ВНУТРЕННИЕ БОЛЕЗНИ
INTERNAL DISEASES

THE ENHANCED RECOVERY PROGRAM IN UROLOGY. SYSTEMATIC REVIEW AND META-ANALYSIS

Vorobev V.A.,
Beloborodov V.A.,
Tukhiev A.R.

Irkutsk State Medical University
(Krasnogo Vosstaniya str. 1,
Irkutsk 664003, Russian Federation)

Corresponding author:
Vladimir A. Vorobev,
e-mail: terdenecer@gmail.com

ABSTRACT

A systematic review and meta-analysis of data on the problem of enhanced recovery in urology was performed. Inclusion criteria – clinical trials of the enhanced recovery program in urology.

The aim of the study *was to assess the significance of the enhanced recovery program (ERP) in the provision of surgical care in the "urology" profile.*

Materials and methods. *The systematic review was performed according to the guidelines for the presentation of systematic reviews and meta-analyses by PRISMA. The registration number in the international system Prospero was received (CRD42022358982). The review included 364 studies. Studies in urologic oncology were excluded from the meta-analysis. The meta-analysis included 15 studies involving 2293 subjects. A comparison was made between the application of ERP and the standard treatment protocol.*

Results. *The use of ERP leads to an expected two-fold reduction in the duration of postoperative length of hospitalization (OR = –1.96; 95% CI: –2.56÷–1.36; p < 0.00001). The reduction in the duration of hospitalization with the use of ERP in urology does not lead to the increased risk of readmission or re-operation (p = 0.35). The risks of developing postoperative complications ≥ Class 2 by Clavien – Dindo classification were comparable in both groups (p = 0.13). The use of ERP increases the expected success of the treatment by 1.74 times (OR = 1.74; 95% CI: 1.08–2.79; p = 0.02). With the use of ERP in reconstructive urology, a significantly lower risk of complications was established (p = 0.02).*

Conclusion. *The ERP program allows you to reduce the time and cost of treatment, reduce the likelihood of re-hospitalization and achieve better treatment results. The use of ERP is not accompanied by increased risk of complications > Class 2.*

Key words: *enhanced recovery after surgery, rapid recovery after surgery programs, fast track surgery, FTS, ERAS, enhanced recovery, ERP*

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ПРИМЕНЕНИЕ ПРОГРАММЫ УСКОРЕННОГО ВЫЗДОРОВЛЕНИЯ В УРОЛОГИИ. СИСТЕМАТИЧЕСКИЙ ОБЗОР И МЕТААНАЛИЗ

Воробьёв В.А.,
Белобородов В.А.,
Тухиев А.Р.

ФГБОУ ВО «Иркутский государственный медицинский университет» Минздрава России (664003, г. Иркутск, Красного Восстания, 1, Россия)

Автор, ответственный за переписку:
Воробьёв Владимир Анатольевич,
email: terdenecer@gmail.com

РЕЗЮМЕ

Выполнен систематический обзор и метаанализ данных по проблеме ускоренного выздоровления в урологии. Критерии включения – клинические исследования применения программы ускоренного выздоровления в урологии.
***Цель исследования** – оценка значимости программы ускоренного выздоровления при оказании хирургической помощи по профилю «урология».*
***Материалы и методы.** Систематический обзор выполнен согласно методическим рекомендациям по представлению систематических обзоров и метаанализов PRISMA. Получен регистрационный номер в международной системе Prospero (CRD42022358982). В систематический обзор включены 364 исследования. Онкоурологические исследования из метаанализа были исключены. Проанализировано 15 исследований с участием 2293 субъектов. Выполнено сравнение применения программы ускоренного выздоровления (ПУВ) и стандартного протокола лечения.*
***Результаты.** Применение ПУВ приводит к ожидаемому двухкратному сокращению срока послеоперационного пребывания (ОШ = –1,96; 95% ДИ: –2,56÷–1,36; p < 0,00001). Сокращение сроков госпитализации при применении ПУВ в урологии не приводит к увеличению риска повторного обращения или реоперации (p = 0,35). Риски развития послеоперационных осложнений ≥ 2-го класса по универсальной классификации Clavien – Dindo оказались сопоставимы в обеих группах (p = 0,13). Применение ПУВ повышает предполагаемую успешность проводимого лечения в 1,74 раза (ОШ = 1,74; 95% ДИ: 1,08–2,79; p = 0,02). При применении ПУВ в реконструктивной урологии установлен достоверно меньший риск развития осложнений (p = 0,02).*
***Заключение.** Программа ускоренного выздоровления позволяет сократить сроки и стоимость лечения, уменьшить вероятность повторной госпитализации и добиться лучших результатов лечения. Применение ПУВ не сопровождается увеличением риска развития осложнений > 2-го класса по Clavien – Dindo.*

***Ключевые слова:** протокол ускоренного выздоровления, программа ускоренного выздоровления, ПУВ, ускоренное выздоровление*

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The Enhanced Recovery Program (ERP) is aimed at reducing the duration of treatment from the moment of diagnosis to recovery of working capacity [1].

The aim of the study was to assess the significance of the enhanced recovery program in the provision of surgical care in the "urology" profile.

A systematic review and meta-analysis of data on the problem of ERP in urology were performed. Search for sources was performed in the following databases: PubMed, Google Scholar, Cochrane Library, RSCI, Scopus, Web of Science. Scientific publications in Russian and English were selected, available for obtaining directly or through third-party services, as well as the library and subscription of the Irkutsk State Medical University.

When performing the study, the following questions were formulated: How does the use of enhanced recovery protocols affect the outcomes of surgical treatment of urological diseases? Is there any convincing evidence of the superiority of enhanced recovery protocols over the standard approach? Is there an increased risk of complications, re-operation, readmission or death when using enhanced recovery protocols?

OBTAINING EVIDENCE

A systematic search was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement [2, 3].

A systematic review was registered in PROSPERO (identification number CRD42022358982).

In the databases PubMed, Google Scholar, Cochrane Library, RSCI, Scopus, Web of Science, a search was made for studies on the use of enhanced recovery protocols in urology and reviews on the problem in the period from January 1, 1995 to April 1, 2023 (Fig. 1).

The following keywords were used in the search (by continuous OR search): "fast track surgery" , "FTS", "ERAS", "enhanced recovery", "enhanced recovery urology", "enhanced recovery" (in Russian), "ERP" (in Russian).

The results of interest were: 1) reviews of the use of enhanced recovery protocols in urology; 2) cases of application and development of protocols in urology; 3) clinical studies of the results of the use of protocols in urology; 4) systematic reviews and meta-analyses of data on the use of ERP in urology.

This systematic review was aimed at evaluating the developed protocols of enhanced recovery used in urology, as well as at performing a meta-analysis of the results of clinical studies on this problem.

