ARTÍCULO ORIGINAL

Gac Méd Caracas 2023;131(4):921-932
DOI: 10.47307/GMC.2023.131.4.14

Immediate Results of Orthotopic Intracorporeal Ileoneocystoplasty in the Modification of the Clinic

Resultados Inmediatos de la Ileoneocistoplastia Intracorpórea Ortotópica en la Modificación de la Clínica

Daria Shamraieva[1]*, Andriy Leonenko[2], Andrii Kondratenko[3], Maria Ridchenko[4], Sergiy Shamrayev[5], Valeria Vasilieva[6], Sergiy Vozianov[7a]

SUMMARY

Relevance*: Bladder cancer remains an urgent problem in the field of oncological urology, which requires great attention and additional clinical trials. Based on information from the World Health Organization, bladder cancer ranks 10th in the overall prevalence of all cancer pathologies worldwide in 2022 with an upward trend.* **Objective***: This study aimed to evaluate the improved reconstructive stage of radical cystectomy for neocyst formation in patients with muscle-invasive bladder cancer.* **Results:** *A study involving 9 patients undergoing orthotopic ileoneocystoplasty revealed that all maintained normal urinary function. The procedure showed promise in mitigating its radical nature through positive changes, aided by advanced suture techniques that reduced surgical duration and minimized tissue traumatism and scarring. Additionally, its adaptability to various Radical Cystectomy approaches suggests its potential as a versatile option in urological surgery.*

Conclusion: *During the postoperative observation in patients, authors noted the absence of problems with self-controlled urination, violations of the tightness of the vesicourethral anastomosis, or metabolic changes due to the removal of the ileum part of the small intestine. In all cases, the neocyst functioned normally and the patients had no complaints about the radical nature of this method of surgery.*

Keywords: *Muscle-invasive bladder cancer, neobladder, radical cystectomy, neovesica, urinary diversion.*

RESUMEN

Relevancia*: El cáncer de vejiga sigue siendo un problema urgente en el campo de la urología oncológica, que requiere gran atención y ensayos clínicos adicionales. Según datos de la Organización Mundial de la Salud, en 2022 el cáncer de vejiga ocupará el 10º lugar en la prevalencia global de todas las patologías oncológicas a nivel mundial, con una tendencia al alza.* **Objetivo:** *Este estudio tuvo como objetivo evaluar la etapa reconstructiva mejorada de la cistectomía radical para la formación de neoquistes en pacientes con cáncer de vejiga músculo-invasivo.*

DOI: https://doi.org/10.47307/GMC.2023.131.4.14

ORCID: 0000-0003-0919-2099[1]
ORCID: 0000-0002-1077-6625[2]
ORCID: 0000-0001-9885-0860[3]
ORCID: 0000-0002-5028-5767[4]
ORCID: 0000-0002-2765-9193[5]
ORCID: 0000-0002-1042-9733[6]
ORCID: 0000-0003-3782-0902[7]

4th Department of Urology, Institute of Urology named after Academic O.F. Vozianov of the National Academy of Medical Sciences of Ukraine, 04053, 9a V. Vynnychenko Str., Kyiv, Ukraine

*Corresponding author: Daria Shamraieva. E-mail: dariashamraieva@ukr.net

[a]Department of Endoscopic Urology and Lithotripsy, Institute of Urology named after Academic O.F. Vozianov of the National Academy of Medical Sciences of Ukraine, 04053, 9a V. Vynnychenko Str., Kyiv, Ukraine.

Recibido: 3 de marzo 2023
Aceptado: 24 de septiembre 2023

Resultados: *El estudio que incluyó a 9 pacientes sometidos a ileoneocistoplastia ortotópica reveló que todos mantuvieron una función urinaria normal. El procedimiento resultó prometedor al mitigar su naturaleza radical mediante cambios positivos, ayudado por técnicas de sutura avanzadas que redujeron la duración quirúrgica y minimizaron el traumatismo tisular y la cicatrización. Además, su adaptabilidad a diversos abordajes de cistectomía radical sugiere su potencial como opción versátil en cirugía urológica.* **Conclusiones:** *Durante la observación postoperatoria de los pacientes, los autores observaron la ausencia de problemas con la micción autocontrolada, violaciones de la estanqueidad de la anastomosis vesico-uretral o cambios metabólicos debidos a la extirpación de la parte del íleon del intestino delgado. En todos los casos, el neoquiste funcionaba con normalidad y los pacientes no tenían quejas sobre el carácter radical de este método de cirugía.*

Palabras clave: *Cáncer de vejiga músculo-invasivo, neovejiga, cistectomía radical, neovesica, derivación urinaria.*

INTRODUCTION

The statistics show that about one-third of 600 thousand already diagnosed cases of bladder cancer (BC) will be fatal. Diagnostic problems often arise on the way to successful treatment of this disease because the main diagnostic method is cystoscopy, which is an invasive and expensive procedure. Most cases of BC are diagnosed in the early stages, but about 25 % are detected already in the period of muscle-invasive BC (MIBC), which significantly reduces the chances of patients' recovery (1). At the initial stages of oncogenesis, the cancer cells do not affect the muscle layer of the bladder and this stage, called muscle non-invasive BC (MNBC), has the best prospects for recovery. With the progression of MNBC, the cancer cells reach the muscle membrane and according to morphological features, this stage is classified as MIBC. In cases of MIBC, radical cystectomy (RCE) is widely used, in which the bladder is completely taken out and the urostoma is removed. Studer et al. (2) developed the method of forming a neocyst, an artificial orthotopic bladder, built from the small intestine and directly connected to the urethra, which made a notable discovery in the field of urology. However, a significant drawback of this intervention was the difficulty in bringing the left ureter under the sigmoid mesentery to create a ureteral-enteric anastomosis. The intracorporeal technique was carried out in 2011 at the Carolina University headed by surgeon Jonsson et al. (3). The main adaptation to the "traditional" ileoneocystoplasty was in conducting the ileourethral anastomosis as the first step of reconstruction, which helped to create a tight anastomosis without tension.

