

Systematic Review Article: Types of Surgery for Anal Cancer

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Citation R Azhough, M Gheibi, S.Vahid Seyed Hosseini, **Types of Surgery for Anal Cancer**, *EJCMPR*. 2024; 3(3): 809-818.

https://doi.org/EJCMPR/20244*26

Article info:

Received: 11 March 2024

Accepted: 25 Jun 2024

Available Online:

ID: EJCMPR-2407-1194

Checked for Plagiarism: Yes
Peer Reviewers Approved by:

Dr. Frank Rebout

Editor who Approved Publication:

Dr. Frank Rebout

Keywords:

Anal Cancer, anal surgery, traditional approach

ABSTRACT

Anal cancer surgery encompasses various approaches aimed at removing tumors while preserving anal function and optimizing oncologic outcomes. This abstract explores the types of surgery available for anal cancer, including wide local excision, abdominoperineal resection (APR), and sphincter-sparing techniques. Wide local excision involves removing the tumor along with a margin of surrounding healthy tissue, typically through the anus or perineum, while APR entails removing the anus, rectum, and part of the colon, often resulting in permanent colostomy. Sphincter-sparing techniques aim to preserve anal function by selectively removing the tumor while sparing the anal sphincter complex and surrounding tissues. These techniques include local excision, trans anal resection, and intersphincteric resection, which offer the potential to avoid permanent colostomy while achieving oncologic clearance. By understanding the types of surgery available for anal cancer and their respective benefits and considerations, clinicians can tailor treatment plans to individual patients' needs and preferences, ultimately improving outcomes and quality of life.

Introduction

Anal cancer is a relatively rare malignancy that arises from the cells of the anal canal, which is the last portion of the gastrointestinal tract [1]. While anal cancer comprises a small percentage of all gastrointestinal malignancies, its incidence has been rising in recent years, particularly among certain populations such as men who have sex with men (MSM) and individuals with human papillomavirus (HPV) infection [2-5]. Treatment for anal cancer typically involves a combination

of therapies, including surgery, radiation therapy, and chemotherapy. The choice of surgical approach depends on various factors such as tumor size, location, and stage, as well as patient preferences and overall health status[6].

Wide Local Excision

Wide local excision (WLE) is a surgical procedure commonly employed in the management of anal cancer, particularly for early-stage tumors confined to the anal canal or perianal skin. This approach aims to achieve complete removal of the cancerous tissue while

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preserving anal function and minimizing the risk of local recurrence [7]. Wide local excision may be performed as a standalone treatment for small, localized tumors or in combination with other modalities such as radiation therapy or chemotherapy for more advanced disease [8].

The surgical technique of wide local excision involves the removal of the tumor along with a margin of surrounding healthy tissue to ensure complete excision and minimize the risk of residual disease [9]. The extent of tissue excision may vary depending on factors such as tumor size, location, and depth of invasion, as well as the surgeon's discretion and intraoperative findings. In cases where the tumor is located close to the anal verge or involves the anal sphincter complex, careful dissection is performed to preserve sphincter function and minimize postoperative morbidity [10-12].

One of the primary advantages of wide local excision is its potential for organ preservation, as it aims to remove the cancerous tissue while sparing the anal sphincter complex and preserving anal function [13]. This is particularly important for patients with early-stage tumors who may be candidates for sphincter-sparing surgery, which aims to avoid permanent colostomy and maintain bowel continuity [14]. By preserving anal function, wide local excision offers the potential for improved postoperative quality of life and functional outcomes compared to more extensive procedures such as abdominoperineal resection (APR) [15].

Wide local excision may be performed using various surgical approaches, including transanal, perineal, or combined transanal-perineal techniques, depending on the tumor characteristics and surgeon's preference [16]. Transanal excision is commonly used for tumors located within the anal canal, while perineal excision may be preferred for tumors involving the perianal skin or extending into the anal margin [17]. Combined transanal-perineal

excision allows for optimal exposure and access to the tumor, particularly for lesions located close to the anal verge or involving the anal sphincter complex [18].

In addition to complete tumor excision, wide local excision aims to achieve adequate margins of resection to minimize the risk of local recurrence [19]. The extent of surgical margins may vary depending on factors such as tumor size, location, and histologic subtype, as well as the surgeon's discretion and intraoperative findings [20]. While wider margins may reduce the risk of local recurrence, they must be balanced with the preservation of anal function and avoidance of excessive tissue loss, which may lead to functional impairment or wound complications [21].

