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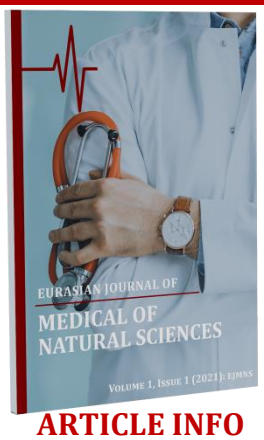

KT/V - TEST DIAGNOSIS IN CHILDREN WITH ACUTE KIDNEY INJURY

Anvarov A. A.
Third year Master's Degree of Department of Pediatric nephrology
Mamatqulov B. B.
Scientific supervisor: Associate Professor Department of emergency pediatrics, Salvation medicine, Candidate of Medical Sciences
Tashkent Pediatric Medical Institute
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ABSTRACT
Kt/v is a quantitative parameter that reflects the dose of dialysis. The classic way to determine it is the calculation, which is based on the values of urea concentration before and after dialysis, the duration of dialysis, the patient's body weight, and the volume of ultrafiltration.

Kt/v is the main indicator of the dialysis dose. At the same time, there are two main approaches to calculation. The first is the so–called single pool (single pool kt/v, spkt/v), the calculation of which assumes that uremic toxins are evenly distributed in the human body. The second is a two–pulse, or balanced (ekt/v, dpkt/v), which takes into account the fact that urea is unevenly distributed in the body, and at the end of the hemodialysis session, the blood is more purified than the tissues. Indeed, if you determine the level of urea immediately after the procedure, and then after half an hour, then we will see that the second indicator will be higher. This is due to the movement of excess urea in the tissues into the blood. A sufficient value for single–pulse kt/v is 1.4, whereas for double-pulse it is 1.2. These figures were obtained from the results of a survey of thousands of patients receiving hemodialysis, and it has been proven that when they are reached, mortality and the risk of cardiovascular complications significantly decrease.

Modern models of hemodialysis machines are equipped with their own techniques that allow you to determine the approximate value of kt/v without taking blood tests at each session. Currently, there are 2 ways to estimate the dose of dialysis. Kt/v is the main indicator of the dialysis dose, image No. 1. The most common is the conductometric method (in devices Nipro Surdial X, Gambro Artis, Fresenius 4008, 5008). It has confirmed its accuracy in more studies, so it is considered more reliable. This method is based on changing the concentration of sodium ions in the dialysis solution and determining its clearance through the dialysis membrane. The mass of sodium differs very slightly from the mass of urea, therefore, kt/v can be calculated with considerable accuracy from the clearance of the former. The second method is spectrophotometric (in BBraun Dialog + and Nikkiso DBB devices), which is based on measuring the optical density of the dialysis solution. The disadvantages of the method include 2 important factors. First, the optical density is influenced by many factors, not only the urea content. Second, there is a very strong dependence of the displayed value on the calibration of optical sensors. To date, the evidence base regarding the extent to which this

method can predict negative clinical outcomes is low. It is important to understand that the kt/v value may vary slightly on different devices. This is due to the peculiarities of the technical implementation in each model of the device. A striking example is Gambro Artis, whose value is close not to the single-zero Kt/v, the norm of which is 1.4, but to the two-zero kt/v (ekt/v), the normal value of which is 1.2.

Thus, the following conclusions can be drawn:

1) The different value of kt/v during treatment on different devices is most often determined not by how one or another device "cleans", but by the method of determination (conductometric, spectrophotometric) and the kt/v variant (single-pulse, double-pulse).

2) Even when using the same method and the same type of kt/v on different devices, all other things being equal, the dialysis dose rates may differ only due to the peculiarities of the implementation of the method in different models. Therefore, it is always necessary to compare the Kt/v value measured by the device with the Kt/v calculated from the results of the urea test before and after the hemodialysis session.

And in conclusion, we note that kt/v can only be evaluated with hemodialysis 3 times a week for at least 4 hours. In other modes, there are other ways to evaluate. Adequacy of hemodialysis: balanced Kt/V and the proportion of urea reduction spKt/v (single pool, single chamber model) (Daugirdas (1989, 1994)): Kt/V = -ln (Ct/C0 – 0.008*t – UF/W)

- Ct - serum urea level after dialysis, mmol/l;
- C0 - serum urea level before dialysis, mmol/l;
- K – clearance of the urea dialyzer, ml/min;
- t is the dialysis time, h;
- UF – volume of ultrafiltrate, l;
- W – dry body weight, kg.
- eKt/v (balanced, two-chamber model):

The balanced Kt/V (eKt/V) index is calculated using an equation based on a 2-chamber (two-pulse) kinetic model with regional blood flow, which takes into account the postdialysis rebound of urea.

Arteriovenous access: eKt/V = spKt/V – 0.6 x (spKt/V) x t + 0.03.

