Studies on Statistical Pattern Change of Nitric Oxide at Aortic Blood Flow Change

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1. Introduction

NO is formed from the amino acid L-arginine by a family of enzymes. Its formation in vascular endothelial cells, in response to chemical stimuli and to physical stimuli such as clamping, maintains a vasodilator tone that is essential for the regulation of blood flow and pressure. NO(Nitric Oxide) is generated in large quantities during host defense and immunological reactions. Such generation of NO was first observed in activated macrophages, where it contributes to their cytotoxin against tumor cells, bacteria, viruses and other invading microorganisms. Peroxynitrite is a powerful oxidant; however, there seem to be very effective mechanisms for its removal and inactivation. Thus, NO plays a role in immunological host defense and is also involved in the pathogenesis of conditions such as septic shock and inflammation. It is slightly soluble in many solvents and can diffuse relatively easily across biological membranes.

2. Methods

To examine the role of NO, we observed the blood pressure and change pattern of NO of rats with clamping blood vessel using the NO-501 Nitric Oxide Monitoring Device over two times.

Animals

Male Sprague-Dawley rats (weight 250 – 350g) were obtained from Chemical Research Institute (Taejon, KOREA). The rats were kept in individual cages in a room in which lighting was controlled(12 hours on/12 hours off), temperature was maintained at 23 ° C to 24 ° C .

Experimental Procedure and NO Measurements

Polythylene catheters were inserted into the left carotid artery to measure blood pressure

and into the right jugular vein for infusions. In the blood flow experiments, a mechanical occluder was placed around the aorta located above the renal arteries to allow for changes in aortic blood flow. Pneumograph signals were obtained by measuring the impedance between two electrodes applied to the thorax in the rats. We We calibrated the device by generating a standard curve using the NO donor, S-nitroso-N-acetyl-DL-penicillamine (SNAP) in PBS according to the manufacturers' instructions. Nitric oxide electrodes were precalibrated in vitro by adding known doses of the NO donor compound SNAP to a cuvette in which they were immersed. Using the calibration curve, we made the NO current-concentration conversion formula as follows; NO currents (pA) = 1.501 * NO concentration (nM) + 0.636

3. Result

While the rat's blood vessel is clamped and stop up the supply of Oxygen, blood pressure rises and change of the NO pattern is very clear. Also, when the supply of Oxygen is reopened, NO pattern looks like returning normality. But we can find that the change of NO pattern between first and second experiment is very different.

To examine difference of changing pattern of NO, we try to observe Periodogram with dividing three parts such as before clamping blood vessel, during clamping and reopening supply the Oxygen. Before clamping, NO is showed similarly the type of relatively fast frequency wave in both two experiments. During clamping, type of relatively slow wave appears. And in first experiment power value of relatively fast wave decreases. So RP (relative power) of two wave is 0.4386. In second experiment, such a tendency is more apparent than that of first experiment, RP is 3.1132. When reopening of the supply of Oxygen, relatively fast wave in second more decreases than that of first. RP is separately 0.6162 and 17.9569.

In the statistical analytic process, we can find that a numerical value of RP is changed very much between the first experiment and second experiment. And so we can say that this value is related to character and role of NO. Therefore, by analyzing the RP change pattern of NO, we consider that NO is related to not only a function of the control in blood pressure but also a memory of the cell.

It is expected that such a statistical analysis of changing pattern will be also a good method in molecular biology experiments .

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