Severity scoring and mortality 1 year after acute renal failure

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Introduction

Various scoring systems have been developed to optimize the use of clinical experience in ICU for prognosis and to address questions of effectiveness, efficiency, quality of care and correct allocation of scarce resources [1,2]. The general severity scoring systems, however, are inappropriate for a disease-specific population [3]. We introduced a scoring system, useful for all patients with acute renal failure (ARF) admitted to the ICU, whether treated or not with renal replacement therapy (RRT). The Stuivenberg Hospital Acute Renal Failure (SHARF) score for hospital mortality of patients with ARF was developed in a single centre study, using two scoring moments (baseline and after 48 h) [4]. In a second phase, the SHARF score was tested in a multi-centre study in 293 patients. After adaptation, this predictive model for hospital mortality in ARF proved to be useful in different settings for comparing groups of patients and centres [5].

Even more than hospital mortality, long-term survival and quality of life have become important outcome parameters studied in other areas of epidemiological research. Also in the treatment of ARF, it has been recommended that these outcome measures should be incorporated in future research [6,7]. To date, however, little is known about the long-term outcome of ARF.

We used the cohort of the multi-centre SHARF study to investigate mortality and renal function 1 year after ARF and to assess the long-term predictive value of the SHARF score.

Subjects and methods

In our prospective cohort study, 8 centres included all consecutive patients \( n = 293 \) with ARF defined as a creatinine above 2 mg% without known preexisting renal disease [5]. Half of the patients died during their hospital stay. The remaining 145 patients were contacted 1 year after hospital discharge. After mortality was checked in the National Registry, a questionnaire was sent to the general practitioner (GP). Where the GP was not known, the questionnaire was sent directly to the patient or to the nursing home where the patient lived. Data on serum creatinine and body weight were collected. Reminders to GPs, direct mailing to the patient, consultation of hospital databases and phone calls were used to complete the missing data.

Renal function at hospital discharge and 1 year later was investigated using the calculated creatinine clearance according to the Cockroft and Gault formula [8]. Stages of chronic kidney disease at hospital discharge and after 1 year were defined according to the NKF K/DOQI guidelines [9].

Data were analysed using the SPSS statistical package. For descriptive results, differences were tested using Student’s \( t \) and chi-square test with significance level put at \( P < 0.05 \). Survival was investigated using the method of life table analysis.

Results

The population studied consisted of 145 patients that survived hospitalization after ARF. Patient characteristics at hospital discharge are given in Table 1. Mortality after hospital discharge could be traced for all patients: 32 out of the 145 hospital survivors \( (22.1\%) \) died within 1 year. Total mortality increased by the end of hospitalization from 51 to 62% within 1 year after ARF (Figure 1). At hospital discharge, 46 patients showed a normal to mild decreased GFR (creatinine clearance of 60 ml/min and more), 85 patients had a moderate to severe decreased GFR (creatinine clearance between 15 and 59 ml/min) and 14 patients had kidney failure (creatinine clearance below 15 ml/min). In these three groups, 1 year mortality was 33, 18 and 14%, respectively.
One-year non-survivors were older than survivors (73.5 (SD = 10.1) vs 65.5 (SD = 14.3) year; \( P = 0.004 \)) and had more heart failure (59 vs 31%; \( P = 0.003 \)) and multi-organ failure (38 vs 21%; \( P = 0.052 \)) during ICU stay. At hospital discharge, non-survivors had a mean serum creatinine of 1.7 mg/dl (SD = 0.9) compared with 2.1 mg/dl (SD = 1.9) in survivors (\( P = 0.282 \)). No difference in 1-year survival could be observed in patients treated or not treated with RRT (Figure 2).

In contrast to APACHE II and Liano, the SHARF scores calculated during ICU stay differed significantly between the 1-year survivors and non-survivors (Table 2).

Renal function 1 year after hospital discharge could be documented for 105 out of 113 survivors. Mean serum creatinine of these survivors was 1.7 mg/dl (SD = 0.9) compared with 2.1 mg/dl (SD = 1.9) in survivors (\( P = 0.282 \)). No difference in 1-year survival could be observed in patients treated or not treated with RRT (Figure 2). In contrast to APACHE II and Liano, the SHARF scores calculated during ICU stay differed significantly between the 1-year survivors and non-survivors (Table 2).

The observation, that the highest mortality was observed in patients discharged with normal to mild decreased GFR and lowest mortality in ESRD patients, cannot be explained. It is possibly due to the low numbers and the rather short observation period for mortality. It can be indicative for ‘survival of the fittest’ in the ESRD group. Overall, it is clearly demonstrated that renal failure strongly increases cardiovascular risk [12], albeit that a 1-year period is rather short to result in an increased mortality. It is still possible that renal failure of patients at hospital discharge was an indirect sign of their bad cardiovascular situation. This was suggested by the finding that heart failure during ICU stay was more prevalent in non-survivors than in survivors.

The bad prognosis of ARF is generally expressed as hospital mortality. The SHARF score and other
Severity scores were developed using hospital mortality as an outcome variable. One can question, however, whether this kind of score remains partly predictive for long-term survival. We were able to demonstrate that the SHARF score showed significant differences between survivors and non-survivors while the APACHE II and Liano scores did not.

We conclude that a large number of patients surviving ARF in ICU died during the first year after hospital discharge. Further investigation should focus on long-time survival and look for preventive measures in this field, such as a better follow-up of ARF patients after hospital discharge.

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References


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Table 2. Severity of illness scores of long-term survivors and non-survivors

<table>
<thead>
<tr>
<th></th>
<th>One-year survivors*</th>
<th>One-year non-survivors*</th>
<th>( P )-value of difference</th>
<th>Predictive value of mortality area under ROC curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II</td>
<td>18.9 (5.7)</td>
<td>20.0 (5.0)</td>
<td>0.315</td>
<td>0.623</td>
</tr>
<tr>
<td>Liano</td>
<td>0.53 (0.16)</td>
<td>0.59 (0.14)</td>
<td>0.054</td>
<td>0.587</td>
</tr>
<tr>
<td>SHARF 0</td>
<td>34.2 (18.6)</td>
<td>42.9 (21.4)</td>
<td>0.028</td>
<td>0.791</td>
</tr>
<tr>
<td>SHARF 48</td>
<td>27.8 (19.4)</td>
<td>39.2 (24.9)</td>
<td>0.011</td>
<td>0.833</td>
</tr>
</tbody>
</table>

*Mean (SD).