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Management of Obstructed Colorectal Cancer: Review Article

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Abstract

Colorectal cancer (CRC) represents a major global health burden, ranking as the third most common malignancy in men and the second in women worldwide. In 2020, over 1.9 million new cases and 930,000 CRC-related deaths occurred globally, with significant geographical variations in incidence and mortality. Approximately 7–29% of CRC patients present with acute large bowel obstruction, a life-threatening emergency that confers significantly worse prognosis compared to non-obstructed cases, with 5-year survival rates below 29%. These patients frequently present with locally advanced disease, perforation, adjacent organ invasion, or metastatic dissemination. Emergency colorectal procedures are associated with higher morbidity and mortality rates, particularly in elderly and frail populations, creating complex surgical decision-making challenges. The optimal management strategy whether primary resection with anastomosis, resection with stoma formation (Hartmann procedure), or diversion alone remains controversial despite decades of clinical experience. Recent advances including endoscopic stenting as a bridge to surgery, laparoscopic approaches, and evolving guidelines from major surgical societies have added further complexity to treatment algorithms. The selection of surgical modality must balance oncological principles with patient safety, hemodynamic stability, disease stage, and available expertise, making individualized, multidisciplinary decision-making essential for optimizing outcomes in this challenging patient population.

Keywords: Colorectal cancer, bowel obstruction, emergency surgery, primary anastomosis, Hartmann procedure, colostomy, diverting stoma, endoscopic stenting, bridge to surgery, laparoscopic surgery.

INTRODUCTION

Colorectal cancer (CRC) remains one of the most significant global health challenges, representing the third most common malignancy in men and the second in women worldwide. In 2020, more than 1.9 million new cases of colorectal cancer and over 930,000 colorectal cancer-related deaths occurred globally, with wide geographical variations in incidence and mortality. The incidence rates are highest in Europe, Australia, and New Zealand, while mortality rates peak in Eastern Europe. This disease predominantly affects elderly individuals, with over 70% of cases occurring in patients aged over 65 years and a mean age at diagnosis of 72 years (1,2).

Despite advances in screening programs and early detection strategies, approximately 7–29% of CRC patients present with total or near-total bowel obstruction as their initial manifestation. The incidence of obstruction varies significantly by tumor location, with up to 50% of splenic flexure malignancies causing obstruction, compared with 25% in the descending colon and only 6% in the rectosigmoid region. These patients face markedly poorer outcomes compared to those presenting with non-obstructed malignancies, with 5-year survival rates of less than 29%. Population-based statistics indicate that the proportion of patients presenting with obstruction has remained relatively stable at approximately 8-10% over recent decades, despite improvements in screening programs (3,4).

The management of obstructed colorectal cancer presents unique diagnostic and therapeutic challenges for surgeons and oncologists. Emergency presentations are frequently associated with advanced disease stages,

peritoneal contamination, hemodynamic instability, and significant physiological compromise. These factors contribute to substantially higher postoperative morbidity and mortality rates, particularly in frail and elderly patients. Emergency abdominal procedures carry postoperative mortality rates of up to 16% and an odds ratio of death of 2.3 compared with elective surgery. The poorer outcomes in this group have been attributed to poor preoperative state resulting from consuming disease, dehydration, electrolyte imbalance, and inadequate time for patient optimization (5,6).

The optimal surgical strategy whether primary resection with anastomosis, resection with stoma formation, or diversion alone has been a source of ongoing debate for decades. Traditionally, some surgeons have contended that resection in the emergent setting (single-stage procedure) has the benefit of removing the obstructing lesion sooner with concurrent treatment of underlying malignancy. Others maintain that a multistaged procedure to relieve obstruction initially and operate electively has the advantage of adequate staging and patient optimization. Current management must balance adherence to oncological principles—including adequate resection margins, lymph node harvest, and R0 resection—with the urgent need to relieve obstruction and address life-threatening complications (7,8).

Major surgical societies, including the Association of Coloproctologists of Great Britain and Ireland (ACPGBI) and the World Society of Emergency Surgery (WSES), have published guidelines to assist in this complex decision-making process. The ACPGBI 2007 position statement suggests that single-stage resection with primary anastomosis is the treatment of choice (Grade A recommendation) as long as there is no evidence of perforation with fecal peritonitis or patient-related factors predisposing to poor anastomotic healing. The WSES 2010 Guidelines echo these recommendations with preference for primary anastomosis over Hartmann's procedure (Grade 2C+ recommendation) (9,10).