Improving the quality of life of MIBC patients remains an urgent problem. The RCE involves the absolute removal of the bladder together with the organs and lymph nodes located nearby. An uncommon method of orthotopic ileoneocystoplasty is a modified robot-assisted U-shaped neobladder, which was developed to facilitate the creation of a cystourethral anastomosis in extracorporeal reconstruction, first performed by Hu et al. (4). When using a Y-shaped ileal orthotopic artificial bladder after previous pelvic exenteration performed by Martínez-Gómez et al. (5), there were also cases of frequent urinary incontinence, especially at night, which is a typical problem after neocyst creation during RCE. If the authors talk about the complications of RCE, it is worth mentioning the occurrence of such a rare pathology as the formation of ileal neobladder fistulas (ileal fistula), which requires fistulectomy, partial ileostomy and creation of ileal "end to end" anastomosis. Lu et al. (6) conducted research on this complication in 2022. This phenomenon usually occurs a long time after orthotopic neocystoplasty and undergoes effective treatment by surgical intervention methods.

Currently, the "golden standard" for creating an orthotopic artificial bladder is the use of ileal segments, but sigmoid segments are less commonly used. In 2019, El-Helaly et al. (7) investigated in detail the differences in postoperative periods after neocystoplasty with two different segments of the small intestine: ileal and sigmoid. In general, there was no fundamental difference in the intraoperative and postoperative period in ileal or sigmoid neobladder, the complications occurred with the same frequency in both groups with no significant variations in urination. The only difference was the lower frequency of nocturnal urination in patients with ileocyst than in patients

who underwent sigmoid neocystoplasty. This observation favours ileoneocystoplasty as the most optimal type of urine derivation with further improvement in the living conditions of an MIBC patient. The main reason for this choice is the absence of urostomas, which significantly worsens the psycho-emotional state and life quality of the patient as it necessitates constant care and treatment.

The purpose of this study was to evaluate the effectiveness of MIBC treatment notably by creating an artificial reservoir for urine derivation from small intestine segments of the patients and to study urination and other urinary system functions in the postoperative period. In addition, due to the formation of the neobladder in the usual place and its binding to the functionally healthy external bladder sphincter, the patient can perform self-controlled urination, which is a positive aspect after RCE.

MATERIALS AND METHODS

Nine patients with MIBC in the clinical stage T2aN0M0-T3bN0M0 were eligible for the study based on the Academician Vozianov Institute of Urology of the National Academy of Medical Sciences of Ukraine. All patients were males, aged 45 to 85 years, examined in the medical institution during 2019-2020. All subjects underwent cystectomy and lymphadenectomy by laparoscopy, but one-third of patients underwent open bladder resection in other hospitals. Two patients were subject to intracorporal ileoneocystoplasty and six received a change of access from the midline laparotomy. All operations were carried out in the Trendelenburg position using combined peridural intravenous anesthesia with endotracheal intubation. First, the surgeons removed the bladder and then proceeded to the resection of regional lymph nodes and prostate gland along with seminal vesicles. Next, an ileal segment approximately 50 cm long was isolated and brought to the pelvic cavity, with subsequent restoration of the small intestine integrity. The first step in creating the neocyst was to mark two inflection points 15 cm from the opposite ends of the segment with betadine solution (Figure 1), marked 4 and 5 respectively.

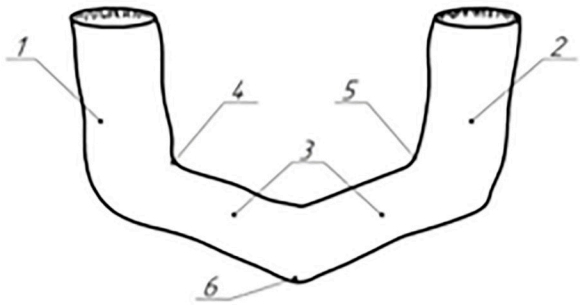

Figure 1. Isolation of the ileal segment.
Note: 1 – right segment; 2 – left segment; 3 – middle segment; 4 – the first inflection point; 5 – the second inflection point; 6 – the sagging point. Source: Vozianov et al. (8).

The ligature holders (suture material Vicryl 4/0) were applied to two defined points and the nondetubularized ends of the ileum graft were transferred to the vertical position (Figure 1 – 1, 2). The same betadine solution was used to dot the area of sagging in the projection of the middle ileal segment (Figure 1 – 6). The next step was to give a spherical shape of the bladder to the two isolated parts of the ileal segment along the counter-mesenteric edge, while the central part was placed asymmetrically, having previously made a 5 cm long midline incision 0.7-0.8 cm from the duplicate peritoneum. From the middle segment, the authors moved back to the counter mesenteric edge, and an integral intestinal lamina was formed (Figure 2) due to this manipulation, which had a cervical strip (Figures 1 – 6).

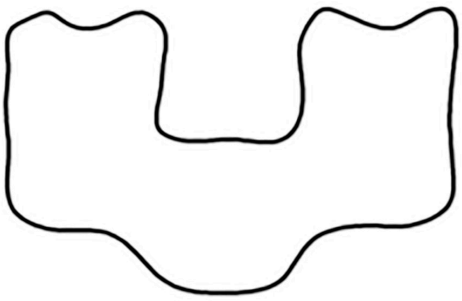

Figure 2. Detubularization of the ileal segment. *Source: Vozianov et al. (8).*
Using the *Hendo-60-3,0A* stapler or continuous suture *V- Lock 2/0* the median edges of the two segments were connected to the upper edge of the central part of the graft (Figure 3 – 3).

