

## Sphincter preservation in rectal cancer patients

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*Introduction.* While sphincter preservation is quite a simple procedure in patients with tumors of the upper rectum, it still remains the evolving method in low-lying rectal cancer. Several developments directly influence the increasing number of sphincter saving procedures in patients with rectal cancer.

*Methods.* Medical literature was reviewed to identify the optimal treatment modality for low-lying rectal cancer with the intention of sphincter-sparing.

*Conclusions.* Long-term preoperative radio-chemotherapy can downsize the tumor, downstage the disease, diminish the risk of local recurrence and increase the chances for a sphincter-saving procedure. Partial resection of the anal sphincter is sometimes necessary to reach R0 resection and spare the sphincter function. It can be performed without significant impairment of the sphincter function. Low anterior resection with total mesorectal excision is a technically demanding procedure, enabling sphincter-saving, preserving the genitourinary function, and warranting good oncological outcome. Colonic reservoir used for bowel continuity reconstruction improves the quality of life.

### Zaoszczędzenie zwieraczy odbytu u chorych z rakiem odbytnicy

*Wprowadzenie.* O ile dość łatwo można zachować zwieracze odbytu u pacjenta z wysoko położonym rakiem odbytnicy, to w przypadku nisko położonych nowotworów metody leczenia prowadzące do zaoszczędzenia zwieraczy wciąż podlegają intensywnemu rozwojowi. Wiele osiągnięć bezpośrednio sprzyja wzrastającej liczbie operacji z zaoszczędzeniem zwieraczy odbytu.

*Metody.* Na podstawie przeglądu literatury medycznej przedstawiono optymalne metody leczenia nisko położonego raka odbytnicy, sprzyjające zaoszczędzeniu zwieraczy odbytu.

*Wnioski.* Przedoperacyjna długotrwała radiochemioterapia może doprowadzić do zmniejszenia masy guza, obniżenia stopnia zaawansowania choroby, zmniejszenia ryzyka nawrotu miejscowego oraz do zwiększenia szansy na zaoszczędzenie zwieraczy. Niekiedy zaoszczędzenie zwieraczy w warunkach resekcji R0 wymaga usunięcia części aparatu zwieraczowego. Można tego dokonać bez znaczącego ograniczenia jego sprawności. Niska przednia resekcja z całkowitym usunięciem krezki odbytnicy jest skomplikowanym technicznie zabiegiem. Umożliwia zaoszczędzenie zwieraczy odbytu, zachowanie sprawności układu moczopłciowego oraz zapewnia dobry wynik leczenia onkologicznego. Wytworzenie zbiornika kałowego w celu odtworzenia ciągłości przewodu pokarmowego poprawia jakość życia chorych po resekcji odbytnicy.

**Key words:** rectal cancer, sphincter preservation

**Słowa kluczowe:** rak odbytnicy, zaoszczędzenie zwieraczy odbytu

### Introduction

One of the main objectives of surgical oncology is to restore bowel continuity and to preserve adequate sphincter function in patients treated for rectal cancer. It particularly concerns patients with tumors located in the middle and lower rectum. Increasing knowledge on cancer biology and rectal anatomy and physiology, supported by constant improvement in treatment methods, contribute to the growing number of sphincter-

saving procedures in the treatment of rectal cancer [1-6]. Low anterior resection (LAR) with sphincter saving fulfills the requirements of radical surgery and preserves satisfactory quality of life in as many as 80% of rectal cancer patients [7]. It is believed that in the future multimodal therapy will render abdominoperineal resection of rectal cancer (APR) an obsolete operation. We still observe that APR or Hartmann's procedure are performed in more than 30% of radically operated rectal cancer patients [8-11]. Sparing the sphincter is much easier when the tumor is located in the upper part of the rectum, and it is not always possible in tumors of the middle and lower rectum. High volume center provides a better chance for the treatment with sparing the sphincter [9, 12, 13].

