
Abdominoperineal Resection

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History

In 1908, investigating the pathogenesis of rectal cancer, Miles established the role of the lymphatic system in the spread of malignancy and emphasised the need for synchronous removal of the rectum and its “lymphatic drainage” with the abdominoperineal approach [1].

This event was supposed to be the beginning of state-of-the-art surgery of rectal cancer, though during the following 30 years the Miles operation played an insignificant role in the treatment of rectal adenocarcinomas because of high operative mortality caused by imperfection of anaesthesia technique and peri-operative care [2]. Progress in medicine resulted in a decrease in post-operative deaths and allowed abdominoperineal resection (APR) to yield better long-term results as compared to trans-sacral procedures. Soon APR became the gold standard of treatment of rectal cancer [3].

Further investigation into the principles of spread of rectal adenocarcinomas [4] along with the wide use of stapler techniques and hand-suture colo-anal anastomosis made it possible to largely replace the operation that was “ideal” in the recent past. At the present time, APR is undeniably utilised for adenocarcinoma of the lower third of the rectum, located in close proximity to the dentate line, which can also be involved in malignancy. The use of total mesorectal excision (TME) has enabled surgeons to substantially decrease local recurrence and to increase the five-year survival after APR, though the results obtained for the lower third of the rectum are still worse than those obtained for the middle and upper thirds [5]. The development of a nerve-sparing technique has brought about the improvement in urinary and sexual function outcomes of APR [6]. Nevertheless, the main drawback, abdominal colostomy, has not been eliminated. All the circumstances mentioned have determined the place of APR in the surgery of rectal cancer in the beginning of the 21st century.

Anatomic Background

Prior to considering the indications for APR, it is necessary to describe the specific features of spread of adenocarcinoma of the low rectum. During the last century, there has been the following dominant concept: when the tumour is located to within 5.0 cm of the anal verge, all the elements of anal canal, the ischiorectal tissue and the perianal skin should be removed [7]. In order to evaluate how often the mentioned anatomic structures are involved in malignancy and in which cases it is possible to save them, we have performed a morphological investigation.

Morphological Investigation

Material

Seventy-one specimens were selected to perform a morphological investigation. They represented rectums with adenocarcinoma and contiguous anatomic structures (pararectal and ischiorectal tissues, external and internal sphincters, and perianal skin) obtained as a result of curative APR. In these series of specimens, the lower margin of the tumour was located within 5 cm of the level of perianal skin. Specimens obtained in the course of palliative APR of the rectum or with positive lateral margin were not analysed. All the tumours possessed adenocarcinomas that differed in the degree of differentiation. A high degree of differentiation was characteristic for 19 (26.8%) adenocarcinomas, 44 (62.0%) adenocarcinomas had a good degree of differentiation, whereas a low degree was characteristic for 8 (11.2%) adenocarcinomas. The T2 stage was revealed in 15 observations, T3 in 53 specimens and T4 in three cases. Thus, 68 (95.8%) of 71 tumours examined did not exceed the visceral fascia of the rectum. In three patients only (4.2%) were the contiguous organs involved in malignancy: vagina (1.4%) and prostate (2.8%). The margin of resection of invaded organ remained intact

in all three cases. In 30 (42.3%) cases, the tumours had demonstrated involvement of the upward lymph nodes. In 41 (57.3%) cases metastases to regional lymphatic nodes were not observed. Most of the tumours had a near-spherical shape. The mean values of their longitudinal and transverse dimensions were as follows: 50.5 (35–65)×49 (25–80) mm.

Methods

The macrospecimen was cut through all the layers of rectum by a plane of minimum cancer lesion. After fixing in formalin solution (10%) for 24 h, the specimen was sliced through the tumour by the longitudinal plane at a step of 3 mm.

