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Acute peritoneal dialysis in neonates: challenges and outcomes

(Dialyse péritonéale aiguë chez le nouveau-né : défis et pronostic)

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Summary

Background: Neonates with acute kidney injury (AKI) have a high risk of serious complications and mortality. For this population, peritoneal dialysis (PD) is often the best kidney replacement therapy (KRT) because it is straightforward, safe, and cost-effective, especially in settings with limited resources.
Objective: To review the most recent data on the indications for PD in newborns, along with the associated techniques, the types of catheters available, the complications, and the outcomes.
Methods: Recent studies and clinical experiences were examined to determine the effectiveness and safety of acute PD in neonatal intensive care units (NICUs).
Results: The primary causes of neonatal PD are oliguric AKI, inborn errors of metabolism, and excessive fluid after cardiac surgery. It is preferable to use flexible catheters, such as the TenckhoffTM type, because they are associated with fewer complications. Most of the complications that have been reported are catheter leakage, blockage, peritonitis, and metabolic disorders like hyperglycemia. While mortality rates are still high, especially in premature infants and newborns with multiple organ failure, starting PD early could help improve survival and decrease the time spent on mechanical ventilation and in the NICU. In extremely low birth weight (ELBW) infants, PD is possible but challenging because of a higher risk of complications.
Conclusion: PD remains an important part of neonatal KRT, especially in resource-limited countries. It is a simple, effective, and life-saving treatment for newborns with AKI, including preterm and ELBW infants. For improved outcomes, it is important to choose an appropriate catheter, start therapy early, and train local staff. In Morocco and other countries in which advanced KRT methods may not be widely available, promoting PD could be advantageous for both public health and clinical care.

Keywords: peritoneal dialysis, neonate, infant, newborn, acute kidney injury, extremely low birth weight, catheter, complications, outcomes

Résumé

Introduction : Les nouveau-nés présentant une insuffisance rénale aiguë (IRA) encourent un risque élevé de complications et de mortalité. La dialyse péritonéale (DP) constitue, dans cette population, la modalité de suppléance rénale la plus accessible et la plus adaptée, notamment en cas de ressources limitées.
Objectif : Passer en revue les données les plus récentes concernant les indications de la DP chez le nouveau-né, ses techniques, les types de cathéters disponibles, les complications observées et les résultats obtenus.
Méthodes : Les études récentes et les expériences cliniques publiées ont été analysées afin d'évaluer l'efficacité et la sécurité de la DP aiguë en unités de soins intensifs néonataux.
Résultats : Les principales indications de DP en période néonatale sont l'IRA avec oligurie, les erreurs innées du métabolisme et la surcharge hydrique après chirurgie cardiaque. L'utilisation de cathéters flexibles, tels que les cathéters de type Tenckhoff™ , est recommandée, car elle est associée à un taux plus faible de complications. Les complications les plus fréquemment rapportées sont les fuites et les obstructions de cathéter, la péritonite et divers troubles métaboliques (notamment l'hyperglycémie). Les taux de mortalité demeurent élevés, surtout chez les prématurés et les nouveau-nés présentant une défaillance multiviscérale. Toutefois, une mise en route précoce de la DP pourrait améliorer la survie et réduire la durée de ventilation mécanique et de séjour en réanimation. Chez les nouveau-nés de très faible poids de naissance, la DP est réalisable, mais reste difficile en raison d'un risque accru de complications.
Conclusion : La DP demeure une modalité essentielle de suppléance rénale chez le nouveau-né, notamment dans les pays à ressources limitées. Elle représente un traitement simple, efficace et potentiellement vital pour les nouveau-nés atteints d'IRA, y compris les prématurés et les très faibles poids de naissance. L'optimisation des résultats nécessite le choix d'un cathéter approprié, l'instauration précoce du traitement et la formation du personnel local. Au Maroc et dans d'autres pays où les techniques de suppléance extracorporelle avancées restent peu accessibles, le développement de la DP pourrait avoir un impact bénéfique majeur en santé publique et en pratique clinique.

Mots-clés : dialyse péritonéale, nouveau-né, insuffisance rénale aiguë, prématuré, faible poids de naissance, cathéter, complications, évolution

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Introduction

Acute kidney injury (AKI) in newborns is a serious condition that leads to longer stays in the neonatal intensive care unit (NICU) and a higher death rate [1]. It is linked to a rise in deaths and associated with increased morbidity and mortality [2]. AKI is defined as a sudden drop in the glomerular filtration rate, which causes nitrogenous waste products to accumulate, fluid and electrolyte levels to become imbalanced, and acid-base homeostasis to be disrupted [3]. Reports say that 30% of newborns have AKI, but the rate varies depending on how far along the pregnancy is [4]. Due to its severe complications, identifying AKI early and starting treatment immediately are crucial for lowering the avoidable effects (metabolic disorders and fluid-electrolyte and acid-base imbalances) [1].

