Survival from acute renal failure with and without multiple organ dysfunction

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Summary

A 10-year retrospective analysis has been carried out of 114 patients dialysed for acute renal failure. Fifty-eight patients, predominantly suffering from multiple organ failure, required treatment in an Intensive Therapy Unit (ITU); 56 less severely ill patients were treated in a Renal Unit. Overall survival in the former group was 36% and in the latter group 63%.

In the first 5 years of the study, survival in the ITU patients was 31% and in the second 5 years, was 38% in spite of a trend towards increased severity of illness. These results challenge the view that haemodialysis is rarely worth-while in patients with multiple organ failure, and suggest that current management techniques have improved prognosis. The most important adverse factors continue to be old age, sepsis and gastrointestinal disease.

Introduction

A degree of renal impairment is common in critically ill patients, the majority of whom regain full renal function with conservative management (Brown, 1977). A small number, however, progress to established acute renal failure (ARF). The high mortality in critically ill patients with ARF, particularly amongst those with associated respiratory failure (Kraman *et al.*, 1979; Glenney *et al.*, 1979) has led to doubts about the value of dialysis in this situation.

In the present retrospective study a review was made of 2 groups of patients dialysed for ARF. Because of the severity of their illness one group of patients required treatment in an Intensive Therapy Unit (ITU) while the other group was managed in a Renal Unit. A clinical scoring system provided an assessment of the severity of illness in both groups of patients.

Patients and methods

The period under review extended from January

1969 to December 1978. The diagnosis of ARF was based on standard clinical and biochemical criteria and all patients had at least one dialysis. No patient with pre-existing chronic renal failure was included. Fifty-eight patients (33 male, 25 female) were treated in the ITU and 56 patients (36 male, 20 female) in the Renal Unit.

A previously described clinical scoring system (Civetta, 1977) was used to quantify the severity of illness; a modification of the system was introduced to take account of the duration of shock (Table 1).

TABLE 1. Clinical scoring system (adapted from Civetta, 1977)

Constant = 57.7	
Complication co-efficients	
Age	= 0.25/year
Renal	= 10.2
Sepsis	= 5.6
Shock < 4 hr	= 5.6
Shock > 4 hr	= 11.2
Gastro-intestinal	= 3.4
Bleeding	= 2.6
Cardiac	= 0.75
Respiratory	= 0.45

Co-efficients for individual complications are subtracted from the computer-calculated constant to give the 'Clinical severity score'. Patients with scores less than 20 are unlikely to survive.

Each patient was scored immediately before the first dialysis and the resulting figure used as a 'clinical severity score'. A low score indicated a severe illness with a poor prognosis.

Death was attributed to renal failure if advanced uraemia, serious electrolyte imbalance (such as hyperkalaemia) or fluid overload, uncontrolled by dialysis, were present at the time of death. The criterion of survival was discharge from hospital.

The same team of physicians was responsible

for dialysis throughout the 10-year period. Haemodialysis was used in all patients except for 2 in the ITU and 6 in the Renal Unit who received peritoneal dialysis. Dialysis was performed 3 or 4 times per week in the early part of the study but on a daily basis during the later phase. Disposable coil dialysers were used initially and hollow fibre kidneys during recent years. Mechanical ventilation was required at some stage in all the ITU patients, but in none of those in the Renal Unit.

Results

The period of study was divided into 2 halves; a greater number of patients appeared in the second 5-year period in both groups. The clinical scores and survival are presented in Table 2. The clinical scores and survival were lower in the ITU group than in the Renal Unit group ($P < 0.05$) but more than one third of the ITU patients survived overall. Moreover, in spite of a statistically significant fall in clinical score ($P < 0.01$) amongst the ITU group in the second 5-year period, survival did not fall.

The principal precipitating conditions together with survival are shown in Table 3. Sepsis was the commonest aetiological factor in both groups, with associated shock predominating in the ITU patients. Survival amongst patients with gastrointestinal sepsis in the ITU was the lowest of any group (20%).

Survival was greatest amongst patients with obstetric disorders and poisoning. Age was not a factor of prognostic significance amongst ITU patients but in the Renal Unit group survivors were younger (48 years) than non-survivors (61 years; $P < 0.005$). The mean duration of dialysis amongst survivors in the ITU group was 11 days (range 1–35 days) and in the renal group was 9 days (range 1–49 days).

Survivors in the ITU group had a lower overall clinical score than had survivors in the Renal Unit group ($P < 0.001$). The clinical scores for survivors and non-survivors were calculated for 2-year periods in both groups (Fig. 1). The mean clinical score amongst survivors in the ITU group (23 ± 1) was significantly higher than amongst non-survivors (16 ± 1 ; $P < 0.001$). The comparable figure for Renal Unit patients were 28 ± 1 and 22 ± 1 respectively ($P < 0.001$). There was a trend amongst survivors in both units during the later phase of the study to be more severely ill.