In order to perform histologic investigation, we selected the sections with the maximum depth of cancer invasion and the lowest distal verge of the cancer. The pectinate area including tumour was subjected to pathomorphometry. The following parameters were measured and summarised in the morphological map: the maximum depth of invasion in the lateral direction, the level of the distal margin of the tumour from the dentate line and perianal skin, the number of lymphatic nodes and their location. The histologic structure (haematoxylin–eosin) and the distal intramural spread of malignancy were studied.

Results

It is worth noting that the cancer invasion decreased gradually in depth outward from the centre of the tumour. The level of maximum invasion therewith was located well above the distal verge of the cancer, on the average, 28.8 mm (5–50 mm) from the dentate line. In the area of distal margin of the tumour, invasion of the cancer into the rectal wall was minimum (Fig. 1). As a rule, the invasion was confined by the mucous and submucous layers of the rectal wall, which is undoubtedly favourable from the viewpoint of implementation of sphincter-saving technique.

When investigating the spread of adenocarcinoma in the circular direction, we noticed that the mean distance from the lateral margin of the cancer to the circular line of resection at a level of maximum invasion was 5 mm (range 1–10 mm). Close examination revealed no cancer cells in the circular margin of resection.

Depending on the location of the lower margin of the tumour from the dentate line, all the specimens were divided into three groups. The first group comprised 18 specimens in which the distal verge of the tumour was located 1–2 cm above the dentate line.

The second group consisted of 45 specimens, in which the caudal margin of the tumour was located within 1 cm above the dentate line. The third group comprised 8 specimens in which the tumour involved the dentate line and anal canal to within 1 cm below the anorectal junction.

In the first group, all 18 tumours were presented to adenocarcinomas in T3 stage. Most of them had histologic structure with high and good degrees of differentiation ($n=17$). Low differentiation was observed in one case. Examination revealed no involvement of the structures of the anal canal, the ischiorectal tissue or the perianal skin. Distal intramural spread of malignancy was not observed in this series.

In the second group, most of the tumours were attributed to adenocarcinomas of high and good degree of differentiation ($n=41$). A low degree of differentiation was observed in four cases. T3 stage was found in 44 cases and T4 in one case. In 36 of 45 observations the structures of anal sphincter, the ischiorectal tissue and the perianal skin were not involved in malignancy. In eight cases the involvement of the internal sphincter was observed. In this connection, the levator ani muscles, external sphincter, ischiorectal tissue and perianal skin remained intact. Interestingly, in this series, the tumour had a structure of poorly differentiated adenocarcinoma in three of eight cases.

There was only one case of poorly differentiated tumour infiltration of the levator ani muscles, the internal sphincter and the prostate. In this examination, we observed the effect of distal intramural spread of malignancy along the submucous layer and the internal sphincter over a length of 12 mm from the macroscopically determined lower margin of the

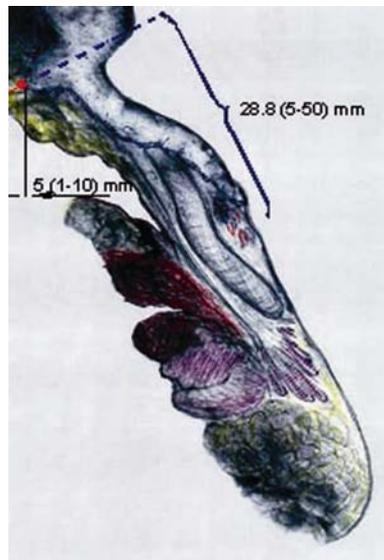


Fig. 1. Level of maximum invasion

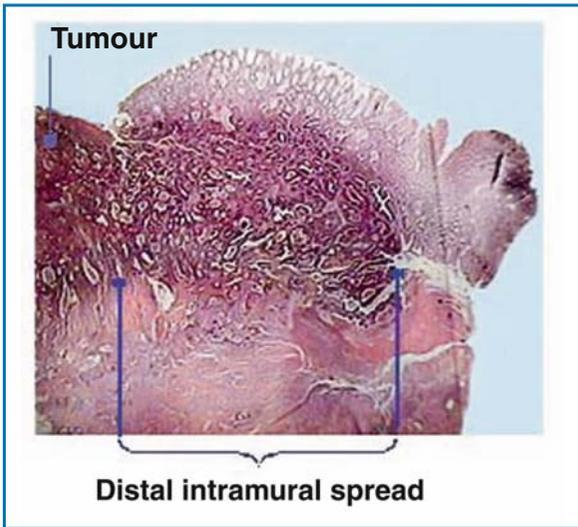


Fig. 2. Distal intramural spread

tumour (Fig. 2). However, the structures of external sphincter, ischiorectal tissue and perianal skin remained intact.

