Prevalence of Acute and Chronic Renal Failure in Patients aged over 59 Years

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Abstract

Introduction: This study compared the prevalence of acute renal failure (ARF) and chronic renal failure (CRF) or chronic kidney disease (CKD) in patients aged over 59 years admitted to hospital in the ED, for 2 periods: 1997 and 2005, or 9 years apart.

Methods: In 1997, the study was conducted over 6 months and covered 5783 hospitalized patients, 54.6% aged over 59 years. That of 2005 was also conducted over 6 months, and covered 4677 hospitalized patients, 64.9% aged over 59 years. Renal failure (RF) was defined as a serum creatinine level over 149 µmol/L on admission. CRF was defined as the persistence of a serum creatinine level over 115 in male and 90 µmol/L in female at the end of the study period; ARF was defined as a serum creatinine level under 116 and 91 µmol/L respectively, at the end of the study period.

Results: The prevalence of RF on admission in hospitalized patients aged over 59 years was 6.4% in 1997, with 8.2% in men and 4.9% in women and 9.4% in 2005, with 13.5% in men and 6.3% in women (an increase of +46% in 9 years +64% in men and +28% in women). The prevalence of ARF was 1.5% in 1997, (1.3% in men and 1.6% in women) and 2.9% in 2005, (3.9% and 2.2% respectively), the risk of ARF on admission to hospital having significantly increased in 9 years of +55% in men. The prevalence of CKD was 4.4% in 1997 (6.2% in men and 2.7% in women) and 5.5% in 2005 (8.2% and 4%). The risk of CKD in ED increased to more than 19% in 9 years (+23% in men and +19% in women). The incidence of an ESRD treatment occurring during hospitalization or in the period of the study in 1997 was 1.5 per 1000 hospitalized patients aged over 59 years and in 2005 it was 1.3/1000 patients. A nephrologist advice was sought for 25% of the patients in 1997 and 54% in 2005.

Conclusion: The hospital epidemiology data on RF at ED are original and suggest actions to be taken for optimal and early nephrological care for patients after admission to hospital.

Keywords: The hospital epidemiology data on RF at ED are original and suggest actions to be taken for optimal and early nephrological care for patients after admission to hospital.

Introduction

The increasing prevalence of chronic kidney disease (CKD) in the general population is linked to longer life expectancy and the aging of kidney vessels. The last two decades have been characterized by the increasing prevalence of ESKD treatment in patients growing older [1,2].

Several studies point out that 30-40% of new dialysis patients have not received prior support by a nephrologist [3] and that this lack of specialist monitoring before ESKD treatment represents an early mortality factor on dialysis [4]. CKD in the elderly is unknown and its severity is underestimated [5]. The number of CKD patients in France is estimated in 2002 to be 1.75 to 2,500,000 [6], the imprecision of this number is linked to the lack of validation of methods for measuring glomerular filtration rate (GFR) in elderly patients [7-9]. Preventing a worsening CKD can prevent or delay the ESKD treatment. It can also reduce cardiovascular morbidity and mortality associated with kidney failure condition. CKD is recognized as a major risk factor for cardiovascular mortality, including myocardial infarction [10,11].

The emergency department (ED) of a general hospital is frequented by a population of elderly patients with cardiovascular co-morbidities. The ED is a special place for observation to assess and monitor the prevalence of acute renal failure (ARF) and CRF in patients hospitalized for diseases other than nephrology.

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This work aims to assess the prevalence of ARF and CRF at ED of a general hospital in patients older than 59 years, and to monitor its evolution in 9 years interval (1997-2005). It also clarifies how a nephrologist is urged by his hospital colleagues to support these patients with renal failure (RF) ten years after the recommendations of the High Committee of Public Health [12].

Methods

An initial survey was conducted from January, 1 to June, 30, 1997. During this period, 16,221 patients were admitted at the ED of Yves Le Foll Hospital of Saint Brieuc and 5,783 (35.6%), 2,820 men and 2,963 women were hospitalized, with 54.6% aged over 59 years (1,420 men and 1,737 women). The second survey was conducted from January, 1 to June, 30, 2005 in the same ED. During the second period, 18,835 patients were admitted and 4,677 (24.8%), among those 2,198 men and 2,479 women were hospitalized, with 64.9% aged over 59 years (1,310 men and 1,730 women).

