Acute Renal Failure Requiring Dialysis – A 5 Year series

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Summary

A retrospective review of 246 patients with established acute renal failure (ARF) needing dialysis from 1990 - 1994 is reported from Hospital Sultanah Aminah, Johor Bahru. Peritoneal dialysis was more commonly used than haemodialysis or haemofiltration. Patients on mechanical ventilation in Intensive Care Unit (ICU) who were hypercatabolic and fluid overloaded were treated with haemofiltration. Males outnumbered females by a ratio of 1.5 : 1. The majority were Malays (61.4%). Most patients were from the district of Johor Bahru, but 41.5% were from other districts in the Johor state. The mean age was 47.1 years (SD 18.2). The ARF was caused by acute tubular necrosis in 55.3%, post-renal obstruction in 22.8%, nephrotoxins in 5.7% and other causes in 16.2%. The proportions of patients referred from the medical, surgical and obstetric and gynaecology units were 50.8%, 45.5% and 3.7% respectively. The mortality rate was 48%. Patients with established ARF should be dialysed early as they tolerate uraemia poorly. Prevention is by prompt treatment of patients with sepsis, avoidance of hypovolaemia and nephrotoxic drugs.

Key Words: Acute renal failure, Dialysis

Introduction

Acute renal failure (ARF) is reversible renal failure of sudden onset. Dialysis is required when it is severe, prolonged or when complications such as fluid overload, hyperkalemia and metabolic acidosis supervene. The commonest cause is ischaemic acute tubular necrosis (ATN)[1,2] although urinary tract obstruction and drug toxicity are not uncommon causes.

Hospital Sultanah Aminah Johor Bahru (HSAJB) has 960 beds[3], being the major general hospital in the Johor state (population 2.2 million) serving an immediate population of about 800,000[4] in the district of Johor Bahru. Dialysis, either peritoneal dialysis or haemodialysis is readily available for all patients with ARF. Continuous arterio-venous, veno-venous haemofiltration and haemodiafiltration (CAVH / CVVH / CVVHD) were also available from late 1991. In this series all patients with ARF requiring dialysis admitted between 1/1/90 and 31/12/94 were included. Causes, outcome and patient characteristics are discussed.

Materials and Methods

Patients' records were analysed from the "acute haemodialysis" register and from records of peritoneal dialysis kept in the medical wards and intensive care unit (ICU) between 1/1/90 and 31/12/94. Patients with chronic renal failure were excluded. It was possible to trace all the case notes.

Statistical analysis: Values were expressed as mean ± standard deviation (SD) or percentages where appropriate. Variables were tested for association with survival using χ^2 (chi squared) analysis. Significance level was set at $p < 0.05$.

Results

There were 246 patients with ARF, 145 of whom were males. The male : female ratio was 1.5 : 1.

Three hundred and fifty-six peritoneal dialyses were performed in 191 patients (77.6%) (average 1.9 times per patient). Haemodialysis was performed on 34 patients whilst 8 patients had both haemo- and peritoneal dialysis. Haemofiltration was performed in 13 patients (10 had CVVHD, 2 CAVH and 1 CVVH).

The mean age was 47.1 years (SD 18.2; range 5 months to 88 years). The peak age range was 51 - 60 years (Figure 1).

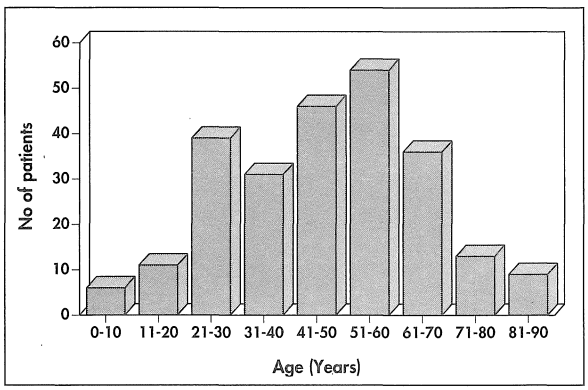

Fig. 1: Age distribution of patients

Figure 2 illustrates the ethnic composition of the patient group. Fifteen of the patients in the category labelled "others" were Indonesians. One hundred and forty-four of the patients were from the Johor Bahru district.

