Surgery of the cancer of the low rectum: towards a conservation of the sphincter

To know the carcinological criteria of the conservation sphinctérienne
To know the new surgical methods of safeguarding

Place: Bordeaux
Author (S): RULLIER E

Drawn separately: Drawn separately: Eric Rullier, Service of Digestive Surgery, Saint-Andrew Hospital - 33000 Bordeaux.

Preceding page
To print the page
To consult the pdf (202 KB)
Diaporama (12665 KB)
"Live" conference

Summary

The conventional low former résection with mechanical or manual colo-anal anastomosis is an alternative to the amputation abdomino-périnéale in cancers of the low rectum. The technique of résection inter-sphinctérienne, which includes the ablation of the sphincter intern, allows a conservation sphinctérienne for the rectal tumours juxta and intracanalaires. The néoadjuvants treatments facilitate the preserving surgery by the induction of a down-staging. The results oncologic of conventional colo-anal anastomosis and the résection inter-phinctérienne are similar to those of the amputation abdomino-périnéale, in terms of survival and local control. The limits of the preserving surgery are functional rather than oncologic. The rectal rebuilding by the use of a tank colic decreases the functional disorders after anastomosis coloanale. The evolution of specialization and the development of the surgical techniques direct towards a rate of 10% of amputation abdomino-périnéale in the surgical treatment of rectal cancer.

Introduction

After the cure of the disease, the safeguarding of the anal function sphinctérienne is main goal of the patients treated for a cancer of the rectum. A better knowledge of the aturelle histoiren of rectal cancer and the appearance of new surgical techniques led the surgeons to propose more conservation sphinctérienne. Mechanical fastening [1] and the technique of colo-anal anastomosis transanale [2] made it possible in years 1980 to extend safeguarding sphinctérienne to cancers of the average rectum. In the years 1990, in fact the néoadjuvants treatments pushed towards a conservation sphinctérienne for tumours of the low rectum. The beginning of the years 2000 pushes the limits of the conservation sphinctérienne even more far from the fact of new surgical techniques and new therapeutic concepts.

Evolution of the concept of preserving surgery sphinctérienne

The conventional low former résection

The low rectum is defined like one the lower third of the rectum, i.e. in lower part of 5-6 cm of the anal margin or with less than 2 cm of the higher edge of the ring sphinctérien. A conventional low former résection associates a total exérèse mésorectum with a conservation sphinctérienne. Safeguarding sphinctérienne is technically made by a colo-rectal anastomosedite low mechanics by exclusively abdominal way or an colo-anal anastomosis which associates the way endoanale. The surgeon chooses the latter when it is not possible to fasten the rectum below the tumour because of a narrow pelvis or of a very low tumour. In all the cases, the decision between a preserving surgery sphinctérienne and an amputation abdomino périnéale with colostomy is related mainly to the distance between the tumour and the anal sphincter. This decisional concept is traditional and historical. The reasons are the potential risk of microscopic invasion of the rectal wall below the tumour and the need for keeping the totality of the anal sphincter to preserve a good function.

The guides of practice for the preserving surgery sphinctérienne are thus directly related to the rule of the distal safety margin, it is-àdire how much we need cm between the tumour and the surgical section. Until 1980, 5 cm of margin of distal wall were regarded as necessary [3], thereafter 2 cm appeared sufficient [4, 5]. Thus in 2005, this rule of 2 cm justifies for many surgeons the amputation as soon as the tumour is located at less than 2 cm of the sphincter, is with less than 5 cm of the anal margin. Recent studies [6, 7] suggested shortening the distal margin with 1 cm for selected tumours: well differentiated lesions vegetating, occupying less than 50% of the circumference of the rectum and early cancer (stage I and II, i.e. T1T2 and T3N0). It there not of consensus on the optimal distal margin in the advanced diseases (stage III or T3T4/N1) [8], although after radiochimiothérapie néoadjuvante a narrow distal margin is acceptable at the good responders [9].

Technique of résection intersphinctérienne

The surgical technique of résection intersphinctérienne (LAUGH) was proposed like an alternative to the amputation for cancers of the low rectum [10]. The goal of LAUGH is to remove a part or totality of the sphincter anal intern, with an aim of obtaining a healthy distal margin and of preserving the natural function of the defecation. The indications of LAUGH are the tumours located at less 1ou 2 cm of the anal sphincter, they is-àdire the tumours with less than 4 or 5 cm of the anal margin. The tumours posed on the anal sphincter or invading the sphincter anal intern are thus indications of LAUGH. The only counter-indications are the infiltration of the external anal sphincter. The technique of LAUGH developed in Europe [10-13] and more recently in Asia [14-15]. Thus, the exérèse of part of the sphincter intern allows a healthy distal margin in all the cases [16] and the decisional factor for the type of surgery, preserving or not, does not depend the tumoral height but on the infiltration or not of the external sphincter. The concept of distal margin is thus replaced by that of circumferential margin.