Epidemiology and Risk Factors

Colorectal cancer accounts for approximately 8% of all new cancer diagnoses globally, with an estimated 132,700 new cases diagnosed in the United States in 2015. The mortality rate stands at approximately 8.1 per 100,000 population, making it one of the leading causes of cancer-related deaths. The disease shows marked geographical variation, with incidence rates of 25.1 per 100,000 in developed regions compared to only 3.9 per 100,000 in developing countries. This disparity reflects differences in screening programs, dietary patterns, and healthcare infrastructure (11,12).

Interestingly, while overall CRC incidence has shown a gradual decline in some developed nations—attributed to increased colonoscopy screening and removal of precancerous lesions in adults aged 50 to 75 years—there has been a concerning rise in early-onset colorectal cancer (EOCRC) in individuals under 50 years of age. The use of colonoscopy increased from 19.1% to 54% in 2013, contributing to this decline in traditionally aged populations. However, the observed increase in EOCRC incidence is mainly in sporadic cases without known hereditary syndromes. Obesity, sedentary lifestyle, and westernization of diet have been proposed as potential etiological factors, though the precise mechanisms remain unclear. Studies in Egypt have explored dietary habits and exposure to pesticides as potential contributors to EOCRC (13,14).

Risk factors for colorectal cancer can be broadly categorized into hereditary and environmental factors. Hereditary factors account for approximately 35% of cases and include familial adenomatous polyposis (FAP) and hereditary non-polyposis colorectal cancer (Lynch syndrome). Lynch syndrome is associated with mutations in mismatch repair (MMR) genes, specifically MLH1, MSH2, MSH6, and PMS2. Mutations in MLH1 and MSH2 account for approximately 90% of mutations found in families with hereditary colorectal cancer. Additional genetic syndromes, including mutations in APC, MUTYH, SMAD4, BMPR1A, and STK11, represent less than 5% of all colorectal cancer cases. It is estimated that these genetic syndromes represent about 10% of all cases of colorectal cancer (15,16).

Beyond hereditary syndromes, approximately 25% of cases demonstrate familial clustering without identifiable genetic mutations, suggesting complex gene-environment interactions. Personal history of inflammatory bowel disease, particularly ulcerative colitis and Crohn's disease, significantly increases risk, with these patients facing 30-50% greater risk of developing colorectal cancer. Patients with a personal history of adenomatous polyps or

previous colorectal, ovarian, endometrial, or breast cancer also face elevated risk. Diabetes mellitus has been identified as an independent risk factor for colorectal cancer development (17,18).

Environmental and lifestyle factors play crucial roles in colorectal carcinogenesis. High consumption of red and processed meats, low dietary fiber intake, obesity, physical inactivity, tobacco smoking, and excessive alcohol consumption have all been associated with increased risk. Conversely, protective factors include regular aspirin or non-steroidal anti-inflammatory drug (NSAID) use, high dietary fiber intake, and consumption of fruits and vegetables. The molecular basis for NSAID protection involves inhibition of cyclooxygenase-2 (COX-2), which is overexpressed in 80% of colorectal cancers and plays a role in epidermal growth factor receptor (EGFR) signaling through activation of the transcription factor c-Jun dependent protein activator 1 (AP-1) (19,20).

The presentation of colorectal cancer with obstruction is particularly associated with advanced disease stage, left-sided tumor location, and delayed diagnosis. Cheynel et al., in a review of all patients presenting with CRC from 1976-2000, found that 8.3% of patients presented with obstruction, and this proportion remained stable over the study period. Overall postoperative mortality across the study period was 19.5%, but decreased significantly over time from 32.6% (1976-1980) to 15.2% (1996-2000). These patients often have unfavorable tumor characteristics, including larger size, deeper invasion (T4), higher rates of lymph node involvement, and increased likelihood of synchronous metastases. The emergency nature of presentation frequently precludes adequate preoperative staging and patient optimization, contributing to worse outcomes (21,22).

Pathophysiology and Molecular Biology

Colorectal cancer develops through well-characterized molecular pathways involving accumulation of genetic and epigenetic alterations over 10-15 years. The two primary carcinogenic models are the chromosomal instability pathway (also known as the suppressor or classic pathway) and the microsatellite instability pathway (mutator or alternative pathway). The chromosomal instability pathway follows the traditional adenoma-carcinoma sequence and accounts for approximately 80% of sporadic colorectal cancers. This pathway involves sequential mutations in tumor suppressor genes (APC, TP53, DCC) and oncogenes (KRAS, CTNNB1), with specific mutation frequencies: APC 60%, TP53 70%, DCC 70%, KRAS 40%, and BAX 50% (23,24).

