Original Article

Clinical Features of CIN in Chinese Very Elderly Patients Undergoing Coronary Angiography Procedure With Hydration Treatment: A Three-Center, Prospective Study

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S U M M A R Y

Background: To assess the morbidity and risk factors of contrast induced nephropathy (CIN) in Chinese very elderly patients.
Methods: The very elderly patients whose age ≥75 year-old, from North Huashan Hospital, South Renji Hospital and Tongren Hospital, underwent coronary angiography or percutaneous coronary intervention, were included in this study. All of these patients were treated by hydration, those who developed contrast-induced nephropathy were divided into CIN group and the others were divided into non-CIN group. The baseline information was evaluated and serum creatinine was measured prior to the coronary angiography and 24 h, 48 h after procedure. The data was analyzed by the software SPSS17.0.
Results: 163 very elderly patients were included in this study. The occurrence of CIN in very elderly patients was approximately 8.6%. In CIN group, serum creatinine concentration was statistical significance between prior data and 24 h/48 h after procedure data, but there's no statistically significant differences between 24 h data and 48 data after procedure. Multivariable analysis showed that patient's age (p value 0.026, OR 1.171, 95% CI 1.019−1.347), and complicated lesion (p value 0.025, OR 3.91, 95% CI 1.185−12.896) were correlation with CIN.
Conclusion: The incidence of CIN with hydration treatment is similar to that of average patients. Very elderly patient with older age, higher dosage of contrast media and complicated lesion is vulnerable to develop CIN.

1. Introduction

Contrast induced nephropathy (CIN) is the 3rd major reason of acute renal failure in patients admitted in hospital, which happened about 5% in relatively healthy patients. In general, according to definition of contrast induced acute kidney injury (AKI) from the European Society of Urogenital Radiology, CIN is diagnosed when serum creatinine (Scr) levels increased by 25% or 0.5 mg/dl after use of contrast.[1,2] Previous study demonstrated that older age is one of the most important risk factors of CIN in general population.[3] Besides, diabetes, chronic renal dysfunction, overuse

of contrast were also proved to be the risk factors which contributes to CIN development and the prevention procedure includes hydration treatment, special medication.[4−8]

In 2010, the average life expectancy of China was officially[9] estimated at 72.5 year-old in male and 76.8 year-old in female, compared with earlier data, which indicates that the elderly population has increased significantly these years in China contributes to the economic development and the living standards' improvement. Based on an estimation by the United Nation,[10] in China, the population of 75 year-old or even older will reach to 103 million in 2050 which will become a great burden to Chinese healthcare system. Elderly population are prone to have more cardiovascular problems combined with hypertension and diabetes, accompanied with renal function impairment, who need coronary angiography (CAG) or percutaneous coronary intervention (PCI) for diagnosis and treatment. More contrast agents will be used in these elderly patients.

By this reason, it is important for Chinese doctors to understand whether very elderly patients, whose age ≥75 year-old, are more vulnerable to contrast agents or not, and what other factors combined with elderly age would lead more possibility to develop CIN. In this study, we prospectively analyzed renal function change of elderly patients receiving contrast agents for CAG/PCI procedure and undergoing the treatment of hydration. We compared incidence of CIN in very elderly patients receiving CAG or PCI treatment with average patient in other studies and analyzed the risk factors combined with elderly age that may help lead to CIN in this population.

2. Materials and methods

2.1. Study population

A total of 163 patients whose age ≥75 year-old undergoing CAG with or without PCI were enrolled in succession in this study from February 2012 to March 2013 in three centers in Shanghai, including North Huashan Hospital, South Renji Hospital and Tongren Hospital, which represents the population of north, southeast and middle part of Shanghai. Patients were enrolled for CAG if they complained of angina at rest or after exercise and possessed cardiovascular risk factors and excluded if: (1) they received contrast agents within one week prior to this study; (2) patients with allergy to contrast agents and/or anesthetic agents; (3) patients receiving hemodialysis treatment or e GFR < 30 ml/min/1.73 m^2 at the same time. After confirmed stenosis of coronary greater than 75%, patients diagnosed ACS or angina will be treated by PCI. This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Fudan University. Written informed consent was obtained from all participants.

