



Perspectives on the Management of the Acute Complications of Colorectal Cancer

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Abstract

Colorectal Cancer (CRC) is the commonest gastrointestinal malignancy and the second commonest cause of cancer death. Emergency presentations constitute about 20% of admissions for CRC. The author's perspective on the current arguments and evidence that drives the decision-making in emergency colorectal surgery for complications (obstruction, perforation and bleeding) of colorectal cancer is expressed. The global disparities and improvement strategies are discussed. A literature search of the MEDLINE (PubMed) database, Cochrane library, and Science citation index was performed to identify original published studies on CRC emergencies and the management from 1984-2025. The goal of the surgeon is to control in-hospital mortality, local recurrence of CRC and quality of life. There is a paradigm shift in the management of emergency presentations of CRC towards temporization and semi-elective surgery. The timeliness and adequacy of management of the complications of CRC depend on an interaction between patient, disease and surgeon-related factors.

Keywords: Colorectal cancer; Complications; Emergency; Decision-making; Intervention

Introduction

Background

Colorectal Cancer (CRC) is the most common gastrointestinal malignancy and the second commonest cause of cancer death. Emergency presentations constitute about 20% of admissions, Obstruction occurs in 80%, perforation in 10% to 20% and, acute massive lower gastrointestinal bleeding in 5% to 10% [1]. The 30-day mortality and postoperative complication rates were 4.6 and 1.8 times higher in emergency than elective colorectal surgery [2,3]. The Swedish colorectal cancer registry had demonstrated emergency colorectal surgery having a significantly higher 30-day and 90-day mortality, more postoperative complications and lower 5-year survival compared to elective surgery [4].

Rationale and knowledge gap

There is a paradigm shift in the management of emergency presentations of CRC towards temporization and semi-elective surgery. The timeliness and adequacy of management of the complications of CRC depend on an interaction between patient, disease and surgeon-related factors.

Objective

The objective is to review the current arguments and evidence that drives the decision-making in emergency colorectal surgery for complications of colorectal cancer and discuss the global disparities and improvement strategies.

Current status and risks of Emergency Colorectal Cancer (CRC) surgery

The majority of patients presenting as emergency tend to be elderly with worse performance status, tumours proximal to the splenic flexure with worse biology (T4), more metastases and, are less likely to have major curative resections [5]. This reflected the high 30-day 8.9% mortality observed [6]. A national audit in the Netherlands demonstrated similar demography entailing older male patients with high comorbidity, predominance of right-sided tumours, advanced and perforated tumours. Emergency surgery had the highest risks for postoperative death (8.5% emergency vs. 3.4% elective) [7]. Most of these emergency presentations are associated more with colonic tumours than rectal and a statistically significant proportion of ethnic minorities observed in the North American meta-analysis [5]. Patients with advanced cancer who underwent emergency

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Table 1: Factors influencing morbidity and mortality from intra-abdominal sepsis in colorectal surgery.

Patient-related factors • Age • Comorbidity • Disease process • Immune/organ response • Patient's life style (smoking (relative risk (RR) 3.18, 95% c.i.1.44-7.00); alcohol abuse: RR 7.18(96% c.i.1.20-43.01)
Perioperative (anaesthetic) • Hypotension, (blood transfusion: hazard ratio, 6.5(955 ci, 1.4 -30): p= .018) • Hypoxia (pulmonary disease: 6.3 [1.6-26]; p=.009) • Hypothermia
Surgeon-related factors • Decision-making • Surgical procedure & technique

C I: Confidence Interval; RR: Relative Risk.

Table 2: Modifiable, Non-modifiable and Intra-operative risk factors of anastomotic leakage following resection of colorectal cancer.

Modifiable Risk Factors	Non-Modifiable Risk factors	Intra-operative Risk factors
Poor nutrition (pre-albumin) Anaemia (<10g/dl) (OR 5.40, P< .001) Hypothermia periop (<36 OC) Hyperglycaemia periop (<180mg/dl) (OR 2.80, P= .003) Antibiotic prophylaxis Vasopressors (OR 1.62, P= .047) Epidural analgesia (OR, 1.81. P= .014) Contamination of operative field (OR 2.98, P< .001)	Male Active smoker Obesity Diabetes Radiotherapy Tumour size	Blood loss (>250cc) No of stapler firing (>2) Duration of Surgery (>3-4 hrs) (OR 1.80, P=.010)