## Contraindications for sphincter saving

Anatomical integrity and functional effectiveness of the sphincter apparatus preserve good control over defecation after rectal resection, and decrease the symptoms of the anterior resection syndrome. Patients with an anatomically impaired, functionally inadequate sphincter are not candidates for sphincter-saving procedures [14]. Some people, especially women with a history of childbirth, present occult sphincter impairment [15]. The anterior resection syndrome is usually unavoidable after rectal resection with coloanal or low located colorectal anastomosis [16]. Radiotherapy of the sphincter region additionally aggravates the syndrome symptoms [3, 15]. Patients who do not meet the criteria for the sphincter-sparing surgery present with the following: bulky tumor, in the case of which maneuvers leading to lifting the tumor up before safe and oncologically appropriate tumor resection cannot be undertaken. In patients with tumors located close to the sphincter, when rectal resection, even with partial sphincter excision, does not assure proper resection margin, the sphincter apparatus is usually sacrificed [5]. The age of the patient should not be a contraindication to sphincter preservation. In patients older than 75 years, similarly as in younger people, 85% of persons with sphincter preservation did not observe any serious trouble with sphincter function [14, 17]. Significant co-morbidity may be an obstacle in performing coloanal or low lying colorectal anastomosis [7].

## Diagnostics before sphincter saving

Case history and careful clinical examination should be supported by imaging techniques [15, 18]. Endoanal and endorectal ultrasound examination represent minimally invasive, very sensitive and specific methods of recognizing not only anal anatomical malformations, but also allowing for accurate T feature estimation (staging accuracy up to 89%). To a somewhat lesser extent even the N feature estimation is possible. Staging accuracy reaches 85%, and increases to 92% when ultrasound guided fine needle node biopsy is performed [18]. MRI with its endorectal coil is also very useful in showing the anatomical integrity of the sphincter apparatus and in staging the tumor preoperatively. Its accuracy is comparable with that of endo-ultrasound examination. MRI assures T feature estimation with an accuracy of up to 81%. The N feature can be diagnosed with an accuracy up to 63% [19-21]. The pathological involvement of the circumferential margin can be discerned by MRI with an accuracy rate of 83% [22]. CT seems not to be as correct as endo-ultrasound or MRI in preoperative staging of low located rectal cancer [10, 18-21]. However, all these methods are not accurate enough to restage the patient correctly after neoadjuvant treatment, and their impact upon qualification for less extensive surgery, even in the case of complete clinical response, seems to be unclear [11].

## The choice of surgical treatment

Choosing the optimal method of surgical treatment one must keep in mind that coloanal anastomoses associate with a higher rate of postsurgical complications than colorectal anastomoses [23].

Low located T1 rectal cancer characterized by favorable pathoclinical features can be treated by local excision with sphincter preservation [24-26]. It must be a full-thickness excision with 1cm peripheral margin of the bowel wall. Transanal endoscopic microsurgery was found to be especially useful in these cases [25, 27]. In more advanced tumors local excision is associated with an unacceptable rate of local recurrences and with the risk of undertreatment in spite of adjuvant therapy. In T1 tumors with favorable pathoclinical features endocavitary radiation alone, or in conjunction with external beam radiotherapy, can be used alternatively to surgical excision [26].

T2 and more advanced tumors require proctectomy or partial rectal resection, together with the peripheral lymph nodes [12, 24, 28-30]. Rectal resection with complete excision of all fatty tissue enclosed within the perirectal fascia, is the optimal surgical method in the treatment of rectal cancer [2, 12, 13, 31, 32]. The principles of this operation, practiced in many surgical institutions for entire decades, had been widely propagated by Richard Heald, who described this procedure as total mesorectal excision (TME). When performed correctly, TME ensures the risk of local recurrence below 10% and provides better results of rectal cancer treatment than standard rectal resection [12, 33, 34]. Even IV degree tumors should be resected as during radical operation, for this method provides the best level of local control of the disease, facilitates sphincter saving, and improves the quality of life significantly [35].

TME is an operation in the course of which the rectum and the perirectal fat is sharply dissected in a circumferential manner between the visceral and pelvic fascias, with special care to save the visceral fascia intact, and to preserve pelvic autonomic plexuses and nerves, as this assures the satisfactory function of the genitourinary tract (2,4,32,36). In spite of careful tissue preparation after TME sexual functions may deteriorate (4). Urinary function can also be impaired [4, 36]. However, this is observed more often in patients who had undergone TME during APR than after LAR. Preoperative radiochemotherapy aggravates functional complications [3, 4, 15, 37].

In case of rectal resection with the entire internal sphincter or with partial resection of the internal sphincter, coloanal anastomosis is placed below the dentate line, but always with at least a 1 cm distal margin [5]. In deep penetrating tumors, part of the external sphincter together with the internal sphincter can also be successfully excised without significant deterioration of sphincter function, and with assurance of sphincter adequacy in the future. The sphincter function and the rate of local recurrences in patients with coloanal ana-

stomosis at the level of the dentate line are comparable to those observed in case of coloanal anastomosis located in the anal canal. Temporary oostomy seems to be a necessity in all these cases [14, 15].