2.2. Study protocol

Patients' baseline clinical data, such as age, gender, weight, history of hypertension, diabetes, heart failure, contrast volume and multiple vessel disease were recorded if enrolled into study. Serum creatinine were sampled prior to the operation, 24 h and 48 h after procedure and according to serum creatinine concentration, eGFR was calculated by MDRD formula[11,12] in every patient. CIN was diagnosed when serum creatinine levels increased by 25% or 0.5 mg/dl after the use of contrasts. Hypertension is defined as previous diagnosis treated with anti-hypertension drug or blood pressure over 140/90 mmHg twice admitted in hospital. Diabetes is defined as previous diagnosis treated with hypoglycemic agent or fasting blood glucose over 7.0 mmol/L or OGTT glucose over 11.0 mmol/L admitted in hospital. Heart failure is defined as systolic or diastolic dysfunction of left ventricular measured by echo admitted in hospital.

Patients were divided into two subgroups according to eGFR: normal group (eGFR≥60 mL/min/1.73 m^2) and abnormal group (eGFR<60 mL/min/1.73 m^2). All patients were given hydration treatment (treated by 0.5% saline given intravenously at a rate of 1 ml/kg/h starting the same day of CAG and from about 3 h before scheduled time for CAG) because of their very elderly age to prevent them from renal dysfunction in a certain extent.

2.3. Contrast agents use

Combined with hydration, non-ionic contrast agent, iopamidol, produced by Bracco Xinyi Pharmaceutical Co Ltd, Shanghai, was used for patients in this study. Generally, specific formula [5 (ml) × patient's body weight (kg)/serum creatinine (mg/dl)] was used to calculate the maximum recommended dose of contrast agent prior to the operation and the maximum dose of contrast could not exceed 300 mL in every patient.

2.4. Statistical analysis

SPSS17.0 software was used for statistical analysis. Pearsonchi-square test was used for comparison of data rate between groups. The t-test was used for analysis of measurement data as mean ± standard deviation between groups for normal distribution of measurement data. For not normal distribution of measurement data between the two groups, Wilcox on test was used. Multivariable analysis was used to detect the risk factors. $P < 0.05$ was considered statistically difference.

3. Results

A total of 163 subjects were enrolled from North Huashan Hospital, South Renji Hospital and Tongren Hospital during February 2012 to March 2013, which included 96 patients with simple coronary angiography and 67 patients with coronary angiography treatment by PCI. In 163 patients, 111 patients were divided into normal group (eGFR ≥60 mL/min/1.73 m^2) and 52 patients into abnormal group (eGFR <60 mL/min/1.73 m^2). All of these patients in both groups were treated by hydration and 14 (8.6%) patients (7.2% in normal group lower than 11.5% in abnormal group, $P < 0.05$) were diagnosed CIN according to CIN definition. According to the incidence of CIN, we classified all subjects into 4 groups, CIN with CAG group (5 patients), CIN with PCI group (9 patients), non-CIN with CAG group (91 patients) and non-CIN with PCI group (58 patients) (Table 1).

The patients' age was average at 81.3 year-old and 40.5% of them were male. Baseline database was recorded, which indicated 93% patients in CIN group and 63% in non-CIN group had hypertension, 29% in CIN group and 17% in non-CIN group had diabetes, 14% in CIN group and 6% in non-CIN group had chronic heart failure. Baseline serum, BUN and hemoglobin were also recorded (Table 2).

The absolute changes or relative changes compared with baseline serum creatinine concentration was the basic steps to the judgment of CIN. So we analyzed that the creatinine values in the CIN and non-CIN group before operation, 24-h after operation and 48-h after operation (Table 3). There was obvious difference between pre-operation and 24 h post-operation in CIN group, P value was 0.016; the result was the same between preoperative and 48 h postoperative data in CIN group, P value was 0.027. Furthermore, there was no significant statistics difference between 24 h postoperative data and 48 h postoperative data (P value was 0.70) in CIN group. On the other hand, no obvious statistics difference was discovered between preoperative, 24 h postoperative and 48 h postoperative data in non-CIN group.

Compared with patients in both groups, age, gender, volume of contrast and complex lesion showed statistical significance in single factor regression analysis. Then multivariable analysis showed

Table 1
The incidence of CIN in both groups.

	Normal group			Abnormal group		
	CIN group	Non-CIN group	Total	CIN group	Non-CIN group	Total
CAG	3	66	69	2	25	27
PCI	5	37	42	4	21	25
Total	8 (7.2%)	103	111	6 (11.5%)	46	52

Note: CAG, coronary angiography; PCI, percutaneous coronary intervention; CIN, contrast induced nephropathy; non-CIN, non-contrast induced nephropathy.