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USE OF PERITONEAL DIALYSIS IN A NEWBORN FOR EXTRARENAL INDICATIONS

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Renal replacement therapy in newborns and young children is rapidly developing. Experience in the use of extracorporeal hemocorrection and intensive care methods is accumulating in many centers across the Russian Federation. Taking into account the anatomical and physiological characteristics of children and the technical capabilities of various methods, we are able to provide renal replacement therapy even in premature infants with extremely low birth weight. Despite this rapid development, not all medical institutions providing care for newborns utilize these methods in their practice. Essentially methods for replacing a vital function, they should be used with the same breadth as mechanical ventilation is used for respiratory distress. The use of hemocorrection methods is not limited to the elimination of excess fluid and uremic toxins. In the presented clinical case, we successfully applied flow-through peritoneal dialysis to a premature infant admitted to hospital in critical condition, including due to severe dehydration. The child had persistent metabolic disturbances that were intractable by other commonly used treatments. The lack of response to these interventions should prompt the clinician to consider renal replacement therapy before the disturbances become irreversible.

Keywords: *Renal replacement therapy, neonatology, peritoneal dialysis, acidosis*

Introduction. Peritoneal dialysis is increasingly used in newborns suffering from acute kidney injury. The incidence of AKI among patients in neonatal intensive care units is approximately 32.9%. Of these, approximately 5% require renal replacement therapy (RRT) [1]. Given the specific nature of neonatal medical care, not all neonatal intensive care units have specialized supplies for RRT [2]. Technical difficulties in establishing vascular access, the volume of the extracorporeal circuit, and the lack of equipment make the use of extended RRT methods challenging. For this reason, peritoneal dialysis is often the most acceptable treatment method. In most cases, peritoneal dialysis supplies are poorly adapted for neonates due to their low body weight, limited abdominal space, and thin anterior abdominal wall, which complicates the correct placement of a standard Tenckhoff catheter. Problems associated with catheter obstruction and migration, infection, and dialysate leakage may arise during the procedure. The use of unadapted catheters is also associated with the development of these complications; however, in some cases, the use of a modified flow-through peritoneal dialysis allows one to overcome a number of problems associated with low body weight and hemodynamic instability [3].

In the Russian Federation, indications for the initiation of RRT in the neonatal period have been formulated:

– anuria (less than 0.3 ml/kg/hour) for more than 24 hours despite adequate therapy (see above) in a child older than 48 hours of life

– anuria/oliguria in combination with:

– multiple organ dysfunction syndrome (MODS) and weight gain of more than 15% in 48 hours;

– MODS and signs of volume overload and development of cerebral edema/pulmonary edema/heart failure, circulatory failure;

– the impossibility of providing adequate therapy and nutrition to the child due to the risk of developing hyperhydration lasting more than 2 days;

– decompensated metabolic acidosis, unsuccessfully corrected by conservative measures (pH 7.15 and below, HCO3 less than 12 mmol/l);

– hyponatremia, the concentration of serum sodium in venous blood is below 120 mEq/l;

– hyperkalemia in venous blood above 7 mmol/l in 2 tests taken within 6 hours during therapy aimed at correcting excess potassium;

– an increase in urea levels over 30 mmol/l against the background of enteral or parenteral nutrition (at least 2 g of protein per kg of body weight) [2].

The primary reason for the need for RRT is acute kidney injury, accompanied by clinical manifestations such as hyperhydration, decreased diuresis, and severe metabolic and electrolyte disturbances [4]. A fairly typical situation is when oliguria and edema syndrome do not correspond to the infusion ambitions of the intensive care physician, due to the multitude of administered drugs (cardiotonic support, transfusion media, parenteral nutrition, etc.). Being one of the methods of replacing a vital function, dialysis can be useful in other situations not associated with severe hyperhydration. Moreover, the use of the method is possible even in a dehydrated patient in order to correct severe acidosis that cannot be corrected by other methods [5].

Target. To demonstrate the results of patient treatment using renal replacement therapy methods for extrarenal indications.

