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Original Article

The spectrum of risk factors for contrast induced nephropathy in patients undergoing coronary angiography or intervention



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ABSTRACT

Introduction: Contrast induced nephropathy is an unfavorable acute event which can complicate the clinical course of patients undergoing coronary angiography. Clinical characteristics predisposing to its occurrence are still rather obscure.

Methods: We enrolled 591 patients (mean age 64.2 ± 10.98 ; 449 male and 142 female) who underwent emergency or elective Coronary angiography/Angioplasty in our Cardiology Division between 10/2006 and 06/2008, paying attention to their Cardiovascular risk factors, dose and type of contrast medium, type and number of affected coronary arteries, pharmacological therapies, baseline renal function and extracoronary atherosclerosis. We performed a univariate and multivariate analysis to compare these factors, analyzing them by χ^2 or Fisher test and T Student test.

Results: 105 patients developed contrast induced nephropathy (increase in creatinine level $\geq 25\%$ of baseline, decrease of GFR of $>10\%$): affected patients were the oldest of the sample and, in most case, they were affected by diabetes mellitus, hypertension, or under diuretic therapy, in acute cardiocirculatory failure, treated with higher contrast doses, affected by more marked extracoronary atherosclerosis and previous renal insufficiency and with higher inflammation indexes (CRP, fibrinogen, ESS).

Conclusions: Different Contrast induced nephropathy risk factors can be taken into account to identify high risk patient before performing contrast techniques: they include both patient and procedural factors, and particularly general inflammation and atherosclerosis.

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1. Introduction

Contrast induced nephropathy (CIN) is an unfavorable event which can complicate the clinical course of patients who undergo coronary angiography.¹ It is commonly defined as an acute deterioration of the renal function characterized by a significant increase in creatinine serum levels, usually more than 0.5 mg/dl (44 mol/L) or than 25% of baseline levels, within 24–48 h since contrast administration, in the absence of any alternative etiology^{1,2} and a decrease in eGR of at least 10%. Its resolution needs 1 week in average, but in some patients can evolve to renal failure.³

CIN can be also described as an aspect of the intersection between renal dysfunction and cardiovascular disease, which has been widely proved till now: actually, many studies confirm that a baseline impaired renal function would be an important factor able to suggest a higher risk of acute coronary syndromes and heart failure. Moreover, cardiovascular diseases seem to predispose to a progressive deterioration of the kidney function.^{4–12} That's why the heart and the kidney can be imagined as two variables of the same system.

Some of the trials published so far in the literature suggest that atherosclerosis may be an actual link between these two nosological entities^{10,13} and, according to the latest evidences regarding the role of inflammation in atherosclerotic initiation and progression,^{14–19} the existence of a direct link even between systemic inflammation and renal damage might be hypothesized.

Clinical characteristics predisposing to CIN occurrence are still rather obscure, since etiology and pathophysiology of this clinical condition are the same object of speculation.

The aim of our study has been to make a picture of patients at highest risk of developing CIN after undergoing coronary angiography and percutaneous coronary intervention (PCI), identifying all peculiar baseline characteristics distinguishing them from patients who do not show any deterioration of renal function after the same cardiologic contrast procedures, in order to take appropriate prevention measures.

2. Material and methods

2.1. Patient population

In our clinical experience we studied a population 600 patients treated with coronary angiography and, if necessary, elective or emergency percutaneous angioplasty.

Patients who accepted to participate to our study were enrolled from 10/2006 to 06/2008 and evaluated for an average period of 22 months.

Creatinine serum level and estimated GFR using MDRD was measured at admission in every patient to evaluate how renal function would have changed after coronary angiography.

All individuals at admission in hospital underwent an accurate anamnesis, objective exam and hematochemical measurements.

A further exam was made to evaluate pharmacological therapies that patients underwent during stay in hospital if potentially able to influence their renal function.

The following parameters were considered to be important for our study: number of sick coronary arteries (with or without the involvement of common trunk), number of treated vessels with angioplasty and number of stents, type and mean doses of contrast medium used to make coronary vessels opaque.

All patients before and after coronary angiography received continuous IV hydration (with NaCl 0.9%) for at least 48 h.

2.2. Follow up

All enrolled patients were closely monitored during their stay in hospital assessing their creatinine serum peak and their eGFR 3–4 days after contrast procedure: if subjects were discharged earlier, they were invited to undergo a blood sample privately and to transmit us their results.

So, patient sample was divided up into 2 groups according to percentage variation of serum creatinine between the pre and the post-procedural phase: those who showed an increase in creatinine level equal or more than 25%, according to the most common definition, were assigned to the “CIN-group” (114 subjects), while the other 486 subsequently fell into the “non-CIN group”.

2.3. Statistical analysis

Statistical analysis of data was performed by the statistical package “NCSS”, evaluating the categorical variables by χ^2 test or Fisher's test, when appropriate, and expressing the continuous ones as average values \pm standard deviations compared by pair wise t test (two codes). We performed a univariate and multivariate analysis to assess the role played by each potential risk factor in predisposing to CIN. Values ≤ 0.05 were considered as statistically significant (confidence interval 95%).

3. Results

Regarding risk factors of cardiovascular disease, the presence of diabetes mellitus showed to be in actual and strong correlation with the risk of CIN onset ($p = 0.03$); a significant difference of baseline systolic arterial pressure at the admittance in hospital was found between the two samples (130.57 \pm 20.71 mmHg in the non-CIN group versus 137.35 \pm 26.44 in the CIN one; $p = 0.02$).

Among therapies administered during stay in hospital other important differences were proved: in particular, patients who underwent therapy with diuretics resulted significantly more numerous among the CIN group than the control group ($p = 0.02$).

As regards cardiology procedures, in subjects who developed CIN a higher dose of contrast medium was administered in average (136.9 \pm 101.7 cc versus 115.1 \pm 83.5 cc; $p = 0.04$) (picture 1), while the compared analysis of the patient groups in relation to the molecule type chosen to make coronaries opaque (iodixanol, iomeprol, ioversol), did not show any significant statistical difference ($p = 0.27$).

Furthermore, subjects who underwent emergency procedures showed a risk level very higher if compared with

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