

BLADDER DYSFUNCTION IN RATS WITH FOCAL CEREBRAL ISCHEMIA

Aims of Study

The purpose of this study was to evaluate the active contractile properties of detrusor smooth muscle from bladders of rats with focal cerebral ischemia(CI rats).

Methods

The cerebral infarction of 8 to 9 week-old male Sprague-Dawley rats was induced by occlusion of the left middle cerebral artery. The control groups received sham operation. At 1, 2 and 4 weeks after operation, bladder muscle strips were evaluated for force development in response to electrical field stimulation, 5 μ M carbachol(CCh) and 60mM KCl by an isometric transducer(n=10). By measuring the contractile response to field stimulation after adding 1 μ M atropine and 5 μ M α,β -methylene ATP, contributions of cholinergic and purinergic transmission were determined. Cystometrogram(CMG) in anaesthetized rats was recorded(n=6). Pathology of detrusor muscles was evaluated by hematoxylin and eosin(H&E) staining and Masson's trichromic staining for collagen(n=5). Immunohistochemical staining was performed to detect the expressions of M2 muscarinic receptor and P2X1 and P2X2 purinergic receptors.

Results

The body weight of cerebral-infarcted rats was smaller than that of sham-operated rats. Compared to sham-operated rats, CI rats showed a shorter voiding interval (144.2 \pm 43.9 vs 88.4 \pm 28.9sec. at 4 weeks, p<0.05), smaller peak voiding pressure (48.4 \pm 10.5 vs 34.1 \pm 7.9cmH₂O at 4 weeks, p<0.05), smaller voiding volume (0.62 \pm 0.10 vs 0.29 \pm 0.10ml at 4 weeks, p<0.01) and more residual urine (0.14 \pm 0.08 vs 0.29 \pm 0.07ml at 4 weeks, p<0.01) in CMG. Compared to sham-operated rats, CI rats showed smaller tension (1.82 \pm 0.64 vs 1.25 \pm 0.44g at 4 weeks, p<0.05) at maximum contraction induced by CCh and quicker response (99.9 \pm 45.2 vs 64.5 \pm 21.4 sec. at 4 weeks, p<0.05) to maximum contraction induced by KCl. CI rats also showed smaller tension at maximum contraction induced by KCl. CI rats time-dependently showed the increase (8.2 \pm 5.1 vs 17.2 \pm 9.9% at 4 weeks p<0.05) in the proportion of purinergic components and the decrease (72.8 \pm 9.7 vs 51.1 \pm 14.3% at 4 weeks, p<0.01) in the proportion of cholinergic components. Histologically, the muscle fibers of CI rats appeared to be atrophic compared to that of sham-operated rats and an accumulation of collagen was noted in CI rats. In the expressions of M2, P2X1 and P2X2 receptors, no differences were noted between sham-operated and CI rats.

Conclusions

CI rats showed changes in detrusor activity, contractility and proportion in cholinergic and purinergic components. The increase in purinergic contraction of detrusor muscle is believed to have a relation with bladder instability. The result of this study will be useful for explanation of the detrusor hyperactivity with impaired contractility (DHIC) in patients with cerebral infarction.