

<https://doi.org/10.33878/2073-7556-2024-23-2-85-92>



Hemorrhoidectomy with lateral ultrasonic dissection in cutting mode in patients with stages 3–4 hemorrhoids

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ABSTRACT *AIM: to assess original method of hemorrhoidectomy with lateral ultrasonic dissection in cutting mode in patients with stages 3–4 hemorrhoids.*

PATIENTS AND METHODS: a retrospective study included 140 patients with hemorrhoids 2–4 stages. In the main group (n = 80), an original technique of lateral ultrasound dissection in cutting mode was used (patent for invention No. 2722997). Patients in the control group (n = 60) underwent Milligan-Morgan hemorrhoidectomy using electrosurgical scalpel.

RESULTS: significant differences were achieved in intensity of pain syndrome, morbidity rate, which were significantly in the main group. Histology showed that the depth of coagulative necrosis when in the original technique was $145 \pm 25 \mu\text{m}$ vs $1730 \pm 180 \mu\text{m}$ in the controls ($p < 0,001$). Anorectal manometry data, significantly less dysfunction anal sphincter was noted in the postoperative period in the main group.

CONCLUSION: hemorrhoidectomy with lateral ultrasonic dissection in cutting mode reduces tissue trauma, morbidity rate and intensity of pain, and also promotes rapid restoration of anal continence.

KEYWORDS: stage 3–4 hemorrhoids, hemorrhoidectomy with lateral ultrasonic dissection in cutting mode, removal of hemorrhoids with an electrosurgical scalpel, postoperative complications, transanal manometry, pathomorphological changes

CONFLICT OF INTEREST: the authors declare no conflict of interest

FORCITATION: Sazonov A.A., Maistrenko N.A., Romashchenko P.N., Ardankin A.G. Hemorrhoidectomy with lateral ultrasonic dissection in cutting mode in patients with stages 3–4 hemorrhoids. *Koloproktologia*. 2024;23(2):85–92. (in Russ.). <https://doi.org/10.33878/2073-7556-2024-23-2-85-92>

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Received — 23.01.2024

Revised — 19.03.2024

Accepted for publication — 24.04.2024

INTRODUCTION

Hemorrhoids is one of the socially significant diseases, which is confirmed by the high prevalence, especially in industrialized countries. According to the results of multicenter studies, the incidence of hemorrhoids among the adult population of megacities reaches 30–40% [1,2]. Considering that the main exogenous factors contributing to circulatory disorders in hemorrhoids and degeneration of their skeletal apparatus (inactivity and irregular diet with low fiber content) have become characteristic features of the modern human lifestyle, the prospect of further increase in morbidity seems obvious. The primary diagnosis is often established in the late stages of hemorrhoids,

when minimally invasive surgical methods cannot provide the proper level of radicality [3,4]. In this regard, excision procedures based on the principles of hemorrhoidectomy proposed in 1937 by Milligan, E. and Morgan, C. have not lost their significance and, according to a number of experts, remain the ‘gold’ standard in the treatment [4,5].

The most significant disadvantage of hemorrhoidectomy, of course, is its traumatic nature, which creates the prerequisites for an intense and persistent pain syndrome due to the high concentration of nociceptors in the anoderm. The latter not only significantly complicates the rehabilitation of patients, but also contributes to the development of complication morbidity [5,6]. It is noteworthy that

according to a multicenter study, which estimated the intensity of pain in 115 thousand patients on the first day after performing 179 different procedures, hemorrhoidectomy took the 3rd place among all operations, the second only to coloproctectomy and pancreatoduodenal resection [7]. Thus, the reduction of pain syndrome in the postoperative period remains one of the problematic issues in providing surgical care to patients with hemorrhoids.

An equally urgent task is to reduce the morbidity risk rate, which remains very high after hemorrhoidectomy. Thus, according to some authors, urinary retention in the early postoperative period is noted in almost every fourth patient, and the risk of bleeding reaches 10% [1, 5]. Late complications as incontinence and anal stricture are less common: in 3–8%, however, given their disabling nature, such indicators cannot be considered satisfactory [2,6]. A promising direction in improving the results of surgical treatment of this disease, according to Russian and foreign experts, is the performance of hemorrhoidectomy using high-energy devices [1,4,6]. One of them is an ultrasonic (harmonic) scalpel, the principle of operation of which is based on the induction of high-frequency and low-amplitude vibrations, leading to the destruction of hydrogen compounds in collagen protein structures with their gluing, thereby obturation of blood vessels with a diameter of up to 3–5 mm is achieved. An equally important feature of the interaction of the harmonic scalpel with biological tissues is the cavitation effect resulting from vibrations, which ensures the separation of tissues within the anatomical layer [8,9]. The mechanisms presented above allow, on the one hand, to achieve reliable hemostasis, and, on the other hand, to carry out precision tissue dissection [10,11]. The first reports of performing hemorrhoidectomy with an ultrasound scalpel were published by Armstrong, D.N. et al. at the beginning of the XXI century. The authors drew attention to a decrease in the intensity of

