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Research Report

Sensory and somatomotor components of the "sensory branch" of the pudendal nerve in the male rat

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ABSTRACT

Surgical microscopy and electrophysiological techniques were used to describe in the adult male rat the peripheral distribution of the sensory branch of the pudendal nerve (SBPdn) and its sensory and somatomotor axonal components. Gross and histological features of the urethralis muscle were also determined. We propose to name the SBPdn branches according to the corresponding target structure. We found branches to the urethral diverticulum, major pelvic ganglion, corpus cavernosus of the penis, urethralis muscle, preputial glands, corpus spongiosus of the penis, foreskin and glans penis. Under the pubic bone three anastomotic branches form a bridge-like structure we called pelvic plexus. Through electrophysiological studies it was determined that the SBPdn carries efferent fibers to the striated urethralis muscle, as well as afferent axons from the glans penis and foreskin. We concluded that the SBPdn of the male rat has sensory and somatomotor components. This nerve is mixed and not exclusively sensory as was previously described. The finding of the anatomic relation to the major pelvic ganglion implies nerve communication with the autonomic nervous system. The functions of the somatomotor component and nerves to the urethral diverticulum, cavernosus bodies and preputial glands of the SBPdn remain to be determined. According to its targets, this innervation could contribute in the control of genitourinary functions such as voiding, erection, ejaculation and urinary marking.

1. Introduction

In mammals the pudendal nerve is involved in the physiology of micturition (Maggi et al., 1989; Cruz and Downie, 2005), defecation (Dubrovsky and Filipini, 1990) and mating-related responses such as sexual arousal and lordosis, penile erection and ejaculation (Adler et al., 1977; Sachs and Liu, 1992; Jonson, 2006; Zempoalteca et al., in press). This nerve has been considered a major component of the innervation of the pelvic structures, carrying efferent and afferent axons (Hulsebosch and Coggeshall, 1982).

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In male rats the pudendal nerve has motor and sensory components (McKenna and Nadelhaft, 1986; Pacheco et al., 1997). The motor component carries efferent axons to the perineal muscles such as the ischiocavernosus, ventral and dorsal bulbospongiosus, coccygeus muscle, as well as to the external anal and urethral sphincters (McKenna and Nadelhaft, 1986; Pacheco et al., 1997). The sensory component carries afferent axons from the perineal skin, penis and scrotal skin (Pacheco et al., 1997; Manzo et al., 2003). The innervation supplied by the pudendal nerve is complex due to its relationships with the well described sacral plexus (Pacheco et al., 1997; Manzo et al., 2003). This structure is composed of fibers of the lumbosacral trunk and the pudendal nerve (Pacheco et al., 1997). From the innervation supplied by the sacral plexus and the pudendal nerve, several well defined nerves are given off to the pelvic structures (McKenna and Nadelhaft, 1986; Pacheco et al., 1997). Thus, after the pelvic nerve separation the pudendal nerve gives off the coccygeus muscle branch, the distal scrotum branch, the sensory branch of the pudendal nerve (SBPdn) and the anastomotic branch (Pacheco et al., 1997). Most of these nerves had been well analyzed (McKenna and Nadelhaft 1986; Pacheco et al., 1997; Manzo et al., 2003). Some spinal circuitry and functional studies of the SBPdn, also referred to as the dorsal nerve of the penis, have been done (Núñez et al., 1986; Sachs and Liu, 1992; Pescatori et al., 1993; Aîoun and Rampin, 2006; Rampin et al., 1997). In some studies the SBPdn has been considered to be exclusively sensory and the principal afferent component of the pudendal nerve (Núñez et al., 1986; McKenna and Nadelhaft, 1986). In others, the SBPdn has been considered to carry also autonomic sympathetic fibers and may be the major route for adrenergic innervation of the penis (Galindo et al., 1997). However, a detailed anatomical study of the distribution and components of the SBPdn has not been done in the rat. In rabbits the dorsal nerve of the penis has somatic sensory and motor components innervating the foreskin and glans and a perineal striated muscle, the bulbospongiosus (Zempoalteca et al., in press). Because of the great importance of the SBPdn in the regulation of genitourinary functions and the relevance of the rat as an animal model in this field, it is necessary to study the anatomy

