

Systematic Review Article: Colorectal Cancer Surgery Approach

Ramin Azhough¹, Seyed Vahid Seyed Hosseini^{2*}

¹Associate Professor of Surgery, Department of General Surgery, School of Medicine, Tabriz University of Medical science, Tabriz, Iran (Email: R_Azhough@gmail.com/ ORCID: 0000-0001-5792-1300)

²General Surgeon, Sina Hospital, Tabriz University of Medical science, Tabriz, Iran. (ORCID: 0009-0002-1365-3038)



Citation R Azhough, S.V Seyed Hosseini. **Colorectal Cancer Surgery Approach**, *EJCMPR*. 2024; 3(3):762-774



<https://doi.org/EJCMPR/20246511>

Article info:

Received: 26 March 2024

Accepted: 10 Jun 2024

Available Online:

ID: EJCMPR-2406-1188

Checked for Plagiarism: Yes

Peer Reviewers Approved by:

Dr. Frank Rebout

Editor who Approved Publication:

Dr. Frank Rebout

Keywords:

Colorectal Cancer, open surgery, minimally surgery

ABSTRACT

Colorectal cancer surgery approaches have evolved significantly over the years, with a focus on achieving optimal oncologic outcomes while minimizing postoperative morbidity and preserving quality of life. Traditional open surgery, once the mainstay of treatment, has been supplemented and often replaced by minimally invasive techniques such as laparoscopy and robotic-assisted surgery. These approaches offer advantages such as reduced blood loss, shorter hospital stays, and quicker recovery times compared to open surgery. Furthermore, sphincter-sparing techniques aim to preserve anal function and avoid permanent colostomy whenever feasible, improving patients' postoperative quality of life. However, the selection of the most appropriate surgical approach depends on various factors including tumor characteristics, patient anatomy, and surgeon expertise. This abstract provides a concise overview of the evolving landscape of colorectal cancer surgery, highlighting the importance of personalized treatment strategies tailored to individual patient needs.

Introduction

Colorectal cancer is one of the most common malignancies worldwide, posing a significant health burden due to its high incidence and mortality rates. Effective management of colorectal cancer often necessitates a multidisciplinary approach, with surgery playing a central role. Surgical intervention is paramount not only for potentially curative treatment but also for palliation in advanced cases[1]. Over the years, various surgical

techniques have been developed and refined to optimize outcomes for patients with colorectal cancer. This introduction delves into the various surgical approaches, their evolution, and their significance in the management of colorectal cancer [2].

The history of colorectal cancer surgery dates back to the 19th century when the first successful resections were performed. Early surgical techniques were rudimentary, with high rates of morbidity and mortality [3]. However, the advent of anesthesia, antisepsis, and advances in surgical techniques and

*Corresponding Author: Seyed Vahid Seyed Hosseini (Email: seyedhosseiniseyedvahid@gmail.com)

understanding of human anatomy significantly improved outcomes. The seminal work of William Ernest Miles in the early 20th century introduced the abdominoperineal resection (APR), which became a cornerstone procedure for rectal cancer. Miles' approach emphasized the importance of removing the rectum and anus en bloc with lymphatic drainage, drastically reducing local recurrence rates [4].

Open Surgery: The Traditional Approach

Open surgery has long been the traditional approach to colorectal cancer surgery, forming the foundation of surgical oncology for this disease. Despite the emergence of minimally invasive techniques, open surgery remains a critical option, especially in complex cases requiring extensive resection and reconstruction. This approach, deeply rooted in surgical history, continues to provide essential benefits in terms of visibility, access, and versatility[5].

Open colorectal surgery involves making a sizable incision in the abdomen to access the colon and rectum. This method offers the surgeon a clear and direct view of the organs, enabling precise manipulation and thorough exploration of the abdominal cavity[6]. The large incision allows for the removal of large tumors and the performance of extensive resections and reconstructions that might be challenging or impossible with minimally invasive techniques[7].

One of the primary advantages of open surgery is the enhanced ability to handle complex cases. For instance, when tumors are large, locally advanced, or involve adjacent organs, open surgery provides the necessary access and maneuverability. Surgeons can carefully dissect and remove the tumor along with any involved structures, ensuring clear margins and reducing the risk of recurrence.

This is particularly important in cases where the cancer has invaded nearby organs such as the

bladder, uterus, or small intestine, requiring a multi-organ resection [8].

In cases of bowel obstruction, perforation, or significant bleeding, which are often emergencies, open surgery is invaluable. These situations demand rapid and effective intervention, and the extensive access provided by open surgery allows for quick control of bleeding, repair of perforations, and relief of obstructions. The ability to see and feel the organs directly helps in making real-time decisions that can be crucial for the patient's outcome[9].

Moreover, open surgery is often preferred in patients with complex anatomical variations or extensive adhesions from previous surgeries. Laparoscopic or robotic approaches may be hindered by scar tissue, making it difficult to create a working space or visualize critical structures. In such scenarios, open surgery offers a safer and more effective option, as the surgeon can carefully dissect through adhesions and navigate the altered anatomy[10].