Thus, this review included the following:

1. Publications devoted to the development of protocols for enhanced recovery in urology;
2. Literature reviews, systematic reviews and meta-analyses of enhanced recovery in urology;
3. Publications devoted to the results of clinical trials (randomized and non-randomized) of the effectiveness of enhanced recovery protocols in urology;
4. Publications in English and Russian.

The following was excluded from the review:

1. Publications devoted to application of enhanced recovery protocols in oncology, including urologic oncology;
2. Publications devoted to case-control studies;
3. Publication with no access to the full texts of the article.

Observational studies (cross-sectional and case-control) were excluded from the study due to their low significance when performing meta-analysis. The search revealed two available case-control studies. Duplicate studies, reprints, studies in languages other than the declared ones (English and Russian), animal studies, letters and short messages were excluded.

A tool developed by the National Institutes of Health (NIH) was used to assess the risk of systematic error and the methodological quality of research (to assess the feasibility of integrating the results into the study). The results of the review and analysis were independently verified before the work was completed by the Vice-Rector for Science and the Vice-Rector for Medical Work of Irkutsk State Medical University. The revealed discrepancies in the evaluation of the results were eliminated after discussion by the team of authors.

The database on clinical trials was formed according to the developed form: date of publication; number

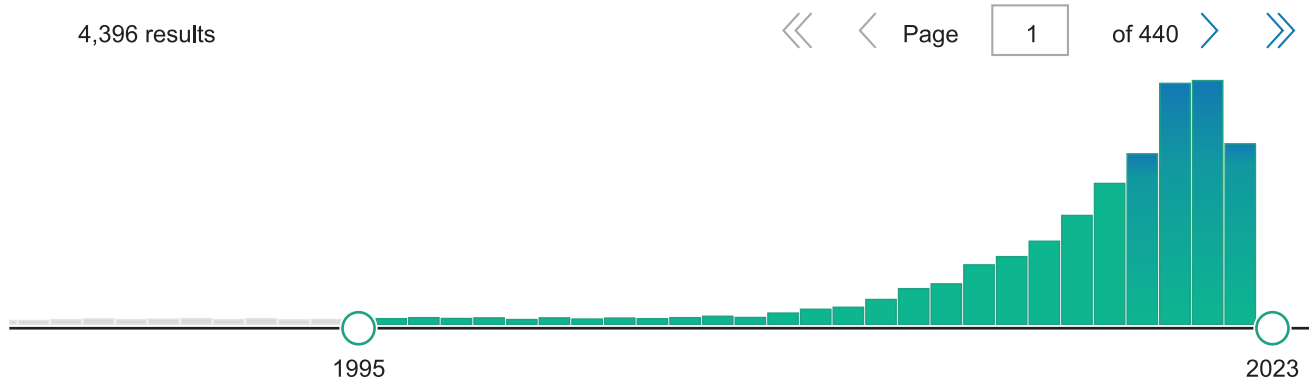

FIG. 1.

Chronometric diagram of search results for "enhanced recovery", "human", "01.01.1995 – 01.04.2023" in the English-language text database of medical and biological publications in PubMed database

of participants; study design; comparison groups; scope of the protocol, the results obtained (nominal, ordinal and predictive).

Meta-analyses that meet the criteria of the study were not revealed during a systematic search. All identified systematic studies of ERP in urology directly relate to the oncourological direction.

The evaluation of the results during the meta-analysis was carried out according to the following parameters: 1) the comparative effectiveness of the treatment; 2) the comparative probability of the occurrence of adverse events (complications or readmissions); 3) comparative duration of hospitalization; 4) comparison of predictors of the success of the treatment; 5) differences in mean values, odds ratio (OR), relative risk (RR), chi-squared (χ^2) occurrence of the event or outcome.

EVIDENCE AND STATISTICAL TECHNIQUES

The data obtained were compared in the Microsoft 365 software package (Microsoft Corporation, USA), and the analysis was performed using Stata v. 16 (College Station, TX, USA). Meta-analyses were performed to analyze the combined data on the impact of the use of enhanced recovery protocols on various treatment outcomes, predicting the occurrence of various events.

The systematic review was carried out according to the methodological recommendations for the submission of systematic reviews and meta-analyses of PRISMA [3]. The survey was registered, and a registration number was obtained in the Prospero international system for registration of systematic reviews (CRD42022358982).

Meta-analysis of proportions was performed using the metaprop command in Stata v. 16 and verified in the RevMan ver. 5.4.1 application. The random effects model was applied using the DerSimonian and Laird method. The proportions were transformed using the double inverse Freeman – Tukey arcsine transform, and confidence intervals (CI) were calculated using the Score method. The use of this method makes it possible to include studies with zero or single parameter values in the meta-analysis [4]. Heterogeneity within and between subgroups was estimated by I^2 or χ^2 statistics [5]. The significance was set at 0.05. If neither the χ^2 analysis nor the I^2 test indicated significant heterogeneity between studies, a fixed-effects model was used. In cases of high statistical heterogeneity, a random effects model was used.

A graphic portrait of the results of the meta-analysis is presented in the form of diagrams consisting of a series of horizontal segments showing the RR and 95% CI of individual studies at the point being compared. I2 levels equal to 25 %, 50 % and 75 % are defined as weak, medium strength and pronounced heterogeneity, respectively. The data pool was analyzed by the method of inverse fixed-effect model in cases of low-moderate heterogeneity ($I^2 < 50$ %), and random-effect model in cases of moderate-high heterogeneity ($I^2 > 50$ %).

The results were measured using a risk ratio (RR) representing a confidence interval (95% CI) and a *p*-value [6]. For studies without a control group, a comparison modeling method was used [7].

The publication bias was assessed using the Begg and Mazumdar test, the Egger regression asymmetry test, as well as funnel graphs with an improved contour. Sensitivity analysis was performed to determine the effect of uncertainty on the effect of exposure; the analysis was repeated when performing direct and indirect comparisons. Sensitivity analysis was carried out by excluding studies on one of the analyses. This allowed us to assess whether one study had a significant impact on the results.

The assessment of the risks of blindness for non-randomized clinical trials (NCI) was carried out according to the RoBANS [8] and MINORS [9] criteria.

The evaluation of the quality of research was determined according to the Oxford Recommendations of 2011 by levels of evidence from 1 to 5. Level 1 – data obtained from systematic reviews and/or meta-analyses; Level 2 – randomized clinical trials; Level 3 – non–randomized controlled cohort studies with sufficient follow-up period; Level 4 – series of clinical observations; Level 5 – expert opinion.

The subgroup analysis was performed by testing interactions between subgroups (presented as an unadapted *p*-level). A subgroup analysis was performed to identify possible causes of heterogeneity when comparing the results of direct and indirect comparisons.

SYSTEMATIC REVIEW

The search algorithm on PubMed. Filters: 01.01.95 to 01.04.23; "Human"; "Russian" or "English". Search: "enhanced recovery" or "ERAS" or "fast track" and "urology". Found: 353 publications. A similar algorithm is used for other scientific databases.