pain syndrome in the postoperative period, as well as a reduction in the period of disability [10]. Extensive experience in using this technique has been summarized by specialists of the RNMRC of Coloproctology of the Ministry of Health of the Russian Federation. The results of their research have demonstrated that hemorrhoidectomy with an ultrasonic scalpel has a number of advantages compared to other methods [9]. Thus, the high prevalence and late diagnosis of hemorrhoids, along with dissatisfaction with the results of surgeries performed, do not allow us to doubt the relevance of searching for new and improving already proven methods of surgical treatment.

AIM

To analyze the results of the application of the original technique of hemorrhoidectomy with lateral ultrasound dissection in cutting mode in patients with hemorrhoids stages 3–4.

PATIENTS AND METHODS

A retrospective cohort study of the clinical and morphofunctional results of surgical treatment of 145 patients with stages 3–4 hemorrhoids who were operated on in the period between September 01, 2019 and September 01, 2023 was done. Depending on the method of surgical treatment, patients were divided into 2 groups.

Representatives of the control group ($n = 65$) underwent the Milligan-Morgan hemorrhoidectomy using monopolar electrocoagulation. Patients of the main group ($n = 80$) underwent hemorrhoidectomy using the original technique of lateral ultrasound dissection in cutting mode (patent for invention No. 2722997) [12].

The main essence of the technique is to mobilize the external component of the hemorrhoidal complex from its lateral side using an ultrasonic scalpel (Fig. 1A). To minimize the

Table 1. *Clinical characteristics of patients*

	Main Group (n = 80)	Control Group (n = 65)	p-value
Gender, abs. (%)			0.9
Male	46 (58)	36 (55)	
Female	34 (42)	29 (45)	
Mean age, years	56.4 ± 4.5	53.7 ± 6.0	0.8
Stage of hemorrhoids, abs. (%)			0.24
– 3	26 (32)	23 (36)	
– 4A	23 (29)	25 (38)	
– 4B	31 (39)	17 (26)	
Combination of hemorrhoids with chronic anal fissure, abs. (%)	19 (23)	10 (15)	0.3
Charlson comorbidity index, points	4.9 ± 0.5	4.6 ± 0.7	0.9

thermal effect on the fibers of the subcutaneous portion of the external sphincter, tissue dissection was performed with the sharp edge of a titanium blade of a harmonic scalpel in cutting mode. After mobilization, the vascular pedicle was stitched, and the hemorrhoidal node was cut off with an ultrasonic scalpel, which also functions in cutting mode (Fig. 1B). Postoperative wounds were not sutured and are conducted openly (Fig. 1C).

The main feature of the presented technique, which is of fundamental importance, is the use of the highest (fifth) level of the amplitude of vibrations of the working branch of the ultrasonic scalpel, which ensures the predominance of the effect of dissection of tissues over

their coagulation (cutting mode) [13]. This, in turn, makes it possible to significantly reduce the thermal effect on tissues, which helps to reduce the degree of trauma of the surgery. It is important to emphasize that the use of the cutting mode does not have a negative impact on the safety of the surgical aid from the point of view of the reliability of hemostasis, since the treatment of the vascular pedicle is carried out using traditional (ligature) technique [13]. For an integral assessment of the clinical manifestations of the disease, the classification of chronic hemorrhoids modified by the staff of the RNMRC of Coloproctology of the Ministry of Health of the Russian Federation was used [14]. During the comparative analysis of the