For AKI, hemodialysis (HD) and peritoneal dialysis (PD) are often the two main options for kidney replacement therapy (KRT) [4]. PD offers a nonvascular way to treat newborns with kidney failure and some metabolic disorders [5]. This approach uses the patient's peritoneum as a semipermeable membrane to allow the movement of fluids and solutes (electrolytes, urea, creatinine, glucose, osmotically active particles, and other small molecules) from the blood to the dialysate. The dialysate, in turn, delivers osmotically active substances that draw water (ultrafiltration) and contains lower solute concentrations than plasma, enabling solute clearance [5]. Critically, PD is easy to use, even for very low birth weight (VLBW) preterm infants who are not stable hemodynamically [4]. While PD is generally considered the best type of dialysis, few studies have examined its effects on newborns [4]. This treatment is generally simple, when a PD catheter is inserted in a small newborn, it often requires some technical adjustments [6]. Ethical challenges also often emerge in newborn cases, particularly when dealing with extremely premature infants with poor prognoses [7].

Overall, though, this therapeutic convenience greatly increases the chances of survival for severely sick newborns, especially in places or homes with few financial resources [8].

Materials and Methods

This review followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) rules.

Data Sources and Search Strategy:

A comprehensive search was conducted in PubMed/MEDLINE, Scopus, Web of Science, and Cochrane Library, enhanced by a manual investigation of reference lists from pertinent articles. The search proceeded from January 2010 to June 2025.

Keywords and MeSH terms included the following: *peritoneal dialysis, neonate, infant, newborn, acute kidney injury, extremely low birth weight, catheter, complications, outcomes*.
French equivalents were also used: *dialyse péritonéale, nouveau-né, insuffisance rénale aiguë, prématuré, faible poids de naissance, cathéter, complications, pronostic*.

Inclusion Criteria:

• Original research articles, case series, clinical trials, guidelines, or systematic reviews on PD administered in the neonatal period.

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• Publications reporting at least one of the following: PD indications, techniques, catheter types, complications, or clinical outcomes.
• Studies that included preterm and/or extremely low birth weight (ELBW) infants.
• Articles published in English or French.

Exclusion Criteria:
• Studies exclusively addressing other kidney replacement therapies without neonatal PD data.
The initial search yielded **222** records. After removing duplicates, **218** titles and abstracts were screened. Of these, **179** were excluded because they did not meet the inclusion criteria. Ultimately, **33** studies were included in the qualitative synthesis.

Discussion

1. Definition and Epidemiology of AKI

The application of standardized criteria, such as the KDIGO Modified Neonatal AKI Classification *(Table I)*, has significantly enhanced the identification and study of neonatal AKI over the past two decades [9]. With these enhanced techniques, studies have found that AKI affects almost one in three newborns admitted to NICUs, although reported rates vary across geographic regions, from about 8% to 24% overall and between 3.4% and 4.2% in different centers in India [10,11]. The additional rates differ depending on the newborn's gestational age, with AKI affecting about 48% of extremely preterm infants, 18% of late preterm infants, and 37% of term neonates [3, 12]. Notably, large international studies, like the AWAKEN cohort, have found that neonatal AKI is strongly linked to a higher risk of death, longer hospital stays, prolonged mechanical ventilation, and a higher risk of developing chronic kidney disease later in life [13].

Table I. KDIGO Modified Neonatal AKI Classification and STARZ Score [1, 40]

KDIGO Stage	Serum Creatinine Criteria	Urine Output Criteria	STARZ Score Range	Risk of Severe AKI
0	No rise or < 0.3 mg/dL within 48 h	≥ 1 mL/kg/h	< 31.5	Very low
1	≥ 0.3 mg/dL rise within 48 h or 1.5–1.9 × baseline	< 1 mL/kg/h for 24 h	31.5–59	Moderate
2	2.0–2.9 × baseline	< 0.5 mL/kg/h for 24 h	59–66	High
3	≥ 3 × baseline or ≥ 2.5 mg/dL or initiation of dialysis.	< 0.3 mL/kg/h for 24 h or anuria for 12 h	≥ 66	Very high—severe AKI, often requires PD

Due to these serious complications, it is crucial to identify high-risk infants promptly. The STARZ (Sethi Tibrewal Agarwal Raina waZir) score is a practical bedside tool for this purpose [13]. Severe AKI in the STARZ system corresponds to KDIGO Modified Neonatal AKI Classification stages 2–3 *(Table I)*, which usually requires PD; specifically, a STARZ score ≥ 66 points has been proposed as a threshold predicting this severe form of AKI and the possible need for dialysis [13]. The score has high sensitivity (92.8%), specificity (87.4%), and accuracy (89.4%), and it can be used even in low- and middle-income settings to help with early management [1].

Such advancements around standardizing definitions and risk scores have improved the consistency of neonatal AKI research and have enabled clinicians to make treatment decisions more rapidly and accurately.

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2. Etiology of AKI

As previously mentioned, neonatal AKI is a relatively common occurrence associated with longer hospital stays, high morbidity and mortality, a greater need for mechanical ventilation, and an increased risk of chronic kidney disease (CKD) [2, 14]. Neonatal kidneys are particularly vulnerable to hypoperfusion due to their limited glomerular flow, high plasma renin activity, and high renal vascular resistance, leading to reduced sodium reabsorption, impaired filtration, and low intracortical perfusion [15]. These perfusion abnormalities, related to the renin-angiotensin system and prostaglandins, also make neonates more susceptible to nephrotoxic drugs such as ACE inhibitors and NSAIDs [2].