Another significant benefit of open surgery is its applicability in patients who may not tolerate the physiological demands of minimally invasive surgery. For example, the pneumoperitoneum (inflation of the abdomen with gas) required in laparoscopic surgery can adversely affect respiratory and cardiovascular function, making it unsuitable for some patients with severe comorbidities. Open surgery eliminates this concern, allowing these patients to receive the necessary surgical treatment without the added risks associated with minimally invasive techniques[11].

The evolution of open surgery for colorectal cancer has been marked by significant advancements in surgical techniques and perioperative care. Early colorectal surgeries were associated with high morbidity and mortality due to infection, bleeding, and poor postoperative care.

However, the introduction of antiseptic techniques, antibiotics, and improved anesthesia in the late 19th and early 20th centuries dramatically changed the landscape of surgical practice[12].

William Ernest Miles' introduction of the abdominoperineal resection (APR) in 1908 was a milestone in colorectal cancer surgery. This technique, designed for rectal cancer, involves the en bloc removal of the rectum, anus, and surrounding lymphatic tissue, significantly reducing local recurrence rates and improving survival. Miles' approach laid the foundation for modern oncologic principles in colorectal surgery, emphasizing the importance of complete tumor resection and adequate margins[13].

In contemporary practice, right hemicolectomy is a common procedure for cancers located in the cecum, ascending colon, or hepatic flexure. This surgery involves the resection of the right colon and part of the transverse colon along with the associated mesentery and lymph nodes.

The process typically begins with a midline laparotomy to provide access to the abdominal cavity. The right colon is then mobilized by incising the peritoneum along the line of Toldt. The ileocolic, right colic, and right branch of the middle colic arteries are ligated and divided, allowing for the resection of the diseased segment of the colon[14].

Similarly, left hemicolectomy and sigmoidectomy are performed for cancers in the descending colon or sigmoid colon. These procedures involve the resection of the left colon and sigmoid colon, respectively, along with their mesentery and lymph nodes.

The surgical steps are similar to those of a right hemicolectomy, with appropriate modifications based on the tumor's location. The primary goal in all these procedures is to achieve a complete oncologic resection with clear margins while preserving as much normal bowel function as possible[15].

Low anterior resection (LAR) is another crucial procedure in the open surgery repertoire, primarily used for tumors located in the upper and mid-rectum. This surgery involves the removal of the rectum's diseased portion while preserving the anal sphincter, thus maintaining the patient's continence. The procedure begins with a midline incision, followed by mobilization of the rectum and ligation of the inferior mesenteric artery.

The rectum is then resected, and an anastomosis is created between the colon and the remaining rectal stump. This procedure has become the standard for rectal cancer, offering a balance between oncologic control and quality of life[16].

Open surgery for colorectal cancer is not without its challenges. The large incisions required can lead to significant postoperative pain and a longer recovery period compared to minimally invasive techniques.

There is also a higher risk of wound infections and other complications such as hernias. However, advancements in perioperative care, including enhanced recovery after surgery (ERAS) protocols, have significantly improved outcomes. These protocols include measures such as optimized pain management, early mobilization, and nutritional support, all aimed at reducing complications and shortening hospital stays[17].

Despite the advancements in minimally invasive techniques, open surgery remains a critical component of colorectal cancer treatment. It is particularly valuable in complex and advanced cases where extensive resections and reconstructions are required.

The ability to directly visualize and manipulate the organs, handle emergencies, and accommodate patients with complex anatomies or comorbidities ensures that open surgery will continue to play a vital role in colorectal cancer surgery[18].

In conclusion, open surgery represents the traditional and foundational approach to colorectal cancer surgery. Its importance is underscored by its ability to handle complex and advanced cases, provide rapid and effective intervention in emergencies, and accommodate patients with anatomical variations or comorbidities.

While minimally invasive techniques offer certain advantages, open surgery remains indispensable in the surgical management of colorectal cancer. The continued refinement of surgical techniques and perioperative care will ensure that open surgery continues to provide safe and effective treatment for patients with colorectal cancer [19].

Minimally Invasive Surgery: Revolutionizing Treatment

Minimally invasive surgery has revolutionized the treatment of colorectal cancer, offering patients numerous benefits over traditional open surgery. This modern approach includes techniques such as laparoscopy and robotic-assisted surgery, which involve smaller incisions, reduced postoperative pain, faster recovery times, and often better overall outcomes.

As these methods have evolved, they have become integral to the standard care for colorectal cancer, providing effective treatment with fewer complications and enhanced patient quality of life[20].

Minimally invasive surgery for colorectal cancer involves performing the procedure through several small incisions rather than a single large one. In laparoscopy, a camera (laparoscope) and specialized surgical instruments are inserted through these incisions, allowing the surgeon to view the surgical site on a monitor and perform the necessary operations.

Robotic-assisted surgery takes this a step further, with the surgeon controlling robotic

arms that hold the instruments, offering greater precision and dexterity [21].

