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Clinical outcomes of patients undergoing elective percutaneous coronary intervention with same-day discharge. Ten-year follow-up

Desfechos clínicos de pacientes submetidos à intervenção
coronária percutânea eletiva com alta hospitalar no mesmo
dia. Evolução em 10 anos

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ABSTRACT – Background: Same-day discharge for percutaneous coronary interventions is an attractive and safe strategy. Observational and randomized data show equivalent results as compared to overnight observation. In addition, it ensues great savings for the healthcare system. Nevertheless, in Brazil, this approach is underused. The objective of this study was to describe the characteristics and outcomes of patients undergoing percutaneous coronary intervention with same-day discharge. **Methods:** A single-center study with patients who underwent selected procedures, uneventful, discharged on the same day. Clinical and angiographic characteristics were described. Major cardiovascular events and complications were analyzed, reported, and compared to a historical cohort. **Results:** A total of 413 patients were included, mean age of 64±10 years. After a 30-day follow-up, no major cardiovascular event was observed in selected patients submitted to the same-day discharge strategy. In addition, we found an increase in clinical and angiographic complexity as compared to the previous series, which did not translate to rise in adverse outcomes. **Conclusion:** Uncomplicated percutaneous coronary interventions, with same-day discharge, are safe among appropriately selected patients, encouraging further adoption of this approach.

Keywords: Patient discharge; Percutaneous coronary intervention; Ambulatory care; Treatment outcome

RESUMO – Introdução: A alta no mesmo dia para intervenções coronárias percutâneas é uma estratégia atraente e segura. Dados observacionais e randomizados mostram resultados equivalentes em comparação com a observação durante a noite. Além disso, ela proporciona grande economia para o sistema de saúde. No entanto, no Brasil, essa abordagem é subutilizada. O objetivo deste estudo foi descrever as características e os desfechos de pacientes submetidos à intervenção coronária percutânea com alta no mesmo dia. **Métodos:** Estudo realizado em um centro com pacientes submetidos a procedimentos selecionados, sem complicações, que tiveram alta no mesmo dia. Foram descritas características clínicas e angiográficas. Os principais eventos e complicações cardiovasculares foram analisados, relatados e comparados com uma coorte histórica. **Resultados:** Foram incluídos 413 pacientes, com média de idade de 64±10 anos. Após 30 dias de seguimento, nenhum evento cardiovascular maior ocorreu em pacientes selecionados submetidos à estratégia de alta no mesmo dia. Além disso, houve aumento da complexidade clínica e angiográfica em comparação com casuística anterior, que não se traduziu em aumento dos resultados adversos. **Conclusão:** Intervenções coronárias percutâneas, isentas de complicações, com alta no mesmo dia, são seguras entre pacientes adequadamente selecionados, incentivando a adoção mais ampla dessa abordagem.

Descritores: Alta do paciente; Intervenção coronária percutânea; Assistência ambulatorial; Resultado do tratamento

INTRODUCTION

Percutaneous coronary intervention (PCI) is currently one of the most frequent invasive cardiology procedures conducted in the world. In Brazil, it is estimated that

more than 120 thousand PCIs were performed in 2019,¹ generating a great demand for hospital beds and financial resources, which sometimes are limiting factors for these procedures.

One-night hospital stay after PCI is the standard procedure to monitor post-procedural complications, such as major bleeding, complications at the entry site and ischemic coronary events.² Developments in interventional cardiology in recent years, especially with the optimal stent deployment, dual antiplatelet therapy, material with smaller profile, and the use of the radial access have led to consistent good results and reduction in these acute complications. According to the National Cardiovascular Data Registry (NCDR) CathPCI Registry, elective PCIs in patients with chronic coronary artery disease have a high success rate (99.2%) and low complication rate (0.17% need for emergency surgery and 0.65% in-hospital mortality).² When present, these complications appear within the first 6 hours or 24 to 48 hours after the procedure, therefore it is possible to challenge the need for a routine overnight stay to monitor complications.^{2,3}

Same-day discharge after elective PCIs has therefore been gaining ground globally, combining safety, efficacy, cost reduction and better patient satisfaction. Despite representing the practice in about 57% of procedures in the United Kingdom, 32% in Canada and 14% in the United States,⁴ in Brazil it is still little used.

The objectives of this study were to describe the clinical and angiographic characteristics of patients who underwent elective PCI with same-day discharge; assess of major adverse cardiac events, in-stent thrombosis, re-admission, and vascular complications at 30 days, as well as to demonstrate progression in the daily practice of PCI with same-day discharge, over a 10-year period.

