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Displaced dermal fat flaps for anal sphincter insufficiency

© S.G. BAGAUDINOVA[1], Z.V. KURBANOVA[1], A.L. ISTRANOV[2], KH.Z. OMAROVA[1], M.G. KURBANISMAILOVA[1], M.M. ISRAPILOV[1], N.A. ABUALRUB[1], L.A. BIYACHUEVA[2, 3]

[1]Dagestan State Medical University, Makhachkala, Russia;
[2]Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia;
[3]Pirogov Russian National Research Medical University, Moscow, Russia

ABSTRACT

Objective. Searching for optimal highly effective surgical approach for anal sphincter insufficiency via anal ring autoplasty.

Material and methods. The study enrolled 62 patients with anal sphincter insufficiency between 2004 and 2020 at the Russian Railways Hospital (Makhachkala). Inclusion criteria: complaints of intestinal incontinence and objective indicators of reduced pressure in anal canal Patients meeting selection criteria were divided into four groups: group 1 — patients with anal sphincter incontinence after correction of anorectal defects; group 2 — patients with anal sphincter incontinence after proctological surgery; group 3 — anal sphincter incontinence after childbirth; group 4 — patients with idiopathic anal sphincter incontinence. Correction of anal incontinence was performed original technique of displaced perianal dermal fat flaps.

Results. Immediate results were evaluated after 3 weeks, long-term results — after 6 months and 1 year. We assessed the following criteria: patient satisfaction with treatment outcomes, overall improvement in the quality of life, postoperative complications, WIS score (0-20) and degree of anus gaping (complete absence of gaping).

Conclusion. Good immediate and long-term treatment outcomes were observed in 87.6% and 46.8% of cases, respectively. Important prognostic criteria are damage to anal sphincter and basal pressure in anal canal. Original correction of anal sphincter incontinence has a long-term effect and requires widespread implementation in clinical practice.

Keywords: *anal sphincter incontinence, autoplasty, dermal fat flaps.*

INFORMATION ABOUT THE AUTHORS:
Bagaudinova S.G. — https://orcid.org/0000-0001-5574-5905; e-mail: Bagaudinova86@list.ru
Kurbanova Z.V. — https://orcid.org/0000-0002-2791-9895; e-mail: kurbanova.zarema@gmail.com
Istranov A.L. — https://orcid.org/0000-0001-5574-5905; e-mail: plasticsurgeon@yandex.ru
Omarova Kh.Z. — https://orcid.org/0000-0003-1715-3567; e-mail: mica72@rambler.ru
Kurbanismailova M.G. — https://orcid.org/0000-0002-6034-4388; e-mail: meren.1967@mail.ru
Israpilov M.M. — https://orcid.org/0000-0002-3270-3056; e-mail: doctorisrapilov82@gmail.com
Abualrub N.A. — https://orcid.org/0000-0003-1186-5395; e-mail: nemir.1994@gmal.com
Biyachueva L.A. — https://orcid.org/0000-0002-4368-9501; e-mail: larisabiyachueva@gmail.com
Corresponding author: Biyachueva L.A. — e-mail: larisabiyachueva@gmail.com

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Introduction

Anal sphincter insufficiency (ASI) is defined by uncontrolled discharge of intestinal contents through the anal canal. ASI is a big social problem. Patients suffering from anal incontinence experience feelings of inferiority and psycho-emotional depression. They are often socially maladjusted [1–4].

ASI is more common in women due to anatomical and physiological characteristics (female-to-male ratio 4-5:1). According to literature data, prevalence of ASI is 1:1000. True prevalence of disease established in epidemiological surveys and anonymous survey data is 10.9 per 1000 males and 13.3 per 1000 females [3].

To date, optimal surgical and therapeutic approaches for ASI with stable long-term and functional results are unclear. The indications for surgery are ineffective therapy, persistent incontinence due to obvious defects of external anal sphincter and puborectalis muscle [3, 5, 6]. Treatment strategy seems difficult in case of intact external anal sphincter. Therapeutic approaches for ASI include gymnastic complexes, electrical stimulation, neuromodulation and biofeedback therapy. The disadvantages of these methods are the lack of clear indications and low effectiveness.

Physiologically, the mechanism of normal continence is largely provided by internal smooth muscle anal sphincter in permanent hypertonicity. This muscle realizes 80% of basal pressure in the anal canal and closes the walls of anal canal at rest [3, 7–9]. Consequently, damage or insufficiency of the internal anal sphincter can impair continence. It is a common cause of anal sphincter insufficiency.

