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Local recurrence in patients treated for rectal cancer using total mesorectal excision or transection of mesorectum

Lokalni recidiv kod bolesnika lečenih od karcinoma rektuma metodama totalne mezorektalne ekscizije ili transsekcije mezorektuma

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Abstract

Background/Aim. Rectal cancer is a major health problem throughout the world, despite the great progress in the treatment and control of the disease. The aim of this study was to determine the effect of mesorectal excision type on local recurrence in patients operated on for rectal cancer within a 3-year period. **Methods.** The clinical retrospective study was conducted at the Clinic for General Surgery at the Clinical Center in Niš, Serbia, and included 225 patients with rectal cancer. Postoperatively, the patients were observed 36 months. Total mesorectal excision (TME) method was used in 129 (57.33%) patients, and partial mesorectal excision (PME) in 96 (42.66%). There were 145 (64.44%) man and 80 (35.55%) women, average age 66.8 years. **Results.** In 58 (25.77%) of the patients cancer was localized in the proximal third of the rectum, in 99 (44%) in the medium third, in 68 (30.22%) it was 8 cm of the anocutaneous line. In 167 (74.22%) patients rectal cancer was in T3 stadium. TME was performed in all the patients with cancer in the distal third of the rectum and in 61.61% of the patients with cancer in the medium third of the rectum. PME was performed in all the patients with localized cancer in the proximal third and in 38.38% of the patients with cancer in the medium third of the rectum. Local recurrence occurred in 20 (8.88%) patients, 12 (9.30%) in the TME group and 8 (8.33%) in the PME group, which was not a statistically significant difference. In 75% of the cases, relapse occurred in the patients in T3 stage. Relapse occurred in 55% of the cases in the second year after the surgery. The median survival of all the patients amounted to 35 months. The total mortality of all respondents in a 3-year period amounted to 5.3%. **Conclusion.** There were no statistically significant differences in the incidence of local recurrence and survival among patients who underwent TME and those underwent PME. The type of mesorectal excision does not affect the incidence of local recurrence in node-negative disease stages.

Key words:
rectal neoplasms; neoplasm recurrence, local; digestive system surgical procedures; surgical procedures, operative; neoplasm staging; prognosis.

Apstrakt

Uvod/Cilj. Karcinom rektuma predstavlja veliki medicinski problem širom sveta, uprkos znatnom napretku u lečenju i lokoregionalnoj kontroli bolesti. Cilj rada bio je da se utvrdi uticaj tipa mezorektalne ekscizije na pojavu lokalnog recidiva kod bolesnika operisanih od karcinoma rektuma, u trogodišnjem periodu. **Metode.** Klinička retrospektivna studija sprovedena je na Klinici za opštu hirurgiju Kliničkog centra u Nišu i obuhvatila je 225 bolesnika operisanih od karcinoma rektuma. Bolesnici su postoperativno praćeni 36 meseci. Metodom totalne mezorektalne ekscizije (TME) operisano je 129 (57,33%) bolesnika, a metodom parcijalne ekscizije mezorektuma (PME) 96 (42.66%) bolesnika. Muškaraca je bilo 145 (64,44%), a žena 80 (35,55%); prosečna starost 66,8 godina. **Rezultati.** Kod 58 (25,77%) bolesnika karcinom je bio lokalizovan u proksimalnoj trećini rektuma, kod 99 (44%) u srednjoj trećini, a kod 68 (30,22%) do 8 cm od anokutane linije. Kod 167 (74,22%) bolesnika karcinom rektuma bio je u T3 stadijumu. Metoda TME primenjena je kod svih bolesnika sa karcinomom u distalnoj trećini rektuma i kod 61,61% bolesnika sa karcinomom u srednjoj trećini rektuma. Metoda PME primenjena je kod svih bolesnika sa lokalizacijom karcinoma u proksimalnoj trećini i kod 38,38% bolesnika sa lokalizacijom u srednjoj trećini rektuma. Do pojave lokalnog recidiva došlo je kod 20 (8,88%) bolesnika. U grupi TME bilo je 12 (9,30%), a u grupi PME 8 (8,33%) bolesnika sa lokalnim recidivom, što

