REVIEW

Assessment and management of the malignant colorectal polyp

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ABSTRACT

Colorectal cancer is the second most common cancer affecting men and women in England. The introduction of National Bowel Cancer Screening in 2006 has led to a rise in the proportion of colorectal cancers detected at an early stage. Many screen-detected cancers are malignant colorectal polyps and may potentially be cured with endoscopic resection, without recourse to the risk of major surgery or prolonged adjuvant therapies. Endoscopic decision making is crucial to select those early lesions that may be suitable for local endoscopic excision as well as identifying lesions for surgical resection, thus avoiding unnecessary surgical intervention in some and ensuring potentially curative surgery in others. This paper uses the current evidence base to provide a structured approach to the assessment of potentially malignant polyps and their management.

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INTRODUCTION

Colorectal cancer is the second most common cancer affecting men and women in England.¹ The introduction of National Bowel Cancer Screening in 2006 has led to a rise in the proportion of colorectal cancers detected at an early stage. Many screen-detected cancers are malignant colorectal polyps (10%) and may potentially be cured with endoscopic resection, without recourse to the risk of major surgery or prolonged adjuvant therapies.² Endoscopic decision making is crucial to select those early lesions that may be suitable for local endoscopic excision as well as identifying lesions for surgical resection, thus avoiding unnecessary surgical intervention in some and ensuring potentially curative surgery in others.

Endoscopists assessing these polyps must have the necessary skills and experience to

do so thoroughly and safely. Only those competent at resection of such lesions should consider removal. Each case should be considered individually with regard to patient comorbidity and polyp characteristics to determine the best management approach.

Endoscopy units should develop systems for referral and management of patients with malignant polyps. Some regions in the UK (South Wales and the North East of England) have developed complex polyp multidisciplinary meetings, and this is one model that may be appropriate. A British Society of Gastroenterology (BSG) position statement is anticipated in 2015, which will address the management of large polyps.

This paper uses the current evidence base to provide a structured approach to the assessment of potentially malignant polyps and their management.

ASSESSMENT

Assessment of any polyp requires time to wash the polyp and to make an adequate visual assessment. High-definition endoscopy is preferred, with the use of narrow band imaging (NBI) or dye spray to more accurately assess the pit pattern.

Accurate assessment of polyp size is one of the most important factors in determining the risk of cancer in a polyp. While polyp size can be measured easily following resection, open biopsy forceps (of known width) can be used to estimate polyp size endoscopically. A large study that included >10 000 colorectal adenomas demonstrated that increasing polyp size was associated with increased likelihood of containing invasive carcinoma.³ No cancers were found in adenomas <5 mm in diameter; however, 42.7% of adenomas between 26 and 35 mm contained carcinoma, rising to 75.8% in adenomas > 35 mm.³

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Location of the polyp also affects the risk of finding cancer within it. One study, which examined adenomas measuring >5 mm, demonstrated the rate of finding invasive cancer within a rectal polyp (32.9%) significantly higher than in polyps in the right (17.9%) or left colon (13.8%).³ The size of polyp in relation to its location is also predictive of carcinoma risk, with the same study showing that adenomas measuring >35 mm in the right or left colon were more likely to contain invasive cancer than polyps of the same size in the rectum.³

Polyp morphology is best described using the Paris classification.⁴ Protuding lesions may be pedunculated (Ip), semi-pedunculated (Isp) or sessile (Is). Flat, elevated lesions are classified as 0-IIa or 0-IIa+IIc where there is a central depression. 0-IIb describes truly flat lesions (these are very rare in the colon), 0-IIc are flat with mucosal depression and 0-IIc+IIa demonstrate lesion depression with a minimally raised edge⁴ (figure 1). Adenomas may display mixed morphology, where two characteristics are present. A study investigating endomucosal resection of advanced polyps in 479 cases found that Is lesions were at low risk (7.5%) of containing cancer, whereas 0-IIc or IIa+c adenomas carried a 31.8% risk.⁵