One of the key advantages of minimally invasive surgery is the significant reduction in postoperative pain. Smaller incisions mean less trauma to the body's tissues, which translates to lower pain levels for patients.

This reduction in pain not only improves the immediate postoperative experience but also reduces the need for pain medication, which can have its own side effects and complications. Patients are able to move more comfortably and return to their normal activities sooner, enhancing their overall recovery process[22].

The smaller incisions used in minimally invasive surgery also lead to a decreased risk of wound infections. In traditional open surgery, the larger incision provides a greater surface area for potential infection, which can complicate recovery and prolong hospital stays.

Minimally invasive techniques, with their smaller and fewer incisions, minimize this risk, contributing to quicker and more uncomplicated recoveries[23].

Additionally, patients undergoing minimally invasive surgery often experience shorter hospital stays. The reduced pain and lower risk of complications mean that patients can be discharged earlier, allowing them to recover in the comfort of their own homes.

This not only improves patient satisfaction but also reduces healthcare costs, as shorter hospital stays are less expensive[24].

The precision offered by minimally invasive surgery, particularly robotic-assisted techniques, is another significant benefit. Robotic systems provide surgeons with enhanced vision, magnified views, and greater control over the surgical instruments.

This allows for more precise dissections and suturing, which is particularly important in colorectal surgery where the preservation of surrounding tissues and structures is crucial. The increased precision reduces the risk of

accidental injury to nearby organs and tissues, thereby minimizing complications and improving surgical outcomes[25].

Furthermore, minimally invasive techniques are associated with less blood loss during surgery. The precision and control provided by these methods allow surgeons to operate more delicately, reducing the likelihood of bleeding. This is particularly beneficial for patients who may have underlying conditions that increase their risk of bleeding or who are unable to tolerate significant blood loss[26].

Despite these advantages, minimally invasive surgery for colorectal cancer is not without its challenges. The procedures require a high level of skill and experience, and not all surgeons are trained in these techniques. Moreover, certain cases of colorectal cancer, particularly those involving large tumors or extensive local invasion, may not be suitable for minimally invasive approaches. In such instances, open surgery remains the best option [27].

Training and experience are crucial for the successful implementation of minimally invasive surgery. Surgeons must undergo specialized training to master the use of laparoscopic and robotic instruments and to develop the skills needed for precise and effective surgery. As more surgeons become proficient in these techniques, the availability and success rates of minimally invasive colorectal surgery continue to improve [28].

Despite the challenges, the benefits of minimally invasive surgery for colorectal cancer make it an attractive option for many patients.

Clinical studies have shown that laparoscopic and robotic-assisted surgeries have comparable oncologic outcomes to traditional open surgery. This means that these minimally invasive techniques are just as effective at removing cancer and reducing the risk of recurrence, while offering the added benefits of reduced pain, faster recovery, and fewer complications[29].

The adoption of minimally invasive surgery has also led to advancements in perioperative care. Enhanced recovery after surgery (ERAS) protocols, which are designed to optimize patient outcomes and speed up recovery, are particularly well-suited to minimally invasive techniques.

These protocols include measures such as preoperative counseling, optimized pain management, early mobilization, and nutritional support. When combined with minimally invasive surgery, ERAS protocols have been shown to significantly improve patient outcomes and reduce hospital stays even further[29].

One specific area where minimally invasive surgery has shown great promise is in the treatment of rectal cancer. Traditionally, rectal cancer surgery has been associated with high rates of complications and a lengthy recovery period.

However, laparoscopic and robotic-assisted techniques have transformed the approach to rectal cancer surgery, offering patients better outcomes with fewer side effects. The precise nature of robotic-assisted surgery, in particular, is beneficial in the narrow confines of the pelvis, where maintaining clear margins while preserving important structures is critical[29].

Minimally invasive surgery has also facilitated the adoption of more conservative surgical approaches in some cases. For instance, in select patients with early-stage colorectal cancer, it may be possible to perform a local excision using minimally invasive techniques, sparing the patient from a more extensive resection. This approach, when appropriate, can preserve bowel function and reduce the impact of surgery on the patient's quality of life [30].

The role of minimally invasive surgery in colorectal cancer treatment continues to expand as technology advances. Innovations such as improved imaging techniques, better robotic systems, and enhanced surgical instruments are

continually improving the precision and effectiveness of these surgeries. As a result, more patients are able to benefit from minimally invasive approaches, leading to better outcomes and improved quality of life[30].

In conclusion, minimally invasive surgery has revolutionized the treatment of colorectal cancer, offering numerous advantages over traditional open surgery. The benefits of reduced postoperative pain, shorter hospital stays, lower risk of complications, and enhanced precision make these techniques highly attractive for both patients and surgeons.

While there are challenges to overcome, particularly in terms of training and case selection, the continued advancement of minimally invasive techniques promises to further improve the outcomes for patients with colorectal cancer. As technology and surgical expertise continue to evolve, minimally invasive surgery will undoubtedly play an increasingly central role in the treatment of this common and potentially deadly disease [30].