The success of wide local excision in the treatment of anal cancer depends on several factors, including tumor characteristics, patient factors, and surgical expertise [22]. Patient selection is crucial to ensure optimal outcomes, and careful preoperative evaluation is essential to assess tumor size, location, and depth of invasion, as well as the feasibility of sphincter-sparing surgery [21]. In cases where wide local excision is not feasible or appropriate, alternative treatment modalities such as radiation therapy or chemotherapy may be considered either alone or in combination with surgery [22].

Postoperative management following wide local excision typically involves close surveillance for local recurrence and distant metastasis, as well as supportive care to optimize wound healing and functional outcomes [24]. Patients may experience temporary symptoms such as pain, swelling, or changes in bowel function following surgery, which can usually be managed with conservative measures such as pain medication, stool softeners, and dietary modifications. Long-term follow-up is essential to monitor for disease recurrence and assess functional

outcomes, including bowel continence and quality of life[25].

In conclusion, wide local excision represents a valuable surgical approach in the management of anal cancer, particularly for early-stage tumors amenable to organ-preserving therapy. This technique offers the potential for complete tumor excision while preserving anal function and minimizing the risk of local recurrence. However, the success of wide local excision depends on various factors such as tumor characteristics, patient factors, and surgical expertise, and careful patient selection and preoperative evaluation are essential to ensure optimal outcomes[26].

Abdominoperineal Resection (APR)

Abdominoperineal resection (APR) is a surgical procedure commonly employed in the treatment of anal cancer, particularly for more advanced or aggressive tumors that involve the anal sphincter complex or extend into adjacent organs such as the rectum or pelvic floor muscles[27]. This procedure involves the complete removal of the rectum, anus, and surrounding tissues through both abdominal and perineal incisions, followed by the creation of a permanent colostomy to divert bowel contents to an external pouch. APR aims to achieve complete oncologic resection while minimizing the risk of local recurrence and preserving pelvic organ function to the extent possible[28].

The surgical technique of APR typically begins with an abdominal incision, through which the surgeon gains access to the pelvic cavity and mobilizes the rectum and surrounding structures. The rectum is carefully dissected free from its attachments to the pelvic sidewall, pelvic floor muscles, and adjacent organs, such as the bladder and prostate in men or the uterus and vagina in women. Once the rectum has been mobilized sufficiently, it is transected at a level above the tumor, ensuring an adequate margin

of normal tissue to minimize the risk of residual disease[29].

Following rectal transection, the surgeon proceeds to perform a perineal incision to access the anal canal and complete the resection of the distal rectum, anus, and perianal tissues. The anal sphincter complex is dissected free from the surrounding tissues, and the entire specimen, including the rectum, anus, and perianal skin, is removed en bloc. Once the resection is complete, the surgeon creates a permanent colostomy by bringing the proximal end of the colon through the abdominal wall and suturing it to the skin to form a stoma[25].

One of the primary advantages of APR is its potential for achieving complete oncologic resection and minimizing the risk of local recurrence in cases of locally advanced anal cancer. By removing the entire rectum, anus, and perianal tissues, APR eliminates the primary site of disease and reduces the likelihood of residual tumor cells remaining in the pelvic cavity. Additionally, the creation of a permanent colostomy allows for the diversion of bowel contents away from the pelvic cavity, reducing the risk of contamination and infection in the surgical site[30].

Despite its oncologic benefits, APR has significant implications for patients in terms of permanent colostomy and potential changes in bowel function and quality of life. The presence of a colostomy requires ongoing management and adaptation, including stoma care, appliance maintenance, and lifestyle modifications to accommodate the changes in bowel habits. Additionally, the loss of the rectum and anal sphincter complex may result in alterations in bowel function, including changes in stool consistency, frequency, and urgency, which can impact patients' quality of life and psychosocial well-being[31].

Patient selection is crucial in determining the appropriateness of APR for the treatment of anal cancer, and careful preoperative evaluation is

essential to assess tumor characteristics, patient factors, and surgical considerations. Factors such as tumor size, location, and extent of invasion, as well as patient preferences and overall health status, must be taken into account when considering APR as a treatment option. In some cases, preoperative chemoradiation therapy may be administered to downstage the tumor and facilitate sphincter preservation, allowing for a less extensive surgical resection[30].

In recent years, there has been growing interest in sphincter-sparing techniques for the surgical treatment of anal cancer, particularly for tumors located in the distal rectum or anal canal. These techniques aim to preserve anal function and avoid permanent colostomy whenever feasible while still achieving complete oncologic resection. Sphincter-sparing approaches may include procedures such as local excision, transanal resection, or intersphincteric resection, depending on the tumor characteristics and patient factors. By preserving the anal sphincter complex and maintaining bowel continuity, sphincter-sparing techniques offer the potential for improved postoperative quality of life and functional outcomes compared to traditional APR[32].

