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EDITORIAL

T1 colorectal cancer management in the era of minimally invasive endoscopic resection

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Abstract

T1 colorectal cancer (CRC), defined by tumor invasion confined to the submucosa, has historically been managed by surgery. Improved understanding of recurrence and lymph node metastases risk, coupled with advances in endoscopic resection techniques, have led to an increasing capacity for organ-sparing local excision. Minimally invasive management of T1 CRC begins with optical evaluation of the lesion to diagnose invasive disease and quantify depth of invasion, which informs therapeutic decision making. Modality selection between various available endoscopic resection techniques depends upon lesion characteristics, technique risk-benefit profiles, and location-specific implications. Following endoscopic resection, established histopathology features determine the risk of recurrence and subsequent management including surveillance or adjuvant surgical excision. The management of non-operative candidates deviates from conventional recommendations with emerging treatment strategies in select populations.

Key Words: Cancer; Colonoscopy; Endoscopy; Polyp; Surgery

Core Tip: Advances in minimally invasive endoscopic resection techniques, including endoscopic mucosal resection, endoscopic submucosal dissection, endoscopic full-thickness resection and transanal endoscopic surgery, have revolutionized the management of T1 colorectal cancer (CRC); allowing for organ preservation while mitigating the associated morbidity of colorectal surgery. Herein we outline the pre-resection, resection and post-resection phases of care for T1 CRC including emerging techniques and adjuvant strategies for non-operative candidates.

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INTRODUCTION

T1 colorectal cancer (CRC), as described by the Vienna Classification and the American Joint Committee on Cancer, refers to lesions with neoplastic invasion confined to the submucosa[1,2]. This does not include high grade dysplasia or carcinoma in situ; as in these scenarios neoplasia is confined to the mucosa, which is devoid of lymphatics and therefore metastatic potential[3]. With prevalence estimates as high as 5% within population-based screening, T1 CRC represents an important well-characterized clinical entity associated with established risks of recurrence and lymph node metastases (LNM)[4].

Historically, radical surgery was the default management strategy for T1 CRC. However, in low-risk T1 CRC, surgery has modest additional oncologic benefit but with significant mortality and morbidity including permanent ostomy formation. In a population-based cohort of 5170 patients with T1 CRC who underwent surgery, 30-d mortality was 1.7% and 8.3% had severe adverse events requiring re-intervention[5]. Therefore, with a growing number of patients with advanced age and comorbid disease, an alternative approach to treatment is needed[6].

Minimally invasive endoscopic resection offers a safe, effective, and organ-sparing alternative. Modalities include endoscopic mucosal resection (EMR), endoscopic submucosal dissection (ESD), endoscopic full thickness resection (EFTR), and transanal endoscopic surgery (TES; Table 1). A retrospective analysis of 1069 T1 CRC that underwent EMR, ESD and conventional snare resections demonstrated a 5.5% rate of adverse events and no procedure-associated mortality [7]. Minimally invasive endoscopic resection also has comparable efficacy to surgery; in a meta-analysis comparing minimally invasive endoscopic resection and surgery for T1 CRC, the 5-year recurrence-free survival was similar at 96.0% and 96.7%, respectively[8].

Advances in minimally invasive endoscopic resection techniques alongside an improved understanding of metastatic risk have led to a paradigm shift in the management of T1 CRC; with minimally invasive endoscopic resection now considered first-line. Herein we describe the risk stratification of T1 CRC, optical evaluation characteristics and performance, resection modalities, post-resection management, and treatment of non-operative candidates with review of emerging therapeutic strategies.

T1 CRC RISK STRATIFICATION

Low risk T1 CRC is defined by established histopathology risk factors for local and distant recurrent disease. International consensus guidelines define low risk T1 CRC by the absence of lymphovascular invasion (LVI), poor differentiation (PD), tumor budding (TB), and deep submucosal invasion (DSI; ≥ 1000 μm), as well as en-bloc resection with negative histologic margins (R0 resection). Conversely, the presence of any of these features denotes high risk T1 CRC and requires completion surgery[9-11]. In a meta-analysis including 71 studies with 5167 patients, the pooled incidence of local and distant recurrence for T1 CRC was 3.3%[12]. However, when stratified by high risk and low risk T1 CRC, pooled incidence of local and distant recurrence was 7.0% and 0.7% respectively[12]. Given the low risk of recurrent disease, compared to the adverse event profile of completion surgery, endoscopic resection followed by surveillance for low risk T1 CRC is now recommended[10,11].

