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USE OF FOAMY AEROSOLS FOR PROPHYLAXIS OF COMPLICATIONS IN RECONSTRUCTIVE AND RECOVERY COLORECTAL SURGERY

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Abstract.

Despite the introduction of stapling apparatuses, application of new suturing materials, and improvement of surgical techniques, the problem of anastomotic leak in reconstructive colorectal surgery remains relevant. The use of foamy aerosols (Suliodovizol, Dioksizol, Miramistin, Gipozol-AN) during preparation of the rectal stump and when checking the tightness of the anastomosis can significantly reduce the incidence of failure of colonic anastomoses in the postoperative period.

Objective of research. To substantiate the efficacy and feasibility of foamy aerosols for the prevention of the insolvency of colonic anastomoses in performing reconstructive operations.

Materials and methods. Belgorod Regional Coloproctological Center conducted 611 reconstructive operations in the period from 1987 to 2015, with 286 cases treated AKA-2 devices, AKA-4, EEA, CEEA, KYGW, ILS with head diameter of 25-33 mm. We used foamy aerosols (Suliodovizol, Dioksizol, Miramistin, Gipozol-AN) in the preoperative period, for rectal stump exercises, during surgery to search for and single out the stump and to test the anastomotic leak, as well as in the postoperative period.

Results. The anastomotic leak with clinical evidence of local or general peritonitis after reconstructive surgery on the colon occurred in 3 patients, which required their re-operation and imposition of the stoma. The anastomotic leak in one patient, which led to the development of peritonitis and an increasing multi-organ failure, caused death.

Conclusion. The program we have developed for the prevention of the leak of colonic anastomoses in reconstructive operations has approved itself and has been successfully used in the department since 1987.

Keywords: colonic anastomosis, anastomotic leak, foamy aerosols.

Introduction. Despite more than 200-year history of surgery for colon cancer, the problem of the leak of intestinal anastomoses remains still relevant. According to literature data, the frequency of the leak of colonic anastomoses

ranges from 3.2 to 25.1%, and the mortality rate in this case reaches 12-32% [1, 2]. It should be noted that despite the introduction of staplers, application of new suturing materials, improvement of surgical techniques, no significant reduction in the number of anastomotic leak has been observed over the past 30 years [3, 4]. This is especially true when conducting reconstructive operations on the colon, since in the case of the developing anastomotic leak the main objective of the operation - the elimination of colostomy - is not achieved. In addition, this complication itself often runs hard and can lead to death. Numerous studies of the causes of seam leaks during colon reconstructive surgery have established a multifactorial nature of occurrence of this complication [5, 6, 7, 8]. This prompted the surgeons from all over the world to search for new ways of forming an anastomosis, to use the decompression devices for the anastomosis zone and to create new forms of drugs for use in colorectal surgery [9, 10, 11, 12].

Objective of research. To substantiate the efficacy and feasibility of foamy aerosols for the prevention of the insolvency of colonic anastomoses in performing reconstructive operations.

Materials and methods. Belgorod Regional Coloproctological Center conducted 611 reconstructive operations in the period from 1987 to 2015, with 186 cases treated AKA-2 devices, AKA-4, EEA, CEEA, KYGW, ILS with head diameter of 25-33 mm. The time interval since the first operation to the reconstructive one ranged from 3 months to 2 years. The patients aged from 18 to 77 years; women - 22%, men - 78%. The reconstructive colon plastics with the formation of a circular sigmoidectal anastomosis with the use of a stapler after the previously performed radical surgery for colon cancer was performed in 142 patients, the remaining patients had an earlier superimposed colostomy for the complicated diverticulitis of colon, bowel injury or complicated Crohn's disease.

We used foamy aerosols (Suliodovizol, Dioksizol, Miramistin, Gipozol-AN) in the preoperative period, for rectal stump exercises, during surgery to search for and single out the stump and to test the anastomotic leak, as well as in the postoperative period.

Suliodovizol aerosol is a combined preparation in the form of a foamy aerosol, consisting of 7.5 g iodovidon. Suliodovizol when applied topically has a bactericidal, fungicidal and anti-inflammatory effect. /Registration Certificate No. 94/158/7/. Dioksizol aerosol - a foamy preparation consisting of active ingredients such as /g/ balloon: dioxidine - 0.6 or 0.3, and trimekain - 3.0 or 1.5, on a hydrophilic water-soluble base. Dioksizol has an antibacterial effect on gram-negative and gram-positive, aerobic and anaerobic, spore-forming and asporogenic microflora (*Pseudomonas aeruginosa*, *Proteus*, *Klebsiella*, *E. coli*, *Staphylococci*, *Streptococci*, *Clostridium*, *Bacteroides*, *Peptococci*, etc.) in the form of monocultures and microbial associations, including hospital strains of multidrug-

resistant bacteria to other chemotherapy drugs. Dioksizol has local anesthetic action and hyperosmolar properties, relieves wound and perifocal inflammation, stimulates the repair processes and the activity of phagocytes in the wound. / Registration Certificate No. 94/301/6/. Miramistin aerosol has the following composition /g/ package: miramistin 0.125; trilon B - 0.125; proxanol 268 - 6.375; 1,2-propylene glycol - 10.4; purified water - 7,975; freon-12 - 5.0. Miramistin aerosol has an antibacterial effect on gram-negative and gram-positive, aerobic and anaerobic, spore-forming and asporogenic microflora in the form of monocultures and microbial associations, including hospital strains of multidrug-resistant bacteria to other chemotherapy drugs. The drug has antifungal activity on *Candida* fungi. Gipozol-AN aerosol has an anti-inflammatory, antimicrobial and wound-healing effect. It includes: aekol 15 and 7.5 g, nitazol 1.0 and 0.5 g, methyluracilum 1.0 and 0.5 g, tween-80 1.2 and 0.6 g, alcohols of C₁₆-C₂₁ or C₁₆-C₂₀ fraction 2.3 and 1.15 g, glycerol 2.0 and 1.0 g, ethyl alcohol 95% 2.0 and 1.0 g, purified water 25.5 and 12.75 g, freon-12 7.0 and 3.5 g.