Moreover, in all cases of cancer invasion into the internal sphincter, with the exception of one case with the distal intramural spread of malignancy, the lesion was not total. It was located within the upper third of internal sphincter.

In five of the eight observations in the third group, the tumours were attributed to high and well differentiated adenocarcinomas. The T3 stage was observed in six cases and the T4 in two cases. In all specimens the structures of anal canal were involved in malignancy. In six cases there was involvement of the internal sphincter within its proximal portion. The levator ani muscles, the external sphincter, the ischiorectal tissue and the perianal skin remained intact. Interestingly, in this series, the tumour had a structure of poorly differentiated adenocarcinoma in one of the six cases. In one case only, the complex lesion of the internal and portions of external sphincter were observed. The tumour possessed a low degree of differentiation. In this case, the ischiorectal tissue, subcutaneous part of external sphincter and perianal skin were not involved in malignancy.

One more examination revealed the complex lesion of the levator ani muscles, internal and external sphincter. The tumour also possessed a low degree of differentiation. However, the ischiorectal tissue and perianal skin remained intact. The data obtained in the course of investigation into involvement of the structures of the anorectal area in malignancy are presented in Fig. 3.

It must be emphasised that, in all cases, the perianal skin, subcutaneous portion of external sphincter

and ischiorectal tissue remained intact. The puborectal muscle and levator ani muscles were not involved in malignancy in the majority of cases (97.2%). Their lesion was revealed in case of a low degree of differentiation of the tumour only. In every fifth observation, the upper third of internal sphincter was involved in malignancy. However, the incidence of its total lesion did not exceed 3%. The low degree of differentiation was observed in all cases of total lesion of internal sphincter as well as in the presence of distal intramural spread of adenocarcinoma along the submucous layer.

Thus, when the lower margin of the tumour was located within 2 cm above the dentate line, the internal sphincter was rarely involved in malignancy (9/63, 14.3%). In these cases, the tumour invaded its proximal third and the spread into external sphincter (in this case, into levator ani muscles) was revealed in one specimen with a low degree of differentiation of malignancy (1.6%). Other structures of dentate area remained intact.

When the distal margin of the tumour was located below the dentate line, the internal sphincter was invaded in 100% of cases and the external sphincter in every fourth case. Such behaviour can be explained in terms of low degree of tumour differentiation. However, the ischiorectal tissue, subcutaneous portion of external sphincter and perianal skin remained intact even for this group of specimens.

The revealed behaviour of malignancy in the distal area of the rectum can be elucidated as follows: the

