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## EFFICACY ASSESSMENT OF THE RADIO-WAVE SURGERY AND THE HIGH-FREQUENCY ELECTROSURGERY IN THE TREATMENT OF PATIENTS WITH THE COMBINED ANAL CANAL AND RECTUM PATHOLOGY

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The surgical treatment results obtained in 236 patients with combined pathology of anal canal and rectum using "Surgitron" radio wave surgery device, as well as 50 patients with combined pathology of anal canal and rectum using "KLS Martin" high-frequency electrosurgical device have been analyzed. According to the study results, it was established that using "Surgitron" radio wave surgery device and "KLS Martin" high-frequency electrosurgical device reduces the operation length to  $15 \pm 5$  min, bleeding volume - to  $20 \pm 10$  ml, need of narcotic analgesics - to  $2 \pm 1$  ml and the period of inpatient treatment - to  $4 \pm 1$  days. The morphological study results indicate that application of the above modern technologies leads to insignificant depth of tissue necrosis from  $0.165 \pm 0.11$  mm in case of using "Surgitron" device to  $0.192 \pm 0.12$  mm in case of using "KLS Martin" device providing cosmesis of the operations.

**Key words:** radio-wave surgery device, high-frequency electrosurgical device, metal surgical scalpel, combined pathology, anal canal, rectum.

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The latest two or three decades are characterized by a tendency to a rapid increase in the number of proctologic diseases throughout the world, among which the specific weight of the anal canal and the rectum combined pathology is progressively growing, sometimes reaching 65% [8]. Surgical treatment of the anal canal and rectum combined pathology: hemorrhoids, anal fissures, chronic and acute paraproctitis, their immediate and distant outcomes, possible complications and relapses, is quite actual nowadays, requiring a special approach to the choice of surgical treatment in this pathology [1]. To date, the diagnosis and surgical treatment of combined non-tumor proctologic diseases is a complex and, so far, unsolved problem. Some authors have a positive view of combined operative interventions due to the reduced inpatient treatment length and the absence of re-operation necessity. Others believe that after combined operations, the percentage of complications is higher and performing such operations is only necessary for severe indications [2].

Progressive development of modern surgical technologies contributed to the active implementation of new surgical high-tech methods for various anal canal and rectum pathologies treatment into coloproctological practices. So, one of the first widely used in the coloproctology was the "Liga Sure" electrothermal system for surgical treatment of hemorrhoids. It provided proper hemostasis, tripled the reduction of operation length, reduced the number of dysuric phenomena, and halved the terms of patients' rehabilitation. But, unfortunately, this technique has a number of disadvantages: postoperative bleeding (1.6-2.5%), anal canal strictures (2.1 - 2.8%), relapse of diseases (7.5%) [3].

Application of the HARMONIC ultrasound scalpel for the treatment of anorectal pathology permitted to reduce both the duration of operations and intraoperative blood loss. However, this method is accompanied by the emergence of postoperative bleeding (2 - 6.1%), pronounced pain syndrome (5%), prolonged healing of postoperative wounds (6%) and relapses (9.1%) [4, 7].

Recently, more and more authors recommend to use the "Surgitron" radio-wave scalpel manufactured by Ellman International (USA) for surgical treatment of anorectal pathology. The principle of this apparatus operation lies in the atraumatic incision and coagulation of soft tissues by means of high-frequency radio waves, causing heat in the tissues, under the influence of which disintegration of cell structures and their evaporation occurs, causing the effect of the tissues "di-hescence". At the same time, the thermal damage of the tissues is minimal, and the maximum depth of the coagulation necrosis is 0.1-0.2 mm, which creates favorable conditions for wound healing, reduces the healing duration, inpatient treatment and patients disability terms [5, 6, 9]. The advantages of high-frequency (3.8-4 MHz) radio-wave

surgery are: minimal damage to tissues, acceleration of their regeneration processes, sterilizing effect of radio waves with the indicated frequency, good cosmetic effect [5, 10]. However, it is thought that the hemostatic properties of the radio waves are insufficient, particularly in the presence of biological fluids, which requires additional vascular ligation and reduces its efficacy during hemorrhoidectomy [3, 11].

