

# UPGRADING OF LAPAROSCOPIC INTERVENTION OF THE PROSTATE GLAND TUMORS

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## ABSTRACT

**Relevance:** Laparoscopic surgery supplies many benefits due to lower postoperative sequelae. Laparoscopic radical prostatectomy has become a first-line treatment for patients with localized prostate cancer worldwide.

**The study aimed to** compare outcomes after traditional laparoscopic extraperitoneal radical prostatectomy with modified laparoscopic extraperitoneal radical prostatectomy (MLERPE).

**Methods:** All information about patient treatment for this historical cohort study was obtained from the "Electronic In-patient Registry" of the Republic of Kazakhstan. The study included case records of 94 patients who underwent laparoscopic extraperitoneal radical prostatectomy from 2017 to 2021. Of them, 45 underwent a modified laparoscopic prostatectomy, and 49 – a traditional laparoscopic prostatectomy. Data are presented as the means  $\pm$  standard deviation or as frequencies and percentages. Pearson's Chi-square was used for qualitative data. T-test and Mann-Whitney U test were used to compare the means of the two groups. The statistical significance level was 0.05.

**Results:** We revealed significant differences between the laboratory parameters of both groups after surgery. The mean difference in hemoglobin level between the two groups was 14.04, the mean difference in erythrocyte level was 0.69, the mean difference in leukocyte level was 1.26, and the mean difference in ESR level was 2.01. All differences were statistically significant ( $p=0.000$ ). We found a statistical difference in the duration of operation and hospital stay between the two groups ( $p=0.000$ ).

**Conclusion:** The modified laparoscopic technique avoids adverse worse outcomes such as bleeding, pneumoperitoneum, and decreasing oxygen saturation. This technique is also beneficial in the early postoperative period for excluding peritonitis, and the late postoperative period avoids adhesive processes.

**Keywords:** Prostate gland tumors, prostate cancer, laparoscopic surgery, extraperitoneal prostatectomy, clinical outcome, Kazakhstan.

**Introduction:** Laparoscopy is a method of examining the peritoneal cavity and its contents by opening the abdominal cavity and obtaining its image using a lighted telescope. Laparoscopic surgery lowers postoperative sequelae and is a more suitable surgical procedure than traditional prostatectomy. In addition, better visualization of the operative site improves the quality of surgery due to optical enlargement and the maneuverability of the laparoscope, which provides a previously unobtainable anatomical view.

Laparoscopic radical prostatectomy was first executed in 1991 by Schuessler et al. [1]. Then an initial series with nine cases was published in 1997 [2]. However, the authors concluded that 'laparoscopic is not an efficacious surgical alternative to open prostatectomy for malignancy.' Since then, laparoscopy has undergone many modifications. Guillonnet and Vallancien described an LPR Montsouris technique that allowed surgery in less than three hours [3]. The new decision was implemented to avoid complications associated with the transperitoneal route [4, 5]. Preperitoneal access proposed by Raboy and colleagues [6] was used and justified in a series of 42 cases by Bollens and co-workers in 2001 [7].

Comparing laparoscopic techniques and open procedures supplied more benefits for laparoscopic procedures due to diminishing postoperative hospital stay, quick return to physical activity, and through advanced optical systems, better vision of the operative field [8]. For patients

with localized prostate cancer, laparoscopic radical prostatectomy is the best treatment method [9]. Laparoscopic radical prostatectomy has become a first-line treatment for patients with localized prostate cancer worldwide.

**The study aimed to** compare outcomes after traditional laparoscopic extraperitoneal radical prostatectomy with modified laparoscopic extraperitoneal radical prostatectomy (MLERPE).

**Materials and Methods:** This historical cohort study involved case reports of 94 patients with prostate cancer who underwent laparoscopic extraperitoneal radical prostatectomy surgery at the East Kazakhstan region multi-profile Center of Oncology and Surgery in Oskemen, the Center of Nuclear Medicine and Oncology in Semey, and the Kazakh Institute of Oncology and Radiology in Almaty between 2017 and 2021. Of them, 45 underwent MLERPE, and 49 patients with traditional laparoscopic extraperitoneal radical prostatectomy (TLERPE). We compared clinical outcomes such as blood count, duration of operation, and hospital stay after TLERPE and MLERPE.

All information about patient treatment was obtained from the electronic patient registry – an information system entitled "Electronic In-patient Registry" (EIPR) that comprises health records of all patients hospitalized at healthcare facilities in Kazakhstan. Approval from the Ethical Committee of Semey Medical University (Semey, Kazakhstan) was obtained (Protocol №2, October 18, 2019).

The MLERPE technique received patent protection in the RK on December 31, 2021, under patent no. 35437, "Method for preparing the operating place for extraperitoneal endoscopic treatment tumors of the prostate gland."