A total of 364 studies are included in this systematic review: 45 are devoted to the review of the problem, 4 – to the development of protocols for enhanced recovery, 21 – to clinical studies, 2 – to observational and case-control studies.

Seventeen studies met the criteria for inclusion in this systematic review. The meta-analysis included 15 studies involving 2,293 subjects (Table 1). The research Design flowchart (PRISMA) is shown in Figure 2.

The methodology was evaluated for each study included in the meta-analysis (Table 1). The bias characteristic of the included studies is shown in Figure 3. Most of the included studies had a good or satisfactory level.

A survey among practicing urologists regarding the introduction of ERP elements into their practical activities, was carried out in 2021 [25]. Of the 714 completed questionnaires, 113 (16 %) were found to be reliable. 58 % of the respondents were employees of the university clinic. 61 % of urologists were unfamiliar with or knew little about the enhanced recovery program. Only 20 % of respondents used ERP systematically, guided by the developed proto-

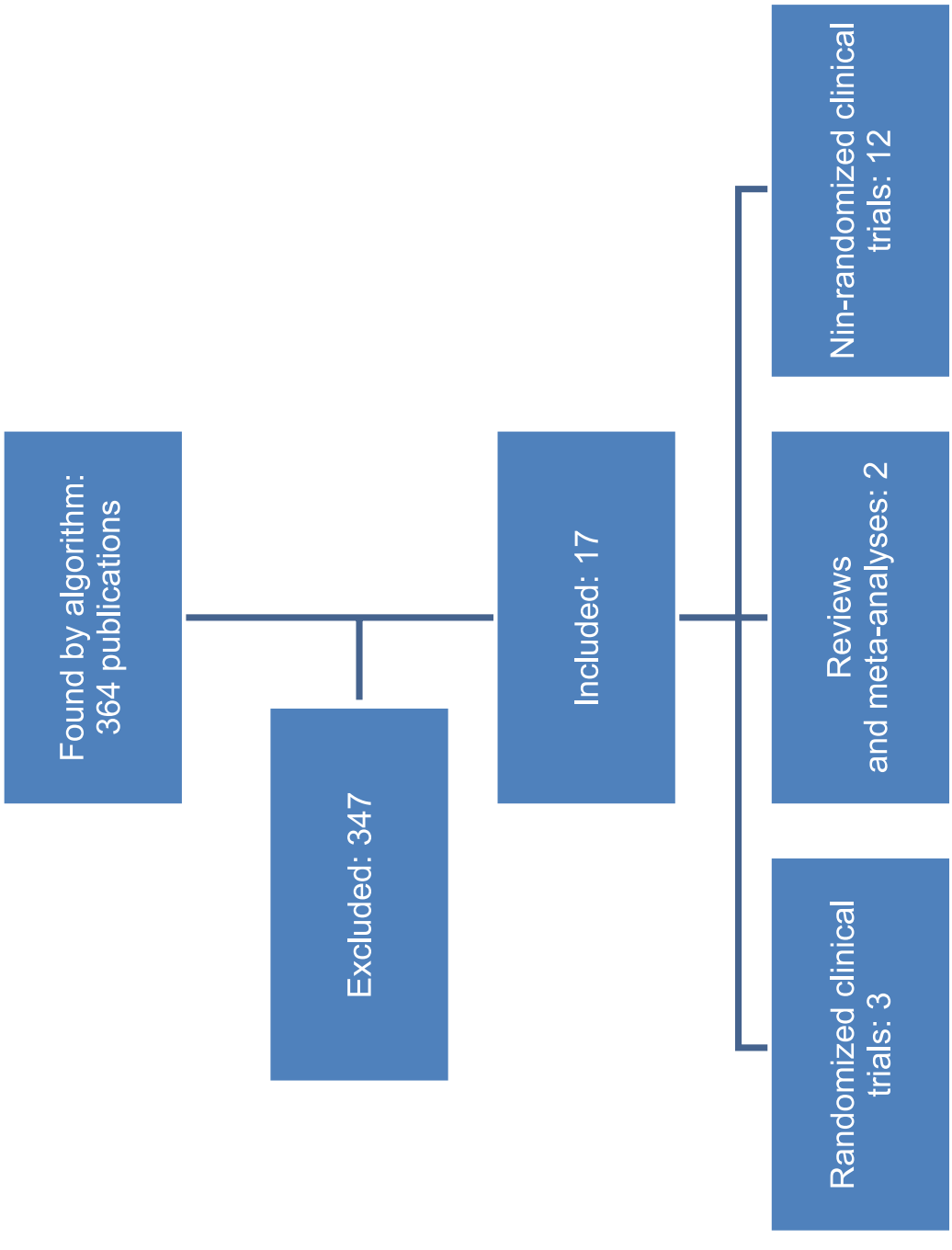

FIG. 2.
Block diagram of the study design

TABLE 1
CHARACTERISTICS OF THE INCLUDED STUDIES

Author, date	Design/ Quality	Number of participants	Comparison group, ERP/Standard	Application	Results: ERP/Standard	Comments
Firoozfard, 2003 [10]	NCT/3	75	25/50	Open nephrectomy	Blood loss: 700/1050 ml; Mortality: 1/1 cases; Complications: CD2 – 4/2 cases, CD3a – 5/5 cases, CD3b – 2/2 cases; Readmission: 1/1 cases. Hospitalization: 4/8 days. VAS POD1: 1/5 points.	Signs of a defect in methodology and statistics
Mansour, 2017 [11]	RCC/2	224	113/111	Laparoscopic and open nephrectomy	Operation time: 156.2 ± 33.2/172 ± 45.5 min. Incision: 6.7 ± 2.4/15.2 ± 3.2 cm/. Blood loss: 165.6 ± 45.2/185 ± 78.5 ml. Hospitalization: 2.8 ± 1/3.9 ± 1.7 days. VAS POD1: 4 ± 1.8/7.2 ± 1.0 points. Disability: 25.3 ± 12.5/41.7 ± 16.5 days. CD2: 15/40 cases. Death: 0/0 cases. Readmission: 0/0 cases.	Poorly described complications
Мазуренко, 2017 [12]	NCT/3	67	29/38	PNL	Stone size: 25.8/27.1 mm. Operation time: 27.98 ± 11.13/26.34 ± 12.21 min. Hospitalization: 27.2/54.7 hours. Complications: CD2 – 5/8 cases, CD3a – 0/1 cases. SFR 4 mm: 91 %/90 % of cases. Death: 0/0 cases. Readmission: 0/0 cases.	Not all sections describe the statistics correctly.
Wong, 2018 [13]	NCT/3	302	126/176	Reconstructive urology, urethroplasty for hypospadias	Duration of catheterization: 10.7 ± 2.8/10.2 ± 2.9 days. Hospitalization: 2 ± 0.5/10 ± 2 days. Complications: CD2 – 7/28 cases, CD3 – 22/61 cases. Success rate: 87/71 cases. Predictor of success: ERP (OD = 0.35, 95% CI: 0.15–0.85; $p = 0.02$).	
Rove, 2018 [14]	NCT/3	39	13/26	Reconstructive urology	Operation time: 277 (189–314)/270 (203–342) min. Hospitalization 5 ± 1/6 ± 1 days. Readmission: 1/7 cases. Complications: CD2 – 9/22 cases, CD3 – 1/10 cases, CD4 – 0/4 cases. Predictor of complications: traditional approach (HR = 0.71, 95% CI: 0.51–0.97).	