During the last decade, it was indeed shown that the margin of circumferential résection was a concept oncologic more important than the problems of the distal margin in the surgery of rectal cancer [17, 18]. The limit of the techniquede LAUGH is thus the risk of repetition local due to an insufficient margin circumferential, which justifies the use of néoadjuvants treatments. The early rectal tumours (T1T2) can be treated by surgery alone, whereas the advanced tumours (T3) and those infiltrating the sphincter anal intern must be treated by preoperative radio-chemotherapy. Such a reduced processing induced tumoralet volume undown-staging, which facilitates the surgery [19].

Place amputation abdomino-périnéale

The absolute indications of the amputation are the tumours infiltrating the striated muscles with the pelvic floor, i.e. the external anal sphincter and the raising devices of the anus, the low tumours fixed (except the vaginal fixity), and the patients with an old anal incontinence (> 6 months). The relative indications of the amputation is the tumours sanatoria, it be-with saying to less than 1 to 2 cm of the higher edge of the sphincter. Thus, the conventional indication of amputation for all the tumours with less than 2 cm of the sphincter evolved to more limited indication of amputation if the patient is addressed to colorectaux surgeons who control LAUGH it [20]. In our institution, the rate of conservation sphinctérienne aaugmenté from 43% to 91% among 1000 patients operated for rectal cancer between 1979 and 2004 (1). The choice of the procedure requires a rectal examination by the surgeon before any néoadjuvant treatment. The rectal examination is carried out with and without voluntary anal contraction to evaluate the exact distance between the tumour and the higher edge of the anal channel. An examination under anaesthesia is sometimes necessary, in particular when the anal channel is invaded or in the event of fixed tumour. Endo-rectal echography and the imagery by magnetic resonance are increasingly necessary to confirm the clinical examination and to optimize the selection of the patients [21].

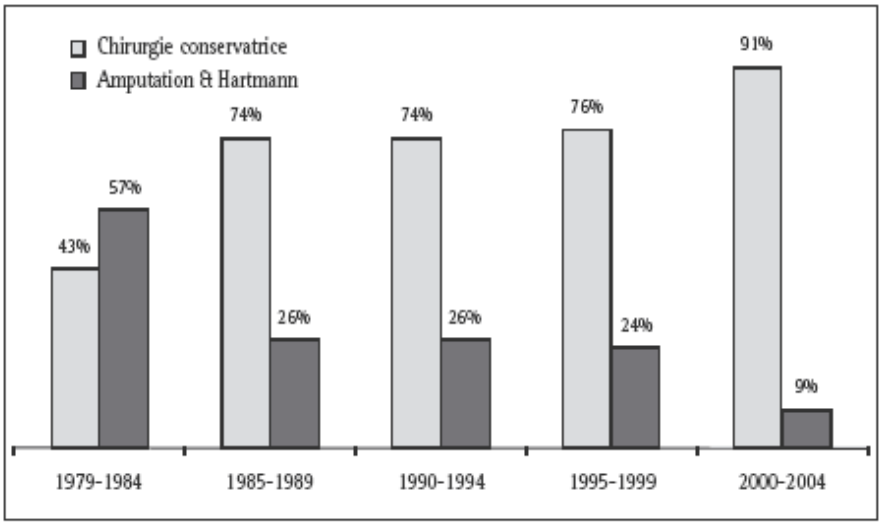

Figure 1. – Évolution des procédures chirurgicales à l'hôpital Saint-André

Procedure

The goal of the conservation sphinctérienne is to obtain a sure anastomosis with an aim of minimizing post-operative morbidity. The objectives are an anastomosis without tension and a distal colon vascularized good. It is thus necessary initially to mobilize the left colon and the sigmoid one. The lower mesenteric artery is divided in manner proximale to 1-2 cm of the aorta to preserve the nerves of ejaculation. The section of sigmoid must be carried out on a colon quite vascularized and compliant able to reach the very low part of the pelvis. If a tank is considered, 5 cm length moreover are necessary.

After exérèse total of the mésorectum, three types of surgical procedures are technically feasible: a mechanical colo-anal anastomosis, a manual colo-anal anastomosis after mucosectomy and a manual anastomosis coloanale after LAUGH (2). The choice of the technique depends on the level of the tumour and the anatomy on the pelvis. Colo-anal anastomosis mécaniqueest recommended if the fastening of the rectum is technically feasible. The procedure is easily realizable for many tumours of the average rectum and for some low lesions. The advantage is the realization of the intervention by a purely abdominal approach. Anastomosis is carried out with a circular stapler (2A).