The first implantations of bulking agents into submucosal layer of anal canal have been performed since the early 1990s to increase basal pressure in patients with injuries and insufficiency of internal sphincter [10–12]. According to foreign literature, there are multiple trials devoted to synthetic autografts and allografts for the treat-

ment of fecal incontinence with analysis of long-term results [12–20]. There are many options for anal repair in patients with anal incontinence, but a universal surgical method for ASI is still unclear. This problem is especially important due to social significance of anal sphincter incontinence accompanied by deterioration in the quality of life and appearance of some psycho-emotional and behavioral disorders in these patients.

The purpose of our study was searching for optimal highly effective surgical approach for anal sphincter insufficiency via anal ring autoplasty. We established the following objectives: to differentiate the choice of optimal approach for anal sphincter incontinence, to evaluate data of anal sphincters, to distinguish the most significant methods for diagnosing anal sphincter insufficiency, to determine the indications for original technique of anal ring repair, to assess treatment outcomes in all groups.

Material and methods

The study was conducted at the Dagestan State Medical University between 2004 and 2020. We analyzed 62 patients with ASI. Data analysis was performed using the Statistica for Windows v. 6 and Microsoft Excel software packages. Between-group differences were analyzed using the Fisher's exact test with confidence intervals. The GastroScan software was used to create a database of objective sphincterometry and calculate mean values. Differences were significant at p-value <0.05. Age of patients ranged from 18 to 77 years (mean 40.5±7.5) **(Table 1)**. In the international registry, age of patients with ASI varies from 60 to 80 years.

Inclusion criteria: anal incontinence, indications for surgical sphincter repair, reduced pressure in anal canal.

Patients meeting selection criteria were divided into groups depending on the cause of ASI. We considered complaints, medical history and diagnostic data. Patients with anal incontinence following unknown cause and insufficiency of internal anal sphincter were included in the 4th group (idiopathic ASI) **(Table 2)**.

Thus, patients with postpartum incontinence and ASI after correction of anorectal defects comprised the largest groups (32.3% and 29.0%, respectively). Onset of disease was an important variable. More than 30% of patients of young and middle age appealed for medical care within 2 years after clinical manifestation. Duration of disease from 8 to 20 years was observed in 14% of cases. These were elderly patients as a rule that indicated delicacy of the problem.

Severity of incontinence is essential for symptoms of ASI [20, 21]. All patients had various degrees of ASI from involuntary and uncontrolled release of gases to impossible control of defecation. Patients with ASI grade I and II prevailed (78.9%) **(Table 3)**. Degree of incontinence and severity of ASI symptoms are directly proportional to extent of sphincter defect.

Considering various age categories of patients (from 20 to 72 years), we emphasized the role of individual approach in diagnosis of disease. Older patients (⩾50 years) underwent colonoscopy after sigmoidoscopy even if no abnormalities were found. This approach is explained by oncological alertness and need to exclude colon cancer.

Complaints are important in development of disease and dynamics of treatment. We analyzed the complaints using a questionnaire. The last one included the following parameters: passport data, duration of disease, previous childbirth / birth trauma, surgical interventions, concomitant diseases. Survey also implied assessment of severity of incontinence.

Incidence of episodes is an important diagnostic criterion for severity of anal incontinence.

Scoring systems for assessing the severity of incontinence became widespread in scientific and clinical prac-

Table 1. **Sex- and age-adjusted distribution of patients**

Age	Women		Men		Total	
	n	%	*n*	%	*n*	%
<35	18	47.7	3	17.6	21	39.3
35—49	8	18.9	11	29.4	21	21.4
50—69	10	22.1	8	47.1	18	30.4
⩾70	1	11.3	1	5.9	2	8.9
Total	37	100	25	100	62	100

Table 2. **Distribution of patients depending on the cause of ASI**

Cause of ASI	Number of patients (*n*=62)	
	n	%
Group 1 — ASI after correction of anorectal anomalies	18	29.0
Group 2 — ASI after colorectal surgery	11	17.7
Group 3 — post-partum ASI	20	32.3
Group 4 — idiopathic ASI	13	21