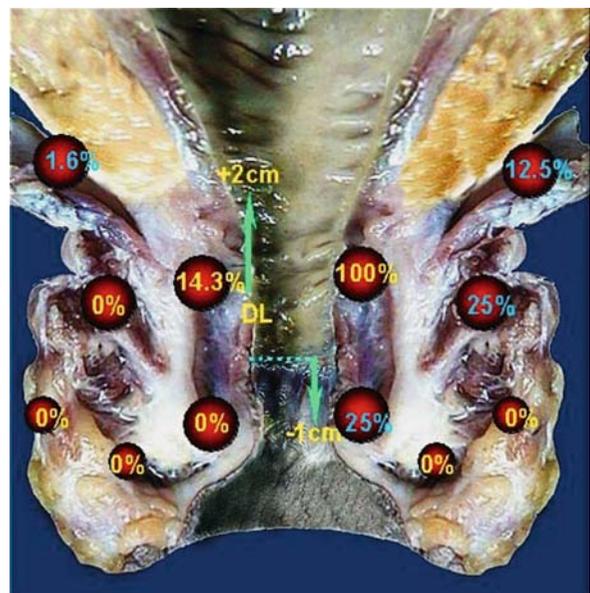


Fig. 3. Incidence involvement of the structures of the anorectal area

anorectal area, once being an integral anatomic–functional formation, is not the same from the viewpoint of its histogenesis. From the viewpoint of providing adequate circular margin of resection, the implementation of TME in the course of the abdominal phase of the operation allows surgeons, along with the removal of the rectum within of the visceral fascia, to take in the specimen the regional lymphatic nodes as well. The inclusion of the longitudinal muscle of anal canal in resection plan makes it possible to provide lateral clearance in the distal area of the specimen with entire or partial saving of anal sphincter.

The data obtained suggest that APR should be undoubtedly utilised when the dentate line and/or parietal fascia of the pelvis are invaded. However, the low differentiated adenocarcinomas can serve as a reason to reject the decision to save sphincter in favour of APR in cases of tumour location within 1–2 cm above dentate line as well.

Indications for APR

The results of morphological investigation currently testify in favour of surgery of low rectum cancer, if only APR and colostomy are to be used, for no more than 20% of such cases, thus for about 6–8% of all patients suffering from rectal cancer. In fact, even in specialised centres, the number of such procedures rises only to 20–30% of those performed for adenocarcinoma of the rectum. This is associated with the fact that the surgeon rejecting sphincter-saving operation in favour of APR should take into account a variety of variables, characteristic for the tumour and the patient.

Tumour Variables

APR of the rectum is conventionally performed when the tumour is located 0–5 cm from the perianal skin. However, APR (with permanent stoma) is not always the appropriate operation. In this case, when a low-dimensional tumour (less than 2 cm in diameter) is characterised by a high or good degree of differentiation, its invasion does not exceed the submucous layer, and the surgeons have no information on whether there is lymphovenous invasion, it is reasonable to apply various local procedures (transanal excision, TEM, diathermocoagulation via anoscope, etc.). At the same time, the T2 or T3 tumours without involvement of internal sphincter and longitudinal muscle in case of highly and well differentiated adenocarcinomas located 1–2 cm from the dentate line cannot be considered as an implicit indication for APR. Such tumours should be judged from the view-

point of the possibility of implementing resection of the rectum with subsequent formation of either ultralow stapled colorectal or hand-sutured colo-anal anastomosis. Therefore, the surgeon should make the final decision of operative technique upon completion of TME, being certain of the absence of macro- and microscopic symptoms of cancer invasion in the circular and distal margin of expected resection (“rectum neck” in the area of junction to levator). An impossibility of providing an uninvaded margin of any of the lines of resection can serve as an indication to perform APR. Invasion of dentate line or a free margin less than 1 cm is an indication for APR. However, there have recently been discussions of the possibility of using the intersphincteric or “close-shaved” approach to treat such patients when a portion or the whole of internal sphincter is resected [8–10]. Control over continence after such operations is accomplished by the residual portion of anal sphincter in combination with the reservoir technique. It is undeniable that cancer of the low rectum (prevailing situation) can serve as an indication for APR when the parietal fascia are involved as well as when there are symptoms of lymphatic spread (finger investigation, TRUS, MRT), regardless of the distal margin of the tumour from the dentate line.