OR: Odd Ratio; P: value-statistical significance.

laparotomy for bowel perforation showed a 30-day mortality of 34%, and, 52% of survivors were discharged to an institution. Patients who had surgery for obstruction had a 30- day mortality of 18% and 41% had complications. Renal failure, septic shock, dependent functional status, ascites, dyspnoea at rest were independent pre-operative predictors of death at 30 days. Respiratory, cardiac complications and age (75-84 years) were also predictors of 30-day mortality [8]. The outcome of these patients can be improved by pre-operative optimisation despite the minimal time available, improved perioperative care, the timing of surgery, the operating surgeon (colorectal) and the operating modality used. Monitoring lactate levels as an index of metabolic acidosis while working- up these high- risk patients by correcting fluid and electrolyte balance, nutritional status and maintaining normothermia is essential. A modified Enhanced Recovery After Surgery (ERAS) pathway for laparotomy for obstructive CRC rendered a shorter hospital stay but no big difference in Anastomotic Leakage (AL) and 30 day-readmission rates [9]. The timing of surgery improves outcome. The patient in obstruction may be stabilized by the use of a stent or stoma as a bridge to semi-elective surgery [1]. In perforated CRC, an initial sepsis control with a defunctioning stoma, drainage and antibiotic therapy will render a more stable patient for a definitive oncological resection [10]. A nationwide population- based study in Sweden had demonstrated better survival for patients with colon cancer operated on by specialized colorectal surgeons [11]. The patient-related, peri-operative and surgeon-related factors influencing morbidity and mortality from intra-abdominal sepsis in colorectal surgery [12-14] are shown in Table 1. AL is more frequent in emergency than elective colorectal surgery and, more prevalent in patients with left-sided disease because of the tenuous marginal arterial blood supply. it is associated with an increased rate of local recurrence of tumour (7.3% vs. 15.6%) and reduced disease- free survival (42 vs. 75 months) [2]. The majority of enterocutaneous fistulas occur in postoperative patients as a consequence of anastomotic breakdown. Risks for this include the age of the patient, the state of the bowel undergoing anastomosis, preoperative nutritional status and the site of the anastomosis. When associated with malignancy, factors including

tumour fixity, presence of obstruction, previous radiotherapy, associated abscess and surgical technique all affect the mortality risk [1]. Decision- making is influenced by the specialty of the surgeon and knowledge of the effect of AL on local recurrence of tumour [1-8]. The pre-operative, peri-operative and intra-operative risk factors for AL [13,14] are shown in Table 2.

Core principles of preoperative evaluation and clinical-decision-making

Peritoneal sepsis is seldom the sole cause of death but compounds coincidental cardiovascular, respiratory or renal pathology [1-8,12-14]. Decision-making must therefore integrate oncological principles with comprehensive geriatric assessment and clearly defined patient-centred goals [12-19]. A hierarchical decision-making pathway for emergency CRC surgery progresses through the clinical assessment of the patient's haemodynamic status, sepsis grading, anatomical tumour location, patient baseline condition and futility evaluation, a surgical strategy selection and finally a Multidisciplinary Team (MDT) evaluation of the post-operative strategy including adjuvant chemotherapy (Table 3 and 4) [20]. The decision-making hierarchy thus prioritizes physiological status, anatomical presentation and long-term oncological intent [20,21] and is summarized in Table 5. Resuscitation includes rapid fluid infusion, broad-spectrum antibiotics and correction of coagulopathy. The evaluation of futility includes the assessment of the physiological reserve using the American Society of Anaesthesia (ASA), Physiologic and Operative Severity Score for the Study of Mortality and Morbidity (POSSUM) or Mannheim Peritonitis Index (MPI) scoring systems. The acute physiology of the patient is critical as it will determine the timeline within which to intervene and sometimes will influence the surgical procedure taken. A knowledge of the natural history of the underlying disease process both with or without surgical intervention and the consideration of interventional radiology options such as endoluminal stenting for left-sided obstruction and medical treatments available is important. The challenge is in recognising futility from both the emergency and oncological viewpoints. Futility can be qualitative as to the risk of death or severe morbidity and quantitative as to how likely the

Table 3: Clinical pathway for Elderly patient (>80 years) with Emergency CRC perforation.