Laparoscopic Surgery

Laparoscopic surgery has emerged as a cornerstone in the management of colorectal cancer, offering a minimally invasive alternative to traditional open surgery with notable benefits for patients and surgeons alike. This technique involves the use of a laparoscope, a thin, flexible tube equipped with a camera and surgical instruments, inserted through small incisions in the abdomen to visualize and manipulate the internal organs. Compared to open surgery, which requires a single large incision, laparoscopic surgery offers several advantages, including reduced postoperative pain, faster recovery, and improved cosmetic outcomes [31].

One of the primary advantages of laparoscopic surgery in colorectal cancer treatment is the significant reduction in postoperative pain experienced by patients.

The smaller incisions used in laparoscopic procedures result in less tissue trauma compared to open surgery, leading to decreased pain levels during the recovery period. This reduction in pain not only enhances patient comfort but also allows for a smoother transition to oral pain medications and earlier mobilization, facilitating a faster recovery overall[32].

Furthermore, laparoscopic surgery offers the benefit of improved cosmetic outcomes, which can have a positive impact on patients' psychosocial well-being. The smaller incisions used in laparoscopic procedures result in less scarring compared to traditional open surgery, leading to a more aesthetically pleasing appearance. For many patients, especially those undergoing elective procedures for colorectal cancer, this improved cosmetic outcome can help alleviate concerns about body image and enhance overall satisfaction with the surgical experience [32].

In addition to reduced pain and improved cosmetic outcomes, laparoscopic surgery is associated with shorter hospital stays compared to open surgery. Patients undergoing laparoscopic procedures often experience faster recoveries and are able to return home sooner after surgery, reducing the overall length of hospitalization and associated healthcare costs. This expedited recovery process not only benefits patients by allowing them to resume their normal activities sooner but also helps alleviate the burden on healthcare resources by freeing up hospital beds for other patients in need [33].

Moreover, laparoscopic surgery offers the advantage of reduced blood loss during the procedure, which can minimize the need for blood transfusions and decrease the risk of postoperative complications such as anemia. The precise dissection and hemostasis afforded by laparoscopic instruments allow surgeons to operate with greater precision, minimizing

bleeding and preserving surrounding tissues. This is particularly important in colorectal cancer surgery, where excessive blood loss can complicate the procedure and prolong recovery[34].

Another significant benefit of laparoscopic surgery in colorectal cancer treatment is the reduced risk of surgical site infections. The smaller incisions used in laparoscopic procedures result in less disruption to the skin and underlying tissues, reducing the likelihood of wound contamination and infection. Additionally, the use of specialized instruments and techniques, such as carbon dioxide insufflation and meticulous hemostasis, further decreases the risk of surgical site infections, contributing to improved overall outcomes for patients[35].

Furthermore, laparoscopic surgery allows for a more rapid return of bowel function compared to open surgery, which can reduce the risk of postoperative complications such as ileus and hasten the recovery process.

The minimally invasive nature of laparoscopic procedures minimizes the manipulation of the intestines and preserves the integrity of the bowel, allowing for quicker restoration of normal bowel function. This can lead to earlier initiation of oral intake, reduced reliance on intravenous fluids, and faster resolution of postoperative ileus, ultimately facilitating a smoother recovery for patients[35].

In addition to these benefits, laparoscopic surgery offers advantages for surgeons as well, including improved ergonomics and visualization, reduced fatigue, and enhanced precision. The use of laparoscopic instruments allows for more precise dissection and suturing, facilitating meticulous surgical technique and ensuring optimal oncologic outcomes. Moreover, the enhanced visualization provided by the laparoscope allows surgeons to identify and dissect anatomical structures with greater

accuracy, reducing the risk of intraoperative complications and improving patient safety[36]. Despite these numerous advantages, laparoscopic surgery for colorectal cancer is not without its challenges. The technique requires specialized training and expertise, and not all surgeons may be proficient in performing laparoscopic procedures. Additionally, certain cases of colorectal cancer, particularly those involving extensive tumor involvement or the need for complex reconstructive procedures, may not be amenable to laparoscopic surgery and may require open approaches instead[36].

Furthermore, laparoscopic surgery may be associated with longer operative times compared to open surgery, particularly during the initial learning curve.

The setup and equipment required for laparoscopic procedures can also be costly, and not all healthcare facilities may have access to the necessary resources. Additionally, while laparoscopic surgery offers numerous benefits for patients, it is not suitable for all individuals, and careful patient selection is essential to ensure optimal outcomes[36].

In conclusion, laparoscopic surgery has revolutionized the management of colorectal cancer, offering a minimally invasive alternative to traditional open surgery with numerous benefits for patients and surgeons alike.

