Prevalence and etiologies of acute kidney injury in elderly

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Abstract
Introduction: Several renal diseases are more common in elderly patients, and even in healthy older individuals renal physiology has its characteristics.
Objectives: The purpose of our study is to evaluate the epidemiological profile of acute kidney injury (AKI) in hospitalized elderly patients.
Patients and Methods: A retrospective study was carried out over one year period including 70 patients whose age was ≥65 years and who presented with an AKI.
Results: The mean age was 75 years. Patients were hospitalized in an emergency or resuscitation unit in 46% of cases. Mean serum creatinine was 515 µmol/l, 28% of patients had hyperkalemia. The causes of AKI were use of contrast in 40%, nephrotoxic drugs in 33% of cases and dehydration in 23% of cases. Obstructive AKI was observed in 25% of cases. Around 36% needed emergency dialysis. 8% were dead while performing dialysis.
Conclusion: Being aware of the fragility of the elderly to AKI and the early diagnosis and efficient prevention of this syndrome are the best alternatives to reduce its high prevalence.
Keywords: Chronic kidney disease, Acute kidney injury, Serum creatinine, Glomerular filtration rate
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Introduction

Acute kidney injury (AKI) is defined as an abrupt (within hours), decrease in kidney function, which encompasses both injury (structural damage) and impairment (loss of function) (1). The current diagnostic approach of AKI is based on an acute decrease of glomerular filtration rate (GFR), as reflected by an acute rise in serum creatinine levels and/or a decline in urine outcome over a given time interval (2,3). Recently several biomarkers have been proposed for the diagnosis of AKI and these are in various stages of development and validation (4-7). Advanced age is a risk factor of AKI, mortality and dependence to dialysis.

The elderly represent the fastest growing subgroup of the general population in developed countries. The incidence of AKI is rising in individuals of all ages; however, elderly patients (older than 65 years) are particularly susceptible to the development of AKI due to aging process, the presence of co-morbidities, and the reduced ability to recover (8).

Objectives

The purpose of our study is to evaluate the epidemiological profile of AKI in hospitalized elderly patients

Patients and Methods
Study design

We conducted a retrospective study over one year period between July 2016 and July 2017 including patients whose age was ≥65 years and who presented with an AKI admitted in the Internal Medicine Department. Data collection was carried out from a pre-determined grille recording clinical, paraclinical and outcomes features. For statistical analyses, statistical software SPSS 19.0 was used. Qualitative variables were expressed as percentages. A *P* value of <0.05 was considered significant.

Results

There were 70 elderly patients with AKI. There were almost as many men as women (sex-ratio = 1,12). Among the patients, 56% had hypertension, 32% diabetes, 28% cardiovascular disease. Twenty-two percent of them had a prior history of chronic kidney disease (CKD). Patients were hospitalized in an emergency or resuscitation unit in 46% of cases. Mean blood pressure was at 83 mm Hg. Thirty-three percent of patients had lung overload and

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■ **Implication for health policy/practice/research/ medical education**

Several renal diseases are more frequent in elderly patients today, and even in healthy older individuals renal physiology has its own peculiarities. This leads to the need for a specific approach on renal aging and renal function in the elderly. The aim of our study is to evaluate the epidemiological profile of acute kidney injury in hospitalized elderly patients.

39% had a normal diuresis. Mean serum creatinine was 515 μmol/L, 28% of the patients had hyperkalemia, 48% had hyperleukocytosis and increased C-reactive protein (CRP) and 56% had metabolic acidosis. Mean serum sodium was 134 mmol/L, while 55% of patients had hyponatremia and 3% hypernatremia (Table 1).

The causes of AKI were nephrotoxic drugs in 33% of cases, use of contrast in 40% of cases and dehydration in 23% of cases. Obstructive AKI was observed in 25% of cases.

Other etiologies were respectively hepato-renal syndrome in 6%, heart failure in 3%, multiple myeloma in 4% and crescentic glomerulonephritis in 1% of cases (Table 2)

The main risk factors of AKI in elderly were sepsis/infection (33%), tumoral disease (28%), recent surgery (26%), nephrotoxic drugs (31%), heart failure (15%) and prior history of CKD (22%). Twenty-five patients (36%) needed emergency dialysis. It was indicated respectively for metabolic acidosis and hyperkalemia in 36%, metabolic acidosis and lung overload in 16% hyperkalemia in 20%, metabolic acidosis in 12% and lung overload in 16%.