Table 3. **Grades of anal incontinence**

Grade	Features	Number of patients (n=62)	
		n	%
I	Gas incontinence	23	37.0
II	Gas and liquid stool incontinence	26	41.9
III	Incontinence of gases, liquid stool and solid stool	13	20.9

Table 4. **Wexner Incontinence Severity Rating Scale (WIS, Browning-Parks, 0-20)**

Incontinence type	Incidence of episodes				
	never	1 time per a month	1 time per a month — 1 time per a week	>1 time per a week	daily
Gases	0	1	2	3	4
Liquid stool	0	1	2	3	4
Solid stool	0	1	2	3	4
Use of pads	0	1	2	3	4
Lifestyle changes	0	1	2	3	4

Table 5. **Normal pressure at rest and under maximum volitional straining in men and women**

Mean pressure in the anal canal	Women	Men
Pressure at rest, mm Hg	50.4	63.2
Pressure under maximum volitional straining, mm Hg	94.7	121.5

tice. The Wexner Incontinence Score is important for determining the severity of incontinence. G.G. Browning and A.G. Parks first proposed this scale in 1983. The Wexner Incontinence Score considers severity of incontinence, incidence of episodes, need for special hygiene measures and quality of life. We used this classification to analyze own data (Table 4). Total WIS score of anal incontinence is determined by summing up the scores (0 points — complete continence, 20 points — complete anal incontinence) [5, 19].

We obtained primary information about the patient after digital rectal examination of the distal rectum. We analyzed elasticity and length of the sphincter, defects and neoplasms of rectal mucosa.

All patients underwent sphincterometry to assess pressure at rest and under volitional straining. The advantages of this diagnostic method are low cost, availability and simplicity. The principle of sphincterometry is measurement of pressure provided by internal anal sphincter at rest and external anal sphincter under volitional straining using elastic sensor inserted into the anus. After diagnostic procedure, the recording unit is connected to a special computer program for analysis of results. The disadvantage of this diagnostic method is small amount of normative data [5].

We used sphincterometer SF-01 (GastroScan-SF) (NPF Kvarts LLC, Russia) **(Fig. 1)**. Creation of the database and interpretation of results were carried out using a special GastroScan software.

Sphincterometry was performed in all 62 patients strictly in the left lateral position with knees raised **(Table 5)**. This position is the most physiological for this procedure. Pressure sensor of sphincterometer includes

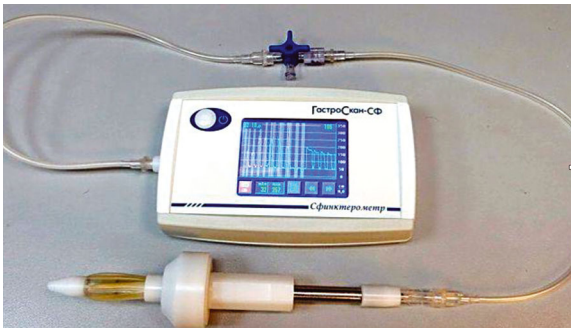


Fig. 1. **Sphincterometer SF-01 (“GastroScan-SF”).**

a special rod with metal kernel and protective system of plastic fasteners. A condom intended for ultrasound was necessarily put on the rod and fixed with a tip.

Preoperative examination of all patients with anal incontinence consisted primarily of sphincterometry. This procedure was also performed after 3 weeks, 6 and 12 months after surgical treatment. Pressure in anal canal and before and after surgical treatment is the main objective indicator for evaluating the results.

Anal canal repair with free dermal fat grafts for anal sphincter insufficiency

Anesthesiologist consulted all patients after analysis of anamnestic data and examination with determining the indications for surgical treatment. Patients were electively prepared for surgical treatment if contraindications were absent.

Surgery was carried out in the operating theatre under intravenous anesthesia in supine position. Risk of complications after general anesthesia exceeded the risk of surgery in 4 (6.4%) elderly patients with comorbidities. Therefore, we preferred local anesthesia in these cases (lidocaine 0.5%). After 3-fold preparation of surgical field with solutions of alcohol-containing antiseptics, we performed 2 incisions around the anal ring with the base at anterior semicircle 1 cm away from the anal ring **(Fig. 2, 3)**.

Width and depth of the flap were 1.0 and 1.0–1.5 cm, respectively, depending on constitutional features of patients. We carried out deepidermization between the incisions and formed a dermal fat flap **(Fig. 2, 5)**. This approach ensures better viability of the flap due to preserved vascular plexus in subcutaneous fat and skin.

