

ORIGINAL PAPERS

THE USEFULNESS OF ANORECTAL MANOMETRY IN PATIENTS WITH A STOMA BEFORE AND AFTER SURGERY TO RESTORE THE CONTINUITY OF THE GASTROINTESTINAL TRACT

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The operation to restore the continuity of the gastrointestinal tract is another surgical intervention in a given patient, which directly translates into an increased risk of complications during and after surgery. That is why proper qualification is important for the operation to restore the continuity of the gastrointestinal tract in terms of performance and efficiency of the anal sphincter apparatus, among other things.

The aim of the study was to evaluate the effect of restoring physiological defecation routes on the sphincter function and to observe the parameters of anorectal manometry in patients before and after surgery to restore the continuity of the gastrointestinal tract.

Material and methods. The study included 29 patients scheduled for restoration of the continuity of the gastrointestinal tract, 12 women and 17 men. The average age in the group was 62 years. Anorectal manometry was performed both before surgery as well as one month and three months afterwards in all patients. The average time to have a stoma was 12 months.

Results. The resting pressure in the anal canal (MRP) three months after the restoration of the continuity of the gastrointestinal tract increased by 30.4%. The maximum systolic blood pressure in the anal canal (MSP) increased by 22.2%. The value of recto-anal inhibitory reflex (RAIR) decreased by 19.2%. The length of the high pressure zone in the anal canal (HPZL) increased by 27%. The study results of visceral rectal sensation thresholds decreased by 23.3% for the sensation threshold, and 14.4% for the pressure threshold.

Conclusions. Restoring the continuity of the gastrointestinal tract improves the anal sphincter function which is evident in the parameters of anorectal manometry. The restoration of passage improves the sphincter function, and these changes are statistically significant.

Key words: anorectal manometry, intestinal stoma, anal sphincters

Anorectal manometry is of the most common methods used to measure the function of the anal sphincter. The first attempts of manometric studies were performed at the end of the nineteenth century, however, it was only at the turn of the 70s and 80s of the twentieth century that they led to the development and dissemination of this diagnostic method. Anorectal manometry is a test consisting in measuring the pressure in the intestinal lumen, rectal bulb and anal sphincters using probes (probes perfused with water or microprocessor probes), connected to a pressure transducer

and a system of registration, analysis and data processing. The measuring tube should be further equipped with a latex balloon mounted on its top. The study is carried out after the preparation of the rectum with an enema. We evaluate the basic parameters determining the activity of sphincter of the anal and rectal canal, such as:

- maximum resting pressure MRP of the anal sphincters,
- maximum squeeze pressure *MSP* of the anal sphincters, dependent on the will of a patient,

- recto-anal inhibitory reflex RAIR,
- high pressure zone length HPZL,
- functional sphincter length FSL,
- reflex sphincters contraction RSCC – for example when coughing,
- anocutaneous reflex ACR, or contraction reaction of the external sphincter beyond control.

Thresholds of visceral rectal sensation are also rated, i.e. the volume at which the first sensation appears, a feeling of pressure at stool, and pain threshold (1). Normal values are difficult to determine unambiguously since they depend on the age of the patient, their sex and the measurement methods. Thus, the maximum resting anal pressure MRP is 40-140 mm Hg. This value consists of the pressure generated by the internal anal sphincter (40-65% of the MRP), RDS (20-50% MRP) and hemorrhoidal plexus (approx. 15% MRP). MSP is the highest pressure recorded at any point of the anal canal during the maximum contraction of any muscle; its value is typically 2- or 3-fold greater than that of MRP. HPZL is determined as the length of the intestine segment where the pressure is greater than half the value of MRP; in women it amounts to 2-3 cm, and to 2.5-3.5 cm in men. During a manometry study, two basic sphincter reflexes are usually also evaluated: RAIR and RSCC. The Recto-Anal Inhibitory Reflex RAIR is the reflex relaxation of the internal anal sphincter during the stretching of the rectal wall using a balloon with a volume of 50-200 ml (2, 3, 4).

Restoration of the continuity of the gastrointestinal tract is performed as an elective procedure. The period from the primary operation to restorative treatment is different and depends on the type of illness, the patient's condition and other test results. In the study presented by Law et al., the average time between the original operation and the closure of the stoma was 183 days in the group with a loop ileostomy and 180 days in the colostomy group (5).

