Same-day-discharge ad hoc percutaneous coronary intervention: Initial single-centre experience

Angioplastie ambulatoire ad hoc : expérience initiale monocentrique

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KEYWORDS
Percutaneous coronary intervention; Revascularization; Angioplasty; Radial access

Summary
Background. — Progress in techniques and equipment facilitates same-day-discharge percutaneous coronary intervention (PCI).
Aim. — To present initial experience of a same-day-discharge intention-to-treat ad hoc PCI strategy with a preferentially radial approach.
Methods. — The first 102 same-day-discharge PCIs performed in our centre were analysed retrospectively. Subjects were stable or stabilised coronary patients, free of cardiac insufficiency, with a normal Allen test and residing within 60 min of the centre. Discharge was authorised after six hours’ event-free monitoring. The principal assessment criterion combined major adverse cardiovascular events, stroke, major haemorrhage and unscheduled medical consultation in the 30 days following PCI. Overall patient satisfaction and anxiety associated with same-day discharge were assessed by telephone questionnaire at some time after the intervention.
Results. — Between January 2006 and March 2008, 95 day-hospital patients underwent 102 distinct PCIs (50 complex, 13 bifurcation lesions, nine intravascular ultrasound, 18 fractional flow reserve, two Rotablator procedures). Crossover to overnight admission was necessary for 5.9% (n = 6) of interventions. Baseline clinical and angiographic characteristics were similar to those of an unselected Western population. At 30 days, four clinical events were observed (3.9% of interventions), which occurred within 6 hours (n = 2) or after the 24th hour. Classical 24-hour admission would thus have provided no added benefit. On an analogue scale, overall satisfaction was high (8.9/10) and anxiety associated with same-day discharge was low (1.7/10).
Conclusion. — A same-day-discharge ad hoc PCI strategy proved reliable and safe for most patients selected a priori on simple clinical criteria, entailing no unexpected complications due to shorter medical monitoring.

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MOTS CLÉS
Angioplastie coronaire ; Ambulatoire ; Cardiologie interventionnelle ; Voie radiale

Résumé Les progrès des techniques et du matériel permettent d’envisager les angioplasties coronaires avec une prise en charge ambulatoire. Le but de notre étude est de présenter notre expérience initiale, en intention de traiter, d’une stratégie d’angioplastie ambulatoire ad hoc par voie d’abord radiale préférentielle.

Patients et méthodes. — Les 102 premières angioplasties ambulatoires réalisées à l’hôpital cardiologique de Lyon ont été analysées de manière rétrospective. Les patients étaient des coronariens stables ou stabilisés, sans insuffisance cardiaque, avec un test d’Allen normal et habitant à moins de 60 minutes du centre interventionnel. Le retour à domicile était autorisé après six heures de surveillance sans événement. Le critère de jugement principal était la survenue d’un événement cardiaque majeur, d’un accident vasculaire cérébral, d’un saignement majeur ou d’une consultation non programmée durant les 30 jours suivant l’angioplastie. La satisfaction globale des patients et l’anxiété ressentie par un retour à domicile le jour de l’intervention ont été évaluées par un questionnaire téléphonique effectué à distance de la procédure.

Résultats. — Entre janvier 2006 et mars 2008, 95 patients en hospitalisation de jour ont bénéficié de 102 procédures distinctes d’angioplasties coronaires (50 procédures complexes, 13 lésions de bifurcation, neuf échographies endocoronaires, 18 guides de pression, deux procédures avec Rotablator). La conversion en une nuit d’hospitalisation a été nécessaire dans 5,9 % des interventions (n = 6). Les caractéristiques cliniques et angiographiques des patients sont comparables à celles d’une population occidentale non sélectionnée. À 30 jours nous avons constaté quatre événements cliniques (3,9 %). Ces complications sont survenues soit avant la sixième heure (n = 2) soit après la vingt-quatrième heure. On peut donc supposer qu’une hospitalisation traditionnelle d’une durée de 24 heures n’aurait apporté aucun bénéfice. Sur une échelle analogique, la satisfaction globale a été mesurée à 8,9/10 et l’anxiété ressentie par une sortie précoce à 1,7/10.

Conclusion. — Une stratégie d’angioplastie ambulatoire ad hoc est fiable et sûre pour une large proportion de patients sélectionnés a priori sur des critères cliniques simples. Elle n’entraîne pas de complications inattendues liées à une surveillance médicale plus courte.

