

Surgical Sphincter Preservation in Rectal Cancer

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ABSTRACT

Improved understanding of the biological features and advances in diagnostic and surgical procedures have been the basis for increased applications of sphincter preserving operations in lower rectal tumors. The relevant treatment strategies along with their indications will be presented and analyzed. New operative procedures comprise transanal excision of early rectal cancer or trans-sphincteric resection or ultralow anterior resection with colon-pouch creation

to improve continence. Recently, for cases in which the removal of the rectal sphincter is indispensable for oncological reasons, a continent perineal colostomy has been developed. Reconstruction of the sphincter function is achieved using a seromuscular cuff. This procedure avoids an abdominal colostomy. The neosphincter can also be formed secondarily, after a prior abdomino-perineal excision with transabdominal colostomy. *The Oncologist* 1996;1:288-292

INTRODUCTION

The treatment of rectal cancer has changed fundamentally over the past ten years. The general thrust of these changes has been toward a less invasive approach with preservation of intestinal continuity and avoidance of the psychological sequelae of a stoma. Still, in the 1970s and 1980s, the majority of patients with carcinoma of the rectum underwent abdomino-perineal excision as proposed by E.W. Miles in 1908 [1]. For the patients, this resulted in a definitive loss of continence and the formation of an end colostomy sited in the left iliac fossa. The rationale of this radical and mutilating approach was that only by such a procedure could tumor relapse be safely avoided. Apart from these deficits in knowledge on tumor biology, the limited and hitherto insufficiently developed operative techniques further restricted the possibilities of restitution of intestinal continuity in the small pelvis or the supra-anal region.

With the rediscovery of pathoanatomical and pathophysiological knowledge comprehensively laid out by Westhus as early as the 1930s, a reorientation process set in and led to new surgical concepts for the therapy of rectal cancer [2]. The key fact supporting these new concepts is that an intramural tumor dissemination beyond 2 cm toward the distal end of the rectum is extremely uncommon. The lymphatic drainage of the rectum, beginning at the levator level, primarily follows its central direction exclusively. Therefore, to avoid local recurrence, safety margins are less determinative in their distal

direction than they are for lateral spread [3-5]. Only a minority of rectal cancer patients (approximately 20%) requires an abdomino-perineal amputation to obtain disease-free distal and lateral resection margins. Similarly, operative techniques such as colo-anal anastomosis or the application of circular and linear staples have been developed, allowing a safe anastomosis deep in the small pelvis [6-8]. The recognition that the probability of lymphatic metastases depends on the size, and more so on the depth of invasion and the degree of differentiation of the tumor [9, 10], has made it feasible to treat selected tumors in the distal third of the rectum exclusively by local excision. In consequence, for the majority of rectal cancer patients there is no advantage (in terms of local recurrence, occurrence of distant metastases, and five-year survival) in performing abdomino-perineal resection instead of a sphincter-preserving procedure. It is also important to note that anal continence can effectively be maintained with sphincter-saving procedures. The relevant treatment strategies, along with their indications and results, will be presented and analyzed in the following.

ANTERIOR RESECTION OF THE RECTUM

Beginning in the early 1940s, a debate focusing on the extent of resection began. In particular, tumors of the upper third of the rectum were to be treated by anterior resection [2]. The technical requirements for this procedure could easily be met, since the continuity of the large intestine can usually be

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restored transabdominally without problems even if a distal safety margin of 5 cm is maintained. Problems are not to be expected in the dissection of the lymphatic drainage areas, either, for which the inferior mesenteric artery and vein should be ligated just below the offshoot of the left colic artery and vein [11]. With a tumor located in the upper third of the rectum, the remaining portion of descending colon will usually be mobile enough to achieve a sufficiently tension-free anastomosis, even if a distal safety margin of 5 cm is maintained. Consequently, for this tumor location, there was early agreement that a more radical distal dissection, including dissection of the sphincter apparatus, does not yield a greater chance for cure. Anterior resection, and thereby sphincter preservation, was soon professed the standard procedure in these cases. However, rectal carcinomas are localized at this high level in only 20% to 30% of cases. Therefore, the percentage of anterior resections was low in comparison with the total number of surgically treated rectal cancer patients. Survival rates of these patients corresponded with those of patients having sigmoid carcinomas. Continence in these cases is largely unaffected since the rectal ampulla remains surgically unscathed.

