

EFFECT OF SIMULATED CHILDBIRTH INJURY AND SUBSEQUENT PUDENDAL NERVE STIMULATION ON BLADDER AND ANAL CONTRACTILE FUNCTION

Hypothesis / aims of study

Vaginal delivery may cause direct injury to the nerves and muscles of the pelvic floor, and induce temporary bladder and anal dysfunction. We previously demonstrated that dual simulated childbirth injury, consisting of bilateral pudendal nerve crush (PNC) and vaginal distension (VD, 4 hours of balloon inflation after dilator accommodation), results in slowed recovery of both continence & pudendal nerve function. We also recently demonstrated that electrical stimulation of the pudendal nerve proximal to the injury/crush site immediately after simulated childbirth injury can upregulate expression of neurotrophins in Onuf's nucleus and has the potential to become a treatment to facilitate nerve recovery after childbirth. In this study, we investigate if electrical stimulation affects bladder and anal function immediately after simulated childbirth injury.

Study design, materials and methods

Seventeen female, Sprague-Dawley rats weighing 250-300 g were randomized into two groups of VD+PNC (Dual injury, n=8), and sham VD+PNC (Sham Injury, n=9). Under ketamine/xylazine anesthesia, rats in the dual injury group received 4 hours of VD immediately followed by bilateral PNC. Rats in the sham injury group underwent sham procedures. Bladder pressure was recorded via a transurethral polyethylene catheter (PE-50) with filling cystometry (5ml/h). Anal pressure was recorded by a water-filled balloon (4x6mm) which was placed in the anal canal. All rats underwent 1 hour of electrical stimulation (20 Hz, 0.3mA, 0.1 ms duration) of the left pudendal nerve immediately after dual or sham injury. Bladder pressure and anal pressure were simultaneously recorded before, during, and after electrical stimulation. Two way ANOVA was utilized to statistically compare the effects of electrical stimulation and childbirth injury on contraction pressures in both the bladder and the anus.

Results

Simulated childbirth injury significantly decreased bladder contraction pressure (* $p < 0.01$). Pudendal nerve stimulation did not produce a significant change in bladder contraction pressure (Fig. 1). Simulated childbirth injury also significantly decreased anal sphincter contraction pressure (** $p < 0.01$). Pudendal nerve stimulation also did not produce a significant change in anal contraction (Fig. 2).

Concluding message

Childbirth injury has an immediate effect on bladder and anal function. However, despite previous evidence that subsequent electrical stimulation of the pudendal nerve upregulates neurotrophins, this does not translate into an immediate improvement of bladder or anal function. Upregulation of neurotrophins by electrical stimulation may lead to improved bladder and/or anal function in the long term.

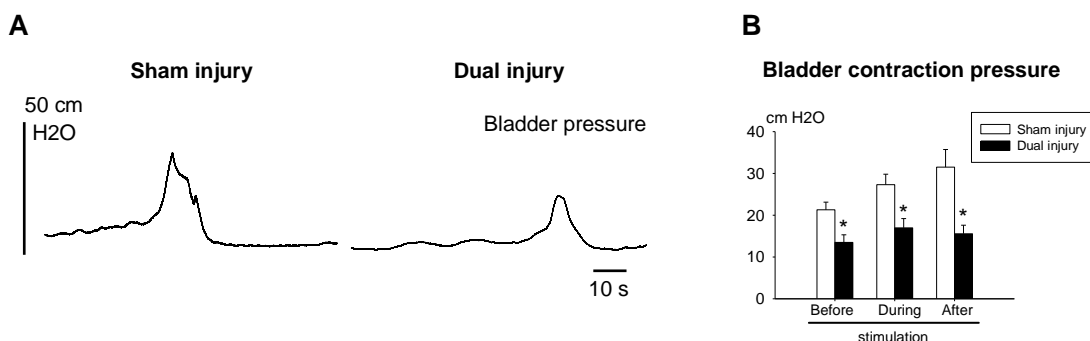


Figure 1. Effect of simulated childbirth injury and subsequent pudendal nerve stimulation on bladder contractile function. **A.** Samples of bladder contraction in sham and dual injury animals. **B.** Comparison of bladder contraction pressure between sham and dual injury animals before, during, and after electrical stimulation. Data is presented as mean \pm standard error of the mean of each group. * indicates significant difference compared to the sham injury.

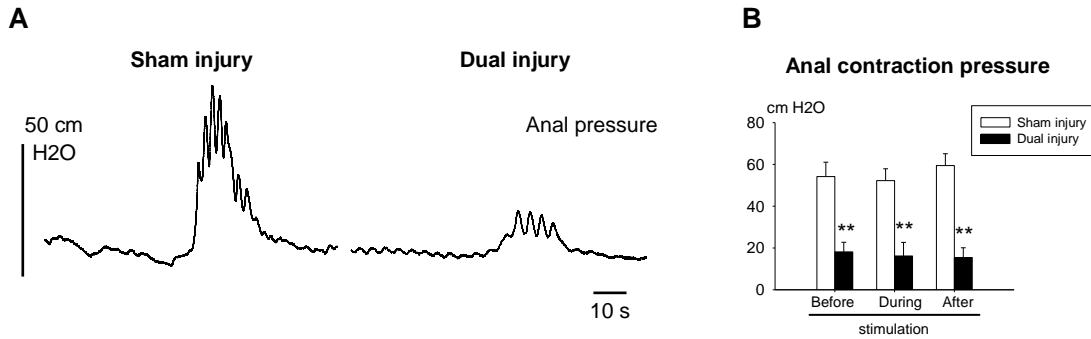


Figure 2. Effect of simulated childbirth injury and subsequent pudendal nerve stimulation on anal contractile function. **A.** Samples of anal contraction in sham and dual injury animals. **B.** Comparison of anal contraction pressure between sham and dual injury animals before, during, and after electrical stimulation. Data is presented as mean \pm standard error of the mean of each group. ** indicates significant difference compared to the sham injury.

<i>Specify source of funding or grant</i>	NIH RO1 HD38679-10, the AUA Foundation Research Scholars Program, and the Society for Urodynamics and Female Urology
<i>Is this a clinical trial?</i>	No
<i>What were the subjects in the study?</i>	ANIMAL
<i>Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?</i>	Yes
<i>Name of ethics committee</i>	the Cleveland Clinic Institutional Animal Care and Use Committee