The adenoma-carcinoma sequence begins with inactivating mutations in the APC tumor suppressor gene, which regulates the Wnt/β-catenin signaling pathway controlling cellular proliferation, tissue homeostasis, and differentiation. Approximately 85% of colorectal cancers without hereditary associations demonstrate APC mutations, and alterations in this pathway are found in 95% of patients with colorectal cancer. Following APC inactivation, activating mutations in KRAS oncogene (located on chromosome 12) occur in approximately 40% of cases, predominantly affecting codons 12 and 13 (95% of mutations), with only 5% occurring in codons 61, 146, and 154. KRAS mutations are mainly observed in patients with metastases and are associated with more aggressive tumor behavior, higher metastatic rates, and resistance to anti-EGFR antibody therapy. Associations with codon 12 mutations present mucinous-type cancers, while mutations in codon 13 are related to non-mucinous cancer, which is more aggressive with higher metastatic rates (25,26).

Subsequent mutations in TP53 tumor suppressor gene occur in approximately 50-70% of cases and tend to appear later in the carcinogenic sequence. TP53 mutations are associated with chromosomal instability and progression from adenoma to carcinoma. Additional genetic alterations include loss of heterozygosity at chromosome 18q (involving DCC, SMAD2, and SMAD4 genes) and activation of PIK3CA and BRAF oncogenes. The SMAD7 gene variants (rs44939827, rs12953717, and rs4464248) in the 8q21 chromosome have been associated with increased risk of colorectal cancer. These cumulative genetic changes result in progressively dysregulated cell cycle control, impaired apoptosis, enhanced angiogenesis, and metastatic capability (27,28).

The microsatellite instability pathway accounts for approximately 20% of sporadic colorectal cancers and 80% of hereditary cases, particularly Lynch syndrome. This pathway results from defective DNA mismatch repair mechanisms due to mutations or epigenetic silencing of MMR genes (MLH1, MSH2, MSH6, PMS2). Tumors exhibiting microsatellite instability demonstrate distinct clinicopathological features, including proximal colon location, mucinous histology, lymphocytic infiltration, and paradoxically better prognosis despite higher tumor

grade. Importantly, MSI-high tumors show poor response to 5-fluorouracil-based chemotherapy but demonstrate excellent response to immune checkpoint inhibitors (29,30).

The development of bowel obstruction in colorectal cancer reflects the interplay of tumor growth pattern, location, and luminal diameter. Colorectal cancer usually starts as a polyp in the intestinal mucosa, but can also exist as an initial benign lesion called adenoma that has the ability to transform into a malignant lesion depending on its histological presentation and size. Approximately 60% of cases are simple adenomas, and 40% are multiple adenomas, with 24% of patients with untreated polyps developing cancer. Left-sided tumors, particularly those in the sigmoid colon and descending colon, more frequently cause obstruction due to smaller luminal diameter (the sigmoid and descending colon being narrower than the right colon), more circumferential growth pattern, and solid consistency of stool in the distal colon. Right-sided tumors typically grow as exophytic masses into the larger-caliber cecum and ascending colon, less frequently causing obstruction but more commonly presenting with anemia from occult bleeding (31,32).

The pathophysiological consequences of malignant large bowel obstruction extend beyond mechanical blockage. Proximal colonic distension increases intraluminal pressure, potentially compromising blood flow and leading to ischemia. The closed-loop obstruction created by a competent ileocecal valve places the cecum at particular risk, as it represents the segment with the largest diameter and thinnest wall (Law of Laplace). Cecal perforation occurs in approximately 3-10% of obstructed cases and dramatically worsens prognosis, with these patients requiring more extensive surgery and facing higher mortality rates. Additionally, bacterial translocation across distended, ischemic bowel wall contributes to systemic inflammatory response and sepsis (33,34).