Nephron development starts in the fifth week of gestation and ends around 34–36 weeks, with 60% occurring during the third trimester [16]. The final nephron number varies greatly and increases by about 200,000 per additional kilogram of birth weight (BW) [16, 17]. Consequently, low birth weight (LBW) and prematurity reduce nephron endowment and raise the risk of AKI and future CKD. After birth, renal maturation continues for about two years, with rising renal blood flow, decreasing vascular resistance, and progressive achievement of an adult-level glomerular filtration rate (GFR) [2].

Neonatal AKI is often triggered by low BW, perinatal events (e.g., infections, hypoxia), nephrotoxic drugs (loop diuretics, aminoglycosides), thrombosis, and congenital anomalies [18] *(Table II)*. Many of these risk factors are specific to the neonatal period and are rarely seen in older pediatric age groups [5]. Indeed, prerenal factors account for 76%–80% of cases [8, 18].

Table II. Etiology of neonatal AKI [20]

• Prerenal AKI • (85%)	• Renal AKI • (11%)	• Postrenal AKI • (5%)
• hypovolemia • sepsis • hypoxia • medication	• acute tubular necrosis • bilateral renal vascular thrombosis • nephrotoxic drugs • radiocontrast agents	• intrinsic obstructions • extrinsic compression • congenital causes of urinary tract obstruction

As intimated above, etiological patterns vary between countries and even between centers from middle-income countries [19]. In high-income countries, the main causes are sepsis, post-cardiac surgery ischemic/hypoxic injury, and nephrotoxicity, particularly in preterm infants (42.2%) and those with congenital heart disease (CHD) (11.7%) [19]. In a multicenter Turkish study, AKI was obstructive, intrinsic, and pre-renal in 23.9%, 72.9%, and 3.2% of infants, respectively [20]. Similarly, Gerçel et al. [6] reported inborn errors of metabolism (12.9%), asphyxia (25.9%), prematurity (24.7%), sepsis (8.2%), necrotizing enterocolitis (**NEC**) (5.9%), dehydration (5.9%), hydrops fetalis (5.9%), CHD (5.9%), and renal anomalies (4.7%) as the main causes. In premature infants, Okan S et al. [21] also reported patent ductus arteriosus, NEC, sepsis, hypoxia, and hydrops fetalis as causes of neonatal AKI.

3. Kidney replacement therapy (KRT) in neonatal AKI

The two primary KRT modalities for newborns are HD/hemofiltration and PD [22]. Since its introduction in the late 1950s, PD has remained the most widely used option for neonatal KRT [22], as it is less expensive and more accessible than HD, particularly in resource-limited settings

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[5, 23]. Because PD uses the peritoneum as a semipermeable membrane, it does not require vascular access, anticoagulation, or large extracorporeal circuits, which are often challenging in neonates [8, 23, 24]. PD also allows for the gradual removal of fluids and solutes, reducing the risk of hemodynamic instability [8, 23].

PD is especially suitable for premature and low birth weight (LBW) infants when vascular access is difficult or impossible [22, 25, 26]. In some settings, it is the only immediately available option [3, 18]. While PD is widely favored in low- and middle-income countries due to the limited availability of trained personnel and equipment for extracorporeal dialysis [10,18,27], PD is contraindicated in neonates with pleuroperitoneal connections, diaphragmatic hernias, recent abdominal surgery, intra-abdominal infection, NEC, or any defects affecting the integrity of the abdominal or peritoneal wall [18, 22]. When PD is not feasible or must be discontinued, miniaturized continuous kidney replacement therapy (CKRT) systems such as Carpediem can be considered [27].

While PD is effective in managing AKI, it is less efficient than HD or CKRT at rapidly reducing plasma ammonia in severe hyperammonemia [28]. Nevertheless, it remains useful for AKI linked to metabolic disorders or mild hyperammonemia [29] and for fluid removal in neonates with heart disease (those post-cardiac surgery or on extracorporeal membrane oxygenation (ECMO)), with fewer anticoagulation-related complications [22, 26].

PD in neonates has several specific challenges, such as obtaining appropriately sized catheters, ensuring correct exchange volumes, and compensating for immature peritoneal function [6, 29]. Standard catheters often need adaptation for LBW infants [6]. Capillary leak syndrome in septic neonates may hinder ultrafiltration but can improve solute clearance [22, 30]. Furthermore, both dialysate volume and dwell time influence PD efficiency: High volumes with short dwell times enhance ultrafiltration, whereas longer dwell times improve solute diffusion [30].

Economically, PD is more cost-effective than its alternatives—amounting to about one third the cost of HD and one fourth the cost of continuous arteriovenous hemofiltration [31]. In one study, 64% of infants receiving PD survived versus 32% with CKRT [32].

4. Indications for Peritoneal Dialysis in Neonates

AKI remains a serious and life-threatening problem in NICUs. When conservative treatments, such as diuretics, fluid resuscitation, or inotropes, fail to correct fluid overload, persistent oliguria, electrolyte imbalance, or uremia, KRT becomes necessary [10, 33]. As mentioned earlier, among KRT modalities, PD is particularly suitable for preterm and LBW infants.