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Abbreviations

ECG electrocardiogram
MACE major adverse cardiovascular events
NSTEMI non-ST-segment elevation myocardial infarction
PCI percutaneous coronary intervention
STEMI ST-segment elevation myocardial infarction
TIMI thrombolysis in myocardial infarction

Background

Recent progress in PCI techniques and equipment offers the hope of outpatient management, with admission, performance of coronary angiography and PCI, and discharge all in one day [1—3]. Hospital monitoring of just a few hours’ duration after revascularization entails special risk precautions in terms of the arterial puncture-point, acute stent thrombosis and coronary complications, compared with the classic procedure with overnight hospital admission.

The radial approach has been shown to be as good as the femoral approach in terms of immediate success [4,5] and severe cardiac events (death, myocardial infarction, cardiac surgery or emergency repeat PCI) but with half as many puncture-point vascular complications [6] and allowing same-day discharge [1,3].

While acute stent thrombosis and post-PCI coronary complications are serious, the risk factors are well defined clinically and in terms of antiplatelet treatment and interventional cardiology outcome [7—11], so that it is possible to select low-risk patients [1,2]. Moreover acute stent thrombosis has been shown to occur either very early (less than one hour after implantation in 50% of cases) or after the 24th hour (50%) [8,9], justifying a strategy of just six hours’ post-procedural monitoring, with discharge generally within 24 hours.

In this study, we sought to present our initial experience of a same-day-discharge PCI strategy with intention to treat, as implemented in a high-volume French centre.

Materials and methods

Since our day hospital was opened in January 2006, all PCI patients were followed up with a specific protocol and included in the present study.
A priori patient selection for same-day-discharge interventional procedure

Patients were eligible for same-day-discharge management if they were aged more than 18 years, had been pretreated with clopidogrel 75 mg and aspirin 75 mg for at least 5 days, and if same-day discharge was feasible. A radial approach was preferred systematically. Exclusion criteria were residing more than 60 min from the hospital, negative Allen test result with regard to the radial approach, STEMI, NSTEMI (TIMI risk score > 5), decompensated cardiac failure or renal insufficiency (creatinine clearance < 50 mL/min). There were no angiographic exclusion criteria.

Same-day discharge was authorised if the PCI result was considered to be optimal with systematic stenting, at least six hours’ monitoring was possible, there was no puncture-point bleeding, the patient was entirely asymptomatic and there was no alteration in the post-procedural ECG. Otherwise, day-hospital management was converted into classic admission with at least one night’s monitoring.

A letter and interventional report were faxed on the same day to the patient’s cardiologist and copied to the patient. Advice on puncture-point care and action in case of complications or difficulties experienced by the patient and the 24/7 interventional cardiology centre contact details were provided systematically to the patient on discharge.

Assessment criteria

The main composite assessment criterion was implemented at 30 days, including MACE (death, myocardial infarction, emergency revascularization of the treated artery), symptomatic stroke and major haemorrhage (with at least 2 g/dL haemoglobin loss requiring packed red blood cell transfusion or vascular surgery). Any such events were categorized as having occurred within 6 hours (in hospital), 6–24 hours, 1–3 days or 3–30 days.

Secondary assessment criteria were crossover to overnight admission, non-scheduled medical consultation, minor puncture-point bleeding (defined as any postdischarge wrist haematoma) and symptomatic radial thrombosis.

Two additional criteria were taken into consideration: subjective anxiety and patient satisfaction.

Procedure and follow-up

The coronary angiographic approach was radial or femoral. PCI, where indicated, was performed in the same step, using 5F or 6F sheaths. Patients were pretreated with aspirin (75 mg/day) plus clopidogrel (75 mg/day) after a 300-mg loading dose. A single dose of heparin 50 IU/kg was delivered after sheath insertion for radial approaches and 30 IU/kg ahead of PCI for femoral approaches. Stenting was systematic. The choice between drug-eluting or bare-metal stents was left up to the operator. The sheath was withdrawn immediately after the procedure and haemostasis was ensured by compression with a haemostasis bracelet (TR Band TM, Terumo Corp., Tokyo, Japan) for radial approaches or with a closure procedure (Angio-Seal TM, Saint Jude Medical Inc., Saint Paul, MN, USA) for femoral approaches.

Post-PCI treatment comprised permanent aspirin 75 mg/day and clopidogrel 75 mg/day for at least one month for bare-metal stenting, 12 months for active stenting and 12 months for PCI secondary to acute coronary syndrome.

