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Aikawa K[1], Akaihata H[1], Ogawa S[1], Haga N[1], Kushida N[1], Hata J[1], Sato Y[1], Kataoka M[1], Yanagida T[1], Ishibashi K[1], Kojima Y[1]

1. *Fukushima Medical University*

INVOLVEMENT OF AFFERENT FUNCTION ON UNDERACTIVE BLADDER WITH AGING

Hypothesis / aims of study

Recently, attention has focused on voiding function that is impaired with aging even men and women without an underlying disease [1]. However, the main mechanism of pathogenesis of underactive bladder from normal aging processes is unresolved. To study healthy aging, animal model is usually used. Previous reports have shown that in vivo or in vitro bladder contractile function may not diminish with aging [2, 3]. The present study attempted to determine whether the difference of afferent activation induces underactive bladder with aging. Thus, we investigated micturition pressure and residual urine volume with shifting infusion rates of cystometry in both young and aged rats.

Study design, materials and methods

Male Sprague-Dawley rats of the two following age groups were used: 12 weeks (young; n=15) and 84 weeks (aged; n=15).

I) Continuous cystometry was performed in each conscious rat without restraint. Saline infusion rates were used 0.5, 2.5 and 5 ml/hour for young rats, and 1, 5 and 10 ml/hour for aged rats. We compared the effect of infusion rates on maximum micturition pressure and residual urine volume between young and aged rats. Residual urine volume was drained and measured after a completed micturition cycle at the end of cystometric recording. The bladder was then removed from each rat.

II) The full-thickness section of bladder was stained using the Elastica-Masson technique for smooth muscle and collagen fibers. To quantify the smooth muscle ratio in the bladder muscle layer, morphometric analysis of full-thickness sections was performed using Image Pro Plus software.

III) Longitudinal bladder strips were transferred to a 5-ml organ bath containing Krebs solution. The strips were stimulated at 2-40 Hz (EFS), 20 μM carbachol (Cch), and 80 mM KCl.

Results

I) Maximum micturition pressure was significantly lower at a rate of 1 ml/hour than at other rates in aged rats (Figure 1). And residual urine volume significantly increased at a rate of 1 ml/hour compared to other rates in aged rats (Figure 2). On the other hand, the infusion rates had no effect on maximum micturition pressure (Figure 3) and residual urine volume in young rats.

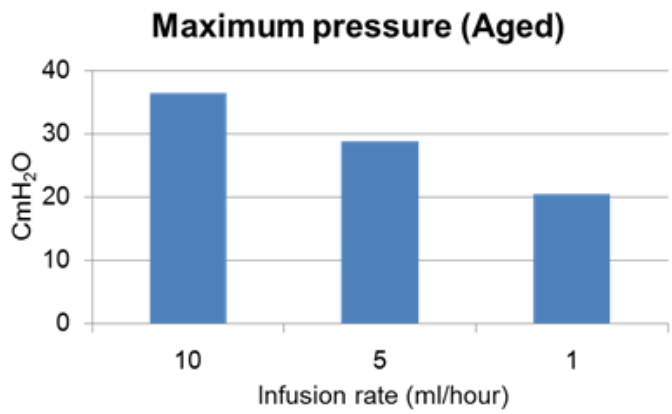

Figure 1

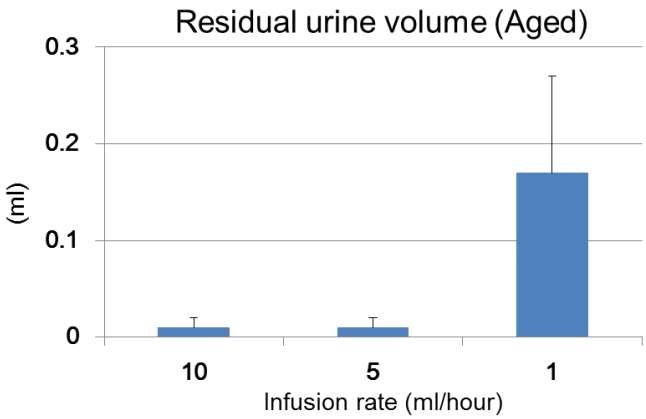

Figure 2

II) The smooth muscle ratio in the bladder muscle layer was not significantly different in the young and aged rats (Figure 4).

