

## HYDROGEN WATER PREVENTS THE DEVELOPMENT OF DETRUSOR OVERACTIVITY IN A RAT MODEL OF BLADDER OUTLET OBSTRUCTION

### Hypothesis / aims of study

Bladder outlet obstruction (BOO) is often associated with bladder dysfunction including detrusor overactivity (DO). In addition, BOO is known to induce a decrease in bladder blood flow, leading to bladder ischemia. There is increasing evidence that ischemia/reperfusion injury and a subsequent generation of free radical contribute largely to the mechanisms by which BOO causes bladder dysfunction. In this context, antioxidants may be benefits in the treatment of obstructive bladder dysfunction. Recently, attention has focused on hydrogen (H<sub>2</sub>) that selectively reduces the hydroxyl radical and effectively protects cells against oxidative damage. Thus, the present study was undertaken to investigate whether H<sub>2</sub> saturated in water (hydrogen water) would prevent the development of bladder dysfunction in rats with BOO.

### Study design, materials and methods

BOO was induced by incomplete ligation of urethra in male Sprague-Dawley rats. Rats were anesthetized with ketamine (80 mg/kg) and xylazine (10 mg/kg) via intraperitoneal injection. The abdomen was opened through a midline incision, a 3-0 silk suture was tied around the proximal urethra using an 18G needle as a guide to obstruct. Hydrogen water was created by saturating water with H<sub>2</sub>. BOO rats were randomly divided into two groups: a control BOO group (n=8) with unlimited access to normal water and a H<sub>2</sub>-BOO group (n=8) with unlimited access to hydrogen water. Six rats received a sham operation and accessed normal water freely. The rats in the H<sub>2</sub>-BOO group freely took hydrogen water 7 days before the surgery. The rats in both BOO and Sham groups also freely took normal water 7 days before surgeries. On the 2 weeks after the surgeries, urine was collected from the rats in a metabolic cage over a 24hr period to determine urinary concentrations of creatinine and 8-hydroxy-2'-deoxyguanosine (8-OHdG) as oxidative stress marker. After the urine collection, cystostomy was made, and 3 days later cystometry was performed. Micturition interval, volume and pressure were recorded. Data were expressed as mean ± SEM.

### Results

In the H<sub>2</sub>-BOO rats that had H<sub>2</sub> water, micturition interval was significantly prolonged while micturition volume was significantly increased, as compared those in the control BOO rats (Figure 1 & Figure 2-A, B). Micturition pressure was significantly higher in both BOO and H<sub>2</sub>-BOO rats than that in the Sham rats (Figure 1 & Figure 2-C). The level of urinary 8-OHdG in the BOO rats was significantly higher than that in the Sham rats (Figure 3). The urinary 8-OHdG level in the H<sub>2</sub>-BOO rats was significantly lower than in the BOO rats (Figure 3).

### Interpretation of results

It is suggested that hydrogen water improves DO by decreasing oxidative stress in the bladder, since our data showed that prolongation of the micturition interval was associated with a decrease in urinary 8-OHdG level in the rats treated with hydrogen.

### Concluding message

Hydrogen water is likely able to prevent the development and progression of detrusor dysfunction secondary to BOO.

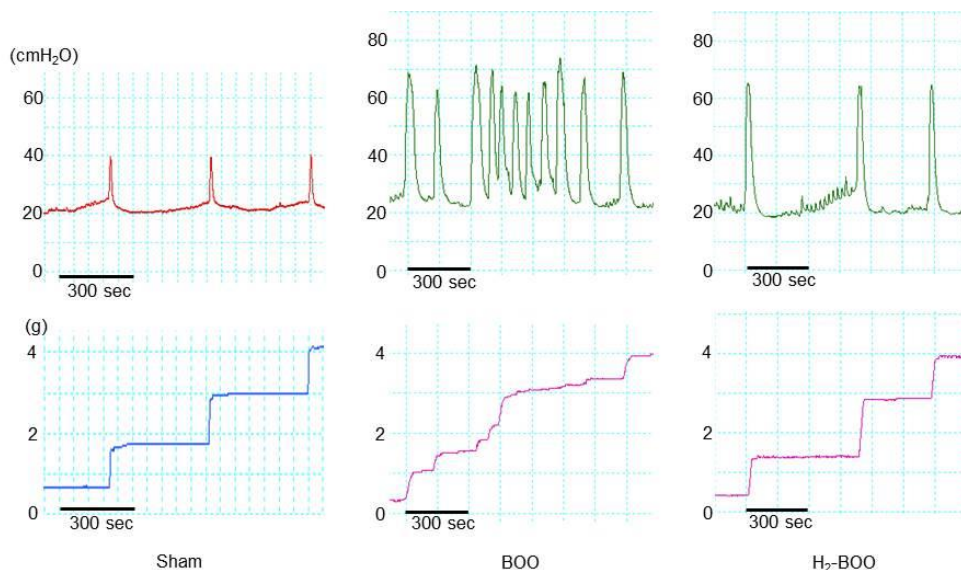


Figure 1: Cystometrogram in conscious Sham, BOO and H<sub>2</sub>-BOO rats.

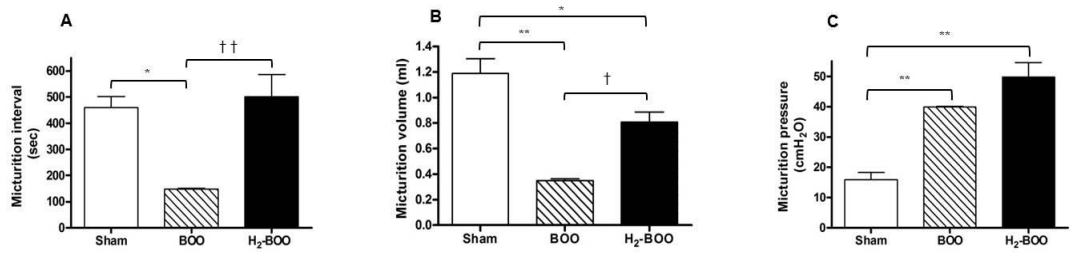


Figure 2: Urodynamic parameter in conscious Sham, BOO and H<sub>2</sub>-BOO rats. **A:** Micturition interval, **B:** Micturition volume, **C:** Micturition pressure. \*  $P < 0.05$ , \*\*  $P < 0.01$  versus Sham, †  $P < 0.05$ , ††  $P < 0.01$  versus BOO. Data represented mean  $\pm$  SEM ( $n = 5, 6$ ).

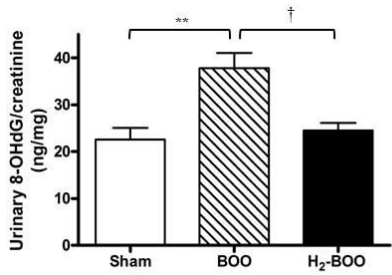


Figure 3: Effect of hydrogen water on urinary 8-OHdG in Sham, BOO and H<sub>2</sub>-BOO rats. \*\*  $P < 0.01$  versus Sham, †  $P < 0.05$  versus BOO. Data represented mean  $\pm$  SEM ( $n = 6, 8$ ).

Disclosures

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