Relationship between acute kidney injury and some surgical interventions and the effects of medicine in premature infants at Children’s Hospital 1

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ABSTRACT
Objective: Determining the relationship between acute kidney damage and some surgical interventions and the effects of nephrotoxic drugs in premature infants at the Children’s Hospital 1. Object and method: A cross-sectional study describing a series of analyzes involving 20 premature infants with acute kidney injury and 120 premature infants without acute kidney injury met the criteria for joining the department of neonatal resuscitation at the Children’s Hospital 1 from September 2017 to May 2018. Results: PDA surgery and general surgery are not associated with acute kidney damage. The use of antibiotics has the potential to affect kidney function: Amikacin, Vancomycin, and Amphotericin B are all associated with acute kidney damage (p <0.05). The group with
Acute kidney damage had a higher death rate than the group without acute kidney damage (p <0.001). **Conclusion:** there is the relationship between acute kidney damage and the effects of antibiotics on premature infants.

**Keywords:** acute kidney injury, premature infants, surgical interventions, drugs.

1. **INTRODUCTION**

Acute kidney damage, commonly referred to as an acute renal failure, is a condition of a sudden loss of kidney function, determined by a rapid decrease in glomerular filtration rate. Acute kidney damage will lead to disorders of the physiological functions of the kidneys: reduced ability to eliminate nitrogen products from the body, disorders of water balance, electrolytes, and acidosis (Khwaja, 2012; Jetton and Askenazi, 2014). The death rate in infants with high acute kidney damage, up to 69.2%, according to Vesna stojanovié research (Alabbas et al., 2013). Another study conducted by Ankara Daga et al. at the Philadelphia Center in the United States published in 2016, involving 115 very low birth weight infants presenting some risk factors for acute kidney damage: antenatal NSAIDs, low gestational age, low birth weight, respiratory failure, mechanical ventilation, patent ductus arteriosus, hypotension, delayed onset neonatal infection and high CRIB II score (Makris and Spanou, 2016). A retrospective study conducted by Abbas et al., published in Pediatr Nephrol 2013, in 122 infants with cardiac surgery, found that acute kidney damage occurred in 62% of infants (Alabbas et al., 2013).

2. **MATERIALS AND METHODS**

Twenty preterm infants with acute kidney damage and 120 preterm infants without acute renal injury who met the neonatal resuscitation admission criteria at Children’s Hospital 1 from September 2017 to May 2018 were selected.

Criteria for selecting a disease: preterm infants <37 weeks old and having a medical condition requiring intensive respiratory resuscitation or intravenous feeding are admitted to the neonatal resuscitation department. Criteria for determination: Children with increased serum creatinine > 1.5 mg / dL (standard 1) and / or kinetics for creatinine change meeting AKIN criteria (Waikar and Bonventre, 2009).

**Exclusion criteria:** children were not given creatinine once during treatment at the neonatal resuscitation department. Babies die within 48 hours after admission. Children whose mothers were recorded acute/chronic renal failure. Patients with kidney disease, urology, kidney surgery, and urology. Family members did not agree to participate in the study.

**Research targets:** Using nephrotoxic drugs such as Gentamycin (causes proximal tubular toxicity, causes constriction of blood vessels in the kidneys, constricts the glomeruli and mesenchymal cells); Amikacin (an antibiotic Toxic to the proximal tubular, causes constriction of blood vessels in the kidney, causes contraction of glomeruli and mesenchymal cells); Vancomycin (an antibiotic with a mechanism of acute renal damage unknown, possibly due to renal tubular toxicity); Amphotericin B (an antibiotic Causes distal nephrotoxicity, constriction of blood vessels and reduces glomerular filtration rate); PDA column surgery; Other surgical surgery; Dead. Follow-up time: Up to 28 days from the date of admission to the neonatal resuscitation department or until the following events occur within 28 days: If the child appears acute kidney damage: monitor until the child recovers or dies. If the child does not have acute kidney damage: follow up until he/she is eligible for neonatal resuscitation or death Criteria for neonatal resuscitation: stable, no need for respiratory and circulation support.

Data processing method: calculating the value of n (%), Mean ± SD, comparing with T-test, comparing percentages with OR, p makes sense when having value <0.05. Based on collected data entered and processed on SPSS 22.0 biomedical statistical software.

3. **RESULTS**

**Table 1** Comparison between acute and non-renal impairment groups with surgical intervention

<table>
<thead>
<tr>
<th>Related factor</th>
<th>Acute kidney damage</th>
<th>p</th>
<th>OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes n(%)</td>
<td>No n(%)</td>
<td></td>
</tr>
<tr>
<td>PDA surgery</td>
<td>Yes 4(23,5)</td>
<td>13(76,5)</td>
<td>&gt;0,05</td>
</tr>
<tr>
<td></td>
<td>No 16(13,0)</td>
<td>107(87,0)</td>
<td></td>
</tr>
<tr>
<td>Other surgical surgery</td>
<td>Yes 5(18,5)</td>
<td>22(81,5)</td>
<td>&gt;0,05</td>
</tr>
<tr>
<td></td>
<td>No 15(13,3)</td>
<td>98(86,7)</td>
<td></td>
</tr>
</tbody>
</table>

Comments: There was no relationship between acute kidney damage and the case of PDA column surgery or other surgical surgery (p > 0.05).
Table 2 Comparison between acute and non-renal impairment groups regarding the use of drugs that affect renal function

