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# Open Anatomical Anterograde Radical Prostatectomy, a Technique Developed at Rio de Janeiro State University

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## Abstract

Introduction: Radical prostatectomy is the gold standard treatment for localized prostate cancer, and videolaparoscopic prostatectomy represents a new leap forward. However, the latter approach adds great technical complexity and entails a long and very slow learning curve that can be successfully completed by only a small number of highly skilled surgeons. These factors have significantly hampered a more widespread uptake of this technique. Robotic-assisted laparoscopic surgery democratized laparoscopic radical prostatectomy by allowing many surgeons, even the least experienced ones, to perform this procedure with the same expertise as experienced surgeons. Nevertheless, the high cost of this technology greatly limits its more widespread use, especially in countries in the global south. Methodology: In 2015, a discussion began on the possibility of using some concepts from laparoscopic prostatectomy to improve open prostatectomy. Based on a study of the various techniques performed using the open, laparoscopic and robotic route, we developed an innovative technique to reproduce robotic prostatectomy openly, without recourse to any new special instruments or materials. This technique is called "Open Anterograde Anatomic Radical Retropubic Prostatectomy" (AORP). Results: AORP was superior to Open Radical Prostatectomy in critical parameters: a median estimated blood loss of 300mL versus 500mL (p=0.0003); more rapid urethrovesical anastomosis, at 20min versus 25min (p=0.005); shorter duration of indwelling vesical catheterization, at 7 versus 14 days; increased surgeon perception of nerve-sparing, at 101 (87.8%) versus 71 (67.6%) (p=0.0009); increased urinary continence, at 70 (60.9%) versus 45 (42.0%); fewer complications (p=0.007) and equivalent oncological control. Discussion: We understand that the gains of robotic surgery depend not only on the introduction of technology but also on improvements in the technique of dissection, preservation and reconstruction that can be reproduced in open surgery, thus enabling similar operations with improved procedures but without access to robotic technology.

**Keywords**: Prostate neoplasms, Prostatectomy, Laparoscopy, Surgical, Anastomosis, Surgical, Urinary incontinence.

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## Introduction

Radical prostatectomy (RP) is the gold standard treatment for localized prostate cancer. A better understanding of prostate anatomy and the contributions of the open prostatectomy surgical technique described by Patrick Walsh in 1982 were fundamental to the improvement of the functional and morbidity results of this surgical procedure.

In the 1990s, videolaparoscopic prostatectomy constituted a new leap forward in the treatment of prostate cancer, enabling smaller incisions and shorter hospitalization times.[1] However, this procedure added great technical difficulty – meaning that only very skilled surgeons with long training in video surgery and subject to a very long learning curve were able to overcome this challenge. These difficulties made the universalization of the technique extremely difficult. Robotic-assisted laparoscopic surgery,[3] in turn, replaced straight instruments with articulated forceps with greater freedom of movement and the possibility of dissection of structures not reached by laparoscopy (Figure 1).