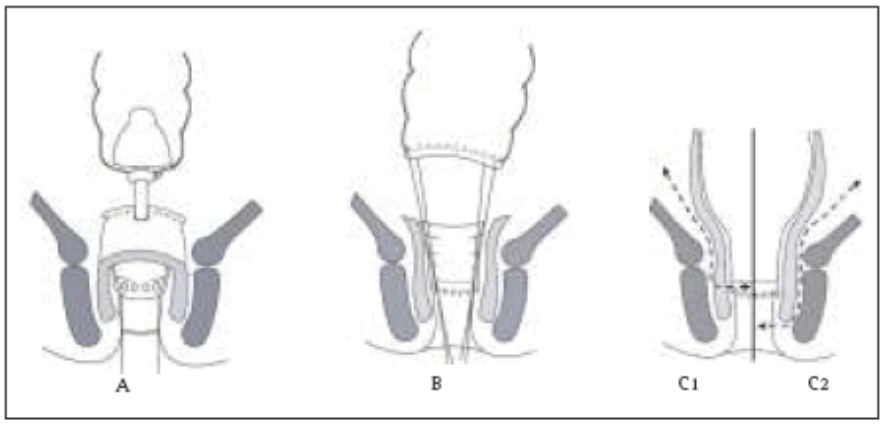

Figure 2. – Types d'anastomoses colo-anale. A. Anastomose coloanale mécanique ; B. Anastomose coloanale manuelle après mucosectomie ; C. Résection inter-sphinctérienne partielle (C1) et totale (C2)

Among certain patients, mechanical anastomosis is not realizable for technical reasons (pelvis narrow) or oncologic (tumour near the anal sphincter). In other cases, particularly after radiochimiothérapie, it is not suitable because the thickness of the rectal wall prevents from using the grips with mechanical fastening. A way thus should be associated initially périnéale. The anus is isolated and the distal rectal mucous membrane is excisée according to the procédurede Parks [2]. That makes it possible to preserve the totality of the sphincter anal intern and to obtain a manual endo-anal anastomosis on the notched line. The colon left by the anal channel and an anastomosis coloanale known as direct is carried out (2B). When a tank in J is associated, anastomoselatéro-final is carried out (3). The fixing of the tank on the raising devices of the anus can be useful to avoid a tension of anastomosis.

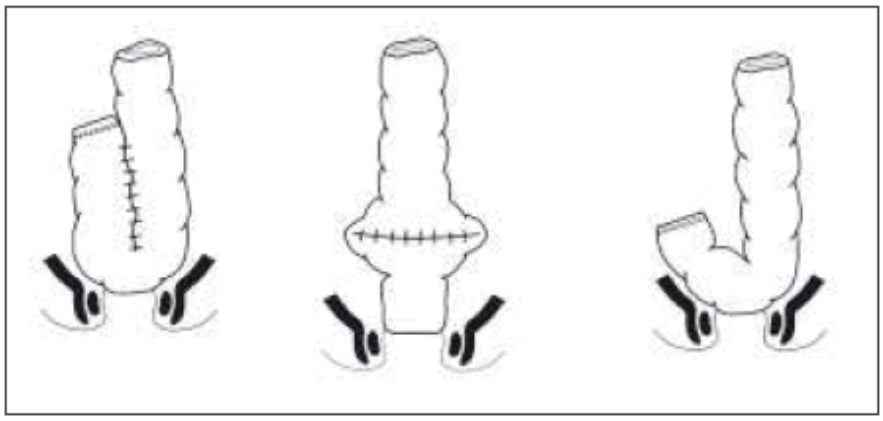

Figure 3. – Réservoirs coliques pour reconstruction rectale.
A. Réservoir en J; B. Coloplastie transverse; C. Anastomose latéro-terminale

For the tumours extending to the anal sphincter, LAUGH it is necessary to remove the sphincter anal intern and to obtain a healthy distal margin (2C). One LAUGH partial or high (2C1) begins with the pectinate line, removing half supérieuredu sphincter intern. It is indicated for the tumours located between 3 and 4 cmde the anal margin. One LAUGH total or low (2C2), beginning in lower part from the pectinate line and removing totality from the sphincter intern, is necessary for the tumours to less than 3 cmde the anal margin, i.e. endocanalaires. Although LAUGH it partial can be realized by an abdominal approach among certain patients [11, 13], the trans-anal approach is the optimal way for LAUGH high and low, because the dissection is more anatomical and visual and allows a more precise evaluation of the lower edge of the tumour.