Serum creatinine was measured at least twice during the stay: at the time of admission to the ED and at the end of the hospital stay. Renal failure was defined in the two survey periods by a serum creatinine value equal to or higher than 150 µmol/L at the time of admission. Patients on chronic dialysis, transplant patients hospitalized at the ED, as well as patients who were already monitored by a nephrology team were excluded from the study. Only one hospitalization was taken into account, the first one, in case of new admission of the patient during the study period.
The method for the determination of serum creatinine dosage was the same in 1997 and 2005 (Jaffe method). Renal failure was considered as acute when the serum creatinine level regresses to a level equal to or less than 115 µmol/l in men and 90 µmol/l in women at the end of the stay or the period of the study [9].

Renal failure was considered as chronic when the serum creatinine level was unchanged or higher than 115 µmol/l in men and 90 µmol/l in women at the end of the stay or during the period of the study. The average hospital stay of renal failure in patients was 14 +/- 12 days in 1997 and 13 +/- 15 days in 2005. Seventeen patients had no second determination of serum creatinine in 1997 and seven in 2005. They were excluded from the calculation of prevalence of ARF and CRF.

The orientation of the patients, with renal failure in the ED, towards the specialty departments other than the nephrology was studied, as well as the frequency of the requests for nephrologist advice from the hospital experts of the respective departments during the stay of the patients. The hospital has a nephrology department since 1978 where 5 nephrologists practised in 1997 and 7 in 2005.

In 1997, a prospective study was led by same investigators [13]. In 2005, the research was carried out over the same period of the year as in 1997 by another investigator, from the computerized medical file.

In the two studies, the prevalence in the hospitalized population at the ED is calculated over a 6 month period and prolonged to 12 months. The prevalence of the ARF and the CRF was evaluated only in the hospitalized population of more than 59 years of age. The Hospital of St Brieuc is a local hospital for a catchment population of 158,917, including 41,318 aged over 59 (19,007 men and 22,311 women), called Pays de St Brieuc [14]. The department of nephrology has a wider appeal than Pays de St Brieuc since it is the only specialized department for a health care area of 400,000 inhabitants. It is the reason why, only the patients presenting themselves on admission of St Brieuc hospital are considered as the relevant recruitment of the Pays de St Brieuc, three other hospitals within the health care area (Lannion, Paimpol and Guingamp), being equipped with one admission department ensuring their own recruitment.

The prevalence of the ARF and the CRF was functional in 64/90 patients (71.2%), parenchymatous in the 26 others (28.8%).

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The incidence of the ESRD treatment occurring in the course of hospitalization in patients admitted with RF at the ED was calculated in the following way: number of new patients aged over 59 years from Pays de St Brieuc and definitively taken on chronic dialysis during or immediately after the hospital stay, reported either to the number of patients of more than 59 years of age hospitalized during the time of the study (n/1000 hospitalized patient/year), or to the total population of Pays de St Brieuc (n/105/year) evaluated in censuses in 1997 and 2005 [13]. This data represented the part of the patients not treated beforehand by a nephrologist and arriving at the stage of the ESRD during the period of the study.

The statistical analysis of the two studies was carried out with the method of Chi-2 and Student coefficient. If the number of hospitalized patients at the ED in 2005 was 19% lower than that of the patients hospitalized in 1997, the difference between the patients of more than 59 years of age with patients under 59 years was not significant (3040 vs 3140, - 3.7%), and higher for men (1310 vs 1420, - 7.7%) than women (1730 vs 1840, - 6.4%).

The prevalence of the ARF in these hospitalized patients was 1.5% in 1997 (1.3% in men and 1.6% in women) and 2.9% (3.9% and 2.2%) in 2005. The risk of having an ARF at the time of the admission to the hospital in the aged population of more than 59 years increased by +28% in 9 years, primarily in men (+55%) (Table 3). The annual incidence of ARF on admission to ED, reported to the aged population of more than 59 years living in Pays de St Brieuc, was in 1997, 227,5 patients per 100,000 inhabitants and in 2005, 218/100 000 (ns).