Patient Variables

The variety of factors which can affect the surgeon’s decision whether to perform resection of the rectum should include the condition of anal sphincter, bowel function, patient’s age, concomitant diseases and capability of self-care of stoma. Thus, in case of anal incontinence, for patients with adenocarcinoma located 1–2 cm from the dentate line, it is unreasonable to aim for intestine continuity, because incontinence can even deteriorate. Such an approach can be applied to patients with intestine function characterised by urgent desires and diarrhoea. At the same time, upon solving question in favour of APR for patients suffering from the blindness, severe arthritis, mental insanity or neurologic diseases (para- and tetraplegia), intimate conversations with the patients and families caring for them are required because, besides medical indications for colostomy, the social indications play a significant role. One more factor capable of changing the plan of operation from sphincter-saving to APR is a “difficult” pelvis. In this case, not only the general surgeon, but the experienced colorectal specialist faces insurmountable technical obstacles when dealing with the fat and tall male with a narrow, long pelvis.

Operative Technique

APR should start with a discussion with the patient in the course of which he must be informed of the nature of disease, the need of removal of the rectum and anal sphincter and, if required, the need of resection of vagina wall, adnexa or bladder as well as about the formation of colostomy. Prior to the operation, the patient should be examined by a stomatherapist, which along with the selection of a location for a future stoma must as much as possible adapt the patient to the idea of the possibility of living under modified conditions.

Moreover, it is necessary to perform bowel preparation by means of antegrade lavage with 4 l of polyethylene glycol pre-operatively. Until now, the idea of antibacterial preparation of the bowel before operation has not been totally supported.

The two-team approach to APR is preferred. However, the presence of an experienced surgeon-assistant capable of performing the perineal phase of the surgery is an obligatory condition. This will significantly reduce the operative time, enabling surgeons to correct the direction of extraction of the rectum (especially in case of advanced tumours), and facilitate providing the final haemostasis after removal of the specimen. The abdominal team should play the crucial role in extraction of the rectum. In order to proceed with the perineal phase of the operation, it is necessary to complete TME. This is due to the fact that procedures carried out by the perineal team necessarily result in the drift of the rectum in the pelvis area, which prevents the precise extraction of the rectum and the synchronous saving of the autonomic nerves of the pelvis. Moreover, the visceral fascia can be injured. After the TME technique has been developed, the technical difficulties of extraction of the anterior wall of the rectum from the perineal side appear easily surmountable.

After total anaesthesia in combination with a peridural anaesthesia, the patient is placed on the table in a perineolithotomy position. Pneumatic compression devices are fitted to the legs to prevent thromboembolic complications. The perineum of the patient must project over the end of the table. The catheter is inserted into the bladder. Along with urine drainage, this allows attainment of required orientation when the front wall of the rectum in males is extracted. Proctoscopy examination is performed to reassess the rectal cancer and irrigate the rectum until clear. The abdominal and perineum skin (including vagina in females) are prepared in the conventional way.

Abdominal Phase

Incision and Exploration

The midline incision of abdomen is optimal for APR. After examination of abdominal cavity and making a decision to perform the operation, the required exposure is attained with the use of retractors.

Sigmoid Mobilisation

The sigmoid is mobilised by retracting it anteromedially. The incision is extended along the peritoneum at the left of the base of mesentery of sigmoid towards the splenic flexure and caudal to the cul-de-sac. Next the left ureter is retracted down and laterally out of the dissection field. Such an incision is extended at the right of the base of sigmoid. As a rule, the right ureter remains under the peritoneum laterally out of incision.

Ligation of Vascular Pedicle

The mobilised sigmoid colon is retracted anteriorly and laterally. The vascular pedicle is divided from the fascia covering aorta. In this connection, it is necessary to identify superior hypogastric plexus and leave it on the fascia. Upon division of the vascular pedicle up to the area where the a. mesenteric inferior (IMA) takes off the aorta, surgeons should be very careful with the left branch of sympathetic pre-aortic trunk, as the pedicle is closely adjoined to it over a length of 2–3 cm. After confirming that the left ureter is out of the operative field, a high ligation of IMA is performed at the area where it takes off the aorta. When there are no data on the lymphovenous invasion and the tumour is low-dimensional, it is possible to perform low ligation of the vessel just distal to the take-off of the left colic artery. The v. mesenteric inferior is ligated separately according to the level of artery ligation. Next the mesentery of sigmoid is serially clamped, divided and ligated from the point of the pedicle ligation to the level at which the colon will ultimately be divided. This level is determined by holding the colon up to the abdominal wall to be certain the colostomy can be constructed without tension.