Rectal rebuilding with tanks colics

After exérèse total of the mésorectum, much from patients with a direct colo-anal anastomosis suffer from frequent saddles, fragmented, of imperiosity and fecal incontinence. These digestive disorders, called syndrome of the former résection, occur at the half of the patients after exérèse rectal [23-25]. The principal reasons are the loss of the rectum and the traumatism of the anal sphincter. The functional results are regarded as goods (< 3 saddles per day and continence supplements) at 76%, 53% and 35% of the patients according to whether anastomosis is located above 6 cm, to 3-6 cm, and below 3 cm of the anal margin respectively [25]. The loss of the rectal tank thus led the surgeons to propose tanks colics to increase the compliance of the néo-rectum. The tanks colics are recommended as soon as the stub rectalfait less than 3 cm.

Three types of tanks colics can be used as alternative to a direct colo-anal anastomosis (3). The tank in J is the standard tank, whereas the transverse coloplastie and latéro-final anastomosis constitute an alternative [26-35].

Results oncologic

Results of the former résection and the amputation

For ethical reasons, no randomized test acomparé the two radical surgical options for the cancer of the low rectum, low former résection with anastomosis coloanale and amputation abdomino-périnéale. The preserving surgery sphinctérienne was allowed successively for the tumours top then average rectum exclusively starting from comparative historical series [36]. In 2005, the data of comparative and noncomparative series showed that local control was identical between preserving surgery sphinctérienne and amputation for cancers of the low rectum (Table I). In the majority of the series, the rate of local repetition varies from 5 to 15% and the survival from 60 to 80% for the two surgical techniques.

Since the introduction of the total technique of exérèse of the mésorectum, some authors observed a rate of local repetition higher after amputation than after former résection [48, 49]. The risk of death is increased by 30% in the Norwegian register among patients treated by amputation compared to those treated by former résection [49]. One of the reasons is the higher risk of rectal perforation during amputations [49]. This can induce a dissemination of tumoral cells in the broad wound périnéale. Moreover, the post-operative pelvic sepsis is very frequent after amputation and the inflammatory response to the sepsis supports the tumoral and metastatic propagation via the released cytokines [50]. Thus, association between the opening of the pelvic floor and périnéaux fabrics, a local ignition and a nonoptimal surgery (rectal perforation) can explain the worst forecast of the amputations. The English surgeon Bill Heald, promoter of the technique of exérèse of the mésorectum, regards the amputation as “an

operation endangering potentially" [51]. The total exérèse of the mésorectum with safeguarding sphinctérienne seems on the contrary a more anatomical and surer technique on the level oncologic than the amputation, including for a great majority of cancers of the low rectum [52].

TABLEAU I
COMPARAISON ENTRE ACA ET AAP POUR CANCER DU BAS RECTUM

	ACA			AAP		
	n	RL	Survie	n	RL	Survie
Gamagami 1999 (37)	164	8%	78%	31	13%	74%
Lavery 1997 (38)	162	8%	70%	99	11%	62%
Topal 1998 (39)	41	21%	62%	41	26%	58%
Mc Anema 1990 (40)	56	4%	-			
Marks 1993 (41)	52	14%	85%			
Léo 1994 (42)		55%	13%			
Mohiuddin 1998 (43)	48	15%	82%			
Rullier 2001 (19)	43	2%	85%			
Luna-Perez 2001 (44)				137	9%	75%
Enker 1997 (45)				148	5%	60%
Nissan 2001 (46)				292	6%	58%
Dehni 2003 (47)				165	10%	76%

ACA : anastomose colo-anale ; AAP : amputation abdomino-périnéale ; RL : récidive locale

Results of the résection intersphinctérienne

The technique of résection inter-sphinctérienne is the ultimate radical surgical technique before the amputation. The series of résection inter-sphinctérienne showed the possibility of obtaining a margin of healthy distal résection for cancers of the low rectum [15, 53, 54]. In our series of 92 LAUGH for tumours T2T3 with 3 (extremes 1.5 to 4.5) cm of the anal margin, including/understanding 20% of infiltration of the sphincter anal intern, the median distal margin was 2 cm and was healthy in 98% of the cases [16]. LAUGH thus allows to obtain an optimal distal margin in all the cases, including in the narrow pelvis, at the obese patients and when there is an invasion of the internal anal sphincter. The technique also makes it possible to obtain a healthy circumferential margin for tumours being with less than 1 cm of the anal sphincter [15, 16, 54]. In our experiment, the median circumferential margin for such tumours was 5 mm and was invaded (< 1mm) in 11% of the cases [16]. Because of the risk of local repetition in the event of invaded circumferential margin, this possibility must be discussed with the patient before the surgery. Among patients with a positive margin after LAUGH, an immediate complementary amputation must be proposed. In the event of refusal, the alternative is an intensive monitoring including/understanding a rectal examination, a rectal echoendoscopy and a pelvic scanner abdomino every 4 months during 2 years, then every 6 months.