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ne predstavlja statistički značajnu razliku. Kod 75% bolesnika recidiv se javio u T3 stadijumu bolesti. Kod 55% bolesnika lokalni recidiv se javio u drugoj godini. Prosečno preživljavanje svih ispitanika iznosilo je 35 meseci. Ukupna smrtnost na trogodišnjem nivou iznosila je 5,3%. **Zaključak.** Nije bilo statistički značajne razlike u incidenciji lokalnog recidiva i dužini preživljavanja između bolesnika kojima je urađena TME i onih kojima je urađena PME. Tip mezorektalne ekscizije ne utiče na incidenciju lokalnog recidiva u *nodus* negativnim stadijumuma bolesti.

Ključne reči:
rektum, neoplazme; neoplazme, lokalni recidiv; hirurgija digestivnog sistema, procedure; hirurgija, operativne procedure; neoplazme, određivanje stadijuma; prognoza.

Introduction

Colorectal cancer (CRC) with the incidence rate of 27 *per* 100,000 people represents the third leading cause of morbidity, right after lung and breast cancer. Annually, about 1.2 milion people are affected by CRC. In Serbia, CRC is the second leading cause of death in men and the third in women. Over the past few years, intensive work on improving the prevention, diagnosis and surgical techniques has been done in order to improve the results of treatment and quality of life of patients with CRC. However, the overall survival percentage remains unsatisfactory, because only 50% of patients live five years after the curative resection [1]. Screening of general population has an important role, because it allows the prevention of the disease, and the early detection of cancer, at a stage when the chances of cure are the largest and most certain. Surgical treatment is the most important link in the treatment of patients with rectal cancer [1]. The decision on the type of surgical intervention, *ie* total mesorectal excision (TME) or transection of mesorectum or partial mesorectal excision (PME), depends on several factors, primarily the tumor location and stage of the disease. For tumors of the distal third of the rectum, surgical method of choice is TME. In tumors of the medium third of the rectum (8–12 cm) it is possible to perform PME in selected cases. For tumors of the rectum laid 12–15 cm above the anocutaneous line, PME is a surgical method of choice [1, 2]. According to the literature [2–4], rectal cancer recurs in 8–50% of the cases. The highest percentage of the disease recurrence is within the first two years of the treatment completion [5, 6]. One of the most important risk factors for the disease recurrence represents the stage of the tumor. In the first stage of the disease local recurrence occurs in 10%, in the second stage about 24%, and in the third in around 41% of the patients who underwent potentially curative procedures [7]. The local recurrence is significantly influenced by poor tumor differentiation and perineureal and vascular space involvement of the tumor [7]. Risk factors for local recurrence are age, general condition of patients, as well as the knowledge and experience of surgeons in this field of surgery [8]. The tendencies of modern treatment of rectal cancer are to decrease the incidence of the local recurrence rate below 10% by constantly improving the surgical techniques and adjuvant therapy [1, 9]. If, in rectal cancer treatment only surgery is applied, local relapse frequency is pretty high, 15–45%. If radiotherapy and chemotherapy are applied together with TME, local relapse percentage is under 10%. Neoadjuvent and adjuvant radiotherapy application improves local disease control in great amount, while with chemotherapy micrometastases can be controlled. In locally progressive rectal cancer in T3 stage, radiotherapy is applied preoperatively, with the aim of tumor resectability enhancing, transferring cancer from the inoperable to operable stage, reducing malignant potential and local relapse percentage.

The aim of this study was to determine the effect of mesorectal excision type on local recurrence in our series of operated patients after the initial treatment for rectal cancer within a 3-year period.