TABLE 1 (*continued*)

Author, date	Design/ Quality	Number of participants	Comparison group, ERP/Standard	Application	Results: ERP/Standard	Comments
Haid, 2018 [15]	NCT/3	30	15/15	Reconstructive urology	Operation time: 336.5 ± 21.42/387.9 ± 32.34 min. Hospitalization: 11.93 ± 0.64/19.87 ± 2.04 days. Complications: CD2 – 0/3 cases, CD3 – 0/0 cases.	
Gridley, 2020 [16]	RCC/2	80	52/30	RIRS	Prestenting: 17/7 cases. Access sheath: 43/20 cases. Stones size: 15.3 ± 12.7/15.5 ± 9.4 mm. Operation time: 116 ± 31/122 ± 34 min. Stenting: 8.1 ± 7/6.0 ± 3 days. Opiates: 26/41 cases. VAS > 5 points: 10/7 cases. Death: 0/0 cases. Readmission: 0/0 cases.	There is no description of the developed protocol, the duration of hospitalization is not indicated.
Li, 2020 [17]	RCC/2	235	117/118	PNL	Stone size: 21.03 ± 9.43/19.19 ± 8.16 mm. SFR: 93.2 %/89.8 % of cases. Operation time: 54 ± 12/58 ± 11 min. VAS POD0: 0.79 ± 0.76/2.79 ± 0.98 points. Hematuria: 2/10 cases. Sepsis: 5/6 cases. Complications: CD2 – 14/21 cases, CD3b – 1/1 cases. Hospitalization: 4.6 ± 1/6.2 ± 1.1 days. Nephrostoma: 3.6 ± 1/5.2 ± 1.1 days. Catheter: 2.6 ± 1.0/4.2 ± 1.1 days. Death: 0/0 cases. Readmission: 0/0 cases.	No size specified for SFR.
Han, 2021 [18]	NCT/3	39	13/26	Reconstructive urology	Hospitalization: 5 ± 1/6 ± 1 days.	The study focused primarily on the aspect of anesthesia, complications and details of surgical aspects are not presented.
Chan, 2021 [19]	NCT/3	40	20/20	Reconstructive urology	Hospitalization: 4 (3–29)/9 (2–31) days. Readmission: 6/4 cases. Re-operation: of 3/6 cases. Complications: CD2 – 6/9 cases, CD3 – 3/6 cases.	

TABLE 1 (*continued*)

Author, date	Design/ Quality	Number of participants	Comparison group, ERP/Standard	Application	Results: ERP/Standard	Comments
Shu, 2022 [20]	NCT/3	435	216/219	RIRS	Stone size: 20 (5)/20 (5) mm. Operation time: 75 (50)/90 (50) min. Hospitalization: 2 (1)/3 (1) days. Complications: CD2 – 6/9 cases. Hematuria: 18/35 cases. SFR: 78.3 %/75.8 % of cases.	
Gao, 2022 [21]	NCT/3	341	104/237	PNL	Stone size: 44 ± 21.5/41.7 ± 23.1 mm. Density: 1088 ± 681/1011 ± 591 HU. Fever: 10/12 cases. Operation time: 88.2 ± 46.5/93.6 ± 27.7 min. Sepsis: 4/5 cases. SFR: 91.3/87.5 % of cases. Hospitalization: 4.49 ± 2.4/6.64 ± 3.1 days. Complications: CD2 – 16/20 cases.	
Satvaldieva, 2022 [22]	NCT/3	92	42/50	Reconstructive urology	Operation time: 84 ± 9.7/min. Hospitalization: 38 ± 1.9/hour.	There is no data on complications, there is no data on the control group. Only the analgesic status is presented.
Dutta, 2022 [23]	NCT/3	173	91/82	Reconstructive urology, urogynecology	Operation time: 97.8 (10–268)/82.4 (6–223) min. Complications: CD2 – 4/10 cases, CD3 – 0/1 case. Readmission: 7/12 cases.	A number of important data, such as the duration of hospitalization, are not specified.
Girgiss, 2022 [24]	NCT/3	121	55/66	PNL	Stone size: 38.3 ± 36/30.2 ± 20.6 mm. Operation time: 98.1 ± 35.4/133.3 ± 39.4 min. Hospitalization: 1.22 ± 1.47/1.31 ± 1.95 days. Complications: CD2–3 10/9 cases. Readmission: 7/8 cases.	

Note. CD – Clavien – Dindo classification of complications; VAS – visual-analog pain scale; POD – postoperative day; PNL – percutaneous nephrolapaxy; RIRS – retrograde intrarenal surgery; URS – ureteroscopy; HU – Hounsfield units for measuring X-ray density; SFR – freedom from residual concretions; OR – odds ratio; RR – risk ratio.

col. Of the 24 elements recommended by ERAS, 15 were implemented on average. About half of them face administrative or collective problems with the implementation of ERP.