Results

Between January 2006 and March 2008, 244 patients were admitted on an outpatient basis for diagnostic coronary angiography, and 102 distinct PCIs (42%) were performed on 95 patients by two trained operators (GR and GF). This amounted to 3% of the PCIs performed in the centre as a whole over that period, and 8% of those performed by these two operators.

Table 1 shows the clinical and angiographic characteristics of this population compared with PCI patients as a whole treated during the study period with standard hospitalization (i.e. stay ≥ 2 nights) in our centre. The two populations were similar in terms of risk factors and coronary status. A history of coronary artery disease occurred more frequently in the study population and, not surprisingly, a shift in the clinical presentation was seen between groups, as stable angina was the preferred indication for ambulatory care. Consequently, the treated lesions were less complex and multiple PCIs were performed less frequently in the study group. Interestingly, the rate of preinvasive ischaemia testing was high and ischaemia testing even increased to almost 100% with the use of intravascular ultrasound and/or fractional flow reserve during the invasive procedure. NSTEMI...
Table 1  Population characteristics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study group (n = 95)</th>
<th>Overall population (n = 3136)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>63 ± 12</td>
<td>65 ± 13</td>
<td>0.72</td>
</tr>
<tr>
<td>Men</td>
<td>84 (88)</td>
<td>2383 (76)</td>
<td>0.005</td>
</tr>
<tr>
<td>Diabetic</td>
<td>20 (21)</td>
<td>690 (22)</td>
<td>0.82</td>
</tr>
<tr>
<td>Hypertension</td>
<td>45 (47)</td>
<td>1590 (51)</td>
<td>0.52</td>
</tr>
<tr>
<td>Dyslipidaemia</td>
<td>47 (49)</td>
<td>1367 (44)</td>
<td>0.25</td>
</tr>
<tr>
<td>Current smoker</td>
<td>38 (40)</td>
<td>1047 (33)</td>
<td>0.18</td>
</tr>
<tr>
<td>History of coronary disease</td>
<td>34 (36)</td>
<td>754 (24)</td>
<td>0.009</td>
</tr>
<tr>
<td>Indication</td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Stable angina</td>
<td>57 (56)</td>
<td>744 (24)</td>
<td></td>
</tr>
<tr>
<td>Silent ischaemia</td>
<td>27 (26)</td>
<td>261 (8)</td>
<td></td>
</tr>
<tr>
<td>Unstable angina and NSTEMI</td>
<td>18 (18)</td>
<td>1504 (48)</td>
<td></td>
</tr>
<tr>
<td>STEMI</td>
<td>0 (0)</td>
<td>627 (20)</td>
<td></td>
</tr>
<tr>
<td>Radial approach</td>
<td>82 (80)</td>
<td>527 (17)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Coronary status</td>
<td></td>
<td></td>
<td>0.007</td>
</tr>
<tr>
<td>One vessel</td>
<td>66 (66)</td>
<td>1591 (51)</td>
<td></td>
</tr>
<tr>
<td>Two vessels</td>
<td>26 (26)</td>
<td>994 (32)</td>
<td></td>
</tr>
<tr>
<td>Three vessels</td>
<td>8 (8)</td>
<td>525 (17)</td>
<td></td>
</tr>
<tr>
<td>Ad hoc PCI</td>
<td>90 (95)</td>
<td>2846 (91)</td>
<td>0.18</td>
</tr>
<tr>
<td>&gt; 1 artery treated in one step</td>
<td>18 (18)</td>
<td>1040 (33)</td>
<td>0.003</td>
</tr>
<tr>
<td>Prior non-invasive ischaemia test</td>
<td>58 (57)</td>
<td>533 (17)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Prior non-invasive ischaemia test except ACS</td>
<td>58 (75)</td>
<td>533 (53)</td>
<td>0.002</td>
</tr>
<tr>
<td>Intravascular ultrasound</td>
<td>9 (9)</td>
<td>141 (4.5)</td>
<td>0.02</td>
</tr>
<tr>
<td>Fractional flow reserve</td>
<td>18 (18)</td>
<td>112 (3.5)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Distal protection</td>
<td>5 (5)</td>
<td>204 (6.5)</td>
<td>0.63</td>
</tr>
<tr>
<td>Rotational atherectomy</td>
<td>2 (2)</td>
<td>43 (1.4)</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Lesion characteristics