LOW ANTERIOR RESECTION

Controversies in sphincter-saving rectal resections arise mainly from tumors localized in the middle and distal thirds of the rectum [12, 13]. Numerous investigations have shown that tumors located as low as the levator level can be anteriorly resected with sufficient radicality. This level represents the anatomical boundary between the phylogenically discernible visceral and somatic parts of the human anatomy [3]. As a consequence, the lymphatic drainage cephalad to this level is directed strictly viscerally, i.e., intra-abdominally, whereas drainage caudad to this level is directed toward the perineum and the inguen. Under these conditions, the relevant lymphatic drainage regions of rectal tumors localized above the levator level can be radically removed by the abdominal approach. There, the principle of complete removal of the entire mesorectum is of the utmost importance [4].

The dissection can be achieved transabdominally, i.e., anteriorly, with the same precision as through an additional perineal access. Only when the direction of lymphatic drainage is reversed due to a compromise by massive proximal lymphogenic metastases should perineal and inguinal metastases be considered. However, in such situations, regional operative options for cure are restricted. The safety margin at the rectal organ itself depends on the probability of a distal intramural tumor cell propagation, which is influenced by the macroscopic growth pattern and the grading of the tumors [14]. A distal safety margin of 2 cm is usually sufficient for polypoid, highly differentiated adenocarcinomas (G1), whereas

in ulcerating and especially in poorly differentiated tumors (G3), as well as in mucinous carcinomas, margins of 3 to 4 cm are mandatory. Tumors located at 4 to 5 cm above the anal verge (under favorable conditions) and those 6 cm or more above the anal verge (in the case of unfavorable morphology) are radically resectable under sphincter preservation by an abdominal approach.

For the restoration of continence, however, not only the resectional level but also the relative possibility of a technically feasible and safe restoration of continuity are important criteria. The narrow and deep male pelvis, especially, can make a transabdominal anastomotic procedure difficult to perform. Mechanical suturing methods, especially double-stapling, constitute a further improvement in this field. Using a linear stapler movable in two planes, the remaining rectal stump can be closed and the anastomosis subsequently performed using a circular stapling gun. After insertion of the separate head of the apparatus into the proximal colon, and after fixation by a purse-string suture, the gun itself is inserted transanally with the guiding pin positioned to perforate the closed rectum at the suture line. The head and plate are approximated and the anastomotic mechanism activated.

Alternatively, the anastomosis can be achieved by transanal manual suturing [8]. For this purpose, two Parks retractors are inserted to dilate the anal canal. The proximal colon is shifted to this region and anastomosis is achieved by interrupted seromuscular sutures which include parts of the external sphincter in their distal portions. To establish the anastomosis after low anterior resection, a sufficient mobilization of the colon across the left flexure up to the mid-transverse colon is necessary. If after this step the colon were shifted, a preserved main stem of the inferior mesenteric artery would act obstructively. For this reason, and even more for the sake of the required complete dissection of the mesenteric lymphatic drainage area, the separation of the main stem of the inferior mesenteric artery should be programmatic. The blood supply of the colonic segment to be anastomosed will then be entirely provided by the middle colic artery via Riolan's anastomosis.

TRANS-SPHINCTERIC RESECTION

The determination of the intended transabdominal safety margin may be problematic. This is especially so in tumors positioned low in the distal third of the rectum, resectable according to the principles mentioned above, with a sufficient distal safety margin. In these cases, it is advisable to determine the resection line primarily through a transanal approach and to incise the rectum in the upper sphincteric area [15]. Thereby, the intended safety margin can be ascertained visually. The remaining dissection of the mesenteric lymphatic pathways,

together with the complete dissection of the mesorectal tissue, is achieved through the anterior access. The re-anastomosis in trans-sphincteric resection, however, will only be possible by employing a transanal manual suture with the possibility of everting the anastomotic line at first and repositioning it after completion (coloanal anastomosis). Therefore, the old rule of the index finger, "If you can feel it, you cannot preserve the sphincter," no longer applies. The increasing rate of anterior and very low trans-sphincteric resections and the converse decrease in abdomino-perineal amputations are justified by the large number of clinical series proving the oncological adequacy of a conservative approach.

