2.1 Surgical Neuroanatomy of the Male Pelvis ........................................... 12
Thilo Schwablenber, Rudolph Hohenfellner, Jochen Neuhaus, Mathias H. Winkler, Evangelos N. Liatsikos, Jens-Uwe Stolzenburg

2.1.1 Neuroanatomical Basics of Radical Prostatectomy ........................... 12
2.1.2 Sympathetic System ................................................................. 14
2.1.3 Parasympathetic System ............................................................ 14
2.1.4 Pelvic Plexus (Inferior Hypogastric Plexus, Pelvic Ganglion) .............. 16
2.1.5 Pudendal Nerve  ................................................................. 17
References ................................................................................. 18

2.2 Inter- and Intrafascial Dissection Technique of Nerve-Sparing Radical Prostatectomy ......................................................... 20
Jens-Uwe Stolzenburg, Jochen Neuhaus, Thilo Schwablenberg, Katharina Spanel-Borowski, Sabine Löffler, Rudolph Hohenfellner, Evangelos N. Liatsikos
References ................................................................................. 23

2.3 The Muscular Systems of the Bladder Neck and Urethra ................................................. 24
Jens-Uwe Stolzenburg, Jochen Neuhaus, Lars-Christian Horn, Evangelos N. Liatsikos, Thilo Schwablenberg

2.3.1 Components of the Urethral Sphincter ....................................... 25
2.3.2 Vesical Sphincter ................................................................. 27
2.3.3 Urethral Muscles and Radical Prostatectomy ............................ 27
References ................................................................................. 30
Exact neuroanatomical knowledge of the male and female pelvis has become increasingly important to both anatomists and pelvic surgeons (bowel surgery, urology, gynaecology). Anatomical discoveries are often the basis for the development of new operating methods. In addition, functional results after operative procedures have become the target of detailed anatomical scrutiny.

New operating methods that spare the important neural structures of the urogenital tract have led to improved results in terms of bladder function, urinary continence and erectile potency. Well-described examples are nerve-sparing radical prostatectomy [1, 2] and cystectomy [2, 3] (continence, potency), ureteric antireflux surgery [4] (bladder function), extended radical hysterectomy with total mesometrial resection [5, 6] (bladder function) and rectal resection [7, 8] (continence, bladder function, potency).

Urologists, gynaecologists and bowel surgeons often encounter neural structures of similar origin in the true pelvis. Commonly, visceral pelvic nerves of organs dealt with by one specialty run through the operating spaces of another specialty. This requires an interdisciplinary approach. A new generation of pelvic surgeons is called for.

### 2.1.1 Neuroanatomical Basics of Radical Prostatectomy

During radical prostatectomy the surgeon encounters nerve fibres that run dorsally and laterally to the prostate, also known as neurovascular bundles (NVB). This term does not have an exact anatomical correlate as it describes a topographically related cluster of nerves and blood vessels. In the literature the description of the NVB differs widely and in regard to its existence and exact position is subject to inter-individual variations [9–12]. These autonomic nerve fibres originate in the pelvic plexus (synonyms: pelvic ganglion, inferior hypogastric plexus), which unites sympathetic and parasympathetic nerves. In contrast to the NVB the pelvic plexus is an anatomical structure subjected to only minute inter-individual variability. It is rhombic in shape, situated at the lateral pelvic wall and represents a concentration of ganglion cells. The pelvic plexus is the central neural plexus that provides autonomic innervation to male urogenital organs. Particular attention is paid to the dissection and preservation of nerves that run from the NVB to the cavernosal bodies during radical prostatectomy. These purely autonomic nerves are called nervi cavernosi penis (or cavernosal nerves).

The autonomic supply is strictly separated from somatosensory nerves. The relevant nerve in regard to radical prostatectomy is the pudendal nerve, which supplies not only the muscles for erection and ejaculation but also the striated part of the external urethral sphincter. Especially during apical dissection, potential for injury exists at radical prostatectomy.

With regard to the neuroanatomy of radical prostatectomy the discussion here focuses on the localisation of the NVB, the question of autonomic innervation of urethral sphincter structures and the existence of nerve connections between autonomic and somatosensory systems. Historically, the discussion about neural structures concerned with continence and erectile function began as early as 1863, when Eckhard [13] defined the nervi erigentes in animal experiments. In a landmark paper in 1982, Walsh and Donker [14] highlighted the clinical relevance of cavernosal nerves for the preservation of potency at radical prostatectomy.

Table 2.1.1 shows historically important publications which have profoundly influenced our understanding and surgical methodology in the quest for preservation of autonomic pelvic nerves.