Level 1: Emergency Resuscitation	Sepsis bundle Broad-spectrum antibiotics Haemodynamic stabilization ICU Evaluation
Level 2: Severity Stratification	Localized vs generalized peritonitis Organ dysfunction Frailty evaluation
Level 3: Localized perforation and stable: Oncologic resection: Hartmann's procedure Primary anastomosis only in selected patients	Generalized Peritonitis/ Septic shock: Damage control surgery: Rapid source control Limited resection Peritoneal lavage Faecal diversion
Level 4	Delayed Reconstruction after stabilization

intervention will benefit the patient [22]. The goal of management is either with intent to cure, treating the immediate emergency to allow further oncological treatment, surgical palliative treatment or non-operative supportive treatment for the terminally ill. The shared decision-making with the patient and anaesthetist on the goals of the surgical intervention helps manage expectations of the patient, relatives and the entire team. It also allows the surgeon to evaluate all the intra-operative strategies, and focus and navigate the complexities involved. With experienced surgical and anaesthetic teams, the perioperative mortality should be less than 10% [1]. The decision to operate or not in the CRC surgical emergency setting will firstly focus on the patient's wish as to the goals of treatment i.e. palliation or curative [16].

Strategies towards emergency presentations of left-sided tumours have moved towards temporization and semi-elective surgery. The short- and long-term outcome after emergency presentation of Right-Sided Colon Cancer (RCC) are poor, with inadequate access to subsequent chemotherapy [17]. Thus, delaying major resectional surgery with central mesocolic excision for optimisation may improve outcome and access to neo-adjuvant / adjuvant therapies for RCC. A non-closed loop right-sided obstruction with an incompetent ileo-caecal valve allows colonic decompression into the small bowel and nasogastric aspiration will allow a semi-elective oncological right hemicolectomy [23]. Endoscopic interventions for left-sided colonic obstruction with Self-Expandable Metallic Stents (SEMS) have been increasingly supported by emerging evidence as a bridge to surgery [1,20]. Studies have demonstrated that Minimally Invasive Surgery (MIS) can provide benefits in CRC emergencies, such as reduced morbidity and a shorter length of hospitalization. The applicability may be limited in the emergency setting by factors such as suboptimal patient physiology precluding safe pneumoperitoneum, protracted operating time, resource constraints and the lack of trained staff outside working hours [24]. As the outcome in CRC surgery are strongly affected by patient frailty and perioperative burden there is the growing benefit of robotic surgery in older patients [25].

Management of Specific Emergencies

Colorectal perforation

Colonic perforation is the most lethal complication of colon carcinoma associated with a higher morbidity, an operative mortality of 30%, and a crude 5-year survival rate of 7% [10,14,26]. There is a wide heterogeneity in the presentation of perforated colorectal cancer (T4). It may be contained perforation at the tumour site or proximal to the tumour or, with free perforation at tumour site, proximal to tumour in same segment or different segment e.g., caecum. These

require different treatment strategies [26]. Generalised peritonitis from a free perforation has poor short-term outcome but perforation per se is not an independent predictor of poor outcome. The biology of the obstructing or perforating tumour is most important. However, the short-term survival of perforated CRC is determined by sepsis. In generalised peritonitis, sepsis is controlled with a defunctioning stoma, antibiotic therapy and drainage, followed by a definitive elective oncological resection in a more stable patient. This provides a favourable overall cancer survival [10,26]. This is akin to damage control surgery in the critically ill, trauma or unstable patient with poor physiological reserves aimed at reducing the operative time and avoiding the triad of death (hypotension, acidosis and coagulopathy). The patient is returned to theatre for definitive anatomical correction 24-48 hrs later after the physiological derangement is corrected [15,20]. If the perforation is at the tumour site, resection according to oncologic principles should be the primary goal in a haemodynamically stable patient [1,15,20,26].