Methods

A retrospective analysis of the initial treatment results in 225 patients with rectal cancer without metastases was conducted at the Clinic for General Surgery at the Clinical Center in Niš, Serbia, in a period 2009–2012. Postoperatively, the patients were observed 36 months. Of the total number of patients, there were 145 males (64.44%) and 80 (35.55%) females, average age 66.8 years. Histopathological examination of biopsy specimens revealed adenocarcinoma in all the cases. The localization and disease stage (TNM) are given in Table 1. The patients underwent potentially curative resection surgery

Table 1

Localization of rectal cancer and TNM stage tumors by the type of mesorectal excision (TME/PME) before the treatment period

Parameter	TME	PME	Total
Localization of rectal cancer, n (%)			
proximal 12–15 cm	-	58 (100)	58 (25.77)
medium 8–12 cm	61 (61.61)	38 (38.38)	99 (44)
distal 2–8 cm	68 (100)	-	68 (30.22)
Stadium of the disease (TNM)			
T1, T2 N0 M0	8	7	15
T1-2 N1-2 M0	19	21	40
T3 N0 M0	74	65	139
T3 N1-2 M0	25	3	28
T4 N1-2 M0	3	-	3
Total, n (%)	129 (57.33)	96 (42.66)	225 (100)

TNM – tumor, nodus, metastasis; TME – total mesorectal exacision; PME – partial mesorectal excision.

(standard resection anterior of the rectum – RAR, in all patients). TME was performed in all the patients with cancer in the distal third of the rectum [129 (57.33%) patients], and in 61.61% of the patients with carcinoma of the medium third of the rectum. PME was performed in all the patients with localized cancer in the proximal third [96 (42.66%)] of the rectum, and in 38.38% of the patients with cancer localized in the medium third of the rectum.

As a part of the resection procedure, preoperative radiotherapy was performed in 63 patients (28.0% of the total number of patients in the series – 225) (all from the group with TME – the sT3 N0 M0, sT3 N1-2 M0, sT4 N1-2- 3 M0), by the protocol 25 gray (5 Gy/fraction each day during the week) and a subsequent operation, as well.

The patients were observed through regular three month check-ups in the first two years, 6 month later on. In some cases when, based on patients' symptoms and physical examination, it was suspicious of local relapse existence, we used tumor markers (CEA and Ca 19-9), computed tomography (CT) of the abdomen and pelvis one *per* year, ultrasonography of the abdomen every six months, later multislice CT (MSCT) and nuclear magnetic resonance (NMR) and chest x-ray after one year.

Statistical analysis

Statistical analysis was performed using SPSS version 18 for Microsoft Windows. Survival analysis was carried by Kaplan-Meier method. Multivariate analysis was performed using the Cox regression model. *P*-values less than 0.05 were considered statistically significant.

Results

Data on localization of rectal cancer, TNM stage of tumors the type of mesorectal excision (TME/PME), before the treatment period are presented in Table 1.

In 167 (74.22%) of the patients rectal cancer was in T3 stadium (TNM).

The patients in stages of the disease N1-2 had 8-14 lymph nodes removed. In 220 (97.78%) operated patients, mechanical anastomoses were performed, in 54 (41.86%) patients from the TME group protective transverse colostomy was performed, and in 75 patients (58.13%) ileostomy was done.

Local recurrence occurred in 20 (8.88%) patients; 12 (9.30%) in the TME group and 8 (8.33%) in the PME group, which was not a statistically significant difference (OR = 0.86; 95% CI = 0291–2496; $p = 0.755$).

During a 3-year follow-up period, 38 (16.88%) of the patients developed distant metastases (liver, peritoneum, bones) and 17 (7.56%) had local recurrence associated with distant metastases.

Characteristics of local recurrence are shown in Table 2.

In 15 (75%) of the cases in T3 stage at the time of the surgery relapse occurred. Relapse occurred, at the earliest, six months after the surgery, and in 55% of the cases in the second year after the surgery.