<table>
<thead>
<tr>
<th>(n = 120)</th>
<th>(n = 4529)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex lesion</td>
<td>59 (49)</td>
<td>2750 (61)</td>
</tr>
<tr>
<td>Bifurcation lesion</td>
<td>13 (13)</td>
<td>377 (8)</td>
</tr>
<tr>
<td>Chronic occlusion</td>
<td>12 (12)</td>
<td>266 (6)</td>
</tr>
<tr>
<td>Primary success</td>
<td>113 (94)</td>
<td>3740 (90)</td>
</tr>
<tr>
<td>Direct stenting</td>
<td>36 (30)</td>
<td>1150 (25)</td>
</tr>
<tr>
<td>Number of stents per procedure</td>
<td>1.4 ± 0.7 (median = 1 II: 1–2)</td>
<td>1.4 ± 0.6 (median = 1 II: 1–2)</td>
</tr>
<tr>
<td>Drug eluting stent</td>
<td>115 (81)</td>
<td>2237 (49)</td>
</tr>
</tbody>
</table>

Data are mean ± standard deviation or absolute values (%).

and STEMI indications apart, the two groups were clinically similar; in terms of the defined enrolment criteria, geographic location and referring clinician were the sole reasons for choosing ambulatory versus classical hospitalization. Overall, approximately half of the stable coronary patients could be eligible for ambulatory PCI.

Immediate results and follow-up

A radial approach was adopted in 80% of cases, with two crossovers to a femoral approach due to radial puncture failure (2%). Crossover to overnight admission was necessary for 5.9% (n = 6) of the interventions (twice for clinical reasons and four times by the physician’s choice). Mortality was zero. There was no loss to 30-day follow-up, with direct patient contact in 74.5% of cases. There were four primary assessment criterion events (3.9% of interventions), none of which occurred between the 6th and 24th hours (Table 2).

Two patients had major cardiac complications within 30 days of discharge (2.9%). There were no acute or subacute stent thromboses.

Two hours after mid-left anterior descending stenting, one patient experienced typical retrosternal pain with ST-segment elevation on the ECG. Control coronary angiography disclosed occlusive dissection downstream of the stent, treated successfully by restenting. The patient was transferred to the intensive care unit for 24 hours and discharged after 48 hours.

During catheterization, one patient had a transitory ischaemic accident: right-eye upper lateral quadranspox, resolving spontaneously within 15 min.

Two patients had unscheduled medical consultations after discharge and had to be admitted to hospital: one for recurrence of angina 15 days after mid-left anterior descending stenting (control coronary angiography disclosed subocclusive dissection downstream of the stent, treated...
Same-day-discharge ad hoc PCI

Table 2 Post-PCI clinical events and onset intervals.

<table>
<thead>
<tr>
<th>Event</th>
<th>&lt; 6 hours</th>
<th>6–24 hours</th>
<th>1–3 days</th>
<th>3–30 days</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACE</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>Major bleeding</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Principal criterion</td>
<td>2 (2.0)</td>
<td>0</td>
<td>0</td>
<td>2 (2.0)</td>
<td>4 (3.9)</td>
</tr>
</tbody>
</table>

MACE, major adverse cardiovascular event; PCI, percutaneous coronary intervention.

Discussion

Given simple clinical selection, an intention-to-treat strategy of ad hoc same-day-discharge PCI with a preferentially radial approach is safe, with a low risk of crossover to classic management.

PCI and day care

Over the past few years, two studies have validated outpatient strategies in interventional cardiology [1,2]. The Early Discharge After Transradial Stenting of Coronary Arteries (EASY) study by Bertrand et al. randomized 1005 patients considered free of complications after radial-approach stenting to same-day discharge or overnight monitoring. In a moderate-to-high-risk population, the same-day-discharge strategy was shown to be without disadvantage compared with classical hospital care at 30 days, with zero mortality, 3.2% MACE and 4% readmission (p = 0.017) [1]. The Elective PCI in Outpatient Study (EPOS) by Heyde et al. randomized 800 patients undergoing elective PCI by the femoral route, with a similar protocol, and at 30 days reported zero mortality, 3.7% MACE and 4% readmission, similar to the classically managed control results (difference = −0.020, confidence interval −0.045, −0.004; p < 0.0001) [2].

