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MODERN TECHNOLOGIES IN SURGICAL TREATMENT OF COMBINED ANORECTAL PATHOLOGY AND THEIR RESULTS

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Ключевые слова: *сочетанные анальные и ректальные заболевания, радиохирургическая технология, электрохирургические технологии*

Abstract. Modern technologies in surgical treatment of combined anorectal pathology and their results. Balytskyy V.V., Zakharash M.P., Kuryk O.H. *Surgery of combined anal and rectal diseases requires an unconventional tactics and methods of treatment of these pathologies, which provide minimal impact on tissues, preventing postoperative complications. The aim of the study was to conduct a comparative evaluation of the effectiveness of new radiosurgical and electrosurgical technologies in the treatment of combined anal and rectal diseases by analyzing the clinical course of the postoperative period and the impact of these energy devices on the morphostructure of operated tissues. The results of treatment of 747 patients with combined anal and rectal diseases divided into four research groups and control group have been analyzed. In the first research group 169 (22,6%) patients with electrosurgery device "ERBE ICC 200" have been operated on in the second research group – 114 (15,3%) patients with electrosurgery device "EFA", in the third research group – 107 (14,3%) patients – with electrosurgery device "KLS Martin" and in the fourth research group – 245 (32,8%) patients with radiosurgery device "Surgitron". The control group consisted of 112 (14,9%) patients operated with a surgical scalpel. After surgery 30 patients from each study group underwent morphological investigation of rectal and anal tissues for measurement of the thickness of thermal impacts on them, which was performed using an eyepiece-micrometer scale. Due to the minimal and insignificant impact on the tissues during application of electrosurgery devices "KLS Martin", "EFA" and "ERBE ICC 200", as well as radiosurgery device "Surgitron", there were detected neither scar anal strictures in any of the four study groups, nor scarring deformities of the pararectal areas, which contributed to the cosmetic nature of the combined operations and caused rapid rehabilitation of patients in the study groups. In the control group in 2 (2%) patients the formation of scar anal stricture was diagnosed, which required conservative (1 patient) and operative (1 patient) measures to eliminate them. Using modern radiosurgery and electrosurgery technologies for treatment of combined anal and rectal diseases reduces the operation duration, volume of bleeding and intensity of the postoperative pain. Application of these above technologies prevents the occurance of anal strictures and scar pararectal deformations.*

Реферат. Сучасні технології в хірургічному лікуванні поєднаної аноректальної патології та їх результати. Балицький В.В., Захараш М.П., Курик О.Г. *Хірургія поєднаних анальних і ректальних захворювань вимагає нестандартної тактики та методів лікування цих патологій, що передбачають мінімальний вплив на*

тканини, запобігаючи виникненню післяопераційних ускладнень. Метою дослідження було проведення порівняльної оцінки ефективності застосування нових радіохірургічних та електрохірургічних технологій у лікуванні поєднаних захворювань анального каналу і прямої кишки шляхом аналізу клінічного перебігу післяопераційного періоду та впливу цих енергетичних пристроїв на морфоструктуру оперованих тканин. Проаналізовані результати лікування 747 пацієнтів з поєднаними захворюваннями анального каналу і прямої кишки, розподілених на чотири досліджувані групи та контрольну групу. У першій досліджуваній групі було прооперовано 169 (22,6%) хворих електрохірургічним апаратом "ERBE ICC 200", у другій досліджуваній групі – 114 (15,3%) хворих електрохірургічним апаратом "ЭФА", у третій досліджуваній групі – 107 (14,3%) хворих електрохірургічним апаратом "KLS Martin" та в четвертій досліджуваній групі – 245 (32,8%) хворих радіохірургічним апаратом "Surgitron". Контрольну групу склали 112 (14,9%) пацієнтів, прооперованих з використанням хірургічного скальпеля. Після оперативних втручань 30 пацієнтам з кожної досліджуваної групи проводилось морфологічне дослідження тканин прямої кишки та анального каналу з метою вивчення глибини термічного впливу на них за допомогою шкали окуляр-мікрометра. Завдяки мінімальному та незначному впливу на тканини при використанні апаратів високочастотної електрохірургії "KLS Martin", "ЭФА" та "ERBE ICC 200" так, як і при використанні апарату радіохвильової хірургії "Surgitron", у жодного пацієнта з чотирьох досліджуваних груп не було виявлено ні рубцевих анальних стриктур, ні рубцевих деформацій параректальних ділянок, що сприяло косметичності комбінованих операцій та зумовлювало швидку реабілітацію пацієнтів досліджуваних груп. У контрольній групі у 2 (2%) пацієнтів було діагностовано формування рубцевої анальної стриктури, що вимагало консервативних (в 1 пацієнта) та оперативних (в 1 пацієнта) заходів з їх ліквідації. Використання сучасних радіохірургічних та електрохірургічних технологій для лікування поєднаних анальних та ректальних захворювань зменшує тривалість операції, інтраопераційну крововтрату, післяопераційний больовий синдром. Застосування вищевказаних технологій для лікування поєднаних анальних і ректальних захворювань запобігає виникненню анальних стриктур та рубцевих деформацій параректальних ділянок.

