

The Use of Peritoneal Dialysis in Acute Renal Failure during Severe Malaria : a Survey at Tak Provincial Hospital

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Abstract

Eighteen patients (14 males, 4 females ; aged 19-56 years) with severe falciparum malaria complicated by acute renal failure (ARF) were treated with peritoneal dialysis (PD) at the Tak Provincial Hospital. All patients received standard antimalarial therapy consisting of 20 mg quinine/kg infused over 4 hours, then 10 mg quinine/kg infused over a period of 2 hours every 8 hours for 7 days. Five patients (28%) with ARF died by the fifth day of hospitalisation. There was an association between the day of illness when PD was started and mortality rates (7.8 days in nonsurvivors vs 4.9 days in survivors, $p < 0.0001$). These observations suggest that PD may be beneficial in treating ARF associated with severe malaria, especially when instituted earlier in the course of illness. (*J Infect Dis Antimicrob Agents 1997;14:5-9.*)

INTRODUCTION

In 1994, 1,141 malaria patients [falciparum (83.6%) and vivax (16.4%)] were admitted to the Tak Provincial Hospital. Twenty-one deaths (1.8%) were attributed to complications of falciparum malaria to include cerebral involvement (coma), pulmonary edema or acute renal failure (ARF) (1). Since ARF in severe falciparum malaria carries a high mortality rate, ranging from 10 to 90 percent (2-4), early diagnosis and treatment to restore renal function is recommended (5,6). One method of treating ARF associated with malaria is hemodialysis which has been shown to decrease mortality (7,8). However, hemodialysis requires sophisticated equipment not available in most hospitals in malarious areas. Peritoneal dialysis (PD) is a simpler technique that can be performed in most community hospitals. The aim of this survey was to describe outcomes in patients who were treated with PD for malaria related ARF in a community hospital setting. The findings suggest that PD is useful in ARF associated with severe malaria, especially when initiated early in the course

of illness.

PATIENTS AND METHODS

Patients treated by PD for ARF associated with severe falciparum malaria at the Tak Provincial Hospital from October 1992 to November 1995 were characterized. Patients included in the survey were at least 16 years old, had asexual parasite forms in blood smears consistent with *Plasmodium falciparum*, fulfilled the criteria for severe malaria according to the WHO criteria (3), and had clinical and laboratory evidence of ARF which included a urine output of less than 400 ml in 24 hours and/or a urine output of less than 20 ml/hour after resuscitated with intravenous normal saline and diuretic therapy. A detailed history was obtained all patients to include description of symptoms and duration of illness and fever. "Days of illness" were indexed to the day fever was first noted. All patients received antimalarial therapy consisting of quinine : a loading dose of 20 mg/kg infused over 4 hours, then 10 mg/kg infused over 2 hours every 8 hours for 7 days. General supportive

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therapy included antipyretics, fluid and electrolyte maintenance, and treatment of other complications such as hypoglycaemia, anemia, pulmonary edema, convulsions, and sepsis were instituted as necessary. A standard protocol for PD (1-2 litres of peritoneal dialysis fluid ; Perisolution A & C[®] , Osuka ; per 1-2 peritoneal cycle hours) was performed when ARF was diagnosed. PD was discontinued when there were objective signs that ARF was resolving such as decreasing levels of uremia and increasing urine output with adequate osmolality.

RESULTS

Eighteen patients (14 males, 4 females ; 19-56 years old) developed ARF. Clinical and laboratory data are shown in Tables 1 and 2. Based on mortality rates,

two groups of patients were identified : patients receiving dialysis before the 7th day of illness (mean 4.9 days, n=13)(early PD, Group I) and patients receiving PD after the 7th day of illness (mean 7.8 days, n=5)(late PD, Group II). In comparison to the patients in early PD group, the patients in the late PD group generally delayed seeking medical evaluation despite for a febrile illness.

All early PD patients (group I) survived. The mean number of PD cycles was 95.4 ± 51.1 (\pm SD) with a range of 22-230. Four patients in this group developed peritonitis that responded to antibiotic therapy. Three patients required blood exchange transfusion for hyperparasitemias.

All late PD patients (group II) had ARF unresponsive to PD and none survived. The mean number of PD

Table 1. Clinical characteristics of patients that received early or late PD based on the duration of illness.

Group I Pt. no.	Age (yr.)	Sex (Male/Female)	Fever before admission (day)	Illness before dialysis (day)
1	38	M	3	4
2	25	F	4	5
3	30	F	2	4
4	25	M	3	4
5	43	M	4	6
6	28	F	3	5
7	38	M	2	5
8	28	M	2	4
9	35	M	5	6
10	53	M	3	5
11	26	M	5	6
12	29	F	1	5
13	19	M	3	5
Mean	32.1	1.3	3.0	4.9
SD	9.1	0.4	1.2	0.7

Group II Pt. no.	Age (yr.)	Sex (Male/Female)	Fever before admission (day)	Illness before dialysis (day)
14	35	M	7	7
15	39	M	6	8
16	56	M	7	8
17	25	M	4	9
18	20	M	6	7
Mean	35.0	1.0	6.0	7.8
SD	13.9	0.0	1.2	0.8
t	0.5	1.4	4.6	7.01
p	0.6	0.1	0.0003	<0.0001

cycles was 35.2 ± 28.2 (SD). One patient died from complications of adult respiratory distress syndrome (ARDS). Another patient required blood exchange transfusion for hyperparasitemia. In comparison to early PD patients, late PD patients had significantly lower urine outputs when PD was initiated ($p < 0.5$, Table 2) and higher parasitemias.