The frequency of the type of dialysis undertaken is shown in Table I. All the 13 patients on haemofiltration were treated in ICU (the mortality rate was 61.5%). CAVH and / or CVVH were carried out 3 times between 1991 and early 1993. From August 1993 till December 1994 the 10 patients who received haemofiltration were treated with CVVHD (continuous veno-venous haemodiafiltration).

Table II summarises the causes of ARF.

Dialysis was performed most commonly in the male medical wards (40.7%) followed by ICU (30.9%), female medical wards (26%), the paediatric wards (1.2%) and the coronary care unit (1.2%).

As figure 3 shows, the commonest causes of ARF were ischaemic acute tubular necrosis (ATN), obstructive uropathy and nephrotoxins. Forty-three patients (17.5%) were diabetic.

Septicaemia (n = 15), pneumonia (n = 9) and leptospirosis (n = 13) were common causes of ARF in the medical wards. The patients with ARF caused

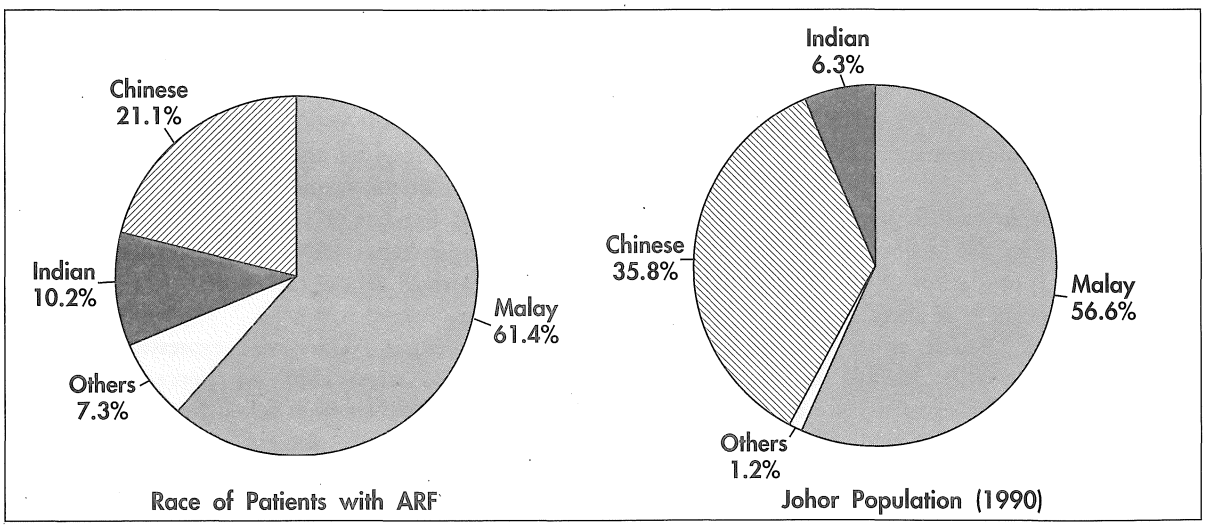

Fig. 2: Ethnic composition of the patients in comparison to the population of Johor

Table I

Type of dialysis	Number
Peritoneal dialysis (PD) alone	191
Haemodialysis (HD) alone	34
HD & PD	8
CVVHD	7
CVVHD & PD	2
CVVHD & HD	1
HD & PD & CAVH	1
CAVH & CVVH	1
CVVH alone	1
Total	246

PD = Peritoneal Dialysis
HD = Haemodialysis
CVVHD = continuous veno-venous haemodiafiltration
CAVH = continuous arterio-venous haemofiltration
CVVH = continuous veno-venous haemofiltration

primarily by drugs or poisons had a mortality rate of 91%. In 17 patients nephrotoxic drugs contributed to the ARF, but were not the main aetiological factor. Fifteen of the surgical cases were related to intraabdominal injury, 6 of whom survived.