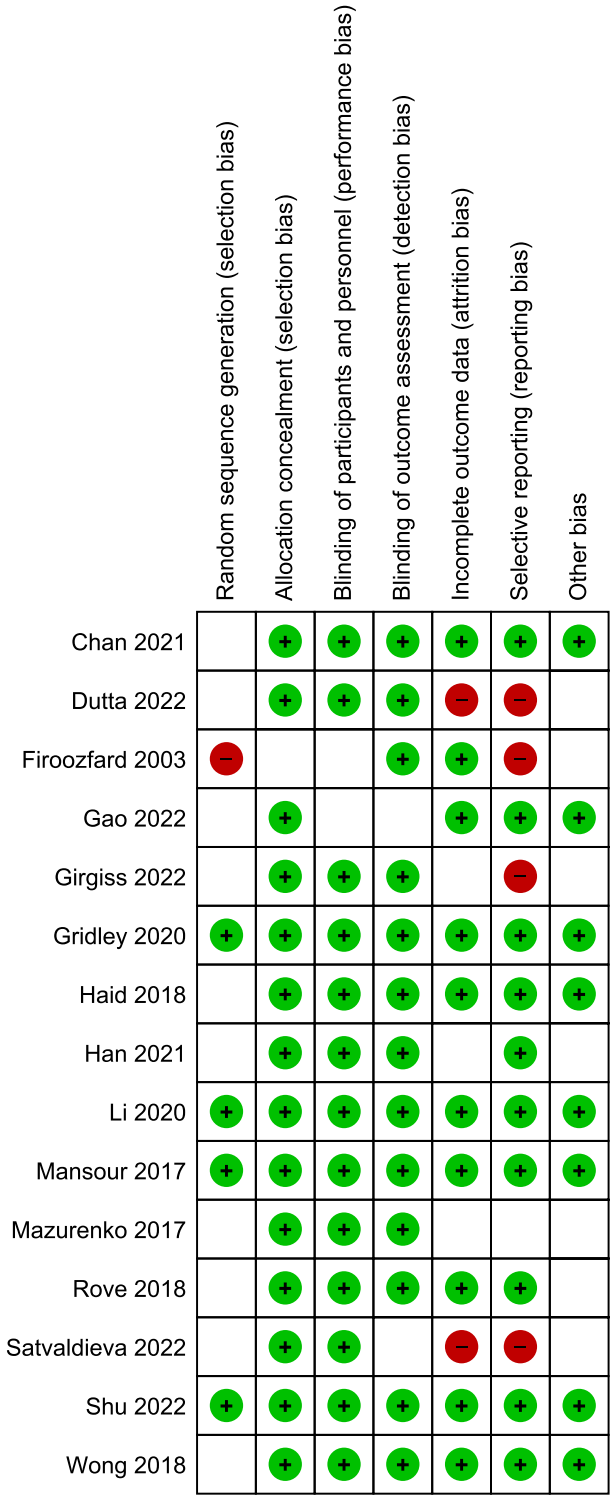

FIG. 3.
Characteristics of the bias of the included studies

Also of scientific interest is the description of the methodology and the process of developing a protocol for enhanced recovery in pediatric reconstructive urology (PURSUIT), presented in 2020 [26]. The paper provides clear criteria and design of the study, a template for the planned protocol, a roadmap, data and statistical analyses.

There are no completely original protocols of enhanced recovery among the included works. All the presented studies are based on the general concept of the ERAS strategy, consisting of 22 elements. The level of involvement in the protocol is described in some separate papers.

META-ANALYSIS OF LITERATURE DATA

The results of treatment were compared according to the principles of meta-analysis of data between groups of patients treated according to the standard protocol and according to the enhanced recovery program.

Among 15 clinical trials and 2,293 patients included in the meta-analysis, there were no significant differences in age ($p = 0.77$) or gender ($p = 0.63$) between the groups.

One of the basic advantages of enhanced recovery is a shorter hospital period, and the main disadvantage is the risk of readmission or re-operation, that is, re-hospitalization and repeated surgical intervention.

According to the results of the analysis (Fig. 4), a significant statistical difference in the duration of hospitalization was established: patients under the enhanced recovery protocol stay in the hospital less long ($p < 0.00001$). There is a very high heterogeneity of the results obtained ($I^2 = 97$ %) due to a significant difference in the timing of hospitalization in the included studies. When using the same treatment protocol and type of surgical intervention, the patient can stay in the hospital from one [12] to five days [17]. The mean difference in the length of stay is 2 days (95% CI: –2.56÷–1.36; $p < 00.00001$).

The reduction in the duration of hospitalization does not lead to an increase in the risk of re-treatment or re-operation when using ERP in urology ($p = 0.35$), which is shown in Fig. 5. The heterogeneity value for this test is considered insignificant ($I^2 = 0$ %), which indicates the general homogeneity of the data of different authors.

The risks of developing postoperative complications ≥ Class 2 according to the universal Clavien – Dindo classification were comparable in both groups ($p = 0.13$), which is shown in Figure 6. The heterogeneity of the combined results corresponds to an intermediate between moderate and high ($I^2 = 73$ %), since in several studies the predominance of complications in the ERP group was noted, however, most studies show that ERP is accompanied by a lower risk of complications. We should note the results of group analysis in reconstructive urology: a significantly lower risk of complications ($p = 0.02$) was established in the ERP group. In the subgroup of endourological operations – percutaneous puncture nephrolithotripsy and retrograde intrarenal surgery ("ЧПНЛ" and "РИРХ" in Fig. 7, respectively) – low heterogeneity was revealed, which increases the significance of the data obtained.

The use of ERP increases the expected success of the treatment by 1.74 times (OR = 1.74; 95% CI: 1.08–2.79; $p = 0.02$), which is shown in Figure 7. The results ob-