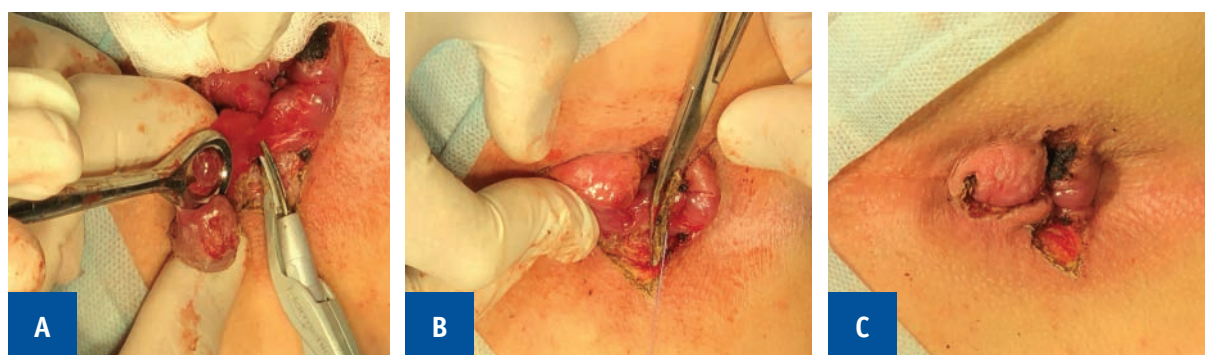


Figure 1. Stages of hemorrhoidectomy with lateral ultrasound dissection in cutting mode: A — mobilization of the hemorrhoid; B — treatment of the vascular pedicle; C — final appearance of postoperative wounds

studied groups, there was no significant difference in the main clinical indicators (Table 1). It should be noted that in the main group of patients, a combination of hemorrhoids with chronic anal fissure was somewhat more common, which did not have a fundamental effect on the choice of surgical tactics, but required a more scrupulous approach to its implementation to prevent anal stricture and a number of other complications.

The comparative analysis of the results of surgical treatment was complex. At the first stage, the most important clinical indicators were evaluated: the operation time, the morbidity rate, the intensity of pain syndrome, as well as the quality of life of patients in the late postoperative period. As part of the analysis of the pain syndrome, the original questionnaire (priority reference No. 2022114928) was used, which, in our opinion, allows us to objectify its assessment through the implementation of a pathophysiological approach by taking into account three indicators in a comprehensive manner: the mean daily intensity of pain on a visual analog scale, the degree of its effect on the act of defecation and motor activity of the patient, as well as the need for analgesics [10]. The quality of life of patients was assessed using the SF-36 questionnaire in 6–12 months after surgery.

As part of a comprehensive analysis of the traumatic nature of operations, morphofunctional changes occurring in the rectal tissues in the early postoperative period were studied. To determine the degree of pathophysiological disorders, the function of the rectal sphincter was studied using balloon manometry: intraanal pressure at rest was assessed, as well as with volitional contraction of the sphincter before the surgery and on the 3rd day after surgery [13]. To study the nature of pathomorphological changes in tissues, a histology of the removed hemorrhoids was performed using a standard technique with staining of specimens with hematoxylin and eosin.

Statistical processing was carried out using the STATISTICA 10 program for Windows (StatSoft Inc., USA) and Microsoft Excel (Microsoft Office 2020). The Shapiro-Wilk criterion was used to test the studied aggregates for the normality of the distribution. As part of the statistical analysis of the results obtained, when comparing parameters between the groups, the Student t-test was used for quantitative values; when analyzing four-field tables, qualitative indicators compared the Pearson χ^2 with the Yates correction at expected rates > 10 and with the Fisher two-sided exact test at expected rates < 10 ; multifield tables compared the Pearson χ^2 . The differences were considered significant at $p < 0.05$.

RESULTS

The mean operation time in the main group of patients turned out to be less than in the control group: 27 ± 5 minutes versus 39 ± 7 , respectively ($p = 0.06$), which was due to better visualization of the surgical field and the lack of need for additional hemostasis when performing hemorrhoidectomy with lateral ultrasound dissection in cutting mode. During the comparative assessment of the pain syndrome, lower values of its intensity were traced in representatives of the main group, while the differences during the first three days after the surgery reached statistical significance

