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CASE REPORT

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Management of acute kidney injury with encephalopathy in a 5 -year old male using improvised peritoneal dialysis in University of Uyo Teaching Hospital, Uyo, Nigeria: A Case report

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Abstract: Acute kidney injury (AKI) has become increasingly prevalent in both resource rich and resource poor countries and is associated with significantly higher morbidity and mortality in the later, where access to renal replacement therapy (RRT) is poor. Peritoneal Dialysis (PD) is a well acknowledged and established form of RRT and it appears to be the most practical modality in young children with AKI in such countries. PD, though a cheaper alternative to haemodialysis (HD), is still challenging and unaffordable due to complex problems like lack of standard PD catheters and dialysate fluid, poor access to health facilities for rural dwellers, late presentations to health facilities and pervasive poverty. With some ingenuity, cheaper and more widely available alternatives like improvised catheters e.g. nasogastric tube, rubber catheter, intercostal drainage catheter, haemodialysis catheters and self-constituted fluid e.g. fortified ringers lactate, 0.9% sodium chloride with modified sodium lactate can been used with success. In this article, we share our experience on how acute PD was carried out successfully in a five-year old male with AKI complicated by uraemic encephalopathy, using improvised peritoneal dialysis and self-constituted PD solution in a place where standard renal replacement therapy does not exist.

Key words: AKI, improvised, peritoneal dialysis, uraemic-encephalopathy

Introduction

Acute kidney injury (AKI) has become increasingly prevalent in both developed and developing countries and is associated with poor outcomes.[1-4] AKI is associated with significantly higher morbidity and mortality especially in resource poor regions where access to haemodialysis and other forms of renal replacement is poor.[1-6]

Peritoneal Dialysis (PD) is a well acknowledged and established form of renal replacement therapy(RRT).[7,8] PD is comparable to other forms of dialysis in effectiveness in cases of AKI.[3] Its use throughout the world is increasing and has provided a means of managing some patients who would otherwise have been denied treatment because haemodialysis was unavailable or contraindicated.[8] Although there is a perception that the use of PD is declining worldwide, over the last 12years the number of PD patients increased in developing countries by 24.9 patients per million population and 21.8 patients per million population in developed countries.[9] The proportion of PD patients remained unchanged in developing countries but declined in developed countries.[9] The use of PD has increased by 2.5 fold in developing countries[10] especially with the increase in the number of people living in poverty in poor resource countries. Of the total number of PD done in Africa, 85% of the patients reside in South Africa, contribution of north Africa to PD is 0-3%.[11] Recent reports from Nigeria, India and Brazil have demonstrated its continued efficacy in the treatment of paediatricAKI.[5,7,12]

The choices of Renal replacement therapy in childhood AKI are limited in low resource settings.[13] Whilst nephrologists in rich countries look for the choice of modality of RRT to use in AKI, their counterparts in resource poor countries are helpless due to lack of resources for such interventions, leading to increased mortality.[3,14,15,16] However, PD appears to be the most practical modality for RRT in young children with AKI in most resource poor countries.[14] PD has served as the primary means of dialysis in the management of AKI in children to a large extent due to its advantages. These include reduced cost when compared with haemodialysis (HD), its ability to be carried out at home, less re-

quirement for highly trained personnel and major infrastructure, requirement of a single access, improved quality of life and freedom of activities, ease of implementation and lack of need for vascular access,[17,18] therefore, a therapeutic option for AKI in resource poor countries.[19] PD also helps in better preservation of haemodynamics and maybe more physiologic and less inflammatory than haemodialysis due to the absence of contact between blood and synthetic membrane, with a reduced risk of blood borne infection posed by hemodialysis.[18]
Though PD is cheap, easy and reliable, it has its limitation in the treatment of AKI, the most important being an intact peritoneal cavity with adequate peritoneal clearance capacity. It is less efficacious for severe acute pulmonary oedema and in life threatening hyperkalaemia. It uses high fluid volume and may impair diaphragmatic movement in very ill patients on ventilators in the ICU.[20] In resource poor countries, though PD is a cheaper alternative to HD, it is still challenging and unaffordable due to complex problems. Lack of standard PD catheters, poor access to health facilities for rural dwellers, late presentations to health facilities and pervasive poverty all constitute significant issues in the management of AKI in children.[3,7,13,15] Despite newer modalities in management of AKI, PD is still used extensively in resource poor settings[5,21]

Availability of standard PD catheters and dialysate fluid is still a big challenge in resource poor countries. Despite the above challenges, with some ingenuity, cheaper and more widely available alternatives maybe employed as materials in PD and used to save children in resource poor settings from morbidity and mortality from AKI.[3,13,22,23] Improvised catheters e.g. nasogastric tube, rubber catheter, intercostal drainage catheter, haemodialysis catheter[3,13,22,23] have been used for PD in resource poor settings. This improvised catheters have a higher risk for dialysate leakage, infection and blockage.[7] Also, where standard PD fluid is not available, self-constituted fluid can be used e.g. fortified ringers lactate recommended by the international society for peritoneal dialysis guidelines has been lifesaving in children with AKI,[3,22] 0.9% sodium chloride with modified sodium lactate has been used with success.[18] Improvised PD fluid if not prepared under strict asepsis increases the risk of peritonitis.[24,25]