Colorectal obstruction

Cicatrizing tumours which involve the narrower parts of the colon- sigmoid colon (58%), splenic flexure (38%) is the commonest site of malignant Large Bowel Obstruction (LBO) [1,23]. Left-sided lesions precipitate obstructive symptoms at an earlier stage because the content of the left colon is more solid than the right side. Acute-on-chronic obstruction by carcinoma usually implies a more advanced tumour and a poor prognostic variable [18,23]. In a series of 156 patients with obstruction, hospital mortality was twice that of the non-obstructive group. The ability to perform a potentially curative resection was only 58% and, the overall 5-year survival was only 18% compared with 40% in the uncomplicated cancer resection group [27]. Urgent decompression is required to prevent ischaemia or perforation. Following resuscitation, obstructing carcinoma of right colon is usually amenable to resection and primary anastomosis [20]. The ileum has a good blood supply and there is rarely a need to dysfunction the bowel proximally. It is treated by right hemicolectomy and of distal transverse colon or splenic flexure by Extended Right Hemicolectomy (ERH) especially if there is doubt about the viability of the caecum. This provides a lympho-vascular clearance of the tumour and the obstructed right colon, and results in a well vascularised ileo-colonic anastomosis. Extended Left Hemicolectomy (ELH) is often preferred for tumours in the proximal descending colon or just below the flexure. Both ERH and ELH offer similar adequate lymph node yields and show no significant difference in

Table 4: Clinical pathway of Elderly patient (>80 years) with Emergency CRC Obstruction.

Level 1: Initial Clinical Assessment Haemodynamic stability Presence of sepsis or peritonitis Frailty status Comorbidity burden	Contrast Enhanced CT scan Site of obstruction Tumour stage Bowel perforation Presence of metastatic disease
Level 2: Haemodynamically Stable Bridge-to surgery strategy - SEMS (left-sided obstruction) - Primary oncological resection (right-sided obstruction) - Consider diverting stoma in frail or high-risk patients	Haemodynamically Unstable/ Septic Emergency Surgery: - Hartmann's procedure - Resection with end stoma - Primary anastomosis discouraged
Level 3: Physiological Optimization Multidisciplinary evaluation Nutritional and medical optimization	
Level 4: Elective Minimally Invasive Resection	

terms of 5-year overall survival, disease-free survival or recurrence rates [28]. Most studies find no significant difference in AL rates or overall complications. However, some studies suggest that extended surgery is seldomly indicated to cure splenic flexure cancer [2]. However, this will be dictated by individual anatomy with the most important criteria being the lack of tension and good blood supply. The controversy is highlighted by the observed high local recurrence rate and poor survival for patients with splenic flexure carcinoma, regardless of stage and presentation which may reflect surgical inadequacy of primary treatment [18,29]. The higher mortality in colonic obstruction reflects the features of closed loop obstruction. The clinical features are right iliac fossa tenderness indicating caecal distension and imminent caecal perforation if the caecal diameter is greater than 15cm as a result of the competent ileo-caecal valve will provide operative problems with the weight of the grossly distended fluid-filled small bowel [23]. This provides a difficult right hemicolectomy which include decompressing small bowel, clearing the duodenum early, resecting the cancer and anastomosing if possible, and creating a protective loop ileostomy if anastomosis is futile. It is also important to assess the downstream colon prior to anastomosis [1]. To prevent tension at the suture line adequate mobilization of the colon is essential so that there is redundant gut on at least one side of the anastomosis. For left-sided anastomosis, the tumour location and patient anatomy would play a major role in determining the surgeon's decision to mobilise the splenic flexure. Visible pulsation at the proximal anastomotic segment or visible bleeding at the cut ends would ensure the maintenance of gut perfusion to which the large bowel is very sensitive. Indocyanine Green (ICG) fluorescence imaging of the microcirculation of the anastomotic segments is advocated [30]. A short-coming of ICG is that although healthy, viable bowel ends are joined together, blood pressure may fall in the early postoperative period or the blood becomes haemoconcentrated because of inadequate fluid replacement leading to sludging in the perianastomotic arteries. The area of the bowel may infarct, over a number of days and finally perforate as an AL [1,31,32]. Thus, the creation of a defunctioning loop ileostomy for a low colorectal anastomosis is routine [1,30,33].