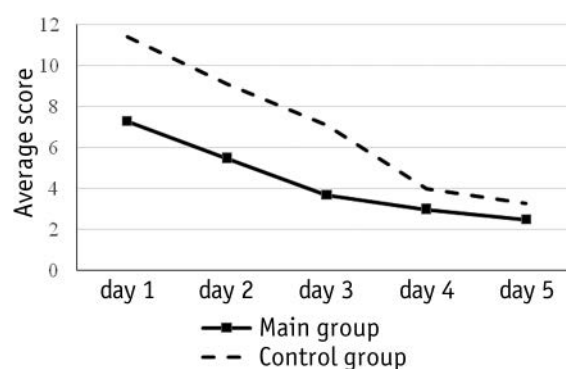


Figure 2. Dynamics of pain intensity

Table 2. Structure of postoperative morbidity

Morbidity, abs. (%)	Main group (<i>n</i> = 80)	Control Group (<i>n</i> = 65)	<i>p</i> -value
Bladder dysfunction	4 (5)	8 (12)	0.1
Bleeding	–	1 (1.5)	0.4
Incontinence (1st degree)	1 (1)	3 (4.5)	0.3
Stricture of the anal canal	–	2 (3)	0.2

Note: * Two patients in the control group developed 2 complications

(Fig. 2). It should be noted that in 11% of patients in the control group, nonsteroidal anti-inflammatory drugs proved ineffective, which forced the resort to a short-term course of opioid analgesics while there was no such need in the main group of patients.

Postoperative complications developed in 5 patients in the main group and in 12 in the control group, which amounted to 6.3% and 18.4% ($p = 0.04$). The most common of these was bladder dysfunction (Table 2). The most severe complication (grade IIIa as per the Clavien-Dindo scale) in the form of bleeding, which required hemostasis in the operating room, was noted only in one patient of the control group. It should also be noted that two representatives of this group had the anal stricture, which was eliminated by augmentation. Symptoms of anal incontinence of the I degree were noted in one patient of the main group and in 3 patients of the control group, while in all cases they were transient in nature and did not require surgery. The mean post-op hospital stay after hemorrhoidectomy with lateral ultrasound dissection in the cutting mode turned out to be significantly less than when performing the Milligan-Morgan surgery with a monopolar electrocautery: 3.5 ± 0.5 vs. 5.0 ± 0.8 ($p = 0.02$).

Late results in 1–5 years from the moment of surgery were assessed in 85% and 79% of patients in the main and control groups, respectively. Recurrence of the disease was noted in only one patient of the control group. In a comparative assessment of the quality of life, the average score as per the SF-36 questionnaire in patients of the main group turned out to be

higher than in the control group: 68.4 ± 2.7 versus 61.4 ± 2.7 , but the differences did not reach statistical significance ($p = 0.08$).

It was found that the depth of coagulation necrosis during hemorrhoidectomy with lateral ultrasound dissection in cutting mode was $145 \pm 25 \mu\text{m}$, while with excision of nodes by a monopolar electrocautery, this indicator reached $1730 \pm 180 \mu\text{m}$ ($p < 0.001$).

In addition, after hemorrhoidectomy with an electrosurgical scalpel, pronounced necrobiotic changes in tissues adjacent to the carbonation zone, including karyopycnosis of fibroblasts, as well as a pathological vascular reaction in the form of spasm of small arteries, were detected. After applying the original hemorrhoidectomy technique, these changes were significantly less severe, were reversible and manifested by moderate vasoconstriction. When comparing the results of balloonographic manometry, significantly less pronounced changes in intraanal pressure at rest and with volitional contraction of the sphincter after hemorrhoidectomy with lateral ultrasound dissection in cutting mode were found. Thus, in patients of the main group, the difference between the amplitude and duration of tonic waves measured before and after the surgery did not exceed 10%, while in the control group it reached 30% (Fig. 3, 4).

DISCUSSION

The first experience of performing hemorrhoidectomy using an ultrasonic scalpel was presented only at the beginning of the XXI century. However, in a relatively short period of

time, this technique has gained well-deserved recognition among specialists [9–11]. The data obtained in the course of this study indicate that the use of a harmonic scalpel is accompanied by significantly less severe tissue trauma, which makes it possible to improve both immediate and late results.

It should be noted that in recent years, encouraging results of the application of this technique have been increasingly cited by both foreign and Russian authors [8,11]. However, within the framework of the presented studies, the use of a harmonic scalpel is carried out exclusively in the coagulation mode, which, according to experts, is necessary to achieve more reliable hemostasis, allowing to refrain from ligation of the vascular pedicle [8–10]. At the same time, the depth of the tissue necrosis zone when using it reaches 300–400 μm , which, taking into account histology,

significantly exceeds the same indicator when using the cutting mode [13]. At the same time, the reliability of hemostasis, despite the technical capabilities of the device, is not absolute and does not exclude the development of delayed bleeding from the vascular pedicle of the node during biodegradation of the coagulation scab, which is confirmed by a number of cases [8,10]. The technique considered in the framework of this work involves performing ultrasonic dissection at the highest amplitude of vibrations of the working branch of the tool (cutting mode). This makes it possible to reduce the traumatic effect on the rectal tissues and reduce the severity of functional difficulties on the part of the anal sphincter, which is confirmed by the results of histology and balloonographic manometry. The implementation of this aspect in conjunction with the ligation of the vascular pedicle of the hemorrhoid node,