The choice of statistical criteria for data analysis depended on the type of analyzed variables. We used descriptive statistics to analyze the data. Pearson's Chi-square was used for qualitative data. Data are presented as the means  $\pm$  standard deviation or as frequencies and percentages. If the test statistic followed a normal distribution, we used Student's T-Test to compare the means of two independent groups.

If the test statistic did not follow a normal distribution, we used the Mann-Whitney U test to compare the means of the two groups. The statistical significance was 0.05. Analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (SSMU Semey city).

By nationality, 40,4% of patients were Kazakh, 50,0% were Russians, and other nationalities composed 9,6%. The average age of patients was 68.7 ( $\pm 3.93$ ) years, and most patients had the IIIB stage disease. The two groups had no statistical difference in age or disease stage. The main characteristics of patients are presented in Table 1.

**Table 1 – Patient characteristics**

Characteristics	MLERPE	TLERPE	All
Age (yr.), mean (SD)	68.6 (3.97)	68.7 (3.94)	68.7 (3.94)
Nationality, n (%)			
Kazakh	17 (37.8%)	21 (42.9%)	38 (40.4%)
Russian	23 (51.1%)	24 (49.0%)	47 (50.0%)
Other	5 (11.1%)	4 (8.2%)	9 (9.6%)
Disease stage, n (%)			
IA	1 (2.2%)	1 (2.0%)	2 (2.1%)
IB	1 (2.2%)	1 (2.0%)	2 (2.1%)
IIA	6 (13.3%)	6 (12.2%)	12 (12.8%)
IIB	10 (22.2%)	10 (20.4%)	20 (21.3%)
IIIA	12 (26.7%)	15 (30.6%)	27 (28.7%)
IIIB	15 (33.3%)	16 (32.7%)	31 (33.0%)

**Results:**

A comparison of mean clinical parameters in two groups before and after surgery is presented in Table 2.

**Table 2 – Comparison of mean clinical parameters in two groups before and after surgery**

Characteristics	MLERPE	TLERPE	p-value
Duration of operation (minutes), Me (Q1; Q3)	90.0 (90.0; 107.5)	110.0 (110.0; 120)	U=272.2, Z=-6.61, p=0.000
Duration of hospital stay (day), Me (Q1; Q3)	9.0 (9.0; 10.0)	11.9 (11.0; 12.0)	U=55.5, Z=-8.12, p=0.000
Before surgery, the mean (SD)			
Hemoglobin (g/L)	137.5 (11.9)	137.7 (11.3)	t=-0.067, df=92, p=0.947
Erythrocytes ( $10^{12}/L$ )	4.98 (0.40)	4.94 (0.52)	t=0.407, df=92, p=0.685
Leukocytes ( $10^9/L$ )	6.11 (1.11)	6.16 (1.07)	t=-0.232, df=92, p=0.817
ESR (mm/H)	12.4 (3.09)	13.10 (3.11)	t=0.993, df=92, p=0.323
After surgery, the mean (SD)			
Hemoglobin (g/L)	136.3 (10.6)	123.6 (9.6)	t=6.10, df=92, p=0.000
Erythrocytes ( $10^{12}/L$ )	4.91 (0.42)	4.24 (0.52)	t=6.80, df=92, p=0.000
Leukocytes ( $10^9/L$ )	6.16 (1.09)	7.43 (1.28)	t=-5.19, df=92, p=0.000
ESR (mm/H)	14.2 (3.02)	17.6 (3.16)	t=-5.24, df=92, p=0.000

We found a statistical difference between the two groups in the duration of operation (p=0.000) and length of hospital stay (p=0.000).

There is no statistical difference in mean clinical parameters in both groups before surgery (Table 2). However, we noted significant differences between clinical parameters in the two groups after surgery.

**Discussion:** Laparoscopic procedures in the East Kazakhstan region multi-profile "Center of Oncology and Surgery" were launched to meet the global trend in urology, the interests and expectations of patients from laparoscopy, and the increasing importance of laparoscopy in Kazakhstan [10].

We carried out many laparoscopic operations on patients with prostate cancer and tried to improve this technique. A method of upgrading this procedure was proposed by Umurzakov in his Ph.D. thesis [10]. This surgery could be rec-

ommended for prostate gland tumors. In the known method of laparoscopic extraperitoneal radical prostatectomy, they create a cavity between the muscles of the anterior abdominal side and the peritoneum before surgery. In the extraperitoneal technique, a 2 cm incision is made along the midline 1 cm below the navel. After opening the anterior leaflet of aponeurosis and pulling the rectus abdominal muscle backward, a finger dissection is performed to access the Retzius space. Then, a dissector balloon is pasted toward the bosom, and up to 800 ml of gas is insufflated under visual control. After creating the working area, the balloon dissector is removed, and an optical trocar is installed. Four working trocars are installed in the extraperitoneal space under the optics control. Trocars 1 and 2 are installed along the pararectal line in the space of the iliac spines, 5 mm to the right and 10 mm to the left [10]. Then, a standard prostatectomy is performed following an established technique [1, 6, 11].