The above features which define high risk T1 CRC are associated with differing clinical relevance, particularly depth of invasion. Prior meta-analyses report increased LNM in the presence of DSI, with a relative risk of 5.2[13,14]. However, it was noted that the effect of DSI may be due to concurrent high-risk features; in their absence, T1 CRC with DSI in isolation had a frequency of LNM as low as 1.2%[15]. Similarly, a recent meta-analysis of 67 studies and 21238 patients found that DSI was not an independent risk factor for LNM after adjusting for other high risk criteria[16]. Studies have proposed alternative assessments including deeper cut-offs of ≥ 1800 or 2500 μm[15,17], or total area of submucosal invasion as a proportion of tumor stroma[17].Therefore, it is reasonable to consider expanding current low-risk criteria to allow for DSI.

The definition of a negative margin on histopathology is also in question. Recent guidelines from the US Multi-Society Task Force suggest a distance from the margin of at least 1 mm[9], whereas the Japanese Society for Cancer of the Colon and Rectum define safe margin as > 0 mm[10]. Further, measurement of the margin may be confounded by specimen handling and cautery effect[12]. For low risk T1 CRC, residual disease remains infrequent with either definition. Gijsbers *et al*[18] compared margins of 0.1-1 mm and > 1 mm in 522 low risk T1 CRC and found no significant difference in the frequency of residual disease at 2.9% and 0.6% respectively. Conversely, residual tumor rate of high risk T1 CRC is 6%-16% in studies with margins < 1 mm[19,20]. While histopathology remains definitive, endoscopic evaluation to define margin adequacy remains notable; local recurrence or residual neoplastic tissue in the surgical specimen was only found in 0%-3% of T1 CRC with macroscopically complete resection, even if the original local excision had R1/Rx status[19-21]. Further study is needed to delineate an optimized definition of a negative histologic margin, particularly for low-risk T1 CRC to avoid unnecessary surgery.

Table 1 Common endoscopic techniques, specific applications, and associated outcomes

Endoscopic technique	Application in T1 CRC	Outcomes	Advantages	Disadvantages
EMR	Recommended for lesions < 20 mm due to risk of piecemeal resection	En-bloc resection: 85.2%[44]; R0 resection: 83.9%[44]	Widely available, efficient, less resource intensive, high technical success in expert centers	Limited en-bloc resection rate with increasing size
ESD	Recommended for T1 CRC without signs of deep submucosal invasion	En-bloc resection: 98.7%[45]; R0 resection: 97.4%[45]	High en-bloc resection, technical success, and clinical success rate	Resource intensive and requires specific training
EFTR	Primary and secondary resection of T1 CRC	Technical success: 87.0%[48]; R0 resection: 85%[48]	High en-bloc and R0 resection rate, particularly for deep invasion and submucosal fibrosis	Depends on local expertise and technology availability. Risk of appendicitis and heightened risk of delayed perforation
TES: TEM, TAMIS	Rectal T1 CRC	TEM: En-bloc resection: 97.0%[57]; R0 resection: 93.0%[57]	Full thickness-resection. High en-bloc and R0 resection rate, particularly for deep invasion	For rectal lesions only. Resource intensive and requires specific training. May affect planes for completion total mesorectal excision

EFTR: Endoscopic full-thickness resection; EMR: Endoscopic mucosal resection; ESD: Endoscopic submucosal dissection; TAMIS: Transanal minimally invasive surgery; TEM: Transanal endoscopic microsurgery; TES: Transanal endoscopic surgery; CRC: Colorectal cancer.

PD, TB, and LVI are well-established histopathologic features. PD and TB have an odds ratio (OR) for LNM of 2.14 and 2.83, respectively, in the prior meta-analysis including 21,238 patients[16,22,23]. LVI is commonly reported as a combined entity, which is associated with an OR for LNM of 3.16. However, when considered separately lymphatic and vascular invasion are seen in 20% and 14% of T1 CRC with LNM, and lymphatic invasion has a higher OR for LNM[13,14,24].

