KSN 2017 Abstract

KSN-17-P005

Study on biological markers of acute kidney injury

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Objectives : Approximately 30-50% of children undergoing cardiac surgery using cardiopulmonary bypass have acute kidney injury, which is thought as an important prognostic factor for cardiac surgery. However, changes in serum creatinine, which is used as a criterion for evaluating acute kidney damage, increases after a reduction of 50% or more in kidney function, and thus it has a limitation to the early diagnosis of acute kidney injury. We investigated the clinical usefulness of new biological markers of acute kidney injury by cardiopulmonary bypass.

Methods : From March to July, 2016, pediatric patients under the age of 18 who underwent open heart surgery using cardiopulmonary bypass in the Department of cardiovascular surgery, Kyungpook National University Hospital, were included. Serum creatinine levels were measured at before surgery, 6, 24 and 48 hours after surgery and the values of urinary NGAL (neutrophil gelatinase-associated lipocalin), KIM-1 (kidney injury molecule-1) and IL-18 (interleukin-18) were also measured at each times.

Results : The mean age of the 10 patients was 7.97 ± 11.45 months and the ratio of gender was male : female= 7: 3. The number of patients with congenital heart disease was as follows: 2 atrial septal defect, 2 ventricular septal defect, 2 Transposition of the great arteries, 1 Tetralogy of Fallot, 1 double outlet right ventricle syndrome, and 1 mitral regurgitation, and 3 of them were cyanotic heart disease. Mean urine volume was measured as 3.7 ml/kg/hr for 24 hours and 4.1 ml/kg/hr for 24 hours to 48 hours. The mean value of serum creatinine (mg/dL) was 0.28 ± 0.11, 0.31 ± 0.16, 0.32 ± 0.14, and 0.31 ± 0.08 at 0, 6, 24, and 48 hours, respectively. There was no statistically significant difference of serum creatinine. On the other hand, urine KIM-1 (ng/dL) was measured as 107.85 ± 268.20, 55.41 ± 52.53, 265.13 ± 245.14, 99.50 ± 100.65 at 0, 6, 24, and 48 hours and there was a significant difference between 6 and 24 hours (p = 0.037). The values of urine KIM-1/Cr (ng/mg) were 1.83 ± 2.36, 5.23 ± 8.09, 36.72 ± 66.37 and 6.90 ± 10.88, respectively, and there was significant difference between 0 and 24 hours (p = 0.023). However, the values of Urine

NGAL (ng/dL) and urine NGAL/Cr (ng/mg) were continuously increased until 48 hours and there was no significant change in urine IL-18/Cr (ng/mg).

Conclusions : Urine KIM-1 had significantly elevated at 24 hours after cardiac surgery. Therefore, it is suggested that urine KIM-1 is more sensitive to acute kidney injury than serum creatinine. But NGAL and IL-18 did not change significantly within 48 hours after cardiac surgery .

Keywords : cardiopulmonary bypass, acute kidney injury, KIM-1, NGAL, IL-18