The technique is associated with reduced postoperative pain, faster recovery, improved cosmetic outcomes, and enhanced precision, making it an attractive option for many patients undergoing colorectal cancer treatment. While laparoscopic surgery is not without its challenges, including the need for specialized training and expertise, the technique has become an integral component of the standard of care for colorectal cancer and continues to play a central role in improving patient[37]

Robotic-Assisted Surgery

Robotic-assisted surgery has emerged as a transformative tool in the management of colorectal cancer, offering surgeons enhanced precision, dexterity, and visualization compared to traditional laparoscopic techniques.

This advanced surgical approach utilizes robotic systems, such as the da Vinci Surgical System, to perform intricate procedures through small incisions with the aid of robotic arms controlled by the surgeon. Robotic-assisted surgery represents a significant evolution in minimally invasive techniques, providing numerous benefits for both patients and surgeons [38].

One of the primary advantages of robotic-assisted surgery in colorectal cancer treatment is the improved precision and dexterity it offers to surgeons. The robotic arms used in these procedures can maneuver with greater flexibility and range of motion than human hands, allowing for more precise dissection, suturing, and tissue manipulation. This enhanced precision is particularly beneficial in colorectal surgery, where delicate maneuvers are required to preserve critical structures and achieve optimal oncologic outcomes [38].

Moreover, robotic-assisted surgery provides surgeons with enhanced visualization of the surgical field, thanks to high-definition, three-dimensional imaging systems.

This improved visualization allows for better identification of anatomical structures, such as blood vessels and nerves, and facilitates more precise dissection and tissue removal.

As a result, surgeons can perform complex colorectal procedures with greater confidence and accuracy, minimizing the risk of intraoperative complications and improving patient safety[38].

In addition to improved precision and visualization, robotic-assisted surgery offers the benefit of reduced surgical trauma for patients. The smaller incisions used in robotic procedures result in less tissue damage and disruption

compared to traditional open surgery, leading to decreased postoperative pain and faster recovery times. This reduced surgical trauma also contributes to shorter hospital stays and quicker return to normal activities for patients, enhancing overall patient satisfaction with the surgical experience [39].

Furthermore, robotic-assisted surgery enables surgeons to perform colorectal procedures with greater ergonomics and comfort compared to traditional laparoscopic techniques.

The robotic console provides a comfortable seated position for the surgeon, with ergonomic controls and adjustable settings that reduce fatigue and strain during long surgical procedures. This ergonomic design not only improves surgeon comfort but also enhances surgical precision and reduces the risk of fatigue-related errors, leading to better outcomes for patients [39].

Another significant advantage of robotic-assisted surgery is the potential for improved oncologic outcomes in colorectal cancer treatment.

The enhanced precision and visualization provided by robotic systems allow surgeons to achieve more complete tumor resections while minimizing damage to surrounding healthy tissues. Additionally, robotic-assisted surgery enables lymph node dissection and vascular reconstruction with greater accuracy, reducing the risk of residual disease and improving long-term oncologic outcomes for patients [39].

Moreover, robotic-assisted surgery offers the benefit of a shorter learning curve for surgeons compared to traditional laparoscopic techniques.

The intuitive interface and ergonomic design of the robotic console make it easier for surgeons to adapt to robotic-assisted procedures and achieve proficiency more quickly. As a result, surgeons can perform complex colorectal surgeries with greater confidence and accuracy, leading to improved outcomes for patients[39].

In addition to these benefits, robotic-assisted surgery allows for greater access to minimally invasive colorectal procedures for patients with complex anatomies or previous abdominal surgeries.

The articulating robotic arms and flexible instruments used in robotic-assisted procedures can navigate around scar tissue and anatomical variations with greater ease than traditional laparoscopic instruments, making them well-suited for challenging cases. This expanded access to minimally invasive surgery enables more patients to benefit from the advantages of robotic-assisted techniques, leading to improved overall outcomes[40].

Despite these numerous advantages, robotic-assisted surgery in colorectal cancer treatment is not without its challenges and limitations. The high cost of robotic systems and associated equipment can present financial barriers to adoption for some healthcare institutions, limiting access to robotic-assisted procedures for certain patient populations.

Additionally, robotic-assisted surgery may be associated with longer operative times compared to traditional laparoscopic techniques, particularly during the initial phases of the learning curve [40].

Furthermore, while robotic-assisted surgery offers numerous benefits for patients and surgeons, it is not suitable for all cases of colorectal cancer. Certain patient factors, such as obesity, extensive intra-abdominal adhesions, or complex tumor anatomy, may pose challenges for robotic-assisted procedures and necessitate open or laparoscopic approaches instead. Additionally, careful patient selection and thorough preoperative evaluation are essential to ensure that patients are suitable candidates for robotic-assisted surgery and to minimize the risk of intraoperative complications[40].

In conclusion, robotic-assisted surgery represents a significant advancement in the management of colorectal cancer, offering

surgeons enhanced precision, dexterity, and visualization compared to traditional laparoscopic techniques.

The benefits of robotic-assisted surgery include improved oncologic outcomes, reduced surgical trauma, shorter hospital stays, and quicker recovery times for patients. While robotic-assisted surgery is associated with challenges and limitations, its widespread adoption is expected to continue as technology evolves and surgeons gain experience with these advanced techniques. Ultimately, robotic-assisted surgery holds great promise for improving the outcomes and quality of life for patients undergoing treatment for colorectal cancer[41].