Venovenous access (i.e. in the absence of cardiopulmonary recirculation)

- eKt/V = spKt/V – 0,47 x (spKt/V) x t + 0,02,
- spKt/V is a single–pool (single-pool) Kt/V , which is calculated using the formula given above;
- K – clearance of the dialyzer (ml/l) for urea;
- t is the duration (h) of the hemodialysis procedure;
- V is the volume of urea distribution(l).
- The proportion of urea reduction (URR) URR = 100 x (1 - post-Urea/ pre-Urea),
- where post-Urea is the urea level after dialysis (mmol/l);
- pre–Urea is the urea level at the beginning of dialysis (mmol/l).

Comments:

- eKt/V = 1,2 – adequate hemodialysis.
- eKt/V = 1.6 – optimal hemodialysis.
- eKt/V = 2.3 – ideal hemodialysis.

- The URR must be at least 65%.

Dialysis is a method of renal replacement therapy, a procedure for purifying the patient's blood from toxins, toxins and excess fluid using an artificial dialyzer filter. No matter how effective dialysis is, it cannot completely replace kidney function, so it is important to choose the right dose. There is a concept of "target dose of dialysis", which is necessary for the normal quality of life of the patient. According to the formal signs of urea removal, with three dialysis sessions of 4-5 hours, we replace no more than 15% of the function of healthy kidneys. This is enough to fully live on dialysis and feel good. Methods for estimating the dose of dialysis and the formula for calculation. The methods are based on measuring the level of urea in the blood before and after the procedure. Numerous studies have found that the results of treatment are significantly better if the urea level decreases to 65-70% during the procedure. This value is indicated by the abbreviation DSM or URR — the proportion of urea reduction (Urea reduction rate). A more complex method is also based on the amount of urea removed per procedure (in milliliters per minute). The calculation is much more complicated and is denoted as Kt/V, where:

- K — the ability of the dialyzer to purify blood from urea,
- t is the duration of therapy,
- V is the volume of fluid in the patient's body.

To date, the calculation of Kt/V is a generally accepted method for determining the adequacy of a dialysis procedure. In common practice, two calculation options are used: spKt/V — single—pulse and eKt/V - balanced. Depending on the calculation method, the figures of these indicators also differ, which indicate that an adequate dose of dialysis has been achieved.

What is needed to correctly assess the dose of dialysis. In order to correctly assess the dose of dialysis, it is necessary to take blood in compliance with simple rules: A blood sample before the dialysis procedure must be taken from a fistula needle until the moment of connection. A blood sample after the procedure should be taken from a fistula needle or arterial line until the moment of disconnection, after one minute of slow blood flow, ultrafiltration and dialysate flow are turned off. If these rules are not followed, the laboratory will receive distorted blood samples that will show incorrect results. Additional requirements for the correct assessment of the dialysis dose, which must be met for all patients:

- the proportion of urea reduction should be at least 65-70%,
- spKt/V (single-pole Kt/V) is greater than 1.4,
- eKt/V (balanced Kt/V) is greater than 1.2.

To achieve optimal dialysis quality, one Kt/V indicator is not enough, it works under additional conditions:

- Dialysis should be performed at least 3 times a week with a total dialysis time of at least 720 minutes per week.
- Control the volume of blood perfusion — at least 240 liters per week or at least 80 liters per procedure.
- The duration or frequency of hemodialysis procedures can be changed for patients with good residual renal function, hemodynamic instability or cardiovascular diseases.

Ways to increase the dose of hemodialysis.

When the required dose is not reached with the selected dialysis regimen, it needs to be increased. It happens that even when the target values are reached, the dose is increased if there are signs of uremic intoxication and dialysis insufficiency, which can be explained by the following conditions:

- persistent anemia with prescribed therapy with erythropoietin and iron,
- low protein levels combined with poor appetite, provided that there are no inflammatory reactions or infectious diseases,
- hypertension, despite salt restriction,
- itching with normal indicators of phosphorus-calcium metabolism,
- hyperphosphate,

To increase the dose of dialysis, you can use the following methods: Add the number of dialysis procedures. Increase the duration of the dialysis procedure. Use a more powerful dialyzer. Increase the blood flow rate. Make full use of the time allotted for the dialysis procedure:

- do not reduce time due to delays and premature shutdowns,
- reduce ineffective dialysis periods during hypotension,
- minimize ineffective dialysis periods during decreased blood flow through the dialyzer.

To improve the washing of peripheral tissues, provide physical activity to muscles and good blood flow. In the process of improving the treatment plan, the task is to minimize complications and improve the quality of life of patients on hemodialysis. In order to achieve the effectiveness of procedures, first of all it is necessary to pay attention to the patient's state of health in order to make therapy as comfortable as possible.

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