ORIGINAL ARTICLE

Factors affecting postoperative leakage complications in rectal tumour resection

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Abstract. *The low anterior resection (LAR) of the rectum performed by the total mesorectal excision (TME) method is, from an oncologic point of view, a sufficiently radical surgical procedure in rectal carcinoma treatment. Its advantage is also the reasonable life standard of the patient without permanent colostomy. A serious problem of this operation can be the fact that the possible dehiscence of the anastomosis suture may appear.*

Aim of the study: Statistical evaluation of the influence of various factors on the anastomosis dehiscence occurrence in the patients in the test group.

Patients and methods: In our test group there were 69 patients, 36 males and 33 females, average age 62 years (45 – 78). The localisation of the tumour in the rectum is on average 8 cm (5 – 14) from the anal verge. The TME method was applied during the resection. Several aspects were monitored: the relationship between anastomosis dehiscence occurrence on one side and the sex of the patients, their age, the intercurrent diseases, neoadjuvant therapy, the localisation of the tumour in rectum, the stage of malignant disease and the stage T of the tumour on the other side. The Fisher's exact test was used for the statistical evaluation of the four-polar table evaluation and standard methods of descriptive statistics were also applied.

Results: The total number of postoperative anastomosis dehiscence in the tested group of patients was 7, i.e. 10.1 %. The relation between BMI, preoperative radiotherapy and tumour localisation in the rectum was not proven. The frequency of anastomosis dehiscence was statistically significant in males of a higher age group. There was a statistically significant difference in the age of operated patients; the females were operated at a higher age than males. In two cases the anastomosis dehiscence was complicated by occurrence of rectovaginal fistulas.

Conclusions: The total number of postoperative anastomosis dehiscence in the tested group of patients was 7, i.e. 10.1 % (CI 0.95 = 4.7; 19.6). The higher age of male patients seems to represent a risk factor for the occurrence of anastomosis dehiscence in the tested group of patients.

Key words: *rectal cancer, rectal resection complications*

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Souhrn. *Nízká přední resekce rekta provedená metodou totální mezorektální excize je z onkologického hlediska metodou dostatečně radikální. Její předností je, že zajišťuje přiměřený životní standard bez nutnosti vytvoření trvalé kolostomie. Vážným problémem je však možnost vzniku pooperační dehiscence anastomózy.*

Cíl studie. Statistické vyhodnocení vlivu různých faktorů, které ovlivňují vznik dehiscence anastomózy.

Pacienti a metodika. V souboru je 69 pacientů (36 mužů a 33 žen) průměrného věku 62 let (45 – 78 let). Lokalizace tumoru v rektu byla v rozmezí 5 – 14 cm od análního okraje. Při resekčním výkonu byla použita metoda totální mezorektální excize. Sledována byla souvislost vzniku dehiscence anastomózy s pohlavím pacientů, jejich věkem a přidruženými chorobami, souvislost s lokalizací tumoru, T- stadiem onemocnění a neoadjuvantní terapií.

Výsledky. Celkem vznikla dehiscence u sedmi pacientů (10,1 %). Dvakrát byla komplikována vznikem rektovaginální píštěle. Ve sledovaném souboru faktorů byl statisticky významný počet dehiscencí u starších pacientů mužského pohlaví.

Závěr. Počet dehiscencí anastomóz koreluje s počty dehiscencí uvedených v literatuře. Statisticky prokázanými rizikovými faktory pro vznik dehiscence anastomózy byli pacienti muži a jejich vyšší věk.

Klíčová slova: *karcinom rekta, komplikace resekcí rekta*

The low anterior resection of the rectum using total mesorectal excision (TME) method is now considered to be a sufficiently radical oncological treatment in the therapy of rectal carcinoma (1,2,7,9,12). The introduction of TME has achieved a decreased frequency of local recurrences of the disease as well as concurrently improving the five-year survival of the patients (8,14,18). Generally TME is suggested for the operation of tumours in the distal and medial third of the rectum, but certain workplaces advocate its use in all rectal tumours (3,17). By adhering to conservative operative techniques it is also possible to preserve the function of pelvic organs (7,20).

A serious problem of the low anterior rectal resection is the possible occurrence of postoperative dehiscence of the anastomosis. This complication drastically endangers the patient's life, requires demanding postoperative care and often needs re-operation thereby making the entire treatment significantly more expensive.

