

ADVANTAGES AND DISADVANTAGES OF MAIN SURGICAL APPROACHES FOR ROBOT-ASSISTED RADICAL PROSTATECTOMY

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⊗ The introduction of robotic-assisted surgery into clinical practice has opened up new possibilities for the surgical treatment of urological patients. Robot-assisted radical prostatectomy (RARP) is one of the most commonly performed robot-assisted surgery. The review is devoted to the main surgical approaches for RARP. An analysis of publications on this topic was carried out using the search engines of the scientific databases PubMed, Medscape, Google Scholar, eLibrary when writing the article. The article presents an overview of the advantages and disadvantages of the existing four access options for RARP: anterior, perineal, lateral and posterior, as well as oncological and functional outcomes of operations. It has been shown that a surgeon with different approaches can choose the most suitable one for a given clinical situation, focusing on the stage of the disease, the patient's age, anatomical features of the prostate gland, the state of the patient's erectile function, and the history of operations on the abdominal cavity and pelvic organs.

⊗ **Keywords:** retzius-sparing; robot-assisted radical prostatectomy; robotic surgery; Da Vinci robot; Retzius space.

ПРЕИМУЩЕСТВА И НЕДОСТАТКИ ОСНОВНЫХ ОПЕРАТИВНЫХ ДОСТУПОВ ПРИ ВЫПОЛНЕНИИ РОБОТ-АССИСТИРОВАННОЙ РАДИКАЛЬНОЙ ПРОСТАТЭКТОМИИ

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⊗ Внедрение в клиническую практику робот-ассистированной хирургии открыло новые возможности оперативного лечения урологических больных. Робот-ассистированная радикальная простатэктомия (РАРП) — одна из наиболее часто выполняемых робот-ассистированных операций. Статья посвящена основным оперативным доступам, используемым при выполнении РАРП. Проведен анализ публикаций по данной тематике с использованием поисковых систем научных баз PubMed, Medscape, Google Scholar, eLibrary. Представлен обзор преимуществ и недостатков существующих четырех вариантов доступа при РАРП: переднего, промежностного, латерального и заднего, а также онкологических и функциональных исходов операций. Показано, что хирург, владеющий разными доступами, может выбрать наиболее подходящий из них для данной клинической ситуации, ориентируясь на стадию заболевания, возраст пациента, анатомические особенности предстательной железы, состояние эректильной функции пациента, наличие в анамнезе операций на органах брюшной полости и малого таза.

⊗ **Ключевые слова:** робот-ассистированная радикальная простатэктомия; РАРП; оперативный доступ; робот-хирург «Да Винчи»; ретциево пространство.

INTRODUCTION

Nowadays, in the surgical treatment of patients with prostate cancer, functional results, such as the frequency of restoring continence and erection, are now of significant importance. As a tool for achieving high functional results, robot-assisted radical prostatectomy (RARP) has established itself. The design aspects of the da Vinci robot allow the surgeon to freely perform complex manipulations in the limited space of the small pelvis and to use various approaches to the prostate gland.

This purpose of this study was to analyze the main approaches used in RARP, their advantages and disadvantages, as well as their oncological and functional effects. When writing the article, a review of scientific literature on the databases, such as PubMed, Medscape, Google Scholar, and eLibrary, was conducted. Further, the results of Russian and international studies of the last 5 years were analyzed.

During RARP, the primary approaches are anterior, perineal, lateral, and posterior (Retzius-sparing RARP).

Anterior approach

In RARP, anterior approach is the most popular in the world. In this approach, the first stage is the opening of the parietal peritoneum between the median umbilical ligaments above the urinary bladder, and the prevesical (Retzius) space is dissected. The *standard technique* involves the stages of sequential opening of the pelvic fascia and transection of the puboprostatic ligaments, ligation of the dorsal vascular complex, dissection of the bladder neck, mobilization of the seminal vesicles and vas deferens, and subsequent antegrade mobilization of the prostatic gland along the posterior surface. Next, the apex of the prostate gland is cut off from the arbitrary urethral sphincter. At the last stage, a vesicourethral anastomosis is applied.