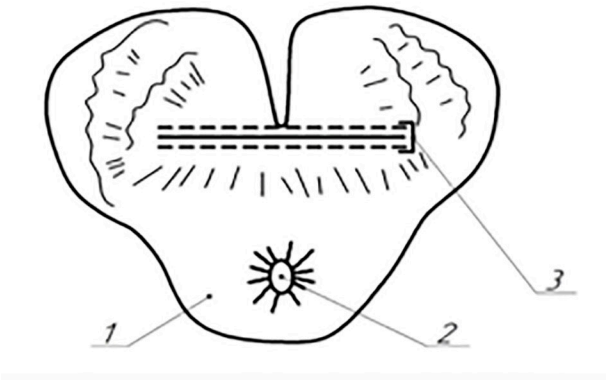

Figure 3. Formation of the bladder neck.
Note: 1 – cervical flap; 2 – hole in the projection of the sag point (tank neck hole); 3 – the line of fixation of the medial edge of the right and left segments to the upper edge of the middle segment. Source: Vozianov et al. (8).

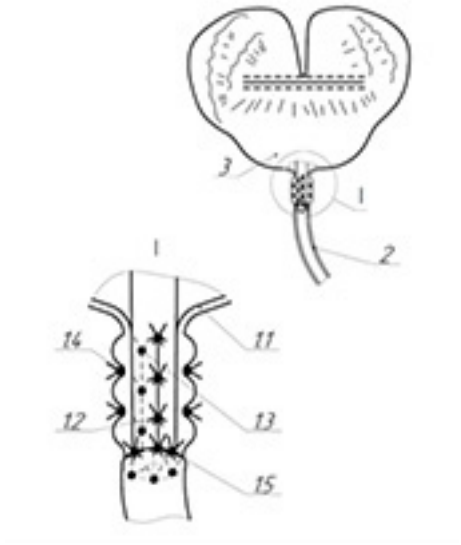

Figure 4. Duplication of the bladder neck.
Note: 1 – vesico-urethral segment (the outlined fragment includes the reconstructed bladder neck and vesico-urethral anastomosis); 2 – posterior urethra; 3 – cervical flap; 1.1 – bladder neck; 1.2 – front tubular seams; 1.3 – rear tabularizing seams; 1.4 – side duplication seams; 1.5 – vesicourethral anastomosis. Source: Vozianov et al. (8).

An opening with a diameter of 0.6-0.8 cm was formed in the marked area of the sagged neobladder (Figure 3 – 2). With the same mechanism, the authors joined the upper thirds of the lateral margin of two ileal segments using intestinal suture *V-Lock 2/0* or stapler *Hendo-60-3,0A*, forming the aboral and adoral intestinal openings. The diameter of the neocyst neck orifice was increased to 1.0-1.5 cm and a Foley genitourinary catheter (Ch 26-30) was inserted into the created hole, formed hemispheres were turned outward and tubularized on the catheter tube, making 3-5 knot sutures *Vicryl 5/0* on the front and rear surfaces. The neobladder neck was duplicated with two nodular mucosal-muscular sutures *Vicryl 3/0*, superimposed in parallel to its axis (Figure 4 - 1).

The formed neobladder neck and the membranous part of the urethra were sutured with six knotted sutures *Vicryl 2/0*, forming a vesicourethral anastomosis (Figure 4 – 2). When performing this manoeuvre, the front edge of the strip (Figure 4 – 3) was shifted in caudo-ventral direction during cervical suturing and in cranio-dorsal direction during urethral ligature suturing (Figure 4 – 2 and Figure 4). The ureters on the posterolateral plane of the neobladder underwent anastomosis with suture material *Vicryl 4/0* (Figure 5 – 1, 2).

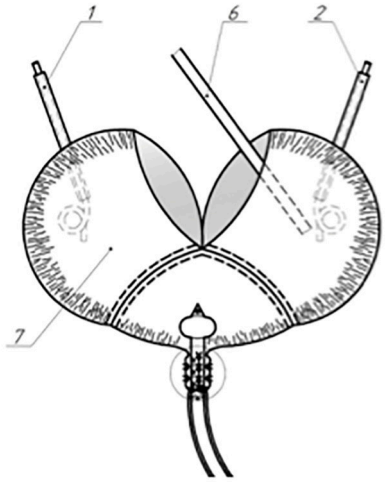

Figure 5. Formation of uretero-neovesica anastomosis.
Note: 1 – right ureter (drained); 2 – left ureter (drained); 3 – intestinal reservoir; 4 – reconstructed vesico-urethral segment; 5 – membranous urethra (catheterized). Source: Vozianov et al. (8).

The unadhered edge of the cervical strip and the neck of the reservoir itself are connected with the lower thirds of the lateral side of two ileum grafts, and the pre-formed intestinal openings are sealed with an intestinal stapler *Hendo-60-3,5A* or a continuous suture *V-Lock 2/0*. It is also important to insert a cystostomy drain Ch 22-24 into the aboral opening before the sealing stage (Figure 5 – 6). The final stage of ileoneocystoplasty is the closure of the visceral peritoneum defect of the anterior surface area of the neocyst, where the sutures of the ileal segments are located, followed by the installation of pelvic drains (Figure 6).