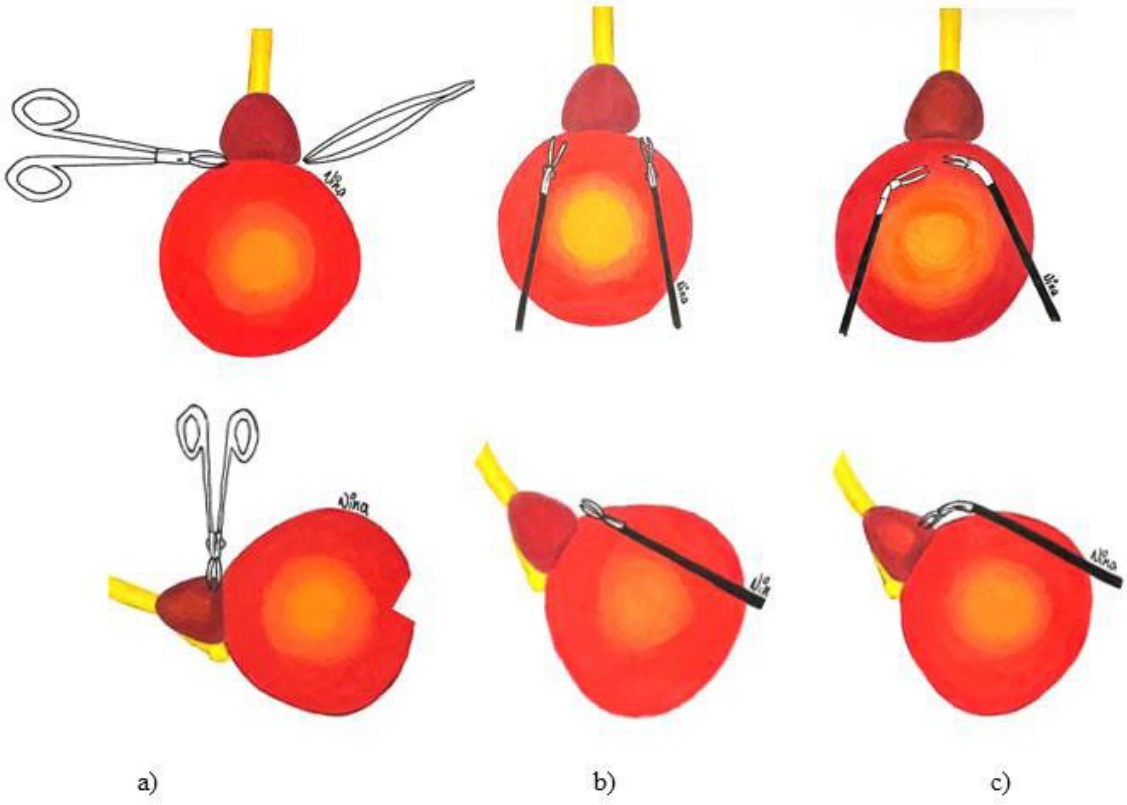


**Figure 1. Schematic design demonstrating the working angles of tweezers**
**Source:** The authors (2023).

Furthermore, robotic surgery offered the advantage of the main surgeon being able to control four arms, including the optics and three more clamps, fixing one and working with three others. This ability constituted a very significant advantage, since finding the exact location where the surgeon wants to work in pure laparoscopy is difficult, even with experienced assistants. Another important change in robotic-assisted laparoscopy is that the optics have two cameras that provide the surgeon with a three-dimensional view and a sense of depth, in addition to ensuring that the surgeon's view is exactly at the anatomical point where he wants to work, since he is the cameraman himself. Therefore, robotic-assisted laparoscopic prostatectomy has become the procedure of choice for qualified surgeons and for patients. To date, no differences have been demonstrated in oncological and functional results in the medium- and long-term when compared to other surgical treatment modalities.[4]

## Methodology and resources

In 2015, the possibility of using some concepts from laparoscopic prostatectomy to improve open prostatectomy was discussed. Three differences were identified between the techniques that could be adapted: first, the dissection route, which was retrograde in open surgery and antegrade in laparoscopic surgery; second, preservation of the bladder neck and a considerable portion of the abdominal urethra; and third, vesicourethral anastomosis, which is performed with a continuous suture as described by Van Veltholven.[6] Since these differences are partly responsible for making surgery easier laparoscopically, whether or not assisted by a robot, why not try to perform these same techniques of dissection, preservation and anastomosis during open surgery?

A pilot study was carried out and subsequently published using the successful Anatomical Antegrade Open Radical Prostatectomy (AORP) technique.[7] Through a literature review, we identified fundamental studies for the development of the new surgical AORP technique.[2,8-10]

Campbell described the primordial technique of retropubic RP 1959. It was performed with anterograde dissection, however, this surgery used very rudimentary techniques, the principle was early vascular and lymphatic control before the greater manipulation of the gland, in order to avoid the spread of tumor cells, an important consideration in the treatment of all tumors during that time. This wide dissection – reseating the entire nerve vascular bundle without preserving the bladder neck, and therefore requiring bladder neck plastic and a vesicourethral anastomosis – was performed without any sutures.[8]