The mucosal surface seen with chromoendoscopy or NBI is useful in assessing polyp histology. Kudo describes five different 'pit patterns'.⁶ Type I describes small round pits that typically represent normal histology. Stellar or papillary pits are type II, and roundish tubular pits are classified as type III (smaller than type IIIL) or type IIIL (larger than type IIIs). Type IV describes 'branch-like' or 'gyrus-like' pits, and type V pits show no structure (figure 2). Pit patterns I and II are usually not associated with malignancy.⁵ Types III and IV have 4.4% and 5.0% risk of containing carcinoma, respectively, whereas polyps with pit pattern V carry a 56.0% risk of malignancy.⁵

The Narrow-Band Imaging International Colorectal Endoscopic (NICE) classification system categorises

Figure 1 The Paris endoscopic classification of superficial neoplastic lesions. Reprinted from Participants in the Paris Workshop. The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach, and colon, *Gastrointest Endosc* 2003;58:s3–43 with permission from Elsevier.

the NBI appearance of the polyp surface according to colour, vessel appearance and surface pattern⁷ (figure 3). Type 1 appearances most likely demonstrate hyperplastic polyps and are characterised by colour similar to or lighter than normal mucosal background, few or no vessels and presence of dark or white spots. Adenomas appear browner compared with normal mucosa and brown vessels can be seen that surround white structures. These are classed as type 2. Lesions that likely contain invasive cancer are classified type 3 and appear dark with an unclear surface pattern and disrupted or absent vessels.

Laterally spreading tumours are superficial neoplasms measuring >1 cm, which extend laterally along the colon wall. These have either a granular appearance (LST-G), non-granular appearance (LST-NG) or a mixture of the two appearances⁸ (figures 4–7). LST-NG carry a higher risk of malignancy (14%) than LST-G (7%).⁸ Presence of a large nodule in an LST-G is the highest independent predictor of malignancy and also tends to be the site of deepest submucosal carcinoma invasion. LST-NG lesions are considered at higher risk of submucosal carcinoma invasion where the lesion is ≥20 mm or Paris pit pattern V is seen.⁸

Additional features that may signal the presence of invasive carcinoma within a polyp include an ulcerated or irregular appearance. Polyps that do not lift with appropriately placed submucosal injection of fluid are more likely to contain sm3 invasive carcinoma⁹ (figures 8–10).

The histological subtype of the adenoma also determines the risk of finding a carcinoma within it.¹⁰ Within the Bowel Cancer Screening Programme, villous adenomas are most likely to contain malignancy (10–18%), whereas tubulovillous (6–8%) and tubular adenomas (2–3%) carry lower rates of malignancy.¹⁰ These risks increase with increasing polyp size.³

STAGING MALIGNANT POLYPS

Malignant colorectal polyps are T1 cancers, meaning that malignant cells invade through the muscularis mucosae into the submucosa, but do not breach the muscularis propria.¹¹ Whereas malignant colorectal polyps are staged as T1 according to the tumour, node, metastases (TNM) classification system, not all T1 cancers are necessarily polyp cancers.¹¹ Pedunculated malignant colorectal polyps are classified according to the Haggitt criteria.¹² Haggitt level 1 describes carcinoma invasion into the submucosa but which is restricted to the head of the polyp. In level 2, invasion extends into the neck of the polyp; however, this can often be difficult to define. Level 3 includes carcinoma invasion of the stalk of the polyp, and level 4 describes invasion below the stalk but still limited to the submucosa with no extension into the muscularis propria¹² (figure 11). The Haggitt criteria can only be applied following excision of the polyp. Levels 1–3 can be managed endoscopically; however,

