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Prognostic factors of acute kidney injury in patients submitted to percutaneous coronary angioplasty

Abstract

Introduction: Acute Kidney Injury (AKI) is frequently associated with contrast use and Percutaneous Coronary Angioplasty (PCA) in particular can be more deleterious in this aspect depending on all the clinical aspects of each patient.

Aims: Determination of all the significant variables that may be protective or harmful for the incidence of AKI in PCA based on the data of 3662 patients that underwent this procedure. All the medical conditions were described, such as route of access, contrast characteristics, patient preparation, and presence of stable or unstable coronary disease conditions, medications in use, clinical and surgical follow up and outcomes plus length of stay in hospital.

Evidence review: PCA is accounted for the occurrence of AKI due to the use of iodinated contrast and also worsened by conditions such as heart failure, diabetes, old age, concomitant use of nephrotoxic medications, among other factors.

Place in therapy: Attention must be focused in proper preparation of each patient prior and during the procedure, preference for radial access whenever possible, use of medications, cardiac conditions and medications in use mainly.

Conclusion: Prognostic factors associated with increased risk for AKI in PCA were mainly age, previous coronary revascularization, heart failure, use of inotropic medication and length of stay in hospital prior to the PCA. The association with less occurrence of AKI were male gender, stable coronary clinical condition, radial access, use of statins and of angiotensin converting enzyme inhibitors.

Keywords: interventional cardiology, iodinated contrast, renal patients, cardiac patients

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Abbreviations: AKI, acute kidney injury; AMI, acute myocardial infaction; PCA, percutaneous coronary angioplasty

Introduction

Contrast-related acute renal failure is a relatively common clinical entity being an important prognostic factor of severity in patients undergoing percutaneous coronary angioplasty (PCA) for the diagnosis of coronary lesions.[1,2] It is the third most common cause of acute renal failure intrahospital and induced by cardiac surgery and hypotension.[3] Classically, percutaneous coronary angioplasty due to the use of intravenous contrast by renal elimination can lead to various complications, including worsening of the renal function. The progression of chronic renal failure, with the need for the patient to undergo dialysis, reversible or not, or even death may occur in a few cases, it can be considered as the more important.[1] The growth of cardiological interventions in elderly patients, using iodinated contrasts, can lead to the hypothesis that the incidence of this type of acute renal injury could be increasing in the coming years.

Currently, acute kidney injury(AKI) induced by contrast media is defined as: increased creatinine >0.3 mg/dl within 48 hours or 1.5 times the baseline value, or the volume urine <0.5 ml/kg/h for 6 hours after words by KDIGO guidelines.[4] Prior to this definition of KDIGO, this type of acute renal failure was considered as such in patients whose creatinine increased 0.5 mg/dl or >25% of the baseline within 72 hours after contrast administration.[5] The main risk factors involved in the development of contrast nephrotoxicity with renal injury are: pre-existing renal disease, diabetes mellitus, elderly patients, heart failure, and concomitant use of other nephrotoxic drugs.[6,7] In these patients, AKI due to the contrast is associated with increased need for dialysis, increased length of hospital stay, increased costs and higher mortality rate.[8]

Objective

The aim of this study was to analyze the prognostic factors involved in the risk of developing AKI by performing retrospective analysis of our databank, in a tertiary large hospital, submitted to coronary angioplasty.

The intention for the consideration of the parameters that presented the greatest risk for complications of such procedure, and propose prophylactic interventions to be established in order to minimize these risks.

Methods

The retrospective cohort study included patients submitted to PCA from April 2013 to December 2016. We adopted as an inclusion criterion the cases submitted only to the first procedure. Patients were excluded from dialysis (n=37), as well as cases in which access was via brachial (n=23). Thus, our study covered a total of 3662 patients. AKI was defined as increased serum creatinine more than 1.5 times from the baseline serum creatinine (taken drawn within seven days

prior to the procedure) or need for dialysis by any other indication. Statistical analysis - Descriptive analysis, followed by univariate analysis and selected factors with p<0.20 for analysis multivariate by logistic regression. Data Bank variables: gender, sex, BMI in categories, smoking, positive family history, diabetes, hyperlipidemia, hypertension, creatinine clearance, renal preparation, previous stroke, previous CVD, previous arterial peripheral insufficiency, previous Acute Myocardial Infaction (AMI), previous coronary revascularization, previous angioplasty, previous heart failure, use of medications (metformin, ACE inhibitors, ARBs, diuretics, inotropics and statins), clinical status, vascular access type, contrast type and contrast volume.