Predictive models and artificial intelligence systems to determine the risk of LNM in T1 CRC are being developed that incorporate clinical and histopathological parameters, with good performance against current guidelines[25,26].

PRE-RESECTION: OPTICAL EVALUATION

Optical evaluation refers to classifying the lesion by location, size, and lesion morphology alongside interrogating the surface pit and microvascular pattern to predict: (1) Lesion histopathology (adenomatous *vs* serrated); (2) the presence of invasive disease; and (3) the depth of invasion.

Multiple optical features have been evaluated as a predictive tool for invasive disease and to stratify depth of invasion [27]. This includes increasing lesion size, distal location (rectosigmoid), gross morphological features (GMF) and abnormal pit/microvascular surface patterns as evaluated by image enhanced endoscopy [*e.g.*, narrow band imaging (NBI), magnifying chromoendoscopy (MCE)]. Using NBI, submucosal invasion appears as a loss of the regular microvascular pattern, such as NBI International Colorectal Endoscopic classification III or Japan NBI Expert Team classification IIB/III. Using MCE, an amorphous pit pattern may be seen, corresponding with Kudo Pit Pattern Vi/Vn. Finally GMF are identified with high definition white light endoscopy and include non-granular morphology, depression (Paris 0-IIc), ulceration, presence of a large nodule, spontaneous bleeding, white spots, exudate, and non-lifting sign)[28-35]. In a meta-analysis of 31568 lesions, optical prediction of T1 CRC was superior using NBI and MCE features. Sensitivity and specificity was 85% and 94% for NBI, 90% and 96% for MCE, compared to sensitivity of 21%-46% for GMF. Similarly, sensitivity and specificity for prediction of DSI was 77% and 98% for NBI, 81% and 95% for MCE, and 18%-68% and 80%-98% for GMF[35].

Optical evaluation by endoscopists, even without magnification, has demonstrated high negative predictive value (NPV) and reasonable positive predictive value (PPV). In a prospective study, advanced endoscopists using GMF and NBI predicted T1 CRC with PPV of 68% and NPV of 96%; DSI was predicted with PPV of 86% and NPV of 96%[36]. Subsequently, a real-world study including non-expert endoscopists retained a high NPV of 98% for DSI, though PPV was 41%[31]. While this is potentially attributable to the low prevalence of deeply invasive lesions, it suggests overestimation of DSI.

While DSI is challenged as an independent risk factor for LNM, the presence of other high risk T1 CRC criteria are associated with similar optical features including, protuberance within the depression, expansiveness, and loss of mucosal pattern[37].

For large non-pedunculated colorectal polyps, submucosal invasion may be present without any optical features, thus termed "covert" submucosal invasive cancer. In an analysis of 2277 lesions, Burgess *et al*[30] found that location, morphology, and granularity were associated with covert submucosal invasion. Rectosigmoid Paris 0-IIA+IS granular lesions and Paris 0-IS/0-IIA+IS non-granular lesions of any location were associated with a > 10% risk of submucosal invasion; these lesions should be treated as T1 CRC and removed en-bloc (Figure 1 and Table 2).

Table 2 Pre-resection optical evaluation of colorectal polyps

Optical evaluation	Corresponding histopathology	Suspicion of malignancy	Recommended management
NICE I, JNET I	Serrated Polyp	Low	Endoscopic polypectomy, EMR, CSR
NICE II, JNET II	Adenomatous Polyp	Low	If suspected superficial invasion: en-bloc resection by EMR[1], ESD, EFTR, TES[2] If suspected deep invasion: surgery or multidisciplinary review
JNET IIB	Superficial submucosal invasion	Yes, superficial	
NICE III, JNET III	Deep submucosal invasion	Yes, deep	
Paris 0-IIa+Is granular lesions in distal colorectum	Covert submucosal invasion	Yes	
Paris 0-Is/0-IIa+Is nongranular lesions in distal colorectum	Covert submucosal invasion	Yes	

[1]Applicable for lesions < 20 mm.

[2]Applicable to rectal lesions.