There are several studies that, while evaluating the occurrence of complications after rectal resection, consider the indication for a protective stomy (4,11,21). A possible compromise would be placing a protective stomy in high risk patients. This does not directly prevent the occurrence of dehiscence, but it does restrict the extent of severe complications caused by leaks. However, this procedure requires another operation thus leading to further postoperative complications (11,13).

It is therefore ideal to perform a detailed analysis of the group aiming to determine the risk factors that may cause postoperative dehiscence of the anastomosis.

Patients and methods

The group consisted of 69 patients, 36 men and 33 women with an average age of 59 and 64 years respectively. The patients in the study group had a preoperative diagnosis of rectal carcinoma, including five cases of villous adenoma with high-grade dysplasia. The operations were performed from the year 1998 to the year 2005. All operations were elective and all patients were stabilised, including blood count, and prepared for the operative procedure.

The operative procedure was the lower anterior resection of the rectum using the method of mesorectal excision according to Heald (9) suggested in the year 1982. In three cases a protective ileostomy was performed. The least distance from the tumour border to the resection line during the incision of the rectum was 1.5 – 2 cm in tumours of the distal third of the rectum (13). In five cases the anastomosis was performed by manually placed sutures. Two of these consisted of an ileoanal anastomosis (J-pouch) with the formation of a protective ileostomy. In seven patients the anastomosis was performed solely by a circular stapler, in the remaining 57 cases it was done using a bistapler technique. To ensure the integrity of the anastomosis, a careful inspection of the completeness of both rings of tissue extracted from the circular stapler was done. In four cases, where the tissue rings were not complete, the anastomosis at the location of the defect was manually sutured (in these patients there were no complications in anastomosis healing during the postoperative phase). Another type of integrity test of the anastomosis is an underwater air test. However, this test can be difficult to perform in obese patients. Prior to performing the colo-rectal (anal) anastomosis, the distance between the tumour

border and resection line is carefully evaluated. It is crucial that this distance is beyond the mentioned limit. If this limit cannot be fulfilled then the operation is converted into Miles abdominoperineal resection of the rectum.

All resection lines of the rectal wall were histologically examined and in none of the examined specimen was tumour infiltration found. As a standard, the anastomosis site is extraperitonealised with a preventive drain, which is removed on the 7 – 8th postoperative day. In case of anastomosis dehiscence the drain is retained and is used for the drainage of the intestinal secretions. When a dehiscence is confirmed, not requiring an operative revision of the abdominal cavity, the patient is placed on parenteral nutrition and a conservative approach is taken until the anastomosis fully heals. In cases of colo-anal anastomosis and anatomical discrepancies in the pelvis, a protective ileostomy is performed and based on X-ray controls it is electively removed 2 – 3 months after the operation.

In the wake of the evolving ideas concerning the complex treatment of rectal carcinoma, the types of preoperative oncological preparation has also undergone distinct development. In 9 patients preoperative radiotherapy was performed in five doses, in 35 patients neoadjuvant chemoradiotherapy was performed after which operative treatment followed 5 weeks later. In the other patients preoperative radiotherapy was not administered. Prior to the operation all patients were examined by an oncologist who evaluated the necessity of preoperative chemoradiotherapy based on the overall state of the patient and oncological staging of the tumour (Table 1). Endoscopy (+ histological examination), CT, ultrasound and endoscopic-ultrasonographically preoperatively determined the stage of the disease. Patient characteristics related to the staging of the disease, specifically the T oncological classification are presented in Table 1. The patients from this group never had previous operations for colorectal carcinoma. All patients signed an informed consent prior to their operation.

The localisation of the rectal tumour was determined based on preoperative endoscopic examination. The distance between the distal border of the tumour to the distal anal verge is presented (Table 1). The distal respects the border defined by the dentate line from which the sections are divided at 5 cm intervals. In this paper, the site of rectal cancer was defined according to International Guidelines for Cancer Registrars; i.e. 7 cm or less from the anal verge, low rectum; over 7 cm to 12 cm, mid rectum; over 12 cm but less than 17 cm (3).

In this work we assessed the number of clinically proven postoperative anastomosis dehiscence. We statistically evaluated the frequency of postoperative anastomosis dehiscence in relation to: the localisation of the tumour within the rectum; the distance from the rectal resection line to the tumour border; preoperative radiotherapy; age group and sex of the patient; stage T of tumour infiltration, value of BMI (body mass index).