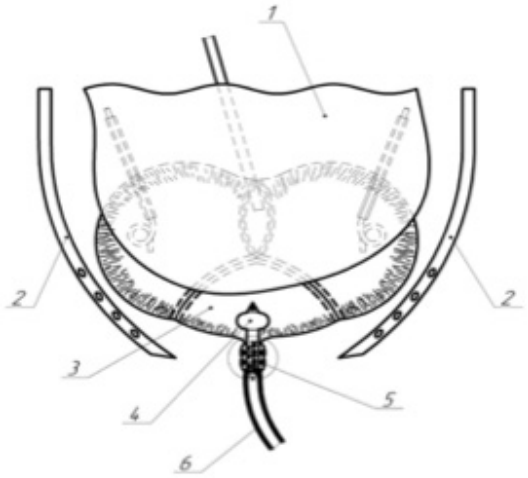

Figure 6. Peritonization and installation of pelvic drains. Note: 1 – peritoneum (after the reversible peritonesis maneuver;) 2 – pelvic drains; 3 – urethral catheter balloon; 4 – intestinal bladder; 5 – reconstructed vesico-urethral segment (the outlined fragment includes the reconstructed bladder neck and vesico-urethral anastomosis); 6 – urethra (catheterized). Source: Vozianov et al. (8).

The example for this study was orthotopic artificial ileoneocystoplasty carried out by Studer et al. (2), which was described in his work in 1989. However, the development of modern medicine helps to reduce traumatism from surgical interventions, using minimally invasive methods and improving the quality of life of the patients, involving new approaches of creating artificial reservoirs for urine derivation.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. A study was approved by the National Academy of Medical Sciences of Ukraine.

RESULTS

To form and compare the findings of the study based on the postoperative period, all patients were divided into two groups: the patients who underwent bladder reconstruction by standard open surgical access and the patients who underwent intracorporeal ileoneocystoplasty using the laparoscopic method. The first group included seven patients, and the second group had two (Table 1).

Key eligibility criteria for surgery included preoperative transurethral biopsy and screening. These assessments histologically confirmed the invasion of tumor cells into the bladder's muscle layer, demonstrating malignancy with high specificity and sensitivity. This confirmation served as the primary indication for orthotopic ileoneocystoplasty. It is also worth mentioning that now there are techniques for conducting RCE, in which men retain the prostate, but only if the cancer process has not damaged its anatomical structures. The controversy surrounding this topic stems from the fact that it has both benefits and risks. On one hand, it raises the risk of cancer recurrence in the urethra. On the other hand, it enhances patients' quality of life by not causing erectile dysfunction and facilitating postoperative recovery and social adaptation.

To assess the quality and benefits of the artificial bladder method, authors evaluated the following indicators: neobladder volume, the act of urination, its frequency per day and cases of urinary incontinence, the presence or absence of narrowing of the vesicourethral anastomosis, as well as its impermeability. At the same time, the neocyst volume was initially determined directly during the surgery, and then the final measurements were made after 6 months to compare with the initial value. For

Table 1

Comparison of ileoneocystoplasty results in the postoperative period ($p<0.05$)*

Indicators	Open RCE	Laparoscopic RCE
The volume of the artificial bladder, mL:		
– intraoperatively	180 ± 23	160 ± 50
– in 6 months	420 ± 68	380 ± 50
Postoperative period in a medical institution, days	14.2 ± 4.2	7.2 ± 1.5
Time of urine derivation stage, h	1.5 ± 0.5	2.5 ± 0.5
The process of urination	Preserved	Preserved
Tightness of vesico-urethral anastomosis	Tightness is preserved	Tightness is preserved
Stenosis of vesico-urethral anastomosis	Not applicable	Not applicable
Stress urinary incontinence	1/7 in the daytime and at night	2/2 at night

Note: * – the difference between two groups is relative.

Source: S.O. Vozianov et al. (8).

example, in the group of patients who underwent an open cystectomy, the volume of the artificial reservoir was on average 180 mL with a possible error of 23 mL, and six months later its volume increased by 240 mL, amounting to 420 mL with an error of 68 mL. In patients who underwent RCE by laparoscopic method, the volume of the neobladder during surgery was 160 mL, and after 6 months, it increased by 220 mL, and in both cases, the difference was ±50 mL. In summary, the second group of patients had a significantly shorter hospital stay after surgery compared to the first group. However, the patients who underwent ileoneocystoplasty through open surgical access experienced a longer recovery period with a higher risk of complications. In general, the period of rehabilitation after RCE and ileoneocystoplasty was much longer in patients who underwent a full incision to access the abdominal cavity than in patients who were subject to minimally invasive surgical techniques that provided minimal trauma and intervention in the body. In addition, the emergence of new innovative methods of creating surgical sutures such as intestinal sutures and sutures with a surgical stapler can significantly reduce the time of surgical intervention.

It is advisable to clarify that two patients had previously undergone open bladder resection in other hospitals, which could also affect the recovery rates in the postoperative phase. After ileoneocystoplasty, all patients were subject to periodical monitoring to detect timely postoperative complications or other abnormalities that could be associated with the intervention. The investigators reported self-controlled urination in both groups, which is the main goal in the search for new methods of bladder reconstruction in people suffering from MIBC. The kidneys also showed no accumulation of urine, which could be evidenced by the dilation of the collecting tubes, renal cups, and pelvis (hydronephrosis). The impermeability of the vesicourethral anastomosis was intact with no constriction detected in further examinations. This can be explainable by the addition of standard ileoneocystoplasty with a new method of forming the neck of the artificial "neovesica" bladder, which eliminates the possibility of tension of the vesico-urethral anastomosis. This disadvantage of ileoneocystoplasty in Studer's surgery was the impetus for scientists to conduct clinical studies to find a solution to this complication. The main reasons for the tension of the vesicourethral anastomosis are short mesentery of the intestine, insufficient length of the membranous part of the urethra, and adhesions of the small intestine and pelvis due to previous surgical interventions when in such cases it is possible to form an anastomosis in a more bent position. Shortening of the membranous part of the urethra in men occurs due to enlargement of the prostate gland, which is removed during RCE, or it may be due to congenital anatomical features that are not

considered pathology. In these complications, the tightness of the vesicourethral anastomosis may be compromised, which subsequently leads to its stenosis, and, as a result, urination disorders. To reduce the probability of tension of the vesicourethral anastomosis, it is necessary to choose the ileal segment with the largest number of mesenteries (2).