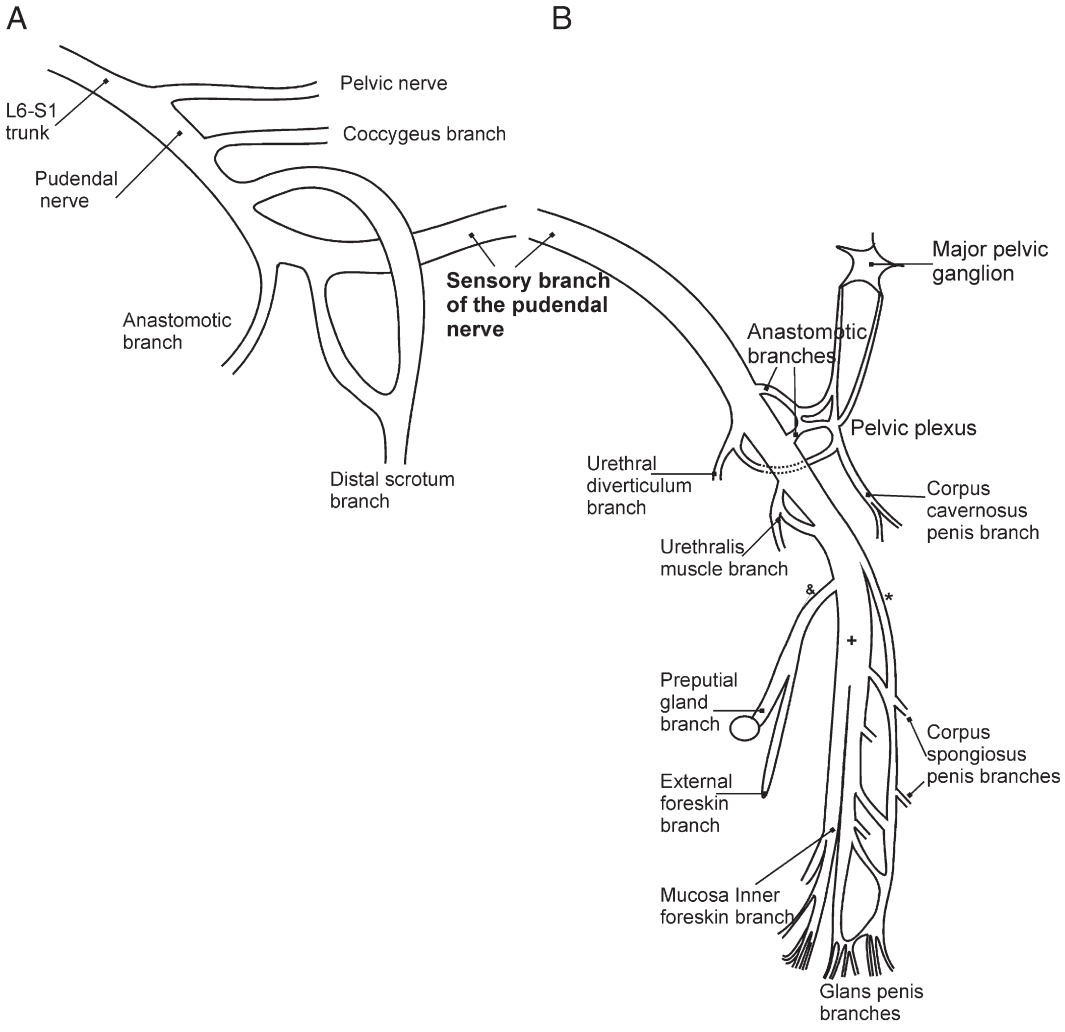

Fig. 1 – Origin and distribution of the sensory branch of the pudendal nerve (SBPdn) of the male rat. A. Pudendal nerve branches and the origin of the SBPdn. B. Branches and distribution of the SBPdn. * medial branch, + the middle branch and & the lateral branch.