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Protective Effects of Green Tea Polyphenol on L-arginine Induced Renal Toxicity

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Purpose : Green tea polyphenol, (-)-epigallocatechin 3-O-gallate (EGCG), has potent antioxidative effects. The aims of this study were to investigate the antioxidative effects of green tea polyphenol on human mesangial cells and mice with L-arginine induced acute renal toxicity.

Methods : Human mesangial cells were cultured on DMEM (Dulbecco's minimum essential medium) with L-arginine, iNOS inhibitor (L-NAME, N-nitro-L-arginine-methylester, Sigma) and green tea polyphenol, respectively. The cell proliferation was determined by MTT assay. The iNOS mRNA was determined by reverse transcription polymerase chain reaction (RT-PCR) and Western blot. The NO (nitrate and nitrite) measured by NO ELISA kit (StressXpress^{TM} Hsp60 ELISA kit). The mice (n=20) were divided into 4 groups (n=5/group); group 1 (control group) mice were intraperitoneal (ip) injected 0.9% saline 3 times at 4 day intervals, group 2 (L-arginine group) mice were ip injected L-arginine 30 mmol/L 3 times at 4 day intervals, group 3 (iNOS group) mice were ip injected L-arginine and L-NAME 12 mmol/L 3 times at 4 day intervals, group 4 (polyphenol group) mice were ip injected L-arginine and subcutaneous (sc) injected green tea polyphenol 100 mg/kg 3 times at 4 day intervals. The iNOS mRNA and NO measured by same methods. The histologic examinations were performed after 3 days.

Results : The L-arginine significantly inhibited the proliferation of human mesangial cells in concentration-dependent manner compared with that of control group when the concentration of L-arginine in the media was higher than 51 μmol/L ($p<0.05$). The NO level were significantly increased in mesangial cell with L-arginine than control group (0.139 ± 0.047 vs 0.047 ± 0.026, $p<0.01$) but significantly decreased in green tea polyphenol group than L-arginine group (0.052 ± 0.032 vs 0.139 ± 0.047, $p<0.01$). In the iNOS RT-PCR and western blot, iNOS fragments were increased in L-arginine group and decreased in iNOS inhibitor group but significantly not decreased in green tea polyphenol group ($p>0.05$). In group 2 (L-arginine group) mice, nitrate and nitrite were increased, iNOS RT-PCR and Western blot, iNOS fragment were increased. In group 4 mice, given green tea polyphenol, the NO was decreased but iNOS fragment were significantly not changed ($p>0.05$).

Conclusion : The excessive L-arginine developed renal injury by increasing the production of NO and iNOS. The antioxidative effects of green tea polyphenol were potent in mesangial cell and mice with L-arginine induced acute toxicity by decreasing NO product with NO scavenging effect. Therefore green tea polyphenol would showed a potent protective effect against the renal disorder.