With the standard technique, a pronounced damage to the integrity of the periprostatic anatomical structures can adversely affect the functional results of treatment [1]. In order to improve them,

a technique has become widespread in recent years, in which the pelvic fascia and puboprostatic ligaments are not dissected after dissection of the prevesical space, and the dorsal vascular complex is not ligated. Instead, the bladder neck is dissected immediately and the posterior surface of the prostate is reached. In the next stage, the pelvic fascia is not opened but rather exfoliated from the anterolateral surfaces of the prostate, and the puboprostatic ligaments are not transected. The dorsal vascular complex is separated bluntly and sharply from the anterior surface of the prostate, and ligation is not always necessary. After performing the vesicourethral anastomosis, the integrity of the pelvic fascia is restored [2, 3].

The anterior RARP approach shows superiority over open retropubic radical prostatectomy in restoring continence and erectile function [4–6]. Compared with open and laparoscopic surgery, it is associated with lower blood loss volume and lower incidence of perioperative complications with comparable oncological outcomes [7–9].

Training a surgeon to perform RARP with an anterior approach takes less time than training to perform laparoscopic techniques, while previous laparoscopic experience does not provide surgeons with major advantages in mastering robotic-assisted technologies [10]. In selecting a technique for performing radical prostatectomy, the anterior approach can be recommended in cases where the use of another approach option increases the risk of unfavorable oncological outcomes [11].

The anterior approach is the most commonly used and considerably surpasses the rest of the approaches in the frequency of use in the world. This approach has been transferred into robotic surgery from laparoscopy, where it, in turn, appeared from conventional open surgery. In several scientific publications, the aspects of approach and its stages have been described and presented at numerous congresses, and in mastering the RARP technique, it is the most simple and understandable for most surgeons.

Perineal approach

With the advent of robotic surgeries in oncology, the perineal approach to the prostate has also been developed [12]. With this approach, in the first stage, the perineal skin is dissected along the semi-circle formed by the ischial tuberosity and the base of the scrotum, adipose tissue is dissected, and then dissection of the pubococcygeal muscle and stratification of *m. levator ani* are performed. Then, a special single-port multichannel trocar is installed into the wound, allowing multiple robot instruments to be used simultaneously [13, 14].

Isolation of the prostate is started from the apex and posterolateral surfaces. With a perineal approach, the neurovascular bundles can be preserved, or a wider dissection of the posterior surface of the prostate can be performed. The next stage consists of the urethral sphincter being dissected from the apex of the prostate gland. Further, the prostate gland is isolated along the anterior and lateral surfaces, the bladder neck is dissected, the gland is dissected away, and the preparation is removed from the operating field. Thereafter, if necessary, a pelvic lymphadenectomy is performed. The surgery ends with the formation of a vesicourethral anastomosis. This method enables surgeries to be performed without insufflation; therefore, it can be performed in patients with severe concomitant cardiovascular pathology [15].

V. Tugku et al. [16] determined that in the perineal RARP group, the indices of immediate continence were significantly lower than in the anterior approach and amounted to 40%, but 3 months after surgery, 94% of patients were able to completely retain urine. Another study also found that, after 6 months, the continence indicators performed by perineal approach after RARP were superior to those with anterior approach (9% vs 72%) [17, 18].

Perineal RARP can be used safely and efficiently in patients with a body mass index greater than 40 kg/m², after interventions on the abdominal cavity and pelvic organs, including after transurethral resection of the prostate. There is no risk of trauma to the abdominal organs, and the approach to the

gland does not require mobilization of other organs. An experienced specialist can reduce the duration of the surgery and the level of blood loss using it. The approach can also be used in situations when the transabdominal approach is complicated by the presence of inguinal hernia meshes, intestinal adhesions, a narrow pelvis, and atypical anatomy of the pelvic vessels [19].

