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Gly16Arg Polymorphism of β_2-Adrenergic Receptor and Perioperative Use of Vasopressor: An Explanation by Nanomolecular Structure View

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Abstract

The effect of genetic polymorphism in anesthetic drug dosage is very interesting. The relationship between Gly16Arg polymorphism of β_2-Adrenergic Receptor and perioperative use of vasopressor is reported. In this short communication, the authors use the theoretic based on nanomolecular structure view to give an explanation for the effect of Gly16Arg polymorphism of β_2-Adrenergic receptor.

Key words: Polymorphism, β_2-Adrenergic receptor, Vasopressor.

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Introduction

Intubation is one of the most important anesthetic Proper drug dosage is very important in anesthesiology. There are many factors that can cause the problem in drug dosage in anesthesiology. The effect of genetic polymorphism in anesthetic drug dosage is very interesting.[1–2] Many genetic backgrounds are mentioned for possible effect of perioperative drug dosage requirement.[1–2] Of several genetic backgrounds, the relationship between Gly16Arg polymorphism of β_2-Adrenergic Receptor and perioperative use of vasopressor is reported.[3] Nielsen et al. observed that "the Arg16-Gln27-Thr164-Arg175-Gly351 haplotype was associated with approximately 13% lower vasopressor requirements than the most common Gly16-Glu27-Thr164-Arg175-Gly351 haplotype.[3]" In this short communication, the authors use the theoretic based on nanomolecular structure view to give an explanation for the effect of Gly16Arg polymorphism of β_2-Adrenergic.

Materials and Methods

This is the basic theoretical study. The concept of basic quantum medicine was used for clarification the reaction between β_2-Adrenergic Receptor and vasopressor drug in naïve situation and situation with the focused polymorphism "Gly16Arg". The standard approach as presented in the previous studies is used.[4 -6].

As a simple mathematical model, the reaction between β_2-Adrenergic Receptor and vasopressor drug can be written as A + B = C where A is β_2-Adrenergic Receptor and B is vasopressor drug and C is the result biological process/product. It can be seen that the amount of A and B is the main determinants for C. Hence, if there is any change in A or B, the reaction can be changed. In general, B is a drug and have fixed molecular structure but A is a receptor that can be changed and affected by genetic polymorphism.

Here, the basic quantum chemical calculation was done in order to calculate the molecular eight change in polymorphism case from naïve case. Then the simulation of polymorphism is applied and the change in required energy for biological reaction is assessed.

Results

In the studied genetic focused "Gly16Arg" polymorphism, the molecular weight change from the naïve case is equal to -99.1334 g/mol and the required reaction substrate is equal to 43.09 % of naïve case.

Discussion

Vasopressor is widely use in perioperative procedure in anesthesiology. The effect of genetic background of the patient on the required dosage of vasopressor is very interesting. Nielsen et al. found that "Gly16 carriers received larger amounts of vasopressor compared with Arg16 homozygotes[3]" and concluded that "this corresponds to previous studies demonstrating that the Gly16 allele in ADRB2 is associated with vasodilation and high cardiac output."[3]

In this work, the author focuses interest on Gly16Arg polymorphism of β_2-Adrenergic receptor.

In fact, Gly16Arg polymorphism of β_2-Adrenergic receptor is widely discussed for effect on several drug

dosage requirements. The effect on the asthmatic drugs requirement are widely mentioned.[7 – 8] Due to the theoretical approach on this work, it can be seen that the reaction between β_2-Adrenergic Receptor and vasopressor drug is easier in the Gly16Arg polymorphism and this can well explain the observation by Nielsen et al.[3] Nevertheless, in the present study, the estimated reduction of required vasopressor can be as high as six-tenths. This value is significantly lower than the observation by Nielsen et al., hence, it should be other additional genetic or non-genetic factors that interfere the observed situation reported by Nielsen et al.[3]

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