In 1978, Patrick Walsh described a technique, the most used until today, that was based on the preservation of nerve vascular bundles. This technique includes a more anatomical dissection, close to the prostate capsule, thus managing to preserve more nerves. However, the dissection route was changed from anterograde to retrograde. The dissection of the prostate began by opening the endopelvic fascia, sectioning the pubic prostatic ligaments and the urethra at the beginning of the surgery. This caused a retraction of the urethra with a smaller amount of proximal urethra, because the urethra was fixed at the apex of the prostate and, after sectioning the pubic prostatic ligaments, the surgeon needed to recover the urethral stump retracted into the perineum. For this reason, the urethrovesical anastomosis in the Walsh technique was, in most cases, performed by a simpler suture with separate stitches.[2]

In 2008, Sciarra published a series of 323 PR with surgery by the anterograde route, but without preservation of the bladder neck and with anastomosis by separate points. Until then, no one had reproduced the robotic dissection technique in open surgery.[9]

Another fundamental article in the development of this new technique was the Pasadena consensus, which describes in precise details the technique of robot-assisted laparoscopic PR dissection.[10]

Based on a study of the various techniques performed by the open, laparoscopic and robotic route, the latter of which is described in detail in the recommendations of the Pasadena Consensus Panel, we developed a novel technique to reproduce robotic prostatectomy openly, without the addition of any new instruments or special materials. Its name is "Open Antegrade Anatomic Radical Retropubic Prostatectomy" technique, and its acronym is AORP.[7,10-11] This new technique is based on the 7 main steps described below:

1. Currently we perform this surgery utilizing a Pfanestiel incision. We no longer perform the incision of endopelvic fascia and section of puboprostatic ligaments with ligation

of the dorsal vascular complex. We have not conducted such procedures for some time, since we prefer the technique of preserving the Retzius space.

2.The dissection of the prostate begins with an anterograde approach, i.e., from bladder neck to the apex, with careful dissection and preservation of the bladder neck, when possible, since it is separated from the prostate.

3. Dissection of the space behind the prostate and bladder neck with identification of ejaculatory ducts and seminal vesicles. Meticulous dissection of these structures with minimal use of cauterization and traction.

4. Meticulous retro prostatic dissection with preservation of the posterior layer of Denonvilliers' fascia, which contains communicating nerve fibers and can be left on the rectum. This dissection must reach the prostatic apex and extend laterally to the pedicle and bundle nerve vascular.

5. Lateral vascular pedicule dissection and ligation of the prostate with an absorbable suture, such as vicryl 2.0 or 3.0. Uni or bilateral nerve-sparing as required through careful lateral dissection of the prostate, without the use of electro cauterization, until the apex is reached. Maximum preservation may be obtained by following the plane between the prostatic capsule and the multilayer tissue of the prostatic fascia when possible.

6. Release of the prostate up to its apex dorsally. Meticulous dissection of the prostatic apex and urethra. Preservation or section of the dorsal venous plexus with traction of the prostate and urethra exposure to be sectioned near the apex, preserving adequate extension of the abdominal urethra to facilitate urethrovesical anastomosis (Figure 2).

7. Urethrovesical anastomosis, without bladder neck reconfiguration or eversion of the bladder mucosa. Anastomosis confectioned with two monofilament, absorbable 3.0 sutures joined at the end to perform a single running suture as described by Van Velthoven *et al*. The first stitch is made through the bladder from the outside to the mucosa and then passed through the urethra from the mucosa to its outer layer (Figure 2).