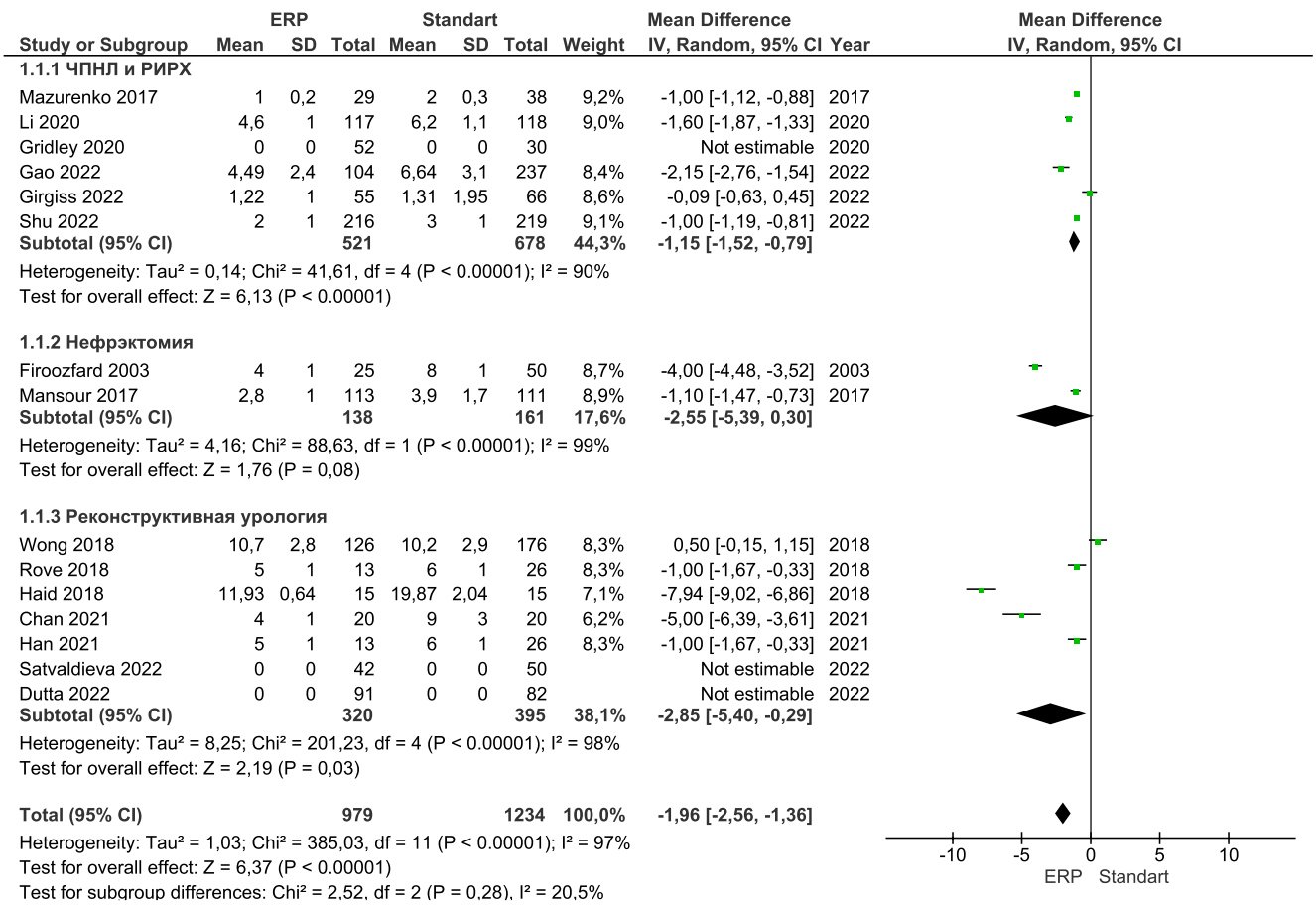

FIG. 4.

Forest diagram comparing the duration of hospitalization with the use of ERP and the Standard Treatment Protocol

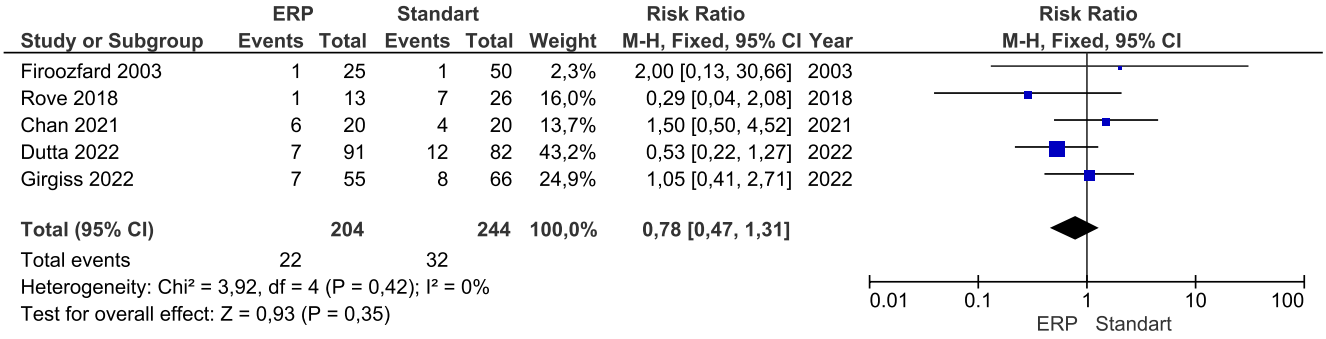

FIG. 5.

Forest diagram comparing the risk of readmission with the use of ERP and the Standard Treatment Protocol

tained have satisfactory heterogeneity of significance and (χ^2 = 10.82; I^2 = 54 %). The group analysis in the subgroups reconstructive urology and andrology ("ЧПНЛ" and "РИРХ") obtained homogeneous data (I^2 = 0 %), which significantly increases the value of the results and confirms the positive prognostic effect of ERP. Thus, when using ERP in reconstructive urology, the success rate of treatment increases by 3 times with high statistical reliability (OR = 3.21; 95% CI: 2.02–5.09; p < 0.00001; I^2 = 0 %).

Evaluation of the scientific validity and quality of meta-analysis

Figure 8 shows the analysis of the bias of the data presented by the authors in the included studies according to the RoBANS criteria. The results of the analysis of all 15 included papers indicate a low risk of bias.

The evaluation of the statistical heterogeneity of the results, presented in each forest diagram through the value of I^2, showed a general moderate heterogeneity of the data obtained by the authors, which is justified by the peculiarities of clinical practice and methodology of the work performed, as well as by different types of surgical techniques included in the meta-analysis (from endourological