The aim of the study was to evaluate the effect of restoring the physiological defecation routes on the sphincter function, to determine the correlation of time of life with a stoma on the sphincter function and to observe the parameters of anorectal manometry in patients before and after surgery to restore the continuity of the gastrointestinal tract.

MATERIAL AND METHOD

The study covered patients qualified to restore the continuity of the gastrointestinal tract in whom the original surgery was not associated with total or partial removal of the rectum. They were patients with a single stoma, after Hartmann's operation, as well as patients with loop stomas. A manometry study was performed both before the surgery to restore the continuity of the gastrointestinal tract as well as 1 and 3 months later. We included 29 patients in the study. The median age was 62 years (Q1-Q3 median, 42-71). Women accounted for 41.4% (12 people), men – 17 people – which corresponded to 58.6% of the study group. The cause of stoma in 9 patients was neoplastic disease (31%). Most patients suffered from diverticulosis of the large intestine – 12 patients (41.3%), injuries accounted for 20.7% (corresponding to 6 patients), and fistulas – 6.9% (2 patients). The time which elapsed from the appearance of the stoma to the restoration of continuity of the gastrointestinal tract was 12 months.

The values of the qualitative characteristics are shown as the number of observations with a percentage rate. Quantitative characteristics, in turn, are presented in the form of a median and the range between the 1st and 3rd quartile (Q1-Q3). The relationship between the time to have a stoma and features describing the morphology and function of the rectum was presented with Spearman's rho coefficient. The established level of statistical significance p for all tests was <0.05 .

Approval by the Bioethics Committee at the Regional Medical Chamber under the Resolution No. 34/13 of 21 November 2013 and informed consent of the patients to participate in the study were acquired in order to carry out the study.

RESULTS

The median value of the maximum resting anal pressure (MRP) measured before the operation was 59.7 mm Hg and increased by 15.3% one month after the operation to the value of 72.6 mm Hg and 83.0 mm Hg (an increase of 30.4%) three months after the treatment. The observed variabilities were statistically significant $p < 0.001$ in the collective term as well as

when comparing the specific periods of study between each other 0-1, 0-3, 1-3 (0 – examination before surgery, 1 – the study a month after the surgery, 3 – the study three months after the surgery). The maximal systolic pressure in the anal canal (MSP) increased a month after the surgery by 9.3% (to a value of 171.8 mm Hg), and by 22.2% three months after treatment (180.5 mm Hg). These results, similarly to MRP results, proved to be statistically significant ($p < 0.001$) in all periods of the study (0-1, 0-3, 1-3). The Recto-Anal Inhibitory Reflex (RAIR) showed statistically significant differences between all periods of the study (0-1, 0-3, 1-3) $p < 0.001$. Its median measured in the period prior to surgery was 53 ml, 47 ml a month after surgery (down 13.5%), and 44 ml 3 months after surgery (down 19.2%). The length of the high pressure zone in the anal canal (HPZL) increased by 27% when comparing the period before surgery and three months after it. The median value of this parameter was 28 mm before treatment, 31 mm after one month, and 32 mm three months after surgery respectively. The observed differences were considered statistically significant ($p = 0.008$). Significant differences were seen in the comparison of periods 0-3 and 1-3, but there was no difference

in the period 0-1. The median value of the residual pressure in the anal, and the rectal pressure measured before and after surgery were not statistically significant. (residual pressure $p = 0.657$, rectal pressure $p = 0.518$).

In the study group, the first sensation in the rectum before surgery appeared at a value of 33 ml (Q1-Q3 median of 30-37). This value was reduced significantly to 28 ml (down 16.1%) one month after the operation and to 25 ml (a decrease of 23.3%) three months after the surgery. The change in these values was statistically significant ($p < 0.001$) for all periods of observation (0-1, 0-3, 1-3). The median pressure threshold before surgery was 78 ml, 70 ml a month after surgery (down 10.7%), 67 ml after three months (down 14.4%). As in the case of sensory threshold, the values proved to be significant statistically ($p < 0.001$), and there were differences between all testing periods (0-1, 0-3, 1-3). These results are illustrated in tab. 1 and 2. In the study group, statistically significant results were not obtained ($p > 0.05$) when comparing the disconnection time of the gastrointestinal tract with the specific parameters of anorectal manometry in the period before reconstruction, one month and three months after the operation (tab. 3).