Dialysis was stopped for 6 patients (hemodynamic instability). Two patients were dead while performing dialysis (8%). In univariate analysis, the factors associated with development of AKI in our elderly population were diabetes mellitus (DM), CKD, and use of contrast agents.

Discussion

The risk of developing AKI as well as an AKI requiring dialysis increases with age (9,10).

In the growing old population there is heightened vulnerability to drug toxicity, partially due to altered drug pharmacokinetics and pharmacodynamics. Furthermore, the elderly use twice as many medications overall, including nephrotoxic agents, compared with younger patients. The vasodilatory increase in the renal plasma flow and GFR that constitutes renal function reserve is decreased considerably in healthy elderly individuals, compromising renal adaptation after acute ischemia, and intensifying vulnerability to AKI. Age-related alterations in renal tubular function also may increase susceptibility to AKI because renal sodium conservation in response to dietary sodium restriction is reduced in the elderly (11). Several risk factors have been associated with AKI in the elderly population and can be broadly classified into three categories; presence of co-morbidities, for instance, DM, CKD, congestive heart failure, and atherosclerosis; use of nephrotoxic medications, aminoglycosides, angiotensin-converting enzyme inhibitors, non-steroidal anti-inflammatory drugs, vancomycin, amphotericin B, cyclosporine, tacrolimus, etc; and genetic profile. Preexisting DM, hypertension, and proteinuria have been determined to be independent risk factors for developing AKI in elderly patients during hospitalization (12).

Approximately 35% of AKI cases have prerenal causes, 40% have intra-renal (intrinsic) causes, and 25% are secondary to post-renal (obstructive) causes. Remodelling in renal structure and physiology with aging lead to some potential changes in the distribution of frequency of etiologies of AKI in this population, when compared to the general population (8).

The risk factors that make the elderly predisposing to develop AKI can be divided into three types; 1) related to kidney senility, 2) secondary to the elderly co-morbidities, and 3) associated with medical intervention (13).

Short and long-term mortality in the elderly patients with AKI is high and may be higher than in other age groups.

The high percentage of mortality and no specific

Table 1. Clinical and biological characteristics

Number of patients 70 >65 years	
Mean age	75 ans [65-96]
Sex ratio	1.2
Medical background	
Diabetes	56% (40)
High blood pressure	28% (20)
Cardiovascular diseases	28% (20)
Neoplasia	26% (19)
Chronic renal disease	22% (16)
Clinical data	
Mean blood pressure, mm Hg	83 [53-137]
Lung overload	33%
Normal diuresis	39%
Biological data	
Serum creatinine, μmol/L	515 [120-2019]
Hyperkalemia >5.5 mmol/L	28%
Mean sodium, mmol/L	134 [118-154]
Biological inflammatory syndrome	48%
Metabolic acidosis	56%

Table 2. Etiologies of AKI in the elderly

Nephrotoxic drugs	33%
Use of contrast agents	40%
Dehydration	23%
Obstructive AKI	25%
Hepato-renal syndrome	6%
Heart failure	3%
Multiple myeloma	4%
Crescentic glomerulonephritis	1%

treatment emphasizes the need for efficient prevention of AKI in the elderly. Among the main strategies used, the following can be mentioned; balance and correction of factors such as hypovolemia and hypotension, careful clinical monitoring, controlling drugs such as diuretics, anti-inflammatory, angiotensin-converting enzyme inhibitors, and other vasodilators should be used with caution, to prevent drug nephrotoxicity-induced AKI. We should also adjust the drug's doses according to the patient's calculated GFR (13).

Conclusion
There is no consensus in the epidemiology of AKI in the elderly. Its high incidence and mortality are admitted in many studies. Risk factors that make the elderly more likely to develop AKI are related to kidney senility, secondary to co-morbidities and, associated with medical procedures. Being aware of the vulnerability to AKI in the elderly and the early diagnosis and efficient prevention of this syndrome are the best ways to decrease its high prevalence, complications, and consequently, mortality.

Limitations of the study
Unfortunately the size of our sample was limited. Patients were hospitalized in other departments. We have not long-term evolution of serum creatinine.

Author' contribution
All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

Conflicts of interest
On behalf of all authors, the corresponding author states that there is no conflict of interest

Ethical considerations
The research followed the tenets of the Declaration of Helsinki. Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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