Molecular markers have emerged as important prognostic and predictive factors in colorectal cancer. Carcinoembryonic antigen (CEA) elevation (>5 ng/mL) correlates with advanced stage, higher recurrence risk, and worse survival, with recurrence detected in 60-70% of cases based on CEA elevation. KRAS mutation status predicts resistance to anti-EGFR therapy (cetuximab, panitumumab) and is associated with worse prognosis, particularly codon 13 mutations. BRAF V600E mutations indicate particularly aggressive disease with poor prognosis. The KISS1/KISS1R system has been identified as a metastasis suppressor, with high expression associated with significantly improved survival—patients with high levels of KISS1 and KISS1R showed survival rates increasing from 44.3% and 39.3% to 73.7% and 67.9% respectively. The homeobox duodenal pancreatic transcription factor (PDX-1) protein and SEPT9 methylation have also been implicated as biomarkers for colorectal cancer detection and prognosis (35,36).

Clinical Presentation and Diagnosis

The clinical presentation of colorectal cancer varies substantially based on tumor location, size, and presence of complications. Patients with obstructing colorectal cancer typically present with symptoms of progressive constipation, abdominal distension, cramping abdominal pain, nausea, and vomiting. The clinical presentation includes alteration of chronic bowel habits, changes in bowel movements, involuntary weight loss, malaise, anorexia, and abdominal distension. The obstruction may be complete or partial, with complete obstruction representing a surgical emergency (37,38).

Left-sided lesions commonly present with obvious changes in bowel habits, visible rectal bleeding, and obstructive symptoms due to the narrow luminal diameter. Distal cancers cause evident rectal bleeding compared to proximal cancers that can give mixed blood with stool, tending to be occult, and consequently anemia may be presented as a secondary sign. In contrast, right-sided lesions more frequently present with occult bleeding, iron-deficiency anemia, and vague abdominal discomfort, with obstruction being less common. Most tumors are localized in the rectum (37%) and sigmoid colon (31%), being less frequent in ascending colon (9%), cecum (8%), descending colon (5%), transverse colon (4%), hepatic angle (4%), and splenic angle (2%) (39,40).

Physical examination may reveal abdominal distension, visible peristalsis, high-pitched bowel sounds (early) or absent bowel sounds (late), tympany on percussion, and a palpable abdominal mass in some cases. Rectal digital examination is essential and may identify distal rectal masses (assessing the distance from the anal verge, relationship with anal sphincters, and mobility), assess sphincter tone, and detect occult blood. Signs of systemic illness including fever, tachycardia, hypotension, and peritoneal signs suggest complications such as perforation,

ischemia, or sepsis. Among unusual clinical findings are peripheral lymphadenopathy, especially the Virchow lymph node in the left supraclavicular space, hepatomegaly from hepatic metastases, ascites in peritoneal carcinomatosis, and loss of muscular mass by cachexia (41,42).

Laboratory investigations in obstructed colorectal cancer patients frequently demonstrate anemia (particularly in right-sided lesions), leukocytosis suggesting inflammation or infection, electrolyte disturbances from vomiting or poor oral intake, and hypoalbuminemia reflecting chronic disease and malnutrition. Preoperative hypoalbuminemia (<3.5 g/dL) has been identified as an independent predictor of worse survival following resection, being related to lower survival both globally and specifically in stage II colorectal cancer. This would constitute a simple and significant marker of poor prognosis available from the time of diagnosis. Elevated inflammatory markers including C-reactive protein (CRP) and lactate dehydrogenase (LDH) correlate with disease burden and prognosis, with studies showing that high LDH levels increase the risk of death from various cancers including colorectal cancer (43,44).

Tumor markers, particularly carcinoembryonic antigen (CEA), should be measured preoperatively to establish baseline values for postoperative surveillance. Elevated CEA (>5 ng/mL) occurs in 60-70% of colorectal cancer patients and correlates with advanced stage, higher recurrence risk, and worse prognosis, with its value maintaining significance mainly in TNM stage II. Serial CEA monitoring detects recurrence in many patients before clinical symptoms develop, potentially allowing for curative intervention. However, CEA lacks sufficient sensitivity and specificity for screening or diagnosis due to false positives that can occur with high consumption of red meat, vegetables, and fruits containing peroxidase, while persons with no bleeding condition who ingest vitamin C may result in false positive tests. Novel biomarkers including circulating tumor DNA, SEPT9 methylation, and microRNA panels show promise but are not yet standard practice (45,46).

Imaging evaluation is critical for diagnosis, staging, and surgical planning. Plain abdominal radiographs may demonstrate colonic distension, air-fluid levels, and absence of rectal gas, but have limited sensitivity for diagnosis. Computed tomography (CT) with intravenous contrast is the gold standard for emergency evaluation, providing information on tumor location and size, degree of obstruction, wall thickening, local invasion, lymph node involvement, distant metastases (particularly liver and lung), and complications such as perforation or ischemia. CT findings associated with higher perforation risk include marked cecal distension (>12 cm), bowel wall thinning, pneumatosis, and mesenteric stranding. Elective colorectal cancer patients must be evaluated with contrast abdomen and thorax CT for local extension and metastasis assessment (47,48).