Deepidermization almost excludes epithelial cysts due to appropriate excision depth with removal of sebaceous glands with excretory ducts, as well as hair follicles as anatomical substrates of epithelial cysts. Perianal dermal fat flaps **(Fig. 3, 6)** are passed through the tunnel and sutured to the sacrococcygeal ligament **(Fig. 7)**.

Surgeon controls narrowing of the anus by inserting a finger into the rectum. Skin is sutured **(Fig. 4, 7)**. All patients underwent intraoperative and postoperative antibiotic therapy to minimize the risk of postoperative infectious complications (ceftriaxone 1 g 2 times a day IV for 5 postoperative days).

Results

We assessed early postoperative results after 3 weeks and long-term results after 6 and 12 months. We analyzed the following criteria:

1) patient satisfaction with postoperative results, QoL improvement;

2) early and late postoperative complications;

3) WIS (0-20) and FISI (Fecal Incontinence Severity Index) (0-61) scores of ASI and their changes;

4) gape of the anus.

Pressure in anal canal at rest and under maximum volitional straining was measured in early and long-term period using sphincterometry. We considered pressure difference before and after surgery.

Treatment outcomes in patients with anal sphincter insufficiency following correction of anorectal defects

After multi-stage preoperative examination, all 18 patients in the 1st group (ASI aftercorrection of anorectal defects) underwent elective repair with free dermal fat grafts. There were no early postoperative complications. Incidence involuntary excretion of feces reduced in all 18 patients at discharge. Moreover, all these patients emphasized complete anal continence within 5 days after surgery. Survey of patients before and 3 weeks after surgical treatment revealed decrease of mean WIS score (8.5±2.5 vs. 1.6±1.4 points, $p<0.01$). Objective examination implied mandatory sphincterometry in all patients. We found higher pressure in anal canal at rest and under maximum volitional straining. For example, mean pressure in anal canal at rest after 3 postoperative weeks was 47.1±1.8 mm Hg in women and 55.8±2.2 mm Hg in men. These values were significantly higher than preoperative data.

Treatment outcomes in patients with anal sphincter insufficiency following colorectal surgery

All 11 patients in this group underwent elective repair with free dermal fat grafts after preoperative examination. These patients had damage to internal and external anal sphincters. This was due to technical difficulties of previous surgery. Thus, these patients had more severe symptoms of anal incontinence. Postoperative complications occurred in 2 (18.2%) patients who underwent debridement and drainage in 14 days after surgery. Survey after 3 postoperative weeks revealed significant decrease of WIS score of anal incontinence (4.2±2.7 points). Despite inevitable complications in this group, all patients with grade III incontinence subjectively noted less number of incontinence episodes. Sphincterometry revealed higher pressure in anal canal at rest and under maximum volitional straining after 3 postoperative weeks (mean pressure at rest was 48.7±1.4 mmHg in women and 60.2±4.8 mm Hg in men).

Treatment outcomes in patients with postpartum anal sphincter insufficiency

Comprehensive preoperative examination of all 20 patients in the 3rd group revealed the indications for surgical treatment with anal sphincter repair. Two (10%) women had previous ruptures of the perineum grade II-III. These patients developed postoperative wound infection after 7 days that required debridement and drainage. Survey after 3 postoperative weeks revealed significant positive trend compared to preoperative data. Indeed, mean WIS score of anal incontinence was significantly below the threshold values (5.4±1.1 points). Sphincterometry revealed higher pressure in anal canal at rest and under maximum volitional straining after 3 postoperative weeks (mean pressure at rest after 3 weeks was 47.8±4.3 mm Hg). The last follow-up examination was carried out in a year after treatment. All patients noted high satisfaction with postoperative outcomes.