POUCH FORMATION TO IMPROVE CONTINENCE

The indication for a sphincter-preserving procedure should always be accompanied by a thorough preoperative sphincteromanometric assessment [16]. In latent sphincter insufficiency, unsatisfactory results are likely to be expected, especially in the very low anterior resections. Both in an impaired sphincteric function and in a borderline surgical-oncological indication for sphincter preservation, the abdomino-perineal excision of the rectum is to be recommended. In each case of evident sphincter weakness, pre- and postoperative sphincter training, including electrophysiological stimulation, should be carried out to improve the functional results. Apart from neurogenic and muscular mechanisms, continence will also be determined by the capacity of the rectal ampulla. Under recognition of these pathophysiological facts, surgical attempts to reconstruct a reservoir can be of benefit for continence [13, 17]. The formation of a colon pouch is recommended, especially in elderly patients. Under the preconception of a higher incidence of partial sphincteric insufficiency and a shorter overall survival in this age group, a quick adaptation to the new situation by coloanal anastomosis is less likely than in younger patients with a sufficient sphincter. With the interposition of a colon-J-pouch, a faster functional adaptation can be expected. It is important to realize that the pouch volume should be kept small so as not to induce constipation by thickening of stool. Another advantage of a pouch reconstruction is the accompanying lower incidence of anastomotic dehiscence. This may be due to the technically necessary lateroterminal formation of the anastomosis. In our own comparative studies between direct coloanal and pouch-anal anastomoses, a clear advantage of the pouch group was noted with respect to compliance, stool frequency, reservoir, and rate of continence [18]. The technical requirements of the formation of a colon pouch do not prolong the

operation unduly. Since there is evidence that pouch formation has a positive effect on the healing of anastomosis, this procedure should be used, especially in elderly patients with subclinical sphincter insufficiency.

Another special problem in the preservation of continence is the necessity of performing a total proctocolectomy in familial polyposis coli patients with a high rectal cancer risk. As long as there is no indication for an ileorectal anastomosis, an ileostomy can only be prevented by the creation of a pouch-anal anastomosis [19]. Here, a reservoir volume for the collection of liquid ileal stool larger than a colon pouch would provide is to be considered. Especially in familial polyposis, the ileopouch-anal anastomosis can lead to favorable functional results and should be viewed differently from the same procedure in ulcerative colitis which has a higher complication rate. Therefore, the colon pouch, as well as the ileum pouch, constitutes a further step toward preservation and improvement of the sphincteric function in colorectal surgery.

LOCAL SPHINCTER-SAVING PROCEDURES

Despite the recent developments mentioned above, there remains an indication for rectal resection in tumors 0 to 5 cm above the dentate line if they are of a certain size and degree of differentiation. Besides the maintenance of sufficient safety margins, the removal of potentially tumorous glands will be possible in these cases by rectal excision only. The likelihood of lymphogenic metastases largely depends upon grading, tumorous infiltration of the intestinal wall, and the size of the tumors [20].

Based on these facts, the question was raised whether in selected patients with advantageous tumor criteria, local excision would yield results as good as the conventional extensive abdomino-perineal tumor excision. Technically, local tumor excision can be achieved transanally or via posterior rectotomy. Because of higher morbidity, posterior rectotomy has been abandoned in the local treatment of rectal cancer. Instead, the transanal access is now widely used and can be achieved by anal retractors, transanal microsurgery, [21] or through special specula, also developed in our department [13].

A precondition for good results is a full-thickness monobloc resection under the maintenance of a safety margin of at least 0.5 cm. Tumors of up to 9 square cm can be resected, whereby in 90% of the cases an R0 situation can be achieved histologically. The resulting defect can be oversewn transanally. The low postoperative morbidity of this procedure as compared with abdomino-perineal excision becomes even more pronounced when we recognize that mostly high-risk groups of patients have

previously been treated by this local procedure. The local recurrence rate after local excision is below 10%.