Colonoscopy remains the gold standard for diagnosis, allowing direct visualization, tissue diagnosis through biopsy, and assessment for synchronous lesions. It is the only technique that provides screening, diagnosis, and therapeutic management of the colon. Approximately 4% of sporadic colorectal cancer patients have synchronous cancers, and 30% have adenomatous polyps. In patients presenting with acute obstruction, complete colonoscopy may not be feasible initially, necessitating completion examination 3 months postoperatively to evaluate the entire colon. Colonoscopy also enables assessment of lesion characteristics (size, morphology, friability, circumferential extent) that influence management decisions. About 65-75% of adenomatous polyps and 40-65% of colorectal cancers are within reach of sigmoidoscopy, though about 50% of advanced adenomas (>1 cm) and proximal colon cancers are undetectable by this method (49,50).

Magnetic resonance imaging (MRI) plays a crucial role in rectal cancer staging, providing superior soft tissue resolution for assessing depth of invasion, relationship to mesorectal fascia (circumferential resection margin), and pelvic lymph node involvement. Endorectal ultrasonography (EUS) also provides valuable information on depth of invasion (T stage) and perirectal lymph nodes for rectal cancers. Positron emission tomography-computed tomography (PET-CT) is not routinely recommended for initial staging but may be valuable in selected cases for detecting occult metastases, assessing treatment response, or evaluating isolated potentially resectable metastases (51,52).

Staging and Prognostic Factors

Accurate staging is fundamental to treatment planning and prognostic assessment in colorectal cancer. The American Joint Committee on Cancer (AJCC) TNM staging system, currently in its 8th edition (2017), represents

the international standard and is used for clinical staging based on perioperative data. The TNM classification incorporates three key components: T (tumor depth of invasion through the bowel wall layers), N (regional lymph node involvement), and M (distant metastasis). These components are synthesized into overall stages (0, I, II, III, IV) that guide treatment algorithms and predict prognosis. Prognosis is most accurately determined based on AJCC stage as determined after surgery (53,54).

The T stage describes the extent of primary tumor invasion. Tis represents carcinoma in situ, T1 tumors invade the submucosa, T2 invade the muscularis propria, T3 penetrate through the muscularis propria into pericolorectal tissues, and T4 tumors invade visceral peritoneum (T4a) or adjacent organs/structures (T4b). T4 tumors require en bloc resection of involved structures when feasible to achieve R0 resection. The depth of invasion correlates strongly with lymph node metastasis risk and prognosis, with T1 lesions having <10% nodal involvement compared to >50% for T4 lesions. For malignant polyps, the Haggitt classification is used for pedunculated polyps (levels 1-4 based on invasion depth), while the Kudo classification is used for sessile polyps (SM1-3 based on submucosal invasion depth) (55,56).

The N stage reflects regional lymph node involvement, which represents one of the most powerful prognostic factors. N0 indicates absence of nodal metastases, N1 indicates 1-3 positive regional nodes (N1a: 1 node, N1b: 2-3 nodes, N1c: tumor deposits without nodes), and N2 indicates 4 or more positive nodes (N2a: 4-6 nodes, N2b: ≥7 nodes). Adequate lymph node harvest is critical for accurate staging, with guidelines recommending examination of at least 12 nodes to ensure proper staging. Insufficient nodal harvest leads to stage migration and potentially inappropriate treatment decisions. The total number of nodes examined and the ratio of positive to total nodes both demonstrate prognostic significance. Studies have shown that survival correlates with the number of resected lymph nodes (57,58).

The M stage indicates distant metastasis presence and location. M0 indicates no distant metastasis, M1a indicates metastasis to one organ without peritoneal metastases, M1b indicates metastases to multiple organs, and M1c indicates peritoneal metastases. The liver represents the most common site of colorectal metastases (occurring in approximately 50-60% of patients during disease course, with 14-18% detected at first consultation and 10-25% at time of primary resection), followed by lungs, peritoneum, and distant lymph nodes. Patients with resectable liver or lung metastases may achieve 5-year survival rates of 25-58% following metastasectomy combined with modern chemotherapy, highlighting the importance of complete staging (59,60).