III) Figure 5 shows maximal contractile responses of the bladder strips to EFS, Cch. Maximal contraction for 5 to40 Hz was significantly higher in the aged rats than in the young rats. Bladder contractile response for Cch was similar for the young and aged rats.

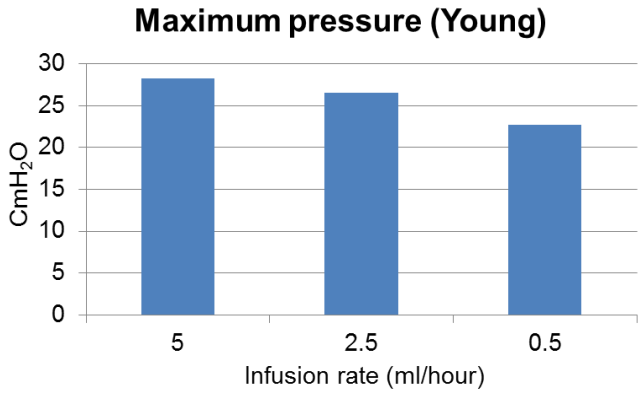

Figure 3

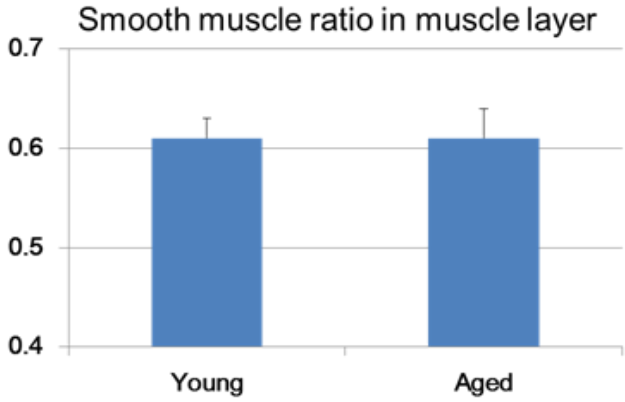

Figure 4

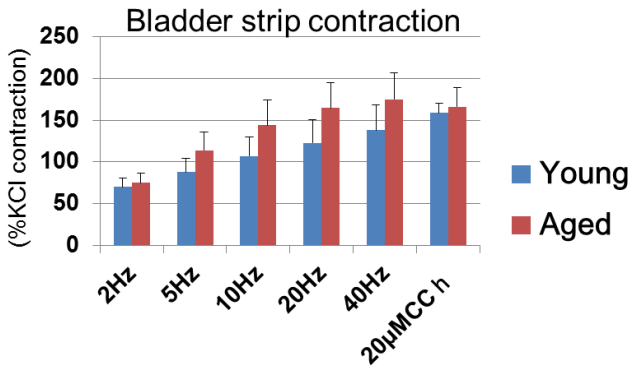

Figure 5

Interpretation of results

Aged rats decreased maximum micturition pressure and increased residual urine volume when infusion rate was low within physiological filling rate. In contrast, young rats did not show such responses. Histological findings showed bladder smooth muscle was not quantitatively different between aged and young rats. In addition, bladder strip contraction study showed bladder smooth muscle did not qualitatively diminish with aging. Taken together, these results indicate that aging easily induces underactive bladder in a certain level of afferent activation. Clinical application of neuroprotective or neurotrophic medicine may be useful as a prevention of underactive bladder.

Concluding message

The present study suggests that underactive bladder with aging is mainly caused by afferent dysfunction

References

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2. Smith PP et al. Am J Physiol Regul Integr Comp Physiol 2012; 302: R577-86
3. Longhurst PA et al. 1992; 148: 1615-20

Disclosures

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