Treatment outcomes in patients with idiopathic anal sphincter insufficiency

All 13 patients in the 4th group had signs of internal anal sphincter insufficiency. Among these patients, a 74-year-old patient (7.7%) with true idiopathic ASI and concomitant type 2 diabetes mellitus developed infectious complication after 14 postoperative days. In this case, infectious focus was drained. There was no deterioration of continence after redo surgery. There was uneventful post-

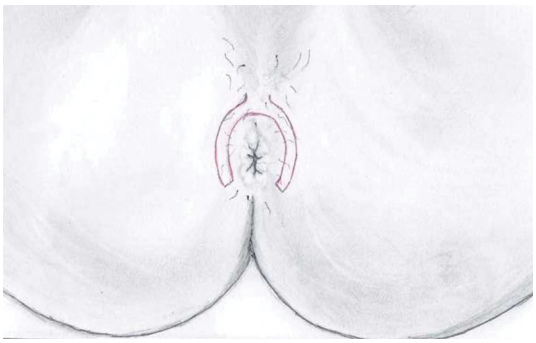


Fig. 2. **Harvesting of perianal dermal fat flaps.**

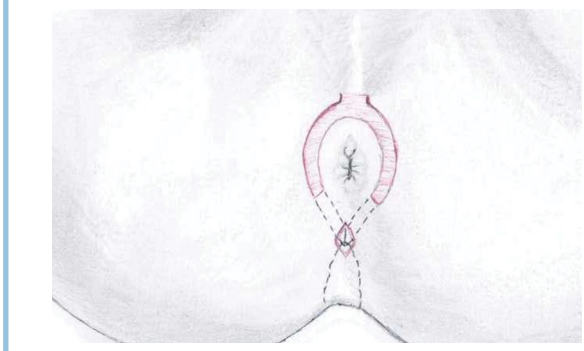


Fig. 3. **Dissection and passage of perianal flaps through the tunnel and suturing them to the sacrococcygeal ligament.**

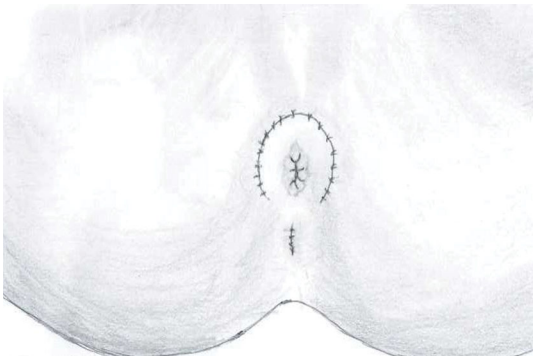


Fig. 4. **Skin suturing.**

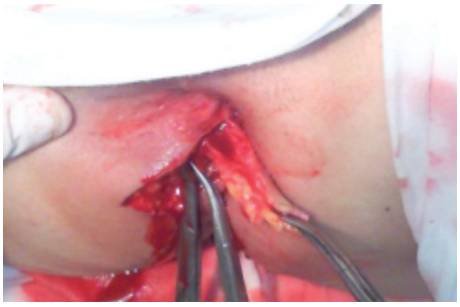


Fig. 5. **Harvesting of perianal dermal fat flap.**

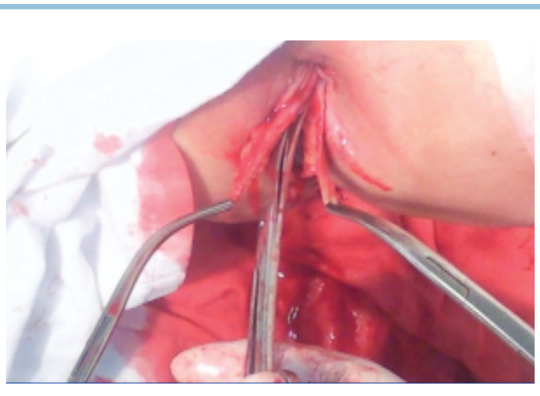


Fig. 6. **Dissection of perianal flap.**

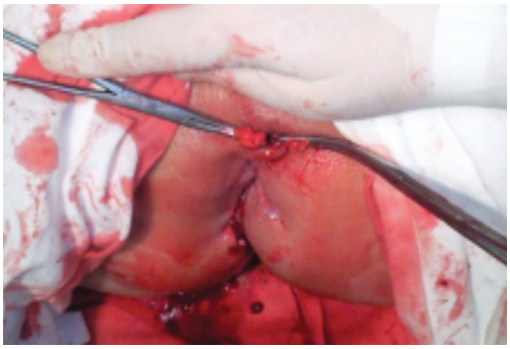


Fig. 7. **Formation of a tunnel and passage of perianal dermal fat flaps around the anus and suturing them to the sacrococcygeal ligament.**

operative period in other 12 (92.3%) patients. Mean WIS score of anal incontinence after 3 postoperative weeks was 5.8±2.6 points. In 3 weeks after surgical treatment, mean resting state pressure in anal canal was 38.7±4.8 mm Hg in women and 50.4±1.8 mm Hg in men. After 1 year, clinical effect was stable in all patients.