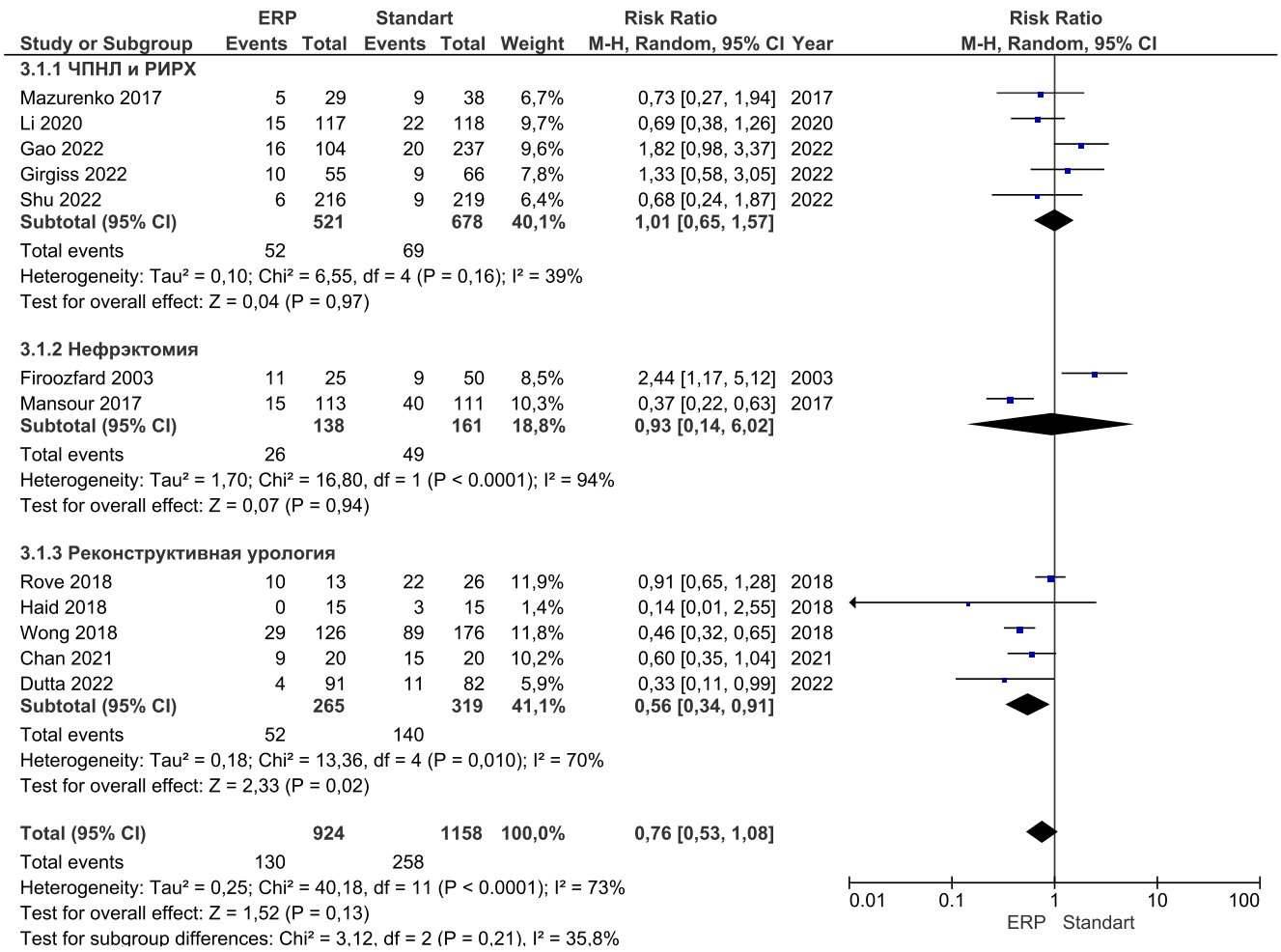

FIG. 6.

Forest diagram comparing the risk of developing complications of Clavien – Dindo ≥ Class 2 for the use of ERP and the Standard Treatment Protocol

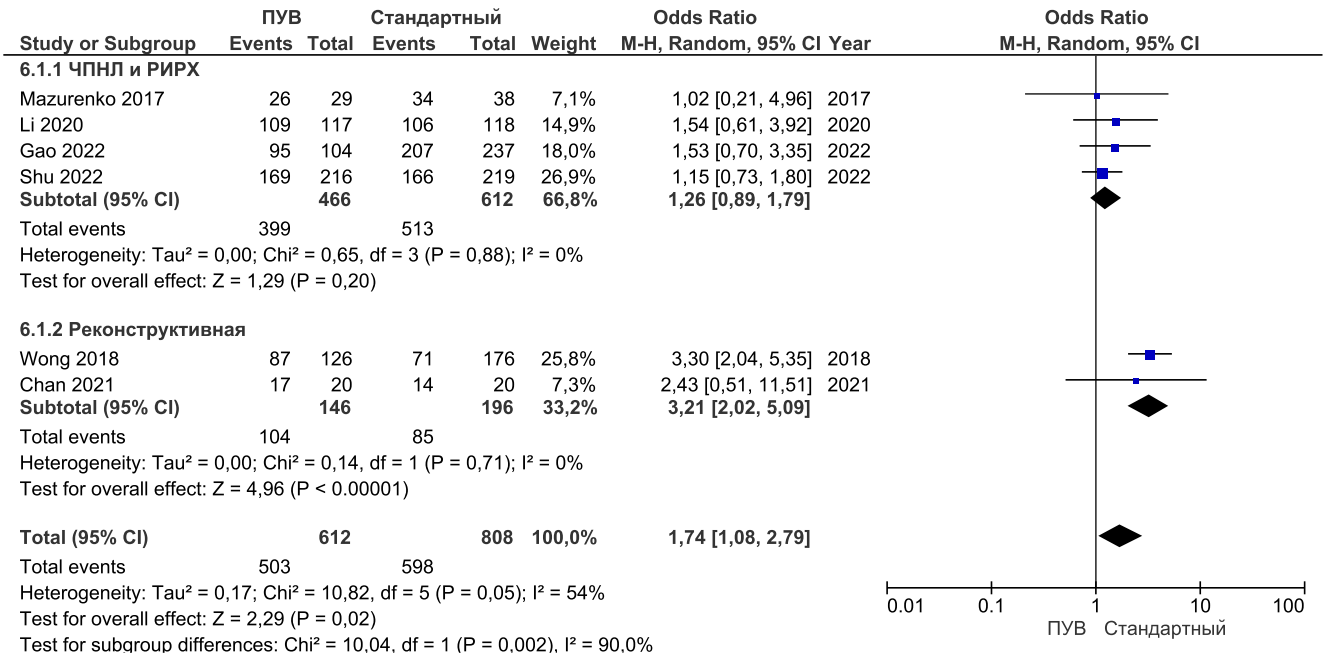

FIG. 7.

Forest diagram comparing the success of the treatment with the use of ERP and the Standard Protocol

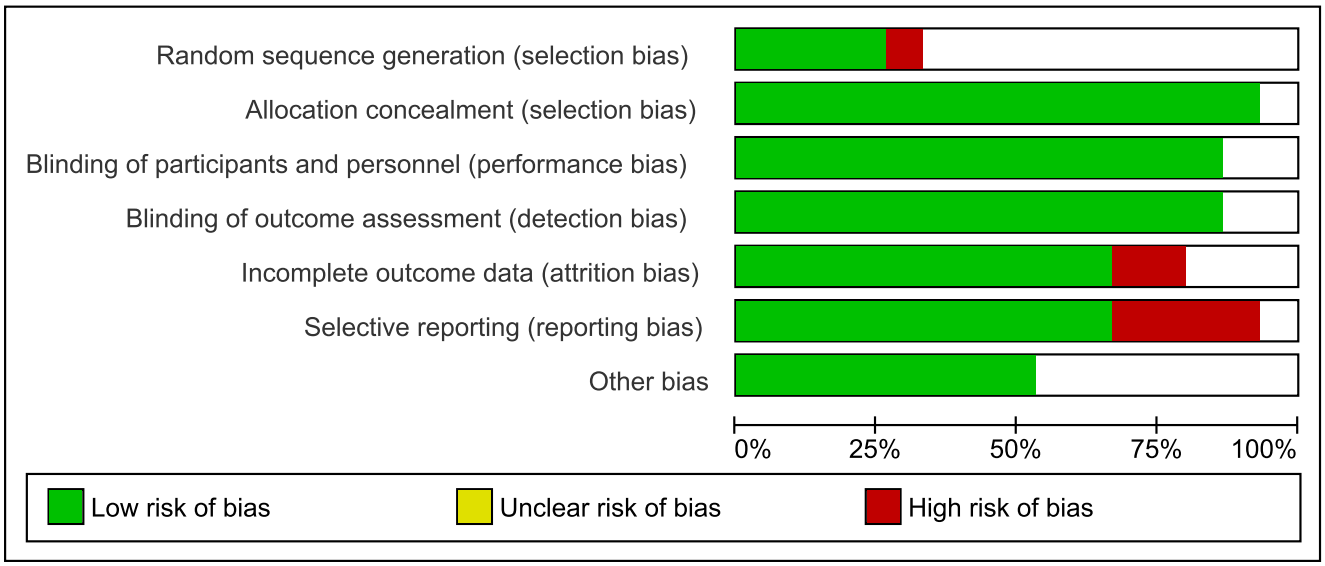

FIG. 8.
Analysis of publication bias

to reconstructive). When performing a subgroup analysis in therapeutic areas, the results are homogenized, which indicates the high significance of the data obtained. An unambiguous conclusion was obtained when analyzing the risk of re-hospitalization. The homogeneity of the initial data increases the reliability of the results obtained due to the absence of the influence of variation in values.