R. Gillitzer et al. [20] revealed that in case of perineal approach RARP, the probability of vesicourethral anastomosis strictures is significantly lower than with the anterior approach (3.8% versus 5.5%).

For large prostate gland volumes (130 ml or more), the perineal approach is considered safe and effective [21]. It could also be proven that such an approach is preferable if there is a history of kidney transplantation, since its use avoids damage to the vesicourethral anastomosis [22].

V. Tugku et al. [18] established that the indicators of erectile function are significantly higher in patients after RARP by perineal approach than in the group of open radical prostatectomy, after 3, 6, and 9 months. M.G. Yenice et al. [23] noted that the perineal approach is safe and effective in patients with a previously installed penile prosthesis.

The disadvantages of perineal approach include a low rate of early recovery of continence [17, 18]. Due to the fact that the surgical field in the perineal approach is very small, intervention using the da Vinci Si robot (the most common model in Russia) can only be performed with two of the three working instruments to avoid instrument collisions, which restricts the capabilities of the robot. Due to the small operating field, the assistant may also experience difficulties during work. With the implementation of the wide application of the single-port surgical system da Vinci SP, perineal approach may become more widespread.

Lateral approach

Prof. R. Gaston (France) introduced the approach into the practice in 2007. As with the anterior approach, in lateral RARP, the first stage consists of the dissection of the parietal peritoneum at the apex

of the bladder but only to the right of the median umbilical ligament. The incision is then extended down to the level of the right vas deferens through the right medial ligament. After this, the approach to the right surface of the bladder neck is formed in the prevesical tissue by a blunt and sharp method. Further, the anterior and left surface of the bladder remains unmobilized. Dissection of the bladder neck is also performed on the right and continues to the left after opening the bladder lumen. In their essence, the subsequent stages of surgery repeat the modern technique of the RARP anterior approach [24].

With a lateral approach during RARP, the structures of the Retzius space can be partly preserved, and the supporting ligamentous apparatus of the urinary bladder and the prevesical tissue are better preserved. This approach will be convenient in the presence of an enlarged middle lobe of the prostate [25].

RARP demonstrates good oncological and functional results using the lateral approach; however, it is inconvenient to perform a wide dissection of the prostate from this approach, so in a locally advanced tumor process, the method can be limitedly applied. The approach can be chosen when treating patients with localized stage T1 to T2a prostate cancer and good baseline erectile function [25]. Due to the unusual topographic anatomy, mastering the lateral approach requires a separate learning curve, even for the trained surgeon.

Posterior approach

In 2010, A. Galfano et al. presented a new technique for performing RARP through the Douglas space for the first time, namely, the posterior (Retzius-sparing) RARP [26]. Preservation of the Retzius space anatomy (puboprostatic ligaments, pelvic fascia, adipose tissue located anterior to the prostate and bladder) stabilizes the external urethral sphincter and bladder [11, 27]. During surgery, the posterior approach is used with sequential opening the parietal peritoneum in the projection of the bladder neck, isolation of the vas deferens and semi-

nal vesicles, isolation of the posterior surface of the prostate and neurovascular bundles, dissection of the bladder neck, dissection of the dorsal vascular complex, application of vesicourethral anastomosis, and suturing of the parietal peritoneum [28, 29]. With the RARP posterior approach, the indicators of continence significantly exceed those with the anterior approach during the first month after surgery. With Retzius-sparing RARP, it is technically easier to preserve the neurovascular bundles compared to the anterior approach [11].

K. Rashid et al. [30] emphasized the additional advantages of the posterior approach. In the event that the patient needs an artificial urethral sphincter implantation or a three-component penile prosthesis in the future, the preservation of the Retzius space can significantly facilitate the approach. Moreover, in patients with kidney transplantation, this approach is also preferable because, in this case, the anterior approach threatens to disrupt the integrity of the vesicourethral anastomosis.