The initial renal failure was improved, but not resumed at the end of the stay or the end of the investigation, in 52 patients (28.2%) in 1997 and in 65 (23%) patients in 2005; it was remaining stable compared with the initial level in 40 (22%) and 91 (33%), and worsened in 46 (24.8%) and 33 (12%) patients. In 1997, the diagnosis of CRF was retained in 138/185 (74.5%) patients (88 men and 47 women) and in 189/279 (68%) patients (121 men and 68 women) in 2005 (ns). In 37.7% of the patients in 1997 and 34.4% in 2005, it was about a functional ARF superimposed to previous CRF including four cases of acute retention of urine in 2005.

The prevalence of CRF in aged patients hospitalized at ED was 4.4% in 1997 (6.2% in men and 2.7% in women) and 5.5% in 2005 (9.2% and 4%, respectively). The risk of having a CRF at the time of admission to hospital increased by +19% in 9 years, this progression being comparable in men (+23%) and in women (+19%) (Table 3). The prevalence of the aged patients with CRF, living in Pays de St Brieuc and not monitored by nephrologists at the moment of their admission to hospital, was of 327/100000 inhabitants (463 men and 211 women) in 1997 and 474/100
000 (658 men and 318 women) in 2005 (p<0.02). Thus, the population older than 59 years, with CRF at the time of admission to hospital and not monitored beforehand by a nephrologist, increases by +45% in 9 years.

In this study, all the patients previously monitored by a nephrologist were not under ESRD treatment at the time of admission to hospital, both in 1997 and 2005. Five patients in 1997 and four in 2005 had during their hospital stay or for the period of the study an irreversible aggravation of initial renal failure, requiring a final decision of renal replacement therapy.

The incidence of ESRD treatment occurring in this aged population hospitalized at ED was 1.5 per 1000 hospitalized patients in 1997 and 1.3 per 1000 in 2005 (ns). Relative to the overall annual incidence of ESRD treatment in the health area, these patients represented 23% in 1997 of incident cases of ESRD treatment (24.2 per million inhabitants or pmr) and in 2005, 18% (19.6 pmr) (ns).

Table 4 shows the specialty departments where patients with RF were admitted from ED. Less than 10% of the patients in 1997 and 19% in 2005 were addressed as first line in the nephrology department. A nephrologist advice was sought in 1997 for 27 patients (15%) hospitalized in the other centres, and for 103 (36%) in 2005.

Thus, in 1997, 25% of the RF patients admitted to hospital at ED had a nephrology care during their hospital stay, and 2005, 55% (p<0.001). This progression of nephrology care was done at the expense of direct hospitalization in cardiology, endocrinology and rheumatology. On the other hand, in the other specialty departments, the rate of addressing was comparable in 2005 with that of 1997. None of the RF patients, not seen by a nephrologist during the hospital stay, was then re-examined in outpatient department for nephrology for the study period.

### Table 1: Distribution by age groups of patients with renal failure aged >59 years on admission to hospital

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>1997 n (%)</th>
<th>2005 n (%)</th>
<th>RR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69</td>
<td>25 (12.4%)</td>
<td>31 (10.8%)</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>70-79</td>
<td>65 (32.1%)</td>
<td>75 (26.2%)</td>
<td>0.96</td>
<td>0.68-1.35</td>
<td>0.82</td>
</tr>
<tr>
<td>80-89</td>
<td>86 (42.5%)</td>
<td>138 (48.3%)</td>
<td>1.16</td>
<td>0.83-1.63</td>
<td>0.39</td>
</tr>
<tr>
<td>90 and +</td>
<td>26 (12.8%)</td>
<td>42 (14.7%)</td>
<td>1.17</td>
<td>0.77-1.78</td>
<td>0.47</td>
</tr>
<tr>
<td>Total</td>
<td>202 (100%)</td>
<td>286 (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serum creatinine on admission (µmol/l)</th>
<th>1997 n (%)</th>
<th>2005 n (%)</th>
<th>RR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 to 199</td>
<td>139 (68.8%)</td>
<td>178 (62.2%)</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>200 to 249</td>
<td>38 (18.8%)</td>
<td>48 (16.8%)</td>
<td>0.99</td>
<td>0.76-1.2</td>
<td>0.95</td>
</tr>
<tr>
<td>250 to 299</td>
<td>7 (3.5%)</td>
<td>32 (11.2%)</td>
<td>2.44</td>
<td>1.23-4.83</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt;= 300</td>
<td>18 (8.9%)</td>
<td>28 (9.8%)</td>
<td>1.12</td>
<td>0.77-1.64</td>
<td>0.54</td>
</tr>
<tr>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of RF</th>
<th>1997</th>
<th>2005</th>
<th>RR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF on admission (all hospitalized patients)</td>
<td>3.9%</td>
<td>6.6%</td>
<td>1.35</td>
<td>1.25-1.45</td>
<td>&lt;10^{-7}</td>
</tr>
<tr>
<td>RF on admission (hospitalized patients &gt;59 years)</td>
<td>6.4%</td>
<td>9.4%</td>
<td>1.19</td>
<td>1.08-1.31</td>
<td>0.001</td>
</tr>
<tr>
<td>ARF on admission (hospitalized patients &gt;59 years)</td>
<td>1.5%</td>
<td>2.9%</td>
<td>1.28</td>
<td>1.13-1.45</td>
<td>0.000008</td>
</tr>
<tr>
<td>CKD on admission (hospitalized patients &gt;59 years)</td>
<td>4.4%</td>
<td>5.5%</td>
<td>1.19</td>
<td>1.08-1.31</td>
<td>0.001</td>
</tr>
<tr>
<td>ESRD treatment (hospitalized patients &gt;59 years)</td>
<td>1.5/1000</td>
<td>1.3/1000</td>
<td>0.91</td>
<td>0.44-1.88</td>
<td>0.78</td>
</tr>
</tbody>
</table>