The overall stage classification synthesizes TNM components: Stage 0 (Tis, N0, M0) can be treated by removing cancer cells by colonoscopy. Stage I (T1-2, N0, M0) has excellent prognosis with 5-year survival >90% and requires surgical resection with radical colectomy. Stage II (T3-4, N0, M0) is subdivided based on T stage and high-risk features, with 5-year survival 70-85%. Stage III (any T, N1-2, M0) indicates nodal involvement and 5-year survival 45-70% depending on extent, with patients receiving complementary chemotherapy after surgery for 6-8 months. Stage IV (any T, any N, M1) indicates metastatic disease with median survival 24-30 months with modern chemotherapy, primarily aimed at improving symptoms and prolonging survival. Notably, some stage II tumors (particularly T4 or stage IIB) may have worse prognosis than stage IIIA or IIIB tumors, and some patients with stage III cancer have better survival than those with stage IIB cancer (61,62).

Beyond TNM staging, additional prognostic factors influence outcomes in colorectal cancer. Histological grade (well, moderate, poor differentiation) correlates with prognosis, with poorly differentiated tumors demonstrating worse outcomes. Lymphovascular invasion and perineural invasion indicate aggressive biology and worse prognosis. Tumor budding (detached single cells or small clusters at the invasive front) represents an independent adverse prognostic factor. Circumferential resection margin positivity in rectal cancer dramatically increases local recurrence risk from 5-15% to 30-40% and worsens survival (63,64).

Molecular markers increasingly inform prognosis and treatment decisions. Microsatellite instability (MSI) status divides tumors into MSI-high (deficient mismatch repair) and microsatellite stable (MSS) categories, with MSI-high tumors demonstrating better prognosis in early-stage disease but poor response to 5-fluorouracil. KRAS, NRAS, and BRAF mutation status predicts response to anti-EGFR therapy, with patients harboring KRAS mutations (approximately 30-50% of colorectal cancers) showing resistance to anti-EGFR antibodies. However, only 40-60% of patients with wild-type KRAS respond to anti-EGFR therapy. Patients with mutated KRAS

demonstrate decreased survival compared to patients with wild-type KRAS. BRAF V600E mutation confers particularly poor prognosis (65,66).

The specific context of obstruction significantly modifies prognosis. Multiple studies demonstrate that obstructing presentation represents an independent adverse prognostic factor, even after controlling for stage. Obstructed patients have higher rates of T4 disease, nodal involvement, incomplete resection, postoperative complications, and cancer-related mortality. The 5-year survival for obstructed stage II colon cancer approximates that of non-obstructed stage III disease. Studies show that survival for obstructed colorectal cancer is variable according to type and stage, with extensive evidence suggesting that outcome for these patients is markedly poorer compared with patients presenting with non-obstructed malignancies. This worse outcome likely reflects more aggressive tumor biology, advanced stage at presentation, emergency surgical conditions, and higher complication rates (67,68).

Surgical Management Strategies

The surgical management of obstructed colorectal cancer has evolved considerably over recent decades, yet optimal strategy remains debated. Up to 20% of newly diagnosed colon cancer patients initially present with locally advanced disease requiring emergency intervention. The primary goals include relief of obstruction, resection of primary tumor with adequate margins when feasible (typically >5 cm margins with minimum 12 lymph nodes harvested), appropriate lymphadenectomy to the root of the nutrient vessel, and minimization of morbidity and mortality. Three main surgical approaches have been employed: primary resection with anastomosis (single-stage), resection with stoma creation (two-stage), and diverting stoma without resection (three-stage or palliative) (69,70).

Primary Resection with Anastomosis

Primary resection with immediate anastomosis represents the most definitive approach, removing the obstructing lesion and restoring intestinal continuity in a single operation. Historical concerns regarding anastomotic safety in the obstructed, unprepared colon have been challenged by contemporary evidence. Proponents argue that this approach avoids the need for temporary stoma and subsequent reversal operation, reduces overall hospital stay and costs, improves quality of life, and may provide superior oncologic outcomes by avoiding delay in addressing the primary tumor. Long-term outcomes analyzed by Vigder et al. suggested significantly higher survival in single-stage procedures compared with multistaged resection (5-year survival 20.8% in multistaged vs 47.5% in primary resections) (71).

