

A NOVEL INTRACEREBRAL HEMORRHAGE-INDUCED RAT MODEL OF NEUROGENIC VOIDING DYSFUNCTION: ANALYSIS OF LOWER URINARY TRACT FUNCTION

Hypothesis / aims of study

Neurogenic lower urinary tract dysfunction (NLUTD) is a major problem in patients with a variety of neurological disorders, and may lead to debilitating symptoms and serious complications such as chronic renal failure and recurrent urinary tract infections. Clinically, stroke is known to be associated with voiding dysfunction. However, lower urinary tract function evaluation in an intracerebral hemorrhage (ICH) model has not been reported. Therefore, we investigated lower urinary tract function in ICH-induced rats and compared the results to those obtained in normal rats

Study design, materials and methods

Adults female Sprague-Dawley rats were divided into two groups: a control group and an ICH-induced group. Induction of ICH in the hippocampal CA1 region was performed using a stereotaxic frame and type IV collagenase. After induction of ICH, we examined the effects of ICH on peripheral bladder function and central micturition centers (medial preoptic area; MPA, ventrolateral gray; PAG, pontine micturition center; PMC, and spinal cord [L4-L5]). For this study, we simultaneously investigated the effects of ICH on central micturition centers by determining the degree of neuronal activation (c-Fos) and nerve growth factor (NGF) expression and assessing voiding function (urodynamic study using cystometry).

Results

Induction of ICH significantly enhanced bladder contraction pressure and time, while simultaneously decreasing voiding pressure and time (Fig. 1). Moreover, c-Fos and NGF expression in the neuronal voiding centers was increased by induction of ICH compared to control rats (Fig. 2).

Interpretation of results

We confirmed that ICH clearly induced NLUTD like as other overactive bladder animal models, including a spontaneous hypertensive rat model, a rat model of dopaminergic brain lesions, and a cerebral infarction model.

Concluding message

We suggest that our ICH-induced NLUTD rat model is a more appropriate method to study NLUTD in stroke patients than a cerebral infarction model, because the former animal model more accurately reflects the nature of the hemorrhage in both type of stroke.

Figure 1. Effect of induction of ICH on urodynamic parameters. Upper: Cystometry results for each group. Lower: Analysis of bladder contraction (pressure/time) and voiding function (pressure/time). Results are presented as means \pm SEMs. * $p < 0.05$ versus control group.