### Table 3: Prevalence of renal insufficiency (RI) in patients admitted to CH of St Brieuc by the emergency department (%), prevalence of CKD and implications of the ARF and ESRD treatment in the hospitalized population aged >59 years and in the population of Pays de St Brieuc (per million inhabitants aged >59 years or pmr).

### Table 4: Department of medical specialties where patients with RF stayed from ED admission

* Internal medicine, dermatology, pneumology, gastroenterology and geriatric medicine.
** Digestive surgery, vascular surgery, orthopedic surgery and traumatology.
*** p Fisher

Discussion

The results of these two investigations show that the prevalence of ARF and CRF on admission to hospital in aged patients of more than 59 years is high. At 9 years of interval, the prevalence of ARF progressed especially in men and that of CRF progressed in both genders. Nephrology care during hospital stay clearly progressed in 2005 compared to 1997.

The prevalence of ARF was evaluated at the beginning of the 90s with approximately 1% of the patients admitted to the veterans of Boston hospital [15]. In this American study, ARF is functional in 70%, parenchymatous in 17% and obstructive in 11%, unspecified mechanism in 2% of the patients.

The average age of the 100 patients studied was 61 years +/-13 years. In 1996, a Spanish study evaluated the annual incidence of ARF in patients hospitalized in 13 hospitals in Madrid with 209 patients per million inhabitants [16]. This study takes into account both ARF on admission and the one occurring in the course of hospitalization. Forty eight percent of the patients studied had a normal renal function on admission. ARF was functional in 22%, obstructive in 11% and parenchymatous origin in 56% of the patients. Nearly 14% of the cases occurred on a pre- existent CRF. The average age of this population was of 63 +17 years. A more recent American study carried out in African-Americans, compares the prevalence of ARF on admission to the one occurring in the course of hospitalisation [17]. The population studied has an average age of 54 years and 67% were men. The prevalence of ARF on admission was 0.55%, 3 times higher than the one that occurred in the course of hospitalization (0.15%).

Our results are hardly comparable to literature data, firstly because we immediately limited our study to the population aged over 59 years, secondly because the definitions of the ARF have evolved in time and according to studies [18]. It must be noted that in this elderly population both in 1997 and 2005, the CRF was mostly functional, joining the vascular kidney of inhabitants. It includes patients with serum creatinine value equal to or greater than 150 µmol/l (17 mg/l), all the men included in the study had at least a stage 3 CKD, while the elderly women with this same stage were excluded from the study. The differences in prevalence of CKD observed between men and women, both in 1997 and 2005 could therefore be reduced.

The method of calculation of the GFR (formula of Cockcroft and Gault) [7] can be inappropriate for the elderly. For the obese patient (BMI higher than 30 kg/m²), it overestimates the actual value of the GFR and for the elderly patient of more than 75 years it is yet to be evaluated [5].