In low resource settings, PD can be successfully performed for the management of childhood AKI and should be promoted.[13] Some countries have adopted the PD first policy in their centres primarily to reduce the cost of dialysis[18] and more centres can adopt this policy. There should be ease of access to standard and affordable PD catheters and fluids and automated peritoneal dialysis should be increased.[13] Establishment of regular PD programs in most tropical countries has been established though more education and training of health workers are still needed.[11] Establishing PD centres in developing countries would increase the use of PD and identifying the strengths, special circumstances, deficiencies peculiar to developing countries and strategize accordingly.[7]

In this article, we share our experience on how acute PD was carried out successfully using improvised peritoneal dialysis and self-constituted PD solution in a place where standard renal replacement therapy does not exist.

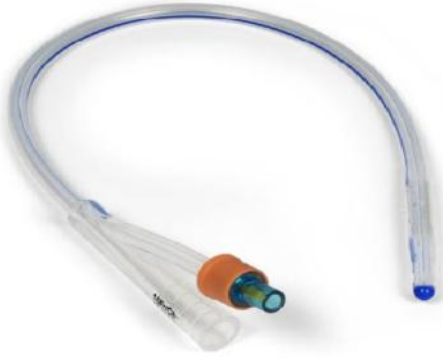
Case Report

A five-year old male who was referred from a secondary health facility to the University of Uyo Teaching Hospital (UUTH), Uyo, on account of oliguria, presented with complaints of fever of 10 days, cough of 8 days and vomiting of 7 days duration. He did not pass urine for 4 days with associated abdominal pain, but no change in colour of urine, no haematuriaordiarrhoea.

There was an initial presentation at a maternal and child health facility where he had some investigations done (Malaria Parasite test was positive ++, Widal test titres were significant). The patient was admitted there and treated with unidentified intramuscular injections for 5 days, intravenous ciprofloxacin and amoxicillin capsules. Oral antimalarial medications probably the artemether based combination therapy (ACTs) was also given for 3 days but symptoms did not improve. He was therefore transferred to a secondary health facility where he received intravenous artesunate and metronidazole. While in the facility, he was noticed not have made urine for a 24-hour period. Serum Electrolyte/Urea/Creatinine (sE/U/Cr) estimation revealed a deranged panel: Creatinine = 780µmol/l, Urea = 17.1mmol/l, Sodium = 149mmol/l, Chloride = 120mmol/l, Potassium = 2.8 mmol/l, and Bicarbonate = 19mmol/l. He was then referred to UUTH for expert management.
He had no history of urinary symptoms prior to onset of illness, although he routinelyhad water-based herbal enemas fortnightly.

At presentation he was conscious, not pale, anicteric, acyanosed, afebrile, with no signs of dehydration, no facial swelling and no pedal oedema. His weight was 23kg, height 120cm BSA= 0.876m^2Respiratory rate was 34cpm, percussion notes resonant with only vesicular breath sounds. Pulse rate was 68bpm, normal volume and rhythm, Blood pressure=120/80mmHg (stage I hypertension). Digestive system revealed normal buccal mucosa, abdomen full, tenderness in the epigastric region with no organomegaly and no ascites. A diagnosis of Acute kidney injury secondary to Severe Malaria was made.

Fig 1



He was admitted and a urinary catheter was inserted for urine collection and monitoring urine output, which drained 5 ml of urine from the bladder. Urinalysis done was essentially normal. HIV serology was non- reactive, HbsAg-negative, anti hepatitis C- negative, genotype AA, FBC-essentially normal, abdominal ultrasound scan revealed increased echogenicity of the kidneys with some preservation of corticomedullary differentiation; findings in keeping with grade 3 bilateral renal parenchymal disease.

Repeat E/U/Cr done showed Creatinine 982umol/l, urea 16mmol/l, bicarbonate of 10mmol/l. Estimated GFR by Swartz equation was 7.57ml/min/1.73m^{2}He had acidosis corrected with 54mEq of 8.4% sodium bicarbonate, received enalapril 5 mg daily. Fluid was restricted to previous day output plus insensible loss.

He was immediately scheduled to commence peritoneal dialysis, which was delayed because of mother's refusal to consent to procedure and procure necessary items for procedure on account of financial constraint. Urine flow rate ranged from 0.3- 0.7ml/kg/ hour. Patient developed generalized oedema, blood pressure increased to 130/100mmHg (stage 2 hypertension). He also developed 2 episodes of convulsion, generalized tonic clonic which lasted less than 5 minutes and aborted with diazepam. Repeat E/U/Cr: Creatinine 1118umol/l, urea 32.5 mmol/l, bicarbonate 10mmol/l and other electrolytes were normal. BP=150/100mmHg.