During the last two or three decades there is a global trend towards a rapid increase in the incidence of proctological diseases, among which the proportion of combined anal and rectal pathology today reaches 65% [5] among all proctological diseases.

The relevance of the problem of combined anal and rectal diseases is too high, which have determined today by lack of a unified approach for surgery of this category of patients. Moreover, a rather small number of publications on the results of scientific researchs are devoted to the study of this problem. Complications after combined operations on the anal canal and rectum are scars anal strictures, anal sphincter insuffiency and perineal deformations [2, 4].

A rapid development of the latest surgical technologies allowed to introduce new high-tech tools for surgery of various anorectal diseases into coloproctological practice [5]. A special difference of the modern period is the use of various energy devices for the treatment of such patients.

Thus, Valleylab (USA) has developed a bipolar electro-thermal system "LigaSure" for surgical treatment of hemorrhoids [3]. This method of hemorrhoidectomy is called "closed sutureless hemorrhoidectomy". The depth of thermal impact on the tissues when using this system is 2 mm [5]. But this method, according to the references, is accompanied by the occurrence of postoperative bleeding (2.1-6.1%), severe pain (5-7.6%), dysuric disorders (5%), tenesmus (10%), prolonged healing. postoperative wounds of the anal canal (6%) and recurrence of anorectal pathology (9.1%) [7, 8, 9, 10].

The ultrasonic harmonic scalpel "UltraCision" from EthiconEndo-Surgery (USA) has become widely used in coloproctology, which thermal impact on the tissues does not exceed 1.5 mm. [7]. But this technology is associated with the occurrence of postoperative bleeding (2.1-6.1%), severe pain (5-7.6%), urinary disorders (5%), tenesmus (10%), long-term healing of anal canal wounds during postoperative period (6%) and disease recurrence (9.1%) [7, 8, 9, 10].

Thus, the urgency of the problem of combined pathology of the anal canal and rectum is quite high and requires the creation and implementation of modern minimally invasive and highly effective methods of surgical treatment of these diseases, which would cause minimal tissue damage, absence of complications and recurrence, reduce duration of inpatient treatment and would promote fast medical rehabilitation of patients.

The aim of the study was to conduct a comparative evaluation of the effectiveness of new radiosurgical and electrosurgical technologies in the treatment of combined diseases of the anal canal and rectum by analyzing the clinical course of the postoperative period and the impact of these energy devices on the morphostructure of operated tissues.

MATERIALS AND METHODS OF RESEARCH

In the period from January 2007 to March 2020 in the proctology department of Khmelnytsky Regional

Hospital of Khmelnytsky Regional Council there were operated 635 patients with combined diseases of the anal canal and rectum, which included various variants of anal polyps, chronic anal fissures, anal fistulas, chronic hemorrhoids, hypertrophied perianal skin markers.

The research was conducted in accordance with the principles of bioethics set out in the WMA Declaration of Helsinki – "Ethical principles for medical research involving human subjects" and "Universal Declaration on Bioethics and Human Rights" (UNESCO).

Among the observed patients, 358 (56.4%) patients were males and 277 (43.6%) were females. The age of patients ranged from 18 to 76 years.

By free sampling, all observed patients were operated using the "Surgitron" radiosurgery device and the "ERBE ICC 200", "EFA" and "KLS Martin" electrosurgery devices. All 635 patients, who were divided into 4 study groups, signed a voluntary informed consent for anesthesia and perfoming surgical operations, which were performed using spinal anesthesia.

The control group consisted of 112 patients with combined anal and rectal diseases, who were operated traditionally using a scalpel.

The first study group consisted of 169 patients, who were operated with device "ERBE ICC 200". Of these, 104 (61.5%) patients were males and 65 (38.5%) were females, age – from 20 to 76 years.

The second study group consisted of 114 patients, who were operated with device "EFA. Of these, 65 (57%) patients were males and 49 (43%) were females, age – from 24 to 72 years.

The third study group consisted of 107 patients, who were operated with device "KLS Martin". Of these, 43 (40.2%) patients were males and 64 patients (59.8%) were females, age – from 19 to 65 years.

The fourth study group consisted of 245 patients, who were operated with device "Surgitron". Of these, 143 (58.4%) patients were males and 102 (41.6%) were females, age – from 18 to 74 years.