METHODS

Study population

In this study, we included all PCI patients who were discharged on the same day of the procedure between March 2012 and March 2020, from the Cath Lab and Interventional Cardiology Service of *Hospital Austa*, in the city of São José do Rio Preto (SP). The Consent Form was previously signed by the patient, after the study had been approved by the Ethics Committee (protocol 4.724.041, CAAE 47009221.6.0000.5489).

All elective PCI patients were candidates for discharge on the same day. The patients were evaluated by the interventional cardiologist, who used the following inclusion criteria: patients with stable angina, *crescendo* angina or asymptomatic, with a positive test for ischemia; absence of significant decompensated comorbidities; absence of periprocedural complications; absence of prolonged chest pain or post-PCI electrocardiographic alterations; absence of vascular complications; PCI conducted before the 13th

hour of the day, and the patient living within 30 km away from the catheterization laboratory (cath lab) and having company overnight.

Procedures

A loading dose of 300mg clopidogrel was the antiplatelet drug used, followed by 75mg daily, for at least 30 days, for bare metal stents, and 6 to 12 months for drug-eluting stents. In addition, patients were prescribed aspirin (100mg daily) indefinitely.

The preferred access was radial, with the femoral or brachial (puncture) arteries as alternative in case of radial failure. After obtaining vascular access (5F or 6F) and introducing the catheter, 70UI/kg to 100UI/kg of unfractionated heparin was administered. Glycoprotein IIb/IIIa inhibitors were not used.

Stent implantation followed the usual technique: predilation, when necessary, should be conducted with short balloons at low pressure; the stent was deployed at high pressure, ensuring full coverage of the lesion, more than one stent could be used, if necessary, with overlapping edges. Post-dilation, if indicated, should be conducted with non-compliant balloons, shorter than the stent, not going beyond its borders, avoiding injury to adjacent segments not covered by the stent.

After PCI, the introducers were immediately removed. For the femoral or brachial approaches, manual compression was carried out for 15 to 30 minutes, followed by a compressive dressing and limb rest for at least 4 hours. In the case of the radial approach, a compressive dressing was applied or a selective wristband (TR Band, Terumo Medical Co., Tokyo, Japan) was used, with the indication of keeping the limb at rest for 2 hours.

Post-procedural follow-up was by electrocardiogram (compared to the pre-PCI electrocardiogram), vital signs and physical examination of the entry point. Markers for myocardial necrosis were not routinely measured. Patients who remained asymptomatic, with no changes in the electrocardiogram and no abnormalities at the puncture site, were discharged, being instructed on the medication, possible complications and return to the cardiologist within 7 days. In the event of any sign or symptom related to the procedure, they were instructed to seek the emergency cardiology service of Hospital Austa, which is available 24 hours a day.

Data collection and analysis

Data were collected by trained physicians and nurses, who filled in previously standardized forms. Data collection included clinical characteristics, laboratory test results, data from the invasive procedure, and characteristics and clinical outcome until hospital discharge. Information on late outcome was obtained through outpatient follow-up at the study center, review of hospital records or telephone contact. Qualitative morphological characteristics were assessed using standardized criteria.

Definitions

Major adverse cardiac events encompassed death, myocardial infarction (MI), target vessel revascularization, and stroke. Deaths included cardiac-related and non-cardiac causes. MI was defined as chest pain and persistent ST-segment elevation >1 mm in two contiguous leads, or new left bundle-branch block on electrocardiogram. Target lesion revascularization was defined as a new intervention, surgical or percutaneous, in lesions with >50% obstruction inside the implanted stent, or in the segment that included the 5 mm proximal or the 5mm distal to the stent. In-stent thrombosis was defined according to the Academic Research Consortium classification, as to the degree of certainty: definitive (angiographic or pathological confirmation), probable (sudden death <30 days after stent implantation, or infarction related to the region of the treated artery, with no angiographic confirmation), and possible (sudden death >30 days after stent implantation). As for the temporal occurrence, thromboses were classified into acute (zero to 24 hours) and subacute (24 hours to 30 days). Angiographic success was defined as a reduction of the target lesion <30%, with maintenance or restoration of normal anterograde flow (Thrombolysis in Myocardial Infarction – TIMI 3).^{5,6}

Periprocedural complications included prolonged chest pain, transient vessel occlusion, no reflow or slow flow, prolonged hemodynamic instability, prolonged cardiac arrhythmia, occlusion of a major lateral branch (>1.5mm), and suboptimal angiographic result. Lesions were classified according to the American College of Cardiology/American Heart Association (ACC/AHA), as types A, B1, B2 and C. Vascular complications included major bleeding according to TIMI classification (intracranial hemorrhage or decrease in hemoglobin >5mg/dL or 15% in hematocrit), hematoma at the puncture site >5cm, pseudoaneurysm, leaks or thrombosis requiring surgical intervention.

