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MINERVA OPINION EDITORIAL

How to preserve continence after radical prostatectomy: do not go straight, remember to curve!

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Despite progressive improvements in the surgical technique, postoperative urinary incontinence after radical prostatectomy (RP) persists beyond one year in 4-31% of patients.[1] Various methods have been demonstrated to achieve urinary continence or shorten the time to continence after RP.[2] However, there is a need to identify additional surgical factors that can aid in the recovery of urinary continence after RP. We know that several mechanisms play a role in male continence (Figure 1A). The urethral sphincter complex comprises two morphologically related but functionally unrelated components: an inner lissosphincter of smooth muscle and an outer rhabdosphincter of skeletal muscle. In addition, several supportive structures are crucial in maintaining male continence. These structures include the pubovesical ligaments, the anterior fibromuscular stroma, the perineal membrane, and the pelvic floor muscles. Together with the pubococcygeus and puborectalis muscles, the puboperinealis muscles work synergistically with the rhabdosphincter to provide a complete mechanism for urinary continence. Damage to any of these supportive structures can result in urinary incontinence, as they are critical for maintaining the position and function of the urinary system. Therefore, surgical procedures such as radical prostatectomy can damage these structures and significantly impact male continence.[3] The presence of an intrabdominal curved shape of the male urethra seems crucial in allowing all these mechanisms to function synergistically. It is the natural intrabdominal curvature of the urethra as it courses from the bladder to the membranous urethra.[4] The anatomical relationship between the prostate and the pubic bone forms this curve (Figure 1B, C). The curve is necessary for the synergistic action of the rhabdosphincter and puboperinealis muscles to compress the urethra against the pubic bone during increased intra-abdominal pressure, which results in the closure of the urethra and prevents urine leakage.[5] Without this curve, the urethra would be straight, and it would not be possible to achieve the same degree of compression of the urethra against the pubic bone. The position of the bladder neck after RP can impact urinary continence. Research has shown that a lower bladder neck position can be associated with prolonged incontinence.[6] On the other hand, a higher vesical-urethral anastomosis location has been correlated with recovery of postoperative urinary continence.[7] To achieve a higher bladder neck position, total reconstruction with stabilization and suspension of the urethral sphincteric complex is an important procedure. Several surgical techniques have been developed to achieve it.[2] It is important to note that the effectiveness of these techniques can vary between patients and depends on several factors, such as the patient's age, preoperative continence status, and the surgeon's skill and experience. The common element of many surgical techniques mentioned above is repositioning the urethra in

