At 14 days post unilateral cervical contusion injury
At 28 days post injury
Histologic evaluation with cresyl violet staining through the spinal cord lesion area

METHODS
Mid-cervical (C4-5) unilateral (n=24) or bilateral (n=24) contusion injuries were produced in adult Sprague–Dawley rats using the Infinite Horizon Impactor. Six naive rats served as controls. LUT function was evaluated electrophysiologically in all rats via continuous transurethral cystometry (7.5 ml/hr) and EUS electromyography. (Figure 1) SCI animals were assessed on post-injury days 7, 14, 28, and 56. Behavioral assessment of bladder function was recorded by daily manual bladder expression and measurement of retained urine.

RESULTS
Naïve animals demonstrated normal LUT behavior and electrophysiology (Figure 2).

Unilateral injury animals demonstrated normal LUT behavior throughout (Figure 3), and normal electrophysiology at early time-points (post-injury days 7, 14), but abnormal electrophysiology at late time-points (post-injury days 28, 56) (Figure 4).

Bilateral injury animals demonstrated significant early LUT behavior dysfunction (<14 days post-injury) (Figure 3) and concomitant abnormal electrophysiology (post-injury days 7, 14) (Figure 5). After 14 days, bilateral injury animals recovered normal LUT behavior, but had persistent late abnormal electrophysiology (post-injury days 28, 56).

CONCLUSIONS
Therefore, with this novel preclinical model, we demonstrate that despite recovery of LUT function behaviorally, abnormal changes electrophysiologically in LUT function are evident late after unilateral and bilateral cervical contusion injury, closely mirroring the clinical condition.

BACKGROUND
Lower urinary tract (LUT) dysfunction is often a significant source of morbidity after chronic spinal cord injury (SCI), irrespective of the spinal level involved. The majority of experimental studies of post-SCI LUT function, however, have investigated only thoracic injury models, and have paradoxically shown recovery of normal LUT function behaviorally after injury. Few studies have shown abnormal LUT function electrophysiologically similar to that seen clinically, characterized by bladder-external urethral sphincter (EUS) dyssynergy, but only in thoracic injury models. Therefore, we propose a study that to the best of our knowledge is the first of its kind, by examining both early and late behavioral and electrophysiological changes in LUT function after experimental cervical contusion injury.