Monitoring in-vivo hypogastric nerve activity during bladder filling in canines

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INTRODUCTION

Objectives: We sought to refined electrophysiological methods for monitoring nerve activity in canines, focusing on in vivo assays of hypogastric nerve activity during bladder filling in intact and acutely lumbosacral-decentralized bladders.

METHODS

Canine groups:
Group 1: Intact bladders
Group 2: Decentralized bladders (all roots caudal to L7) & intact hypogastric nerve
Group 3: Decentralized bladders (L6-L7 dorsal & all roots caudal to L7) & intact hypogastric nerve
Group 4: Decentralized bladders (all roots caudal to L5). *During L2 root stimulation, hypogastric nerve was transected.

- Hypogastric nerve and lumbosacral spinal cord/roots were stimulated to record maximum detrusor pressure (MDP)
- Compared the effect of propofol versus isoflurane anesthesia on evoked detrusor pressure
- Hypogastric nerve recording were performed during bladder filling before and after nerve transection proximal to recording electrode to eliminate efferent inputs.

RESULTS

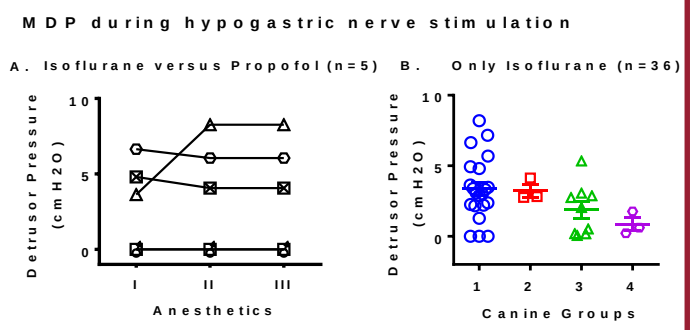

Figure 1. Canines with intact bladder innervation were tested under: **A**) I: isoflurane, II: propofol (5-10 min) and III: propofol (15-20 min). **B.** Under isoflurane, electrical stimulation of the hypogastric nerve evoked detrusor pressure in intact and acutely decentralized bladders. Electrical stimulation of hypogastric nerves evoked low amplitude detrusor pressure in both intact and decentralized bladders that was not different between two anesthetics

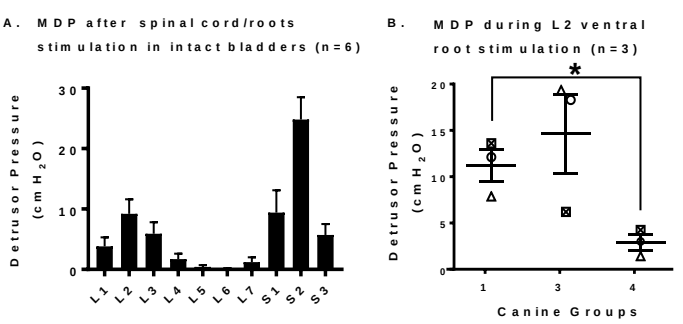

Figure 2 A. Sacral (S1-S3) spinal cord/roots stimulations showed the S2 sacral stimulation evoked highest detrusor pressure in intact bladders. Lumbar (L1-L7) spinal cord/roots stimulations showed the L2 stimulation provided the highest detrusor pressure in intact bladders. B. L2 ventral root stimulation evoked detrusor pressures were suppressed but not statistically significantly eliminated after transection of hypogastric nerves and all spinal roots below L5. (*p=0.01; compared to intact bladders)

REFERENCES

1. Barbe, M.F., et al. Anat Rec (Hoboken). 2018. 301(8): 1426-41.
2. Satchell, P., et al. J. ANS. 1988. 25(1): 41-47.

RESULTS

Hypogastric nerve recording during bladder filling

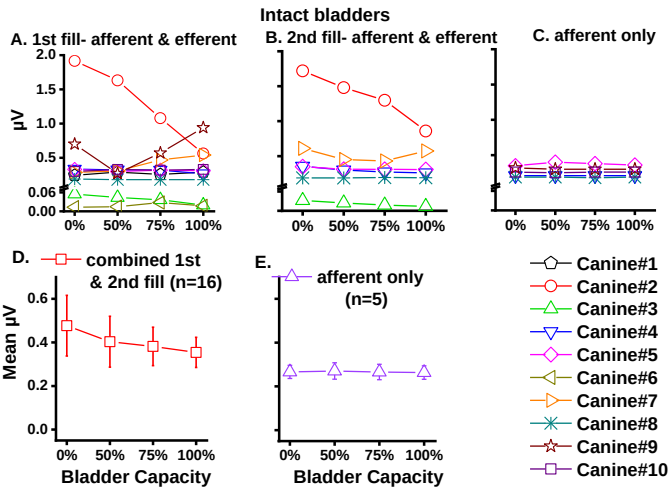

Figure 3. Panels A-C show data obtained for individual canines to observe the individual variations in changes in amplitude of nerve activity at different bladder capacity during bladder filling. D) The average amplitude of both afferent and efferent activity decreased when the bladder reached 100% of its capacity. ANOVA of this data resulted in a statistically significant F ratio however, post hoc Fisher's least significant difference pairwise comparisons revealed no statistically significant differences between the different bladder capacities. E) No statistically significant difference was found between the mean amplitude of afferent nerve activity during bladder filling.

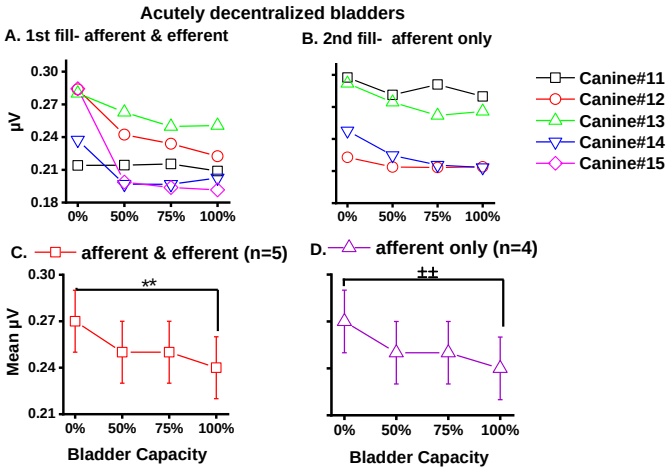

Figure 4. Panels A-B show data obtained for individual canines to observe the individual variations in changes in amplitude of nerve activity at different bladder capacity during bladder filling**.** C-D) The mean amplitude of combined nerve activity (both afferent and efferent) and afferent only, decreased statistically significantly ($p < 0.05$) at 100% capacity during bladder filling. Symbols: ★★: $p = 0.0042$; ++: $p = 0.0040$

CONCLUSIONS

- A decentralized canine bladder model requires transection of the lumbosacral spinal roots innervating the bladder as well as the hypogastric nerves.
- The residual, low amplitude evoked contraction during L2 spinal root stimulation is likely due to low number of direct projections from the L2 ventral horn to the bladder.[1]
- Recording results suggests hypogastric efferent fibers mainly contribute to bladder storage function.[2]
- These refined electroneurogram recording methods may be suitable by monitoring sensory and motor activity in the transferred nerves after bladder reinnervation.

ACKNOWLEDGEMENT

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