CSR: Cold snare resection; EFTR: Endoscopic full-thickness resection; EMR: Endoscopic mucosal resection; ESD: Endoscopic submucosal dissection; JNET: Japan NBI Expert Team; NICE: NBI International Colorectal Endoscopic; TES: Transanal endoscopic surgery.

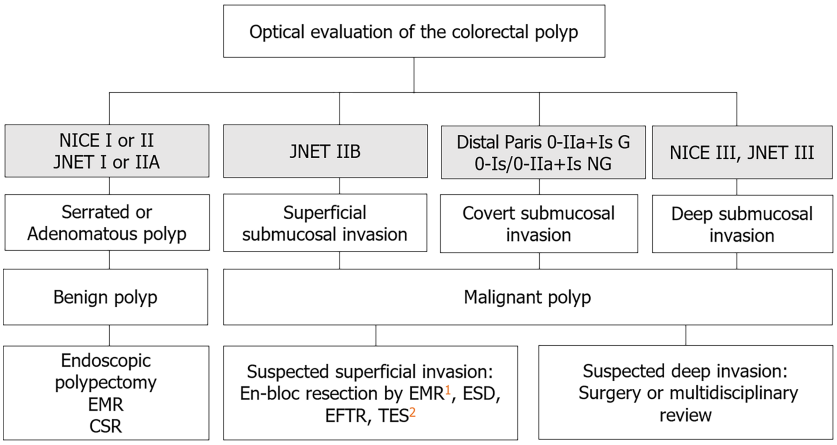

Figure 1 Pre-Resection optical evaluation of colorectal polyps. [1]Applicable for lesions < 20 mm. [2]Applicable to rectal lesions. CSR: Cold snare resection; EFTR: Endoscopic full-thickness resection; EMR: Endoscopic mucosal resection; ESD: Endoscopic submucosal dissection; JNET: Japan NBI Expert Team; NICE: NBI International Colorectal Endoscopic; TES: Transanal endoscopic surgery.

RESECTION: STANDARD MODALITIES AND CONSIDERATIONS

Initial endoscopic en-bloc resection modalities for T1 CRC were EMR and ESD. High-quality EMR involves submucosal injection followed by use of a snare with electrocautery to capture and resect the lesion in question, paying careful attention to capture a generous margin of normal mucosa. In contrast, ESD uses an electrosurgical knife to dissect along the submucosal plane beneath the lesion[38]. Multiple studies evaluating colorectal neoplasia have shown that ESD has superior en-bloc, R0 resection, and recurrence, but longer procedural times and more adverse events compared to EMR [39-41]. Specifically in early CRC, EMR demonstrated en-bloc and R0 resection rates of 85.2% and 83.9% respectively[42], limiting use to lesions smaller than 20 mm given the potential for deep mural injury/perforation[10]. Comparatively, ESD for superficial T1 CRC had an en-bloc resection rate of 98.7% and R0 rate of 97.4%[43]. Thus, incorporating ESD in a selective resection algorithm accounting for T1 CRC can improve oncologic outcomes compared to universal use of EMR [44]. However, in cases of submucosal fibrosis and DSI, R0 resection of ESD is reduced to 64.7%[43].

Endoscopic full-thickness resection was developed to address the deficiencies of ESD. In the colorectum, this is most commonly performed using the full-thickness resection device; where the lesion is pulled into the application cap, incorporating the muscularis propria, with clip closure of the colorectum and ultimately, full-thickness resection of the lesion[45]. Specific to T1 CRC, the Dutch EFTR registry of 330 lesions demonstrated 85% R0 resection, 87% technical success, 8.1% adverse event rate, and 99.3% complete histopathology specimens for both primary and secondary scar resection[46]. The German EFTR registry of 156 T1 CRC had similar results, including 99.4% of lesions with complete risk stratification, with 43.9% re-classified as low-risk T1 CRC[47]. Earlier EFTR studies reported lower R0 resection for lesions > 20 mm[45,48], but can be addressed with a "hybrid-EFTR" technique for larger, non-lifting lesions[49,50]. Availability of EFTR technology and experience with EFTR limits widespread use, but there is increasing uptake in Western countries.

