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Case Report

Improvised Peritoneal Dialysis on a preterm neonate: Experience with Paediatric Central Venous Catheter in Harare, Zimbabwe

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Keywords

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Abstract

Background: Acute kidney injury is one of the commonest diseases among newborn babies hospitalized in the neonatal intensive care units. It is potentially preventable and treatable with timely intervention which includes conventional therapy and Kidney Replacement Therapy. However access to dialysis consumables is a challenge in developing countries. International Society of Peritoneal Dialysis has set recommendations to use when standard peritoneal dialysis is not accessible.

Case diagnosis: A baby born preterm weighing 2100g at 34 weeks with congenital syphilis was admitted in the neonatal intensive care unit for respiratory support and developed anuria after receiving nephrotoxic drugs for 6 days. A diagnosis of acute kidney injury with fluid overload was made.

Treatment/Results: The baby received peritoneal dialysis using a paediatric central venous catheter and fortified Ringers lactate solution with good outcome.

Conclusion: Although commercially prepared dialysis solutions and catheters are preferred, where resources do not permit this, locally prepared fluids and improvised catheters may be used with careful observation of sterile preparation procedures and give good patient outcomes.

CASE PRESENTATION

A preterm baby boy born at 34 completed weeks weighing 2100g was admitted in our neonatal intensive care unit (NICU) soon after delivery for respiratory support. His mother had tested positive during antenatal syphilis screen with Rapid Plasma Reagin (RPR) near delivery and had not been treated. At birth the neonate was noted to have hepatosplenomegaly, anasarca, in heart failure with severe respiratory distress requiring supplementary oxygen via nasal prongs. There was also concern for sepsis with a raised C - reactive protein .The baby received crystapen and amikacin and also antifailure treatment comprising frusemide and captopril. Urine dipstick was negative for protein and initial kidney function tests were normal with sodium 144mmol/L, potassium 4.0 mmol/L, chloride 105 mmol/L, urea 3.1 mmol/L, creatinine 49 umol/L.

On day 6 of life the baby developed anuria of more than 24 hours and had kidney function tests done which showed acute kidney injury (AKI) with creatinine 464mmol/L, urea 19.6mmol/L, potassium 5,7mmol/L, sodium 108mmol/L, bicarbonate 8mmol/L. His respiratory distress and edema worsened. Amikacin was substituted with ceftriaxone, and frusemide and captopril were stopped. Peritoneal dialysis was initiated on day 7 of life.

PD CATHETER INSERTION

Due to unavailability of peritoneal dialysis catheters at the hospital an improvised catheter was used using a size 7.5F paediatric central venous catheter (Figure 1). The Seldinger technique was used under sterile conditions. A 3 way tap was placed at one end of the pots and used to attach the filling and drainage line (Figure 2). The filling line was a fluid giving set connected to a buretrol and the drainage line was an anaesthetic extension line connected to a urine bag. Drainage was via gravity.

DIANEAL FLUIDS

4.5% solution was made by mixing 1l Ringer lactate and 90mls of 50% dextrose and 2.5% solution by mixing 50mls of 50% dextrose to 1l Ringer lactate bag in an aseptic manner. Heparin 500iu/l was added to the improvised dialysis solution.

DIALYSIS PRESCRIPTION AND PROGRESS

Initially the child was dialyzed using 2.5% dialysis solution but was switched to 4.5% after a day due to low ultrafiltration.

Figure 1 Paediatric Central Venous Catheter used for peritoneal dialysis.

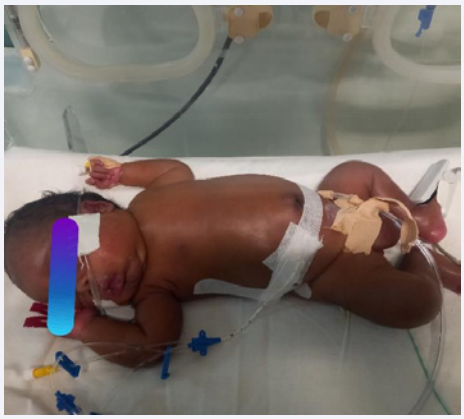

Figure 2 Ongoing peritoneal dialysis using paediatric Central Venous Catheter.

Urine appeared on day 5 of dialysis and gradually increased until dialysis was stopped on 10 days.

An ultrasound scan of the kidneys ureters and bladder showed no structural abnormalities. The child was gradually weaned off oxygen over 2 weeks and then discharged home.