Clinical case

In our practice, we observed a clinical case of a child F., who was urgently admitted to the intensive care unit of the pediatric building of the Samara Regional Clinical Hospital named after V.D. Seredavin. The girl was born through surgical premature birth, the second of dichorionic diamniotic twins. Body weight at birth was 1170 g. She was nursed in the department of premature babies for 36 days, from where she was discharged home in satisfactory condition with a body weight of 2100 g. A week later, the child's mother began to notice the child's increasing lethargy, worsening sucking, pallor of the skin, and the appearance of groans. After an examination by the local pediatrician, an emergency medical team was called and the child was transported to the emergency room of the pediatric building of the regional clinical hospital.

Upon admission, the patient's condition was serious. His body weight was 1770 g. His consciousness was confused, his gaze was not fixed, and his eye movements were floating. The skin was pale, with increased venous markings, and tissue turgor was significantly reduced. Respiration was normal, with tachypnea up to 80 beats per minute and tachycardia up to 184 beats per minute. His head was hydrocephalic, the large fontanelle was sunken, and the cranial bones were overlapping at all sutures. He was immediately taken to the neonatal intensive care unit, where vital signs were monitored, venous access was established, and glucose-saline infusion therapy was started, taking into account the degree of dehydration. The initial acid-base analysis upon admission revealed decompensated metabolic acidosis and severe anemia.

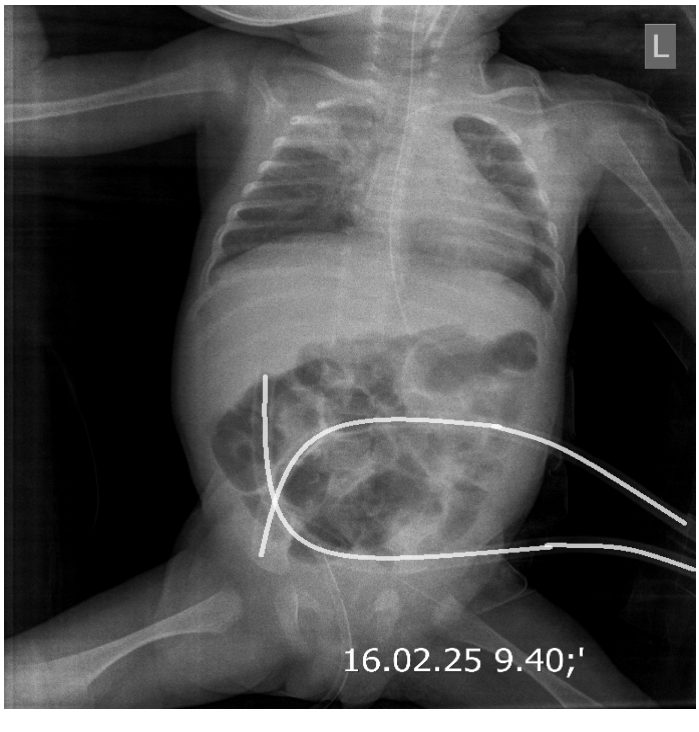

Figure 1. X-ray of child F. After implantation of peritoneal drains (highlighted by white lines)

Given the child's life-threatening condition, he was intubated, forced mechanical ventilation was initiated, and a red blood cell transfusion was administered. During this treatment, concentrated urine output resumed, reaching a diuresis rate of approximately 3.5 ml/kg/h. Upon admission, stagnant bile was noted in the stomach; enteral tube feeding was resumed as the condition resolved. Metabolic acidosis persisted despite these measures. Sodium bicarbonate was administered intravenously several times to correct the acidosis, but this also had no significant effect. Blood chemistry revealed a marked increase in urea (20 mmol/L) and a slight increase in creatinine (65.3 μmol/L), hypernatremia (158 mmol/L), and hyperkalemia (6.7 mmol/L). Considering the impossibility of correcting metabolic acidosis with conservative measures, a decision was made to initiate renal replacement therapy with peritoneal dialysis in a flow modification.

In the neonatal intensive care unit, under sterile conditions, after preparing the surgical field in the left hypochondrium and left inguinal-iliac region, 12-Fr polyvinyl chloride drains were inserted into the upper abdominal cavity and pelvis using a trocar and hermetically fixed to the skin with a purse-string suture (polydioxanone thread), control radiograph, position of drains correct (Figure 1).

A 1.5% peritoneal dialysis solution was infused into the abdominal cavity through one of the drainage lines at a constant rate of 8 ml/h using an infusion pump. A passive drainage system was used to drain the solution into a sterile bag. Immediately after the infusion began, a light yellow dialysate equivalent to the volume of the infused solution was obtained. No significant leakage was observed.