Three of the patients with potentially curative surgery had positive margin on histology. One of them underwent abdominoperineal resection and the other 2 refused further operation and died of liver metastasis.

In our study 63 patients of the TME group were preoperatively treated with radiation therapy and four relapses were noted in this group of patients, out of total 12 relapses in the TME group.

Treatment of the patients with locoregional disease recurrence and distant metastases (liver) was conducted in accordance with consultative assessment and decision, and included a curative resection, chemotherapy and palliative procedures.

The total mortality of all respondents in a 3-year period amounted to 5.3% (12 respondents died out of 225). Causes of death are shown in Table 3.

Figure 1 shows the Kaplan-Meier survival curves of the patients operated for rectal cancer. The median survival of all

Table 2

Characteristics of local recurrence in the patients operated for rectal cancer

Parameter	TME n = 12	PME n = 8	Total n = 20
Localisation of rectal cancer recurrence			
segment of anastomosis	2	1	3
regional lymph nodes	5	4	9
pelvis, peritoneum, omentum, abdominal wall (implants)	5	3	8
Stadium of the disease (TNM)			
T1-2 N0 M0	-	-	-
T1-2 N1-2 M0	1	-	1
T3 N0 M0	3	4	7
T3 N1-2 M0	5	4	9
T4 N1-2 M0	3	-	3
Time of occurrence (months)			
0–6	1	-	1
7–12	2	2	4
13–24	7	4	11
25–36	2	2	4

TNM – tumor, nodus, metastasis; TME – total mesorectal exacision; PME – partial mesorectal excision.

Table 3
Causes of death of patients operated for rectal cancer by TME or PME methods

Causes of death	Number of patients	
	TME	PME
Anastomotic leakage, peritonitis diffuse, MODS	2	2
Cardiopulmonary insufficiency	2	0
Progressio morbi, n	4	2
Total, n (%)	8 (6.2)	4 (4.2)

TME – total mesorectal excision; PME – partial mesorectal excision; MODS – multiple organ dysfunction syndrome.

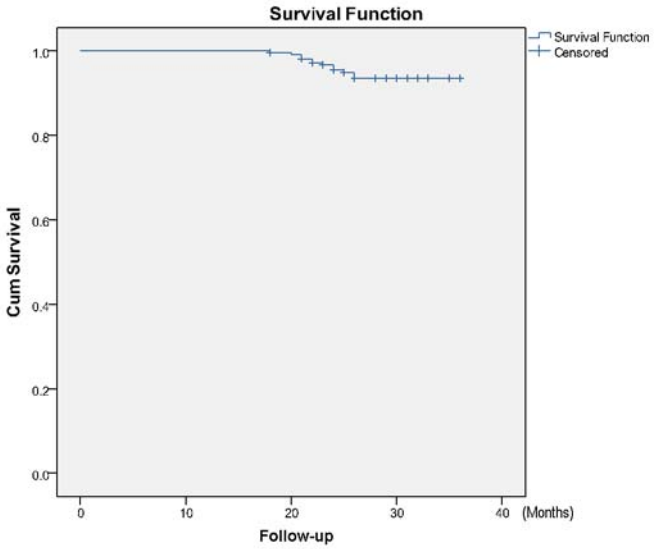

Fig. 1 – Kaplan-Meier survival curves of the patients operated for rectal cancer.

the patients amounted to 35.162 months with a standard error of 0.235 months.

Figure 2 shows the survival of the two groups of patients. The average survival time of the TME patients amounted to 35.078 ± 0.316 months, and the PME patients to 35.287 ± 0.348 months, and no statistically significant difference in the length of survival of analyzed groups was observed (log rank = 0.194; $p = 0.660$). Regarding this, the Cox regression model does not single out the type of surgery as a predictor of the fatal outcome, as well [Hazard Ratio (HR) = 0.764; 95% Confidence Interval (CI) = 0.230–2541; $p = 0.661$].