After surgery using the above radiosurgical and electrosurgical technologies in 30 patients from each study group, the clinical course of the postoperative period was analyzed and morphological examination of anal canal and rectal tissues to measure the depth of thermal impact on them was performed using an eyepiece scale.

The operating material was fixed in 10% neutral formalin solution. Later, the material was placed in a carousel histoprocessor type STP-120, for filling paraffin blocks, station EC-350 was used, for cutting paraffin blocks – rotary microtome series HM – 340E, for staining histological specimens – machine Robot-Stainer HMS-740 (all devices from MICROM InternationalGmbH). Histological preparations were stained with hematoxylin and eosin. An Axioskop 40 microscope with an Axio Cam MRc5 camera (Karl Zeiss) was used.

Statistical analysis of the obtained data was performed using IBM SPSS STATISTICS SUBSCRIPTIONAL TRIAL software. L/N: L-CZAA-BHG85V. The normality of distribution was performed using the Kolmogorov-Smirnov criteria, with Lillefors and Shapiro-Wilk amendments. The equality of variances was checked using the Livin test. The critical level of statistical significance was 0.05 [1].

In groups with homogeneous variances, where the values of the indicators were distributed normally, one-way analysis of variance was used to compare the groups, and the Bonferroni test was used for pair comparison. In groups with inhomogeneous variances, where the values of the indicators were normally distributed, the Welch test and the Brown-Forsyth test were used for comparison, and the Games-Howell test was used for pair comparison. In groups with homogeneous variances, where the values of the indicators were not distributed normally, the Kraskel-Wallis test was used for comparison, and the Mann-Whitney test was used for pair comparison [1].

For pair comparison, the group-adjusted critical significance level was defined as 0.05/10=0.005 (because 5 groups were compared and 10 pair comparisons were performed).

RESULTS AND DISCUSSION

The most common variants of combined diseases of the anal canal and rectum, which occurred in all study groups and types of surgical interventions in 447 patients are presented in Table 1.

Comparative characteristics of the clinical course of the postoperative period with the use of radiosurgical device "Surgitron", electrosurgical devices ERBE ICC 200, "EFA" and "KLS Martin", as well as a metal scalpel in the surgical treatment of patients with combined diseases of the anal canal and rectum is shown in Table 2, in which the indicators are presented as M±SD, where M – arithmetic mean, S – standard deviation (95% CI mean).

As a result of the study it was found that when using radiosurgical device "Surgitron" and electrosurgical device "KLS Martin", the depth of coagulation necrosis was approximately the same being 0.189±0.085 mm at a radiofrequency exposure, and with an electrosurgical device "KLS Martin" – 0.194±0.09 mm. These indicators were the lowest among all study groups. These devices had the shortest duration of surgery, low blood loss volume, least pronounced postoperative pain, and the shortest inpatient treatment term.

Table 1

The most common variants of combined anal and rectal diseases in the studied groups and the types of performed surgical operations

Variant of combined pathology	The type of the performed surgical operations	Number of patients (% of the total number)
Anal polyp and chronic anal fissure	Polypectomy and excision of the anal fissure	110 (17,3%)
Combined hemorrhoids and chronic anal fissure	Excision of the anal fissure and hemorrhoidectomy	80 (12,6%)
Anal fistula and combined hemorrhoids	Excision of the anal fistula and hemorrhoidectomy	62 (9,7%)
Anal polyp and combined hemorrhoids	Polypectomy and hemorrhoidectomy	61 (9,6%)
Anal polyp, chronic anal fissure and hypertrophied perianal skin markers	Polypectomy, excision of the anal fissure and electroexcision of hypertrophied perianal skin marker	38 (5,9%)
Anal polyp, chronic anal fissure and combined hemorrhoids	Polypectomy, excision of the anal fissure and hemorrhoidectomy	32 (5,0%)
Anal polyp and external hemorrhoids	Polypectomy and hemorrhoidectomy	22 (3,5%)
Chronic anal fissure and external hemorrhoids	Excision of the anal fissure and hemorrhoidectomy	18 (2,8%)
Hypertrophied perianal skin markers and anal polyp	Electroexcision of hypertrophied perianal skin marker and polypectomy	14 (2,2%)
External hemorrhoids, anal polyp and chronic anal fissure	Hemorrhoidectomy, polypectomy and anal fissure excision	10 (1,6%)

The use of the electrosurgical device "EFA" was accompanied by a greater depth of coagulation tissue necrosis (0.208±0.097 mm), compared with the previous group. The average duration of operations and the period of inpatient treatment were longer.

When using the “ERBE ICC 200” electrosurgical device, the volume of blood loss was the lowest among all study groups, but the depth of coagulation necrosis was the largest (0.302±0.107 mm), which was accompanied by the most severe pain in the postoperative period and the longest period of inpatient treatment. Nevertheless, even the deepest thermal effect on tissues, which according to our data was 0.409 mm when using this device, was much less than the depth of thermal effect on tissues, which, according to some authors, is from 1.5 to 2 mm, respectively, which is often accompanied by the appearance of scar strictures of the anal canal and a longer period of healing of postoperative wounds [2, 5, 6].