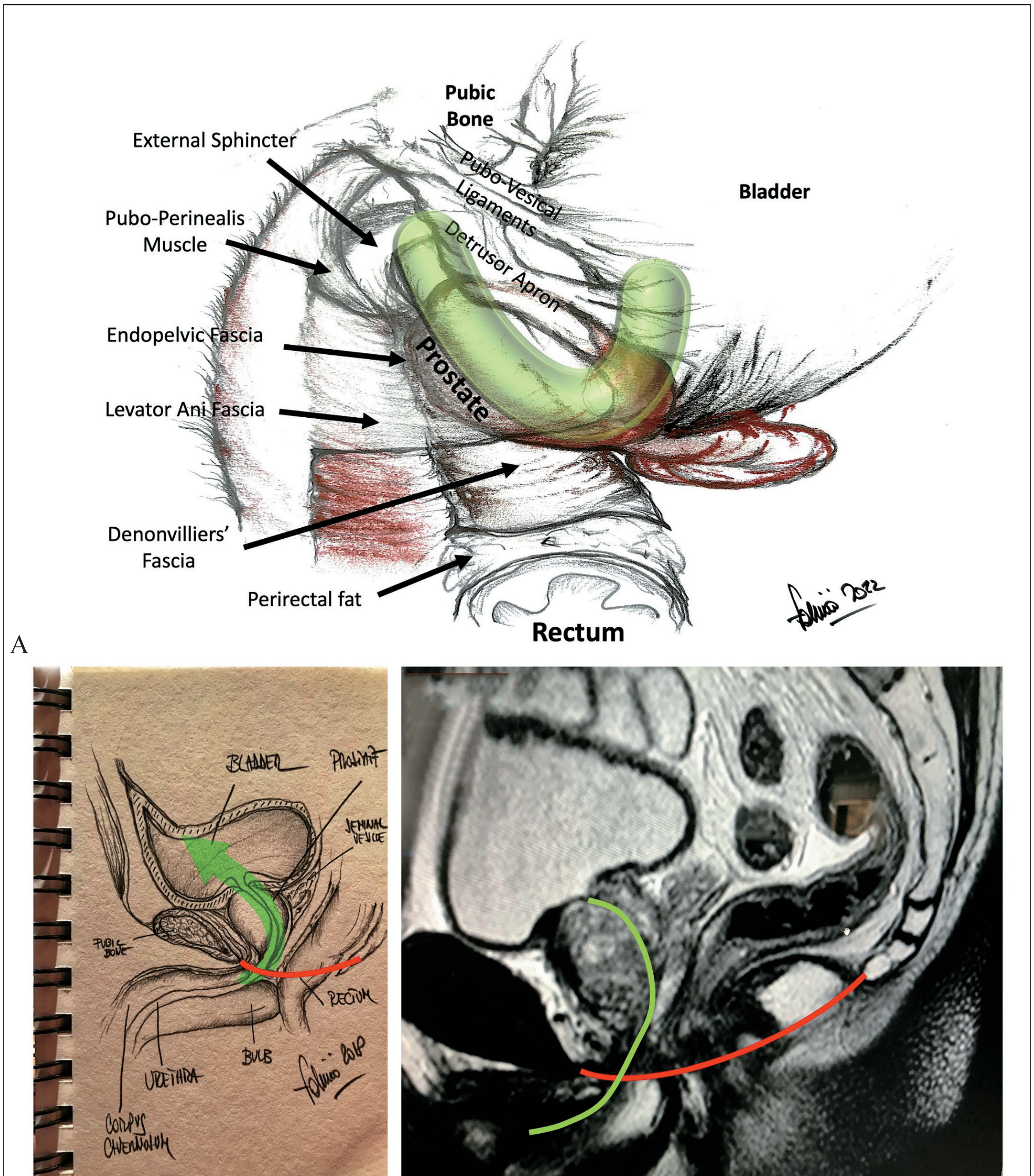

Figure 1.—A) Scheme of the supportive structures of the prostate with the natural curve of the urethra (green). B, C) Scheme and MRI view of the normal position and course of the urethra (green) and the perineal floor (red).

its original location and fixing it to the surrounding structures, particularly maintaining the curvature of the urethra. During stress events, the pelvic floor muscles contract, creating tension in the supportive structures and further increasing the resistance to the pressure of the bladder. This tension is crucial for maintaining continence, as it counteracts the mechanical stress of the blad-