Statistical analysis

The data were inserted and analyzed on Excel program (Microsoft Corp., Redmond, United States). The categorical variables were described as frequencies and percentages, and the continuous variables as means and standard deviation.

RESULTS

Between March 2012 and March 2020, a total of 1,506 PCIs were conducted in our service; in that, 784 were elective procedures, of which 413 were discharged on the same day (27.5% of total PCIs and 52.5% of elective PCIs). The mean age was 64.0±10.4 years, 76% male and 42% diabetic patients. The clinical presentation included stable angina, *crescendo* angina with no rise of biomarker levels, or asymptomatic patients with a positive test for ischemia (Table 1).

As depicted in table 2, the left anterior descending artery was the territory most frequently addressed (48%), with predominance of type A and B1 lesions (54%), but with 46% of type B2 and C lesions. In most cases the radial access was used (87.6%), and 6F introducers (84%). The mean number of stents per patient was 1.48±0.58, most of them drug-eluting stents. The angiographic success rate was 98.8%. Bifurcation lesions occurred in 15% of procedures, and 3% were done on saphenous vein grafts. The observation time of patients was 6.2±1.1 hours. After 30-day follow-up, there were no major adverse cardiac events, in-stent thrombosis, readmission or vascular complications.

Table 1. Baseline characteristics

Variable	
Age, years	64,0±10.4
Male sex	76.0
Diabetes mellitus	42.0
Hypertension	84.5
Dyslipidemia	65.0
Previous PCI	29.0

Results expressed in mean and standard deviation or %.

PCI: Percutaneous coronary intervention.

Table 2. Angiographic and procedural characteristics

Variable	
Culprit artery	
LAD	48.3
LCx	25.4
RCA	21.6
SVG	3.1
LMA	1.2
ACC/AHA lesion types	
A/B1	54.0
B2/C	46.0
Bifurcation lesion	15.2
Stent/patient	1.48±0.58
Approach	
Radial	87.6
Femoral	7.28
Brachial	4.61
Introducer	
5F	15.0
6F	84.0
Drug-eluting stents	74.7
Procedural success rate	98.8

Results expressed in % or mean and standard deviation.

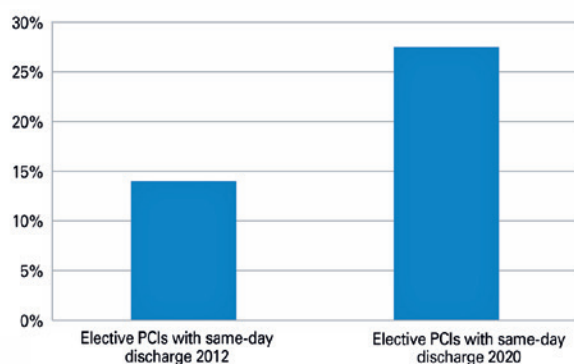
LAD: left anterior descending artery; LCx: left circumflex artery; RCA: right coronary artery; SVG: saphenous vein graft; LMA: left main coronary artery; ACC/AHA: American College of Cardiology/American Heart Association.

DISCUSSION

The constant technical advances in Interventional Cardiology have led to better clinical outcomes and, at the same time, assured excellent level of safety. There is therefore an opportunity for post-procedure care that prescinds of prolonged hospitalization, enabling same-day hospital discharge, without increasing risk of adverse events.⁷ Evidence accumulated in recent years does not show significant differences in safety between same-day discharge or discharge on the following day, the latter being possibly associated with increased risk of in-hospital adverse events, such as infection and falls.⁸ In addition, the most frequent complications occur within 6 hours or 24 hours after PCI, which corroborates the non-requirement for in-hospital monitoring during the post-procedure night.^{2,3}