However, this surgery has some restrictions. Trocars installed at 40–60% injure the peritoneum, and gas is inflated into the abdominal space. This has adverse outcomes, such as pressure on the diaphragm. The bladder is pressed into the area of surgical intervention, and there is a high probability of damage to the lower abdominal and iliac vessels. Our invention solves the problem of injuring the peritoneum, pumping gas into the abdominal space, and injuring the pelvis's vessels. This technique helps avoid adverse outcomes such as bleeding, pneumoperitoneum, and decreased oxygen saturation [10].

The main difference between TLERPE and MLERPE is the placing of working trocars. Traditionally, the balloon dissector is withdrawn after creating the working area, an optical trocar is installed, and four working trocars are placed extraperitoneal under the optics control. In our technique, the balloon dissector is withdrawn after creating the work area, and four working trocars placement is controlled by the index finger, which palpates the lower epigastric vessels from the inside [10].

We compare hospital outcomes of both techniques. As is seen in tables 2 and 3, the initial data of patients in both groups was equal. Our technique allows for avoiding bleeding, which is indirectly evidenced by clinical results. Our method keeps lower epigastric vessels under control from the inside. The comparison showed a significant difference between the blood parameters of both groups.

We revealed significant differences between the laboratory parameters of both groups after surgery. The hemoglobin level in the TLERPE group visibly decreased compared to the MLERPE group. The mean difference in hemoglobin level between the two groups was 14.04, which was significant ( $p=0.000$ ). The erythrocyte level in the TLERPE group decreased compared to the MLERPE group. The mean difference in erythrocyte level between the two groups was 0.69, with a significant difference ( $p=0.000$ ). The leukocyte level in the TLERPE group visibly increased compared to the MLERPE group. The mean difference in leukocyte level between the two groups was 1.26, which is significant ( $p=0.000$ ). ESR level in the TLERPE group visibly increased compared to the MLERPE group. The mean difference in ESR level between the two groups was 2.01. It is a significant difference ( $p=0.000$ ).

The TLERPE operation took longer ( $Me=110.0$  min) compared to MLERPE ( $Me=90.0$  min), with  $U=272.2$ ,  $Z=-6.61$ ,  $p=0.000$ . The hospital stay in the TLERPE group was longer ( $Me=11.9$  min) than MLERPE ( $Me=9.0$  min), with  $U=55.5$ ,  $Z=-8.12$ ,  $p=0.000$ .

**Conclusion:** The placement of trocars is the main difference between traditional laparoscopic and our techniques.

The traditional laparoscopic procedure suggests four working trocars placed extraperitoneal under the optics control. We recommend installing the four working trocars under the control of the index finger, which palpates the lower epigastric vessels from the inside. Our technique avoids adverse worse outcomes such as bleeding, pneumoperitoneum, and decreasing oxygen saturation. Our technique is also beneficial in the early postoperative period for excluding peritonitis, and the late postoperative period avoids adhesive processes.

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#### АНДАТПА

### ҚУЫҚ АСТЫ БЕЗІНІҢ ІСІКТЕРІНЕ ЛАПАРОСКОПИЯЛЫҚ АРАЛАСУДЫ ЖЕТІЛДІРУ

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**Өзектілігі:** Лапароскопиялық хирургия көптеген пайда әкелді. Лапароскопиялық хирургияның мақсаты-операциядан кейінгі асқынуларды азайту. Лапароскопиялық радикалды простатэктомия әлменің көптеген елдерінде локализацияланған простата обыры бар науқастарды емдеудің бірінші әдісі болды.



**Зерттеудің мақсаты** – дәстүрлі лапароскопиялық экстраперитонеальді радикалды простатэктомиядан өткен науқастардағы операциядан кейінгі нәтижелерді жетілдірілген лапароскопиялық экстраперитонеальді радикалды простатэктомиямен салыстыру болды.

**Әдістері:** Бул тарихи когорттық зерттеуге науқастардын емдеу туралы барлық ақпарат "Стационарлық науқастардың электрондық тіркелімінен" алынды. Зерттеуге 2017-2021 жылдар аралығында лапароскопиялық перитонеальді радикалды простатэктомиядан өткен 94 пациенттің медициналық ауру тарихы енгізілді. Оның ішінде 45 пациент модификацияланған лапароскопиялық простатэктомиямен емделді, 49 пациент дәстүрлі лапароскопиялық простатэктомиямен емделді. Деректер орташа мәндер, стандартты ауытқу немесе жиіліктер мен пайыздар түрінде ұсынылған. Сапалы деректер үшін Пирсонның Хи-квадраты қолданылды. Екі топ арасын салыстыру үшін студенттің *t* критерийі, Манн-Уитнидің *U* критерийі қолданылды. Маңыздылықтың статистикалық деңгейі 0,05 болды.