Division of Colon and Colostomy Construction

The implementation of this stage prior to rectal mobilisation decreases the probability of contamination, simplifies access to the rectum, provides optimum conditions for stoma construction and prevents paracolostomy complications. Adequacy of the blood supply to the proposed site of division of the colon is assessed. In order to prevent contamination, the colon is divided with the use of GIA in the plane of sigmoid-descending colon junction. The abdominal surgeon clamps the peritoneum of the lateral abdominal wall in the area of the upper edge of the incision at the left of sigmoid. Then the peritoneum is separated from the posterior and lateral abdominal walls up to the plane of the proposed place of stoma construction. A circular portion of skin and subcutaneous fat, 2.5–3.0 cm in diameter depending on the colon thickness, is excised with the electrocautery down to the fascia of abdominal rectus. If excess fat is excised, the stoma may “settle” and the skin edges will be somewhat concave. A cruciate incision is made in the anterior fascia of the rectus and the muscle fibres are separated longitudinally. The posterior leaf of the rectus fascia is incised in a circular manner, so the abdominal wall defect will accommodate entirely to the circumference of the colon. Usually, two fingers properly fit this defect. Next the colon is fed through the extraperitoneal canal and the abdominal wall defect with care taken to avoid a twist in the colon or mesentery. It is ideal to have the colon protruding about 2.0 cm above the skin level. This method of stoma construction provides the absence of lateral paracolostomy space. Therefore, there is no need to place suture on it.

Rectal Mobilisation

Rectal mobilisation is begun posteriorly by lifting the sigmoid up and forward to expose the avascular space in the posterior midline surface filled with areolar tissue. However, the entrance to the avascular space is closed by the right and especially left branches of hypogastric nerve. Therefore, first it is necessary to separate both branches of hypogastric nerve from the visceral fascia. Electrocautery is used to develop the posterior avascular dissection plane staying anterior to the presacral fascia, sacral nerve plexus and median sacral vessels but posterior to the superior rectal artery and mesorectum up to S4 level from which the rectosacral fascia emerges. This fascia, determined as an area where the presacral fascia gives way to fascia propria of the rectum, is incised anterior to the coccyx. Mobilisation is completed at the level of lig. anococcygeum.

Anterior mobilisation is begun by continuing the previously made parallel incisions of peritoneum to meet in the midline at the deepest portion of rectovesical/rectovaginal pouch. In females, a relatively avascular plane along the rectovaginal septum is developed by electrocautery dissection under direct vision. In males, the plane posterior to Denonvillier’s fascia and anterior to the rectum is developed by electrocautery dissection distally to the inferior margin of the prostate. Care is taken to avoid injury to the posterior wall of the bladder, seminal vesicles and prostate gland to avoid pelvic plexus injury. If removing the tumour localised at the anterior rectal wall, the approach is altered to include a posterior vaginal wall in women and possibly to include a portion or the whole of the prostate in men if direct invasion into contiguous structures is present.

The final step in rectal mobilisation is to complete the division of the so-called “lateral ligament”. The “lateral ligament” on each side is exposed by holding the lateral surface of the rectum in the hand and retracting it to the opposite side of the pelvis. This technique enables surgeons to expose the place of intimate junction of pelvic plexus with the visceral fascia of the rectum. The intimate junction of these anatomic structures is provided by the nerves connecting the pelvic plexus with the rectum and by the branches of the median rectal artery passing through the plexus to the rectum. The performed anatomic investigations have demonstrated that the pronounced trunk of the median rectal artery is observed in 25% of cases [11]. This allows retraction of the lateral wall of the rectum with the use of scissors by coagulation of the branches and even the non-pronounced trunk of median rectal artery. The division and ligation of the tissues by clamps is allowed as a last resort when the trunk of artery is pronounced, because, in such a situation, the pelvic plexus can be injured. Injury of pelvic plexus leads to the urogenital complications. If implementation of APR is required and the two-team approach can be utilised, the perineal team joins the operation.