For early rectal cancer, TES is another option, comprised of transanal endoscopic microsurgery (TEM) and transanal minimally invasive surgery (TAMIS). TEM utilizes a specialized anoscope that facilitates both insufflation and passage of an endoscope and surgical instruments to enable full thickness excision[51]. TAMIS is facilitated by a single transanal port, but uses standard laparoscopic instruments, camera, and insufflator, thus making it a more accessible modality than TEM[52]. Compared to TAMIS, TEM is considered to have less risk of fragmentation but is more time and resource intensive, with a steeper learning curve, and a similar recurrence rate when performed within high-volume centers[53,54]. Compared to ESD, TEM has similar rate of en-bloc, R0 resection, and adverse events, but significantly longer procedure time and length of stay[55,56].There is a signal that TEM and TAMIS may affect subsequent surgery with higher rate of incomplete mesorectal specimens and longer operative time compared to primary total mesorectal excision (TME), however this has not been shown to affect recurrence or survival[57]. Overall, there appears to be similar risk-benefit profiles for TEM, TAMIS and ESD, thus leaving technique selection largely determined by local availability and expertise.

Post-resection: Surveillance

While high risk T1 CRC generally requires subsequent completion surgery due to LNM risk, T1 CRC meeting low risk criteria is recommended to undergo surveillance; which may potentially include both endoscopic and radiographic surveillance (Figure 2 and Table 3). Western guidelines agree that the first endoscopic surveillance should occur in 3-6 months post-resection[11,58], however Japanese guidelines suggest surveillance in 1 year[9]. Proponents for a longer interval surveillance argue a low likelihood of missed synchronous lesions in endoscopically manageable T1 CRC and low rate of local recurrence[59].

Following the first surveillance endoscopy, guidelines diverge. The European Society of Gastrointestinal Endoscopy recommends standard CRC surveillance after 1, 3, and 5 years, for both surgically and endoscopically cured CRC[11]. Comparatively, the American Gastroenterology Association recommendations are specific to endoscopic resection and location of CRC. For colon cancers, the second surveillance colonoscopy is advised after 6 months, then after 1 year. For rectal cancers, flexible sigmoidoscopy is suggested every 6 months up to 5 years, with concomitant regular endoscopic ultrasound or pelvic magnetic resonance imaging surveillance up to 5 years[60], attributed to the higher risk of recurrence in rectal cancers[61]. Following publication of these guidelines, a multi-center cohort study of 336 patients with T1 CRC (84 rectal cancers) underwent radiological surveillance, finding an overall 5-year cumulative incidence of 2.4% for distant recurrence and no distant metastases in low risk T1 CRC[60]. As experience with endoscopic resection of low risk T1 CRC continues to grow, guidelines surrounding surveillance will likely be updated accordingly (Table 4).

DEVIATION FROM STANDARD MANAGEMENT

Endoscopic management in lesions with suspected DSI

While surgery remains standard of care for T1 CRC with suspected DSI, there is emerging evidence for endoscopic management. In lesions with deep invasion, endoscopic resection can retain both diagnostic value for histopathologic risk stratification and potential for definitive therapy. A study of 126 T1 CRC with a focal DSI surface pattern treated by ESD found R0 resection in 76.7% and curative resection in 26.6% meeting low risk criteria[62]. This may partly reflect the moderate PPV of optical evaluation for DSI[31], but highlights the changing role of minimally invasive endoscopic resection for more definitive diagnosis. Thus, particularly for patients who are poor surgical candidates, ESD may still be considered given its safety profile.

Emerging endoscopic resection techniques

Initially developed to address the failure of ESD in attaining deep margins for rectal lesions with submucosal fibrosis, endoscopic intermuscular dissection (EID) facilitates dissection of T1 rectal cancer with DSI and leaves the rectal wall intact in case of potential subsequent TME, providing proposed advantages over ESD and TES, respectively. In a prospective cohort study of 67 patients with deeply invasive T1 rectal cancer, EID achieved R0 resection in 81% and curative resection in 45%, with no major adverse events[63].

Through modification of existing EMR/ESD techniques, endoscopic submucosal resection and snare-based full thickness resection have also been used for deeply invasive T1 CRC which are unresectable with conventional techniques [64,65].