Sphincter-Sparing Techniques

Sphincter-sparing techniques in colorectal cancer surgery represent a significant advancement in the field, offering patients the opportunity for improved quality of life and functional outcomes following surgical treatment. These techniques aim to preserve the anal sphincter complex and maintain continence while effectively removing the cancerous tissue, thus avoiding the need for permanent colostomy in select patients. Sphincter-sparing procedures may include low anterior resection (LAR), coloanal anastomosis, and intersphincteric resection, among others, each tailored to the individual patient's anatomy and tumor characteristics [42].

One of the primary goals of sphincter-sparing techniques is to achieve complete oncologic resection while preserving bowel function and avoiding permanent colostomy whenever possible.

This requires careful preoperative assessment, including imaging studies and endoscopic evaluation, to determine the feasibility of sphincter preservation based on tumor location, size, and involvement of adjacent structures. Additionally, patient factors such as age, comorbidities, and preexisting bowel function

play a crucial role in decision-making regarding sphincter-sparing surgery [42].

Low anterior resection (LAR) is one of the most commonly performed sphincter-sparing procedures in colorectal cancer surgery, particularly for tumors located in the mid to lower rectum.

This technique involves resecting the affected portion of the rectum while preserving the anal sphincter complex and creating an anastomosis between the remaining rectum and the proximal colon. By preserving a portion of the rectum and anal canal, LAR aims to maintain fecal continence and avoid the need for permanent colostomy, thus improving patients' quality of life postoperatively [43].

In cases where the tumor is located very low in the rectum or involves the anal canal, coloanal anastomosis may be performed to preserve the anal sphincter complex and avoid permanent colostomy.

This technique involves resecting the rectum and creating an anastomosis between the proximal colon and the anal canal, effectively preserving bowel continuity while removing the cancerous tissue. Coloanal anastomosis requires meticulous surgical technique to ensure adequate blood supply to the anastomosis and to minimize the risk of anastomotic leakage or stricture formation [43].

Intersphincteric resection is another sphincter-sparing technique that may be employed in select cases of very low rectal cancer or anal canal cancer. This procedure involves removing the distal rectum and part of the internal anal sphincter while preserving the external anal sphincter and anal mucosa.

The remaining rectum is then anastomosed to the anal canal, allowing for preservation of anal continence and avoidance of permanent colostomy. Intersphincteric resection requires careful patient selection and precise surgical technique to achieve optimal outcomes while

minimizing the risk of postoperative complications[43].

The decision to perform sphincter-sparing surgery in colorectal cancer treatment must be individualized based on the patient's tumor characteristics, preexisting bowel function, and overall health status.

While sphincter preservation offers significant benefits in terms of improved quality of life and functional outcomes, it may not be feasible or appropriate for all patients, particularly those with extensive tumor involvement or compromised anal sphincter function. In such cases, permanent colostomy may be necessary to ensure complete oncologic resection and prevent local recurrence of the cancer[44].

It is essential for patients undergoing sphincter-sparing surgery to receive comprehensive preoperative counseling and education regarding the potential risks and benefits of the procedure. This includes discussion of potential postoperative complications such as anastomotic leakage, fecal incontinence, and bowel dysfunction, as well as the need for long-term surveillance and follow-up care. Additionally, patients should be provided with support resources and access to multidisciplinary care teams, including colorectal surgeons, oncologists, and specialized nurses, to optimize their postoperative outcomes and quality of life.

Conclusion

In conclusion, sphincter-sparing techniques represent a significant advancement in colorectal cancer surgery, offering patients the opportunity for improved functional outcomes and preserved quality of life following surgical treatment.

These techniques, including low anterior resection, coloanal anastomosis, and intersphincteric resection, aim to achieve complete oncologic resection while preserving anal continence and avoiding permanent

colostomy whenever possible. However, the decision to perform sphincter-sparing surgery must be individualized based on careful assessment of tumor characteristics, patient factors, and surgical expertise, with the goal of optimizing outcomes and maximizing patient satisfaction.