Discussion

Treatment of anal incontinence is an obvious problem and multidisciplinary objective involving proctologists and reconstructive surgeons. There is no an unequivocal solution regarding formation of controlled anal sphinc-

ter. Treatment of grade III anal incontinence is the most difficult. However, we cannot ignore the issues in choosing the treatment strategy for grade I and II incontinence.

Reconstruction of internal and external sphincter has anatomical differences. However, simultaneous repair of both sphincters is required in some cases. To date, there are several methods for reconstruction of internal sphincter using a free smooth muscle flap. Frolov S.A. et al. [29] proposed an original technique of muscular layer duplication from intestinal wall through perineal approach. A year after surgery, 71.4% of patients had regular stool while the need for a counter enema to empty the bowel was observed in 28.6% of patients. All patients had no episodes of involuntary defecation during the day and at night. Gas incontinence persisted in 42.8% of patients. Analysis of colon motility in 12 months after surgery revealed replacement of hyperkinetic activity by hypokinetic one.

Striated muscles from the perineum, gluteal region and thigh, as well as artificial sphincter from various materials are usually used to recreate external anal sphincter. Almost 100 years ago, Chittenden A.S. [30] described external anal sphincter repair with the gluteus maximus muscle. The original technique consisted in rotation of split muscle flap and wrapping of intestine.

Pickrell K.L. et al. [31] used the gracilis muscle for the same purpose. In 1990, Cavina E. et al. [32] described external anal sphincter repair using the gracilis muscle after electrical stimulation. Incidence of complications was 33% and higher. The main disadvantage of these methods is impossible control of anal sphincter.

In 2000, Sato T. et al. [33] reported treatment of 22 patients with lower ampullary cancer. The authors reconstructed anal sphincter by using of a split gluteus maximus muscle and created anastomosis between the transected lower gluteal and pudendal nerves. This method was the first attempt to reinnervate a muscle mass from the system of removed voluntary sphincter. According to the authors, 68% of patients had voluntary contraction of neosphincter that can be regarded as a satisfactory functional result.

Milanov N.O. et al. [34] proposed a method of neosphincter around the perineal colostomy in the absence or loss of anal sphincter. This method consists in harvesting of latissimus dorsi muscle graft involving thoracodorsal artery, appropriate veins and thoracodorsal nerve. Neosphincter is formed from the latissimus dorsi muscle proximal to the smooth muscle cuff and distal to the previously created coloplastic reservoir. Muscle fibers of the autograft are located across the longitudinal axis of small intestine. Revascularization and reinnervation of the autograft are provided from the lower gluteal vessels and pudendal nerve, respectively.

All these methods are difficult and performed to form a new external sphincter. These techniques require special experience and equipment. They are advisable for severe anal incontinence without alternatives.

These traumatic techniques are time-consuming and unreasonably expensive for anal incontinence grade I/II. Original technique of free perianal dermal fat flaps is simple, highly effective and followed by small incidence of postoperative complications. Special equipment or microsurgical experience is not required. According to our data, this approach is highly effective. Importantly, this technique will not be so effective in severe incontinence and complete absence of sphincter (perineal colostomy). Proper selection of patients and clear indications are essential for good results.

Conclusion

Clinical effect of anal sphincter repair with free dermal fat flaps in patients with anal incontinence is based on providing mechanical closure of anal canal and increase of basal pressure. The indication for plastic surgery is anal sphincter incontinence for various causes. Good immediate and long-term treatment outcomes were observed in 87.6% and 46.8% of cases, respectively. Important prognostic criteria are damage to anal sphincter and basal pressure in anal canal. Original correction of anal sphincter incontinence has a long-term effect and requires widespread implementation in clinical practice.

The authors declare no conflicts of interest.