A Dutch study on TME showed that a majority of properly trained surgeons from small hospitals who practice colorectal surgery, can achieve very good results of surgical treatment of rectal cancer patients, comparable to those achieved by surgeons from large hospital. Other studies have confirmed this observation [9, 12]. This increases the need for proper training in TME – it should be known to every colorectal surgeon, as such policy can not only improve the oncological results of treatment, but also increase the rate of sphincter sparing procedures [12, 13, 34].

### **The impact of the specimen margin upon the treatment results**

In 7% to 20% of rectal cancer cases after TME without neoadjuvant therapy the free circumferential margin is  $\leq 1$ mm [32, 38]. A circumferential margin of less than 2 mm is recognized as positive and associated with a higher risk of local recurrence and distant metastases [13, 39]. Some authors indicate the 3 mm radial margin as critical for worse oncological outcome [8]. The quality of the circumferential margin seems to influence the oncological outcome of rectal cancer treatment more seriously than the T feature, the N feature or the degree of tumor differentiation [8, 13, 38, 39]. The sidewalls of the pelvis are a natural barrier for its widening.

The distal margin plays a crucial role in the planning of sphincter preservation. Tumor infiltration within the bowel wall rarely exceeds 1 cm from the lowest edge of the tumor or ulcer, and according to the studies on the rate of local recurrences and late outcomes of rectal cancer, a 2 cm margin is recognized as a safe distal margin [28]. There are reports showing that a 1 cm distal margin does not influence the results of a rectal cancer treatment negatively, neither in patients after long-term preoperative radio-chemotherapy [8, 40, 41], nor in the group without neoadjuvant treatment, especially with the N0 feature [41]. Intraoperative microscopical examination of the margin quality is highly recommended [8, 28]. A majority of patients with cancer located lower than 2 cm from the dentate line are qualified for APR. However, many surgeons advocate proctectomy in these cases, even in conjunction with partial sphincter resection, especially if it affects its internal part [5, 15].

In tumors located more proximally in the rectum partial rectal resection is recommended, together with partial excision of the mesorectum, instead of excision of the whole mesorectum. The mesorectum should be cut perpendicularly to the bowel wall, 4 to 5 cm below the tumor edge [12, 32]. Such treatment enables sphincter preservation with restoration of bowel continuity and renders the procedure simpler. According to some authors, a 3 cm long distal mesorectal margin is also sufficient for the radical treatment of rectal cancer [42].

### **The role of preoperative radio-chemotherapy in rectal cancer**

In low lying rectal cancers staged T3-4 and/or N(+) long-term radiotherapy in conjunction with chemotherapy appears to be very useful [12, 15, 43, 44]. Long-term radiotherapy usually requires 45 Gy-54 Gy of radiation with 1.8 Gy – 2.0 Gy per dose. 5-Fluorouracil is the most often cytostatic agent used concomitantly to radiotherapy [13, 44, 45]. Surgery is usually performed 6-8 weeks after the termination of neoadjuvant treatment. In almost half of the treated patients tumor downsizing has been observed and in 8% to 24% of cases a complete pathological remission has been reported [8, 10, 11, 44-46]. The rate of R0 resections has been increased [8, 43, 44]. In these patients downstaging related to the N feature estimated preoperatively by endorectal ultrasound can be obtained [10, 45, 47]. However, it does not correlate with disease free survival and with the late oncological outcome [8, 11, 46]. The delay of surgical treatment by more than 8 weeks after radio-chemotherapy has no impact on the rate of sphincter preservation [47].

Downsizing of the tumor facilitates surgical maneuvers in the pelvis during resection and increases the chances of sphincter saving. Nevertheless, still exists the query whether preoperative radio-chemotherapy, leading to tumor downsizing and disease downstaging, allows for a more proximal cutting line in the region initially invaded by the tumor and now appearing normal [10, 11, 13, 44]. According to some authors as many as 75% of patients with low lying rectal cancer qualified for APR before neoadjuvant treatment may be re-qualified for LAR with sphincter sparing despite a distal margin ranging between 1 mm and 1 cm [8]. It is reported that tumor location seems to be a more serious predictor of late oncological outcome than the method of its surgical treatment, which is also a strong argument in favour of sphincter preservation. According to other authors it is allowed in cases with complete pathological tumor remission when pT0N0 is confirmed microscopically [44]. According to some studies there is no difference between the rate of local recurrence and overall survival after surgical treatment between complete and partial pathological responders to neoadjuvant therapy, however there is a trend towards better results in the group with complete pathological response [11, 47]. Many surgeons do not change their policy concerning the cutting line, even if the tumor diminishes significantly [47]. It has been proven that if the patients with complete clinical response are not operated the rate of local recurrences is unacceptably high. [46]. In primary non-resectable rectal cancer long-term radio-chemotherapy can result in achieving 79% of radical resections, and in producing a downstaging rate from T4 to T0-2 to some 38% [43]. Late results for downstaged group were similar to those achieved in preliminary staged T1-2 rectal cancer patients, although neoadjuvant treatment has not improved survival.