Combined endoscopic laparoscopic surgery allow for less invasive and precise full-thickness resection of early colon cancers that are too large for endoscopic resection[66]. Colonoscopy-assisted laparoscopic wedge resection (CAL-WR) has been shown to have R0 resection rate of approximately 90% and adverse rate of 2% for early colon cancer. Further, there were no reported adverse events due to CAL-WR in subsequent completion surgery, which occurred in 29% and were largely due to ≥ T2 colon cancer[67]. CAL-WR has similar efficacy and safety as a secondary technique following incomplete endoscopic resection of T1 colon cancer[68] (Table 5).

Study of long-term oncologic outcomes and cost-effectiveness have yet to be reported for these novel techniques; however, if the need for surgery can be reduced similar to that of large non-pedunculated colorectal polyps, there is potential for significant improvement in patient outcomes and resource utilization.

Role of chemoradiation

Chemoradiotherapy has been used in the neoadjuvant setting to downstage early-stage rectal cancer for local excision, largely TES. Multiple trials have found that the rate of downstaging to T0-1 from T2-3 with neoadjuvant chemoradio-

Table 3 T1 Colorectal cancer post-resection algorithm

	High-risk T1 CRC	Low-risk T1 CRC
High Risk Histopathology Features (lymphovascular invasion, tumor budding, poor differentiation, deep submucosal invasion (≥ 1000 μm)[1], positive resection margin)	Presence of one or more histopathology features	Absence of all high-risk histopathology features
Resection status	Non-curative	Curative
Recommended management	Adjuvant surgery or multidisciplinary review	Surveillance

[1]Deep submucosal invasion may be considered a low-risk feature in isolation.
CRC: Colorectal cancer.

Table 4 T1 Colorectal cancer surveillance

Guideline	First surveillance		Subsequent surveillance
Japanese Society for Cancer of the Colon and Rectum 2019 [10]	Colonoscopy at 6-12 months		No specific comment
European Society of Gastrointestinal Endoscopy 2019[11]	Colonoscopy at 3-6 months		1, 3, and 5 yr
American Gastroenterology Association 2021[60]	Colon	Colonoscopy at 3-6 months	6 months and 1 yr
	Rectum	Flexible sigmoidoscopy at 3-6 months and colonoscopy at 1 yr	Flexible sigmoidoscopy every 6 months up to 5 yr, with concomitant EUS or pelvic magnetic resonance imaging every 3-6 months for 2 yr, then every 6 months to complete 5 yr. May consider CT chest, abdomen, and pelvis for 3-5 yr

EUS: Endoscopic ultrasound; CT: Computed tomography.

Table 5 Emerging treatment options for T1 colorectal cancer

Emerging technique	Description	Application in T1 CRC	Outcomes and evidence
Endoscopic submucosal dissection for suspected focal deep submucosal invasion	En-bloc endoscopic resection for lesions with optical evaluation suggesting focal deep submucosal invasion	For patients preferring or only eligible for conservative management, who would otherwise be referred to first-line surgery	Retrospective study of colorectal neoplasia with focal deep invasion found R0 resection of 77% and curative resection in 27%[62]
Endoscopic intermuscular dissection	Dissection between inner (circular) and outer (longitudinal) muscularis propria	For rectal cancers, particularly with a concern for deep submucosal invasion	Prospective cohort study of T1 rectal cancer demonstrated technical success of 96%, R0 resection of 81%, and curative resection of 45%[63]
Colonoscopy-assisted laparoscopic wedge resection	Laparoscopic resection and closure of colonic lesions under direct intraluminal endoscopic guidance	For colon cancers, particularly with deep submucosal invasion	Case series of patients with high grade dysplasia or T1 colon cancer demonstrated R0 resection of 89%[67]
Neoadjuvant and adjuvant chemoradiation[1]	Use of chemoradiation or chemotherapy alone before or after resection to increase efficacy of local excision[1]	For downstaging early rectal cancer or for prevention of recurrence following local excision of high risk T1 CRC	NEO trial (phase II) of early rectal cancer showed 57% downstaging, 79% organ preservation, and 90% 2-yr local regional relapse free survival[73]. Systematic review subgroup analysis of T1 CRC treated with adjuvant chemoradiation showed local recurrence rate of 3.9%[75]