The results of the study by J. Lee et al. showed the advantage of Retzius-sparing RARP over open radical prostatectomy in terms of early recovery of urinary continence within the first 6 months after surgery, enhancing the quality of life of men [31, 32].

Based on the results of the meta-analysis, N.I. Dirie et al. [33] revealed that continence for 1 month was achieved in 61% of patients with RARP performed by the posterior approach, while only 43% was achieved with the anterior approach. However, the discrepancy in positive surgical margin values was not statistically significant.

In a randomized prospective study, A.D. Asimakopoulos et al. [34] compared the results of continence in the posterior and anterior approach groups in RARP. Thus, immediate continence was achieved in 51.3 and 30% cases, and continence was noted in 98% and 96% of patients, respectively, after 1 year.

In their editorial, A. Abdel Raheem and K.H. Rha compared the oncologic and functional outcomes of RARP performed with a posterior approach and open radical prostatectomy. Furthermore, the authors recognize the use of the posterior RARP approach in

patients with a large prostate gland and an enlarged middle lobe, in moderate- and high-risk patients, as well as in case of a history of prostate surgery conducted by a team of experienced surgeons [35, 36]. L.H.C. Kim et al. [37] also revealed that posterior RARP approach is a safe method for patients with a history of transurethral resection of the prostate. In addition, E.S. Nevirovich et al. [38] demonstrated the successful use of the posterior approach in laparoscopic radical prostatectomy in their study.

In a randomized controlled trial, M. Menon et al. [1] compared continence indicators 1 week after the surgery. Thus, with the posterior approach of the RARP, 71% of patients had urinary incontinence, while only 48% of the patients were able to do so with the anterior approach. After 3 months, these indices were 95% and 86%, respectively, and no variations in values for different approaches were found 1 year after the surgery.

In a randomized controlled trial, R.K. Sayyid et al. [36] showed that the results of the posterior RARP surpassed the results of the RARP performed by the anterior approach in terms of continence after 1 year (97 and 68.5%, respectively). The average duration of the surgery with the posterior approach was 120 min and that with the anterior approach was 144 min. The incidence of positive surgical margins was 17% and 13%, respectively. In a prospective study, a shorter duration of surgery with a posterior approach and a faster recovery of continence were noted by S.K. Lim et al. [40].

Y. Kadono et al. [41] presented the results of a 26-month prospective follow-up of patients after posterior RARP. The authors noted a rather high average level of positive surgical margin, which was 30.6% (14.2% at T2 and 40.8% at T3a stage). During the follow-up period, the biochemical relapse rate was 14.8%.

According to D. Dalela et al. [42], 93.9% of patients had urinary incontinence 1 year after posterior RARP. The authors also observed that within a year after surgery, erectile function recovered in 86.5% of patients in the posterior approach group and in 69.2% in the anterior approach group.

In a randomized controlled trial, L.W. Chang et al. [43] found that, in addition to the higher rates of early continence with the posterior approach of RARP (73.3% and 26.7% after 1 week compared with the anterior approach), the choice of the posterior approach was associated with a low risk of postoperative inguinal hernias (5.8% versus 28.4%), especially in patients with a history of inguinal hernia (20.8% probability with posterior RARP versus 79.2% with anterior RARP). This can be explained by the preservation of the integrity of the peritoneum along the inguinal ligament while choosing the posterior approach of RARP [44, 45]. In patients with a history of inguinal hernia, adhesions are known to develop between the surgical mesh and the bladder, making it difficult to mobilize the bladder with an anterior approach [30].

CONCLUSION

A range of approaches for performing RARP provide the surgeon with ample opportunities when planning the surgery. Due to the technical aspects of the surgical robot, the development of the lateral and posterior approaches was made possible. Furthermore, a surgeon with different RARP approaches can maximally personalize the surgical treatment of the patient, focusing on the stage of the disease, the presence of concomitant pathology, the volume of the intervention to be performed, and data on previous surgeries.

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