Oliguric AKI is the most common indication: It was reported in 61.3% of cases by Matthews et al. [31], 68.8% by Hakan et al. [20], and 84% in a more recent study [5]. Other major causes include sepsis (identified in 43% of cases in Tian [7]), hypoxic-ischemic encephalopathy, congenital metabolic disorders, postoperative cardiac surgery, and severe dehydration [24]. In a Turkish series [5], the main causes were acute tubular necrosis (69.2%), inborn errors of metabolism (19.2%), congenital nephrotic syndrome (3.9%), bilateral polycystic kidneys (3.9%), obstructive uropathy (1.9%), and renal agenesis (1.9%).

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Sinha et al. [34] noted that many AKI cases were multifactorial, often involving sepsis (75%), nephrotoxic antibiotics, hypoxic-ischemic encephalopathy (21%), and the use of diuretics or enalapril in congenital heart disease (CHD) (25%). The main clinical triggers for initiating PD in such contexts are fluid overload, refractory metabolic acidosis, and resistant hyperkaliemia. Notably, not all neonates with congenital anomalies of the kidney and urinary tract (CAKUT) require long-term or chronic dialysis; some only need temporary support during acute decompensation [35].

Metabolic indications include inborn errors such as lactic acidosis and hyperammonemia. Matthews et al. [31] found these errors accounted for 35.5% of secondary PD indications, versus 19.2% in other series [5].

In neonates undergoing cardiac surgery, early PD initiation reduces the time to achieve negative fluid balance, shortens mechanical ventilation, decreases inotropic support, and improves survival [22]. Other reported indications include nonimmune hydrops fetalis and severe salt overload ("salt poisoning") [23].

Although NEC is often considered a relative contraindication, it is reported that carefully monitored PD with small fill volumes and short dwell times can be safely used in selected NEC cases with AKI, particularly in postoperative settings, allowing improved fluid balance and renal recovery without increasing the risk of bowel perforation or peritonitis [36].

5. Catheter Placement in Neonates

The choice and placement of PD catheters are critical for managing AKI in neonates. In neonates, PD catheters are typically 8–10 cm long for ELBW infants and 12–16 cm for term neonates, with one third to half the length being inserted inside the peritoneum to prevent kinking and ensure flow [38, 39]. Because of their fragile anatomy, especially in ELBW infants, catheter placement can be technically challenging. However, when appropriate devices and techniques are used, PD can be performed safely and effectively.

The three main types of catheters used are rigid catheters (stylet-type), flexible catheters such as a Tenckhoff catheter (straight or swan-neck) and Cook PD catheters, improvised catheters (pigtail catheters, angiocatheters, intercostal drainage tubes, feeding tubes, Foley catheters, chest drains) [3, 10, 22, 23]. The International Society for Peritoneal Dialysis (ISPD) strongly recommends flexible catheters because they offer better inflow/outflow rates, lower leakage, and reduced risks of peritonitis or visceral injury [3, 11, 22]. The Tenckhoff catheter is the most widely used and preferred for PD > 5 days due to its double-cuff design, subcutaneous tunnel, and durability.

When Tenckhoff catheters are unavailable or too large, alternatives have been used successfully, including Blake silicone drains (with side channels) [39], Arrow 14-gauge vascular catheters [30], central venous catheters [29], and improvised IV cannulas or suction catheter tips (which are less expensive, easier to insert, and generally safe in fragile neonates) [23].

In very small infants, cutting down Tenckhoff catheters may be required, but this can roughen the tip and reduce flow by decreasing side holes [29, 33].

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Catheter insertion can be surgical (mini laparotomy) or percutaneous (bedside, with guidewire) [37, 38]. Surgical placement is preferred for optimal visualization, but percutaneous insertion is feasible under sterile conditions. Lateral exit sites (right/left lower quadrant) are recommended over median sites to reduce leakage risk [37]. The exit site should be kept clean and dry with a daily inspection [37]. Prophylactic IV antibiotics (usually a first-generation cephalosporin) are recommended at insertion to reduce infection risk, and heparin (500 IU/L) may be added to dialysate during the first 24–48 h to prevent fibrin obstruction [34].

Despite technical advances, catheter-related complications, such as leakage, blockage, displacement, and infection, remain common, especially due to poorly sized devices [8, 29]. The short distance between the umbilicus and symphysis pubis (3–6 cm) in neonates further complicates the placement of standard Tenckhoff catheters [29, 33]. Nonetheless, when appropriate catheters and preventive measures are used, PD is safe and effective: Ao et al. [29] reported successful PD in 10 neonates using central venous catheters with no complications and full renal recovery at discharge, and Tian et al. [8] confirmed the importance of preventive strategies to reduce catheter-related complications.

6. Technique of Peritoneal Dialysis in Neonates

Several factors influence the effectiveness of neonatal PD, including the infant's size and weight, the compliance of the peritoneal cavity, respiratory status, and the severity of uremia [10].

Dialysate volumes should be tailored to the infant's size, starting at 10–20 mL/kg per cycle and gradually increasing to a maximum of about 800 mL/m^2 of body surface area as tolerated while closely monitoring abdominal distension and respiratory function [37, 38]. Because neonates, especially ELBW infants, have relatively hyperpermeable peritoneal membranes, short dwell times (20–30 minutes) are recommended initially to optimize ultrafiltration and prevent rapid reabsorption; longer dwell times can be used once the patient is more stable [38, 39].

A 2.5% dextrose dialysate (standard commercial PD solution containing 2.5% glucose as the osmotic agent) is commonly used in the early phase to enhance ultrafiltration by increasing osmotic pressure and drawing water from the peritoneal capillaries into the dialysate [22, 37].

