclusion of patients transferred after same-day percutaneous coronary intervention during the study

Reason	Patients	
	n	%
Logistical reasons	31	27.4
No nurse escort available	9	8.0
No ambulance available for transport	7	6.2
Late procedure	12	10.6
No bed available in referring centre	3	2.7
High-risk reasons	77	68.1
Angiographic thrombus, no reflow or occluded side branch	8	7.1
No angiographic success	9	8.0
Complex percutaneous coronary intervention	26	23.0
Severe dissection	3	2.7
Prolonged and severe chest pain without change on electrocardiogram	9	8.0
Reanimation	2	1.8
Respiratory problem	3	2.7
Arrhythmia	1	0.9
Puncture site hematoma	16	14.2
Neurological event	0	0
Other or unspecified reason	5	4.4
Total	113	100

22 patients (2.8%) had PCI performed on the following days and 532 patients (66.8%) underwent a same-day ad hoc PCI with planned same-day transfer back to their referring hospital (Figure 1). The reasons for the exclusion of patients transferred after same-day PCI during the study are summarized in Table 1. The study population comprised the 419 consecutive patients who were able to be transferred back to their referring centre

TABLE 2
Clinical characteristics of the study patients (n=419)

Characteristic	Patients	
	n	%
Age, years (mean $\pm$ SD)	66.7 $\pm$ 12.1	
Age range, years	30–95	
Male sex	273	65.2
Patients with angioplasty without a stent	22	5.3
Patients with stent(s) implantation	397	94.7
Number of stents per patient		
One	235	56.1
Two	114	27.2
Three	39	9.3
Four	9	2.1
Use of a platelet glycoprotein IIb/IIIa receptor antagonist	146	34.8
Abciximab	68	16.2
Tirofiban	58	13.8
Eptifibatide	20	4.8
Percutaneous approach		
Femoral access	356	85.0
Radial access	62	14.8
Brachial access	1	0.2
Closure device use	356	85.0
Angio-Seal*	137	32.7
Perclose†	219	52.3

*St Jude Medical, USA; †Abbott Laboratories, USA

TABLE 3
Medications administered before transfer to the Centre hospitalier universitaire de Sherbrooke, Fleurimont, Quebec

Medication	Patients	
	n	%
Acetylsalicylic acid	419	100
Clopidogrel	419	100
Glycoprotein IIb/IIIa inhibitors	58	13.8
Abciximab	0	0
Tirofiban	58	13.8
Eptifibatide	0	0

*No information was available on the use of statins, angiotensin-converting enzyme inhibitors, beta-blockers, calcium channel blockers or nitrates before transfer

the same day after PCI. The overall rate of transfer after PCI was 78.8%. However, if logistical reasons are excluded, the calculated rate of transfer is 83.6%.

Table 2 summarizes the clinical characteristics of the study patients. Table 3 shows the medications that patients had received before arriving at the tertiary care centre (mainly GP IIb/IIIa inhibitors, clopidogrel and acetylsalicylic acid). Table 4 presents the patients' angiographic characteristics. Stents were used for 397 patients (94.7%), with an average of 1.47 stents per patient. Balloon inflation alone without a stent was performed for 22 patients (5.3%). One hundred forty-six patients (34.8%) received a platelet GP IIb/IIIa receptor antagonist. Abciximab was the drug administered most often.

The femoral artery was the most frequent access route for PCI. Hemostatic closure devices were used on the access artery

TABLE 4
Angiographic characteristics of included patients (n=419)

Target artery	Patients	
	n	%
Left anterior descending coronary artery	200	47.7
Right coronary artery	181	43.2
Left circumflex coronary artery	116	27.7
Protected left main coronary artery	2	0.5
Saphenous vein graft	9	2.1
Multiple vessels	83	19.8

for all PCIs performed using the femoral approach: the Angio-Seal was used in 32.7% of cases and the Perclose was used in 52.3% of cases.

The mean duration of patients' stay at CHUS after PCI before returning to their referring centre was 4.4 h (range 0 h to 13.5 h).

Complications during follow-up

No deaths, life-threatening arrhythmias, neurological events or urgent revascularizations were reported during transport to the referring centres or during the 24 h post-PCI follow-up. Twenty patients (4.8%) had a PCI-related MI (Table 5). No abrupt vessel closure was reported. One patient (0.2%) experienced a major bleeding complication after receiving abciximab. It was a femoral hematoma at the puncture site occurring a few hours after the procedure that was managed by manual compression. The hemoglobin concentration fell from 94 g/L to 75 g/L, requiring blood transfusions; no surgical repair was required. Four patients (1.0%) developed pulmonary edema on their return to the referring centre, but none of these events occurred during ambulance transport. These patients were managed with diuretics and vasodilators, and none of them required intubation. Other complications reported were fever (two patients) and renal failure (one patient).

Outcome on waiting time

During the study period, the mean PCI waiting time for patients with UA and NSTEMI from referring hospitals decreased from 5.7 days (median of six days, range zero to 15 days) to 2.1 days (median of two days, range zero to seven days).

DISCUSSION

The present study shows the safety of same-day transfer of selected patients with UA and NSTEMI back to their referring hospital after PCI was performed at CHUS. Among the advantages of this practice is the opportunity for the patient to return to be close to his community, family and treating physician.