DISCUSSION

Acute kidney injury is one of the commonest diseases among newborn babies hospitalized in the neonatal intensive care units [1]. AKI is a sudden decrease in kidney function resulting in decreased glomerular filtration rate (GFR), build-up of nitrogenous waste products, abnormalities in electrolyte homeostasis, and dysregulation of fluid balance. The definition of AKI has evolved from more than 35 divergent definitions to the currently utilized modern Kidney Disease: Improving Global Outcomes (KDIGO) AKI definition [2] (Table 1).

Dehydration and primary kidney diseases remain the most common aetiologies for AKI in developing countries, but major epidemiologic studies are lacking. In developed countries, the aetiology of AKI is often multifactorial in nature reflecting the increasing medical complexity in neonatal and paediatric patients. As in our patient, neonates receiving longer durations of nephrotoxic combination therapy have an increased odds of developing AKI [3] . A systematic surveillance program to identify high-risk infants (≥3 nephrotoxic medication within 24 hours or ≥ 4 calendar days of an intravenous aminoglycoside) and conducting daily serum creatinine until 2 days after end of exposure or end of AKI (whichever occurs last) can prevent nephrotoxic-induced AKI and has the potential to prevent short and long-term consequences of AKI in critically ill infants [4].

AKI is potentially preventable and treatable with timely intervention. "The ability to provide lifesaving treatments for AKI provides a compelling argument to consider therapy for AKI as much of a basic right as it is to give antiretroviral drugs to treat HIV in low-resource regions, especially because care needs only be given for a short period of time in most patients"[5] . This prompted the International Society of Nephrology (ISN) to put forth the human rights case statement of 0by25—i.e., no one should be dying of untreated acute kidney injury in low-resource regions by 2025. It aims to eliminate preventable deaths from AKI by 2025 by calling for global strategies that permit timely diagnosis and treatment of potentially reversible AKI for patients particularly in low-income and middle-income countries.

Once intrinsic kidney failure becomes established, conventional therapy involving management of fluid, electrolytes, and acid-base balance and provision of good nutrition is implemented. Kidney replacement therapy (KRT) is initiated once this conventional therapy fails to control metabolic complications and fluid overload [6]. Hemodialysis (HD) and hemofiltration are technically difficult procedures requiring large extracorporeal circuit volumes, anticoagulation, and vascular access thus limiting their use in neonates. As a result, peritoneal dialysis (PD) is generally the most common form of KRT in neonates, the advantages being relative ease of access and technical simplicity. However access to PD consumables such as appropriate catheters and fluids are a challenge in developing countries. ISPD has recommended the use of improvised PD catheters when no standard PD access is available [7]. In literature use of Foleys catheters [8], intercostal chest drains [9], double lumen Haemodialysis Catheter [10], and nasogastric tubes (with extra side holes cut) [11], has been described. However this is

Table 1: KDIGO AKI grading in neonates.

Stage	Serum creatinine	Urine output [a]
1	≥ 0.3 rise within 48 h or ≥ 1.5–1.9 × rise from baseline (previous lowest value) within 7 days	≤ 1 ml/kg/h for 24 h
2	2.0–2.9 times baseline	0.5 ml/kg/h for 24 h
3	≥ 3 × rise from baseline or serum creatinine ≥ 2.5 mg/dl or renal replacement therapy initiation	≤ 0.3 ml/kg/h for 24 h

[a]Urine output criteria utilized in the AWAKEN study. May also consider utilizing the paediatric urine output data for neonates if the granularity of data allows

the first documented case of use of central venous catheter in our country. Reported complications with the use of improvised catheters include blockage, leakage, exit site infections and peritonitis [9]. We did not experience any complications in our case.

Although commercially prepared dialysis solutions are preferred, where resources do not permit this, locally prepared fluids may be used with careful observation of sterile preparation procedures [7]. McCulloch et al., showed that locally prepared PD solutions at the bedside adapted from intravenous solutions can be used safely and effectively [12]. In a study conducted in Nigeria for the patients in whom improvised PD fluid using Ringer lactate and 50% dextrose for 2-4 days no complications were encountered [9]. These reports, together with ours, show that even in low resource areas PD can be successfully offered and save lives.

CONCLUSION

Kidney replacement therapy is life saving and needs to be accessible to all. Peritoneal dialysis remains the more preferred mode of dialysis children, more so in developing countries. Although commercially prepared dialysis solutions and catheters are preferred, where resources do not permit this, locally prepared fluids and improvised catheters may be used with careful observation of sterile preparation procedures and give good patient outcomes.

DECLARATIONS

Conflicting interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent to publish

Written informed consent was obtained from the patients for their anonymized information to be published in this article.

Authorship

PDMC conceptualized and drafted the manuscript. DM, NC reviewed the medical records and edited the draft. All authors have read and approved the final script. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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