Primary resection with anastomosis (PRA) vs Hartmann's Procedure (HP)

Emergency Primary Resection and Anastomosis (PRA) for left-sided obstructing colorectal carcinoma can be performed with favourable outcome. It should be the treatment of choice in most elderly patients especially as it avoids the fluid and metabolic complications of a stoma in this cohort of patients [31]. Although elderly patients have significantly high premorbid risk factors and postoperative cardiorespiratory complications there was no significant increase in surgical complications including AL when compared to younger patients (6% vs. 4%) and, hospital mortality rate was 9% and 5% respectively [34]. This is corroborated by a recent retrospective cohort study on the emergency management of obstructing colorectal cancer which demonstrated a more favourable outcome in PRA than Hartmann's Procedure (HP) for carefully selected patients with favourable risk profiles [32,34]. HP is suggested for high-risk scenarios. Generally, patients who underwent HP have more comorbidities and advanced lesions than PRA patients [31,34]. In addition, primary left sided anastomosis on an unprepared obstructed colon is not generally regarded as appropriate, although some surgeons have achieved good results in selected cases. A subtotal colectomy may be indicated if the quality of the proximal obstructed

Table 5: Summary of Clinical pathway in emergency colorectal surgery for obstructing and perforating cancer.

Level 1: Patient Resuscitation and Futility Assessment	Haemodynamic status: - rapid fluid resuscitation, broad-spectrum antibiotics, correction of coagulopathy Futility Evaluation: - Assess physiological reserve, baseline wishes (palliative or curative cure)
Level 2: Relieving the immediate crisis (Decompression for obstruction, Source control for perforation)	Obstructing left-sided cancer: - If patient is unstable/frail: defunctioning colostomy - If patient is stable and has no perforation: self-expanding metallic stent (SEMS), can serve as bridge to elective surgery - If fit for resection: Hartmann's procedure is standard, Primary resection with anastomosis (PRA) in select optimized patients Obstructing right-sided cancer: - Right hemicolectomy with primary ileocolic anastomosis
Level 3: Oncological staging & Definitive reconstruction	Oncologic Resection: - When feasible with proper lymphadenectomy Delayed Reconstruction if HP or defunctioning stoma: - Delayed for 3-6 months (allow physiological recovery & potential neo/adjuvant chemotherapy)
Level 4: multidisciplinary Team (MDT) Evaluation	Post-Operative strategy: - Determine need for adjuvant therapy (e.g., FOLFOX chemotherapy)

bowel is poor because of oedema, faecal loading, shut down of the splanchnic blood supply and, an inconsistent marginal vessel. An ileo-colic or ileorectal anastomosis has a good blood supply from the ileum and proximal diversion is unnecessary. The clearance of any synchronous carcinoma and avoidance of surveillance colonoscopy are further advantages. However, a multicentre trial (The SCOTIA study group) compared single-state treatment for malignant left-sided colonic obstruction i.e. lavage to permit primary anastomosis and subtotal colectomy. It found that patients treated by lavage and anastomosis (left hemicolectomy) had an AL rate of 5 % and, a more acceptable postoperative bowel function than subtotal colectomy [35]. Segmental resection of obstructed colon cancer provides better long- term functional results than subtotal colectomy [35,36]. Even in the obstructed left colon cancer patient with caecal ischaemia or diastatic perforation colon-sparing strategy may still represent a valid and safe alternative to subtotal colectomy [37].

Colonic stenting

Colonic endoluminal stenting of malignant left-sided colonic obstruction as a bridge to surgery may provide the surgical advantages of a higher primary anastomosis rate, a lower AL rate and, a lower overall stoma rate [38]. The CREST trial of endoluminal stenting in the UK in patients fit enough to undergo surgery showed reduced stoma formation without a detrimental effect on one year survival. Post-operative mortality, length of hospital stay, critical care usage and quality of life were not different between the two treatment groups [39]. By allowing time for preoperative optimization and bowel preparation, stent placement may reduce the need for emergency surgery with the incipient complications. The disadvantages include the higher local tumour perforation rate predisposing local tumour recurrence and poor outcome, the less likely use in closed loop