During the study, 78.8% of all referred patients with UA and NSTEMI who underwent PCI were able to return the same day to their referring centre. However, if logistical reasons are excluded, then the transfer rate climbs to 83.6%. This is consistent with the Banning et al (5) study, which showed a same-day discharge rate of 84% of patients with elective PCI for stable angina. Koch et al (4), on the other hand, showed that 90.8% of patients discharged the same day after elective PCI had an uncomplicated course.

Of the 419 consecutive patients who were returned to their referring centre the same day, no life-threatening complications

TABLE 5
Complications experienced during the 24 h follow-up after percutaneous coronary intervention (PCI)

Complication	Patients	
	n	%
Death	0	0
Life-threatening arrhythmia	0	0
Urgent revascularization	0	0
Abrupt closure	0	0
Neurological event	0	0
PCI-related myocardial infarction*	20	4.8
Major bleeding complication	1	0.2
Pulmonary edema	4	1.0
Respiratory failure	0	0
Other	3	0.7

*Defined as creatine kinase (CK) and CK-MB isoenzyme greater than three times the upper limit of normal or a recent increase in CK or CK-MB isoenzyme levels to 50% above the previous value after an initial peak

occurred during the 24 h post-PCI follow-up period. The rate of PCI-related MI in our patients (4.8%) was consistent with the rate reported in the literature (6,7). However, no abrupt vessel closure was observed in the present study. The high use of stents (in 95% of PCIs) and platelet GP IIb/IIIa receptor antagonists probably contributed to this result.

The majority of PCI procedures were performed using the femoral artery. Serious local vascular complications for our patients (0.2%) occurred at a lower rate than previously reported (1.5% [7]), even though most patients received clopidogrel and 35% received a platelet GP IIb/IIIa receptor antagonist. The use of small access sheaths and the frequent use of percutaneous vascular closure devices combined with pressure bandages may have helped reduce those complications. However, the main reason for such a low observed rate probably resides in the fact that patients with evidence of such bleeding complications were not allowed to return the same day to their referring hospital and, thus, were not included in the statistics (ie, selection bias).

The present study was conducted at a single, high-volume PCI institution; therefore, the results may not be the same in centres with different patient populations. We assumed that the clinical and angiographic characteristics of our patients were in accordance with those of patients in other populations. The fact that the end points were assessed in an unblinded fashion may also suggest that the results were subject to bias.

Another limitation of the present study was the short follow-up period after PCI (24 h); however, most serious complications usually happen during this period (7). Moreover, some pilot studies (4,5,8,9) suggest that selected patients may be discharged safely on the same day after elective PCI. This is consistent with the present findings. Our practice in the present study was even safer because patients were observed in an intensive care unit in their referring hospital for a minimum of 12 h.

Evidence in the literature has shown the benefits of an invasive strategy for high-risk acute coronary syndrome patients without ST segment elevation. The feasibility of this practice for patients from noninterventional community hospitals is mainly limited by the capacity of our tertiary care centre to observe patients under cardiac monitoring following PCI.

Our protocol, which was designed to return selected patients to their referring community hospital soon after undergoing angioplasty, appears to be feasible and safe. By using tertiary care facilities optimally, our protocol frees more beds, thereby significantly reducing the waiting time from 5.7 days to 2.1 days. It also allows more patients with UA and NSTEMI from community hospitals to benefit from the advantages of an early invasive strategy. This approach should therefore be considered by all tertiary care centres to better serve patients with acute coronary syndrome.

REFERENCES

1. Cannon CP, Weintraub WS, Demopoulos LA, et al. Comparison of early invasive and conservative strategies in patients with unstable coronary syndromes treated with the glycoprotein IIb/IIIa inhibitor tirofiban. *N Engl J Med* 2001;344:1879-87.
2. Braunwald E, Antman EM, Beasley JW, et al. ACC/AHA 2002 Guideline Update for the Management of Patients with Unstable Angina and Non-ST-Segment Elevation Myocardial Infarction: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on the Management of Patients With Unstable Angina). <<http://www.acc.org/clinical/guidelines/unstable/unstable.pdf>> (Version current at February 5, 2006).
3. Smith SC Jr, Dove JT, Jacobs AK, et al; American College of Cardiology; American Heart Association Task Force on Practice Guidelines. Committee to Revise the 1993 Guidelines for Percutaneous Transluminal Coronary Angioplasty. ACC/AHA guidelines of percutaneous coronary interventions (revision of the 1993 PTCA guidelines) – Executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1993 Guidelines for Percutaneous Transluminal Coronary Angioplasty). *J Am Coll Cardiol* 2001;37:2215-39.
4. Koch KT, Piek JJ, Prins MH, et al. Triage of patients for short term observation after elective coronary angioplasty. *Heart* 2000;83:557-63.
5. Banning AP, Ormerod OJ, Channon K, et al. Same day discharge following elective percutaneous coronary intervention in patients with stable angina. *Heart* 2003;89:665.
6. Califf RM, Abdelmeguid AE, Kuntz RE, et al. Myonecrosis after revascularization procedures. *J Am Coll Cardiol* 1998;31:241-51.
7. Baim D, Grossman W. Grossman's Cardiac Catheterization, Angiography, and Intervention. Philadelphia: Lippincott Williams & Wilkins, 2000:35-65.
8. Laarman GJ, Kiemeneij F, van der Wieken LR, Tijssen JG, Suwarganda JS, Slagboom T. A pilot study of coronary angioplasty in outpatients. *Br Heart J* 1994;72:12-5.
9. Cragg DR, Friedman HZ, Almany SL, et al. Early hospital discharge after percutaneous transluminal coronary angioplasty. *Am J Cardiol* 1989;64:1270-4.