Because only small fill volumes are used, manual exchange systems are preferred, and a graduated burette system (Buretrol™) is particularly useful to measure small instilled and drained volumes (as low as 5–10 mL), reducing the risk of fluid overload [37, 38]. Closed gravity-based systems are ideal because they minimize contamination, but open systems with a three-way connector and burette can be used in resource-limited settings if commercial systems are unavailable [22].

7. Complications and Outcomes of Peritoneal dialysis in Neonates

While PD is a life-saving therapy for AKI in neonates, it is associated with complications that can influence short- and long-term outcomes.

Catheter-related issues are the most frequent complication, occurring in 20%–60% of cases [29]. These include dialysate leakage, exit-site infections, obstruction, blockage, and displacement. In Kara et al.'s study [5], 20.6% had leakage, 8.8% blockage, and 5.9% exit-site infection. Gerçel

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[6], meanwhile, reported 8.2% catheter complications (namely drainage failure, hernia, wound dehiscence, leakage). Notably, though, a Tenckhoff catheter with double cuffs and a subcutaneous tunnel significantly reduces these risks [23]. Ustyol [24] found 46.7% complications with automated peritoneal dialysis (APD), but all cases were manageable and nonfatal.

Hyperglycemia was the most common metabolic issue (47.1% in Kara et al. [5]); other issues included hypokalemia and local exit-site infections [8, 11]. These complications are usually manageable and rarely lead to treatment interruption.

Peritonitis is one of the most feared complications of PD in newborns. Reported incidence rates vary widely, but studies suggest they are comparable to or even higher than those seen in adults undergoing PD [37]. Kara et al. [5] reported an 8.8% rate of peritonitis (due to Klebsiella pneumoniae, Staphylococcus epidermidis, Acinetobacter baumannii), all of which were treated successfully with intraperitoneal and systemic antibiotics. Matthews et al. [31] found a 12.9% rate, and Elgendy et al. [32] found an 8.4% rate (close to the 7.9% leakage rate). Peritoneal fluid should always be cultured, and empiric therapy should target both Gram-positive and Gram-negative organisms. Catheter removal is reserved for severe or resistant infections (e.g., fungal or Pseudomonas) or when no improvement occurs within 3–5 days [5]. Improvised catheters such as IV cannulas are associated with a higher risk of peritonitis, likely due to increased leakage [23].

Several studies have confirmed that early PD improves outcomes in neonatal AKI. Tian et al. [8] observed rapid improvements in kidney function, urine output, electrolytes, acid-base status, and infection markers within 1–5 days of starting treatment. Yildiz [18] similarly reported the reversal of fluid overload, hyperkaliemia, hypernatremia, and acidosis. Gerçel [6], meanwhile, showed PD was feasible across a wide range of gestational ages and birthweights (average duration 11.6 ± 13.7 days). However, infants requiring prolonged PD (>1 4 days) had more complications and higher mortality, primarily due to severe underlying disease [6, 11, 32].

Despite these positive signs, mortality rates remain high: Kata et al. [5] reported a mortality rate of 76.9% (mainly due to multiorgan failure, sepsis, inborn errors, and cardiac failure), while mortality rates of 26.7% in Yildiz [18], 36% in Elgendy [32], 60% in S. Tangirala [11], and 67.1% in Gerçel [6] were also reported. Risk factors include delayed PD initiation, hemodynamic instability, and multi-organ failure. Among survivors, 83.3% had full renal recovery, but some developed moderate CKD or hypertension with proteinuria [5]. Matthews et al. [31] found that 5 of 12 survivors required chronic PD and were awaiting kidney transplantation, suggesting that about 15%–20% may progress to end-stage renal disease (ESRD), while the remaining roughly 80% recover normal kidney function.

Some survivors also presented long-term comorbidities, such as developmental delay, growth retardation, or neurological sequelae [6, 18, 32]. Interestingly, survival may be better with PD than with CKRT: Elgendy et al. [32] found a 64% survival rate with PD versus 32% with CKRT. Early PD after ischemic AKI following congenital heart disease surgery was also associated with improved survival [18].

8. Peritoneal Dialysis in Preterm and ELBW Newborns

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AKI is common and severe in premature neonates, especially those with an ELBW (< 1000 g). Because their kidneys and other organs are immature, this population is highly susceptible to sepsis, hypoxemia, nephrotoxic drugs, and hypoperfusion. AKI affects up to 56% of ELBW infants, with renal hypoperfusion and ischemia accounting for about 18% of cases [19].

HD is rarely feasible in this population due to difficulty obtaining vascular access, hemodynamic instability, and the need for large extracorporeal volumes, making PD the preferred option [2,10]. Indeed, studies have shown that PD can safely correct fluid and electrolyte imbalances in unstable preterm infants, especially when started early [8, 30].

ELBW infants have fragile abdominal walls and a very small peritoneal cavity. In Noh's study [10], infants had a mean birth weight of 706.5 g and 27.2 weeks' gestation. Standard PD catheters are often unsuitable, as straight catheters in thin-walled abdomens are linked to higher risks of intestinal perforation, leakage, and obstruction [5, 23]. Makeshift devices, such as IV cannulas, chest tubes, and vascular catheters, have been used with variable success [10, 30]. Leakage is commonly caused by poor catheter anchoring and the lack of subcutaneous fat [23]. Furthermore, most APD machines require minimum fill volumes (> 100 mL) that exceed the safe intraperitoneal capacity of many ELBW infants [10, 23].

