

STRESS URINARY INCONTINENCE AFTER VAGINAL DISTENSION SIMULATED CHILDBIRTH INJURY IN RATS

Hypothesis / aims of study

Stress urinary incontinence (SUI) is a common disorder reported by 5-35% of adult women [1]. Vaginal childbirth is considered an independent risk factor, affecting the nerves, muscles, and collagenous tissue responsible for maintaining continence [2]. Rat models of simulated maternal childbirth injury have been developed, utilizing vaginal distention (VD) to mimic the trauma associated with 2nd stage of labor in women [3]. Most studies used leak point pressure (LPP) to measure the decreased urethral resistance to leakage after VD, indicative of SUI.

However, less is known about how a simulated vaginal birth in rats will affect the urinary continence mechanisms on a long term.

The aim of this study was to determine the long term variation of LPP after multiple VDs in virgin female rats.

Study design, materials and methods

270 Sprague-Dawley rats (250-300 g) were randomized to one of four groups: one VD (VD1), two VDs (VD2), three VDs (VD3), or control (C). For VDs a modified 10 F catheter was used. The balloon was inflated with 3 cc of water and maintained intravaginal for 4 hours. Successive VDs were performed 30 days apart. The LPPs were determined at half bladder capacity on days 4, 14, 42, and 180 after last VD using a suprapubic tube inserted two days prior LPP measurements. The difference between the intravesical pressure at which urinary leakage occurred and baseline intravesical pressure was used for our analysis (Δ LPP). $P < 0.05$ was considered statistically significant.

Results

In control groups, Δ LPP non-significantly decreased after day 42 (Table).

In all VD groups, Δ LPP was lowest on day 4 after last VD. After one VD, Δ LPP increased until day 180. However, after two or three VDs, Δ LPP significantly increased from day 4 to day 42 and then decreased to day 180.

Δ LPP was similar in all VD groups on day 4, 14, 42 and 180 after last VD, with one exception: in group VD1, Δ LPP was significantly higher on day 180.

Compared with age-matched controls, in all VD groups, Δ LPP was lower on day 4 after last VD and similar on day 14, 42, and 180; the only exception was on day 180 in group VD1 where Δ LPP was higher when compared with controls.

Table

Δ LPP	Control VD1	VD1	Control VD2	VD2	Control VD3	VD3
Day 4	24.4 \pm 6.6	16.6 \pm 4.8*	28.2 \pm 7.5	14.5 \pm 2.6*	25.6 \pm 6.7	19.1 \pm 5.8*
Day 14		23.4 \pm 8.9		28.0 \pm 6.1		24.6 \pm 5.3
Day 42	28.2 \pm 7.5	25.1 \pm 10.3	25.6 \pm 6.7	32.0 \pm 10.0		33.3 \pm 12.7
Day 180	20.9 \pm 4.9	27.7 \pm 7.5 [†]	22.5 \pm 4.6	20.0 \pm 5.0	21.9 \pm 6.0	22.2 \pm 4.8

Values are means \pm standard deviation (cm H₂O)
 *p < 0.05 vs controls
 †p < 0.05 VD1 vs VD2, 3, and controls on day 180

Interpretation of results

Δ LPP does not change significantly in virgin female rats even after a long follow-up (240 days). Δ LPP decreases shortly after VD and is similar after multiple VDs performed 30 days apart. By day 14 all groups recovered to the control levels, suggesting that 30 days interval between VDs allows for full recovery.

Concluding message

As a model of birth trauma, VDs can induce SUI in female rats on a short term after the procedure. However, this study suggests that three VDs performed 30 days apart may not be traumatic enough to cause prolonged injuries and therefore sustained decreases in LPPs for a longer period of time.

References

1. Boncher N, Vricella G, Kavran M, Xiao N, Hijaz A. Setting a new standard: updating the vaginal distention translational model for stress urinary incontinence. *Neurourol Urodyn* 2012;31:190-4.
2. Woo LL, Hijaz A, Pan HQ, Kuang M, Rackley RR, Damaser MS. Simulated childbirth injuries in an inbred rat strain. *Neurourol Urodyn* 2009;28:356-61.
3. Wood HM, Kuang M, Woo L, Hijaz A, Butler RS, Penn M, et al. Cytokine expression after vaginal distention of different durations in virgin Sprague-Dawley rats. *J Urol* 2008;180:753-9.

Disclosures

Funding: University Hospitals Family Medicine Fund. Award P0089. **Clinical Trial:** No **Subjects:** ANIMAL **Species:** Sprague-Dawley rats **Ethics Committee:** Case Western Reserve University Institutional Animal Care and Use Committee (IACUC)