Statistical methods

Statistical evaluation was done using widely used methods of descriptive and indicative statistics. The confidence interval to define the risk level of leakage was chosen at $p = 0.95$ and was assessed using Wald's method. To test the differences between the representative values in comparative groups the exact Fisher test for four-polar tables was used.

Results

1. Anastomosis dehiscence occurred in seven operated patients, all of which were clinically proven. When considering the entire group it constituted 10.1 % of patients. The confidence interval for the occurrence of dehiscence in percentage as calculated using Wald's method for $p = 0.95$ was $4.7 \leq 10 \leq 19.6$.
2. No statistically (Fisher's exact test) significant difference between the groups designated for preoperative radiotherapy (Table 2).
3. No statistical (Fisher's exact test) relationship was established between the occurrence of a postoperative leak and the general staging of the disease, nor between the isolated oncological T-stage of the tumour (Table 3).
4. Statistically (Fisher's exact test) no relationship was established between the occurrence of a postoperative leak and the gender or BMI of the patients. For the purposes of statistical evaluation the patients were divided into two groups, defined by a BMI less than 25 and those with a BMI greater than 25 (Table 4).
5. The average age of men with leaks was statistically significantly different from the average age of all operated patients ($p < 0.001$). In the group of women this relationship was not found, women

Table 1
Patients characteristics

		Males	Females	Total
No. of patients		36	33	69
Mean age (range) (years)		60 (23 – 79)	64.5 (47 – 78)	62 (23 – 79)
Stage of disease	High grade dysplasia	4	1	5
	I	4	4	8
	II	11	12	23
	III	15	12	27
	IV	2	4	6
T-stadium of tumour	High grade dysplasia	4	1	5
	T-1	0	1	1
	T-2	4	7	11
	T-3	24	21	45
	T-4	4	3	7
Distance Tumour - anal rim*	0 – 7 cm	7	5	12
	7 – 12 cm	24	22	46
	12 – 17 cm	6	5	11
Five-day preoperative radiotherapy**		4	5	9
Neoadjuvant chemoradiotherapy***		21	14	35
Without radiotherapy		11	14	25

* preoperative endoscopic examination

** Short preoperative radiotherapy at a dosage of 15 Gy in 5 sessions/ 5 working days, 3 days prior to the operation term followed by a postoperative radiotherapeutic dose of 44 Gy in 22 fractions / 22 working days

*** Preoperative radiochemotherapy: dose 45 - 50.4 Gy in 25 - 28 fractions / 25 - 28 working days with concomitant chemotherapy with 5-fluourouracil at a dose of 200mg/m^2 continuously 24 hours daily during the course of radiotherapy, the operation is planned 5-6 weeks after the end of the radiochemotherapy.

Table 2
The influence of preoperative radiotherapy on the incidence of anastomosis leakage

	Leakage yes	Leakage no
Short preoperative radiotherapy	1 (0.8)	8 (7.2)
Neoadjuvant chemoradiotherapy	4 (3.6)	31 (31.7)
Without radiotherapy	2 (2.5)	23 (22.5)
Total	7	62

The value in brackets represents the theoretical frequency calculated while assuming a fulfilled zero hypothesis.

with leaks had a lower average age when compared to the average age of all operated women (Table 5). When assessing the relationship between operated patients with respect to age, a statistically significant difference was established with higher age when comparing amongst the general age of men within the group. Women were operated at an age five years older as compared to the men in the group (Table 6). Amongst the operated group, 28.5 % of patients had diabetes mellitus, 17.1 % had ischaemic heart disease and 45.7 % were treated for arterial hypertension. The χ^2 test excluded any statistical differences in the distribution of these illnesses amongst the men or women of the group. Furthermore no relationship between the occurrence of postoperative dehiscence and these parameters was established.

6. The treatment of postoperative leaks that occurred in seven patients in the group. Rectovaginal fistula in one patient was resolved by placing a derivation stomy followed by the resection of the fistula and removal of the stomy. The second patient was after a hysterectomy followed by actinotherapy of the pelvis. The rectovaginal fistula was resolved by a permanent colostomy. The postoperative revision of the following three male patients was resolved

Table 3
The relationship of leakage with disease staging and oncological stage T

	High grade dysplasia	Staging				T - stadium			
		I	II	III	IV	1	2	3	4
Leak yes	0	1	2	3	1	0	1	4	2
Leak no	5	7	21	24	5	1	10	41	5