In our own experience, there has been no difference in recurrence-free and overall survival in patients with well-differentiated pT1 and pT2 tumors, comparing local with abdomino-perineal excision. Tumors graded G3 or G4, however, have a local recurrence rate of more than 25% within the first 12 postoperative months if excised locally. With a view to total survival, the results for local excision in patients with pT1G1 and pT2G1 tumors are very encouraging and by no means worse than the results of abdomino-perineal excision [4]. Therefore, in pT1 and pT2 tumors with a high degree of differentiation and in a location for which only an abdomino-perineal excision would have been feasible conventionally, today's surgical standard should be local excision. The precondition, however, is that on endosonographic rectal examination, the tumors appear limited to the submucosa or to the luminally sided layers of the circular muscles of the rectum. Also, enlarged or suspicious lymph nodes in the peritumorous tissue or pararectal space must be excluded endosonographically [22]. In cases where a local excision does not produce an R0 situation, a definitive abdomino-perineal excision should follow. Whether postoperative radiation will yield similarly good results and whether preoperative radiochemotherapy will raise the rate of local resectability in rectal carcinomas of the distal third [23] will have to be determined in carefully planned, randomized studies in the future.

In recent years, the indication for an abdomino-perineal excision could thus be narrowed and the numbers of cases subjected to it reduced. Today, the operation is indicated only in locally advanced carcinomas of the distal third of the rectum (uT3 and uT4), in cases where the tumor infiltrates the sphincter apparatus, and in a pre-existing severe sphincteric insufficiency. In patients where sphincter preservation is impossible, surgical methods designed to attempt replacement of the sphincter functions should be considered.

PSYCHOLOGICAL ASPECTS

One of the key aspects in managing patients with rectal cancer concerns the psychological impact of the various forms of treatment. It is not clear whether a colostomy causes sexual dysfunction or whether disruption of the pelvic plexus is the underlying cause of this problem. Only a few studies compared postoperative psychosocial adjustment in ostomy patients with that of non-ostomy patients. In this context, we have to consider that when supraradical lymphadenectomy for rectal cancer is performed, long-term difficulties in passage of urine seem to affect one-third of

the patients, 20% seem to require long-term use of a urinary catheter, and impotency is reported in 76% of patients under the age of 60 years [24]. *Sprangers et al.* [25] identified 17 studies taking into account different aspects of postoperative quality of life. Even these comparisons are biased by the methodological differences in evaluating quality of life, different stages of the disease, differences in surgical procedures, and wide variation in the amount of time elapsed since surgery. The message is that the quality of life, including sexual function, in stoma patients is less than for those with no stoma. Therefore, surgical strategies to overcome the need for a permanent stoma following abdomino-perineal amputation are mandatory.

SPHINCTEROPLASTY

In cases where the removal of the sphincter apparatus is indispensable for oncological reasons, the alternative to the formation of an abdominal colostomy is to create a perineal colostomy in combination with a sphincteroplasty. The formation of a neosphincter by transposition of parts of the gluteus maximus or gracilis muscle has been unsatisfactory until now, since the striated muscles, in contrast with the smooth muscles, are incapable of generating a permanent tone. For this reason, implantable electronic stimulating devices are being worked on at present [26, 27].

In our hospital, a different method of neosphincter formation is being tested in cooperation with the Research Institute of Proctology in Moscow [28]. This method consists of an ample mobilization of the left hemicolon under preservation of the vascular arcades. After abdomino-perineal rectal excision, the mobile colon is pulled into the perineal wound. Then, the muscularis propria layer of a colonic segment measuring 10-12 cm freed from fatty tissue is separated from the mucosa. The resulting seromuscular tube is trimmed in a spiral fashion to form a band, which remains connected with the intestinal wall at its base, from which it is nourished by microcirculation. The distal colon is then enveloped by this seromuscular band and inserted into the perineum to form the colostomy. The seromuscular cuff acts as the internal sphincter. Supported by pelvic floor exercise and electrostimulation of the perineum, the patients learn to perceive the urge to defecate and to distinguish bowel gases from stool. After a three-month practice period, patients were able to regulate the emptying of their bowels by a conscious activation of their gluteal and thigh muscles. The perineal colostomy with the neosphincter can also be formed secondarily, after a prior abdomino-perineal excision with a transabdominal colostomy.

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