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Clinical Justification of Lateral Ultrasound Dissection in Cutting Mode for Hemorrhoidectomy

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Abstract: Hemorrhoidal disease is one of the most common pathologies in modern proctology, affecting up to 25-30% of the adult population in developed countries and occupying a leading position among diseases of the anorectal region. Despite the apparent ease of diagnosis, hemorrhoids represent a complex medical and social problem that significantly reduces the quality of life of patients and requires a differentiated approach to treatment depending on the stage of the disease and its clinical manifestations.

Keywords: Chronic hemorrhoids, hemorrhoidectomy, lateral ultrasound dissection.

Introduction

Hemorrhoidal disease remains one of the most common proctological pathologies, significantly affecting the quality of life of patients and the socio-economic burden on global healthcare. According to international studies, up to 40-50% of the adult population encounters clinical manifestations of hemorrhoids, and the proportion of patients with stages III-IV requiring surgical intervention is increasing annually [1,2]. The current trend in global proctology is aimed at minimizing trauma and postoperative complications, reducing recovery time, and improving functional outcomes. In this context, ultrasound technologies hold a special place due to their ability to ensure precise tissue dissection, controlled coagulation, and reduced intraoperative blood loss. Lateral ultrasound dissection in a cutting pattern is considered a promising, more щадящий, and effective method that combines the advantages of classical hemorrhoidectomy and modern energy platforms, which necessitates further scientific substantiation of its clinical value [3,4].

The purpose of the study is to improve the results of surgical treatment of patients with chronic hemorrhoids using an ultrasound scalpel.

Material and methods.

The dissertation research is based on a comparative analysis of the results of providing specialized surgical care to 161 hemorrhoids treated at the SamSMU General Surgery Clinic and its clinical base - the coloproctology department - between 2020 and 2024. Patients were divided into two groups depending on the methodology of surgical intervention. The main group included 89 patients who underwent hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern. The control group consisted of 72 patients who underwent Milligan-Morgan surgery using electrocoagulation.

The average duration of the disease from the moment of manifestation of the first clinical manifestations until hospitalization in the hospital in representatives of both groups exceeded 10 years, which confirms the characteristic tendency for this category of patients to seek medical help late.

It should be noted that in the vast majority of patients in both groups, a very pronounced clinical picture of the disease was noted, which seems quite natural considering its long history. In addition, 11% of patients in the main group and 9% of patients in the control group were diagnosed with mild post-hemorrhagic anemia, which was interpreted as a complication of the underlying disease.

To perform surgical interventions in the main group of patients, an ultrasound scalpel "Sonoca" manufactured by the company was used.

Result and Discussion

"Ethicon," consisting of a high-frequency microprocessor generator and a work unit with a piezoelectric element and a titanium blade: Harmonic Focus harmonic scissors with fabric adaptation technology for open operations.

The method of hemorrhoidectomy with lateral ultrasound dissection in a cutting mode, developed at the Department of General Surgery of SamSMU, was carried out as follows. After treating the surgical field with antiseptic and delicate posterior diversion using ultrasound scissors, an elliptical incision was made of the perianal skin and anal canal mucosa around the DU to the dental line. Further, its mobilization was carried out from the lateral side (from the outside to the inside) to the vascular pedicle [5]. It should be noted that to minimize the thermal impact on the fabrics, they were cut using the sharp edge of the titanium blade of the harmonic scalpel exclusively in "FULL" mode (cutting). Then, a Bilroth clamp was applied to the vascular end, after which the DU was removed using ultrasonic scissors, also using only the cutting mode. The vascular stalk was sutured and ligated with a resorbable ligature (vikril 2/0). Postoperative wounds were not sutured [6], [7].

The main feature of the presented methodology, which has fundamental significance, is the use of the highest (fifth) level of vibration amplitude of the ultrasonic scissors' working branch (cutting mode), which ensures the predominance of the tissue cutting effect over their coagulation. This, in turn, allows for a significant reduction in the thermal effect on the tissues, which contributes to a reduction in the degree of trauma [8]. It is important to emphasize that the rejection of the coagulation regimen does not negatively affect the safety of the surgical instrument from the standpoint of hemostasis reliability, since the treatment of the vascular pedicle is carried out using traditional (ligature) techniques.

All patients in the control group underwent Milligan-Morgan hemorrhoidectomy using monopolar electrocoagulation. For this purpose, a modern high-frequency "FORCE TRIAD" electric generator from Valleylab and a monopolar electric counter were used [9].