Despite PD's potential benefits, mortality remains high in this vulnerable group. Noh et al. [10] reported mechanical complications in 67% and a mortality rate of 91.7%, while Kara et al. [5] reported an 81.3% mortality, mainly from sepsis, multiorgan failure, and intestinal complications. Other studies have shown mortality rates ranging from 69%–80%, and up to 95% with multiorgan failure [8, 40]. Still, Ustyol et al. [24] reported successful outcomes in neonates weighing as little as 580 g when PD was started early and managed carefully. Tian [8] also observed clinical improvement without adverse effects in a small preterm cohort.

Overall, the evidence shows that starting PD in ELBW infants is an ethically complex decision, given the risk of long-term complications, multiple surgeries, and prolonged hospitalization. Ideally, neonatologists, nephrologists, and ethics specialists should collaborate to balance the benefits of aggressive intervention against long-term quality of life [10].

Conclusion

In the **NICU**, PD remains an important aspect of kidney replacement therapy. It provides a straightforward, affordable, secure, and technically feasible solution for treating AKI and other metabolic conditions in newborns. Serious incidents like peritonitis are relatively rare, especially with correct technique and monitoring, but procedure-related complications like catheter leakage or obstruction are rather common. Nonetheless, there is evidence that in critically ill neonates, urgent therapy initiation and early detection of PD needs can greatly enhance outcomes and lower mortality. Additionally, even in very small infants, such as those weighing less than 2 kg, PD is both possible and advantageous. PD is also a practical and environmentally friendly option in resource-constrained environments like Morocco, where access to more sophisticated modalities like HD or CKRT may be restricted by financial and technological limitations. PD is especially well suited for broader adoption across neonatal units in developing health-care systems due to its ease of use and safety profile.

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Even though both CKRT and PD are linked to high mortality in critically ill newborns, PD is still a useful first-line treatment. The adoption of flexible soft catheters in neonatal care is further supported by the fact that they have been linked to better results and fewer complications than rigid ones. In conclusion, particularly in low- and middle-income nations, PD should be acknowledged and promoted as a practical, life-saving treatment for neonatal AKI. Neonatal survival and recovery may be significantly improved by fortifying the infrastructure for neonatal care and educating medical professionals in PD techniques.

Authors' Contributions

Samira Tizki: conception of the article, data collection, data analysis and drafting of the manuscript
Abdelatif Daoudi: supervision, methodology, critical revision of the manuscript

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Authors declares that they do not have conflict of interest with this article.

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References

1. Sethi SK, Raina R, Wazir S, Agrawal G, Vadhera A, Nair N, Soni K, Tibrewal A, et al. STARZ Neonatal AKI Risk Stratification Cut-off Scores for Severe AKI and Need for Dialysis in Neonates. Kidney Int Rep. 2022; 7:2108–2111. https://doi.org/10.1016/j.ekir.2022.06.020.
2. Coleman C, Tambay Perez A, Selewski DT, and Steflik HJ (2022). Neonatal Acute Kidney Injury. Frontiers in Pediatrics, 10:842544. doi: https://doi.org/10.3389/fped.2022.842544
3. Mishra OP, Prasad R. Acute Peritoneal Dialysis in Neonates with Acute Kidney Injury. Indian Pediatr. 2020; 57:420-2. https://www.indianpediatrics.net/may2020/399.pdf
4. Gerçel, G., & Anadolulu, A. I. (2023). Acute peritoneal dialysis in the newborn: A safe and feasible method. Journal of Pediatric Surgery, 58, 453–457. https://doi.org/10.1016/j.jpedsurg.2022.08.021
5. Kara A, Gurgoze MK, Aydin M, Taskin E, Bakal U, Orman A. Acute peritoneal dialysis in neonatal intensive care unit: An 8 year experience of a referral hospital. Pediatr Neonatol. 2018;59(4):375 379. doi: https://doi.org/10.1016/j.pedneo.2017.11.008.
6. Gerçel G, Anadolulu Aİ. Acute peritoneal dialysis in the newborn: A safe and feasible method. J Pediatr Surg. 2023 Mar;58(3):453–457. doi: https://doi.org/10.1016/j.jpedsurg.2022.08.021.

journal officiel du Registre de Dialyse Péritonéale de Langue Française **RDPLF** www.rdplf.org

7. Lantos JD, Warady BA. The evolving ethics of infant dialysis. Pediatr Nephrol. 2013 Oct;28(10):1943-7. doi: https://doi.org/10.1007/s00467-012-2351-1.

