Rev Port Cardiol. 2016;35(12):673–678

Revista Portuguesa de Cardiologia
Portuguese Journal of Cardiology
www.revportcardiol.org

ORIGINAL ARTICLE

Bailout intravenous esmolol for heart rate control in cardiac computed tomography angiography

Sílvia Aguiar Rosa[a,*], Ruben Ramos[a], Hugo Marques[b], Rosana Santos[b], Cecília Leal[b], Helena Casado[b], Márcia Saraiva[b], Luísa Figueiredo[b], Rui Cruz Ferreira[a]

[a] *Cardiology Department, Santa Marta Hospital, Lisbon, Portugal*
[b] *Radiology Department, Santa Marta Hospital, Lisbon, Portugal*

Received 9 February 2016; accepted 8 July 2016
Available online 17 November 2016

KEYWORDS
Coronary computed tomography angiography;
Esmolol;
Heart rate control

Abstract
Objective: To evaluate the efficacy and safety of a heart rate (HR) reduction protocol using intravenous esmolol as bailout for failed oral metoprolol regimens in patients undergoing coronary computed tomography angiography (CCTA) with 64-slice multidetector computed tomography (64-MDCT).
Methods: Patients who underwent cardiac 64-MDCT in a single institution between 2011 and 2014 were analyzed. Those with HR above 60 beats per minute (bpm) on presentation received oral metoprolol (50-200 mg) at least one hour before CCTA. Intravenous esmolol 1-2 mg/kg was administered as a bolus whenever HR remained over 65 bpm just before imaging. The primary efficacy endpoint was HR <65 bpm during CCTA. The primary safety endpoint was symptomatic hypotension or bradycardia up to hospital discharge.
Results: During the study period CCTA was performed in 947 cases. In 86% of these, oral metoprolol was the only medication required to successfully reduce HR <60 bpm. Esmolol was used in the remaining 130 patients (14%). For esmolol-treated patients mean baseline and acquisition HR were 74±14 bpm and 63±9 bpm, respectively (p<0.001). The target HR of <65 bpm was achieved in 82 of the 130 esmolol-treated patients (63%). Considering the whole population, esmolol use led to a significant increase in the primary efficacy endpoint from 86% to 95% (p<0.001). Esmolol also resulted in a statistically, but not clinically, significant reduction in systolic blood pressure (144±22 to 115±17 mmHg; p<0.001). The combined primary safety endpoint was only observed in two (1.5%) patients.
Conclusion: Despite optimal use of oral beta-blockers, 14% of patients needed intravenous esmolol for HR control. The pre-medication combination of oral metoprolol and on-demand administration of intravenous esmolol was safe and effective and enabled 95% of patients to be imaged with HR below 65 bpm.

* Corresponding author.
E-mail address: silviaguiarosa@gmail.com (S. Aguiar Rosa).

http://dx.doi.org/10.1016/j.repc.2016.07.004

PALAVRAS-CHAVE
Angiografia coronária por tomografia computorizada;
Esmolol;
Controlo de frequência cardíaca

Esmolol endovenoso em regime *bail out* para controlo de frequência cardíaca na tomografia computorizada cardíaca

Resumo
Objetivo: Avaliar a eficácia e segurança de um protocolo de redução de frequência cardíaca (FC) utilizando esmolol endovenoso após falência de metoprolol oral, em doentes submetidos a angiografia coronária por tomografia computorizada (CCTA) de 64 cortes.
Métodos: De 2011 a 2014 foram avaliados os indivíduos submetidos a CCTA num único centro. Os indivíduos com FC >60 bpm à admissão receberam 50-200 mg de metoprolol oral pelo menos uma hora antes da CCTA. Esmolol endovenoso em bólus (1-2 mg/kg) foi administrado se FC >65 bpm imediatamente antes da aquisição de imagem. O *endpoint* primário de eficácia foi FC <65 bpm durante a aquisição de imagem com contraste. O *endpoint* primário de segurança foi hipotensão ou bradicardia sintomática durante a permanência no hospital.
Resultados: Foram efetuadas 947 CCTA durante o período de estudo. Em 86% dos casos, metoprolol oral foi o único fármaco utilizado. Foi necessária a administração de esmolol em 130 (14%) doentes. Nos doentes que receberam esmolol, a FC basal reduziu em média de 74±14 bpm para 63±9 bpm (p<0,001). O objetivo primário de FC <65 bpm foi alcançado em 82 desses 130 doentes (63%). Considerando toda a população, o recurso a esmolol permitiu um aumento significativo da proporção de CCTA realizados com FC <65 bpm (86% para 95% [p<0,001]). A administração de esmolol esteve associada a redução estatisticamente, mas não clinicamente, significativa da pressão arterial sistólica (144±22 para 115±17 mmHg; p<0,001). O *endpoint* combinado de segurança foi observado em dois (1,5%) dos doentes.
Conclusão: Apesar da utilização sistemática de betabloqueante oral, 14% dos casos necessitaram de esmolol endovenoso para controlo adequado de FC. Pré-medicação combinada de metoprolol oral e esmolol endovenoso quando necessária foi segura e eficaz, e permitiu que 95% dos doentes apresentassem FC <65 bpm no momento da aquisição de imagem.

Introduction

Adequate heart rate (HR) control is paramount for optimal cardiac imaging using single-source 64-slice multidetector computed tomography (64-MSDT).[1–5] For these scanners, HR during image acquisition should be below 65 beats per minute (bpm) and preferably lower than 60 bpm for optimal image quality.[6] However, commonly used pre-medication regimens with oral or intravenous metoprolol are frequently unsatisfactory.[7–9] Side effects, including hypotension and bradycardia, are also points of concern.

Intravenous esmolol, due to its rapid onset and short half-life, has been reported as a valuable option for adequate HR control, either alone or in combination with oral beta-blockers.[10–12]

The aim of the present study is to evaluate the efficacy and safety of an HR reduction protocol using intravenous esmolol as bailout for failed oral metoprolol regimens in patients undergoing coronary computed tomography (CT) angiography (CCTA).

Methods

Study population

Patients undergoing CCTA in a tertiary academic medical center between August 2011 and June 2014 were analyzed. Those presenting in sinus rhythm and without contraindications for beta-blockers were included. All patients had indication for coronary anatomy assessment. Nineteen patients also had associated secondary indications: percutaneous aortic valve implantation (two), paroxysmal atrial fibrillation ablation (sinus rhythm during CCTA) (three), assessment of left ventricular morphology (two), evaluation of valve heart disease (three) or ascending aorta (two), and morphological studies for congenital heart disease (seven).

Patient preparation

Oral metoprolol was not used for patients presenting with HR <60 bpm, who proceeded directly to the CT table. Individuals with baseline HR of 60-65 bpm or >65 bpm received 50 mg or 100 mg oral metoprolol, respectively. An additional dose of 100 mg metoprolol was administered one hour later if HR was still above 65 bpm. After repeated oral metoprolol administration another 60 min interval was allowed. Patients were then moved to the CT table. After sublingual nitrate administration and just after scouting or calcium score image acquisition (Figure 1), an intravenous (IV) bolus of esmolol 1 or 2 mg/kg was administered if HR was >65 bpm or >70 bpm, respectively. A second bolus of esmolol was administered 1 min later if HR remained above 65 bpm using the same dosage.