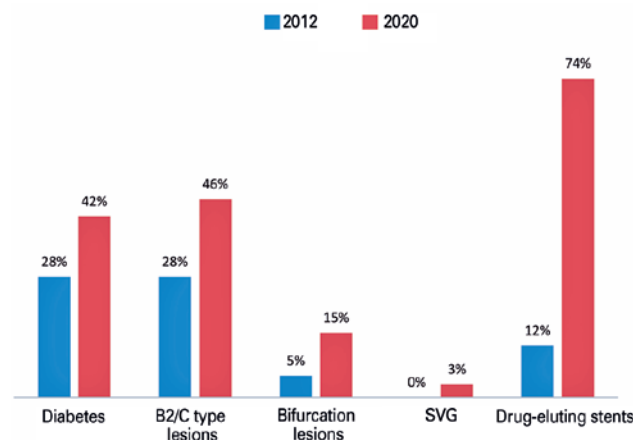
Our outpatient PCI program in elective procedures began more than 10 years ago. When comparing the beginning of the program in 2009, as demonstrated by Trindade et al.,⁹ with the present time, we noticed an increase in cases of same-day discharge. In 2012, elective PCIs with same-day discharge represented 14% of all cases, increasing to 27.5% in 2020 (Figure 1). Even with the increased anatomical and clinical complexity of PCIs in current practice (chronic coronary occlusion, left main coronary artery obstruction, multivessel disease), hospital discharge on the same day remains a feasible and safe strategy in most scenarios.^{10,11}

In our series, we noticed an increase in complexity of cases, demonstrated by an higher percentage of diabetic patients (28% versus 42%), greater number of bifurcation lesions (5% versus 15%), greater use of drug-eluting stents, and an increase in type B2 and C lesions (28% versus 46%), as shown in figure 2. These changes were not associated with an increase in adverse events. This group of patients discharged on the same day remained with no major adverse cardiac events, in-stent thrombosis, readmission, or vascular complications within 30 days during the 10-year period.



PCI: percutaneous coronary intervention.

Figure 1. Elective percutaneous coronary interventions in 2012 versus 2020.



SVG: saphenous vein graft.

Figure 2. Clinical and angiographic characteristics of elective percutaneous coronary interventions with same day discharge in a 10-year follow-up.

From the patient's perspective, there is clear satisfaction with same-day discharge in uncomplicated coronary procedures.¹² As to the organization, same-day hospital discharge provides better allocation of resources for other patients who require hospitalization. In addition, it is closely related to cost reduction, reaching more than \$2,000.00 of savings per PCI, enabling better efficiency of the health system, be it public or private.¹³

In the Brazilian scenario, data are still scarce, limited to observational analyses. However, the consonance with international results is sustained.^{2,14} The data demonstrated same-day hospital discharge to be a safe strategy, especially if associated with some factors, such as the use of radial access, less complex anatomies, and the use of smaller volumes of contrast media.¹⁴ Given the limited resources and availability of beds, especially in the Brazilian public health system, this strategy can provide significant savings and optimization of the use of supplies and beds for other diseases that require hospitalization.

The coronavirus disease 2019 (COVID-19) pandemic prompted solutions to optimize hospital stay, especially in high-risk patients. In this scenario, the interest to expand same-day hospital discharge beyond PCIs emerged, migrating it to structural interventions, such as transcatheter aortic valve replacement. Observational data show this strategy is safe in cases with a minimalist and uncomplicated approach.^{15,16} Indirectly, these data reinforce the results of our analysis, since valve replacement is a more complex procedure from a technical and clinical standpoint, and even in the face of increased complexity, such a strategy proved to be safe.

Important limitations should be noted in the data available so far. Any evidence to date comes either from large observational studies or from small, randomized studies,

therefore some uncertainty remains. Likewise, our results are of only one center and are observational, with all the inherent limitations. It should be emphasized the need to establish specific organizational protocols for the implementation of same-day hospital discharge with due safety. Such protocols range from the creation of a pre-procedure checklist for selecting eligible cases and detection of peri- or post-procedure complications, to adequate patient education upon discharge.

Given the need for updating, especially concerning patient selection and training regarding the structuring for the application of protocols, associated with recently accumulated experiences and evidence, the ACC has organized a consensus of specialists for recommendations for same-day hospital discharge.¹⁷ This document provides relevant information, aligned with contemporary practices, guiding strategies to implement safe and effective same-day discharge. Therefore, with the data presented, aligned with the existing literature and the increasingly imminent need to optimize cost-effectiveness, the strategy of same-day hospital discharge should be encouraged in the appropriately selected cases, providing safe and sustainable results, both for patients and others engaged in their management.

CONCLUSION

After 10 years of launching the outpatient percutaneous coronary intervention program, we noticed an increase in number and complexity of cases, but not hindering procedure safety and efficacy. Same-day hospital discharge, following a short period of observation, is a feasible strategy for patients undergoing percutaneous elective coronary interventions with no complications, providing greater patient satisfaction, in addition to reducing hospital costs.

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None.

DECLARATION OF CONFLICTS OF INTEREST

The authors declare having no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: AHP and LAG; data collection: LFT, AO, DGS, APV, CBG and PF; data interpretation: MAS and AHP; text writing: EL and AHP; approval of the final version to be published: AHP.

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