8. Tian Z, Luo X, Yang H, Ma Z M, Yang J, Ji Y J, et al. Examining the progress and implementation of neonatal peritoneal dialysis in the Ningxia autonomous region. BMC Pediatr. 2025; 25:15. doi:https://doi.org/10.1186/s12887-024-05352-3

9. Jetton JG, Askenazi DJ. Update on acute kidney injury in the neonate. Current Opinion in Pediatrics. 2012;24(2):191–196. doi: https://doi.org/10.1097/mop.0b013e32834f62d5

10. Sun Y, Xu J, Chu X, Zhang W, Gong X, Chen D, et al. Effectiveness and feasibility of continuous renal replacement therapy for acute kidney injury in neonates weighing 3 kg or less: a two-centre, retrospective study. BMJ Paediatrics Open. 2024;8:e002241. https://doi.org/10.1136/bmjpo-2023-002241

11. Cortina, G., Daverio, M., Demirkol, D. et al. Continuous renal replacement therapy in neonates and children: what does the pediatrician need to know? An overview from the Critical Care Nephrology Section of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC). Eur J Pediatr 183, 529–541 (2024). https://doi.org/10.1007/s00431-023-05318-0

12. Jetton JG, Boohaker LJ, Sethi SK, Wazir S, Rohatgi S, Soranno DE, et al. Incidence and outcomes of neonatal acute kidney injury (AWAKEN): a multicentre, multinational, observational cohort study. Lancet Child Adolesc Health. 2017;1(3):184-194. doi:https://doi.org/10.1016/s2352-4642(17)30069-x.

13. Sethi SK, Raina R, Rana A, Agrawal G, Tibrewal A, Bajaj N, Gupta NP, Mirgunde S, Sahoo J, Balachandran B, Afzal K, Shrivastava A, Bagla J, Krishnegowda S, Konapur A, Soni K, Sharma D, Khooblall A, Khooblall P, Bunchman T, Wazir S. Validation of the STARZ neonatal acute kidney injury risk stratification score. Pediatr Nephrol. 2022 Aug;37(8):1923-1932. doi: https://doi.org/10.1007/s00467-021-05369-1.

14. Raina R, Nada A, Shah R, Aly H, Kadatane S, Abitbol C, Aggarwal M, Koyner J, Neyra J, Sethi SK. Artificial intelligence in early detection and prediction of pediatric/neonatal acute kidney injury: current status and future directions. Pediatr Nephrol. 2024 Aug;39(8):2309-2324. doi: https://doi.org/10.1007/s00467-023-06191-7. Epub 2023 Oct 27.

15. Gohiya P, Nadkarni J, Mishra M. Study of neonatal acute kidney injury based on KDIGO criteria. Pediatr Neonatol. 2022 Jan;63(1):66–70. doi: https://doi.org/10.1016/j.pedneo.2021.08.009.

16. Hinchliffe SA, Sargent PH, Howard CV, Chan YF, van Velzen D. Human intrauterine renal growth expressed in absolute number of glomeruli assessed by the disector method and Cavalieri principle. Laboratory Investigation. 1991;64(6):777–784. Permalink: https://pubmed.ncbi.nlm.nih.gov/2046329/

17. Mañalich R, Reyes L, Herrera M, Melendi C, Fundora I. Relationship between weight at birth and the number and size of renal glomeruli in humans: a histomorphometric study. Kidney Int. 2000 Aug;58(2):770-3. doi: https://doi.org/10.1046/j.1523-1755.2000.00225.x.

18. Yildiz N, Erguven M, Yildiz M, Ozdogan T, Turhan P. Acute peritoneal dialysis in neon1ates with acute kidney injury and hypernatremic dehydration. Perit Dial Int. 2013 May Jun;33(3):290–296. doi:https://doi.org/10.3747/pdi.2011.00211

19. Duzova A, Bakkaloglu A, Kalyoncu M, Poyrazoglu H, Delibas A, Ozkaya O, Peru H, Alpay H, Soylemezoglu O, Gur-Guven A, Bak M, Bircan Z, Cengiz N, Akil I, Ozcakar B, Uncu N, Karabay-Bayazit A, Sonmez F; Turkish Society for Pediatric Nephrology Acute Kidney Injury Study Group. Etiology and outcome of acute kidney injury in children. Pediatr Nephrol. 2010 Aug;25(8):1453-61. doi: https://doi.org/10.1007/s00467-010-1541-y. Epub 2010 May 30. PMID: 20512652.

20. Bolat, F., Comert, S., Bolat, G. et al. Acute kidney injury in a single neonatal intensive care unit in Turkey. World J Pediatr 9, 323–329 (2013). https://doi.org/10.1007/s12519-012-0371-3

21. Okan, M.A., Topçuoglu, S., Karadag, N.N. et al. Acute Peritoneal Dialysis in Premature Infants. Indian Pediatr 57, 420–422 (2020). https://doi.org/10.1007/s13312-020-1815-9