REFERENCES

1. Vorobiev GI. *Osnovy koloproktologii.* Rostov-on-Don: Phoenix; 2001. (In Russ.).
2. Rivkin VL. Anal incontinence: the state of the problem. *Consilium Medicum. Surgery (Suppl)*. 2016;1:24-25. (In Russ.).
3. Henry MM, Svash M, eds. *Coloproctology and the Pelvic Floor*. M.: Medicine; 1988:178-183, 256-308. (In Russ.).
4. Kaiser AM. *Colorectal Surgery*. M.: Binom; 2011:192-197. (In Russ.).
5. Menovshchikova LB, Kovarsky SL, Nikolaev SN, Sklyarova TA, Tekotov AN. Application of the new synthetic bulking material Vantris for the treatment of primary vesicoureteral reflux in children. Detskaya khirurgiya. 2012; 4:12-15. (In Russ.).
6. Nedozimovanyi AI. *Lechenie patsientov s inkontinentsiej kala metodov biologicheskoj obratnoj svyazi:* Diss. ... kand. med. nauk. SPb; 2003:11-46. (In Russ.).
7. Lemperle G, Morhenn V, Charrier U. Human Histology and Persistence of Various Injectable Filler Substances for Soft Tissue Augmentation. *Aesthetic Plastic Surgery*. 2003;27:354-366.
8. Lentz GM. *Anal Incontinence: Diagnosis and Management*. In: General Gynecology. Part III. 2013:503-518.
9. Ratto C, Parello A, Donisi L, Litta F, De Simone V, Spazzafumo L, Giordano P. Novel bulking agent for faecal incontinence. *British Journal of Surgery*. 2011;98:1644-1652.
10. Ehrenpreis ED, Chang D, Eichenwald E. Pharmacotherapy for Fecal Incontinence: A Review. *Disease of the Colon & Rectum*. 2006;50:641-649.
11. Herold A. Aus Fettgewebe gezüchtete Stammzellen zur Behandlung komplexer perianaler Fisteln. Eine klinische Phase-II-Studie. *Coloproctology*. 2010;6(32):349. (In German).