DISCUSSION

Acute renal failure complicated from severe falciparum malaria is associated with a high mortality rate. Some therapeutic interventions such as hemodialysis can significantly reduce mortality (15). However, hemodialysis is a sophisticated technique generally not available in hospitals where severe malaria infections present. An alternative to hemodialysis is PD which has also been shown to reduce mortality and is useful

when it is administered promptly upon recognition of ARF (15). Indeed, in this survey of severe falciparum patients stratified into early and late PD based on duration of illness, all patients receiving PD earlier in the course of illness survived whereas patients receiving PD later in the illness did not. As in previous reports, patients with non-oliguric renal failure responded better than oliguric renal failure (mortality rate of non-oliguric renal failure = 8.3 percent [1/12 patients] vs oliguric renal failure = 26.7 percent ; $p < 0.01$) (4-6). As in previous reports, PD appears to be beneficial in ARF associated with malaria especially when started earlier in the course of illness.

The mortality rate of severe falciparum malaria can be reduced by early diagnosis and prompt treatment with antimalarial drugs and recognition of complications. In patients with severe malaria, the three most common

Table 2. Admission hematological and biochemical data of the two groups.

Group I Pt.no.	Hct. (%)	M.P./ 100 RBC	BUN (mg%)	Cr. (mg%)	Total Bilirubin (mg/dl)	Urine output/24 hr. (ml)
1	36	15	96.3	11.1	15.8	900
2	31	13	62.5	6.8	13.8	1,050
3	33	16	78.3	3.5	13.0	450
4	20	75	75.8	8.2	3.0	1,570
5	41	65	86.3	8.9	13.0	1,000
6	16	25	98.6	6.0	36.8	950
7	18	78	62.0	4.0	15.2	800
8	13	90	137.5	17.3	13.0	1,950
9	29	45	169.2	11.7	24.2	420
10	38	63	135.4	5.0	7.5	800
11	25	50	85.0	4.3	34.5	150
12	22	31	62.5	3.7	7.2	700
13	38	25	126.3	6.2	8.2	170
Mean	27.7	45.5	98.1	7.4	15.8	839.2
SD	9.3	26.6	33.9	4.0	10.2	510.4

Group II Pt.no.	Hct. (%)	M.P./ 100 RBC	BUN (mg%)	Cr. (mg%)	Total Bilirubin (mg/dl)	Urine output/24 hr. (ml.)
14	14	85	76.8	4.2	7.5	81
15	25	70	88.8	4.0	13.4	170
16	20	67	88.7	4.3	6.5	225
17	14	69	56.0	5.8	4.6	150
18	21	74	118.7	5.5	10.0	480
Mean	18.1	7.3	85.8	4.7	8.4	221.2
SD	4.7	7.1	22.7	0.8	3.4	153.5
t	2.0	2.2	0.7	1.4	1.5	2.6
p	0.06	0.03	0.4	0.1	0.1	0.01

Table 3. Outcome of peritoneal dialysis.

Group I Pt.no.	Cycles of dialysis	Out come	Blood exchange transfusion	Other complications
1	92	Survive	No	
2	22	Survive	No	
3	69	Survive	No	
4	100	Survive	Yes	
5	230	Survive	No	Peritonitis
6	96	Survive	No	Peritonitis
7	130	Survive	Yes	Peritonitis
8	80	Survive	Yes	Peritonitis
9	94	Survive	No	
10	46	Survive	No	
11	139	Survive	No	
12	83	Survive	No	
13	60	Survive	No	
Mean	95.4	-	-	-
SD	51.1	-	-	-

Group II Pt.no.	Cycles of dialysis	Out come	Blood exchange transfusion	Other complications
14	71	Die	Yes	
15	6	Die	No	ARDS
16	16	Die	No	
17	59	Die	No	
18	24	Die	No	
Mean	35.2			
SD	28.2			
t	2.4			
p	0.02			

complications leading to death are pulmonary edema, acute renal failure, and sepsis (Looareesuwan, personal communication). Since ARF frequently predisposes patients to pulmonary edema and sepsis, it is critical that ARF be promptly recognized and aggressively treated by techniques such as dialysis. Acute renal failure is a hypercatabolic condition that can be recognized by clinical signs and symptoms before levels of urea nitrogen or creatinine increase. Management strategy should also focus on preventing pulmonary edema, infections, high fevers electrolyte imbalance, hypoglycemia, lactic acidosis, and convulsions. Another complication in severe falciparum malaria that requires aggressive management is anemia. In this survey, more than half of the patients (56%) were anemic (hematocrit <25%) and received blood transfusion. Four patients in this study with hyperparasitemias underwent blood

exchange transfusion ; three of them survived. Blood transfusions benefit the patient by restoring the hematocrit. Secondary benefits probably include reduced parasitemias, levels of toxic substances and inflammatory cytokines.

The pathophysiology of ARF in severe malaria primarily involves acute tubular necrosis (9,10) in the tissues which quickly leads to generalized hypercatabolism (11,12). After ARF is established, whether medical management or intervention with dialysis (hemodialysis or PD) is used depends on the facilities available (13-15). Peritoneal dialysis, a straightforward procedure that does not require sophisticated equipment, can be performed in most community hospitals. In agreement with previous reports, this survey found that PD was life-saving when introduced early the course of ARF due to malaria. It is therefore recommended that

wherever available, PD be started promptly in malaria patients diagnosed with ARF.

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