

IS THERE ANY DIFFERENCE IN CYSTOMETRIC PARAMETERS IN RAT LUMBAR CANAL STENOSIS MODELS WITH DECREASED, NORMAL, OR INCREASED CYSTOMETRIC CAPACITY?

Hypothesis / aims of study

A rat lumbar canal stenosis (LCS) model seems to be useful as one of the detrusor underactivity (DU) models 1). LCS rats revealed DU in cystometric studies as well as increased residual urine rate (RUR, %) in metabolic cage studies 1). By the way, Detrusor overactivity was noted in 29% of LCS patients 2). This phenomenon seemed to be caused by the irritation of sacral roots or ischemic disturbances of the conus medullaris 2). DU could be preceded by detrusor overactivity (DO) which was regarded as a compensatory mechanism for decreased shortening velocity 3). Consequently, early DU would be frequently accompanied by DO, while advanced DU would not 3). Unexpectedly, maximum cystometric capacity (MCC) in some LCS rats was not larger than, or rather became smaller than, in sham rats. We investigated cystometric parameters in LCS rats, in terms of the presence or absence of increased MCC. Our hypotheses were as follows:

1. Voiding parameters in LCS rats with normal or decreased MCC would be more favorable than in LCS rats with increased MCC.
2. Frequency of non-voiding contractions (NVCs, /min) would be increased in LCS rats with decreased MCC.

Study design, materials and methods

Wistar rats (180 to 190 g) were employed in the present study. One small hole drilled at fifth lumbar vertebral arch (Sham), and a rectangular piece of silicone rubber was then placed into the L5 to L6 epidural space (LCS). On the eleventh day after cauda equina compression, a polyethylene catheter with a cuff was inserted through an incision into the dome of the bladder and held in place with a purse-string suture. Cystometric investigations were performed without any anesthesia 3 d after bladder catheter implantation in 10 sham rats and 32 LCS rats. Room temperature saline was infused into the bladder at a rate of 2 ml/hr. Three reproducible micturition cycles were evaluated. LCS rats were divided into three groups (Fig. 1): Group A (n=5, MCC < 0.87 mL), Group B (n=13, MCC 0.87-1.81 mL), and Group C (n=14, MCC > 1.81 mL). These ranges corresponded to lower than -2SD, -2SD to +2SD, larger than +2SD of MCC in Sham rats, respectively. Cystometric parameters were investigated in sham and each LCS group.

Results

In each LCS group voided volume (mL), RUR, and maximum intravesical pressure during voiding (mmHg) were significantly smaller, higher, and lower, respectively, than in sham, but among LCS rats these parameters were not significantly different (Tukey-Kramer's HSD test, Fig. 2). Post-void residual urine volume (PVR, mL) in Group A was significantly smaller than in Group B or C, and PVR in Group B was significantly smaller than in Group C (Fig. 2). The frequency of NVCs in each LCS group was not significantly different from that in sham-operated rats (Tukey-Kramer's HSD test). However, a Jonckheere-Terpstra trend test revealed a significant trend toward higher NVCs in the order of sham, Groups C, B, and A ($p=0.036$, Fig. 3).

Interpretation of results

DU in LCS rats could be accompanied by increased frequency of NVCs, especially in rats with smaller MCC. However, voiding parameters except PVR were not favorable in rats with increased frequency of NVCs. Decreased PVR in rats with increased frequency of NVCs was not due to compensated emptying but due to decreased MCC.

Concluding message

LCS rats showed DU to the same degree regardless of MCC. NVCs did not significantly increase in LCS rats with decreased MCC, but there was a significant increase trend toward higher NVCs with smaller MCC.

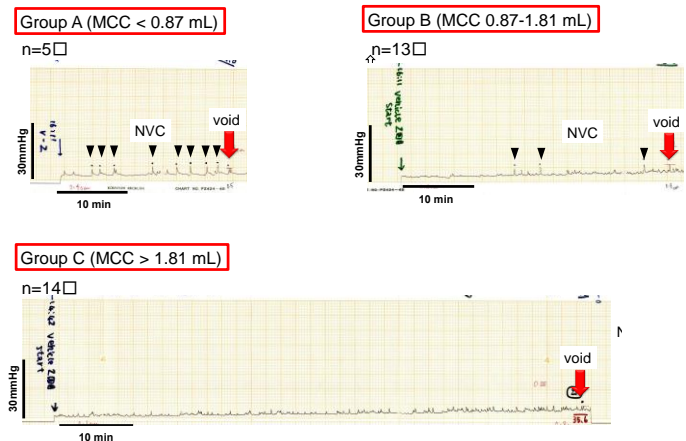


Figure 1. Representative cystometric traces in group A, B, and C

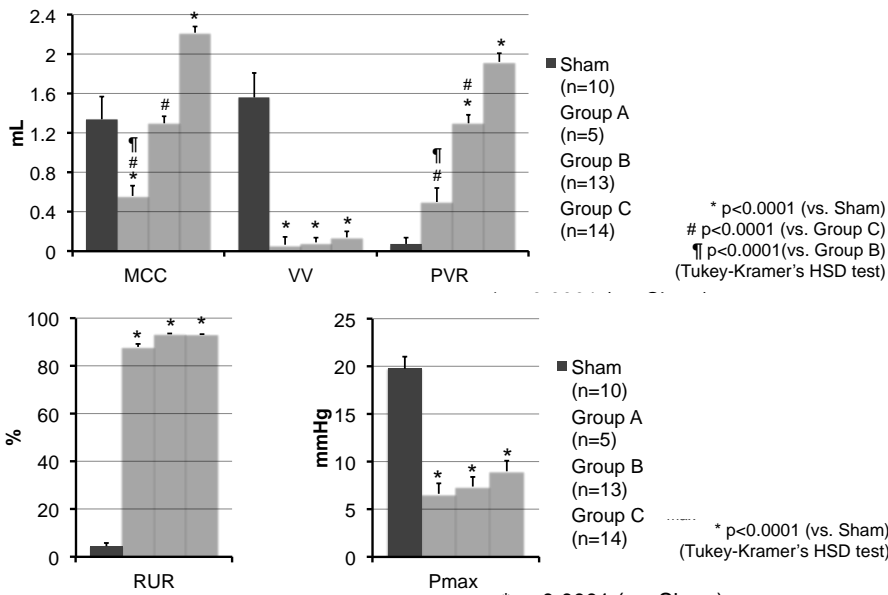


Figure 2. Cystometric parameters in Sham and each LCS group

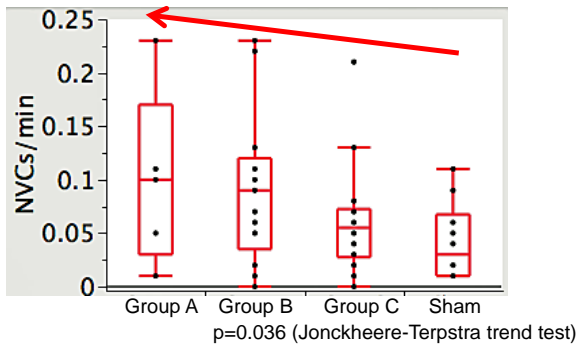


Figure 3. The results of a Jonckheere-Terpstra trend test

References

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Disclosures

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