obstruction and cost-effectivity [40]. The simple decompressing transverse colostomy is also effective in acting as a bridge to elective definitive oncological surgery in left-sided obstructive colon cancer. Veld, et al demonstrated significantly fewer post-resection complications, lower 90-day mortality 1.7 vs. 7.2%, more laparoscopic resections 56.8 vs. 9.2%, more primary anastomoses and fewer permanent stomas [41]. A study by the same Dutch group comparing decompressing stomas with stents demonstrated more primary anastomoses (86% vs. 75%), fewer postoperative complications with no difference in local recurrence, disease free survival and overall survival at 3 years [42]. The role of the Self-Expandable Metallic Stent (SEMS) has evolved since initial concerns of poor long term oncological outcomes from micro perforations, stent migration, technical failure and re-occlusion [43]. It is important to note that the decompressing stoma and stenting approaches are chosen not only by tumour location but also by physiological reserve, local expertise, and access to endoscopy/ interventional radiology. Some clinical centres currently adopt a comprehensive treatment model of 'intestinal stent+ neoadjuvant chemotherapy + surgical resection' in addition to converting an emergency high-risk situation into an elective procedure [44]. This interval also allowed the patient to regain nutritional status and physical strength before the major operation. There were no significant differences observed between elective surgery following Colonic Stenting (CS) and colonic stenting combined with neoadjuvant chemotherapy (CS-NAC) in stent-related complications or specific short-term adverse events, including postoperative incision infection rates, AL rates, and pulmonary infection rates. The CS-NAC strategy significantly improved both 3-year disease-free survival and overall survival [44]. These benefits may result from chemotherapy-induced tumour downstaging and resolution of intestinal oedema facilitating MIS and radical resection. However, these should also be manifested in the scenario of a simple decompressing transverse colostomy.

At present, international guidelines do not agree on the optimal management of malignant left-sided large bowel obstruction [45]. The treatment is individually tailored to each patient, organ-/ function conscious and the choice on the surgical procedure or technique is predominantly driven by patient and disease factors.

Rectal cancer

Rectal cancer rarely causes obstruction because of the rectal capacity and, rectal bleeding and tenesmus heralds the diagnosis. It is essential to discriminate between intraperitoneal (high rectum) and extraperitoneal (low rectum) carcinomas. High rectal carcinomas are often considered similar to colon carcinomas. Carcinoma of the lower rectum (extraperitoneal) carry a higher risk of local recurrence which prompts neoadjuvant chemoradiation prior to anterior or abdominoperineal resection with Total Mesorectal Excision (TME) [46-48]. The infrequent completely obstructing or perforated rectal cancer requires proximal defunctioning, draining the sepsis, staging the tumour and referral to the medical oncologist for chemoradiotherapy prior to an elective (planned) oncological surgery [1,20,24,49]. Colorectal subspecialisation has resulted in an increased use of pre-operative radiotherapy and fewer permanent stomas. However, there was no significant improvement in surgical or oncological outcomes after rectal cancer surgery performed by colorectal surgeons [50]. Japanese studies have demonstrated that colorectal specialists may improve operative management with low in-hospital mortality of 1.3% for obstructing colorectal cancers. This may, however, not necessarily translate to a superior long-term

(5 year) survival because of disease and patient factors [50]. An important differential diagnosis of malignant LBO is acute colonic pseudo-obstruction (Ogilvie syndrome) from colonic hypomotility which occurs in critically ill or postoperative patients producing a massive but reversible dilatation of the colon. It may carry a mortality as high as 45% if not colonoscopically, or operatively decompressed following failure of conservative treatment or laparotomy not performed when clinical signs indicate caecal ischaemia or perforation [51]. Bowel oedema in these acute settings may preclude primary closure of the abdominal wall. The complications of a laparostomy (open abdomen) such as wound infection, fluid and protein loss, catabolic state, loss of abdominal domain, and entero-atmospheric fistula are avoided by the progressive closure with a mesh-mediated fascial traction on a visceral protection layer and negative pressure wound therapy. There is a 20% rate of intestinal fistulation with the use of a Vacuum-Assisted Closure (VAC) system without a visceral protection sheath in patients with intestinal or peritoneal inflammation and/ or multiorgan failure [52]. A summary of the clinical pathway in the management of the obstructive and perforation complications of CRC is illustrated in Table 3.