On average local recurrence in patient subjected to preoperative radio-chemotherapy and radical resection

for rectal cancer appears after 3 years[10]. According to the cited study a follow-up period of 5-7 years is recommended for the exact estimation of the rate of local recurrence in this group of patients. This means that reports concerning the local control of the disease in patients subjected to neoadjuvant therapy and surgery with a median follow-up period of less than 3 years are of limited value.

Widely used short-term radiotherapy, with the delivery of 25 Gy over 5 days (Swedish model), and operation 7-10 days after the onset of radiation therapy successfully diminish the risk of local recurrence of rectal cancer, also after TME (Dutch study). However, probably because of the short time to surgery, this regime neither downsizes the tumor nor downstages the disease and, thus, it does not influence the chance for sphincter preservation [13, 29, 30].

Brachytherapy followed by chemotherapy and other treatment modalities appears to be a very promising tool in increasing the chance for sphincter saving, as the rate of complete clinical response in up to 68% of cases among T2-T4 tumors brachytherapy is superior to the results which can be achieved after long-term radiochemotherapy [48]. The techniques of radiation delivery are constantly improved to save the sphincter function in an optimal way [3].

### The colonic reservoirs

After LAR bowel continuity is restored by straight coloanal or colorectal anastomosis or by anastomosis of the anal canal or anorectal stump with the colonic reservoir. Colonic reservoirs significantly improve the quality of life, as they assure better control of defecation after low anterior resection [14, 49-52]. They are usually advocated after the resection of mid- and low-lying rectal cancer. Optimal length of a colonic J-pouch reservoir should not exceed 5-6 cm. Longer pouches cause more trouble in emptying. Coloplasty is another method for a colonic reservoir. 3-4 cm above the line of the anastomosis the colon is incised 7-10 cm longitudinally and sutured horizontally [15, 14, 49].

Pouches created by coloplasty enable easy access for the stapling gun through the incised colon by an abdominal approach, and at the same time protect the sphincter complex from additional risk of injury while the stapling gun is pushed through it. A kind of a colonic reservoir may be obtained by "side-to-end" anastomosis of the side of the bowel with the anal canal or with the rectal stump [53]. Colonic J-pouches and coloplasty pouches seem to offer similar functional outcome after low anterior resection, although coloplasty pouches are easier to construct and more feasible than J-pouches [49].

### The role of laparoscopy in the treatment of rectal cancer

Staplers increase the number of sphincter saving operations. They allow for safe bowel closure beneath the tumor and for performing low anastomoses with the double stapling technique. They facilitate the creation of colonic reservoirs. They are also widely used during laparoscopic rectal resection, especially with sphincter sparing [54]. Laparoscopy is very useful if used in particular stages of rectal resection. It may be a method for the entire radical operation – also in LAR with sphincter sparing. Late oncological and functional outcomes are comparable with those achieved with open surgery [54-56]. Some authors stress the need for prospective randomized trials which should allow to estimate the role of laparoscopy in the treatment of rectal cancer, also in regard to the option with sphincter sparing.

### Conclusions

Constant improvement in the multimodal treatment of rectal cancer provides better chances for sphincter saving in patients with low-lying tumors, even if the distance from the tumor edge to the dentate line is shorter than 2 cm. Preoperative radio-chemotherapy can downsize the tumor, downstage the disease, diminish the risk of local recurrence and increase the chance for sphincter sparing. TME is the optimal method of surgical treatment of low lying rectal cancer, as it assures the best local control and good oncological outcome and increases the chance for LAR with sphincter saving. Partial resection of the anal sphincter, performed to increase the resection margin, still allows for sphincter preservation and a good functional outcome, even if radiotherapy (which deteriorates sphincter function) is a part of the treatment. Colonic reservoirs significantly decrease the symptoms of low anterior resection syndrome and improve the quality of life of the patients.

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