When using the laparoscopic method during the formation of the urethra-ileal anastomosis, there are several difficulties: insufficient visualization, occurring with open surgical access, and the possibility of mesentery tension or anastomosis caused by the artificial bladder passing to the free end of the urethra without the help of hands. In addition, when evaluating the data on stress urinary incontinence, the authors noted that in the group that underwent laparoscopic RCE, both patients had incontinence at night. In the first group, this disorder was observed only in one patient but both during the day and at night. Urinary incontinence at night is associated with the fact that the pressure inside the urethra decreases, and the pressure in the neobladder begins to exceed the resistance capability of the urethral sphincter. This can be explainable by a violation of the vesicoureteral reflux, which in healthy people is responsible for increasing the tone of the urethral constrictor muscle. In general, problems with urination in patients with the removed bladder are explainable by the fact that RCE violates the integrity of the reflex arc and the very morphology of the genitourinary system, which are responsible for the act of urination. In addition, nocturia can be associated with a decrease in neocyst volume, compared to a healthy bladder, where the volume can reach 750 mL.

The metabolic acidosis caused by an extremely large ileal segment (up to 65 cm) removed from the small intestine is also considered a possible complication after artificial orthotopic ileoneocystoplasty. This resulted from metabolic changes that can further lead to renal failure, but in the early and late postoperative periods, these changes did not show in any of the patients. Therefore, an urgent problem for the field of oncological urology is also the search for options to reduce the length of the ileum graft to lower or eliminate the likelihood of metabolic changes in the gastrointestinal tract. However, the reduction of the segment used for the artificial reservoir can lead to a decrease in the neocyst volume and the creation of subsequent problems with urinary retention and prolonged act of urination. In both groups of patients, this complication did not take place, which is also a positive side of the conducted intracorporeal ileoneocystoplasty.

When conducting cyst prostatectomy in men, it is possible to combine it with nerve-preserving techniques, which helps to preserve erectile function in patients to whom RCE is indicated. This positively contributes to the psychological and emotional aspects of recovery and partially eliminates the negative side of the radical nature of this surgical intervention. The patients also underwent RCE, which involves the removal of regional groups of lymph nodes. The lymph dissection can significantly increase the overall duration of surgery. However, the lack of convincing clinical trials complicates the debate about the need for lymph node resection in RCE.

When performing ileoneocystoplasty, the main problem could be the peristalsis of the ileum graft, but the crossing of the antimesenteric facet and cross-connection of the ends of the ileal segment can compensate for this, as explained in the method of Goodwin et al. (9). The main improvement and modification to standard methods of ileoneocystoplasty was the use of a new "neovesica" technology in the reconstructive stage during the formation of the neck of the urinary neobladder, associated with the elimination of tension of the vesico-urethral anastomosis.

The method of creating an artificial bladder generally helps to preserve the process of natural and most importantly controlled urination, owing to the preservation of the urinary tract structure, and the absence of artificial urine receivers and drain devices. In addition, the technique of ileoneocystoplasty is quite simple and clear in the course of work. However, along with the obvious advantages of this surgical intervention, there are also several contraindications, which include the widespread dissemination of oncological process, the proliferation of cancer cells of the bladder neck in female patients, and the urethra in men, impaired renal function, impaired gastrointestinal tract, and disorder of functional capacity of the external urethral opening and its permeability.

DISCUSSION

There are many approaches to urine derivation used after RCE. Here are the major ones: the imposition of direct ureteral anastomoses, which leads to urine diversion to the intestine, the formation of ileal conduit with the withdrawal of a "wet stoma" and the withdrawal of a "dry stoma" in the formation of artificial urine reservoirs from the detubularized parts of the small intestine. However, the most common option adopted in ileoneocystoplasty is the creation of an artificial orthotopic bladder.

As noted in the previous sections, the main complication in the creation of an artificial bladder is the tension of the vesicourethral anastomosis with the possibility of its tension in the subsequent postoperative period. The research took place to improve the technique "*non-hole*", used in the creation of urethral anastomosis. The essence of this improvement is that the caudal part of the intestinal lamina is anastomosed directly to the urethra with wrapping sutures before attaching the ureters to the artificial reservoir. It starts from 6 o'clock and continues clockwise to 12 o'clock, the next stitch also starts from the previous place but with a change of direction counterclockwise. In this study, the surgeons used a special needle holder with a remote end bent at an angle of 120 degrees. The absence of serious complications in the postoperative period generally favors this modification, but this technique requires further clinical studies to form more accurate and reasonable conclusions (10). In addition, it will be advisable to apply two sutures between the neobladder and the pelvic floor on the side of the anastomosis itself to reduce the tension in the vesicourethral anastomosis, as described in the standard technique of ileoneocystoplasty according to Pavlović et al. (11). Some scientists talk about the need to preserve the neurovascular bundle for further urination without striking deviations. Boccafoschi et al. (12) described the role of preservation of the neurovascular bundle in the further process of urination of patients after RCE and the creation of an artificial reservoir in detail in 1993.

In the present study, all patients had preserved the functional capacity of the urethral sphincter, but there are also cases of urinary incontinence of neurogenic origin. These conditions allow the use of artificial urethral sphincters, applied to the bulbous part of the urethra. The only disadvantage is the possibility of damage to the urinary tract or bladder, which can further lead to infectious diseases of the excretory system, necrosis, and the return of urinary incontinence (13). In this case, there is an urgent need for repeated surgical intervention, which entails negative consequences in the recovery period. However, the study of the technology of implantation of artificial urethral sphincters is insufficient, which makes widespread use of this method impossible, not to mention a wide range of postoperative complications and side effects, confirmed during clinical trials by Si-Chiang et al. (14) and Chung (15), who studied modern surgical devices for stress urinary incontinence.