Table 4
Suture leakage in relation with patient gender and BMI*

	Sex		BMI	
	Males	Females	Up to 25	More than 25
Leak yes	4	3	2	5
Leak no	32	30	27	35

* BMI – body mass index

Table 5
The mean age of the group of patients with dehiscence according to gender

	Males	Females
The mean age	73.0	57.7
SD*	6.9	7.6

* standard deviation

Table 6
Statistical characteristics of age in patients of the group

	Males	Females
Age – range (years)	59.3	64.3
SD*	11.9	9.8
VC (%)**	20.0	15.2

* standard deviation
** variation coefficient

by permanent colostomies – Hartmann's type of operation. In two patients it was possible to heal the dehiscence using a conservative approach - parenteral nutrition and using drains placed at the anastomosis during operation. In the evaluated group of patients there were no deaths in direct connection with the operative procedure.

Discussion

Rullier et al. (21) proved a greater incidence of postoperative anastomosis dehiscence in older men and obese patients. The higher frequency of dehiscence in older men was also described by Law et al. (15). These characteristics were considered to pose a greater risk to the patient. Protective stomy was not considered to be necessary in all patients but only in the patients at greater risk and mainly in cases of a low anastomosis.

In the evaluated group of patients we did not establish a direct relationship between the localisation of the anastomosis and distance of the tumour from the anal verge. Statistical significance seemed apparent in the relation between anastomosis leak and higher age amongst male patients. This situation can perhaps be explained by the narrow male pelvis and furthermore, in older patients, with presumed general manifestation of atherosclerosis, there is a greater risk of impairment to the vascular supply in the region of the anastomosis.

The issue of whether or not to place a protective stomy is under constant debate. Certain authors achieved significant improvement in postoperative complications by employing this procedure. Law et al. (16) assessed various types of stomies. Colostomy was better than ileostomy as indicated by the lower rate of postoperative ileus states. Karanjia et al. (11) quantified the number of complications that occurred by the realisation and removal of a protective colostomy. In any case, this is probably the most important decision to be taken by the surgeon. Balancing

the general state of the patient and the necessity of a colostomy while taking into consideration the relative contraindication of repeated surgical procedures, insight of the general risk to posed on the patient.

At present a bistapler method is used to create low anastomoses and the surgeon is forced to rely on the innate precision of the equipment. It is essential to verify the integrity of the anastomosis but the anatomic conditions in the pelvis make it impossible for direct visual inspection of the anastomosis. In the paper by Folkesson et al. (5) it is described that when using two different circular staplers to produce the anastomosis, there is a 4% difference in the incidence of postoperative leaks. It also reports the possibility of a technical malfunction during the mechanical realisation of the anastomosis.

In older patients it is often considered that the low resection and anastomosis should not be performed but rather to directly perform an abdominoperineal rectal amputation with a permanent sigmoideostomy. A preoperatively impaired continence of the anal sphincter can be improved by the resection operation by removing the pathological secretion from the anal tumour. Older patients with restricted finger mobility may have problems with managing the colostomy. Philips et al. (19) propose that advanced age should not be a definite contraindication for the low rectal resection. Preoperative problems can be to a certain extent objectively judged by endorectal endosonography and the functional examination of the anal sphincter. Hida et al. (10) recommend low resection with the creation of a J-pouch to be a suitable alternative to a permanent colostomy in older patients. In an aptly chosen surgical treatment it has been proven that even the radical resection of the rectum in older patients can have desirable results (6).

The total number of leaks, 7 in the group of 69 patients, was compared with data from other workplaces (2-4,11,14,21). When assessing the data from these workplaces the average dehiscence from the entire group to be 13.4 %; at a confidence interval with p = 0.95 correlates to 11.4 to 15.4. The differences amongst published results from individual authors are statistically significant $\chi^2 = 13.45$. At six levels of freedom statistical significance was proven at p = 0.035. The results from our workplace form a common cluster with data from workplaces that claim percentage leaks at 9.2, 9.8, and 9.6 (3,4,14).

Conclusions

1. Advanced age in men can be considered as a risk factor for the occurrence of a leak in patients operated by low anterior resection method employing total mesorectal excision.
2. The information on the age of the women and men was of statistical significance. In men the average age was 5 years lower.
3. The incidence of the dehiscence of suture anastomosis was 10.1 % in the followed group ($CI_{0.95}$ = 4.7; 19.6). Statistical comparison of these results with results published by other workplaces, taking into account the corresponding confidence intervals, it was established that these results form a common cluster.

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