References

- [1] L.G. Jhonson, M.M. Madeleine, L.M. Newcomer, et al., Anal cancer incidence and survival: the surveillance, epidemiology, and end result experience, **2004** 1973-2000, Cancer 101: 281-288, [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [2] R.A. Nelson, A.M. Levine, L. Bernstein, et al., Changing patterns of anal canal carcinoma in the United States, J. Clin. Oncol. **2013** 31 1569-1575 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [3] F. Jin, I.2 Poynten, A.E. Grulich, HIV treatment and anal cancer: emerging clarity, **2020** pii: S2352-3018(20)30027-30028, Lancet HIV [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [4] N. Nagata, K. Watanabe, T. Nishijima, et al., Prevalence of anal human papillomavirus infection and risk factors among HIV-positive patients in Tokyo, Japan, **2015** 10 (9) e0137434 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [5] A.K. Chaturvedi, M.M. Madeleine, R.J. Biggar, E.A. Engels, Risk of human papillomavirus-associated cancers among persons with AIDS, J. Natl. Cancer Inst. **2009** 101 1120-1130. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [6] V. Colon-Lopez, M.S. Shiels, M. Machin, et al., Anal cancer risk among people with HIV infection in the United States, J. Clin. Oncol. **2017** JCO2017749291. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [7] Z.Y. Jin, X. Liu, Y.Y. Ding, et al., Cancer risk factors among people living with HIV/AIDS in China: a systematic review and meta-analysis, Sci. Rep. **2017** 7(1):4890 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [8] G. Gatta, L. Ciccolallo, I. Kunkler, et al., Survival from rare cancer in adults: a population-based study, Lancet Oncol. 7 (2) **2006** 132-140 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [9] V. Kumar, A.K. Abbas, N. Fausto, R.N. Mitchell, Robbins Basic Pathology, eighth ed., Elsevier (A Division of Reed Elsevier India Pvt. Limited), 2008. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [10] D.J. Zaccarini, K.K. Khurana, Histopathologic and cytologic follow-up in high-risk male patients with unsatisfactory anal cytology, Pathol. Res. Int. **2017** 9780213 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [11] A.J. Watson, B.B. Smith, M.R. Whitehead, et al., Malignant progression of anal intraepithelial neoplasia, ANZ J. Surg. **2006** 76:715-717 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [12] J. Tinmouth, V. Peeva, H. Amare, et al., Progression from perianal high-grade Anal intraepithelial neoplasia to anal cancer in HIV-positive men who have sex with men, Dis. Colon Rectum, **2016** 59 836-842 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [13] A.M. Schofield, L. Sadler, L. Nelson, et al., A prospective study of anal cancer screening in HIV-positive and negative MSM, 1, AIDS, **2016** 30 (9):1375-1383 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [14] D.B. Stewart, W.B. Gaertner, S.C. Glasgow, et al., The American society of colon and rectal Surgeons clinical practice guidelines for anal squamous cell cancers (revised 2018), Dis. Colon Rectum, **2018** 61 (7):755-774 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [15] A. Libois, F. Feoli, M. Nkuize, et al., Prolonged antiretroviral therapy is associated with fewer anal high-grade squamous intraepithelial lesions in HIV-positive MSM in a cross-sectional study, Sex. Transm. Infect. **2017** 93 (1):15-17 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [16] B.J. Cummings, J.A. Ajani, C.J. Swallow, Cancer of the Anal Region. Principle & Practice of

- Oncology, eighth ed., Lippincott, Philadelphia, PA, 2008. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [17] M.K. Washington, J. Berlin, P. Branton, et al., Protocol for the examination of specimens from patients with primary carcinoma of the colon and rectum, *Arch. Pathol. Lab Med.* **2009** 133 (10):1539–1551 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [18] P. Pandey, Anal Anatomy and normal histology, *Sex. Health*, **2012** 9:513–516 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [19] J.M. Palefsky, A.R. Giuliano, S. Goldstone, et al., HPV vaccine against anal HPV infection and anal intraepithelial neoplasia, *N. Engl. J. Med.* **2011** 365:1576–1585 [[Google Scholar](#)], [[Publisher](#)]
- [20] R. Glynne-Jones, P.J. Nilsson, C. Aschele, V. Goh, D. Peiffert, A. Cervantes, D. Arnold, Anal cancer: ESMO-ESSO-ESTRO clinical practice guidelines, *Ann. Oncol.* **2014** 25(3):iii10–iii20 [[Google Scholar](#)], [[Publisher](#)]
- [21] J. Xu, H. Zhou, Screening for anal cancer in HIV positive patients: should we make it A standard-of-care? *J. Invest. Surg.* **2019** 32 (1):93–94 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [22]
- [23] F. Wei, Y. Su, X. Yao, et al., Sex differences in the incidence and clearance of anal human papillomavirus infection among heterosexual men and women in Liuzhou, China: an observational cohort study, *Int. J. Canc.* **2019** 145 (3):807–816 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [24] Epidermoid anal cancer: results from the UKCCCR randomised trial of radiotherapy alone versus radiotherapy, 5-fluorouracil, and mitomycin. UKCCCR Anal Cancer Trial Working Party. UK Co-ordinating Committee on Cancer Research, *Lancet*, **1996** 348:1049–1054 [[Google Scholar](#)], [[Publisher](#)]
- [25] J. Northover, R. Glynne-Jones, D. Sebag-Montefiore, et al., Chemoradiation for treatment of epidermoid anal cancer: 13-year follow-up of the first randomized UKCCCR Anal cancer Trial (ACT I), *Br. J. Canc.* **2010** 102(7):1123–1128 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [26] D. Meulendijks, L. Dewit, N.B. Tomaso, et al., Chemoradiotherapy with capecitabine for locally advanced anal carcinoma: an alternative treatment option, *BR J Cancer*, **2014** 111:1726–1733 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [27] M. Nathan, et al., Performance of anal cytology in a clinical setting when measured against histology and high-resolution anoscopy findings, *AIDS*, **2010** 24:373–379 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [28] J.M. Palefsky, et al., Anal cytology as a screening tool for anal squamous intraepithelial lesions, *J. Acquir. Immune Defic. Syndr. Hum. Retrovirol*, **1997** 14:415–422 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [29] G. Bruera, A. Giuliani, L. Romano, et al., Poorly differentiated neuroendocrine rectal carcinoma with uncommon immunohistochemical features and clinical presentation with a subcutaneous metastasis, treated with first line intensive triplet chemotherapy plus bevacizumab FIr-B/FOx regimen: an experience of multidisciplinary management in clinical practice, *BMC Canc.* **2019** 19 (1):960 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [30] J.M. Berry, et al., Performance characteristics of anal cytology and human papillomavirus testing in patients with high-resolution anoscopy-guided biopsy of high-grade anal intraepithelial neoplasia, *Dis. Colon Rectum*, **2009** 52:239–247 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [31] A. Giuliani, L. Romano, G. Coletti, et al., Lymphangiomatosis of the ileum with perforation: a case report and review of the literature, *Ann Med Surg (Lond)*. **2019** 41:6–10 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [32] N.J. Bhuva, R. Glynne-jones, L. Sonoda, et al., To Pet or not to PET? That is the question.

