

P-21

Estimating kidney function in children with growth retardation through analysis of vancomycin pharmacokinetics.

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Growth retardation (GR) results in substantial decrease in nephron number and renal organ mass in experimental animals and newborn infants. Nevertheless, it is hard to estimate actual kidney function in children with growth retardation by using general methods such as monitoring serum creatinine concentration (Scr) or calculating creatinine clearance (CL_{cr}). Therefore, we indirectly compared kidney function in Korean children with growth retardation to estimation from the general equation by analyzing vancomycin pharmacokinetic factor. We selected vancomycin as a comparison drug since its blood concentration is collected in practice and its major elimination organ is kidney. Inpatients who had received intravenous vancomycin for the treatment of suspected or documented methicillin resistant gram-positive infections, and had serum vancomycin trough level sampled at Seoul National University Bundang Hospital between November 2003 and November 2007 were studied retrospectively. Experimental group included children with growth retardation, and control group included children without growth retardation. Each factor including serum creatinine concentration, estimated creatinine clearance by Swartz's method, vancomycin elimination constant, half life and clearance, and relevant factors were evaluated statistically from correlation analysis and t-test. Twenty two children were included in this study. Among them, nine were male and thirteen were female. Their ages were between one month and four years old. And ten had growth retardation while twelve had not growth retardation. Each factor including gestational age, birth weight, age, current height, weight, z score, estimated creatinine clearance had the significant relationship with vancomycin clearance after

univariate analysis ($\alpha=0.05$) Especially, vancomycin clearance had a positive relationship with estimated creatinine clearance, which was derived from the equation that vancomycin clearance = estimated creatinine clearance $\times 1.462 + 0.796$ ($p < 0.01$) by regression analysis The differences of serum creatinine concentration, estimated creatinine clearance, vancomycin elimination constant, half life, clearance between two groups were compared statistically from t-test.

Our study showed that serum creatinine concentration was not significantly different between two groups. However, estimated creatinine clearance ($p < 0.01$), vancomycin clearance ($p < 0.05$) were significantly slower and vancomycin elimination constant ($p < 0.01$) was significantly larger in children with growth retardation from t-test. ($\alpha=0.05$) The half-life of vancomycin was significantly longer in children without growth retardation ($p < 0.05$). In this study, we could find the decreased kidney function in the children with growth retardation compared to the children without growth retardation by analyzing vancomycin pharmacokinetics.

Keywords: children, growth retardation, kidney function, vancomycin, pharmacokinetics, clearance