Perineal Phase

The oncological efficiency of the perineal phase of the operation and its safety directly depend on the professional skills of the surgeon performing it. Thus, this factor must play an important role when assembling the team of surgeons. Usually, the proper position of the patient on the table ensures good exposure from the perineal side. However, if heavy buttocks or a deep anal canal make visualisation difficult, one can suture the buttocks laterally. The per-

ineal operator should first irrigate the now mobilised rectum until clear from secretions, blood and loose bits of tumour. Next the perineal is repped and the anal canal pursestring suture of heavy silk is placed and tied.

Incision

An elliptical incision is made with cutting cautery. The incision extends anteriorly from the mid-portion of the perineal body in males or the posterior area of the vagina in females to the plane of coccyx tip. Such an incision is made in a conventional situation. If resection of the vagina is planned, the elliptical incision is extended anteriorly to incorporate the posterior area of vagina. The initial incision is deepened down through the fat of both ischioanal fossae to the level of the levator ani muscles laterally. The inferior rectal vessels can be controlled by coagulation or suture ligation. Self-retaining or rake retractors facilitate the exposure.

Posterior Dissection

The anococcygeal ligament is divided at the tip of the coccyx to enter the superficial post-anal space. The abdominal operator can retract the rectum anteriorly and guide the perineal surgeon into the correct dissection plane by palpation. This avoids the mistake of lifting the presacral fascia from the bone surface, which can result in the disruption of the presacral venous plexus.

Lateral Dissection

The index finger is inserted through the posterior defect up into the pelvis and then hooks the levator ani muscles laterally. Opposing traction of the rectum tenses the levators, which are serially clamped, divided and suture ligated with an absorbable stitch. The ischial spine defines the extent of lateral dissection.

Anterior Dissection

The skin clamps are pulled anteriorly and the anterior perineal incision is developed in the anterior decussating fibres of the external sphincter down to the superficial and deep transverse perineal muscles. The abdominal operator passes the umbilical tape tied to the proximal rectosigmoid through the posterior dissection plane to the perineal operator who

pulls the mobilised rectum and uses it for counter traction to facilitate the remainder of anterior dissection. The transverse perineal muscles are retracted anteriorly. The abdominal operator protects the prostate, seminal vesicles and urethra while the perineal surgeon follows the median raphe and puborectal muscle. Remaining tissues are divided with electrocautery with attention directed to avoid injury to the prostatic capsule or urethra, which is defined by the palpable bladder catheter. The specimen is thus resected *en bloc*. Any bleeding points are ligated or cauterised.

Wound Closure

The pelvic perineal space is irrigated from above and the perineal wound is then closed in layers from below with absorbable sutures. If a posterior vaginectomy has been performed, 2-0 absorbable synthetic sutures placed through the full-thickness of the vaginal wall starting at the apex will be used to reconstruct the vagina. The vaginal introitus is reconstructed before completion of closure of the perineal wound.

Abdominal Closure

In case of synchronous APR, the abdominal operator assists the perineal surgeon to complete resection. After irrigation of abdomen and pelvis cavity and completion of haemostasis, a soft drain is placed through a lower abdominal wall. As a preventive measure for ileus, the integrity of pelvic peritoneum is reconstructed. Fascia and skin are closed in a routine manner.

Maturation of Colostomy

Eight or ten absorbable sutures are placed around the circumference of the stoma between the skin and the seromuscular layer of the bowel without full-thickness bite of the colon at the edge of the stoma. The area of sigmoid with stapler suture is excised so that an excess of about 2 cm protrudes above the skin. The midline wound is dressed with an aseptic bandage.