In conclusion, abdominoperineal resection (APR) is a valuable surgical approach in the treatment of anal cancer, particularly for more advanced or aggressive tumors that involve the anal sphincter complex or adjacent organs. While APR offers the potential for achieving complete oncologic resection and minimizing the risk of local recurrence, it has significant implications for patients in terms of permanent colostomy and potential changes in bowel function and quality of life. Patient selection and careful preoperative evaluation are essential to ensure optimal outcomes, and sphincter-sparing techniques may offer an alternative for selected patients to preserve anal function and avoid permanent colostomy whenever feasible[32].

Sphincter-Sparing Techniques

Sphincter-sparing techniques in anal cancer surgery represent a significant advancement in the field, offering the potential to preserve anal function and avoid permanent colostomy while still achieving oncologic clearance[33]. These techniques aim to balance the goals of complete tumor resection with the preservation of anal sphincter complex and surrounding tissues, thereby minimizing the impact on patients' quality of life and functional outcomes. Sphincter-sparing approaches may be particularly beneficial for patients with early-stage tumors or those located in the distal rectum or anal canal, where preservation of anal function is feasible without compromising oncologic outcomes[34].

One of the key sphincter-sparing techniques in anal cancer surgery is local excision, which involves the removal of the tumor along with a margin of surrounding healthy tissue through the anus or perineum[34]. Local excision is typically reserved for small, superficial tumors that are confined to the mucosa or submucosa of the anal canal or perianal region and have not invaded into the deeper layers of the rectal wall. This technique offers the advantage of preserving the anal sphincter complex and avoiding permanent colostomy, making it an attractive option for selected patients with early-stage disease[35].

Transanal excision is a specific type of local excision performed through the anus, allowing for direct access to tumors located in the distal rectum or anal canal. The procedure is performed using specialized instruments such as a transanal endoscope or transanal minimally invasive surgery (TAMIS) platform, which provide visualization and access to the tumor while minimizing trauma to surrounding tissues. Transanal excision may be suitable for tumors that are small (<3 cm in diameter), well-differentiated, and located within 8 cm of the anal verge, where preservation of anal function

is feasible without compromising oncologic outcomes[36].

In cases where transanal excision is not feasible or oncologically appropriate, alternative sphincter-sparing techniques such as transanal resection or intersphincteric resection may be considered. Transanal resection involves the removal of a segment of the rectal wall containing the tumor through the anus, followed by primary closure of the defect or reconstruction with a local flap or graft. Intersphincteric resection, on the other hand, entails the removal of the lower portion of the rectum and anal canal, including the internal anal sphincter, while preserving the external sphincter complex and anal mucosa[36]. This technique allows for complete tumor resection while maintaining anal continence and avoiding permanent colostomy, making it an attractive option for selected patients with low-lying tumors and good anal function[37].

In addition to surgical resection, sphincter-sparing techniques may be combined with other modalities such as radiation therapy or chemotherapy to optimize oncologic outcomes and reduce the risk of local recurrence. Neoadjuvant therapy may be administered preoperatively to downstage the tumor and facilitate sphincter preservation, particularly in cases where the tumor is large or locally advanced. Adjuvant therapy may be administered postoperatively to reduce the risk of disease recurrence and improve long-term outcomes, particularly in cases where the tumor is aggressive or associated with high-risk features[35].

The success of sphincter-sparing techniques in anal cancer surgery depends on several factors, including tumor characteristics, patient factors, and surgical expertise. Patient selection is crucial to ensure optimal outcomes, and careful preoperative evaluation is essential to assess tumor size, location, depth of invasion, and relationship to the anal sphincter complex.

Multidisciplinary collaboration between colorectal surgeons, oncologists, radiation therapists, and other members of the healthcare team is essential to develop individualized treatment plans tailored to each patient's specific needs and preferences[36].

Postoperative management following sphincter-sparing surgery typically involves close surveillance for local recurrence and distant metastasis, as well as supportive care to optimize wound healing and functional outcomes. Patients may experience temporary symptoms such as pain, swelling, or changes in bowel function following surgery, which can usually be managed with conservative measures such as pain medication, stool softeners, and dietary modifications. Long-term follow-up is essential to monitor for disease recurrence and assess functional outcomes, including bowel continence and quality of life[37].