Table 1. The results of anorectal manometry

	Before the surgery	One month after surgery	Three months after surgery	p collective	Significant differences	No differences
MRP	59,7 (48,5-78,3)	72,6 (57,4-97,2)	83 (71,1-106,6)	<0,001	0-1, 0-3, 1-3	
MSP	163 (115,5-223,6)	171,8 (129,6-240,4)	180,5 (148,5-263,3)	<0,001	0-1, 0-3, 1-3	
HPZL (mm)	28 (16-37)	31 (19-39)	32 (22-40)	0,008	0-3, 1-3	0-1
Residual pressure in the anal canal	57,7 (40,4-82,2)	58,8 (40,6-88,3)	59,7 (42,5-82,3)	0,657		
Rectal pressure	45,4 (31,6-71,9)	46,5 (33-64,4)	45,2 (25,7-56,4)	0,518		
RAIR (ml)	53 (50-58)	47 (42-50)	44 (40-47)	<0,001	0-1, 0-3, 1-3	
Sensation threshold (ml)	33 (30-37)	28 (25-30)	25 (24-28)	<0,001	0-1, 0-3, 1-3	
Pressure threshold (ml)	78 (72-82)	70 (65-74)	67 (60-71)	<0,001	0-1, 0-3, 1-3	

Table 2. Relative changes as percentages of parameters of anorectal manometry

	Relative change within 1 month	Relative change within 3 months	p
MRP	15,3 (9,5; 36,5)	30,4 (15,4; 54,9)	<0,001
MSP	9,3 (6,7; 18,5)	22,2 (16,4; 28,2)	<0,001
The length of the anal canal (mm)	10,7 (-9,1; 65)	27,0 (-2,4; 66,7)	0,056
Residual pressure in the anal canal	6,2 (-11; 22,7)	-2,2 (-17; 21,4)	0,445
Rectal pressure	-8,3 (-38,1; 42,6)	-9,2 (-33,3; 16,1)	0,739
RAIR (ml)	-13,5 (-16,7; -10,3)	-19,2 (-22; -16,7)	<0,001
Sensation threshold (ml)	-16,1 (-17,9; -13,8)	-23,3 (-25; -20)	<0,002
Pressure threshold (ml)	-10,7 (-13; -6,3)	-14,4 (-18,2; -11,4)	<0,003
Maximal thickness of IAS (mm)	13,0 (6,8; 27,2)	24,8 (15,7; 44,2)	<0,004

Table 3. Correlation of the time to have a stoma with the parameters of anorectal manometry

Correlation of the time to have a stoma with	Status before reconstructive surgery		Change from the reconstruction until 1 month after the surgery		Change from the reconstruction until 3 months after the surgery	
	Spearman's rho	p	Spearman's rho	p	Spearman's rho	p
MRP	-0,29	0,110	-0,10	0,601	0,04	0,848
MSP	0,14	0,438	-0,27	0,143	-0,20	0,274
The length of the anal canal (mm)	-0,24	0,191	0,23	0,213	0,33	0,069
Residual pressure in the anal canal	-0,26	0,150	-0,11	0,549	0,02	0,916
Rectal pressure	-0,01	0,960	-0,14	0,446	-0,18	0,322
RAIR (ml)	0,20	0,284	0,05	0,788	0,12	0,536
Sensation threshold (ml)	0,20	0,287	-0,18	0,332	-0,07	0,694
Sressure threshold (ml)	0,12	0,528	0,02	0,934	-0,12	0,531

DISCUSSION

The operation to restore the continuity of the gastrointestinal tract is at least the second or yet another surgical intervention in a given patient, which directly translates into an increased risk of complications during and after surgery. Patients undergoing these operations are mostly people over 60 years of age with numerous systemic workloads. The most common cause of primary operations resulting in the emergence of stoma was neoplastic disease. The most serious complications of reconstructive surgery of the gastrointestinal tract include leaking anastomosis. This is a serious, life-threatening complication, and – according to data from reference colorectal surgery centres – concerns 9-13% of patients (6, 7, 8). The failure of anal sphincters is a complication which is not a direct threat to the patient's life, yet it decisively reduces its quality and the ability to function properly in society. That is why proper qualification is important for the operation to restore the continuity of the gastrointestinal tract in terms of performance and efficiency of the anal sphincter. Continence is defined as the ability for any control over defecation, distinguishing formed and liquid stool, gases as well as stopping bowel movements during sleep.