The clinical results after LAUGH show a rate of local repetition between 2 and 13% and one survival between 60 and 80%, according to the retreat and the selection of the patients (Table II). These good results oncologic after preserving surgery for tumours juxta or will intra anal are due, partly, with the selection of the patients. Some propose especially LAUGH it for cancers T1 and T2 of the low rectum [13, 53]. Others contra-indicate the tumours of high rank [10, 11]. For our part, by using the néoadjuvants treatments, any rank and any stage of tumours can be considered for LAUGH, except for the fixed tumours (T4) or infiltrating the external sphincter. Validation of this techniqueest in progress. From 2001 to April 2005, a French multicentric study, undertaken by the GRECCAR (Surgical Group of Research in the Cancer of the Rectum), included 200 cancers of the low rectum in lower part of 5 cm of the anal margin, with an aim of evaluating optimal treatment néoadjuvant for the preserving surgery, radiotherapy high amounts [55] vs radiochimiothérapie [19]. The preliminary results show 90% of conservation sphinctérienne with nearly 90% of exérèse microscopically supplements.

TABLEAU II

RESULTATS ONCOLOGIQUES DE LA RÉSECTION INTERSPHINCTÉRIENNE

	n	Tumeur hauteur*	Tumeur stade	Récidive locale	Survie
Schiessel 1994 (10)	34	4 - 7	T1-4	13 %	-
Köhler 2000** (13)	31	3 - 5	T1-3	10 %	79 %
Braun 1992** (11)	63	3 - 9	T1-3	11 %	62 %
Tiret 2003** (53)	26	3 - 6	T1-3	3 %	-
Saito 2004 (15)	35	2 - 5	T1-3	3 %	-
Vorobiev 2004 (54)	27	3 - 4	T2-3	0 %	-
Rullier 2005 (16)	92	2 - 5	T2-4	2 %	81 %
Schiessel 2005	117	1 - 5	T1-3	5 %	-

*Cm de la marge anale; **RIS partielle par voie abdominale

Functional results

The preliminary results of LAUGH suggested similar functional results after LAUGH and low former résection, with two thirds of good continence [10, 12, 13]. Recent data showed functional results a little worse but probably more realistic [55-57]. We compared 40 LAUGH (anastomosis to 1,4 cm of the anal margin) with 37 conventional colo-anal anastomoses (3,1 cm of the anal margin) with 85% of tank in J in the two groups. There was no difference in the frequency of the saddles, fragmentation, the urgency and the dyschesy, but the continence was worse after LAUGH than after conventional colo-anal anastomosis: 53 vs 81%de good continence [58]. The qualitéde life was only slightly faded in comparison with the conventional surgery because the majority of the patients suffered from gastro-intestinal disorders in the two groups, particularly of fragmentation of the saddles and imperiosity. The continence is better after LAUGH if part of the sphincter intern is preserved [56] and if a tank colic is present [19, 57, 59]. The anal pressure of rest, decreased after exérèse of the sphincter intern [10, 12], indeed requires to be compensated by a pressure colic decreased via the tank.

The patients who have important digestive after-effects which persist 6 months after the closing of the temporary stomy require a catch in specific charge. Initially, it is necessary to eliminate an organic cause with the digestive dysfonction. A rectoscopy, a scanner and a radiopaque rectal injection must be carried out to eliminate a anastomotic sténose, an early pelvic repetition, a pelvic sepsis chronicle and an ischaemia distal colic of radic origin. Thereafter a medical treatment is founded, aiming to the beginning at supporting draining colic (stop of the speed reducers of the transit, mucilages, rectal injections evacuation). In the event of failure, a mode low in fibres and speed reducers of the transit are introduced. Thirdly, a rehabilitation périnéale must be proposed in a simultaneous way to improve the function sphinctérienne. It was thus shown that such an assumption of responsibility could decrease the frequency of the saddles (4 with 2/j) and improve the continence and the qualitéde life [60]. In short, a medico-surgical multidisciplinary assumption of responsibility allows 75% of good continence after LAUGH, 50% spontaneously and 25% after medical treatment. The patients who keep a bad functional result after colo-anal anastomosis can be treated by irrigation colic [57], myorraphy of the raising devices [61] or establishment of an artificial sphincter. The colostomy must also be proposed, even if it is necessary in less 10%d are case.

Conclusions

The low former résection with colo-anal anastomosis is a sure oncologic surgical procedure which can be proposed like alternative to the AAP for selected cancers of the low rectum. The technique of LAUGH very low growth the limits of the conservation sphinctérienne, the latter being in connection with the infiltration of the external sphincter and not with the level of the tumour compared to the anal margin. The restrictions for the preserving surgery appear from now on functional rather than oncologic.

REFERENCES

1. Knight CD, Griffen FD. Technical Animproved for low anterior resection of the rectum using the EEA stapler. Surgery 1980; 88:710 - 4.

