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CLINICAL RESEARCH

Predictive factors of contrast-induced nephropathy in patients undergoing primary coronary angioplasty



Facteurs prédictifs de néphropathie de contraste chez les patients traités par angioplastie primaire

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KEYWORDS

Contrast agent;
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Risk assessment

Summary

Background. – Contrast-induced nephropathy (CIN) severely impacts patient morbidity and mortality, especially in patients with ST-segment elevation myocardial infarction treated by primary coronary angioplasty, whose renal function is often unknown at the time of contrast exposure.

Aim. – We sought the incidence and factors predictive of CIN in patients treated by primary coronary angioplasty in our hospital; we also questioned the relevance of Mehran's risk score in this population.

Methods. – We considered all patients admitted for primary coronary angioplasty between January 2010 and December 2011, and included 322 patients with complete data on renal function. CIN was defined as a relative ($\geq 25\%$) or absolute ($\geq 44 \mu\text{mol/L}$) increase in serum creatinine following contrast medium administration. We compared patients with or without CIN, to identify predictive factors, and investigated the effectiveness of Mehran's score using a receiver operating characteristic (ROC) curve, Youden's index and a likelihood ratio test.

Abbreviations: CI, confidence interval; CIN, contrast-induced nephropathy; GFR, glomerular filtration rate; IABP, intra-aortic balloon pump; MDRD, modification of diet in renal disease; STEMI, ST-segment elevation myocardial infarction.

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MOTS CLÉS

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Infarctus du myocarde ;
Évaluation du niveau de risque

Results. — The incidence of CIN was 9.1%. A multivariable analysis identified two independent risk factors for CIN: impaired glomerular filtration rate and cardiogenic shock at admission ($P < 0.05$). An elevated Mehran's score was associated with increased incidence of CIN, but statistical analysis revealed this score to have poor sensitivity, especially in high-risk patients. Youden's index was very low and the area under the ROC curve was 0.59 in our population.

Conclusion. — Renal failure and cardiogenic shock at admission were independent predictors of CIN in our acute myocardial infarction population. Mehran's score added little to the discrimination of patients undergoing primary coronary angioplasty, particularly high-risk individuals.
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Résumé

Contexte. — La néphropathie de contraste impacte le pronostic des patients admis pour infarctus du myocarde avec sus-décalage du segment ST traités par angioplastie primaire, pour qui la fonction rénale est généralement inconnue lors de la prise en charge.

Objectif. — Nous nous sommes intéressés à l'incidence de la néphropathie de contraste chez les patients admis dans notre centre pour angioplastie primaire et avons cherché à déterminer l'applicabilité du score de risque de Mehran dans ce contexte.

Méthodes. — Nous avons inclus 322 patients entre janvier 2010 et décembre 2011. La néphropathie de contraste était définie comme une élévation relative ($\geq 25\%$) ou absolue ($\geq 44 \mu\text{mol/L}$) de la créatininémie au décours de l'injection de produit de contraste. Nous avons évalué la pertinence du score de Mehran en comparant patients avec ou sans néphropathie de contraste en utilisant des rapports de vraisemblance, index de Youden ou courbe ROC.

Résultats. — L'incidence de la néphropathie de contraste était 9,1%. En analyse multivariée, seuls l'insuffisance rénale préexistante et le choc cardiogénique à l'admission étaient prédictifs de néphropathie de contraste ($p < 0,05$). Un score de Mehran élevé s'accompagnait d'une augmentation d'incidence de néphropathie de contraste mais la sensibilité de ce test restait faible, en faisant un outil peu utile comme en témoignaient les index de Youden bas et l'aire sous la courbe ROC à 0,59.

Conclusion. — Insuffisance rénale et choc cardiogénique apparaissent comme les seuls prédicteurs de néphropathie de contraste chez les patients admis pour infarctus du myocarde. L'utilité du score de Mehran n'apparaît pas démontrée dans cette population.

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Background

Contrast-induced nephropathy (CIN) refers to potentially reversible acute renal failure following iodinated contrast medium exposure during angiographical procedures or computed tomography [1,2]. CIN generally occurs within 48 hours of contrast exposure, the increase in serum creatinine peaking 5–7 days later and usually recovering within 7–10 days [3–5], with the majority of patients returning to their baseline values. Clinical and metabolic disorders requiring renal replacement therapy occur in approximately 3% of patients [6,7]. The risk of CIN is even higher in patients referred for primary coronary angioplasty in the context of acute coronary syndromes [8–10]. CIN is responsible for an increased mortality rate of 14% and, for most patients, correlates with increases in hospital stays and the risk of cardiovascular complications [11].

Significant progress regarding contrast media composition, notably the decrease in osmolality [12] and the constant use of intravenous hydration in high-risk patients, have resulted in a reduction in the incidence of CIN from 15% to nearly 7% over a decade [13]. However, because of the increasing number of procedures with iodinated contrast media exposure and population aging, resulting in an

increased prevalence of chronic kidney failure, CIN and its impact on morbidity and mortality remains a growing concern.

While it seems that intra-arterial administration of contrast medium is associated with a higher risk of CIN than intravenous infusion [14–16], primary coronary angioplasty appears to be a particularly high-risk procedure, as it affects a population at greater risk of CIN (i.e. older patients with co-morbidities, such as diabetes, heart failure and chronic renal failure) [17]. Primary coronary angioplasty has been shown to be effective in reducing morbimortality in patients admitted for acute myocardial infarction, and is the cornerstone of first-line therapy in these patients. The main pitfall is that renal function is often unknown at the time of contrast exposure because primary coronary angioplasty has to be performed without delay, leaving no time for renal function assessment. Moreover, the short delay between patient admission and primary coronary angioplasty significantly limits the use of pedigree renal protection measures, such as intravenous hydration (at least prior to the procedure).

Several risk scores have been developed in accordance with the main risk factors identified for CIN, but none has been adequately validated in the literature [6,13,18–21];

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