During the procedure, a gradual and sustained normalization of the acid-base balance, blood pH, bicarbonate concentration, and base deficit was observed. It is worth noting that, despite the severity of the abnormalities, the child did not exhibit significant lactatemia, which was considered a favorable prognostic factor. Intravenous sodium bicarbonate was not required. The dynamics of acid-base balance indicators are presented in Figure 2.

The procedure lasted 29 hours, after which the solution administration was suspended for 24 hours. Given stable blood gas parameters and positive dynamics, the catheter was successfully removed. Clinically, the child's condition improved, with adequate spontaneous breathing restored. The duration of artificial ventilation was 24 hours. Consciousness cleared, the child began to fixate his gaze and independently feed from a bottle. The skin tone became pale pink, the mottled coloration and pathological venousity disappeared. Seven days after admission, the child was transferred to the neonatal and premature infant pathology department. The total duration of hospitalization was 22 days, and the child was discharged home weighing 2800 g in satisfactory condition. Final diagnosis: P92.3 Underfeeding of the newborn. Complications: Cachexia. Exicosis. Multiple organ failure.

Conclusions. Thus, timely initiation of renal replacement therapy made it possible to manage severe metabolic acidosis, refractory to other conservative measures. Given the patient's anatomical characteristics (liver size, abdominal cavity volume, previous surgery, and presence of an intestinal

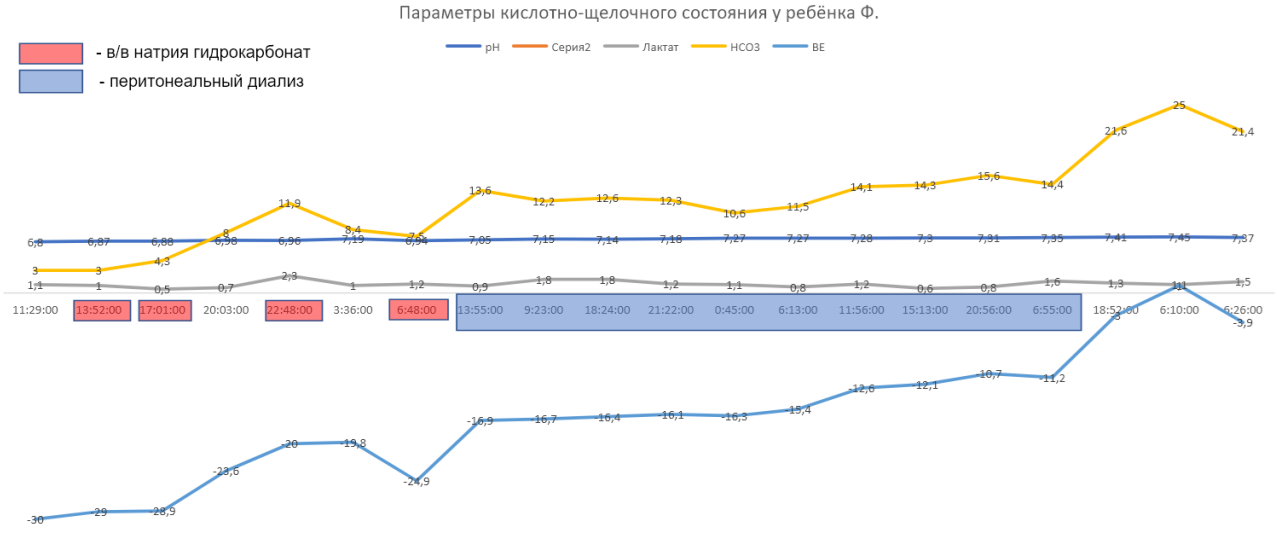

Figure 2. Acid-base balance indicators in child F

stoma), placement of peritoneal catheters on one side of the abdomen is acceptable. The use of flow-through peritoneal dialysis is well tolerated by the patient, allowing for gradual withdrawal of analgesics, transition to spontaneous respiration, and resumption of enteral feeding. Peritoneal dialysis is not limited to the correction of edema syndrome and can be used to accelerate the elimination of endogenous toxic substances from the bloodstream.

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