A rather interesting method of creating an ileobladder is its orthotopic spiral modelling with urethral re-implantation was described in the scientific article by Zhong et al. (16). In achieving this at the design stage, the graft was connected "spirally" and then the surgeon performed anastomosis of the urethra, which was previously "turned outward", holding the artificial reservoir with the help of a urinary stent, using the technique of reflux-free papilla with a disconnected cuff and applying absorbable surgical material to create a suture. After performing this method of ileoneocystoplasty in selected patients, the specialists observed that the functional results in the long-term postoperative period are satisfactory, but the immediate complications after surgery are difficult to control. Quite a positive aspect of this study was also the fact that the scientists were able to significantly reduce the length of the ileum graft (up to 40-45 cm), which eliminates the risk of metabolic acidosis among the possible complications (17).

Miki et al. (18) also conducted a study aimed at stabilizing the neobladder, as well as avoiding the tension of the anastomosis by the method of temporary tension of the anastomosis site itself. For this purpose, patients were divided into two groups: one part of the patients underwent vesicourethral anastomosis intracorporeally with 4 knotted sutures and the second part underwent modified manipulation of anastomosis for-mation. A loop suture was made at 5 o'clock in the bladder neck and then

the reservoir was transferred to the pelvic cavity. The Foley urinary catheter was inserted through the urethra and the last loop of suture was fixed to its end, and the neocyst was placed closer to the urethra, by excessively tensioning the Foley catheter, and the bladder neck was moved to a stable position (19). This tension particularly makes it easier for surgeons to find the neck of the neobladder, and the loop suture keeps the necessary tension during the formation of the vesicourethral anastomosis, later removed at the end of neocystoplasty. When using the described modification, there is a significant reduction in the required time of surgery and the absence of severe complications after the intervention, but these changes have not been popularized in urology due to the lack of clinical studies. From January 2014 to December 2018, on the premises of Nanchang University, Yu et al. (20) conducted a study to compare the performance of the vesicourethral anastomosis laparoscopically and the performance of the same anastomosis, but with tension and ligation and using only one Foley catheter. In conclusion, vesicourethral anastomosis with tension and ligation offers several advantages. It's easier for surgeons to learn, more practical, and more convenient, and it also significantly reduces surgical intervention time compared to the laparoscopic approach.

Urinary incontinence can also be associated with a reduction in the length of the urethra, which leads to changes in its normal functioning (21). It is also worth mentioning that urine detention can be affected when the perineum is lowered down during orthotopic neo-cystoplasty because the anterior part of the sacroiliac ligaments supporting its fixed position is cut (22-24). Authors believe that it is necessary to create a "secondary sphincter", stitching the middle part of the rectal elevator muscle in addition to the edges of the anastomosis to correct this defect. At the same time, the urethra maintains a good position in the abdominal cavity, preventing tension of the anastomosis. Boccafoschi et al. (12) described a "secondary sphincter" technique and all indications and contraindications in a detailed study. The authors emphasize that damage to the spongy part of the urethra should be avoided during this manipulation because it can come out of the pelvic floor, which will lead to a violation of its blood supply.

In Germany, Horstmann et al. (25) conducted a study in which they compared two anastomosis methods using robot assisted RCE with neo-cystoplasty in detail. In the first method, they used 6-knot sutures, and the second method was similar to this study with the formation of vesicourethral anastomosis using a vicryl suture. In the same way, a continuous suture is started at the 6 o'clock mark and, the formed artificial reservoir and urethra are sutured in the clockwise direction to the 12 o'clock mark, and then the second hemisphere of the vesico-urethral anastomosis is created in the counter-clockwise direction. After comparing these two techniques, the surgeons found no striking differences between them, and the postoperative period was favorable in both groups of patients. Koie et al. (26) studied the positive outcomes of automated RCE with intracorporeal cystoplasty. They found that automating the reconstruction process had several benefits, including reduced fluid loss, reduced blood loss, and faster recovery of small intestine function. Similarly, Albisinni et al. (27), conducted a systematic review and concluded that robot-assisted RCE with ileoneocystoplasty offers the typical advantages of minimally invasive surgery. They suggested that this method of surgery is not inferior to open surgical access.

Mineo Bianchi et al. (28) proposed a method of muscular-fascial reconstruction when performing the vesicourethral anastomosis. A study examined 42 clinical cases of patients with BC who had previously undergone robot-assisted RCE and intracorporeal ileoneocystoplasty. Afterwards, these patients underwent recto-prostatic fascia reconstruction using a spiked suture in two directions. After analysing data on daytime and nighttime urination at 3-, 6-, and 12-months post-surgery, researchers found that urinary retention improved significantly. Notably, this improvement was more pronounced in younger patients (29,30).

There is also a way to create a vesico-urethral anastomosis with the CAPIO device, which automatically sews the urethra with a neobladder, studied by Badawy et al. (31). The patients who underwent RCE with neocystoplasty were also divided into two groups but without significant differences in any parameters. Some patients were sutured using the standard method,

while others received sutures using the CAPIO suture device. In the first group, creating the anastomosis took nearly ten minutes longer than in the second group, significantly extending the overall surgical procedure. Moreover, the second group experienced significantly less blood loss. When comparing the postoperative period, the researchers noted fewer cases of uncontrolled urination in the group that underwent anastomosis with the apparatus compared to the group with the traditional suturing technique. Therefore, this device directly affects the anastomosis by preventing scarring in the area of the anastomosis, which can spread to the urethral sphincter, disrupting the process of its closure (32-36).

