

Pradidarcheep W¹, Ruijter J², Dabhoiwala N³, Lamers W⁴

1. Department of Anatomy, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand, 2. Department of Anatomy & Embryology, AMC, University of Amsterdam, The Netherlands, 3. Department of Urology, AMC, University of Amsterdam, The Netherlands, 4. Department of Anatomy & Embryology and AMC Liver Center, AMC, University of Amsterdam, The Netherlands

IMMUNOEXPRESSION OF ADRENERGIC RECEPTORS IN THE RAT URETHRAL SPHINCTER COMPLEX

Hypothesis / aims of study

Recently, intense attention has been focused in urology on improving drug uroselectivity and organ/function selectivity. To this end an exact differentiation of the different receptor subtypes and their precise anatomical distribution is essential. This study aimed to delineate and quantify the expression of all nine adrenoceptor (ARs) subtypes in the individual tissue layers (urothelium, smooth and striated muscles) of the urethral sphincter complex (USC)

Study design, materials and methods

Consecutive sections of the USC from ten Wistar rats were immunostained and quantified for ARs ($\alpha_{1A,B,D}$, $\alpha_{2A,B,C}$ and $\alpha_{1,2,3}$).

Results

No sex difference in distribution of ARs was found. In the urothelium, smooth muscle, and striated muscle components of the USC, the expression of ARs was limited to α_{1D} , α_{2B} , and α_2 subtypes only. Immunoreactivity patterns for α_{1D} - and α_2 - ARs were similar and uniformly distributed in urothelium. By contrast, concentration of α_{2B} -AR was predominant in the basal layer. Significantly, expression of α_1 -AR is present only in the striated component of the USC (Fig.1). Also, the ARs expressed in the pelvic ganglion neurons were the same subtypes as in the striated muscle component of the USC. Additionally, only a few neurons in the ganglia revealed a high intensity staining for the α_1 -AR subtype

Interpretation of results

Interestingly, α_{1D} , α_{2B} , and α_2 - ARs subtypes are present in the urothelium of the USC. However, the functions of these ARs are currently not established.

Normally, striated muscle is known to contract through the action of acetylcholine on nicotinic receptors at the motor endplate. The finding of expression of adrenoceptors in the striated muscle of the USC from this study is quite intriguing. α -adrenoceptor signalling is known to be involved in glycogen metabolism, glucose uptake and electrolyte transport (1). It has also been shown that α_1 -AR agonists increase the contractile force of the external urethral sphincter in human (2). That the main component of the striated muscle of the USC is fast twitch fibers and that the main motor supply is the pudendal nerve are established facts. Perhaps these fast twitch fibers by their nature require and consume larger quantities of energy stores i.e glycogen.

It is intriguing to contemplate whether the limited expression of α_1 -AR subtype in the neurons of the pelvic ganglia is also in some way related to the heterogeneous density of staining found in the striated component of the USC. No current evidence exists that this is so but it seems plausible. Further studies are needed to establish or disprove a functional relationship.

Concluding message

This study opens an interesting possibility of dual neuronal control of the striated component of the USC. New avenues for further investigation of function of this component of the USC and its neuronal control are required.

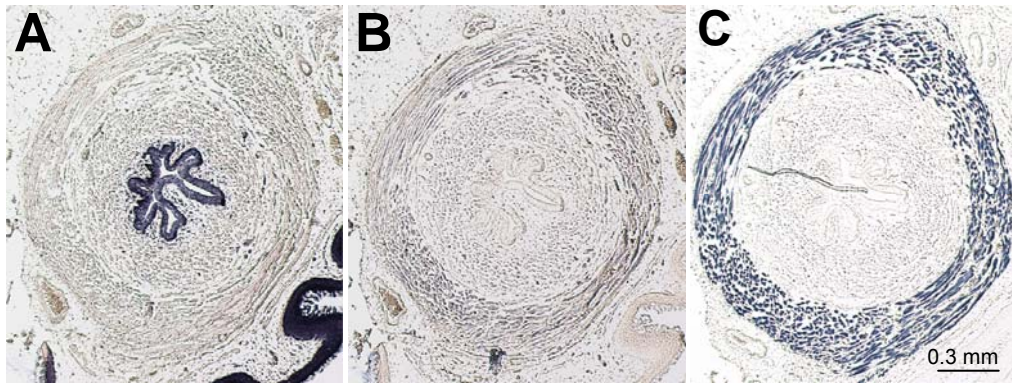


Figure 1. Expression of α_{2B} -adrenergic receptor subtype in the urothelium (A) and α_1 -adrenoceptor subtype in the striated muscle component of the urethral sphincter complex (B). Note the striated muscle fibers in the USC as stained by myosin heavy chain (C).

Reference

1. The positive inotropic effect of epinephrine on skeletal muscle: a brief review: *Muscle Nerve* 12:968-975
2. Experimental studies for urinary incontinence. Effect of α_2 -agonists on the vesicourethral function. *Jpn.J Urol* 80:1597-1604

FUNDING: John L Emmett's foundation