<table>
<thead>
<tr>
<th>Related factor</th>
<th>Acute kidney damage</th>
<th>p</th>
<th>OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes n(%)</td>
<td>No n(%)</td>
<td></td>
</tr>
<tr>
<td>Gentamycin</td>
<td>10(11,4)</td>
<td>78(88,6)</td>
<td>&gt;0,05</td>
</tr>
<tr>
<td></td>
<td>10(19,2)</td>
<td>42(80,8)</td>
<td>-</td>
</tr>
<tr>
<td>Amikacin</td>
<td>17(21,5)</td>
<td>62(78,5)</td>
<td>&lt;0,05</td>
</tr>
<tr>
<td></td>
<td>3(4,9)</td>
<td>58(95,1)</td>
<td>5,3(1,41 – 29,38)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>10(37,0)</td>
<td>17(63,0)</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td></td>
<td>10(8,8)</td>
<td>103(91,2)</td>
<td>6,06(1,91 – 18,8)</td>
</tr>
<tr>
<td>Amphotericin B</td>
<td>4(80,0)</td>
<td>1(20,0)</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td></td>
<td>16(11,9)</td>
<td>119(88,1)</td>
<td>29,75(2,61 – 1476,28)</td>
</tr>
</tbody>
</table>

Comment: No association was found between Gentamycin use and acute kidney damage (p > 0.05). Meanwhile, the use of Amikacin, Vancomycin, and Amphotericin B is associated with acute kidney damage (p <0.05).

Table 3 Comparison between acute and non-renal impairment groups in mortality

<table>
<thead>
<tr>
<th>Related factor</th>
<th>Acute kidney damage</th>
<th>p</th>
<th>OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes n(%)</td>
<td>No n(%)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>8(50,0)</td>
<td>8(50,0)</td>
<td>&lt;0,001</td>
</tr>
<tr>
<td></td>
<td>12(9,7)</td>
<td>112(90,3)</td>
<td>9,33(2,49 – 33,9)</td>
</tr>
</tbody>
</table>

Comments: There is a relationship between mortality rate and acute kidney damage (p <0.05).

4. DISCUSSION

Surgical factors related to kidney damage

Surgical factors such as PDA column surgery and other surgeries such as esophageal atrophy, diaphragmatic hernia, and peritonitis due to hollow visceral perforation are not associated with damage. Acute renal injury. In most cases of PDA column surgery in children with PDA who have hemodynamic disorders but fail with conservative treatment, they have been treated for vasopressors, ensuring hemodynamic stability before surgery. Hence, almost Acute renal damage was not different from the other group. Similarly, most other surgical conditions, such as esophageal atrophy, diaphragmatic hernia, or small bowel atrophy, children will have surgery when the medical condition is stable, so acute kidney damage is rare out on prepared surgical children. In our study, primarily acute kidney damage occurred in a few emergency surgeries for peritonitis due to necrotic enteritis or gastrointestinal rupture. In these children, many factors are contributing to acute kidney damage such as severe sepsis, septic shock, lack of fluid, so surgery alone is not necessarily a high-risk factor for acute kidney damage, but rather a combination of many other risk factors (Makris et al., 2016).

Factors associated with nephrotoxic drugs

Among the four antibiotics that affect the renal function most commonly used in neonatal resuscitation, gentamycin did not record an association with acute kidney damage. In contrast, three The remaining drugs are amikacin, vancomycin (similar to Vesna Stojanovié’s study), and amphotericin B are both associated with acute kidney damage. The occurrence of acute kidney damage in these children can be due to a combination of causes, such as severe sepsis, requiring the use of strong antibiotics, or the effect of drugs on the kidney itself. In particular, we recognize that ¼ of acute kidney damage occurs shortly after amphotericin B use, and the acute kidney damage improves rapidly after drug discontinuation. We, therefore, found a very clear association between amphotericin B and acute kidney damage. Due to the high risk of fungal infections in preterm infants and the increasingly widespread use of amphotericin B antifungal agents, clinicians need to focus on appropriate dose calculations and regular renal function monitoring in infants in the course of using the drug to detect early cases of acute kidney damage after taking amphotericin B.

Death and acute kidney damage

Mortality is associated with acute kidney damage. The group of children with acute kidney damage had a 9.33 times higher mortality rate than the other group. This mortality may be due to the patient’s severe medical condition. In addition, acute kidney damage causes disorders such as metabolic acidosis, water, and electrolyte disorders, aggravates the patient’s underlying pathology, causes
a pathological spiral, and leads to death. If not resolved. However, compared to previous studies by Le Van Tri, The mortality rate in our study was reduced (40% compared to 60%), indicating a greater concern of neonatal resuscitation doctors for acute kidney damage. When comparing the death rate alone in the group of acute kidney damage, the group of oligosacridial kidney injury had a much higher mortality rate than the group without oliguria (87.5% compared with 12.5%). It was found that the group of children with acute kidney damage had a higher death rate than the group without acute kidney damage (69.2% compared to 13.5% with p <0.001). Also, according to this study, the mortality rate in groups of kidney injury grades 2 and 3 is much higher, ranging from 66.6 to 100%, depending on the weight classification at birth. The detection of children with acute kidney damage at stages and causes will help timely treatment, prevent progressive kidney damage, and help reduce mortality.

5. CONCLUSION
In the study of acute kidney damage in 20 premature babies in the 1st Children's Hospital from September 2017 to May 2018, we draw some conclusions: Cases requiring surgical surgery (PDA column surgery and general surgery): no association with acute kidney damage. The use of antibiotics has the potential to affect kidney function: Amikacin, Vancomycin, and Amphotericin B are all associated with acute kidney damage (p <0.05). The group with acute kidney damage had a higher death rate than the group without acute kidney damage (p <0.001).

Funding
This study did not receive any funding.

Conflict of Interest
The authors declare that they have no conflict of interest.

Informed consent
Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval for study protocol
The study was approved by the Medical Ethics Committee of Children Hospital 1 (ethical approval code: 13/2018-CH1).

REFERENCE