Type	Schematic	Endoscopic	Description	Suggested Pathology	Ideal Treatment
I			Round pits.	Non-neoplastic.	Endoscopic or none.
II			Stellar or papillary pits.	Non-neoplastic.	Endoscopic or none.
III _s			Small tubular or round pits that are smaller than the normal pit	Neoplastic.	Endoscopic.
III _L			Tubular or roundish pits that are larger than the normal pits.	Neoplastic.	Endoscopic.
IV			Branch-like or gyrus-like pits.	Neoplastic.	Endoscopic.
V _i			Irregularly arranged pits with type III _s , III _L , IV type pit patterns.	Neoplastic (invasive).	Endoscopic or surgical.
V _n			Non-structural pits.	Neoplastic (massive submucosal invasive).	Surgical.

Figure 2 Kudo classification of pit patterns with photographic correlation of lesions. Reprinted from *Gastrointest Endosc* 2006;64:604–13. Tanaka S, Kaltenbach T, Chayama K, et al. High-magnification colonoscopy (with videos). Copyright (2006), with permission from Elsevier.³⁶

where carcinoma invades below the polyp stalk (level 4+), surgical resection is necessary.

The Kikuchi classification is used to describe sessile and flat malignant colorectal polyps.¹³ sm1 describes invasion of carcinoma in the upper third of the submucosa, sm2 describes invasion into the middle third and sm3 is defined as invasion in the lower third of the submucosa close to the muscularis propria¹³ (figure 12). Application of the Kikuchi classification following endoscopic resection can be problematic as the muscularis propria layer is not included in the specimen. The degree of submucosal invasion in thirds

can therefore only be estimated. This is made even more difficult as carcinoma invasion destroys the muscularis mucosae/submucosal boundary. Measuring maximum depth below the muscularis mucosae may be a more accurate alternative, and it is generally accepted that a depth of invasion of <1 mm is a good prognostic marker for conservative management following endoscopic resection.¹⁴ On deciding upon a conservative strategy following endoscopic excision of a malignant polyp, other histological criteria should be considered, including lymphovascular invasion, differentiation of the tumour and presence of tumour budding.¹⁵

NBI International Colorectal Endoscopic (NICE) Classification*

	Type 1	Type 2	Type 3
Color	Same or lighter than background	Browner relative to background (verify color arises from vessels)	Brown to dark brown relative to background; sometimes patchy whiter areas
Vessels	None, or isolated lacy vessels coursing across the lesion	Brown vessels surrounding white structures**	Has area(s) of disrupted or missing vessels
Surface Pattern	Dark or white spots of uniform size, or homogeneous absence of pattern	Oval, tubular or branched white structure surrounded by brown vessels**	Amorphous or absent surface pattern
Most likely pathology	Hyperplastic	Adenoma***	Deep submucosal invasive cancer
Examples

* Can be applied using colonoscopes with or without optical (zoom) magnification

** These structures (regular or irregular) may represent the pits and the epithelium of the crypt opening.

*** Type 2 consists of Vienna classification types 3, 4 and superficial 5 (all adenomas with either low or high grade dysplasia, or with superficial submucosal carcinoma). The presence of high grade dysplasia or superficial submucosal carcinoma may be suggested by an irregular vessel or surface pattern, and is often associated with atypical morphology (e.g., depressed area).

Figure 3 The Narrow-Band Imaging International Colorectal Endoscopic classification system categorises the narrow band image appearance of the polyp surface according to colour, vessel appearance and surface pattern. Reprinted from Endoscopic prediction of deep submucosal invasive carcinoma: validation of the Narrow-Band Imaging International Colorectal Endoscopic (NICE) classification. Hayashi N, Tanaka S, Hewett DG, *et al.*, *Gastrointest Endosc* 2013;78:625–32 with permission from Elsevier.

All malignant polyps require a careful assessment and discussion within a colorectal multidisciplinary team (MDT) to determine an optimal treatment strategy.