The precise cause of death was difficult to determine even when post-mortem was performed. Death was considered to be a direct result of ARF in only 2 patients in each of the 2 groups. The remaining patients died from other causes while remaining in satisfactory biochemical and fluid balance. The mode of death tended to differ between the ITU and renal groups. In the ITU patients, death usually

TABLE 2. Clinical score and survival from acute renal failure

	Patients No.	Age (in mean years $\pm$ s.e. mean)	Clinical score (mean $\pm$ s.e.)**	Survival %***
ITU				
(a) 1969–73	16	48 (4)	22 (2)*	31
(b) 1974–78	42	46 (2)	17 (1)*	38
Renal unit				
(a) 1969–73	25	51 (3)	26 (1)	56
(b) 1974–78	31	54 (4)	26 (1)	68

*Statistically significant difference between ITU (a)/(b) ($P < 0.01$, *t*-test).

Statistically significant difference between ITU (a) + (b)/Renal Unit (a) + (b) ($P < 0.01$, *t*-test). *Statistically significant difference between ITU (a) + (b)/Renal Unit (a) + (b) ($P < 0.01$, χ^2 test).

TABLE 3. Precipitating conditions and survival from acute renal failure

Precipitating condition	ITU group No. patients (No. survivors)	Renal unit group No. patients (No. survivors)
Shock		
(a) Gastrointestinal sepsis	25 (5)	8 (2)
(b) Other sepsis	10 (5)	4 (2)
(c) Hypovolaemia	14 (5)	8 (4)
Sepsis	1 (1)	13 (8)
Cardiac	3 (1)	5 (2)
Poison/overdose	2 (1)	6 (6)
Obstetric	1 (1)	4 (4)
Other	2 (2)	8 (7)

FIG. 1. Clinical scores for survivors (●---●) and non-survivors (*—*), calculated for 2-year periods, in the (a) ITU and (b) Renal Unit groups.

followed a period of multiple organ failure, and gross sepsis was often present at the time of death; in the Renal Unit group, death usually followed a rapid, frequently cardio-vascular, deterioration in which sepsis was not a prominent feature. Four patients in the ITU group recovered renal function but subsequently died. Two further patients in this group died immediately after starting their first dialysis, perhaps owing to the haemodynamic effects of the procedure in septic patients (Samii *et al.*, 1978).

All the survivors regained adequate renal function although, because of lack of information as to previous state of health, some deterioration in renal function, particularly in older patients, could not be excluded.

Discussion

The presence of associated disturbances complicates comparison between clinical studies of survival from ARF. The overall survival of 49% in the present group of 114 patients is similar to that reported by others (Stott *et al.*, 1972; Kennedy *et al.*, 1973). The clinical subdivision of patients into those with and those without major associated conditions, confirmed by the clinical scoring system, allowed more detailed analysis of available data. The survival of 63% amongst patients without major complications appears to be superior to that reported in recent studies (Dandy and Sapir, 1977) although direct comparison is difficult. The survival of 36% amongst patients with multiple organ failure is clearly less satisfactory but is considerably more encouraging than that suggested by some authorities (Kraman *et al.*, 1979; Robson, 1975; Linton, 1974).

The possibility that more careful selection of patients for dialysis might have affected survival

figures within the ITU group is not supported by the facts. Firstly, the number of patients dialysed increased and secondly, the mean clinical scores decreased over the period of study. In the last 2 years of the study in particular, dialysis was withheld from only 2 patients (on the grounds of age and terminal condition).

The factors that have been recognized in previous studies (Stott *et al.*, 1972; Kennedy *et al.*, 1973) as carrying a poor prognosis—old age, sepsis and gastrointestinal disease—were accounted for in the clinical scoring system, and continue to be of sinister significance. It also appeared that the severity of the precipitating illness was the single most important influence on survival. Morbidity and mortality due to ARF *per se* can be more or less eliminated by aggressive supportive care.

Modifications in management doubtless contributed to the increased survival (despite a trend towards more severe illness). The introduction of the H_2 -receptor antagonist, cimetidine, appears to have reduced the mortality associated with gastrointestinal haemorrhage in established ARF. Regular daily use of dialysis, increased efficiency of modern disposable kidneys, and use of sequential ultrafiltration and dialysis are all major improvements in technique. Ultrafiltration allows the removal of several litres of fluid before or after dialysis. It thus enables a high calorie/high nitrogen intake to be given without attendant overhydration (the current aim in the ITU group is to give at least 2500 kcal and 10–15 g nitrogen/day). In the authors' opinion, there is little place for peritoneal dialysis in the management of adult ARF in the ITU; the technique is less efficient and appears more liable to produce respiratory complications. In addition to

improved renal management, better co-ordinated care of patients in the ITU has also led to increased survival. In particular, a more rational use of antibiotics together with an active approach to surgical elimination of sepsis appears to have reduced mortality from septic shock (Ledingham and McArdle, 1978; Ledingham, McArdle and Macdonald, 1980).

Haemodialysis is not used as often as is possible in many ITUs because in patients with multiple organ failure it is felt to be unrewarding. The survival of 36% in the present study provides justification for the considerable expenditure of time and effort involved in the management of these patients.

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