The advantage of this energy platform is the TissueFect bioelectric control technology, which allows optimizing the effect of electric current on the fabric due to constant monitoring of its parameters (with a frequency of 4000 times per second). This ensures high controllability of coagulation and tissue dissection processes, including when using a monopolar electrocauter, which increases the accuracy of this device's operation [10].

Milligan-Morgan hemorrhoidectomy using electrocoagulation was performed as follows. After a mitigating diversion of the anus using a monopolar electrocauter, an elliptical incision of the perianal skin and anal canal mucosa around the hemorrhoidal node was performed to the dental line. Furthermore, using monopolar electrocoagulation, mobilization of the external and internal components of the hemorrhoidal node was performed as a single block to the vascular pedicle. Then, Bilroth's clamp was applied to the latter, after which the hemorrhoidal node was removed using a monopolar electron knife [11]. The vascular stalk was sutured and ligated with a resorbable ligature (vikril 2/0). Postoperative wounds were not sutured, but were treated openly using dressing with levomekol ointment. It should be noted that to reduce trauma, electrosurgical intervention was carried out in a combined mode, combining hemostatic effect with tissue dissection. If there were signs of ongoing bleeding from the bed of the removed hemorrhoidal node, an additional

"Sprey" mode "planar" electrocoagulation.

Results and their discussion. The average duration of hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern proved to be significantly shorter than Milligan-Morgan operations using electrocoagulation: 25±4 minutes versus 38±6 minutes, respectively ($p=0.04$). These differences, in our view, are explained by a more qualitative visualization of the surgical field due to the practically "bloodless" dissection of tissues by a harmonic scalpel [12]. This is confirmed by the results of a comparative analysis of the need for additional hemostasis after removal of hemorrhoidal nodes, which

was noted in 39 patients using an electrochemical scalpel, which constituted 54.1% of the total number of patients in the control group. At the same time, among the representatives of the main group, additional hemostasis was used only in 6 cases (6.7%). Thus, the differences in this criterion reached statistical significance ($p<0.001$).

The average duration of parenteral administration of non-narcotic analgesics after hemorrhoidectomy with lateral ultrasound dissection was 2.5±0.5 days, while after Milligan-Morgan's operation using electrocoagulation, this indicator reached 4.0±0.5 days ($p<0.05$). It should also be noted that the frequency of administration of non-steroidal analgesics in the control group was higher than in the main group. These factors naturally influenced the total (course) dose of ketorolac, the average values of which per patient were: 150±30 mg - in the main group and 250±30 mg - in the control group, while the differences reached statistical significance [13].

Postoperative complications were detected in 4 patients in the main group and in 14 patients in the control group, which constituted 4.5% and 19.4% of their total number ($p<0.05$). The most common of these were dysuric phenomena (Table 4). At the same time, the frequency of reflex urinary retention, which required bladder catheterization, after hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern, was significantly lower than after Milligan-Morgan's operation using electrocoagulation (3.4% versus 15.3%). Furthermore, it should be noted that the development of this complication in one of the patients in the control group required an epicystostomy (grade IIIa according to Clavien-Dindo) due to technical difficulties in bladder catheterization caused by prostate hyperplasia.

Clinical signs of anal sphincter insufficiency in the form of 1-II degree incontinence (gas and liquid stool incontinence) were noted in one patient of the main group and in 2 - in the control group. It should be noted that this complication did not require surgical correction, as it was transient and resolved within 14-21 days (persistent nature was noted only in one patient of the control group). The main reasons for the development of incontinence in these patients, in our opinion, were their advanced age (61-73 years) and a large volume of removed hemorrhoidal tissue, which, as is known, plays the role of an "additional vascular sphincter." The loss of this closing mechanism requires some restructuring of the act of defecation, which in patients of the geriatric profile, due to involutive pathophysiological processes, apparently occurs somewhat slower [14].

The most severe complications (grade IIIa-b according to Clavien-Dindo) in the form of bleeding, which required hemostasis in the operating room, were noted only in two patients of the control group. In the first case, this complication developed on the 2nd day after Milligan-Morgan's operation using electrocoagulation against a stool background and was associated with inadequate hemostasis in the bed area of the removed hemorrhoidal node at 7 hours, which required additional ligation under general anesthesia (grade IIIb according to Clavien-Dindo). In the second case, the manifestation of bleeding occurred on the 3rd day after the same intervention, also during the act of defecation. During the revision, the rejection of the coagulation crust from the entire surface of the removed external hemorrhoidal nodes was revealed at 3, 7, and 11 hours, which was accompanied by pronounced diffuse bleeding and required additional electrochemical hemostasis under local anesthesia (grade IIIa according to Clavien-Dindo). It should be noted that the volume of blood loss in none of the listed cases exceeded 500 ml, therefore, post-hemorrhagic anemia and any other adverse consequences were avoided [15].