Radiological imaging has a relatively limited role in the assessment of most malignant polyps as few techniques have the necessary spatial or contrast resolution

Figure 4 A granular laterally spreading tumour in the caecum. Photo courtesy of CJR.

Figure 5 The same granular laterally spreading tumour viewed with narrow band imaging. Photo courtesy of CJR.

Figure 6 A mixed laterally spreading tumour that demonstrates both granular (green arrow) and non-granular aspects (blue arrow). The black arrow demonstrates a prominent nodule. Photo courtesy of BPS.

to accurately assess the depth of invasion into the colonic wall (T staging). Although high accuracy of T staging has been documented for both CT and MRI, most reports focus largely on the distinction between transmural penetration of tumours versus those confined to the bowel wall (ie, T3 vs T1/2).^{16 17} Even for rectal malignancies, which are relatively more suitable for high-resolution MR imaging due to reduced motion, MRI has limited accuracy for early-stage lesions and often overstages T1 tumours as showing deeper invasion.¹⁷ Conversely, endoluminal ultrasound (EUS), whether performed using an echoendoscope or a rigid endoluminal transducer, has more promise

Figure 7 The same mixed laterally spreading tumour viewed with NBI. Photo courtesy of BPS.

Figure 8 A Paris IIa lesion. The blue arrows depict the polyp margins. A further small sessile lesion is depicted by the green arrow. Photo courtesy of CJR.

since it has inherently higher spatial resolution. One recent meta-analysis suggested that EUS is approximately 88% sensitive and 98% specific for T1 disease.¹⁸ However, prospectively recorded national audit data from both the UK and Germany suggest that this level of performance may not be generalisable beyond high-volume expert centres, with these real-world data suggesting T stage accuracy of only 55–65%.^{19 20} Accordingly, radiological techniques are rarely of value in assessing local invasion of malignant colonic polyps, and even the use of EUS for malignant rectal polyps should probably be restricted to

Figure 9 Submucosal injection of the same lesion with endoscopic mucosal resection solution. Photo courtesy of CJR.

Figure 10 The same lesion following submucosal injection. The green arrow shows an area that lifted poorly despite adequate injection. The blue arrows demarcate the polyp margins. Photo courtesy of CJR.

high-volume expert centres with audited proof of diagnostic accuracy.¹⁹ Assessment of nodal metastases is similarly limited, with CT, MRI and EUS all being approximately 50–70% sensitive, meaning that they add relatively little to pathological risk estimates made purely on the depth of local invasion.¹⁶ Cross-sectional imaging to search for distant metastases should probably be restricted to patients with high-risk malignant polyps since, by definition, polyps that are suitable for endoscopic removal have low rates of nodal or distant metastases.

MANAGEMENT

Endoscopic resection of probable malignant polyps should only be undertaken by a competent endoscopist with the aim of en bloc resection in one session.¹⁵ If it cannot be removed en bloc, discussion within a multidisciplinary forum should take place to decide upon the best management strategy. If polypectomy is planned or felt possible, biopsy of the polyp (in particular, sessile lesions) should be avoided as this adds a risk of tethering and makes polypectomy more difficult. A multicentre group in the North of England

reviewed the short-term outcomes of malignant colorectal polyps that were managed either endoscopically or surgically.²¹ Of the 386 polyp cancers studied, 165 underwent surgical resection and 221 were excised endoscopically (37 piecemeal excisions, 184 polypectomies). There was no difference in survival between the two groups; however, 12 recurrences were identified over a 23.5-month period of follow-up. Five of these were endoscopically managed (4.2%) and seven were surgically managed (2.6%).

Malignant polyps can be considered adequately removed when there is^{12 15 22}

- ▶ a 2 mm resection margin
- ▶ the tumour is well or moderately differentiated
- ▶ no lymphovascular invasion
- ▶ Haggitt stage 1–3 (stalked polyp) or <1 mm depth of invasion below the muscularis mucosae (sessile/flat lesion)
- ▶ absence of tumour budding.