Thus, the immediacy of the anal canal and rectum combined pathology problem is quite high and contributes to the development and implementation of modern, non-invasive and highly efficient methods of this pathology surgical treatment into the coloproctology practice, which would have a minimal damaging effect on tissues, ensure the absence of complications and relapses in the postoperative period, reduce the timing of inpatient treatment and would facilitate their rapid medical and social rehabilitation.

**The purpose** of the work was to study the impact of “Surgitron” radio-wave surgery apparatus and “KLS Martin” high-frequency electrosurgery apparatus on the anal canal and rectum tissues in the treatment of their combined pathology to determine the efficacy of these surgical techniques application.

**Materials and methods.** In the period of September 2009 - August 2017, 236 patients with the combined anal canal and rectum pathology were operated at the proctology department of the Khmelnsky Regional Hospital using the “Surgitron” radio-wave surgery apparatus. Among them, 142 (60.2%) patients were males and 94 (39.8%) were females. The age of patients ranged from 18 to 74 years. In the first experimental group, surgical intervention for all patients was performed using the “Surgitron F.F.P.F EMC” radio-wave surgery apparatus produced by the Ellman International company (USA). The apparatus is based on the effect of converting electric current into radio waves with an output frequency of 3.8-4.0 MHz, under the impact of which the tissue being cut resists to radio waves penetration, generating heat, which makes cells of the tissue, located on the waves’ pathways, to break up and evaporate, and the tissue “dihecence” occurs. This feature of the radio wave surgery apparatus with the above wave frequency causes a soft effect on the tissues with minimal damage.

In the period from October 2017 to August 2018, 50 patients with the combined anal canal and rectum pathology were operated using the “KLS Martin” high-frequency electrosurgery apparatus at the Proctology Department of the Khmelnsky Regional Hospital. Among them, 20 (40%) patients were males and 30 patients (60%) - females. The age of patients ranged from 19 to 65 years. In the second experimental group, surgical intervention was performed for all patients using the “KLS Martin ME MB1” high-frequency electrosurgery apparatus, produced by “KLS Martin Group” (Germany). An important feature of this electrosurgical unit with an initial frequency of 450 kHz is the available mixed-cutting mode with an edge coagulation effect, as well as the “spray-coagulation” mode, which results in rapid and uniform hemostasis with minimal carbonization, which improves wounds healing and prevents their deep necrosis. The control group included 112 patients with a combined anal canal and rectum pathology, which were traditionally operated using a metal scalpel. All surgical interventions were performed under spinal anesthesia.

After surgical interventions using “Surgitron” radio-wave surgery and “KLS Martin” high-frequency electrosurgery units, morphological examination of tissues was performed to study the depth of their necrosis, and for comparison, a similar study was performed on the tissues of the anal canal and rectum after using a metallic surgical scalpel. Operating material was fixed in 10% neutral formalin solution. The material was then processed in the STP-120 carousel-type histoprocessor; the EC-350 station was used to fill the paraffin blocks; the rotary microtome of HM-340E series - for cutting the paraffin blocks; for the histological preparations staining - the Robot-Stainer HMS-740 automated device (all devices produced by Carl Zeiss MICROM International GmbH). The preparations were stained with hematoxylin and eosin. The Axioskop 40 microscope was used with the Axio Cam MRC5 (Karl Zeiss) photo camera.

**Results of the study and their discussion.** In the course of the study, it was found that in the first study group in 181 patients (77%) 2 pathologies were detected, in 49 patients (21%) - 3 pathologies, and in 6 patients (2%) - 4 pathologies of the anal canal and rectum. The following variants of the anal canal and rectum combined pathology were most common: chronic anal fissure and anal polyp - in 40 (17%) patients, chronic anal fissure and combined hemorrhoids - in 31 (13%) patients, combined hemorrhoids and anal polyps - at 23 (9.7%) patients, combined hemorrhoids and chronic paraproctitis - in 23 (9.7%) patients, external hemorrhoids and anal polyp - in 18 (7.2%) patients, external hemorrhoids and chronic anal fissures - at 12 ( 5%) of patients, chronic anal fissure, anal polyp and hypertrophied perianal skin tags - in 11 (4.6%) patients, combined hemorrhoids, chronic anal fissure and anal polyp - in 10 (4.2%) patients, external hemorrhoids, chronic anal fissure and anal polyp - in 10 (4.2% ) of patients, anal polyps and hypertrophied perianal skin tags - in 10 (4.2%) patients. The nature of the performed surgical interventions depended on the variant of the combined anal canal and rectum pathology. The following types of combined operations were performed on patients: anal fissure excision and polypectomy - in 23 (9.7%)