Bleeding

Vascularized and ulcerative tumours, in the rectosigmoid region, or patients receiving anticoagulant therapy may present with a massive LGI bleed. The effective management of acute bleeding relies on the patient's haemodynamic status. Haemodynamic stabilization followed by identification of the active bleeding source is the initial approach [53]. In patients who are haemodynamically stable colonoscopy is recommended as the first-line approach as it can be used for diagnosis and treatment [54]. Endoscopic clipping, band ligation, and the local administration of epinephrine are options for the endoscopist [55]. It is, however, often limited by inadequate bowel preparation or active bleeding that can interfere with detecting the bleeding focus. A highly effective first-line option for tumour-related bleeding is the non-invasive CT angiographic Transcatheter Arterial Embolization (TAE). It has technical and clinical success rates of 89.1% and 84.8% respectively. There is a 30-day bleeding-related mortality of 15.2% and, a higher rebleeding risk especially with coil-based embolization [56]. An independent predictor of rebleeding is tumour-related, sepsis-induced, or anticoagulant-related coagulopathy. This is strongly associated with 30-day mortality after TAE [57]. Thus, a prerequisite for successful embolization is the correction of any coagulopathy through reversal of anticoagulants and appropriate transfusion of blood components [56]. Although TAE has become a major treatment modality for the management of gastrointestinal bleeding that is refractory to endoscopic management, post embolization ischaemia and bowel infarction is a major concern with Lower Gastrointestinal Bleeding (LGIB). Consequently, intermittent bleeding often causes management difficulties and, close observation is required following TAE. Technical advances in microcatheter and embolic agents have facilitated super selective embolization for LGIB with minor ischaemic complication rate of 4.5% reported [57]. Nonetheless, in a haemodynamically stable patient, conservative measures may suffice. Lesser bleeding may be amenable to local palliative radiotherapy. It could control bleeding in 89% of patients with an overall rebleeding rate of 25% [58]. Persistent or recurrent bleeding despite embolization and/ or when the tumour is respectable is an indication for surgical resection [1,55,59]. MIS approach is recommended especially with the additional consideration of initially performing vascular control and ligation to control further blood loss [24].

Global disparities and improvement strategies

There is a large geographical variation in incidence and mortality rates of CRC with the highest incidence (20-34/100,000) but lower mortality in the Western/ industrialized countries. A predominantly aggressive early onset CRC is rising in the developing world (6-8/100,000 in Sub-Saharan Africa) due to the adoption of the Western diet and life- style [60]. The Apollo trial showed urgent or immediate surgery rates being highest in low and middle- income countries (43.2% vs. 56.3%) [61]. Low and middle- income countries had higher R1 (tumour removed completely macroscopically, but microscopic cancer cells at or < 1mm from the margin of the resected tissue) and R2 (macroscopic residual tumour) resection rates (23.5% vs. 43%) independent of cancer stage [61]. These are because the surgeries were performed more by non-specialist surgeons in low and middle- income countries than in high income countries. The Dutch snapshot study demonstrated a high 30-day mortality from free colonic perforation than with contained perforations (8% to 33% vs. 3% to 5%) and increased postoperative complications (33% to 56% vs. 22% to 28%) [26]. A study from Cameroon, W/Africa showed a mortality of 39.1% from surgery for perforated colon cancer [62]. Although this was associated with late diagnosis and generalised peritonitis an element of inadequate decision -making by mostly general surgeons on the appropriate surgical procedures contributed [11,18,62,63]. A common short-coming is colorectal resection with primary anastomosis in the setting of generalised peritonitis which is associated with an increased mortality from AL [17,18,26,62,63]. Patients presenting with acute complications of colorectal cancer in low and middle- income countries are more likely to undergo urgent surgery, but have decrease specialized surgical care and hospital capacity to rescue [61]. Failure to rescue the major complications of abdominal surgery is an important cause of mortality [64]. This is corroborated by the observation that despite a similar adjusted 90 -day complication rate, the mortality rate is higher in low and middle-income country than in high income countries (27.6% vs. 16.1%) [61]. As CRC is increasing in low and middle- income countries there is need for knowledge of temporisation for semi-elective surgery, access to acute perioperative oncological care and a cost-effective CRC screening programme. This requires resource allocation, specialist training and guideline implementation. Globally, the challenge of recognising futility in the emergency surgery for CRC will remain a problem. However, with the collaboration between an experienced surgical and anaesthetic team, the perioperative mortality from emergency surgery for complications of CRC should be significantly reduced. Future research directions would include AI-assisted emergency decision-making, minimally invasive emergency surgery, endoscopic interventions, Multidisciplinary Team (MDT) collaboration protocols, and liquid biopsy- guided prognostic evaluation in emergency settings.

Conclusion

The management of acute complications of CRC is fundamentally based on appropriate decision-making that aligns physiology, oncologic intent, technical rescue options, and proportionality of care. The challenge is in recognising futility from both the emergency and oncological viewpoints. Strategies in management have moved towards temporization and semi-elective surgery. The timeliness and adequacy of management of the complications of CRC depend on the interaction between patient, disease and surgeon-related factors.

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