22. Slagle C, Askenazi D, Starr M. Recent advances in kidney replacement therapy in infants: a review. Am

J Kidney Dis. 2024;83(4):519-530. doi: https://doi.org/10.1053/j.ajkd.2023.10.012
23. Stojanovic V, Bukarica S, Doronjski A, Marinkovic S. Peritoneal dialysis in neonates with extremely low body weight at birth: New modality of using IV cannula for peritoneal access. Iran J Pediatr. 2013 Dec;23(6):718–720. https://pmc.ncbi.nlm.nih.gov/articles/PMC4025142/
24. Ustyol L, Peker E, Demir N, Agengin K, Tuncer O. The Use of Acute Peritoneal Dialysis in Critically Ill Newborns. Med Sci Monit. 2016; 22:1421–1426. doi:https://doi.org/10.12659/msm.898271.
25. Cortina G, Daverio M, Demirkol D, Chanchlani R, Deep A. Continuous renal replacement therapy in neonates and children: what does the pediatrician need to know? An overview from the Critical Care Nephrology Section of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC). Eur J Pediatr. 2024 Feb;183(2):529-541. doi: https://doi.org/10.1007/s00431-023-05318-0.
26. Sasser WC, Robert SM, Askenazi DJ, O'Meara LC, Borasino S, Alten JA. Peritoneal dialysis: An alternative modality of fluid removal in neonates requiring extracorporeal membrane oxygenation after cardiac surgery. J Extra Corpor Technol. 2014 Jun;46(2):157 161. PMID: 25208433. https://pmc.ncbi.nlm.nih.gov/articles/PMC4566426/
27. Wu CY, Lin YC, Chen CC. A Case Series: Continuous Kidney Replacement Therapy in Neonates With Low Body Weight. Front Pediatr. 2021; 9:769220. doi:https://doi.org/10.3389/fped.2021.769220.
28. Pela I, Seracini D, Donati MA, Lavoratti G, Pasquini E, Materassi M. Peritoneal dialysis in neonates with inborn errors of metabolism: is it really out of date? Pediatr Nephrol. 2008 Jan;23(1):163–168. doi:10.1007/s00467-007-0607-y.
29. Ao X, Zhong Y, Yu X-H, Marshall MR, Feng T, Ning J-P, Zhou Q-L. Acute peritoneal dialysis system for neonates with acute kidney injury requiring renal replacement therapy: a case series. Perit Dial Int. 2018;38(Suppl 2): S45–S52. doi : https://doi.org/10.3747/pdi.2018.00109.
30. Yu JE, Park MS, Pai KS. Acute peritoneal dialysis in very low birth weight neonates using a vascular catheter. Pediatr Nephrol. 2010 Feb;25(2):367-71. doi: https://doi.org/10.1007/s00467-009-1347-y.
31. Matthews DE, West KW, Rescorla FJ, Vane DW, Grosfeld JL, Wappner RS, Bergstein J, Andreoli S. Peritoneal dialysis in the first 60 days of life. J Pediatr Surg. 1990 Jan;25(1):110–115; discussion 116. doi : https://doi.org/10.1016/s0022-3468(05)80174-5
32. Elgendy MM, Othman HF, Mohamed MA, Bou Matar R, Aly H. Kidney replacement therapy in neonates: utilization trends and outcomes. Pediatr Nephrol. 2023;38(3):867–876. doi:https://doi.org/10.1007/s00467-022-05575-5
33. Sinha R, Saha R, Dasgupta D, Bose N, Ghosh S, Modi A, Das B, McCulloch M, Tse Y. Improving acute peritoneal dialysis outcome with use of soft peritoneal dialysis catheter (Cook Mac-Loc Multipurpose Drainage catheter®) among infants < 1500 g in a low resource setting. Pediatr Nephrol. 2023 Apr;38(4):1241-1248. doi: https://doi.org/10.1007/s00467-022-05700-4.
34. Warady BA, Bakkaloglu S, Newland J, Cantwell M, Verrina E, Neu A, Chadha V, Yap HK, Schaefer F. Consensus guidelines for the prevention and treatment of catheter-related infections and peritonitis in pediatric patients receiving peritoneal dialysis: 2012 update. Perit Dial Int. 2012 Jun;32 Suppl 2(Suppl 2):S32-86. doi : https://doi.org/10.3747/pdi.2011.00091.
35. Wühl E, van Stralen KJ, Verrina E, Bjerre A, Wanner C, Heaf JG, Zurriaga O, Hoitsma A, Niaudet P, Palsson R, Ravani P, Jager KJ, Schaefer F. Timing and outcome of renal replacement therapy in patients with congenital malformations of the kidney and urinary tract. Clin J Am Soc Nephrol. 2013 Jan;8(1):67-74. doi: https://doi.org/10.2215/cjn.03310412.
36. Kaul A, Jadhav K, Shah S. Peritoneal Dialysis in an Extremely Low Birth Weight Neonate with Ileostomy. Indian J Crit Care Med. 2019 May;23(5):232-233. doi: https://doi.org/10.5005/jp-journals-10071-23167.
37. Nourse P, Cullis B, Finkelstein F, et al. ISPD guidelines for peritoneal dialysis in acute kidney injury: 2020 Update (paediatrics). Peritoneal Dialysis International. 2021;41(2):139-157. doi:https://doi.org/10.1177/0896860820982120

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38. Zaritsky J, Warady BA. Peritoneal dialysis in infants and young children. Semin Nephrol. 2011 Mar;31(2):213-24. doi: https://doi.org/10.1016/j.semnephrol.2011.01.009.

39. Oyachi N, Obana K, Kimura S, Kubo M, Naito A, Nemoto A. Use of a flexible Blake® silicone drains for peritoneal dialysis in the neonatal intensive care unit. Pediatr Int. 2011 Jun;53(3):417-8. doi: https://doi.org/10.1111/j.1442-200x.2011.03366.x.

40. Csaicsich, D., Russo-Schlaff, N., Messerschmidt, A. et al. Renal failure, comorbidity and mortality in preterm infants. Wien Klin Wochenschr 120, 153–157 (2008). https://doi.org/10.1007/s00508-008-0941-5

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