Post-Operative Care

The enterostomal feeding is begun within two days of APR. Anti-embolism prophylaxis with anticoagulants and pneumatic compression stockings (elastic

bandaging of legs) is continued for seven days after the operation. The drain inserted into the pelvis cavity is removed as soon as drainage is <30–50 ml per day. The bladder catheter is usually removed within three days of surgery. Enterostomal therapy nurses begin teaching the patient and his family appropriate care of the colostomy and help alleviate anxiety by answering all their questions. In our series, the post-operative stay after APR averages 8–10 days.

Clinical Results: Post-Operative Complications and Mortality

One hundred and fifteen patients who had undergone curative APR from 1999 to 2004 at the Moscow State Scientific Center of Coloproctology were reviewed retrospectively. All these procedures were performed for the treatment of adenocarcinoma of the rectum. The series comprised 46 males and 69 females with an average age of 58.0 ± 9.143 years. No patient had undergone pre-operative radiotherapy. The average duration of the operation was 205.7 ± 42.48 min (min. 120, max. 320 min) with a blood loss of 363.3 ± 284.3 ml (from 150 to 1500 ml). 17.4% percent of patients received a blood transfusion, on average 2 units. Indications for transfusion today have markedly changed and most patients do not require transfusion. The perineal wound was primarily closed and drained in 95.7% of patients. Five (4.3%) patients had the perineal space open.

We had no hospital deaths in this series. Post-operative mortality has remained relatively stable over the past two decades and varied from 0 to 4%. The majority of operative mortality in reported series are related with cardiorespiratory and septic complications. While mortality is relatively low, morbidity varied from 15 to 35% [12, 13].

In this series, three (2.6%) patients suffered from severe intraoperative complications: ureteral injury, 1 patient; lacerated internal iliac vein, 1 patient; bladder injury, 1 patient; all patients were managed successfully at the same operation. Thirty-four (29.6%) patients developed post-operative complications. Urologic problems constituted the majority of complications.

Specific Complications of APR

Bladder Dysfunction

Urologic problems constitute the most frequent and troublesome complications following APR. Urinary dysfunction was observed in 23 cases. While bladder neck or prostate angulations may be contributory,

the majority of micturition disturbances are due to neurologic injury. As voiding dysfunction after APR is common and transitory, one can expect it to subside within three to six months post-operatively.

Fowler and coworkers warned that if large volume retention in the post-operative period secondary to bladder denervation is not recognised and remains untreated, bladder rehabilitation and restoration of normal voiding may be impossible. Many Authors advocate the use of urodynamic studies in order to identify patients at risk of developing urologic problems and to detect early post-operative voiding dysfunction.

Urinary dysfunction was of particular interest in the evaluation of the nerve-preserving procedure effectiveness.

Sexual Dysfunction

Male sexual dysfunction is regulated by the autonomic nervous system via the pelvic plexus which lies posterolateral to the bladder. Sympathetic nerves are responsible for ejaculation, while parasympathetic nerves govern erection. Sexual dysfunction after APR defined by partial or total impotence, loss of emission or retrograde ejaculation was observed in 6/40 (15%) who had normal sexual function prior to operation.

Of the female patients, 83.6% were able to experience arousal with vaginal lubrication and 90.1% could achieve orgasm.

Urinary Tract Infection

Urinary tract infection is a very common sequela to APR. This complication occurs in 6–32% of observations [14]. Contributing factors include the use of universal urinary catheter and urinary stasis.

Perineal Complications

In our series of 115 patients undergoing APR, 6.1% had perineal complications. In one case a perineal hernia was observed. Seven patients had a wound infection with delayed healing and the persistence of chronic perineal sinus. Only two of them required surgical repair.

Stomal Complications

An array of stomal complications can occur in patients undergoing APR. The majority of these are

preventable by careful attention to site selection and operative technique. Stenosis, retraction or prolapse was reported to occur in 8 (6.9%) of 115 patients. The incidence of paracolostomy hernia and prolapse was 5/115 (4.3%).

Most complications can be minimised if APR is performed by an experienced team with knowledge of relevant pelvic anatomy paying careful attention to details of operative techniques.

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