patients (37%), anal fissures and hemorrhoidectomy were performed to 31 (13%) patients, hemorrhoidectomy and anal fistula excision – in 23 (9,7%) patients, hemorrhoidectomy and polypectomy - in 23 (9,7%) patients, hemorrhoidectomy and polypectomy - in 18 (7,2%) patients, hemorrhoidectomy and excision of the anal fissure - in 12 (5%) patients, excision of the anal fissure, polypectomy and electroexcision of hypertrophied perianal skin tags - in 11 (4,6%) patients, hemorrhoidectomy, anal fissure excision and polypectomy - in 10 (4,2%) patients, hemorrhoidectomy, anal fissure excision and polypectomy - at 10 (4,2 %) patients, polypectomy and electroexcision of hypertrophied perianal skin tags - in 10 (4,2%) patients. During the study, in the second experimental group, it was found that in 28 (56%) patients 2 diseases were diagnosed, in 17 (34%) – 3 diseases, in 4 (8%) – 4 diseases, in 1 (2%) patient 5 diseases of the anal canal and rectum were revealed. The following variants of the combined anal canal and rectum pathology occurred most frequently in this group: chronic anal fissure and anal polyp - in 8 (16%) patients, chronic anal fissure, anal polyp and combined hemorrhoids - in 7 (14%) patients, chronic anal fissure, anal polyp and hypertrophied perianal skin tags - in 5 (10%) patients, combined hemorrhoids and chronic paraproctitis - in 4 (8%) patients, external hemorrhoids and chronic anal fissure - in 4 (8%) patients, combined hemorrhoids and chronic anal fissure - in 4 (8%) patients, chronic paraproctitis and anal polyp - in 2 (4%) patients, external hemorrhoids and hypertrophied perianal skin tags - in 2 (4%) patients, anal polyps and hypertrophied perianal skin tags - in 2 (4%) patients.

In patients of the second experimental group, the following types of combined operations were performed in the most common variants of combined pathology: excision of the anal fissure and polypectomy - in 8 (16%) patients, anal fissure excision, polypectomy and hemorrhoidectomy - in 7 (14%) patients, excision of the anal fissure , polypectomy and electroexcision of hypertrophied perianal skin tags - in 5 (10%) patients, hemorrhoidectomy and excision of the anal fistula - in 4 (8%) patients, hemorrhoidectomy and excision of the anal fissure - in 4 (8%) patients, excision of the anal fistula and polypectomy – in 2 (4%) patients with hemorrhoidectomy and electroexcision of hypertrophied perianal skin tags in 2 (4%) patients, polypectomy and electroexcision of hypertrophied perianal skin tags - in 2 (4%) patients. As a result of the performed study, it was found that using the “Surgitron” radio-wave surgery apparatus the duration of the operation in the first group of patients was from 10 to 15 minutes, in the second group of patients using the “KLS Martin” high-frequency electrosurgery apparatus the duration of the operation was from 15 to 20 minutes, and in the control group using a metal scalpel - from 25 to 35 minutes. The volume of blood loss in the first study group was from 10 to 20 ml, in the second study group it was from 15 to 25 ml, while in the control group it was greater, ranging from 30 to 50 ml. The post-operative pain syndrome was more pronounced in patients of the control group, where the need for narcotic drugs for analgesia was between 3 and 5 ml, and in the first and the second groups, patients needed 1 to 3 ml of narcotic drugs for analgesia. The period of inpatient treatment in the first study group was from 3 to 4 days, in the second study group - from 4 to 5 days, and in the control group it was greater and ranged from 6 to 8 days.

In the postoperative period, the patients in the first and second study groups did not show signs of anal sphincter deficiency, as well as the formation of scar stricture of the anal canal, while in the control group in 4 (3,6%) patients, the formation of scar stricture of the anal canal was revealed, which required conservative (in 2 patients) and operative (in 2 patients) measures for their elimination.