There was no urologist in HSAJB until January 1993 and patients with bilateral ureteric obstruction were transferred to Kuala Lumpur Hospital after dialysis. From 1993 onwards most patients with renal failure and obstruction were treated on site.

Obstructive uropathy was due to malignancy in 14 cases of which carcinoma of the cervix was the commonest type. Of the non-malignant group the commonest problem was bilateral obstruction due to stones.

There were 8 pregnancy-associated ARFs in 5 years. of whom 4 died. In the corresponding period there were 80,347 births in HSAJB; this amounts to 1 obstetric ARF per 10,043 births.

Table II
Aetiology and outcome of treatment

Cause	No. of cases	Survival rate (%)
Medical		
Infection	66	28/66 (42.4%)
Glomerulonephritis	12	7/12 (58.3%)
Nephrotoxins	14	4/14 (28.6%)
Cardiac	6	4/6 (66.7%)
Others	27	14/27 (51.9%)
Surgical		
Intraabdominal injury	15	6/15 (40%)
Gangrene limbs	16	7/16 (43.8%)
Obstructive uropathy due to cancer	14	8/14 (57.1%)
Obstructive uropathy due to stones	33	26/33 (78.8%)
Others	34	20/34 (58.8%)
O & G causes	9	4/9 (44.4%)
Drugs as a secondary cause of ARF		
Aminoglycosides	10	5/10 (50%)
NSAIDs	5	3/5 (60%)
ACE inhibitors	2	0/2 (0%)

NSAIDs = non-steroidal anti-inflammatory drugs
ACE = angiotensin converting enzyme

The overall mortality of ARF was 47.6%. In 1 patient the outcome was unknown.

Discussion

This was a series of 246 consecutive patients dialysed for ARF over 5 years (1990 - 1994) in HSAJB. The estimated incidence of obstetric ARF is 1 per 10,000 births[7] a rate similar to that observed at HSAJB. 41.5% of patients were from outlying districts, perhaps because facilities for peritoneal dialysis but not haemodialysis are available in Kluang, Batu Pahat and Muar district hospitals.

Table III
Probability of survival

Variable	Survivors No. = 128	Non-survivors No. = 117	χ^2 p value
ICU	30	46	
Male ward	63	37	
Female ward	31	32	P < 0.02
Others	4	2	
Malay	86	64	
Chinese	25	27	
Indian	7	18	p < 0.05
Others	10	8	
> 60 years old	21	37	P < 0.01
Ischaemic ATN	60	76	
Obstruction	43	12	
Nephrotoxins	4	10	P < 0.001
Others	21	19	