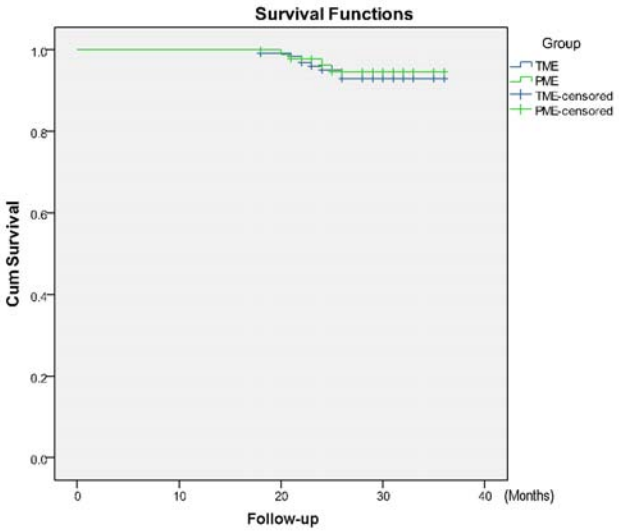

Fig. 2 – Kalpan-Meier survival curve of the patients operated on by total mesorectal excision (TME) and partial mesorectal excision (PME).

Discussion

In the last twenty years, numerous studies on any modalities of therapy for rectal cancer have been carried out and shown that they are subject to the same basic principles [10]. For tumors of the distal and proximal third of the rectum, the attitude on the type of mesorectal excision is clearly defined. However, there are controversies regarding surgical treatment of rectal cancer which is localized in the middle third. In other words, the question is whether to always apply TME in these patients or PME in selective cases [1].

TME was defined as the excision of the rectum with the surrounding mesorectum enclosed by the visceral pelvic fascia at the level of the pelvic flor. Transection of mesorectum at a higher level was considered PME. Local recurrence was defined as the presence of radiologically confirmed or histologically proven tumor in the pelvis within the field of surgery. The time to local recurrence was the duration between the surgical resection and the time of documentation of the recurrence [2]. We analyzed the data from the medical records related to gender, age, tumor location, stage of disease, type of surgical procedures and preoperative radiation.

Most studies indicate that the line of resection to 2 cm below the tumor is enough and oncologically quite safe [1–3, 6, 8, 11]. Also, lateral circumferential propagation is much more predictive of local recurrence compared to the propagation of distal tumors. Incomplete resection of the lateral margin of the tumor is considered the main cause of recurrence. Even with well performed mesorectal excision, a certain number of patients have a positive circumferential resection margin (CRM). Involvement of CRM is a sign of more advanced disease rather than poor surgical techniques. Patients with affected CRM can die of distant metastases before the local recurrence. The bigger the distance of the tumor from CRM the better the prognosis. A margin is positive when the tumor is less than 1 mm of the mesorectal fascia [1].

In the study of Scott et al. [11], the incidence of expansion into mesorectum at a distance of 5 cm, was 20%, which indicated that the excision of mesorectum 5 cm below the tumor is quite sufficient to satisfy the principles of oncology. Postoperative monitoring is essential in the detection of local recurrence. If the local recurrence is detected at an early stage, the chances of recovery are significantly higher. A large number of studies have dealt with the problem of optimal monitoring. The results show that the monitoring program is optimal if 2–3% of patients with recurrent disease are detected at the check-up, if the check-up is done every 2–4 months in the first two years from operation, and then every 6 months [12]. The conclusion is that the monitoring program must be adjusted according to the degree of relapse risk [13]. Local recurrence in 90% of the cases is detected in the first five years postoperatively. Aggravating circumstance is that the patients who relapse are most frequently in bad general condition, with the presence of distant metastases. A small number of patients with local recurrence is in good general condition, with a tumor resectionable at the time of disclosure and without distant metastases [14].