In the morphological study of tissues, it was found that using the “Surgitron” radiosurgical apparatus, there is a preservation of the tissue structure with the formation of a thin coagulation necrosis layer at the cutting edge, the mean depth of which was  $0.165 \pm 0.11$  mm. (fig. 1).

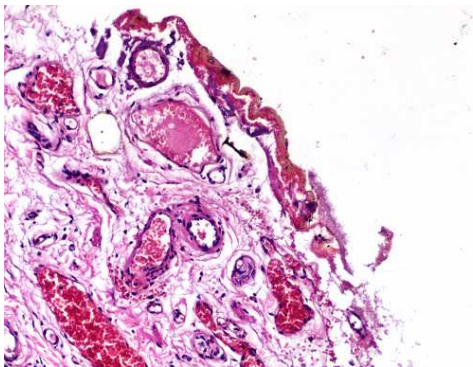


Fig.1. Cutting edge made with the “Surgitron” radio-wave surgery apparatus permits the preservation of the tissue structure with the formation of a thin coagulation necrosis layer along the cutting edge. Staining with hematoxylin-eosin. Magnification x100.

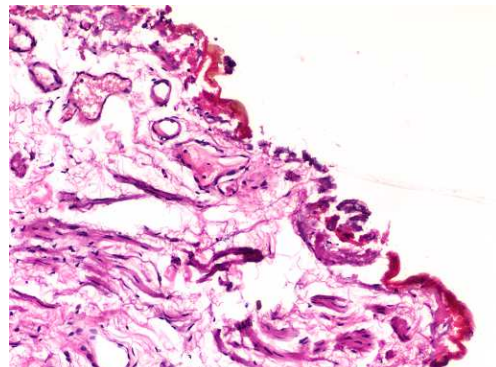


Fig. 2. Preservation of tissue structure with the formation of a thin coagulation necrosis layer after using the “KLS Martin” electrosurgical apparatus. Staining with hematoxylin and eosin. Magnification x100.

With the use of the “KLS Martin” high-frequency electrosurgery apparatus, the incision of tissues occurred due to their dissection and coagulation with control of hemostasis and the formation of a thin coagulation necrosis layer, with the mean thickness of  $0.192 \pm 0.12$  mm (fig. 2).

When using a metal scalpel, multiple hemorrhages were observed at the edges of the surgical cuttings (fig. 3), which indicates a significant tissue injury and subsequent slow healing of the wound and may prevent healing by its primary adhesion, leading to cicatricial changes.

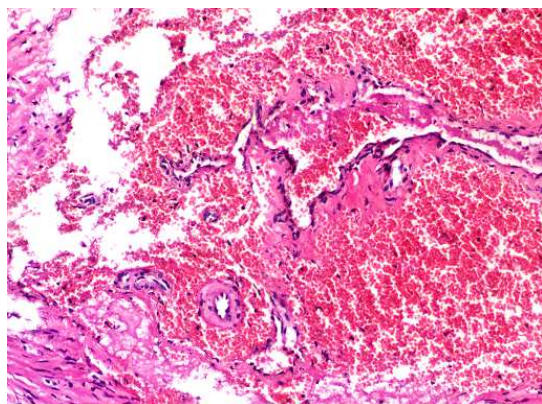


Fig. 3. The edge of the wound after using a metal scalpel – multiple hemorrhages. Staining with hematoxylin-eosin. Magnification x100.

The use of the “Surgitron” radio-wave surgery apparatus, as well as the “KLS Martin” high-frequency electrosurgical apparatus for treating patients with combined anal canal and rectum pathology, was accompanied by formation of a thin coagulation necrosis layer in tissues with the depth ranging from 0.055 to 0.312 mm, reducing pain in patients of the first and second study groups by 2 - 3 times, therefore they needed by 2 - 3 times less narcotic drugs for anesthesia compared to the control group. The minimal effect on tissue using the “Surgitron” radio-wave surgery apparatus (from 0.055 to 0.275mm), as well as the “KLS Martin” high-frequency electrosurgical apparatus (from 0.072 to 0.312mm), prevented the occurrence of the anal canal scar strictures, reducing the wound healing

time, contributing to the formation of cosmetic postoperative scar and providing faster rehabilitation of patients in the studied groups.