When studying the scheme of "traditional" ileoneocystoplasty, introduced by Hamada et al. (37), it can be also noticed that they used only an instrumental method of intestinal margins matching, which can be justified by insufficiently developed surgical instruments at that time. During the period of the introduction of new technologies, it will be more expedient to use less traumatic methods of surgical stapling (e.g., intestinal staplers) and reduce the invasiveness of the operation, compensated by robot-assisted and laparoscopic operations (38-41).

CONCLUSIONS

After a detailed study of all clinical cases of 9 patients who underwent orthotopic ileoneocystoplasty, it can be concluded that the function of the urinary system was preserved in all patients and a number of improvements and changes compensated the radical nature of the surgery during the operation. Due to the use of the latest techniques of intestinal suture formation, namely intestinal suture *V-Lock 2/0* or joining tissues with an intestinal stapler *Hendo-60-3*,0A, the overall duration of the surgical intervention is significantly reduced, as well as traumatism and subsequent scarring of tissues, as is the case with standard suturing methods. In addition, this method of orthotopic ileoneocystoplasty helps to reduce its technology to a single component when using different approaches in the performance of RCE. Using the "neovesica" method for a vesicourethral anastomosis reduces the risk of tension and, therefore, lowers the chances of long-term issues like night-time urinary incontinence or urinary control problems.

Notably, this aspect in the postoperative period improves the overall physical and psycho-emotional well-being of patients, contributing to faster recovery and recovery after RCE. In addition, a significant reduction in the length of the ileal intestinal segment (up to 50 cm), which is removed to create an artificial bladder reduces the risk of metabolic complications associated with disorders of the small intestine, which can lead to metabolic acidosis in patients. Intracorporeal orthotopic ileoneocystoplasty has its advantages, but its adoption is limited due to the lack of minimally invasive equipment and its high cost. As a result, classical ileoneocystoplasty with open surgical access is more commonly used. In summary, further clinical studies with a larger patient sample are required to draw definitive conclusions. Additionally, there is a need for advancements in orthotopic bladder surgery techniques to minimize post-operative complications and adverse outcomes commonly observed in patients undergoing this procedure.

REFERENCES

1. Bladder cancer. 2022. https://www.iarc.who.int/cancer-type/bladder-cancer/.
2. Studer UE, Ackermann D, Casanova GA, Zingg EJ. Three years' experience with an ileal low-pressure bladder substitute. Br J Urol. 1989;63:43-52.
3. Jonsson MN, Adding LC, Hosseini A, Schumacher MC, Volz D, Nilsson A, et al. Robot-assisted radical cystectomy with intracorporeal urinary diversion in patients with transitional cell carcinoma of the bladder. Eur Uro. 2011;60(5):1066-1073.
4. Hu SW, Wu CC, Chen KC, Ho CH. 2019. Modified U-Shaped ileal neobladder designed for facilitating neobladder-urethral anastomosis in extracorporeal reconstruction after robotic-assisted radical cystectomy. J Cancer Res Ther. 2019;15:51-55.
5. Martínez-Gómez C, Angeles MA, Migliorelli F, Martinez A, Bernard M, Ferron G. Creation of a Y-shaped ileal orthotopic neobladder after an anterior pelvic exenteration in 10 logical steps. In J Gynecol Cancer. 2020;30(1):152-153.
6. Lu D, Wu Y, Liao S, Xie X, Zhu D, Ye Sh. Delayed ileal neobladder fistula caused by bladder stones: A case report. BMS Urol. 2022;22:87.