Multiple retrospective studies and meta-analyses support primary resection with anastomosis in selected patients. Breitenstein et al. pooled data from 29 studies including 2286 patients (three randomized and eight nonrandomized controlled studies) and concluded that mortality was lower with single-stage procedures compared with two- or three-stage procedures, although there was no difference in morbidity. They acknowledged that the quality of studies available was limited. However, a Cochrane review in 2004 concluded that there were not enough high-quality studies to allow for meaningful meta-analysis of the data (72,73).

The technique of primary resection with anastomosis requires careful patient selection and surgical technique. The ACPGBI position statement suggests that single-stage resection with primary anastomosis is the treatment of choice (Grade A recommendation) as long as there is no evidence of perforation with fecal peritonitis or patient-related factors predisposing to poor anastomotic healing (for example, ASA Grade IV patients). Ideal candidates include hemodynamically stable patients without significant comorbidities (ASA I-II), absence of perforation, viable bowel, and adequate blood supply for anastomosis. Intraoperatively, decompression of the proximal dilated bowel through enterotomy or colonotomy improves visualization and reduces tension on the anastomosis (74,75).

Historical practice included on-table lavage through appendicostomy or colotomy to decompress the proximal bowel prior to anastomosis. Initial fears regarding higher risk of anastomotic leakage if no colonic irrigation was performed have been dispelled by recent studies. One nonrandomized trial comparing lavage with simple decompression, one randomized controlled trial, and one systematic review pooling results from seven trials with 449 patients all demonstrated comparable results between irrigation/lavage compared with decompression. The pooled analysis showed significantly fewer anastomotic leaks in the decompression-only group compared with

the irrigation/lavage group (relative risk: 6.18). The ACPGBI statement indicates that if segmental colectomy is performed, the use of on-table lavage is not essential (Grade A recommendation) (76,77).

Right-sided obstructing lesions have traditionally been considered more amenable to primary resection with anastomosis compared to left-sided lesions. There has long been a difference of opinion in the treatment of right-sided obstructing lesions compared with left-sided lesions, with most authors agreeing that right-sided lesions should be treated with primary resection and anastomosis. The larger luminal diameter of the right colon, ileocolic anastomosis with its favorable blood supply and healing characteristics, and ability to exteriorize the anastomosis if concerns arise contribute to perceived safety. Right hemicolectomy for right colon tumors involves ligating the ileocolic, right colic, and right branches of middle colic arteries with en bloc resection of distal 10 cm of terminal ileum, cecum, ascending colon, hepatic flexure, and proximal one-third of transverse colon (78,79).

Left-sided obstructing lesions present greater controversy. However, a number of studies have recently suggested that primary resection with anastomosis is safe in left-sided obstructing lesions with no significant differences noted between left and right-sided resections in terms of morbidity, mortality, or anastomotic leak rates. The smaller luminal diameter, less favorable blood supply, greater bacterial load, and technical difficulty of anastomosis in the deep pelvis previously contributed to concerns. Multiple studies demonstrate that primary resection with colorectal or coloanal anastomosis can be performed safely in selected patients, with acceptable morbidity and superior long-term outcomes compared to Hartmann's procedure. For sigmoid colon tumors, sigmoid colectomy with high anterior resection is routinely performed, with IMA ligation distal to the left colic artery (80,81).

Laparoscopic approaches to obstructed colorectal cancer have gained acceptance, particularly for right-sided lesions and in experienced hands. It has been demonstrated that the laparoscopic approach is as safe as the traditional open approach for colorectal cancer. Laparoscopy offers potential advantages including reduced postoperative pain, faster recovery, shorter hospital stay, and improved cosmesis. Recent studies on 1248 colon cancer patients compared laparoscopic and conventional colectomy, showing shorter hospital stay, less postoperative pain, and less pulmonary complications in the laparoscopic group. Another study involving 872 patients reported no difference in intraoperative and postoperative complications, recurrence rate, and disease-free and absolute survival rates between laparoscopic and conventional colectomy (82,83).

Resection with Stoma Creation

Resection with stoma creation, commonly performed as Hartmann's procedure for left-sided lesions, involves resection of the tumor-bearing segment with creation of an end colostomy and closure of the distal rectal stump. This approach has been the standard of care for obstructed left-sided colon cancer for decades. The rationale includes removal of the primary tumor for oncologic control and symptom palliation, avoidance of anastomosis in unfavorable conditions, and reduced risk of catastrophic anastomotic leak. Hartmann's procedure or end colostomy with Hartmann pouch remains one of the most frequently performed methods in obstructing tumors of the left colon (84,85).