Therefore, in addition to radio-wave surgery and high-frequency electrosurgery, there are currently various options for surgical treatment of combined pathology of the anal canal and rectum, such as cryodestruction, plasma surgery, ultrasound surgery, laser surgery, infrared surgery. Our data, according to which radiowave surgery and high-frequency electrosurgery have significant advantages over other surgical methods in the treatment of combined pathology of the anal canal and rectum, coincide with the data of other authors [5, 9, 11]. The main advantages, which the authors also point out, are that the incision and coagulation occur simultaneously, the adjacent tissue does not undergo significant changes due to the decrease in temperature during the intervention. It is also considered that the risk of postoperative infection is reduced due to the effect of sterilization of radiowave exposure [10]. However, some authors point out the advantages of using the radiowave method over electrosurgical. Radu V. et al [10] note that when using radio-wave surgery, cuts and hemostasis occur simultaneously, and when using electrosurgical devices for different interventions, pre-settings are required. The authors also say that with electrosurgical intervention, the healing period is longer, with possible scar formation compared to radiowave surgery, which does not match our data.

## Conclusions

1. The use of the “Surgitron” radio-wave surgery apparatus, as well as the “KLS Martin” high-frequency electrosurgical apparatus for treating patients with combined anal canal and rectum pathology, due to insignificant tissue effects, reduces the duration of the operation, reduces the volume of intraoperative blood loss, significantly reduces the pain syndrome in postoperative period, reduces the terms of inpatient treatment, thus causing rapid medical and social rehabilitation of patients.

2. The use of these modern radiosurgical and electrosurgical technologies is significantly better than using a surgical metallic scalpel because they, due to minimal impact on the tissue, provide faster healing of the postoperative wound, contributing to the formation of a delicate elastic scar and preventing the formation of the anal canal scar strictures, as well as the anal sphincter deficiency in the postoperative period.

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### Реферати

#### ОЦЕНКА ЭФФЕКТИВНОСТИ ЗАСТОСУВАННЯ РАДІОХВИЛЬОВОЇ ХІРУРГІЇ ТА ВИСОКОЧАСТОТНОЇ ЕЛЕКТРОХІРУРГІЇ У ЛІКУВАННІ ПАЦІЄНТІВ З ПОЄДНАНОЮ ПАТОЛОГІЄЮ АНАЛЬНОГО КАНАЛУ І ПРЯМОЇ КИШКИ

Балицький В.В., Захараш М.П., Курик О.Г.

Проведено аналіз хірургічного лікування 236 пацієнтів з поєднаною патологією анального каналу і прямої кишки з використанням апарату радіохвильової хірургії "Surgitron", а також 50 пацієнтів з поєднаною патологією анального каналу і прямої кишки з використанням апарату високочастотної електрохірургії "KLS Martin". В результаті дослідження було встановлено, що застосування апарату радіохвильової хірургії "Surgitron", а також високочастотного електрохірургічного апарату "KLS Martin" скорочує тривалість операції до  $15 \pm 5$  хв, зменшує об'єм крововтрати до  $20 \pm 10$  мл, потребу в наркотичних анальгетиках до  $2 \pm 1$  мл та терміни стаціонарного лікування пацієнтів до  $4 \pm 1$  доба. Результати морфологічного дослідження свідчать про те, що застосування вищевказаних сучасних хірургічних технологій призводить до незначної глибини некрозу тканин від  $0,165 \pm 0,11$  мм при використанні апарату "Surgitron" до  $0,192 \pm 0,12$  мм при використанні апарату "KLS Martin", забезпечуючи косметичність операцій.

**Ключові слова:** апарат радіохвильової хірургії, апарат високочастотної електрохірургії, металевий хірургічний скальпель, поєднана патологія, анальний канал, пряма кишка.

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#### ОЦЕНКА ЭФФЕКТИВНОСТИ ПРИМЕНЕНИЯ РАДИОВОЛНОВОЙ ХИРУРГИИ И ВИСОКОЧАСТОТНОЙ ЭЛЕКТРОХИРУРГИИ В ЛЕЧЕНИИ ПАЦИЕНТОВ С СОЧЕТАННОЙ ПАТОЛОГИЕЙ АНАЛЬНОГО КАНАЛА И ПРЯМОЙ КИШКИ

Балицький В.В., Захараш М.П., Курик О.Г.

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