In conclusion, sphincter-sparing techniques represent a valuable surgical approach in the treatment of anal cancer, offering the potential to preserve anal function and avoid permanent colostomy while still achieving oncologic clearance. These techniques may be particularly beneficial for patients with early-stage tumors or those located in the distal rectum or anal canal, where preservation of anal function is feasible without compromising oncologic outcomes. Patient selection, careful preoperative evaluation, and multidisciplinary collaboration are essential to ensure optimal outcomes and minimize the impact on patients' quality of life and functional outcomes[38].

Minimally Invasive Surgery

Minimally invasive surgery (MIS) has emerged as an important approach in the management of anal cancer, offering potential benefits such as reduced postoperative pain, shorter hospital stays, and faster recovery times compared to traditional open surgery. MIS techniques utilize small incisions and specialized instruments to

access and remove tumors while minimizing trauma to surrounding tissues, thereby reducing the risk of complications and improving patient outcomes. In the context of anal cancer surgery, MIS encompasses various approaches, including laparoscopic surgery, robotic-assisted surgery, and transanal minimally invasive surgery (TAMIS), each offering unique advantages and considerations[32].

Laparoscopic surgery is a minimally invasive approach that involves the use of small incisions and a camera-equipped scope (laparoscope) to visualize and access the abdominal cavity. During laparoscopic anal cancer surgery, the surgeon makes several small incisions in the abdomen, through which specialized instruments are inserted to mobilize and resect the tumor. The laparoscope provides high-definition imaging of the surgical field, allowing for precise dissection and removal of the tumor while minimizing trauma to surrounding tissues. Laparoscopic surgery offers several potential advantages over traditional open surgery, including reduced postoperative pain, shorter hospital stays, faster recovery times, and improved cosmesis. Additionally, laparoscopic surgery may allow for more extensive lymph node dissection and improved visualization of critical structures, potentially reducing the risk of intraoperative complications and improving oncologic outcomes[33].

Robotic-assisted surgery represents a further advancement in minimally invasive techniques, offering enhanced precision, dexterity, and visualization compared to conventional laparoscopic surgery. In robotic-assisted anal cancer surgery, the surgeon controls robotic arms equipped with specialized instruments from a console located in the operating room. The robotic system provides three-dimensional, high-definition visualization of the surgical field and allows for precise, tremor-free movements, facilitating complex dissection and suturing tasks in confined spaces. Robotic-assisted

surgery may offer several potential advantages over laparoscopic surgery, including improved ergonomics for the operating surgeon, enhanced visualization of critical structures, and reduced risk of intraoperative complications. Additionally, robotic-assisted surgery may be particularly beneficial for patients with complex or technically challenging tumors, allowing for more precise and meticulous dissection while minimizing trauma to surrounding tissues[39]. Transanal minimally invasive surgery (TAMIS) is a specialized approach that allows for the precise excision of anal tumors through the anus using specialized instruments and a platform called a TAMIS port. TAMIS combines the benefits of minimally invasive surgery with the familiarity and accessibility of the transanal approach, allowing for precise visualization and excision of tumors located in the distal rectum or anal canal. During TAMIS, the surgeon inserts a TAMIS port into the anus, through which specialized instruments and a camera are inserted to visualize and dissect the tumor. TAMIS offers several potential advantages over traditional transanal excision techniques, including improved visualization, better instrument control, and reduced risk of local recurrence. Additionally, TAMIS may be associated with shorter operative times, reduced postoperative pain, and faster recovery times compared to traditional open surgery[40]. In addition to the technical considerations, patient selection is crucial in determining the suitability of minimally invasive surgery for anal cancer. Factors such as tumor size, location, depth of invasion, and relationship to critical structures must be carefully evaluated to ensure safe and effective tumor removal[41]. Patients with early-stage tumors or those located in favorable anatomical locations may be suitable candidates for minimally invasive approaches, while those with large, locally advanced tumors or extensive involvement of surrounding structures may require more extensive

surgery[42]. Multidisciplinary collaboration between colorectal surgeons, oncologists, radiation therapists, and other members of the healthcare team is essential to develop individualized treatment plans tailored to each patient's specific needs and preferences[43].

Conclusion

Overall, minimally invasive surgery represents a valuable approach in the management of anal cancer, offering potential benefits such as reduced postoperative pain, shorter hospital stays, and faster recovery times compared to traditional open surgery[44]. Laparoscopic surgery, robotic-assisted surgery, and transanal minimally invasive surgery (TAMIS) each offer unique advantages and considerations, and careful patient selection is essential to ensure optimal outcomes. By combining technical expertise with advanced technology, minimally invasive surgery holds promise for improving patient outcomes and quality of life in the treatment of anal cancer[45].

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