Diagnostic procedures are the most important link in the detection of local recurrence and include: physical examination, tumor markers [CEA and Ca 19-9), endoscopic and radiological methods (CT, NMR, endorectal ultrasound (ERUZ), positron emission tomography (PET) scan]. One of the most important indicators that can induce doubt on the existence of local recurrence are the symptoms of patients. If patients with a suspected local recurrence was not detected by a noninvasive diagnostic procedure, “a second look” laparotomy is indicated. Local recurrence of rectal cancer after TME and PME, mostly depends on the characteristics of the tumor. The highest percentage of relapses occurs in ulcer infiltrative tumor forms (26.3%), while the lowest is in egzofit intraluminal form and in tumors smaller than 3 cm (10.8%) and along with the stage of the disease, the frequency of local recurrence is growing; in the third stage it is 40% [15].

Based on the all above, the decision on the type of mesorectal excision, *ie* TME or PME, shall be adopted for each patient individually, depending on the characteristics and stages of tumors [16, 17].

Our study showed that there was local recurrence in 20 (8.88%) of the patients within a 3-year interval after the initial treatment (Table 2). We found no statistically significant difference in the incidence of local recurrence among the groups, which opens the possibility for the PME to be applied in patients with cancer localized in the middle third of the rectum in the early, favorable cases of so-called "good" group (sT1-2, some early sT3 N0 (sT3a (b) and clear – CRM by magnetic resonance imaging (MRI).

Also, in the present study, local recurrence was reported in 55% of the cases in the second year after surgical procedures, and in 75% of the cases, relapse occurred in the patients in T3 stage of rectal cancer at the time of surgery, confirming the data from numerous studies on this subject, that the local recurrence was mostly caused by the stage of the tumor, rather than the surgical techniques [18–21]. The results of studies on this problem, show no significant difference in the incidence of local recurrence in patients operated by TME and PME methods [1].

Local recurrence is most common in stage C according to Dukes (Heald 7 *vs* 27.4%, Hall 14 *vs* 27.8%, Dickson 9 *vs* 39.9%). The study by Killingback et al. [18] which included 549 patients operated by TME and PME showed that the local recurrence of 7.6% after PME was the approximate percentage of recurrence after TME. In patients with carcinoma of the medium third of the rectum, TME is not commonly peformed, but PME was performed instead in selected cases. The 5-year survival of patients in this study was 72.5% [18].

Lopez-Kostner et al. [19], in their study on the emergence of local recurrence in tumors localized 10–15 cm, in which TME and PME methods were performed, proved that there is no significant difference in the occurrence of local recurrence, as well as in a five-year survival, suggesting performing of PME whenever possible due to smaller functional deficits postoperatively.

A study done by Van Lingen et al. [20], showed the local recurrence in 4.6% of the patients after TME in the follow-up period of 25 months.

In a study of Petronella at al. [21], it was demonstrated that the emergence of local recurrence occurred in 6% of patients after TME.

Krivokapic et al. [22], have also dealt with this problem in a series of 1,000 patients operated for rectal cancer. They accepted TME concept for all tumors up to 8 cm above the anocutaneous line. In cases of rectal carcinoma located above 8 cm they usually performed PME. It was no statistically significant difference in local recurrence rates between TME and PME group. The emergence of local recurrence after TME was 7.6% and in the group of patients who underwent PME it was 5.6% of cases, which is in correlation with the results from our study.

Analyzing our results by Kaplan -Meier test, the survival of two groups was not statistically significantly different in overall survival. The median survival of all the patients was 35 months. The total mortality of all respondents in a 3-year period amounted to 5.3%, which was in correlation with the data available in the literature.

In a study conducted by Law and Chu [17], local recurrence in a 5-year interval was 9.7% and the survival percentage was 74.5% with no statistically significant differences between the two groups.

In a study by van Lingen et al. [20] after a follow-up period of 25 months, mortality was 5.3%.