12. Rintala RJ, Pakarien MP. Outcome of anorectalnmalformations and Hirschsprung's diagnose beyond childhood. *Seminars in Pediatric Surgery.* 2010;19:160-167.
13. Meyer I, Richter HE. Impact of Fecal Incontinence and its treatment on quality of life in woman. *Womens Health (Lond).* 2015;11(2):225-238. PMID: 25776296; PMCID: PMC4394646. https://doi.org/10.2217/whe.14.66
14. Ormaechea M, Paladini M, Pisano R, Scagliotti M, Sambuelli R, Lopez S, Guidi A, Muñoz J, Rossetti V, Carnerero M, Beltramo D, Alasino R, Bianco I, Griguol O, Valladares D, De Badiola F. Vantris, a biocompatible, synthetic, non-biodegradable, easy-to-inject bulking substance. Evaluation of local tissullar reaction, localized migration and long-distance migration. *Arch Esp Urol.* 2008;2(61):263-268. https://doi.org/10.4321/s0004-06142008000200023
15. Papafragkakis H, Changela K, Bhatia T, Ona MA, Malieckal A, Paleti V, Fuksbrumer MS, Anand S. Endoscopic and imaging appearance after injection of an ano-rectal bulking agent. *World Journal of Gastrointestinal Endoscopy.* 2014;6(7):324-327.
16. Hussain ZI, Lim M, Stojkovic SG. Systematic review of perianal implants in the reatment of faecal incontinence. *British Journal of Surgery.* 2011;98:1526-1536.
17. Jongen J. Neuartiger „bulking agent" bei Stuhlinkontinenz. *Coloproctology*. 2013;3:198-200. (In German).
18. Kenefick NJ, Vaizey CJ, Malouf AJ, Norton CS, Marshall M, Kamm MA. Injectable silicone biomaterial for faecal incontinence due to internal anal Sphincter dysfunction. *Gut*. 2002;51:354-366.
19. Davis K, Kumar D, Poloniecki J. Preliminary evaluation of an injectable anal sphincter bulking agent (Durasphere) in the management of faecal incontinence. *Aliment Pharmacol Ther.* 2003;18(2):237-243. https://doi.org/10.1046/j.1365-2036.2003.01668.x
20. Graft W, Mellgren A, Matzel KE, Hull T, Johansson C, Bernstein M. Efficacy of dextranomer in stabilized hyaluronic acid for treatment of faecal incontinence: A randomized, sham-controlled trial. *The Lancet.* 2011;377:997-1003.
21. Komissarov IA, Vasil'ev SV, Nedozimovannyi AI, Dement'eva EA. Experience of application of volume forming agent "DAM+" in treatment of anal incontinence associated with incompetence and trauma of anal sphincter. *Grekov's Bulletin of Surgery.* 2016;5:79-82. (In Russ.).
22. Mashkov AE, Kulikov AV, Shumsky VI, Filyushkin UN, Kulikov DA, Slesarev VV, Pykhteev DA, Polyanskaya ZI, Ermilova EA, Rogatkin DA, Litvinova NS. Experience of anal insufficiency treatment using medullary transplantation in experiment and clinic. *Almanakh klinicheskoj meditsiny.* 2011; 25:13-16. (In Russ.).
23. Nurbekov AA. *Posttravmaticheskaya analnaya inkontinentsiya: diagnostika, lechenie i profilaktika:* Diss. ... d-ra med. nauk. Astana; 2009:3-40. (In Russ.).
24. Kulikovsky VF, Oleinik NV, Storozhilov DA, Naumov AV. Features of restoring normal anal holding. *Coloproctology*. 2015;1(51 Suppl):27. (In Russ.).
25. Vasiliev SV, Nedozimovanyi AI, Popov DE, Dementieva EA. *The use of electrical stimulation in the treatment of anal incontinence.* Proceedings of the All-Russian Congress of Coloproctologists with international participation "Operative and conservative coloproctology: modem technologies for a high quality of patient's life" and the Joint Caspian and Baikal Forum on BD problems. 2016;2(56):20-21. (In Russ.).
26. De la Portilla F. Internal anal sphincter augmentation and substitution. *Gastroenterol Rep (Oxf).* 2014;2(2):106-111. PMID: 24759338; PMCID: PMC4020126. https://doi.org/10.1093/gastro/gou004
27. Ashbum JH, Hull TL. *Rectal Prolapse.* In: Fecal incontinence and Defecation Disorders. Part 6. Chapter 34. 2015;500-510.
28. Italian Society of Colorectal Surgery (SICCR); Pucciani F, Altomare DF, Dodi G, Falletto E, Frasson A, Giani I, Martellucci J, Naldini G, Piloni V, Sciaudone G; Italian Association of Hospital Gastroenterologists (AIGO); Bove A, Bocchini R, Bellini M, Alduini P, Battaglia E, Galeazzi F, Rossitti P, Usai Satta P. Diagnosis and treatment of fecal incontinence: Consensus statement of the Italian Society of Colorectal. Surgery and the Italian Association of Hospital Gastroenterologists. *Digestive and Liver Disease.* 2015; 47(8):628-645. https://doi.org/10.1016/j.dld.2015.03.028
29. Frolov SA, Titov AYu, Poletov NN, Kostarev IV, Fomenko OYu. Surgical treatment of patients with severe fecal incontinence. *Pirogov Russian Journal of Surgery.* 2014;4:27-33. (In Russ.).
30. Chittenden AS. Reconstruction of anal sphincter by muscle slips from glutei. *Ann Surg.* 1930;92:152-154.
31. Pickrell KL, Broadbent TR, Masters FW, Metzger JT. Construction of a rectal sphincter and restoration of anal continence by transplanting the gracilis muscle; a report of four cases in children. *Ann Surg.* 1952;135(6):853-862. PMID: 14924540; PMCID: PMC1802208. https://doi.org/10.1097/00000658-195206000-00010
32. Cavina E, Seccia M, Evangelista G, et al. Perineal colostomy and electrostimulated gracilis "neosphincter" after abdomino-perineal resection of the colon and anorectum: A surgical experience and follow-up study in 47 cases. *Int J Colorectal Dis.* 1990;5(1):6-11. https://doi.org/10.1007/BF00496141
33. Sato T, Konishi F, Ueda K, Kashiwagi H, Kanazawa K, Nagai H. Physiological anorectal reconstruction with pudendal nerve anastomosis and a colonic S-pouch after abdominoperineal resection: report of 2 successful cases. *Surgery*. 2000;128(1):116-120. https://doi.org/10.1067/msy.2000.107061
34. Milanov NO, Adamyan RT, Tsarkov PV, Istranov AL, Kravchenko AYu, Tulina IA. *Sposob formirovaniya upravlyaemogo zamykatel'nogo apparata vokrug promezhnostnoj kolostomy pri utrate ili otsutstvii sfinkternogo apparata pryamoj kishki.* Patent na izobretenie №2380047 MPK51 A61V 17/00. 29.09.2008/27.01.2010. Byull. №3. (In Russ.).

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