The use of a surgical scalpel in the control group was accompanied by the longest duration of operations, the largest blood loss, the most pronounced postoperative pain syndrome and the longest period of inpatient treatment.

The analysis allowed us to establish that the used modern technological devices ("Surgitron", "KLS Martin", "EFA" and "ERBE ICC 200"), due to the minimal and insignificant impact on tissues during surgery in the anorectal area did not lead to the development of complications in any of the patients, including the development of scar strictures, which provided fast rehabilitation of patients. At the same time, in the control group in 2 (2%) patients the formation of scar stricture of the anal canal was detected, which required conservative (in 1 patient) and operative (in 1 patient) measures to eliminate them.

Table 2

Comparative characteristics of the use of modern and traditional surgical technologies for the treatment of combined anal and rectal diseases (M±SD)

Comparison criteria	"Surgitron" (n=30)	"ERBE" ICC 200 (n=30)	"EFA" (n=30)	"KLS Martin" (n=30)	Metal surgical scalpel (n=30)	Statistical significance of difference between groups	Statistical significance of difference between groups in pairs
Duration of operation (min.)	15±3	20±3	25±3	15±3	29±3	<0.001*[1]	<0.001 (S-ER)*; <0.001 (S-EF)*; <0.001 (S-K)*; <0.001 (S-M)*; <0.001 (ER-EF)*; <0.001 (ER-K)*; <0.001 (ER-M)*; 1 (EF-K); <0.001 (EF-M)*; <0.001 (K-M)*[4]
Volume of bleeding (ml)	20±6	15±6	20±3	20±6	40±6	<0.001*[2]	0.003 (S-ER)*; 0.011 (S-EF); 0.011 (S-K); <0.001 (S-M)*; 1 (ER-EF); 1 (ER-K); <0.001 (ER-M)*; 1 (EF-K); <0.001 (EF-M)*; <0.001 (K-M)*[5]
Severity of pain syndrome (need for narcotic analgesics - ml)	2±1	3±1	2±1	2±1	4±1	<0.001*[3]	<0.001 (S-ER)*; <0.001 (S-EF)*; <0.001 (S-K)*; <0.001 (S-M)*; 1 (ER-EF); 0.268 (ER-K); <0.001 (ER-M)*; 0.268 (EF-K); <0.001 (EF-M)*; <0.001 (K-M)*[6]
Duration of inpatient period (days)	4±1	6±1	5±1	4±1	7±1	<0.001*[3]	<0.001 (S-ER)*; <0.001 (S-EF)*; <0.001 (S-K)*; <0.001 (S-M)*; <0.001 (ER-EF)*; <0.001 (ER-K)*; <0.001 (ER-M)*; 0.447 (EF-K); <0.001 (EF-M)*; <0.001 (K-M)*[6]
Depth of coagulation necrosis layer (mm)	0.189±0.085	0.302±0.107	0.208±0.097	0.194±0.09	-	<0.001*[3]	<0.001 (S-ER)*; 0.002 (S-EF)*; <0.001 (S-K)*; 0.464 (ER-EF); 0.773 (ER-K); 0.271 (EF-K)[6]

Notes: *Statistically significant difference (first letters of the names of the devices compared are indicated: S – Surgitron, ER – ERBE ICC200, EF – EFA, K - KLS Martin, M – Metal surgical scalpel). Group comparisons were performed using: [1] – one-way analysis of variance; [2] – the Welch test and the Brown-Forsyth test; [3] – the Kruskall-Wallis test; [4] – the Bonferroni test; [5] – the Games-Howell test; [6] – the Mann-Whitney test.

CONCLUSIONS

1. Using of electrosurgery devices "ERBE ICC 200", "EFA", "KLS Martin", as well as radiosurgery device "Surgitron" for the treatment of combined anal and rectal diseases helps to reduce the duration of surgery, volume of bleeding, pain syndrome after operations, and also, due to the minimum influence on tissues, promotes formation of a delicate elastic scar, causing faster healing of postoperative wounds and improving medical rehabilitation.

2. Application of these modern radiosurgical and electrosurgical technologies for the treatment of combined anal and rectal diseases prevented anal strictures and scarring of perianal areas due to the small depth of tissue necrosis, defining the cosmecis of combined operations.

Contributors:

Balytskyy V.V. – methodology, software, formal analysis, investigation, resources, writing – original draft, visualization, funding acquisition;

Zakharash M.P. – conceptualization, writing – review & editing, project administration;

Kuryk O.H. – validation, data curation, visualization.

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