

COMPARATIVE STUDY OF THE RESPONSE OF DETRUSOR VERSUS VASCULAR SMOOTH MUSCLE TO OXIDATIVE STRESS –WHICH IS THE MAIN CAUSE OF CONTRACTILE DYSFUNCTION ASSOCIATED WITH BLADDER OUTLET OBSTRUCTION? -

Aims of Study:

Oxygen radicals involved in the pathogenesis of several conditions including aging, diabetes, carcinogenesis, and cardiovascular disease. It has been well known that ischemia in the bladder is a major etiological factor in the progression of bladder dysfunction secondary to bladder outlet obstruction (BOO). There is increasing evidence that reoxygenation also plays an important role in the detrusor cyclical ischemia/reperfusion injury subjected to BOO. The aim of this study is to determine comparative responses of the detrusor versus vascular smooth muscle to hydrogen peroxide, which rapidly converted to hydroxyl radicals in the presence of endogenous transition metals, and the protective effects of hydroxyl radical scavengers including vitamin E on the smooth muscle contractile ability exposed to oxidative stress.

Methods

Sprague Dawley rat bladder and bilateral internal iliac arteries, which is main feeding vessel for bladder, were excised while the animal was anesthetized, and longitudinal muscle strips of the bladder and circular strips of the internal iliac artery with intact endothelium were obtained, and then mounted in organ baths. The effects of hydrogen peroxide (H_2O_2 ; 0.01 – 1mM) on KCl (30mM)-induced contraction of detrusor or vascular smooth muscle were measured. α -Tocopherol was used as vitamin E, and diluted with minimal DMSO.

Results

H_2O_2 potentiated the KCl-induced contraction in both detrusor and vascular smooth muscles in a concentration-dependent manner, respectively. However, this tonic contraction induced by H_2O_2 was significantly greater in vasculum than in detrusor smooth muscle. While pre-treatment with catalase (2000IU), H_2O_2 scavenger or mannitol (30mM), a hydroxyl radical scavenger significantly attenuated the spastic effect of H_2O_2 in detrusor smooth muscle, no significant difference was found in vasculum. In smooth muscle of internal iliac artery, pre-treatment with vitamin E (0.03mM) showed a strong tendency to reduce the vasospastic contraction responded to H_2O_2 . With severe oxidative stress, whereas detrusor smooth muscle showed an only 4.4% suppression, vasculum revealed a 98.6% suppression of KCl-induced contraction after exposed to 1mM of H_2O_2 .

Conclusions

These results suggested that smooth muscle cell of the vasculum is more sensitive to oxidative stress and vulnerable than of the detrusor. In cyclical ischemia/reperfusion, reoxygenation induces the vascular smooth muscle spasms in both bladder wall and surrounding bladder, which deteriorates further bladder ischemia and may contribute to bladder contractile dysfunction associated with BOO rather than detrusor smooth muscle.