The duration of postoperative treatment in the hospital setting in the main group of patients was shorter than in the control group and amounted to 3.1±0.3 bed-days versus 5.2±0.4, respectively. Furthermore, restoration of work capacity after hemorrhoidectomy with ultrasound dissection was observed in shorter periods.

Evaluation of the long-term results of surgical treatment was carried out in 79 patients of the main group and 59 patients of the control group, which amounted to 88.7% and 81.9% of their total number ($p>0.05$). It was carried out within a period of six months to five years from the time of surgery. The average interval between performing the intervention and evaluating long-term results in the main and control groups was: 28±5 months and 31±6 months, respectively ($p>0.05$).

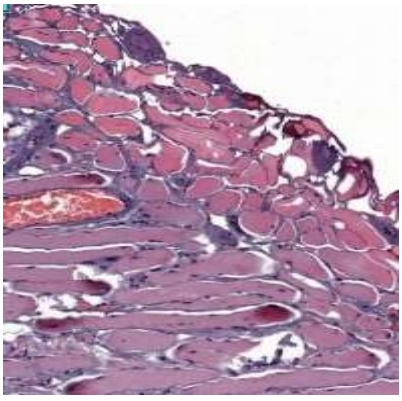
After hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern, no later complications were observed. At the same time, they were noted in 4 patients of the control group (5.6%, p=0.07). In two cases, the development of a scarring stricture of the anal canal occurred, accompanied by severe pain and disruption of the physiological regulation of the act of defecation. This complication was resolved by bougienage, and to achieve a stable result, it was necessary to perform this manipulation 3 times under intravenous anesthesia with intervals of one month. During the control examination, one year after the surgical intervention and 4 months after the buffing procedure, no clinical signs of anal canal scar stenosis were observed, however, one of the two patients complained of periodically occurring difficulties in defecation, requiring laxatives. In another 2 patients of the control group, signs of 1st-degree anal sphincter insufficiency persisted one year after hemorrhoidectomy, which reduced the quality of life but did not limit its social activity.

The study of quality of life was conducted in 47 patients of the main group and 41 patients of the control group, which constituted 52.8% and 56.9% of their total number. Among them, patients with stage 4 hemorrhoids of average age prevailed.

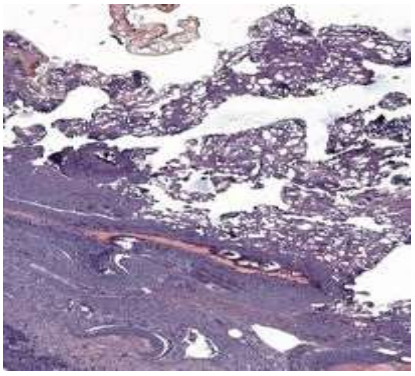
The average values of the initial indicators characterizing the physical component of health in the main and control groups were: 56.8±1.5 and 58.5±1.0, respectively (p>0.05). There was also no statistically significant difference in the initial level of the psychological component of health (61.5±1.5 and 59.8±1.5, p>0.05).

Thus, the increase in such indicators as the physical and psychological components of health, as well as the overall quality of life in the main group of patients, was significantly higher than in the control group and amounted to: 18.1, 10.2, 14.3 versus 7.3, 6.8, 7.1 respectively.

During histological examination of hemorrhoidal nodes removed by lateral ultrasound dissection in a cutting pattern, the depth of coagulation necrosis foci did not exceed 200 μm, and its average value was 145±25 μm (Figure 1A). Pathomorphological changes in the adjacent layer were not pronounced, were reversible in nature, and manifested as moderate vasoconstriction (Figure 2C). When studying hemorrhoidal nodes removed by an electrochemical scalpel, a significantly longer zone of tissue coagulation necrosis with carbonization phenomena was determined, the depth of which reached 2000 μm (Figure 1B). In addition, pronounced necrobiotic changes in adjacent tissues with irreversible changes in cellular structures, including fibroblast karyopyknosis, as well as a pathological vascular reaction in the form of spasm of small arteries, were identified (Figure 1E).