Fig 2

Fig 3

Mother eventually consented to peritoneal dialysis 7 days into admission following seizures from uraemic and hypertensive encephalopathy. Treatment instituted included furosemide, IV labetolol, oral aldomet 250mg bd. Consequent to the absence of Tenckhoff catheter, a size 16 silicon catheter was improvised and was successfully inserted in the theatre through a subumbilical incision into the pelvic peritoneal cavity via the seldinger technique with functioning of the catheter. Also, the dialysate fluid used was constituted due to unavailability of standard fluids. This was done by mixing the following into a urine bag under sterile conditions:

- 1000mls of normal saline
- 440mls of 10% dextrose
- 60mls of 8.4% sodium bicarbonate
- 10mg/L of ceftazidime
- 30mg/L of vancomycin
- 500iu of heparin
- +/- 4 mmol/L of potassium chloride

This was connected to the silicon catheter through a drip giving set for administration of fluid into the abdominal cavity. The same end of the silicon catheter used for fluid administration was used for draining peritoneal fluid into another urine bag and the volume was recorded to balance the fluid.

A dialysis prescription was ordered.

Dwell volume=30ml/kg=750ml

Dwell time: 1 hour-2 hours

The patient had on average 12 cycles of dialysis in the first 48 hours of the procedure then 8 cycles for the remaining 5 days.He improved as generalized oedema regressed, urinary output increased, blood pressure normalized and the concentration of deranged electrolytes gradually decreased to normal. Urine output increased from normal to polyuria up to 7ml/kg/hour. Dialysis was eventually discontinued and urine output returned to normal and child was observed and peritoneal catheter removed.

There were no complications of dialysis.

He was discharged home and has been seen in the nephrology clinic at several follow up visits with normal renal function results.

Days	Creatinine	Urea	Sodium	Chloride	Potassium	Bicarbonate
Before PD	1118	32.5	137	101	4.8	10
Day 2	771.75	33.41	144.9	114.9	3.27	18.6
Day 3	623.81	30.39	143.6	114.7	3.47	22.6
Day 5	466.71	22.33	145.7	110.6	2.99	21.3
Day 7	324.87	12.98	145.8	106.0	2.52	22.5
Day 9	250.10	10.95	148.7	108.3	2.88	22.0
Day 10	208.62	13.60	149.1	109.5	4.07	22.1
Day 14	115.80	12.30	149.5	110.7	4.87	22.3
1week post discharge	89.28	4.94	147.3	107.2	4.37	22.1
2 weeks	87.52	4.53	141.0	101.3	4.61	22.0

Discussion

Peritoneal dialysis forms the mainstay of therapy for AKI due to the relative ease of administration, none requirement for electricity or specialised machines which are grossly inadequate in resource-limited countries. Also PD is preferred for renal replacement therapy in children less than 5 years of age.[26] The ability to perform peritoneal dialysis is essential to prevent increasing kidney failure related mortality especially in children living in poverty.

We report the successful management of a five year old Nigerian boy with AKI most probably due to severe malaria using improvised peritoneal dialysis. The patient recovered renal function despite the challenge of non-availability of dialysate and standard PD catheter without any procedure-related complications. The self-constituted dialysate was adapted from University Teaching Hospital, Enugu. The use of self-constituted dialysate for emergent peritoneal dialysis has also been reported in other tertiary hospitals in Nigeria.[19,27] In Ghana, Antwi[23] successfully carried out the life-saving procedure of improvised PD using self-constituted dialysate in the paediatric intensive unit. Other resource limited countries have also used self-constituted dialysate with success.[18,28]

Catheter placement was done by the paediatric surgeon using size 16 silicone catheter which was our closest substitute for the standard flexible Tenckoff catheter. Previous reports' alternative materials used as replacement for dedicated PD catheters include: nasogastric tube,[27] modified suprapubic aspiration catheter,[28] double lumen haemodialysis catheter,[22] among others.

There was no catheter leakage in this patient and this is in contrast to the report from Kano[27] where this was observed necessitating surgical reviews. There was no catheter blockage likely due to the use of heparin in the self-constituted dialysate.

Other catheter related problems such as intraperitoneal or exit site infection was not also observed in the index patient. This could be because of strict asepsis combined with prophylactic inclusion of vancomycin and ceftazidime in the self-constituted dialysate, as well as use of parenteral antibiotics. Pre-procedural prophylactic use of vancomycin and cephalosporin in self-constituted dialysate was also recommendation of the guidelines for prevention for peritoneal dialysis-related infections.[29,30] Peritonitis, which is a major contributor of PD failure did not also occur. This could be due to the short duration of the procedure as the patient had clinical and laboratory improvement within two weeks coupled with adequate pre-procedural preventive measures. Full recovery was also noted in previous case reports.[23, 27,28] The patient is still on follow-up with evidences of normal clinical and laboratory kidney function.

Conclusion

Improvised peritoneal dialysis is a life-saving procedure for children with AKI requiring renal replacement therapy in resource limited settings and its careful utilisation may reduce the high morbidity and mortality of paediatric AKI.

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