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Acute kidney Injury in Newborns: Frequency, Diagnosis and Treatment

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Acute kidney injury (AKI) is a sudden episode occurring within a few hours or days of kidney failure or kidney damage. AKI allows waste products to build up in your blood, which makes it impossible for your kidneys to maintain the proper fluid balance in your body. Certain organs including brain, heart , and lungs can also be affected by AKI. Acute kidney damage is common in hospitalized patients , in intensive care units, and especially in older adults. Acute kidney injury (AKI) usually occurs when there is sudden damage to your kidneys. The damage that leads to AKI may be caused by, not enough blood flowing through your kidneys, an injury directly to your kidneys or a kidney problem, a blockage in your ureters, the tubes that take urine from your kidneys into your bladder Your chances of having AKI are higher for other health problems (such as kidney disease , stroke , heart disease) or future AKI again. The chances of developing kidney disease and kidney failure increase with AKI occurring each time. You should follow up with your health care provider to keep track of your kidney function and recovery to protect yourself. AKI in newborns develops after asphyxia or accompanies the development of sepsis, the incidence reaches 60% and differs greatly depending on the study groups.

We did a multicenter prospective study "frequency of occurrence of acute kidney injury in newborns in the intensive care units of different levels." The study included 851 newborns from 20 ICUs in 15 Russian cities. The study included all neonates receiving treatment in the ICUs (from 0 to 28 days of life) and having at least 2 biochemical blood tests with serum creatinine level (intervals between tests were from 48 hours to 7 days).The exclusion criteria were: the presence of congenital anomalies of the kidney and urinary tract (CAKUT); death at the first 72 hours in the department; less than 2 biochemical blood tests with serum creatinine level.

Statistical analysis included Pearson's Chi-squared test (with Yates' continuity correction for 2x2 tables), Kolmogorov-Smirnov test Mann-Whitney test. Continuous variables that do not have a normal distribution presented as median and interquartile ranges (IR). Normally distributed continuous variables presented as mean and standard deviation (SD). A significance level of $P < 0.05$ was considered statistically significant. The average birth weight was 2367.34 ± 947.223 g. The median height at birth was 46.5 cm (IR 42 cm; 51 cm). The median gestational age at birth was 35 weeks (IR 32 weeks; 38.5 weeks). The AKI frequency according to the KDIGO classification was 22.7% (n = 193), AKI was more common in the first week of life (early AKI) and was - 18.2% (n = 155). Of 155 newborns with early AKI, 91 (12%) had 1st stage, 45 (6%) had the 2nd stage, and 19 had 3d stage. AKI was more common in premature infants (newborns born before the 29th week of gestation (44.9%)). The AKI frequency in newborns born from 29th to 32 weeks of gestation was 31,4% (38 of 121), from 32 to 35 weeks –18,1% (35 of 183), from 35 to 38 weeks –16,3% (29 of 178), over 38 weeks –18,2% (51 of 280). AKI was more common in newborns with extremely low birth weight (2 of 4newborns with birth weight less than 500 g had AKI). The AKI frequency in newborns with birth weight from 500 to 100 g was 40,8% (29 of 71), from 1000 to 1500 g –32,1% (35 of 109), from 1500 to 2000 g - 24,6% (33 of 101), from 2000 to 2500 –18,6% (30 of 131), from 2500 to 3000 g – 17,8% (23 of 129), from 3000 to 3500 g –15,6% (20 of 128), over 3500 g –18,3% (21 of 115).

AKI was more common in patients with diaphragmatic hernias (83.3%, 5 of 6 neonates) and intestinal obstruction (83.3%, 10 of 12 neonates). The frequency of AKI in neonates with meconium aspiration syndrome was 7% (3 of 41), with intrauterine pneumonia and/or respiratory distress syndrome - 20.6% (73 of 355), with cerebral ischemia and asphyxia - 20.4% (23 out of 113), with gastroschisis –1 of 8, with hemolytic disease of the newborn –4 of 12, with low and very low birth weight — 29% (40 of 138), with intrauterine infection and sepsis – 4 of 43, with esophageal atresia –3 of 8, with intrauterine growth restriction –– 1 of 9, with the hemorrhagic disease of the newborn –– 26.7% (4 of 15), with intraventricular hemorrhages –– 1 of 2, with ulcerative necrotizing enterocolitis –– 6 of 12, and with intestinal atresia –– 1 of 4, respectively.

Newborns with AKI had a lower Apgar score on first minute (5,0(IR 4,0; 7,0) vs 6,0(IR 5,0; 7,0) points, $p < 0.001$). Newborns with AKI also had longer hospitalization (8 (5; 14) vs 6 (4; 8) days, $p = 0,001$), and more lethal outcomes (6.2% vs 0.2%, but this difference was not statistically significant, maybe because of small sample size). Among children with a history of surgical intervention, the AKI rate was 44.6%. The frequency of AKI was higher in children receiving furosemide ($p<0,001$), netromycin ($p<0,001$), vancomycin ($p<0,001$), and NSAIDs ($p=0,002$).

Another problem is the low awareness of neonatologists. According to our survey of 70 neonatologists of ICU in Moscow, the tactics of neonatologists at the earlier stages of AKI in most cases is reduced to limiting the protein load (63%), the appointment of furosemide (45%) and correction of electrolyte disorders (83%). More than half of the respondents (62%) have experienced renal replacement therapy (RRT) in newborns in their practice, of which 30 people (43%) are ready to engage inRRT in their practice on their own or with the involvement of specialists. The main obstacles in the routine use of dialysis technologies in neonatology respondents called the lack of knowledge, lack of technical capabilities.

Conclusions: AKI is common in newborns in ICU. Neonatologists'awareness of AKI and modern treatment methods are required.