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APPLIED ANATOMY OF NERVES TO MALE URETHRAL MEMBRANE SPHINCTER

Hypothesis / aims of study

The structure and distribution of continence nerves to male urethral membrane sphincter remains controversial. Improved understanding of neuroanatomy can modified surgical approaches in pelvic surgery.The objective of our study was to provide a precise anatomic evidences for preserving continence nerves in radical prostatectomy and cystectomy.

Study design, materials and methods

Cadaveric dissections were undertaken in 15 adult male formalin fixed specimens(30 hemipelvics) whose average age of death was 52 years. In each cadaver, the continence nerves were traced from extropelvic way and intropelvic way to their termination in the urethral membrane sphincter.The origin,course and distribution of the branches to the urethral membrane sphincter region were investigated in detail, The dissection was always carried out by the same technique, neural structures were separated by blunt and sharp dissection .Anatomical microscope were used to distinguish small nerve fibers from small strands of connective tissue.

Results

Continence nerves to male urethral membrane sphincter contained branches of inferior hypogastric plexus(IHP),intrapelvic and extrapelvic branches of pudendal nerve. IHP went along the lateral aspect of seminal vesicle and shaped a surgical plane with seminal vesicle,following the surgical plane we can easily separate the two structures in our imitative operations(Fig.1). Pelvic nerves originated from the caudalmost roots of the pelvic splanchnic nerves,which pierced the fascia of the levator ani muscle and run along the surface of the levator ani to enter the urethral sphincter at the 5 and 7 o'clock positions.In 40% of specimens(12 hemipelvics) we found intrapelvic branches which were given by pudendal nerves from extrapelvic.Before leaving the Pudendal canal,pudendal nerve gave an intrapelvic branch that traversed the levator ani to course with the pelvic nerve to innervate the urethral membrane sphincter(Fig.2).The average distance from the point which intrapelvic branche inserted in the urethra to the prostatic apex was (5.3±1.8)mm. In the extrapelvic,the branches originating from the dorsal nerves of penis innervated the urethral membrane sphincter were found in 53.3% of specimens(16hemipelvics),these nerve branches were located only (4.2±1.1)mm from the prostatic apex,and some of these branches were identified only unilaterally or only 1 branch on each side(Fig.3).

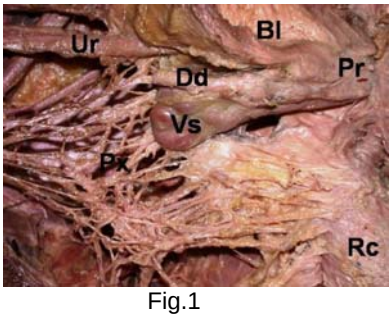

Fig.1

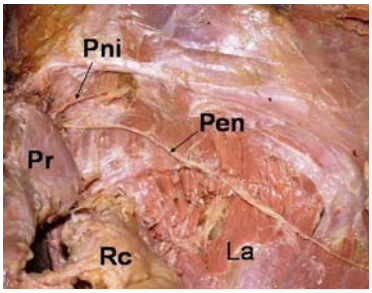

Fig.2

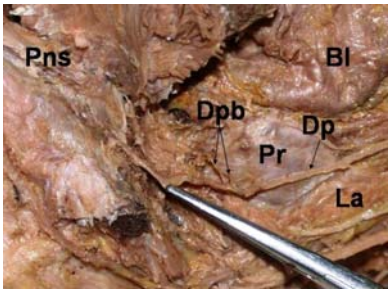

Fig.3

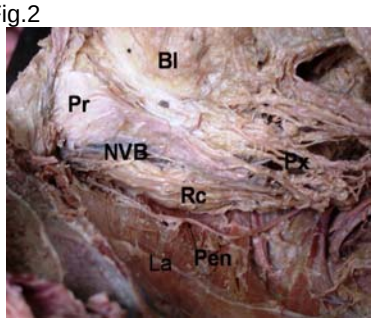

Fig.4

Fig.1 Inferior hypogastric plexus and seminal vesicle(left)
Fig.2 Pelvic nerve and intrapelvic branches of pudendal nerve(right)
Fig.3 Branches of urethral membrane sphincter from the dorsal nerve of penis(left)
Fig.4 Pelvic nerve and neurovascular bundles(left)
Ur ureter Bl bladder Px Inferior hypogastric plexus Rc rectum Pr prostate Vs Seminal vesicle Dd deferent duct Pni intrapelvic branches of pudendal nerve Pen Pelvic nerve La: levator ani Pns:penis Dp dorsal nerve of penis Dpb Branches of external urinary sphincter from the dorsal nerve of penis NVB neurovascular bundles

Interpretation of results

It is generally agreed that the autonomic nerve fibers from IHP and the somatic nervous branches from the pudendal nerve innervate the urethral membrane sphincter. But the exact neuroanatomy of these presumptive innervations is not clear. According to the present study, we find the pelvic nerves from IHP run along the levator ani surface and inserted the urethral membrane sphincter at the 5 and 7 o'clock. Of note, the cavernous nerves, also of IHP

origin,were seen to be completely separate from the pelvic nerves. cavernous nerves had their course within the envelope of the endopelvic fascia, dorsolateral to the prostate, where it course with the blood vessel of prostate to form so-called“neurovascular bundles” (Fig.4).One of the important findings of this study is the presence of intrapelvic branches of the pudendal nerve which provide somatic supply to the urethral membrane sphincter , so the urethral membrane sphincter receives dual somatic innervation from both intrapelvic branches and perineal branches of the pudendal nerve. Another interesting finding is the branches come from the dorsal nerve of penis,although it is not the constant presence on both sides,we think this small branches were also the necessary composition of nervous reflex of urinary continence. Both the somatic and autonomic innervation contribute to optimal urinary continence.Therefore, in order to promote postoperative urinary continence, the following handlings must be much accounted of during radical prostectomy and cystectomy: firstly, dissection of seminal vesicle should be along the correct plane to avoid damaging the neural plates of IHP; secondly, division of the posterior urethra should be refrained from injuring the intrapelvic branches of the pudendal nerve and pelvic nerve; thirdly,don’t isolate the distal urethra excessively to avoid damging the urethral membrane sphincter branches from the dorsal nerve of penis; finally,vesico-urethral anastomotic sutures should avoid the 5 and 7 o’clock areas and only include the 3 4mm edge of the urethra to avoid snaring the continence nerves.

Concluding message

The continence nerves to male urethral membrane sphincter are composed of two parts: pelvic nerves and intrapelvic branches of pudendal nerves innervate the urethral membrane sphincter by intrapelvic ways; perineal nerves and dorsal nerves of penis course to the urethral membrane sphincter from extrapelvic ways. Therefore,the identification of the precise anatomy of the continence nerves seems vital to avoid urethral membrane sphincter denervation. Modified dissections of seminal vesicle and the prostatic apex were crucial for protecting the continence nerves to the urethral membrane sphincter.

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