In a study by Gupta at al. [23], TME was performed in 202 and PME in 96 patients. In the follow-up period of 38.7 months, 32 patients with local recurrence were detected. In a 2-year period after the operation, the local relapse occurred in 7.0% of the cases, and a 5-year monitoring showed the incidence of local recurrence rate of 10.7%. The 5-year overall survival and cancer-specific survival rates were 67.5% and 75.5%, respectively.

Indications for preoperative radiotherapy were patients with preoperatively confirmed T3 and T4 tumor stages (TNM). Local recurrence is the most important measure of the oncologic outcome following rectal cancer surgery [1–3]. The question whether the rate of local recurrence would be reduced in the group of patients with T3 nodule negative and nodule positive stage of the disease, who underwent PME, in accordance with the views and recommendations of other authors [24–27], remains open.

The treatment of rectal cancer is demanding and requires skills and art of the entire multidisciplinary team. Good surgery, good analysis of histological samples, good technique and optimal radiation, chemotherapy, along with a long-term monitoring of morphological and functional results are very important for the quality control [2]. (Non) radicality of the surgical procedure and applied preventive measures against local recurrence by the surgical team, also affect the localization and type of local recurrence [1, 2].

Conclusion

In the series of 225 patients with rectal cancer, after the initial and potentially curable surgical treatment within a 3-year follow-up period, there was a local recurrence in 20 (8.88%) of the patients, while the overall survival was 35 months and the overall mortality 5.3%.

There were no statistically significant differences in the incidence of local recurrence and survival among the patients who underwent TME with low anastomosis and those with PME and high anastomosis.

REFERENCES

1. *Krivokapic Z.* Total mesorectal excision and Transection of mesorectum. In: Krivokapic Z, editor. Rectal cancer. Belgrade: Zavod za udžbenike; 2012. p. 175−204. (Serbian)
2. *Chandler JP, Orkin AB.* Rectal carcinoma: operative treatment. In: Beck ED, Wexner DS, editors. Fundamentals of anorectal surgery. 2nd ed. London: WB Saunders Company Ltd; 1998. p. 301−54.
3. *Kaiser AM, Kang J, Chan LS, Beart RW.* The prognostic impact of the time interval to recurrence for the mortality in recurrent colorectal cancer. Colorectal Dis 2006; 8(8): 696−703.
4. *Das P, Skibber JM, Rodriguez-Bigas MA, Feig BW, Chang GJ, Hoff PM,* et al. Clinical and pathological predictors of locoregional recurrence, distant metastasis and overall survival in patients treated with chemoradiation andmesorectal excision for rectal cancer. Am J Clin Oncol 2006; 29(3): 219−24.
5. *Jorgen F, Johansson R, Damber L, Lindmark G.* Anastomotic leakage after surgery for rectal cancer: A risk factors for local recurrence, distant metastasis and reduced cancer-specific survival. Dis Colon Rectum 2011; 54(9): e249−53.
6. *Micev M, Popov I.* Prognosis of the patients with potential curabile rectal cancer. Srp Arh Celok Lek 2000; 13: 1−6. (Serbian)
7. *Manfredi S, Benhamiche AM, Meny B, Cheynel N, Rat P, Faivre J.* Population-based study of factors influencing occurrence and prognosis of local recurrence after surgery for rectal cancer. Br J Surg 2001; 88(9): 1221−7.
8. *Kim Y, Kim N, Min B, Huh H, Kim J, Kim J,* et al. Factors associated with anastomotic recurrence after total mesorectal excision in rectal cancer patients. J Surg Oncol 2009; 99(1): 58−64.
9. *Heald RJ, Moran BJ, Brown G, Daniels IR.* Optimal total mesorectal excision for rectal cancer is by dissection in front of Denonvilliers' fascia. Br J Surg 2004; 91(1): 121−3.
10. *Beart RW Jr.* Mesorectal excision for rectal carcinoma: The new standard. Adv Surg 1999; 32: 193−203.
11. *Scott N, Jackson P, al-Jaberi T, Dixon MF, Quirke P, Finan PJ.* Total mesorectal excision and local recurrence: a study of tumour spread in the mesorectum distal to rectal cancer. Br J Surg 1995; 82(8): 1031−3.
12. *How P, Shihab O, Tekkis P, Brown G, Quirke P, Heald R,* et al. A systematic review of cancer related patient outcomes after anterior resection and abdominoperineal excision for rectal cancer in the total mesorectal excision era. Surg Oncol 2011; 20(4): e149−55.
13. *Kraemer M, Wiratkapun S, Seow-Choen F, Ho YH, Eu KW, Nyam D.* Stratifying risk factors for follow-up: A comparison of recurrent and nonrecurrent colorectal cancer. Dis Colon Rectum 2001; 44(6): 815−21.
14. *Sugarbaker PH, Gianola FJ, Dwyer A, Neuman NR.* A simplified plan for follow-up of patients with colon and rectal cancer supported by prospective studies of laboratory and radiologic test results. Surgery 1987; 102(1): 79−87.
15. *Gagliardi G, Hawley PR, Hershman MJ, Arnott SJ.* Prognostic factors in surgery for local recurrence of rectal cancer. Br J Surg 1995; 82(10): 1401−5.
16. *Michelassi F, Vannucci L, Montag A, Goldberg R, Chappell R, Dytch H,* et al. Importance of tumor morphology for the long term