[1]Use prior to/followed by local excision with transanal endoscopic surgical techniques.
CRC: Colorectal cancer.

therapy is approximately 50%-65%[69-72]. Following neoadjuvant chemoradiotherapy, there was no significant difference in 5 year recurrence or cancer-related survival between subsequent TES and TME[69,70]. As pre-operative radiation can increase surgical adverse events[72], neoadjuvant chemotherapy alone prior to TES was recently studied in the phase II NEO trial and has shown 57% downstaging, 79% organ preservation rate, and 90% 2-year locoregional relapse free survival[73]. While the watch-and-wait approach for those with complete clinical response following neoadjuvant therapy can enable patients to avoid radical surgery[74], use of local excision maintains organ preservation while addressing local disease, evidenced by the 23% of patients with microscopic residual disease on TES specimens who may appear to have complete clinical response[73].

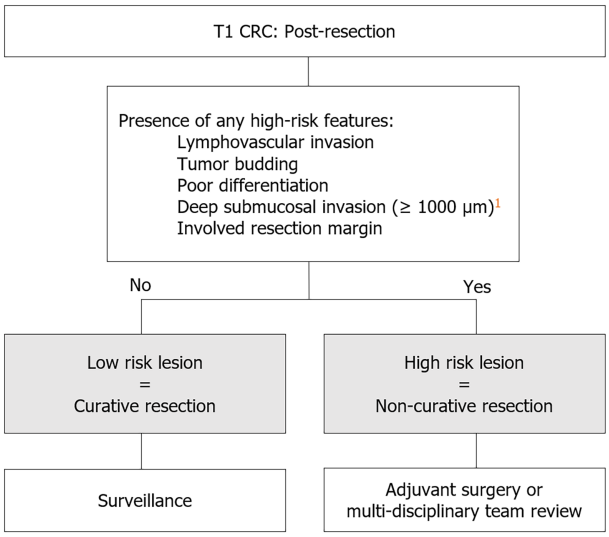

Figure 2 T1 colorectal cancer post-resection algorithm. [1]Deep submucosal invasion may be considered a low-risk feature in isolation. CRC: Colorectal cancer.

Adjuvant chemoradiotherapy has also shown efficacy following local excision for high risk T1 rectal cancers. A systematic review examined a high risk T1 CRC subgroup initially treated with local excision, and found a local recurrence rate of 4.1% with secondary TME and 3.9% with adjuvant chemoradiotherapy[75]. The decision for adjuvant chemoradiation is best determined by multidisciplinary review, taking into account patient preferences and candidacy for surgery or chemoradiotherapy.

Non-curative resection in non-operative candidates

While completion surgery is still recommended following non-curative T1 CRC resection, in patients at high risk for surgery, a conservative approach may be justified. A single center retrospective cohort of 180 patients with non-curative ESD who underwent additional surgery or endoscopic surveillance alone had no significant difference in 5-year overall survival, disease-free survival, cancer-specific survival or cumulative recurrence[76]. In a multicenter cohort of 207 patients with non-curative ESD, conservative management was associated with a recurrence rate of 1.2% and no disease-specific deaths at a median follow up of 28 months, but had higher overall mortality compared to secondary surgery due to non-CRC causes[77]. This finding was reflected in a meta-analysis of 2961 patients with high risk T1 CRC treated by local resection or surgery. Disease-specific survival was similar at 5 years and net benefit of surgery became significant only after 10 years post-resection[78]. Overall survival in non-curative, non-operative patients is likely driven by comorbidities and advanced age, thus limiting long term benefit of further surgical intervention. Conservative management may be a preferable strategy in patients with limited life expectancy, and at high risk of morbidity and mortality from radical surgery.

CONCLUSION

Minimally invasive endoscopic resection techniques provide safe, and effective strategies for T1 CRC. Advances in resection techniques and treatment strategies offer further options for effective local excision, particularly for those of increased age and comorbid populations, in whom surgery is not preferred. With ongoing refinement, endoscopic management will continue to transform early CRC management.

FOOTNOTES

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