Potentially malignant polyps should be photographed and a tattoo placed in accordance with local colorectal surgical policy. The authors suggest first creating a raised saline 'bleb' distal to the polyp before injecting with tattoo solution (figure 13). Ideally a photograph should be taken that demonstrates the location of the tattoo relative to the polyp.

ENDOSCOPIC RESECTION

An endoscopic snare is most frequently used to remove stalked malignant polyps with the snare located closer to the bowel wall to ensure adequate resection margins are achieved.¹⁵ Polyps with thick stalks may require endoscopic pretreatment with dilute adrenaline injection to reduce the risk of periprocedural bleeding.²³ Application of clips or an endoloop are alternative strategies to prevent bleeding; however, placing these prior to resection may impede the resection process. The authors therefore prefer to apply clips or the endoloop following polyp resection if required.

Endoscopic mucosal resection (EMR) involves injection of fluid into the submucosa to raise sessile polyps away from the underlying muscularis propria. This enables en bloc resection using a snare for lesions up to 2 cm in size and reduces the effects of thermal injury to deeper submucosal and muscle layers. Normal saline is commonly used as the injection fluid; however, colloids or solutions such as glycerol

Figure 11 Haggitt criteria (adapted from Haggitt *et al*¹²). The grey area represents carcinoma invasion. Levels 1 and 2 demonstrate submucosal carcinoma invasion restricted to the head and extending to the neck of the polyp, respectively. Level 3 demonstrates carcinoma invasion of the polyp stalk, whereas level 4 shows invasion below the stalk but limited to the submucosa.

Figure 12 Kikuchi classification (adapted from Kikuchi *et al*¹³). The pink area represents carcinoma invasion. sm1 demonstrates invasion into the upper third of the submucosa, sm2 depicts invasion into the middle third and sm3 the lower third of the submucosa.

give a longer lasting effect.^{15 24 25} One author's (BPS) preferred solution is dilute hyaluronate solution (0.1%) for all EMR resections and simple endoscopic submucosal dissections (ESD). Contrast (indigocarmine or methylene blue) may be added to the injection fluid to aid demarcation of the lesion (figures 14 and 15). Injection of fluid directly through the potentially malignant polyp should be avoided due to a theoretical risk of tumour seeding.²⁴

Piecemeal endoscopic mucosal resection (P-EMR), using a snare, involves resection of a larger (>2 cm) flat or sessile lesion in two or more pieces after submucosal injection. This method is less preferable to en bloc resection of potentially malignant polyps because the resultant disordered multiple sections make histopathological interpretation difficult in terms of excision completeness and prognostication.¹⁵ Additionally, piecemeal EMR is more likely to result in residual tumour.²¹ It is therefore not recommended for polyps where malignancy is suspected but may be useful if the patient is not fit for surgery or a more prolonged or complex endoscopic resection technique.¹⁵ Argon plasma coagulation may be applied to the resected edges following P-EMR and to any areas of

prominent submucosa in the resection base, to ensure complete removal and therefore reduce recurrence²⁶ (figures 16–18).

Where en bloc resection is required due to risk of malignancy, but the lesion is ≥ 20 mm, ESD may be used. This involves fluid injection into the submucosa to lift the lesion, followed by dissection of the submucosa using an electrosurgical endoscopic knife.²⁷ ESD enables en bloc resection and acceptable histological assessment of the lesion. It also reduces the risk of local recurrence compared with P-EMR but is significantly more time-consuming and technically difficult, with a high risk of perforation (2–10%) and bleeding.^{28–30} It should therefore be only carried out by those with adequate experience and in a centre with full surgical back-up in the event of a complication.

Malignant polyps in the rectum may be removed using a transanal endoscopic microsurgical technique. This technique allows en bloc resection with adequate resection margins, in addition to enabling repair of the rectal wall defect where full-thickness excision is required. This method has been shown to be superior to conventional ESD when managing malignant rectal

Figure 13 Injection of tattoo solution following submucosal injection of saline. Photo courtesy of LJN.

