Bladder Control in Small Animal Neurological Patients

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Normal Urination

Urination is a reflex that is also under voluntary control (Messonnier 2006):

The pelvic nerve (S1, S2, S3) supplies parasympathetic control to the bladder (the detrusor muscle).(Messonnier 2006; Miller 1955) The cell bodies of the preganglionic axons of the pelvic nerve are located in the intermediate gray column of the sacral spinal cord.(Messonnier 2006) The pelvic nerve also supplies parasympathetic innervation to the urethral smooth muscles.(Braund 2003)

Sympathetic control to the bladder (the detrusor muscle) and the urethral smooth muscle is from the hypogastric nerve. The cell bodies for the hypogastric nerve are located in the lumbar spinal cord segments of L1 – L4.(Messonnier 2006)

Urethral skeletal muscle and importantly the urethral sphincter is supplied by the pudendal nerve. The cell bodies for this nerve are found at S1, S2, and S3 (and sometimes L7).(Chang et al 2005; Messonnier 2006)

Filling of the bladder stimulates afferent nerve endings that carry information to the spinal cord. Then via the spinothalamic tract, or fasciculus gracilis tract, this information can also relay to the brain (to the reticular formation, thalamus, cerebral cortex and via collaterals to the cerebellum) for the conscious perception of bladder sensation.(Messonnier 2006) Efferent from the brain (from the caudal brainstem) then relay information (via the tectospinal and reticulospinal systems) to initiate voluntary micturation. These axons facilitate sacral parasympathetic preganglionic neurons (the pelvic nerve) that inhibit sacral somatic efferents to urethral muscles. As well, there is a facilitation of the somatic effernts to the abdominal muscles which may enable posturing and mechanical bladder expression.(Messonnier 2006)

When the bladder is filling, the detrusor muscle of the bladder is relaxed and the urethral smooth and urethral skeletal muscles contract to hold the urine in. Normal micturation requires conscious perception of bladder filling and then the synchronized contraction of the detrusor muscle of the bladder and the relaxation of the urethral skeletal and smooth muscles in order to void. (Braund 2003; Messonnier 2006)

Describing Neurologic Bladder Dysfunctions

I. UMN lesion bladder dysfunction

An upper motor neuron (UMN) problem that affects the bladder would involve a lesion to the cord cranial to the level of the sacral cord segments.(Messonnier 2006) This type of lesion will result in an increase in urethral tone due to uninhibited activity (spasticity) in the

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urethral skeletal and possibly smooth muscles. Therefore, symptomatically, the animal would have a lack of voluntary urination and may have resistance to manual expression of the bladder.(Braund 2003; Griffiths 1995; Messonner 2006) There is often bladder distension and occasional overflow incontinence.(Braund 2003; Griffiths 1995) However, after a few weeks, these animals tend to develop a 'reflex bladder' with detrusor muscle asynergia, and incontinence characterized by sporadic spurting of urine.(Braund 2003; Messonnier 2006) In this scenario, there is usually a small amount of residual urine remaining in the bladder. (Messonnier 2006)

II. LMN lesion bladder dysfunction

A lower motor neuron (LMN) problem affecting the bladder can generally be localized to the sacral cord, sacral nerve roots or pelvic, hypogastsric and pudendal nerves.(Braund 2003; Griffiths 1995; Messonner 2006) Again in this scenario, there is a lack of voluntary urination. The LMN bladder is atonic and distended and manual expression is easy.(Braund 2003; Messonnier 2006) The development of overflow incontinence is permitted due to the urethral muscle (smooth and skeletal) relaxation. These animals can have large amounts of residual urine remaining in the bladder unless expressed, whereby a small volume of urine may stay within the bladder.(Griffiths 1995; Messonnier 2006)

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