These methodological limits explain the frequent over-estimate of stage 3 of CRF in certain studies of population where the percentage of false positives was estimated at 32% when the GFR was calculated by equation MDRD (Modification of Diet in Renal Disease) from a single measurement of serum creatinine [8]. The results of the NHANES III study published in 1998 [20] were reviewed and corrected in 2000 [21] for these methodological reasons.

The relationship between the level of serum creatinine and GFR measured by inulin clearance was specified in 1999 [9]. This study shows that the relationship between GFR calculated by the Cockcroft-Gault formula and the measured clearance inulin is quite good when the GFR is less than 60 ml/mn [9]. Our first study conducted in 1997 could not take into account these results. In the 2005 study, we retained the 1997 inclusion criteria to support benchmarking. Nevertheless, we considered the results of the study of Couchoud et al. [9] in order to define the ARF and CKD in patients included in both studies.

In the study by Junger et al. conducted in 1992 [22], the prevalence of CKD was calculated from a threshold value of serum creatinine 200 µmol/l (22 mg/l). It increased according to age, with a value of 739 pmi in men, and 354 pmi in women in the age group of 60 to 74 years, and 1124 and 354 pmi in the age group equal to or greater than 75 years. The difference in prevalence between men and women in the study by Jungers et al. [22] fell under the same methodological means other than the one we have just analyzed.

In the prospective study of the Île-de-France, only patients hospitalized in the nephrology departments were recorded. The study of the prevalence of CKD, limited to only the nephrology departments, underestimates the true prevalence of CKD in the hospitalized population. In our study, it is less than 55% of hospitalized patients with CKD who are hospitalized in nephrology. In 1997, with a threshold definition of CKD lower than the one in the study by Jungers et al. [22], the prevalence of CKD in the elderly, from the Pays de St Brieuc, was 5 times higher than that estimated in 1992 in Île-de-France, six times higher in men and 7 times in women. The French study in Île-de-France therefore underestimated the true prevalence of CKD in hospitalized patients, but confirmed that the majority of CKD patients were not seen by a nephrologist during their hospitalization.

In the NHANES III study conducted between 1988 and 1994 in the United States, which selected patients with serum creatinine equal to or greater than 17 mg/l (150 µmol/l), the prevalence of CKD in the American...
population was estimated at 1.9% in men and 0.7% in women [20]. In our study, with the same selection threshold, the prevalence of CKD related to the population of the Pays de St Brieuc was 0.92% for men and 0.42% for women in 1997, 1.3% and 0.63% in 2005.

After the epidemiological data of the NHANES III study were corrected in 2000, the prevalence of chronic kidney disease decreased between 1990 and 2000 by 12% for stage 3 (creatinine clearance between 59 and 30 ml/min) and 32% for stage 4 (creatinine clearance between 29 to 15 ml/min), while the prevalence of ESRD treatment during the same period increased by 70% [21].

Hypotheses to explain these epidemiological changes in 10 years are numerous: a methodological bias when the stage of kidney disease is defined by a single sampling of the serum creatinine [9], high mortality in CKD patients aged over 70 years, 52% of patients with stage 3-4 renal disease and aged over 70 years dying before ESRD treatment [9], a support increasingly early in replacement therapy as shown by serum creatinine at the time of dialysis that happened in the USA, from 87 mg/l in 1995 to 67 mg/l in 2004 [21].

This study provides original epidemiological data on renal failure acquired in a city area and evolving in hospital in population aged over 59 years hospitalized by ED. The existence of a RF on admission in the elderly is a severity indicator that should be taken into account upon admission to ED for patients with RF to receive a nephrologist advice during their hospital stay for an early treatment of those at risk of moving towards ESRD.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

What was Known

• The prevalence of ARF in a hospital intensive care, regardless of patient age
• The prevalence of ARF on admission to hospital regardless of age
• The prevalence of advanced CKD in nephrology departments

What this Article Contains

• The prevalence of renal failure (ARF and CKD) in patients admitted to the emergency department (ED) of a general hospital.
• The prevalence of ARF and CKD in patients aged over 59 years admitted to hospital by the ED.
• The causes of ARF in elderly patients admitted by the ED.
• The incidence of ESRD treatment occurring in hospitals, not attended to previously by a nephrologist.
• (The impact of a nephrology department in the early treatment of a patient with renal failure admitted to hospital by the ED)??
• The mortality rate at within months of patients with renal failure admitted to hospital.
• The evolution of all these data at 9 year interval.

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