2. Parks AG, Percy JP. Colo-anal Resection and sutured anastomosis for rectal carcinoma. Br JSurg1982; 69:301 - 4.

3. Goligher JC, Dukes EC, Bussey Hjr. Room recurrence after sphincter saving excision for carcinoma of the rectum and rectosigmoid. Br JSurg1951; 39:199 - 203.

4. Pollett WG, Nicholls RJ. The relationship between the extent of distal clearance and survival and local curative recurrence spleens after anterior resection for carcinoma of the rectum. Ann Surg1983; 198:159 - 63.

5. Williams NS, Dixon MF, Johnston D. Reappraisalof the 5 centimeter rule of distalexcision for carcinoma of the rectum: patient studies of distalintramural spread and of survival has. Br J Surg1983; 70:150 - 4.

6. Shirouzu K. Lymphatic emboli, rectal prognostic Factor of carcinoma. Cancer 1995; 75:4 - 10.

7. Ueno H, Mochizuki H, Hashiguchi Y, IshikawaK, Fujimoto H, Shinto E, Hase K. Preoperativeparameters expanding the indication of sphincter preserving surgery in patients with advanced low rectal cancer. Ann Surg. 2004; 239:34 - 42.

8. Nelson H, Petrelli NR, Carlin A, Seam J, Flesman J, Guillem J, and Al Guidelines 2000 for colonist and rectal cancer surgery. JNatl Cancer Inst 2001; 93: 583-96.

9. Rullier E, Rullier A, Laurent C, Vendrely V, Smith D. Guidelines for conservative surgery after preoperative radiochemotherapy for rectal carcinoma: pathologicassessment of distalintramural spread. Meeting of the European Association of Coloproctology, Erlangen, 2002; 56.

10. Schiessel R, Karner-Hanusch J, Herbst F, Teleky B, Wunderlich Mr. rectal Intersphincteric resection for low tumours. Br JSurg1994; 81:1376 - 8.

11. Braun J, Treutner KH, Winkeltau G, Heidenreich U, Lerch MM, Schumpelick V. Results of intersphincteric resection of the rectal rectum withdirect coloanal anastomosis for carcinoma. Am J Surg1992; 163:407 - 12.

12. Rullier E, ZerbibF, Laurent C, Bonnel C, Caudry M, SaricJ, and Al anal Intersphincteric resection withexcision of internal sphincter for conservative treatment of very low rectal cancer. Say Colon Rectum1999; 42:1
68-75.

13. Köhler A, Athanasiadis S, Ommer A, Psarakis E. Long term results of low anterior resection withintersphincticanstomosis in carcinoma of the lower one-thirdof the rectum: analysis of 31patients. Say Colon Rectum 2000; 43:843 - 50.

14. Teramoto T, Watanabe M, KitajimaM. Per anumintersphincteric rectaldissection withdirect coloanal anastomosis for lower rectal cancer: the ultimate sphincter-preserving operation. Say Colon Rectum1997; 40: S43-7.

15. Saito NR, Ono M, Sugito M, Ito M, Morihiro M, Kosugi C, Sato K, Kotaka M, NomuraS, Arai M, Kobatake T. Early results of intersphincteric resection for patient with very low rectal cancer: year activates approach to avoid has permanent colostomy. Say Colon Rectum. 2004; 47:459 - 66.

16. Rullier E, Laurent C, Bretagnol F, Rullier A, Vendrely V, ZerbibF. Rectal Sphincter-saving resection for all carcinomas: the end of the 2-cmdistal rule. Ann Surg 2005; 241:465 - 9.

17. Quirke P, Durdey P, Dixon MF, Williams NS. Rectal room recurrenceof adenocarcinoma due toinadequate surgical resection: histopathological study of side tumour spread and surgicalexcision. Lancet 1986; 1:38: 996-9.

18. Birbeck KF, Macklin CP, Tiffin NR, Parsons W, Dixon MF, Mapstone NP and Al Spleens of circumferential resection margin involvement vary between suckers and predict outcomes in rectal cancer surgery. Ann Surg 2002; 235: 449-57.

19. Rullier E, Goffre B, Bonnel C, Zerbib F, Caudry M, SaricJ. Preoperative radiochemotherapy and sphincter-saving resection for T3 carcinomas of the lower thirdof the rectum. Ann Surg 2001; 234:633 - 40.

20. Improving outcome in colorectal cancer. National Institutefor Clinical Excellence. 2001 www. nice.org.uk

21. Holzer B, Urban M, Holbling NR, Feil W, Novi G, Hruby W, Rosen HR, Schiessel R. Magnetic resonanceimaging predicts sphincter invasion of low rectal cancer and influences selection of operation. Surgery 2003; 133:656 - 61.