Figure 14 A flat Paris IIb polyp, the margins of which are not seen clearly. Photo courtesy of CJR.

Figure 15 The same polyp following submucosal injection with endoscopic mucosal resection solution; the margins are seen more clearly. Photo courtesy of CJR.

polyps in terms of en bloc full resection; however, it requires anaesthesia and a longer hospital stay with a small risk of impaired bowel function postprocedure.³¹ Recently, a new hybrid approach has been proposed for complex rectal polyps using a single-access surgical port placed transanally to allow direct rectal access for both endoscope and laparoscopic instruments. This provides a highly flexible platform to facilitate either rectal ESD with retraction or full-thickness excision and wound closure.³²

FOLLOW-UP

Following resection of the malignant polyp, various factors must be taken into account when deciding whether surgical resection is required or whether endoscopic surveillance will suffice. An assessment of

Figure 17 Systematic snare and removal of sections of the same lesion following injection of lifting solution. Photo courtesy of CJR.

the risk of residual malignancy must be made to enable this decision.

Although there is no consensus on what margin is acceptable, patients with resection margins that are not free from malignancy histologically have a high risk of adverse outcome.³³ Histological criteria for adequate local excision have been mentioned earlier.

The presence of lymphovascular invasion is a significant risk factor for lymph node metastasis (OR 4.691).¹⁴ It is uncommon for poorly differentiated cancer to be present within a T1 polyp cancer; however, the presence of poor differentiation is significantly associated with a higher risk of metastatic disease and mortality.³⁴

Figure 16 A large rectal laterally spreading tumour with mixed granular and non-granular components. Photo courtesy of CJR.

Figure 18 Resultant mucosal defect following piecemeal endoscopic mucosal resection (EMR). The muscularis propria is highlighted by EMR solution containing contrast. Photo courtesy of CJR.

Where high-risk factors are present, surgical resection of the affected segment is generally recommended to reduce the risk of residual disease progression.¹⁵ For those patients in whom surgical resection is unnecessary, endoscopic follow-up should be undertaken to identify recurrence at the polypectomy site and to detect high-risk lesions elsewhere in the colon. UK guidelines suggest that where there is doubt about completeness of the original excision repeat endoscopic examination of the site should be performed at 3 months, with careful examination and biopsy of the polypectomy site, although our opinion is that where there is histological uncertainty about completeness of malignant colorectal polyp excision a site check should be undertaken immediately (rather than waiting 3 months).³⁵ If there is doubt about completeness of excision, a further endoscopy is recommended 6 months following this, with ongoing surveillance according to BSG adenoma surveillance guidance once the colon is clear.³⁵

As discussed earlier, radiological imaging is of little use in assessing the depth of local invasion by a polyp cancer but may assist in assessing lymph nodes and detecting metastasis. CT colonography should be employed as a technique for colonic surveillance only when colonoscopy is incomplete or contraindicated.

SUMMARY

Careful endoscopic assessment of all polyps is crucial to detect potential malignant colorectal polyps and to guide appropriate therapy. Tattoo placement is important to enable identification of the lesion at surgery or subsequent endoscopy. All patients with malignant colorectal polyps should be discussed in an MDT meeting to ensure appropriate, patient-specific care is provided, taking into account lesion characteristics, as well as patient comorbidity and preference.

Where endoscopic management is undertaken, the lesion should be removed en bloc by a suitably competent endoscopist. Histological assessment is important in determining the need for further surgical resection.

Contributors CJR conceived the idea for the review. LJN performed the literature search and prepared articles for review. LJN and CJR prepared the manuscript that was circulated repeatedly among all authors for critical revision. AP prepared the radiology section and also reviewed the manuscript. BPS, CJR and LJN provided endoscopic images relevant to the manuscript.

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