prognosis of rectal adenocarcinoma. Am Surg 1988; 54(6): 376−9.

17. *Law WL, Chu KW*. Anterior resection for rectal cancer with mesorectal excision: A prospective evaluation of 622 patients. Ann Surg 2004; 240(2): 260−8.
18. *Killingback M, Barron P, Dent OF*. Local recurrence after curative resection of cancer of the rectum without total mesorectal excision. Dis Colon Rectum 2001; 44(4): 473−83; discussion 483−6.
19. *Lopez-Kostner F, Lavery IC, Hool GR, Rybicki LA, Fazio VW*. Total mesorectal excision is not necessary for cancers of the upper rectum. Surgery 1998; 124(4): 612−7; discussion 617−8.
20. *van Lingen CP, Zebregts CJ, Gerritsen JJ, Mulder HJ, Mastboom WJ, Klaase JM*. Local recurrence of rectal cancer after total mesorectal excision without preoperative radiotherapy. Int J Gastrointest Cancer 2003; 34(2−3): 129−34.
21. *Petronella P, Scorzelli M, Manganiello A, Nunziata L, Ferretti M, Campitiello F,* et al. Our experience of total mesorectal excision for rectal cancers. Hepatogastroenterology 2010; 57(99−100): 482−6.
22. *Krivokapic Z, Barisic G, Markovic V, Popovic M, Antic S, Jovanovic D*, et al. First thousand rectal cancer cases-local recurrence and survival. Acta Chir Iugosl 2004; 51(2): 133−7.
23. *Gupta RK, Agrawal CS, Pathania OP, Bajracharya A, Sah SP, Sah PL*. Anterior resection for rectal cancer with mesorectal excision: Institutional review. Indian J Surg 2013; 75(1): 10−6.
24. *Cammà C, Giunta M, Fiorica F, Pagliaro L, Craxì A, Cottone M*. Preoperative radiotherapy for resectable rectal cancer: A meta-analysis. JAMA 2000; 284(8): 1008−15.
25. Improved survival with preoperative radiotherapy in resectable rectal cancer. Swedish Rectal Cancer Trial. N Engl J Med 1997; 336(14): 980−7.
26. *Kapiteijn E, Marijnen CA, Nagtegaal ID, Putter H, Steup WH, Wiggers T,* et al. Preoperative radiotherapy combined with total mesorectal excision for resectable rectal cancer. N Engl J Med 2001; 345(9): 638−46.
27. *Taylor I, van de Velde C, van Gijn W*. A consensus approach to rectal cancer management. Eur J Surg Oncol 2010; 36(2): 111−3.

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