**Нәтижелері:** Операциядан кейінгі екі топтағы зертханалық көрсеткіштердің орташа мәндері статистикалық маңызды айырмашылыққа ие болды. Екі топ арасындағы гемоглобиннің орташа айырмашылығы 14,04 болды, эритроциттердің орташа айырмашылығы 0,69 болды, ақ қан клеткаларының орташа айырмашылығы 1,26 болды, ЭТЖ орташа айырмашылығы 2,01 болды, Барлық айырмашылықтар статистикалық маңызды болды ( $p=0,000$ ). Екі топ арасында операция ұзақтығының және ауруханада болудың статистикалық маңызды айырмашылығы анықталды ( $p=0,000$ ).

**Қорытынды:** Экстраперитонеальді лапароскопияның өзгертілген әдісі қан кету, пневмоперитонеум және оттегінің азаюы сияқты жағымсыз асқынуларды болдырмауға көмектеседі. Біздің техникамыз сонымен қатар перитонит сияқты операциядан кейінгі ерте асқынуларды болдырмайды және операциядан кейінгі кезеңде адгезияны болдырмайды.

**Түйінді сөздер:** Қуық асты безінің ісіктері, қуық асты безінің қатерлі ісігі, лапароскопиялық хирургия, перитонеальді емес простатэктомиа, клиникалық нәтижелер, Қазақстан.

## АННОТАЦИЯ

### СОВЕРШЕНСТВОВАНИЕ ЛАПАРОСКОПИЧЕСКОГО ВМЕШАТЕЛЬСТВА ПРИ ОПУХОЛЯХ ПРЕДСТАТЕЛЬНОЙ ЖЕЛЕЗЫ

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**Актуальность:** Лапароскопическая хирургия принесла много пользы. Целью лапароскопической хирургии является снижение послеоперационных осложнений. Лапароскопическая радикальная простатэктомиа стала методом первой линии лечения пациентов с локализованным раком предстательной железы во многих странах мира.

**Цель исследования** – сравнение послеоперационных исходов у пациентов перенесших традиционную лапароскопическую экстраперитонеальную радикальную простатэктомию с усовершенствованной лапароскопической экстраперитонеальной радикальной простатэктомией.

**Методы:** Вся информация о лечении пациентов для данного исторического когортного исследования была извлечена из «Электронного регистра стационарных больных». В исследование были включены истории болезни 94 пациентов, перенесших лапароскопическую внебрюшинную радикальную простатэктомию за 2017-2021 гг. Из них 45 были пролечены модифицированной лапароскопической простатэктомией, 49 – традиционной лапароскопической простатэктомией. Данные представлены в виде средних значений, стандартного отклонения, или частот и процентов. Для качественных данных использовался Хи-квадрат Пирсона. Для сравнения средних двух групп использовались *t*-критерий Стьюдента, *U*-критерий Манна-Уитни. Статистический уровень значимости был равен 0,05.

**Результаты:** Мы выявили достоверные различия между лабораторными показателями обеих групп после операции. Средняя разница показателя гемоглобина между двумя группами составила 14,04, средняя разница показателя эритроцитов – 0,69, средняя разница показателей лейкоцитов – 1,26, средняя разница СОЭ – 2,01. Все различия были статистически значимыми ( $p=0,000$ ). Была выявлена статистически значимая разница длительности операции и пребывания в больнице между двумя группами ( $p=0,000$ ).

**Заключение:** Модифицированный метод экстраперитонеальной лапароскопии помогает избежать неблагоприятных осложнений, таких как кровотечение, пневмоперитонеум и снижение насыщения кислородом. Наша методика также позволяет избежать ранних послеоперационных осложнений, таких как перитонит, а в позднем послеоперационном периоде позволяет избежать спаечных процессов.

**Ключевые слова:** Опухоли предстательной железы, рак предстательной железы, лапароскопическая хирургия, внебрюшинная простатэктомиа, клинические исходы, Казахстан.

**Transparency of the study:** Authors take full responsibility for the content of this manuscript.

**Conflict of interest:** Authors declare no conflict of interest.

**Financing:** Authors declare no financing of the study.

**Authors' input:** contribution to the study concept – Kaidarova D.R.; study design – Umurzakov K.T.; execution of the study – Umurzakov K.T., Saidudaliev D.N., Khaikmat A.B.; interpretation of the study – Sagidullin S.O.; preparation of the manuscript – Shalgumbayeva G.M., Nurzhanova A.E.

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