7. El-Helaly HA, Saifelnasr MK, Mohamed KM, Abdelaziz AS, Youssof HA. Outcome of orthotopic sigmoid versus ileal neobladder reconstruction. Urol Ann. 2019;11(2):204-210.
8. Vozianov SO, Shamraev SM, Leonenko AM, Vasileva VD, Shamraeva DM, Ridchenko MA, et al. Immediate results of orthotopic intracorporal ileoneocystoplasty. Urol. 2021;25(3):203-209.
9. Goodwin WE, Winter CC, Barker WF. "Cup-patch" technique of ileocystoplasty for bladder enlargement or partial substitution. J Urol. 2002;168(2):667-670.
10. Hou GL, Li YH, Zhang ZL, Xiong YH, Chen XF, Yao K, et al. A modified technique for neourethral anastomosis in orthotopic neobladder reconstruction. Urol. 2009;74(5):1145-1149.
11. Pavlović K, Hrkać A, Kožul IS, Zalihić D, Zalihić A, Gilja I. Long-term results of augmentation ileocystoplasty in spinal cord injury patients. Cent European J Urol. 2021;74(2):178-184.
12. Boccafoschi C, Annoscia S, Lozzi C, Signorello D. Vesico-urethral and entero-urethral anastomosis: Anatomo-surgical considerations and technical note. Arch Ital Urol Androl. 1993;65(5):563-569.
13. Palleschi G, Cardi A, Falsaperla M. Urodynamic assessment of orthotopic urinary diversions. Front Urol. 2022;2:885826.
14. Si-Chiang V, Ginsberg DA, Teruya KK, Boyd SD. Outcomes of artificial urinary sphincter placement in men after radical cystectomy and orthotopic urinary diversions for the treatment of stress urinary incontinence: The University of Southern California experience. Urol. 2012;79(6):1397-1401.
15. Chung E. Contemporary surgical devices for male stress urinary incontinence: A review of technological advances in current continence surgery. Transl Andrology Urol. 2017;6(2):112-121.
16. Zhong H, Shen Y, Yao Z, Chen X, Gao J, Xiang A, et al. Long-term outcome of spiral ileal neobladder with orthotopic ureteral reimplantation. In Urol Nephrol. 2020;52(1):41-49.
17. Wang L, Hussein AA, Guru K, Li Q. Robotic ileal ureter with bladder augmentation in a modified Studer fashion for a long ureteral stricture and small bladder. Urol Video J. 2022;16:100182.
18. Miki J, Yanagisawa T, Tsuzuki S, Kimura T, Kishimoto K, Egawa S. 2017. Improved technique for intracorporeal neobladder-urethral anastomosis in laparoscopic radical cystectomy. In J Urol. 2017;4(4):330-331.
19. Reifsnyder JE, Hanna MK. Advances in bladder substitution and creation of neobladders in children. F1000Res. 2019: 8:F1000 Faculty Rev-1992.
20. Yu Z, Huang J, Deng H, Zeng Z, Deng L, Xu X, et al. A novel neobladder-urethral drag-and-bond anastomosis technique during laparoscopic radical cystectomy for ileal orthotopic neobladder: Surgical technique and initial research. Cancer Manage Res. 2021;13:2909-2915.
21. Fathi R. Optimization of urolithiasis treatment and diagnosis in the Turkestan region. J Med Life. 2022;15(3):344-349.
22. Luciani LG, Mattevi D, Cai T, Malossini G. Robotics in Urology: No More Shadows? Uro. 2021;1(4):254-265.
23. Dobrovanov O, Králinský K, Kovalchuk VP. Ethiological agents of urinal infections and microbial resistance: Retrospective study. Lek Obz. 2019;(7):186-190.
24. Dobrovanov OY. Efficacy and sensitivity of prenatal and postnatal ultrasound screening of congenital developmental anomalies of kidneys in Slovakia. Wiad Lek. 2021;74(3 cz 1):450-454.
25. Horstmann M, Kurz M, Padevit C, Horton K, John H. Technique of the urethral anastomosis in orthotopic neo-bladder following robot-assisted radical cystectomy (RARC). Aktuel Urol. 2013;44(2):137-140.
26. Koie T, Ohyama C, Makiyama K, Shimazui T, Miyagawa T, Mizutani K, et al. Utility of robot-assisted radical cystectomy with intracorporeal urinary diversion for muscle-invasive bladder cancer. In J Urol. 2019;26(3):334-340.
27. Albisinni S, Veccia A, Aoun F, Diamand R, Esperto F, Porpiglia F, et al. A systematic review and meta-analysis comparing the outcomes of open and robotic assisted radical cystectomy. Minerva Urol Nephrol. 2019;71(6):553-568.
28. Mineo Bianchi F, Romagnoli D, D'Agostino D, Salvaggio A, Giampaoli M, Corsi P, et al. Posterior muscle-fascial reconstruction and knotless urethro-neobladder anastomosis during robot-assisted radical cystectomy: Description of the technique and its impact on urinary continence. Arch Ital Urol Androl. 2019;91(1):5-10.
29. Lukyanenko N, Lenha E, Spaska A, Klets T, Shevchenko T. Tactics for treating young children with pyelonephritis and vesicoureteral reflux associated with impaired fibrillogenesis. Mol Cell Biochem. 2023;478(3):531-538.
30. Lukyanenko NS, Imanmadiyeva DM, Dolinnaya VT, Spaska A. "Clinical masks" of congenital malformations of urinary system in children of early age. Int J Health Sci. 2021;5(3):244-251.
31. Badawy AA, Saleem MD, El-Baset EA, Morsi ES. Decreasing operative time and incontinence rates in patients treated with radical cystectomy and urethral diversion: A prospective randomized trial using a new suturing device (CAPIO). In J Nephrol. 2012;44(3):769-774.

32. Luciani LG, Mattevi D, Cai T, Malossini G. Robotics in Urology: No More Shadows? Uro. 2021;1(4):254-265.
33. Tusupbekova MM, Sharapatov YA, Pronkin EA, Lavrinenko AV, Turgunov YM. Comparative study of morphological changes in the kidney and ureter of a rabbit with various methods of infection. Clin Exper Morphol. 2022;11(1):62-72.
34. Sharapatov Y, Turgunov Y, Lavrinenko A. Pathogenic mechanisms of acute obstructive pyelonephritis. Open Access Maced J Med Sci. 2021;9(F):124-128.
35. Zulkhash N, Shanazarov N, Kissikova S, Kamelova G, Ospanova G. Review of prognostic factors for kidney transplant survival. Urologia. 2023;3915603231183754.
36. Nuradilova D, Kaliyeva L, Vaitkiene D, Kalimoldayeva S, Issenova S. Urogenital mixed infections in reproductive aged women with pelvic inflammatory disease. Georg Med News. 2021;(312):114-118.
37. Hamada A, Razdan S, Etafy MH, Fagin R, Razdan S. Early return of continence in patients undergoing robot-assisted laparoscopic prostatectomy using modified maximal urethral length preservation technique. J Endourol. 2014;28(8):930-938.
38. Koraitim MM, Atta MA, Foda MK. Orthotopic bladder substitution in men revisited: Identification of continence predictors. J Urol. 2006;176(5):2081-2084.
39. Yokota N, Ito F, Ishikawa T, Yamashita K, Nakazawa H. Neobladder-rectal fistula as early postoperative complication of radical cystectomy and orthotopic neobladder construction. Nihon Hinyokika Gakkai Zasshi. 2013;104(4):616-619.
40. Bhongir AV, Sampath S, Bonthapally RK, Gudivada KK, Ramaswamy G. Sequential Application and Post-Test Probability for Screening of Bladder Cancer Using Urinary Proteomic Biomarkers: A Review based Probabilistic Analysis. Asian Pacif J Cancer Prevent. 2023;24(6):2021-2027.
41. Grishin A, Spaska A, Kayumova L. Correction of overactive bladder with botulinum toxin type A (BTX-A). Toxic. 2021;200:96-101.