ns = not significant

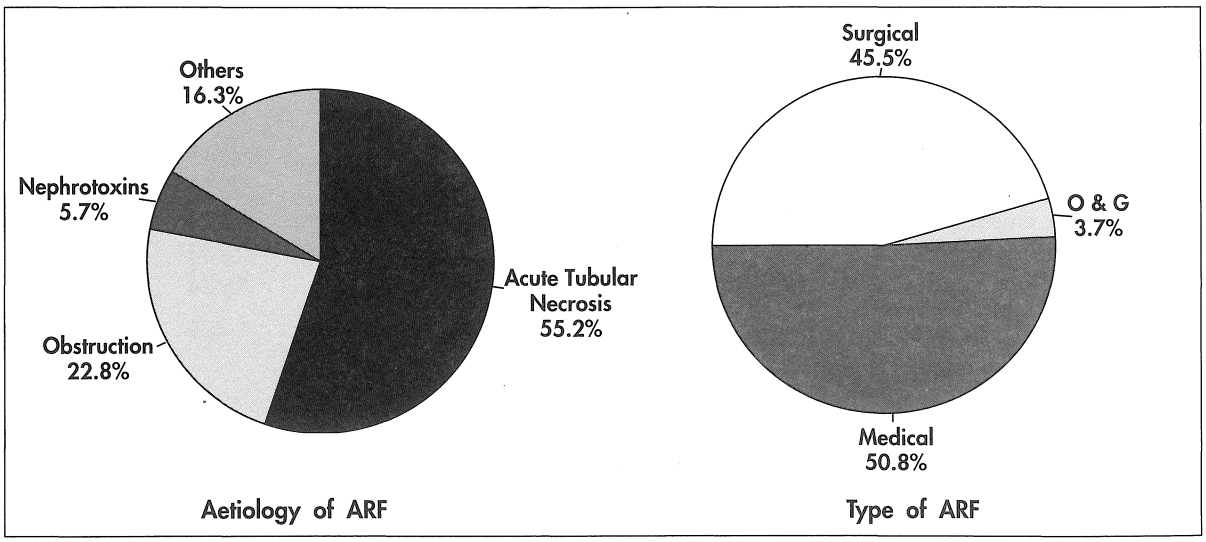

Fig. 3: Causes of ARF

Peritoneal dialysis was used more often (77.6%) than haemodialysis, as in 2 series from Kuala Lumpur Hospital[8,9]. The 13 patients on haemofiltration were managed in ICU, as they were ill, hypercatabolic, often with a recent laparotomy. Diabetes mellitus was present in 17.5% of patients compared to only 4% in the general population[10].

The mortality rate of 48% was similar to other series. There was no significant difference in mortality according to sex of the patient, mode of dialysis or year of observation.

The mortality rate was higher in Indians (72%) than in other races. On analysing the small group of Indians it was found that poisoning (2 from paraquat and 1 from aminophylline), alcoholic complications, i.e. haemorrhagic pancreatitis and hepatic failure with septicaemia (2) accounted for some of the excess mortality. Two non-compliant females who died of SLE were also Indian.

Age of more than 60 years carried a significantly higher mortality. Obstructive uropathy had a better prognosis than ARF caused by ischaemic ATN or nephrotoxins with a mortality of 22% ($p < 0.001$).

While "tropical diseases" still accounted for some cases, the major causes of ARF were septicaemia, post-operative sepsis and nephrotoxins. No case of septic abortion was found in the obstetric group and snake bites were not a cause as there are few poisonous snakes in south Peninsular Malaysia.

The mortality of a series of patients with established ARF depends on aetiology and the underlying disease. The mortality rate of patients with ARF uncomplicated by other organ failure is less than 10% while those with 4 or more organ system failures have a mortality of more than 90%[15]. At present there is no method of scoring and outcome prediction that is accepted.

Patients with ARF tolerate uraemia poorly compared to those with chronic renal failure[16] because of the rapid rise of blood urea. Dialysis should be instituted early before patients are moribund.

The method of dialysis does not have a significant effect on outcome. Peritoneal dialysis may be used in noncatabolic patients but should not be a substitute for extra-corporeal methods of dialysis because of lack of facilities[15]. Patients who are hypercatabolic or with a recent laparotomy should receive haemodialysis or haemofiltration. Haemofiltration is useful in patients with cardiovascular instability[16] and hypotension who are fluid overloaded. It is often used for patients on mechanical ventilation in ICU. Haemofiltration offers superior control of blood urea and fluid balance. Removal of large volumes allows replacement of fluid with total parenteral nutrition.

Prevention of established ARF will lower the mortality rate. There is a lack of awareness that elderly patients are prone to ARF e.g. after a major operation, hypovolaemia or use of nephrotoxic drugs[16] such as aminoglycosides and ACE inhibitors. Sepsis is a major problem in all age groups. There should be meticulous attention to fluid balance and avoidance of toxic drugs.

Gentamicin-induced ARF is a common problem[9,17]. Although therapeutic drug monitoring (TDM) is available it is not used often enough. Patients have developed ARF with drug levels within the therapeutic range because of prolonged usage and tissue accumulation. Gentamicin should be administered with frequent monitoring of drug levels[18] and renal profile. In hospitals where TDM is not available it should not be used.

Conclusion

This paper characterises the causes, mode of treatment and outcome of severe ARF in a general hospital. As dialysis and other treatments of ARF are expensive and time-consuming, a database of patients is useful in future planning of management, prognosis assessment and prevention.

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