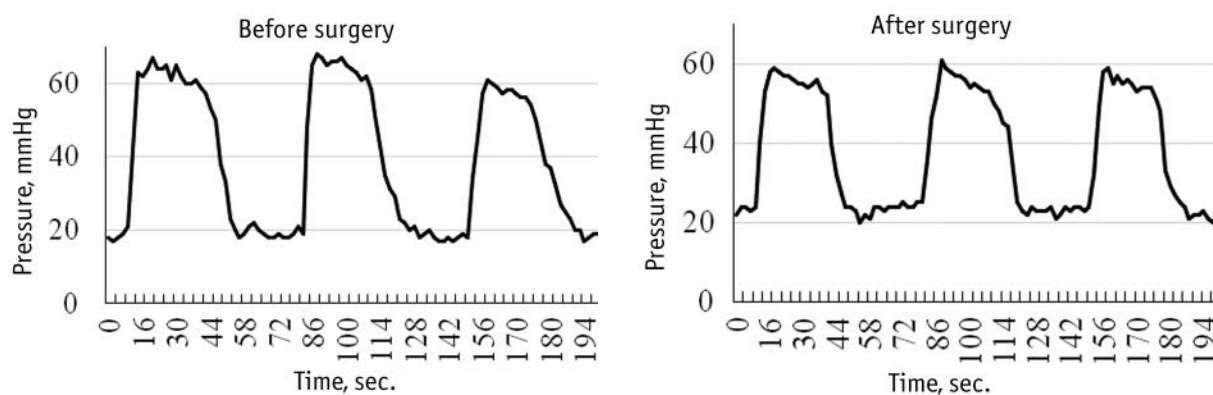


Figure 3. Results of transanal manometry in patients of the main group

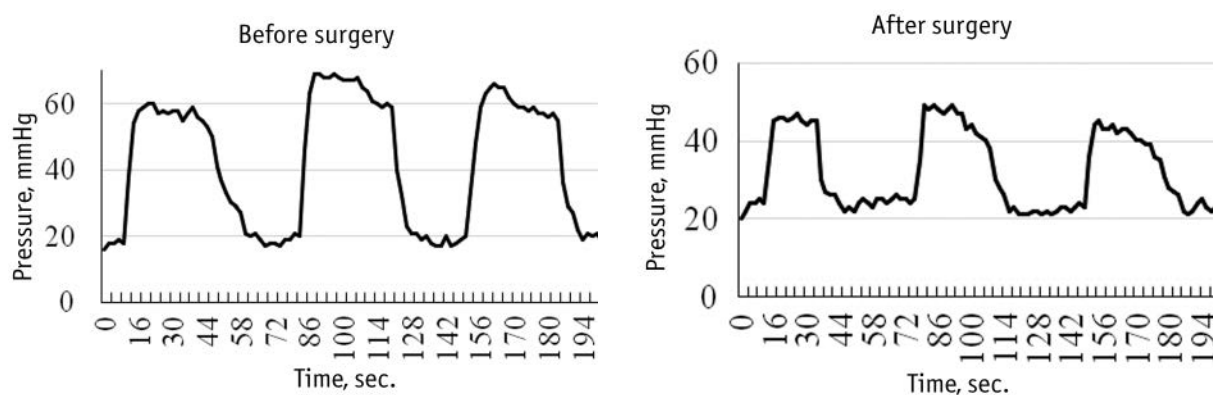


Figure 4. Results of transanal manometry in patients of the control group

in our opinion, provides a solution to the priority task: reducing the traumatic nature of the surgery without compromising its safety and radicality.

CONCLUSION

The results of the study indicate the effectiveness and safety of the technique of lateral ultrasound dissection in the cutting mode in patients with stages 3–4 hemorrhoids. Due to careful tissue dissection and reliable hemostasis, its use is accompanied by a low morbidity rate, provides a reduction in the intensity of pain syndrome, rapid restoration of rectal function, which creates prerequisites for early rehabilitation of patients.

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