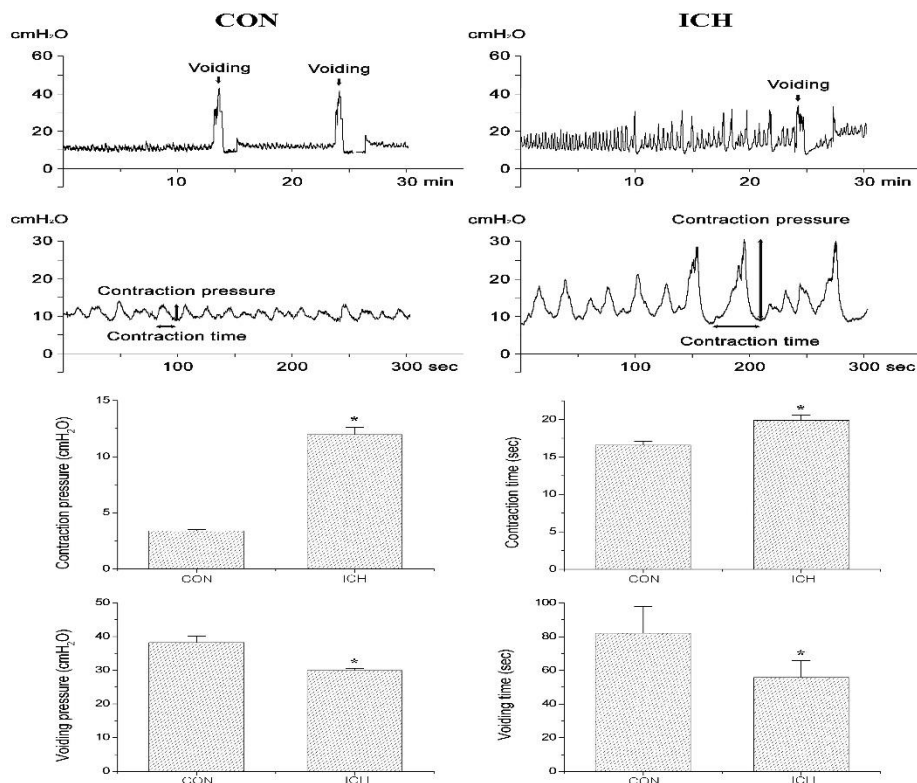
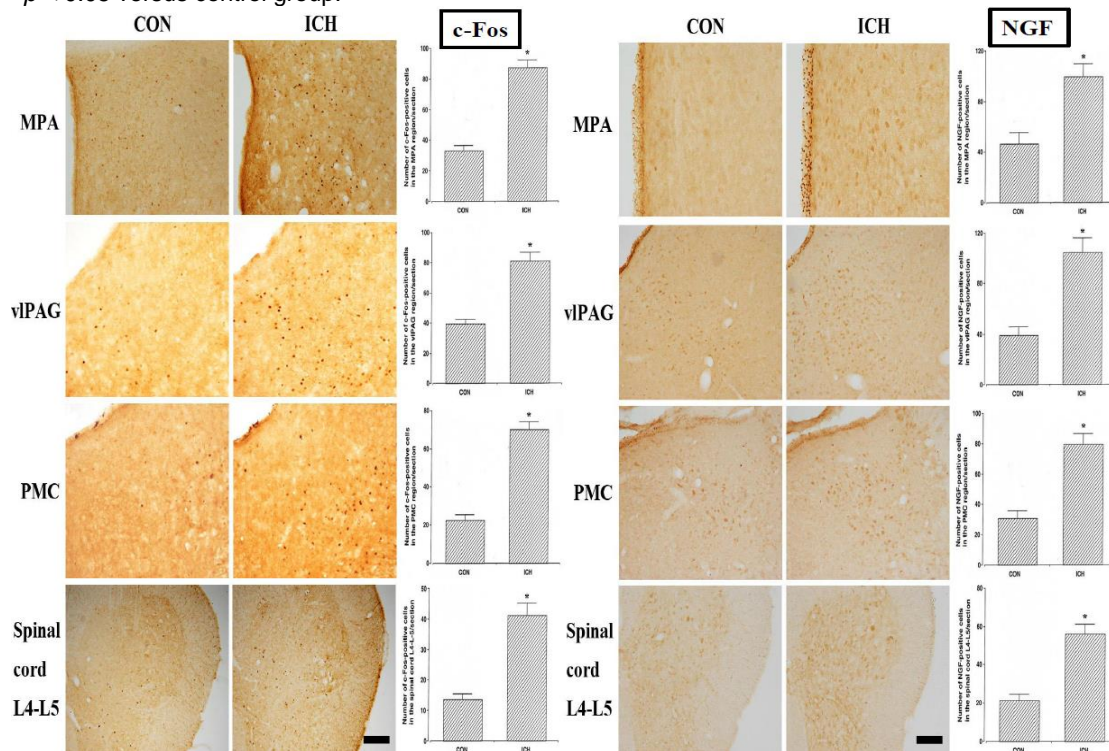


Figure 2. Effect of induction of ICH on c-Fos (Left) and NGF (Right) expression in neuronal voiding centers. Right: Photomicrographs of c-Fos and NGF-positive cells in neuronal voiding centers. Sections were stained for c-Fos and NGF (brown staining). Scale bar represents 200 μ m. Left: Number of c-Fos and NGF-positive cells in each group. Results are means \pm SEMs. * $p < 0.05$ versus control group.



References

1. Fry CH, Daneshgari F, Thor K, et al.: Animal models and their use in understanding lower urinary tract dysfunction. *Neurourol Urodyn* 29: 603-608, 2010.
2. Kajbafzadeh AM, Mohammadinejad P, Hojjat A, et al.: The timing of established detrusor hyperreflexia in a rat model of neuropathic bladder. *J Surg Res* 178: 346-351, 2012.
3. Ozsoy O, Ozsoy U, Stein G, et al.: Functional deficits and morphological changes in the neurogenic bladder match the severity of spinal cord compression. *Restor Neurol Neurosci* 30: 363-381, 2012.

Disclosures

Funding: None **Clinical Trial:** No **Subjects:** ANIMAL **Species:** Rat **Ethics Committee:** Kangbuk Samsung Hospital Institutional Review Board