Hartmann's procedure is particularly indicated in specific clinical scenarios: hemodynamically unstable patients, significant comorbidities (ASA III-IV), advanced age, perforation with fecal peritonitis, ischemic or necrotic bowel, inadequate blood supply for anastomosis, and surgeon inexperience with colorectal anastomosis in emergency settings. The procedure can be performed expeditiously, minimizing anesthetic time in critically ill patients. A subtotal colectomy is advised in cases where there is cecal perforation or ischemia, or where there are synchronous lesions; otherwise, segmental colectomy with primary anastomosis should be considered (86,87).

However, Hartmann's procedure carries significant disadvantages. The stoma may be permanent, as reversal rates are only 40-60%, with many patients never undergoing restoration of continuity due to disease progression, poor functional status, patient preference, or medical comorbidity. Reversal operation, when performed, carries substantial morbidity (20-40%) including anastomotic leak (5-15%), wound infection, intra-abdominal abscess, and small bowel obstruction. Quality of life with permanent stoma, while acceptable to many patients, represents a significant burden including body image issues, sexual dysfunction, and bladder dysfunction. The overall

hospital stay and recovery time when considering both index and reversal operations may exceed that of primary anastomosis (88,89).

Studies comparing Hartmann's procedure to primary anastomosis show mixed results. Some demonstrate equivalent short-term morbidity and mortality, while others suggest higher overall morbidity when considering both index and reversal operations. Long-term survival may be worse in Hartmann's patients, potentially reflecting selection of sicker patients or advanced disease rather than the procedure itself. The WSES 2010 Guidelines suggest primary anastomosis should be preferred over Hartmann's procedure when feasible and safe (Grade 2C+ recommendation), and there is no significant advantage to subtotal colectomy when compared with segmental colectomy and primary anastomosis (Grade 1A) (90,91).

An alternative to Hartmann's procedure for left-sided lesions is resection with primary anastomosis and proximal diverting loop ileostomy. This approach allows restoration of continuity at the index operation while protecting the anastomosis during the high-risk healing period. The diverting ileostomy can be reversed with a simpler operation (compared to Hartmann's reversal) after 2-3 months once healing is confirmed. Studies suggest this approach may provide superior long-term outcomes including higher rates of intestinal continuity restoration (up to 80-90% versus 40-60% for Hartmann's reversal) and better quality of life (92,93).

For right-sided obstructing lesions, extended right hemicolectomy or subtotal colectomy with ileosigmoid or ileorectal anastomosis may be performed, particularly in the presence of synchronous lesions, ischemic proximal colon, or cecal perforation. Extended right hemicolectomy involves ligation of the middle colic artery at its root from the superior mesenteric artery, with resection of proximal two-thirds of the transverse colon. The theoretical advantage includes removing the at-risk, dilated, potentially ischemic colon. However, the WSES guidelines indicate no significant advantage to subtotal colectomy over segmental resection in obstructed cases (94,95).

Conclusion

The surgical management of obstructed colorectal cancer requires individualized decision-making that balances oncological principles with patient safety, guided by tumor characteristics, patient physiological status, and surgeon experience. While primary resection with anastomosis offers optimal outcomes when feasible including shorter hospitalization, lower complication rates, and improved survival trends patient selection remains critical for success. Ideal candidates include those with early-stage disease (T1-T3, N0-N1), absence of perforation or peritonitis, hemodynamic stability, and adequate physiological reserve (ASA I-II). Endoscopic stenting may benefit highly selected patients, particularly for palliation in metastatic disease where it offers rapid symptom relief with minimal invasiveness. However, concerns regarding long-term oncologic outcomes including potential tumor dissemination, silent perforations, and worse cancer-specific survival have substantially tempered enthusiasm for routine bridge-to-surgery applications. Current evidence suggests stenting should be reserved for patients with significant comorbidities precluding emergency surgery, need for neoadjuvant therapy, or palliative intent in unresectable disease, and should only be performed in centers with appropriate expertise. Ultimately, prevention through screening programs remains the most effective strategy for reducing the burden of obstructed colorectal cancer. Early detection through colonoscopy and fecal immunochemical testing allows identification of precancerous lesions and early-stage cancers amenable to curative resection under elective conditions with excellent outcomes. Continued efforts to improve screening participation and expand access, particularly for underserved populations and individuals at risk for early-onset disease, represent critical public health priorities that will reduce emergency presentations and improve overall colorectal cancer outcomes (96).

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