A



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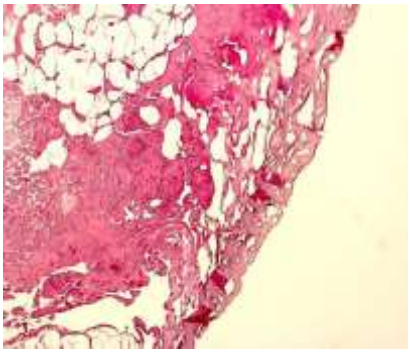

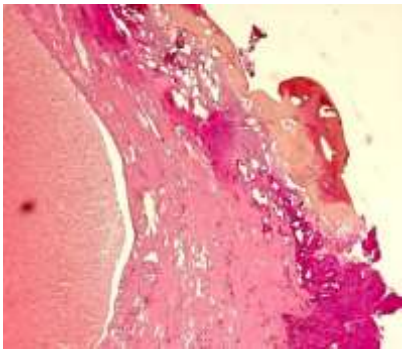

C E

Figure 1 Microphotographs of hemorrhoidal nodes: coagulation necrosis zone in the patient of the main (A) and control (B) groups; pathomorphological changes in the adjacent layer of the necrosis focus in the patient of the main (C) and control (E) groups (coloration: hematoxylin and eosin; magnification x 200).

It should be noted that the nature of the above-mentioned pathomorphological changes correlated with the macroscopic picture. Thus, in patients who underwent hemorrhoidectomy using electrocoagulation, the wound surface in the early postoperative period was made with a hard necrotic scale, which gradually subsided, as a rule, no earlier than 3 days after its execution. In addition, in all cases, pronounced anodermal edema was observed, which persisted until the time of discharge from the hospital (Figure 2V). At the same time, in patients of the main group, the formation of a coagulation scale and tissue edema in the perianal region were not observed (Figure 2A).

A **B**

Figure 2 - Condition of the wound on the 3rd day after surgical intervention (patient E., 32 years old, A - after hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern; B - after Milligan-Morgan's operation using electrocoagulation.

Upon subsequent assessment of the wound process, a significant difference in tissue regeneration timing was observed. The formation of active granulations in the postoperative wound area in patients of the main group was observed starting from the 14th day of the postoperative period, while in representatives of the control group, this process developed no earlier than the 20th day ($p<0.05$). Consequently, complete epithelialization of wounds after hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern occurred significantly earlier: on the 26th-30th day after the intervention. A similar process in the control group of patients was observed only on the 36th-40th day after Milligan-Morgan's operation using electrocoagulation ($p<0.05$).

Thus, the use of hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern is accompanied by less pronounced morphofunctional disorders compared to electrosurgical excision of hemorrhoidal nodes, due to the reduction of mechanical and thermal effects on tissues, which is confirmed by the results of histological studies.

Conclusions.

1. The use of hemorrhoidectomy with lateral ultrasound dissection in a cutting mode is accompanied by a statistically significant decrease in the depth of tissue coagulation necrosis to 145±25 μm, which is 2 times less compared to ultrasound dissection in a coagulation mode and one order less than when using monopolar electrocoagulation ($p<0.05$).

2. Hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern is accompanied by significantly less pronounced disorders in the contractile activity of the rectal obturator apparatus compared to the electrochemical dissection of hemorrhoidal nodes. Changes in the average indicators of intraanal resting pressure and voluntary contraction of the sphincter after its execution did not reach

statistical significance. At the same time, after Milligan-Morgan's operation using electrocoagulation, a decrease in the average value of the intraanal pressure of the voluntary contraction of the sphincter was noted by more than 33% of the initial value ($p<0.05$).

3. Hemorrhoidectomy with lateral ultrasound dissection in a cutting pattern is characterized by a low frequency of complications compared to Milligan-Morgan surgery performed using electrocoagulation (4.5% and 19.4%, $p<0.05$), less pronounced pain syndrome, which significantly improves the course of the early postoperative period and ensures a reduction in the rehabilitation period of patients.

4. Performing hemorrhoidectomy with lateral ultrasound dissection in a cutting mode allows achieving a high level of quality of life for patients in the long-term postoperative period, according to the SF-36 questionnaire survey data. The increase in the average score for such indicators as physical and psychological components of health, as well as the overall quality of life after its implementation, was significantly higher than after Milligan-Morgan's operation using electrocoagulation and amounted to: 18.2, 10.3, 14.4 versus 7.2, 6.9, 7.0, respectively ($p<0.05$).

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