Anorectal manometry is an essential tool in assessing functional disorders of the anorectum (9, 10). Correct and detailed assessment of anorectal pressure is made possible thanks to it. The evaluation of pressures allows us to make treatment decisions and to compare the functional outcome after applying the treatment. It has become an important element of the assessment in common social problems – chronic constipation and faecal

incontinence, which is highlighted by a number of authors (11, 12, 13). Other works are devoted to the assessment of the anal sphincter in patients with intestinal pouch in anastomosis with the anal canal (14, 15). They show interesting results of studies that assess the significance of the restoration of anorectal inhibitory reflex RAIR after the surgery of restorative proctocolectomy using DS-IPAA (double-stapled ileal pouch-anal anastomosis). Some authors show that RAIR is not necessary for the proper stool continence, and that the continence depends on the correct tension of the internal sphincter and normal neorectum capacity. According to others, improving the continence after IPAA is related to the restoration of RAIR. The results of a study conducted by Saigusa et al. indicate no significant differences in terms of capacity, susceptibility or sensory threshold between patients in whom RAIR is present and in whom it disappeared (16). The literature describing the use of anorectal manometry in evaluating sphincter function before and after surgery to restore the continuity of the gastrointestinal tract is very scarce. This explains the need to further explore the changes occurring in the sphincter apparatus before and after the surgery to restore the continuity of the gastrointestinal tract, and to identify factors that could have an influence on the development of disorders in its functioning.

Statistically significant changes were found in the values of most parameters of anorectal manometry in the analysed material. These differences were evident in MRP, MSP, HPZL, RAIR and the thresholds of visceral rectal sensation (sensory threshold and pressure threshold). In the case of residual pressure in the anal canal and rectal pressure, in turn, no

statistically significant differences were found.

We did not find a statistically significant correlation between the time of life with a stoma and the various parameters of anorectal manometry either. Our study confirmed the assumption that the weakening of anal sphincter function is visible in patients with stoma and that restoration of passage through the anus improves this state. Similar conclusions were reached by Sudol-Szopińska's team (17). They presented work showing the usefulness of endosonography in patients with a stoma which emerged before the decision to perform reconstructive surgery. Thickness and echogenicity of the internal anal sphincter (IAS) was evaluated alongside with the function of the external anal sphincter and the puborectalis muscle in a dynamic study. In the vast majority of patients – 27 of 30 people, i.e. 90% – thinning of the IAS was observed. The degeneration of the sphincter could be the result of a lack of passage for gastric contents through the anus and normal sphincter activity. In this work, we did not assess the morphology of the anal sphincter after restoring the continuity of the gastrointestinal tract. Thinning of the IAS as the main component of the resting pressure in the anal canal translates into a decline in the value of MRP. The increase in MRP described in the above study after the restora-

tion of the physiological defecation route should translate into an increase in the thickness of the IAS. The quoted work points to the need to combine anorectal manometry and endosonography for more comprehensive assessment of the phenomena occurring in the anal sphincter apparatus before and after the restoration of the continuity of the gastrointestinal tract. No works comprising the above-described subject matter have been found in Polish and foreign literature, which emphasizes the necessity to conduct broader research on the subject.

CONCLUSIONS

1. Restoring the continuity of the gastrointestinal tract improves the anal sphincter function which is evident in the parameters of anorectal manometry.
2. There was no significant difference in the correlation of life time with a stoma and the parameters of anorectal manometry assessed before and after restoring the continuity of the gastrointestinal tract.
3. Determining a weakening of sphincter function in patients with a stoma should not be a disqualifying criterion for reconstructive surgery.

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