In the present study, presentation characteristics were very similar, with 21% of patients being diabetic (16% for EASY and EPOS), one-third multivessel and 18% unstable angina or NSTEMI (66% for EASY but none for EPOS due to the design). Our same-day-discharge strategy, based on simple clinical criteria applicable in consultation ahead of coronary angiography and ad hoc PCI, differs from that of EPOS, which included only procedures guided by prior angiogram, and from that of EASY, where inclusion followed PCI. Even so, the success rate for our pragmatic strategy was similar (95% versus 93% for EPOS; seven of the eight failures were associated with chronic occlusion), and our complications rate was identical (3.9% at 30 days, versus 3.2% for EASY and 3.7% for EPOS) [1,2]. Interestingly, we had only 1.9% readmission, versus 4% for EASY and EPOS. Likewise our crossover rate to overnight admission was only 5.9%, versus 12.1% for EASY and 19% for EPOS, probably due to the use of abciximab in EASY and the femoral approach in EPOS.

Systematic overnight admission after PCI is based on ward procedure and the fear of MACE in the hours after intervention, requiring the on-site presence of an interventional cardiologist. In a retrospective study of more than 2000 radial-approach PCIs, Small et al. found all complications to occur either within the first 6 hours (3.4%) or after the 24th hour (1.9%), with none occurring in the monitoring period afforded by overnight admission (hours 6–24) [12]. Heyde et al. reported a single readmission in EPOS between hours 4 and 24, for femoral pseudoaneurysm [2]. In the present study, no clinical events occurred between hours 6 and 24, confirming that our strategy of discharge after six hours’ monitoring identified early post-PCI complication risks reliably.

Outpatient PCI and complex procedures

Progress in interventional cardiology enables 6F performance of almost all of the most complex procedures, such as rotational atherectomy or bifurcation lesion treatment (13% for EPOS and 15% for the present series) [2], so that a truly non-selected population can be managed using a radial approach. Moreover, real-time use of complementary diagnostic techniques such as intravascular ultrasound or fractional flow reserve (26% in the present series) refines diagnosis and interventional strategy, allows an ad hoc procedure to be maintained and may optimize the functional and clinical result of revascularization [13,14].

Outpatient PCI and patient’s perception

Quality of life for an equal quality of care is a constant concern. Cooper et al. randomized 200 radial and femoral PCI patients [15]. At both one day and one week postintervention, the radial approach was associated with significantly better patient perception of physical function, pain, body function and general mental health. Moreover, 80% of patients with experience of both radial and femoral intervention prefer the radial approach (p < 0.0001). Heyde et al. used a 0–100 analogue scale in EPOS to show that day-care procedures added 5.0 satisfaction points compared successfully by restenting); the other (who had had a right radial approach) for a slight internal left frontal stroke, four days after intervention, confirmed by magnetic resonance imaging and with moderate sequelae.

Minor puncture-point bleeding was observed in five interventions (4.9%), two femoral and three radial. There were no symptomatic radial thromboses.

On a 1–10 analogue scale, patient satisfaction was observed at 8.9 ± 0.7/10 (median = 9), an indicator of good satisfaction; anxiety associated with same-day discharge was 1.7 ± 1.2/10 (median = 1), an indicator of a low anxiety level.

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with classical admission (78.6 versus 73.6; \( p = 0.001 \)) [2]. The present series showed similar satisfaction, with a median of 9.0/10 on a comparable analogue scale; same-day discharge anxiety, moreover, was minimal (median = 1.0/10). Early discharge, indeed, seemed to make the patients more responsible: retrospective interviewing found them all to be aware of the importance of compliance with the antiplatelet bitherapy and of the advised procedure in case of subjective problems or complications after PCI. The quality of the care and information provided by the team as a whole were mentioned often.

In case of future repeat PCI, the EPOS study found that 73% of the same-day-discharge group would again choose the same-day-discharge strategy (versus 16% for classical admission), and that 32% of the classical admission group would opt for same-day discharge (versus 55% for overnight admission) [2].

**Study limitations**

We here report a pilot study in a high-volume centre; our selection criteria for same-day discharge were purely clinical but our results are to be extrapolated with caution. Also, the satisfaction and anxiety survey was conducted by telephone rather than anonymously, which could bias the results. No specific cost-effectiveness study was done, but same-day-discharge strategies optimize the use of classical hospital beds and, depending on the healthcare system, save $249 in the USA [15] and €258 in the Netherlands [2], given that overnight hospital costs and intervention costs are virtually identical regardless of the type of admission.

**Conclusion**

Same-day-discharge ad hoc PCI proved reliable and safe for a large population selected a priori on simple clinical criteria, entailing no unexpected complications associated with shorter medical monitoring. Larger-scale studies are required before the general use of this strategy, which is favoured by the patients.

**Conflicts of interest**

None.

**References**