The stability of the final summary test to changes in the generalized sample and to the applied methods of analysis is analyzed. The value of the total value confirms the reliability of the results obtained and the absence of evidence of bias of the publications included in the meta-analysis.

DISCUSSION

The Enhanced Recovery Program (ERP) is an actual multimodal perioperative strategy aimed at improving the results and quality of treatment. Regardless of the surgical discipline, it is possible to develop and optimize the program for specific nosology. The application of ERP in coloproctology, thoracic and cardiac surgery, oncology, and neurosurgery is most studied. In the Russian Federation, there are a lot of monographs and several approved clinical recommendations on ERP in coloproctology. However, in a few disciplines, the scientific representation of ERP remains fragmented, both in Russia and in the world.

Several scientific papers devoted to the analysis of the use of enhanced recovery programs in urology demonstrate a relatively small involvement of the new multimodal strategy in the treatment of pathology of the urogenital tract. The authors agree that the use of even individual elements is promising, it will reduce the likelihood and significance of postoperative complications [27, 28]. At the same time, until May 2015, only 15 scientific papers published in English were directly devoted to ERP in urology [29]. By 2020, the number of publications has increased to 55, most of them are devoted to the ERP during radical cystectomy according to ERAS recommendations [30], including ones published in Russian [31–34]. The unequivocal conclusion is that there are no obstacles to expanding the use of ERP to other surgical procedures within the framework of the profile "urology".

The use of the Enhanced Recovery Program when performing endourological, reconstructive or organ removing interventions in urology with comparable risks of complications allows to achieve better treatment results, reduce the time of hospitalization, reduce the likelihood of repeated treatment and, as a result, reduce the total cost of treatment.

In general, a small number of clinical studies are presented on the subject of ERP as part of the search and inclusion strategy, in comparison with oncological urology, abdominal surgery and other disciplines. In total, PubMed presents 295 meta-analyses and systematic reviews on ERP, 9 of them – on oncological urology (the study of ERP during radical prostatectomy and cystectomy). Systematic reviews and meta-analyses on ERP in non-oncological urology have not been revealed.

The main conclusions of the meta-analysis obtained based on scientific evidence:

- Urological patients who are scheduled for surgical treatment should be included in the Enhanced Recovery Program according to an adapted protocol, which reduces the time and cost of treatment, reduces the likelihood of readmission and achieves better treatment results (evidence level – 1; recommendation level – A);
- The use of the Enhanced Recovery Program for urological patients when planning surgical treatment is not accompanied by increased risk of complications > *Class* 2 according to Clavien – Dindo (evidence level – 1; recommendation level – A).

Given the heterogeneity of surgical techniques and nosologies, technical bias should be considered when plan-

ning randomized clinical trials and subsequent meta-analyses.

The presented meta-analysis showed a statistically significant difference between ERP and the Standard Treatment Protocol ($p < 0.02$). The overall result of the performed analysis indicates the positive role of the Enhanced Recovery Program, regardless of the field of application in urology, which is consistent with the data of meta-analyses on the oncological urological profile [35, 36] and interdisciplinary analyses of ERAS programs [37].

Limitations of meta-analysis

A detailed systematic review and meta-analysis of the literature data was performed using standardized and recommended tools for evaluating the research methodology. When assessing the risk of systematic error, most of the included studies were of satisfactory or good quality, however, some were of poor quality.

Of the 15 clinical trials included in the meta-analysis, 12 (80 %) are non-randomized studies, which negatively affects the significance of the data obtained from these studies.

Most of the included studies clearly stated the objectives of the study, and although the selection of patients was generally acceptable, several studies did not clearly indicate the inclusion criteria, or a few statistics required when performing a meta-analysis. In addition, most studies do not provide a detailed description of the study design, the use of placebo control, types of randomizations, etc. There was a large methodological variability between the studies (for example, different protocols of enhanced recovery for similar urological pathology), as well as significant deviations from the ERAS recommendations for the implementation of the program (inclusion of <50 % of the program elements), which may explain the differences in the results obtained.

Since the purpose of this systematic review was to study the effectiveness of the use of enhanced recovery protocols in the treatment of urological diseases, a possible limitation is the excluding works on urological oncological diseases from the analysis. A meta-analysis of various outcomes was carried out with moderate heterogeneity of the results obtained. Therefore, the results should be evaluated and used as corresponding to a high level of evidence.

CONCLUSION

Based on a meta-analysis of data, with a high level of evidence and significance of recommendations (1-A), it was found that the use of the Enhanced Recovery Program allows better treatment results with comparable risks of complications.

Practical recommendations

In urological patients, when planning surgical treatment, the adapted Enhanced Recovery Program should be used, regardless of the nosological characteristics and type of intervention.

Conflict of interest

The authors declare no conflict of interest.

Research transparency

The study was not sponsored. The researchers are solely responsible for submitting the final version of the manuscript for publication.

Declaration on financial and other interactions

All authors participated in the development of the concept and design of the study and in writing the manuscript. The final version of the manuscript was approved by all authors. The authors did not receive a fee for the study.

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Information about the authors

Vladimir A. Vorobev – Cand. Sc. (Med.), Associate Professor of the Department of General Surgery, Irkutsk State Medical University, e-mail: terdenecer@gmail.com, https://orcid.org/0000-0003-3285-5559

Vladimir A. Beloborodov – Dr. Sc. (Med.), Professor, Head of the Department of General Surgery, Irkutsk State Medical University, e-mail: bva555@yandex.ru, https://orcid.org/0000-0002-3299-1924

Artur R. Tukhiev – Postgraduate, Department of General Surgery, Irkutsk State Medical University, e-mail: atukhiev@bk.ru, https://orcid.org/0000-0003-1525-3425

Сведения об авторах

Воробьёв Владимир Анатольевич – кандидат медицинских наук, доцент кафедры общей хирургии, ФГБОУ ВО «Иркутский государственный медицинский университет» Минздрава России, e-mail: terdenecer@gmail.com, https://orcid.org/0000-0003-3285-5559

Белобородов Владимир Анатольевич – доктор медицинских наук, профессор, заведующий кафедрой общей хирургии, ФГБОУ ВО «Иркутский государственный медицинский университет» Минздрава России, e-mail: bva555@yandex.ru, https://orcid.org/0000-0002-3299-1924

Тухиев Артур Русланович – аспирант кафедры общей хирургии, ФГБОУ ВО «Иркутский государственный медицинский университет» Минздрава России, e-mail: atukhiev@bk.ru, https://orcid.org/0000-0003-1525-3425