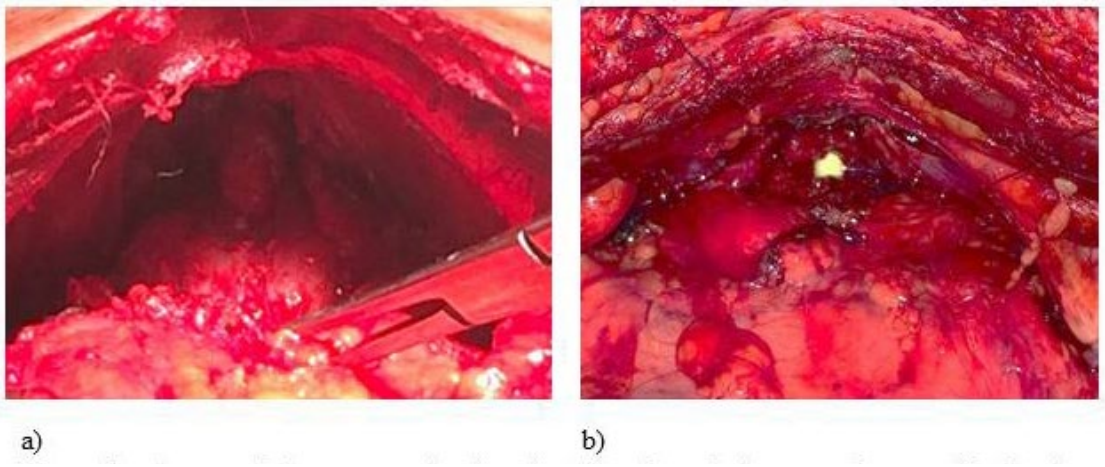


**Figure 2. Dissection of the prostatic apex**

**Legend:** Image of the surgery showing the dissection of the prostatic apex (a) by the anterograde technique, preservation of a large portion of the abdominal urethra, 3 cm, which greatly facilitates the anastomosis with continuous suture (b).

**Source:** The authors (2023).

The main surgical steps of this technique follow the recommendations of the 2012 Pasadena Consensus Panel for Robotic Surgery,[10] modified by the authors to adapt to open retro-pubic surgery: anterograde dissection with preservation of the bladder neck, nerve sparing, preservation of the posterior layer of Denonvilliers' fascia, which remains on the rectum, and preservation of the abdominal urethra. This technique has been described in detail in previous works.[7,10-11] The main changes that occurred over time were the non-opening of the endopelvic fascia, non-section of the pubic prostatic ligaments and, most of the time, the suture or ligation of the penile dorsal vein complex proved to be unnecessary.

## Results and discussion

Our first publication was the pilot study cited above, which evaluated ten patients undergoing AORP at the Pedro Ernesto Hospital of UERJ. What surprised us the most in this study was the proportion of continence of 70% in 30 days, where continence is defined as a patient who did not lose control of urination and did not use a protector pad. This proportion of continent patients was a great surprise and motivated us to carry out larger and definitive study.[7]

The second publication focused on presenting the results of the first 50 patients and a video of the entire surgery with details of the technique as described above.[11]

The most recent study included 240 men chosen randomly from March 1, 2016, to February 27, 2019. These were patients with clinically localized prostate cancer, who had been recommended for unilateral or bilateral nerve-sparing open PR. Among these, 220 completed the three-month follow-up; 115 underwent AORP, and 105 were subjected to ORP. Ethical approval was obtained from the local Ethics Committee on November 2015 under number 1.335.683, and registered on the Plataforma Brasil CAAE:41908815.9.0000.5259 and in ClinicalTrials.gov (identifier NCT02687308). We found that: median estimated blood loss was lower in AORP, at 300mL versus 500mL in ORP ($p$=0.0003); urethrovesical anastomosis was significantly faster, at 20min (15-30) versus 25min (20-30) ($p$=0.005); and indwelling vesical catheterization was shorter, at 7 days (7-7) versus 14 days (14-15) ($p$<0.0001). AORP was superior to ORP in critical parameters. In addition to those mentioned above, the surgeon's perception of nerve-sparing occurred in 101 (87.8%) cases versus 71 (67.6%) ($p$=0.0009). Regarding urinary continence, a larger number of patients achieved early continence through the AORP, at 70 (60.9%) versus 45 (42.0%) for ORP. Our results also showed fewer complications ($p$=0.007) and similar oncological control.[12]

We are currently conducting a study comparing AORP with RRP in terms of safety, oncological and functional results and costs. This study showed small, statistically insignificant differences in terms of hospital stay and bladder catheterization time. However, it showed a much (3.7 times) higher cost for robotic surgery.[13-14]

In conclusion, we understand that the gains derived from robotic surgery are not only a result of the introduction of technology, as described above, but also of an improvement of dissection, preservation and reconstruction techniques, which can be reproduced in open surgery and allow patients without access to robotic technology to be the subject of a similar operation but with improved procedures. Furthermore, the AORP method was reproducible by low-volume surgeons; therefore, it may assist inexperienced surgeons in developing valuable skills for future training with robotic techniques.

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