23. Lewis WG, Holdsworth PJ, Stephenson BM, Finan PJ, Johnston D. rectal Role of the rectumin the physiological and clinical results of coloanal and colorectal anastomosis after anterior resection for carcinoma. Br JSurg1992;
79: 1082-6.

24. Paty PB, Enker WE, Cohen AM, Minsky data base, Friedlander-Klar H. Length-term functional results of coloanal anastomosis for rectal cancer. Am JSurg 1994; 167:90 - 5.

25. Bretagnol F, Troubat H, Laurent C, ZerbibF, SaricJ, Rullier E. Length-term functional results after sphincter-saving resection for rectal cancer. Gastroenterol Covering joint Biol 2004; 28:155 - 9.

26. Dennett ER, Parry Br. Misconceptions butt the colonicJ-pouch: what the accumulating dated show. Say Colon Rectum1999; 42:804 - 11.

27. Hallböök O, Pahlman L, Krog M, Wexner SD, Sjödahl R. Randomized comparison of straight and colonicJ pouch anastomosis after low anterior resection. Ann Surg1996; 224:58 - 65.

28. Lazorthes F, Gamagami R, Chiotasso P, Istvan G, Muhammad S. Prospective, randomized broad study comparing clinical results between small and colonic J-pouchfollowing coloanal anastomosis. Say Colon Rectum1997; 40:1409 - 13.

29. Z' graggen K, Maurer CA, Birrer S, Giachino D, Kem B, Büchler MW. With new surgical rectal concept for replacement after low anterior resection: the transverse coloplasty pouch. Ann Surg 2001; 234:780 - 7.

30. Fazio VW, Mantyh CR, Hull TL. Colonic coloplasty: novel technical toenhance low colorectalor coloanal anastomosis. Say Colon Rectum 2000; 43:1448 - 50.

31. Ho YH, Brown S, Heah SM, Tsang C, Seow-Choen F, Have KW and Al Comparison of rectal J-pouch and coloplasty pouchfor low cancers: has randomized, controlled trialinvestigating functional results and comparative anastomotic leak spleens. Ann Surg 2002; 236: 49-55.

32. Rullier E, His CunhaA, CoudercP, Rullier A, Gontier R, SaricJ. Laparoscopic intersphincteric resection with coloplasty and coloanal anastomosis for mid and low rectal cancer. Br JSurg 2003; 90:445 - 51.

33. Huber FT, Herter B, Siewert JR. Colonic pouch vs. side-to-end anastomosis in low anterior resection. Say Colon Rectum1999; 42:896 - 902.

34. Machado M, Nygren J, Goldman S, Ljungqvist O. Similar outcome after colonic pouch and side-to-end anastomosis in low anterior resection for rectal cancer: prospective randomized trial has. Ann Surg 2003; 238:214 - 20.

35. Bretagnol F, Rullier E, CoudercP, Rullier A, SaricJ. Technical and oncologicalfeasibility of laparoscopic totalmesorectalexcision withpouch coloanal anastomosis for rectal cancer. Colorectal Say 2003; 5:451 - 3.

36. Williams NS, Johnston D. Survival and recurrence after sphincter saving resection and abdominoperineal resection for carcinoma of the middle third of the rectum. Br JSurg1984; 71:278 - 82.

37. Gamagami RA, Liagre A, Chiotasso P, Istvan G, Lazorthes F. distal Coloanal anastomosis for third rectal cancer: futurology study of oncologic results. Say Colon Rectum1999; 42:1272 - 5.

38. Lavery IC, Lopez-Kostner F, Fazio VW, Fernandez-Martin M, Milsom JW, Church JM. Chances of cure arenot compromised with sphincter-saving procedures for cancer of the lower third of the rectum. Surgery 1997; 122:779 - 85.

39. Topal B, Penninckx F, Kaufman L, Spin L, Aerts R, Ectors NR, Kerremans R. Outcome after `curative' surgery for carcinoma of the lower thirdof the rectum. Br JSurg1998; 85:1
8-20.

40. Mc AnemaOJ, Heald R, Lockhart-Mummery HE. Operative and functional results of totalmesorectalexcision with ultra-low anterior resection in the management of carcinoma of the lower one-thirdof the rectum. Surg Gynecol Obstet 1990; 170:517 - 21.

41. Marks G, Mohiuddin M, Masoni L. radical The reality of sphincter safeguarding surgery for distal cancer of the 3 cm rectumfollowing high-amount radiation. Int JRadiation Oncology Biol Phys 1993; 27:779 - 83.

42. Léo E, Belli F, Baldini MT, and Al New perspectivein the treatment of low rectal cancer: rectal total resection and coloendoanal anastomosis. Say Colon Rectum1994; 37: S62-8.