Preparation of the colon stump. A long-term colostomy causes development of inflammation and muscle atrophy of the disabled bowel department being unable to provide reliable peristalsis and promotion of intestinal contents after the restoration of bowel continuity. This leads to stagnation in the first part of the involved bowel section and is dangerous in terms of anastomotic suture leak. To train a disabled bowel section, the colon hydromassage is often applied with the use of enemas with the addition of various herbal teas. However, in addition to the mechanical action, this method has no local therapeutic effect on the mucosa of the intestine and does not affect its microflora. To this end, we used foamy aerosols once daily for a month. After that, the state of the rectal mucosa was visually assessed, the cytological, bacteriological tests were conducted and the tone and strength of the anal sphincter was determined by a polygraph machine. Studies have shown a positive effect of the foamy aerosols on the mucosa of the disabled bowel section. Endoscopic study revealed that the visual signs of inflammation suppression were found by the end of the second week. Cytological picture within 2 weeks changed from the inflammatory phase into regenerative one, and the bacteriological studies have shown a significant reduction in the concentration of pathogens.

The most difficult in the colon plastics after Hartmann's operation is to detect and isolate a colon stump. Its successful outcome depends largely on the successful completion of this phase of the operation. To detect the stump, the bougies of different diameters, a proctoscope or a flexible gavage are used. However, this method is traumatic, may damage the gut wall and is ineffective if the gut has fixed bends as a result of cicatrical adhesions. We have

developed a method of using foamy aerosols to find and isolate the stump of a disabled colon on the operating table.

After laparotomy, the intestine was filled with excess foam via a special transanal nozzle attached to a balloon: an increase in the intraluminal pressure in the rectum resulted in its straightened walls. This caused differentiation of the colon stump from the surrounding tissues, which greatly facilitates its detection and isolation. / Patent UA No. 13771A of 25.04.97/.

An important stage of reconstructive colon plastics is the formation of colonic anastomosis. The main prerequisite for the successful completion of this phase is to mobilize all anastomosed intestinal ends, which will provide on the one hand the absence of tension in the afferent and efferent segments, and, on the other hand - a good blood supply, which was controlled by the presence of arterial bleeding with fat-free epiploic appendages of the anastomosed intestinal ends. The anastomoses were formed with a single-row nodal extra-mucosal atraumatic suture using an absorbable thread (vikryl, polisorb) or via individual nodal nylon sutures, imposed in two rows (one row - intranodal through all the layers, the second row - gray-serous sutures), or by using the suturing devices AKA-2, AKA-4, EEA, CEEA, KYGW, ILS. We have developed a method for intraoperative control of the physical integrity of colonic anastomosis with the help of foamy aerosols. / Patent SU No. 1830249 A1 of 03.15.91/. After the anastomosis imposition, an intestinal clamp was imposed 8-10 cm proximal to it, or the intestine was pinched with hand. Using either a nozzle or a catheter inserted onto the nozzle, the colon was transanally filled with foam, controlling for 1-2 minutes its possible infiltration through the anastomosis line. We consider the use of the foam produced from an aerosol balloon for testing the colon anastomotic leak, to be the most rational method, due to the foam properties. Firstly, the foam has a low specific gravity of 0.075 g/cm^3 , which allows using a small amount of the diagnostic drug to fill the cavities. Secondly, the foam comprises a foaming agent, which is a surfactant that provides wetting of colon mucosa and its more "intimate" contact with the drug. Thirdly, the foam is dispensed from an aerosol balloon under pressure of $3-4 \text{ kgf/cm}^2$, which promotes rapid and complete filling of the intestine. By expanding, the foam presses on the intestinal wall with $0.02-0.04 \text{ kgf/cm}^2$. The anastomosis withstands easily this pressure, as it does not exceed the upper limit of physiological intracolonic pressure. In the case of the anastomotic leak, the foam immediately starts to go through a defect in the anastomosis, which is easily fixed visually by a surgeon. Fourthly, due to the sterility of the foam entering the colon, the intestine itself is sterilized under its influence. The latter prevents the biological permeability to microorganisms. In case of a leaking anastomosis and the foam enters the colon to the abdominal cavity, the purulent complications do not develop as a sterile foam has a bactericidal action.

Postoperatively, to prevent the development of septic complications, promote the anastomosis healing and improve the passage of intestinal contents into the colon, the foam of aerosol drugs was administered 2 times per day for 8 days. The administration was carried out either: directly from the rectal nozzle, through a catheter from a syringe pre-filled with foam, or via a probe located upstream of the anastomosis. The latter method was used most often. Along with decompression, the probe provided an opportunity to deliver drugs to the anastomosis area. At the same time, the drugs had a complex therapeutic effect: significantly reduced the level of microbial contamination in the area of the anastomosis before the onset of the biological integrity, preventing thereby the development of its leak, arresting the inflammation and accelerating its healing. / Patent No. 15302A of 30.06.97/.

Results. The anastomotic leak with clinical evidence of local or general peritonitis after reconstructive surgery on the colon occurred in 3 patients, which required their re-operation and imposition of the stoma. The anastomotic leak in one patient, which led to the development of peritonitis and an increasing multi-organ failure, caused death.

Conclusion. The program we had developed for the prevention of the leak of colonic anastomoses in reconstructive operations has approved itself and has been successfully used in the department since 1987.

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