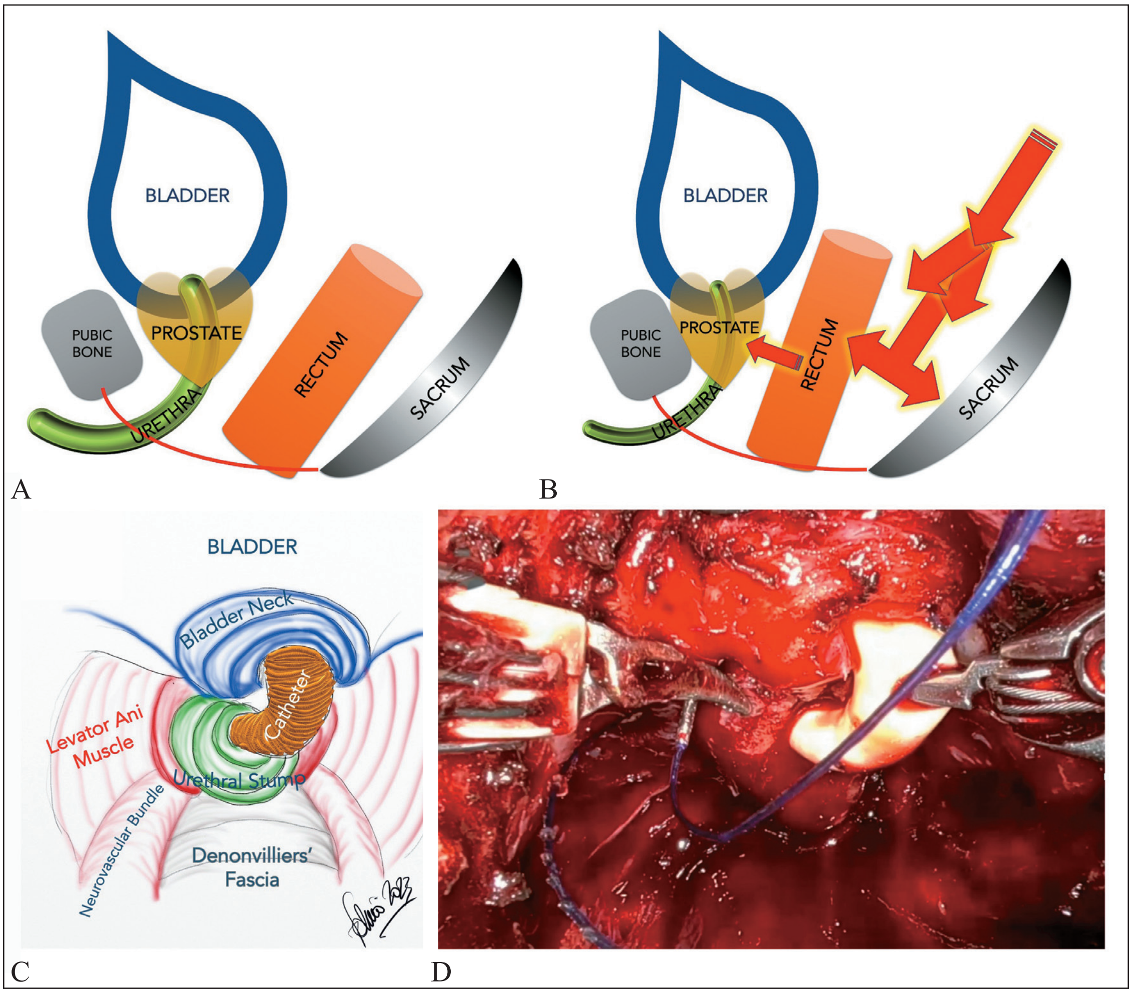

Figure 2.—A, B) During abdominal pressure, the anterior wall of the rectum moves towards the pubic bone. This is believed to occur due to compression of the urethra in the anterior-posterior direction by the levator ani muscle, resulting in increased pressure at the urethral closure. C, D) Scheme and intraoperative view of vesico-urethral anastomosis during RARP-RS, showing that the curvature of the urethra is maintained.

der and urethra during increased intra-abdominal pressure. This is achieved by compressing the urethra against the pubic bone, effectively closing it off and preventing the escape of urine. The pelvic floor muscles, along with the supportive structures, work together to maintain the position and stability of the urethra and prevent it from being displaced by the increase in abdominal pressure (Figure 2A, B). Conversely, weakness or damage to these supportive structures can lead to stress urinary incontinence, as the prostate and urethra can no longer resist the bladder's pressure during these events. The idea of the central role of the urethral curve is relatively new. Indirectly, other studies that have utilized post-RP magnetic resonance imaging (MRI) have demonstrated that the posterior urethral angle (PUVA) and the high position of the vesicourethral anastomosis describe the presence of continence after RP. Post-RP urethral curvature would confirm that the persistence of natural supportive structures maintains an adequate PUVA angle and thus preserve continence. The urethral angle could also have implications for surgical procedures that may affect the anatomy of the urethra, such as RP. Clinicians must know the urethral curve and its role in continence to provide better care for patients with urinary incontinence. Several studies have investigated the difference in outcomes between Retzius-sparing (RS) robot-assisted radical prostatectomy (RARP) and anterior approach (AA) RARP.[8] The RS approach involves a more posterior dissection of the prostate, which preserves the supporting structures of the urethra, including the pubovesical ligaments and the bladder neck. This approach aims to maintain the natural curvature of the urethra. In contrast, the AA approach involves a more anterior dissection of the prostate, which may disrupt the supporting structures of the urethra and cause urethral lengthening or straightening. In fact, during RARP-RS, the preservation of the urethral curve is visible because the anastomosis is performed between the bladder neck above and the urethral stump in front, allowing the urethral curve to be maintained (Figure 2C, D). On the other hand, during RARP-AA, the anastomosis is performed in a straight line without any curve. This can lead to a loss of the urethral curve. Some dynamic MRI findings reported in the literature showed that membranous urethral length and the anterior rectal wall movement toward the pubic bone during abdominal pressure were significant factors in preserving continence in patients who underwent RARP-RS.[9] The authors have emphasized the importance of the position of the urethra after RP, highlighting that in RARP-RS, the high attachment of the anterior bladder wall plays a central role in the urethral closure mechanism during abdominal pressure. However, the concept of urethral curvature provides a more comprehensive explanation of the difference between RARP-AA and RARP-RS regarding continence preservation, although a complete reconstruction of the supporting structures can lead to excellent results in terms of urinary continence due to the restoration of urethral curvature.[10] These findings seem to support the hypothesis that the natural curvature of the urethra is a central element during continence and that preserving this curvature may be crucial for maintaining of continence after RP.

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The author certifies that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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