Results

We evaluated 3662 patients who underwent PCA between April 2013 until December 2016. Our patients were 2446 men (66.8%) and 1215 women (33.2%), with ages varying between 25 and 99 years, being the average age 63.4 years. Patients with stable coronary disease were 2994, corresponding to 80.4% of cases. Patients with acute coronary syndromes were 668 in total, which corresponded to 19.6%. In relation to renal function, the patients were analyzed by creatinine clearance range (according to the Cockcroft gault) and subdivided into clearance ranges ->90ml/min: 926 patients (28.5%), between 60 and 90 ml/min: 1362 patients (41.9%), between 30 and 60ml/min: 873 patients (26.8%) and <30 ml/min: 55 patients (1.7%). Other data evaluated were the use of some medications such as statins, the use of inotropics, hypotensives, routes of access used to perform the PCA (femoral or radial) and length of hospital stay in days. went from zero to 57 days, mean 1.3 days for patients without AKI and 3.2 for those with this complication. The rate of acute kidney injury (AKI) found was 1.9%, referring to 71 patients. Patients undergoing PCA underwent renal preparation for prevention of nephrotoxicity in 29.9% of cases (1095 patients) and this did not present significance in the multivariate analysis. Standard renal preparation for prevention of nephrotoxicity consisted of expansion with saline 1000 ml 1h before up to 12 hours after the procedure, at a rate of 1ml/kg/h, associated with the use of N-acetyl Cysteine 1200 mg via oral or intravenous 12/12h, started 24 hours before the procedure and prolonged until 72 hours after the procedure. The association of preexisting diseases such as: renal failure (creatinine clearance <60 ml kg/min), diabetes, anemia, shock, sepsis and dehydration presented higher values of AKI. These same differences were observed when there was administration of nephrotoxic drugs or when administration of >100 ml of contrast medium was required.

Discussion

In the literature, the incidence of contrast-induced AKI is of approximately 3% (6,7), but may reach up to 30% in some reports. The high risk for development of contrast-enhanced AKIs include preexisting kidney disease, diabetes mellitus, elderly patients, concomitant use of nephrotoxic drugs. In these patients, AKI may be more severe and is associated with greater dialysis need, hospitalization time, increase in mortality and even of costs.[8]

There are well-established current recommendations to prevent AKI induced by contrast.[4] Non pharmacological strategies include using the lowest possible dose of contrast,[9] and preferably using iso-osmolar or low osmolarity iodinated contrasts. The main pharmacological intervention is saline intravenous with isotonic saline, in patients with high risk for contrast-induced AKI 4. There is also the description by some groups of the use of bicarbonate intravenous simultaneously with saline expansion.[10]

KDIGO's international recommendations guide the use of oral N-acetyl cysteine (NAC), along with crystalloids intravenous The UK guidelines state that there is insufficient evidence for the use of NAC. In our sample, we observed that AKI after contrast occurred in less than 2% of patients with normal renal function, lower than the current literature. AKI reached levels of concern in cases of patients with preexisting diseases such as: creatinine clearance <60 ml kg/min, diabetes, anemia, shock, sepsis or dehydration. There was also a great increase in the levels of renal complications when the administration of nephrotoxic drugs or when the administration was of more than 100 ml of contrast.[2]

In summary, AKI rate was low in the PCA procedures sample of PCA. Pre-existing diseases such as kidney injury (creatinine clearance <60 ml kg/min), diabetes, anemia, shock, sepsis or dehydration were associated with IRAs even up to 50%. There was also a large increase in renal complications when with the administration of nephrotoxic drugs or administration of over 100 ml of contrast.

Conclusion

Augmented risk, as expected, was associated with later age, prior revascularization surgery, heart failure. Inotropes use and longer length of hospitalization prior to PCI. Protection factors were male gender, overweight and grade II obesity, stability of coronary disease, use of ACE inhibitors, use of statins and radial access.

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None.

Conflicts of interest

The author declares there is no conflict of interest.

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