- Staging in anal cancer, *Ann. Oncol.* **2012** 23:2078–2082 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [33] A.J. Kole, J.M. Stahl, H.S. Park, et al., Predictors of nonadherence to NCCN guideline recommendations for the management of stage I anal canal cancer, *J. Natl. Compr. Canc. Netw.* **2017** 15 (3):355–362 [[Google Scholar](#)], [[Publisher](#)]
- [34] Y. Wu, X. Han, Y. Li, et al., Survival prediction models for patients with anal carcinoma receiving definitive chemoradiation: a population-based study, *Oncol Lett*, **2020** 19 (2):1443–1451 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [35] N.D. Nigro, V.K. Vaitkevicius, B. Considine Jr., Combined therapy for cancer of the anal canal: a preliminary report, *Dis. Colon Rectum*, **1974** 17 (3):354–356 [[Google Scholar](#)], [[Publisher](#)]
- [36] J.A. Ajani, K.A. Winter, L.L. Gunderson, et al., Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial, *J. Am. Med. Assoc.* **2008** 299 (16):1914–1921 [[Google Scholar](#)], [[Publisher](#)]
- [37] E. Van Cutsem, A. Cervantes, R. Adam, et al., ESMO consensus guidelines for the management of patients with metastatic colorectal cancer, **2016** 27(8):1386–422 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [38] S.N. Bazarbashi, A.M. Alzahrani, M.M. Rahal, et al., Saudi Oncology Society clinical management guideline series. Anal canal cancer 2014, *Saudi Med. J.* **2014** 35 (12):1527–1528 [[Google Scholar](#)], [[Publisher](#)]
- [39] D. Goodman, D. Rothenstein, C. Lajhem, et al., Capecitabine mitomycin in patients undergoing definitive chemoradiation for anal squamous cell carcinoma, *Int. J. Radiat. Oncol. Biol. Phys.* **2017** 98 (5):1087–1095 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [40] R.D. James, R. Glynne-Jones, H.M. Meadows, et al., Mitomycin or cisplatin chemoradiation with or without maintenance chemotherapy for treatment of squamous-cell carcinoma of the anus (ACT II): a randomized, phase 3, open-label, 2 × 2 factorial trial, *Lancet Oncol.* **2013** 14 (6):516–524 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [41] S. Gordeev, A. Rasulov, V. Gordunova, et al., A pilot study of intensity-modulated radiation therapy (IMRT) and concurrent chemotherapy (CT) with paclitaxel, capecitabine and mitomycin C for squamous cell anal carcinoma (SCAC), *J. Clin. Oncol.* **2017** 33 [[Google Scholar](#)], [[Publisher](#)]
- [42] C. Ortholan, A. Ramaioli, D. Peiffert, et al., Anal canal carcinoma: early-stage tumors ≤10 mm (T1 or Tis): therapeutic options and original pattern of local failure after radiotherapy, *Int. J. Radiat. Oncol. Biol. Phys.* **2005** 62 (2):479–485 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [43] E. Ben-Josef, J. Moughan, J.A. Ajani, et al., Impact of overall treatment time on survival and local control in patients with anal cancer: a pooled data analysis of Radiation Therapy Oncology Group trials 87-04 and 98-11, *J. Clin. Oncol.* **2010** 28 (34):5061–5066 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

This journal is a double-blind peer-reviewed journal covering all areas in Chemistry, Medicinal and Petroleum. EJCMPR is published quarterly (6 issues per year) online and in print. Copyright © 2024 by ASC ([Amir Samimi Company](#)) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.