43. Mohiuddin M, Regine WF, Marks GJ, and Al High-dosepreoperative radiation and the challenge of sphincterpreservation surgery for distal cancer of the 2 cmof the rectum. Int J Radiation Oncology Biol Phys 1998; 40: 569-74.

44. Luna-Perez P, Rodriguez-Ramirez S, VegaJ, Sandoval E, LabastidaS. Rectal Morbidity and mortality following abdominoperineal resection for low adenocarcinoma. Rev Invest Covering joint 2001;
53: 388-95.

45. Enker WE, HavengaK, Polyak T, Thaler H, Cranor Mr. Abdominoperineal resection via totalmesorectalexcision and autonomic nervepreservation for low rectal cancer. World JSurg1997;
21: 715-20.

46. Nissan A, Guillem JG, Paty PB, Douglas Wong W, Minsky B, Saltz L, Cohen AMNDT Abdominoperineal resection for rectal cancer At has specialty center. Say Colon Rectum 2001; 44:27 - 36.

47. Dehni NR, McFadden NR, McNamaraDA, Guiguet M, Indent E, ParcR. Oncologic results following abdominoperineal resection for adenocarcinoma of the low rectum. Say Colon Rectum 2003; 46: 867-74.

48. Wibe A, Syse A, Andersen E, Tretli S, Myrvold HE, Soreide O. Rectal Norwegian Group Cancer. Oncologicaloutcomes after totalmesorectalexcision for curefor cancer of the lower rectum: anterior vs. abdominoperineal resection. Say Colon Rectum 2004; 47:48 - 58.

49. Marr R, Birbeck K, Garvican J, Macklin P, Tiffin NJ, Parsons WJ and Al The modern abdominoperinealexcision: the next challenge after totalmesorectal excision. Ann Surg 2005; 242:74 - 82.

50. Yu JL, May L, Lhotak V, Shahrzad S, ShirasawaS, Weitz JI and Al Oncogenic vents regulate tissuefactor expression in colorectal cancer cells: implications for tumour progression and angiogenesis. Blood 2005; 105:1734 - 41.

51. Heald RJ, Smedh RK, Kald A, Sexton R, Moran BJ. Abdominoperinealexcision of the rectum-anendangered operation. Say Colon Rectum1997; 40:747 - 51.

52. Tytherleigh MG, McC Mortensen NJ. Options for sphincter safeguarding in surgery for low rectal cancer. Br JSurg 2003; 90:922 - 33.

53. Indent E, Poupardin B, McNamaraD, Dehni NR, ParcR. Ultralow anterior resection withintersphincteric dissection-what is the limit of safe sphincter safeguarding? Colorectal Say 2003; 5:454 - 7.

54. Vorobiev GI, Odaryuk TS, Tsarkov statement, Talalakin AI, Rybakov EG. Resection of the anal rectum and totalexcision of the internal sphincter with smoothmuscle plasty and colonic pouchfor treatment of ultralow rectal carcinoma. Br JSurg 2004; 91:1506 - 12.

55. Rouanet P, Saint-Aubert B, Lemanski C, Senesse P, Gourgou S, Quenet F, Ychou M, Kramar A, Dubois JB. Nonrestorative Restorative and surgery for low rectal cancer after high-amount radiation: length termoncologicand functional results. Say Colon rectum 2002; 45:305 - 15.

56. Gamagami R, Istvan G, Cabarrot P, Liagre A, Chiotasso P, Lazorthes F. Fecal continencefollowing partial resection of the anal canalindistal rectal cancer: length-term results after coloanal anastomoses. Surgery 2000; 127: 291-5.

57. Bittorf B, Stadelmaier U, Gohl J, Hohenberger W, Matzel KE. Functional outcome after intersphincteric resection of the rectum with coloanal anastomosis in low rectal cancer. Or J Surg Oncol 2004; 30:260 - 5.

58. Bretagnol F, Rullier E, Laurent C, and Al Comparison of functional results and quality of life between intersphincteric resection and conventional coloanal anastomosis for low rectal cancer. Say Colon Rectum 2004; 47:832 - 8.

59. Park JG, Lee MR, Lim SB, Hong CW, Yoon SN, Kang SB, Heo SC, Jeong SY,Park KJ. ColonicJ-pouch anal anastomosis after ultralow anterior resection with upper sphincter excision for low-lying rectal cancer. World JGastroenterol 2005; 11: 2570-3.

60. Laurent C, Benajah D, Bretagnol F, Bourgeyx D, Rullier E, ZerbibF. Management of defecatory function disorders following rectal resection with coloanal anastomosis for low rectal cancer:canfecalincontinence and quality of life improve? Gastroenterology 2005; 128:A267 (abstract).

61. Ho YH. Postanal sphincter repair for anterior resection anal sphincter injuries: report of three cases. Dis Colon Rectum 2001; 4: 1218-20.