Management of colonic polyps and the NHS Bowel Cancer Screening Programme

This article describes the NHS Bowel Cancer Screening Programme and the management of large colonic polyps, many of which are diagnosed and managed successfully during bowel cancer screening, in addition to non-endoscopic management options.

Colorectal cancer is the second most common cause of cancer death in the UK, accounting for 16 000 deaths each year (Logan et al, 2012). It is associated with a significant financial burden in terms of hospital stay and potential surgical, oncological and palliative therapy. Early identification of malignant colonic tumours is associated with improved patient prognosis, less complicated surgery and reduced treatment costs (Winawer et al, 1993a). The most common cause of colorectal cancer is via the malignant transformation of adenomatous polyps. This is known as the 'adenoma-carcinoma sequence' (Bond, 2000). The removal of adenomas during colonoscopy reduces the incidence of colorectal cancer by up to 90% (Winawer et al, 1993b). These factors suggest that colorectal cancer is amenable to screening and numerous studies have examined various different approaches to colorectal cancer screening.

Colonoscopy is the gold standard test for the identification of adenomas and colorectal cancer. However, in the UK, it is neither economically nor logistically viable to perform mass population screening with colonoscopy. The potential harm and risks of colonoscopy also need to be taken into account (Burch et al, 2007).

Faecal occult blood testing allows mass population screening, is economically viable, and is safe and acceptable for patients. Larger adenomas and colorectal cancers tend to bleed intermittently, meaning that the identification of blood in the faeces by faecal occult blood testing may allow their detection. Individuals with positive faecal occult blood testing thus have an enriched colorectal neoplasia yield and can be offered colonoscopy (Lee et al, 2011).

This article describes the characterization and management of colonic polyps, concentrating on the management of large colonic polyps. It then describes the structure and function of the NHS Bowel Cancer Screening Programme, including new developments.

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Characterization and management of colonic polyps

A colonic polyp is an abnormal growth arising from the colonic wall. This section reviews different types of colonic polyps and approaches to their management.

What are the different types of colonic polyp?

The two most common histological types of colonic polyps are hyperplastic and adenomatous lesions. About 80–90% of colorectal cancers are thought to arise from adenomatous colonic polyps (Winawer et al, 1993b). In contrast, hyperplastic polyps are relatively benign lesions. They often arise in the rectosigmoid or rectum: in this location they are felt to be of no clinical significance and usually do not require removal. However, it is increasingly recognized that hyperplastic lesions in the more proximal colon may be precursors for cancer through a separate 'serrated' pathway (Bauer and Papaconstantinou, 2008).

Endoscopic resection of polyps (polypectomy) is an essential skill for colonoscopists as endoscopic removal of adenomatous lesions has been associated with a reduction in the incidence of colorectal cancer, through interruption of the adenoma-carcinoma sequence (Winawer et al, 1993b). Larger adenomas have a greater likelihood of containing cancer or progressing to malignancy than smaller lesions, emphasizing the importance of their detection and removal (Stryker et al, 1987).

Morphologically, polyps can be classified as pedunculated, sessile or flat (*Table 1*). Morphological classification is important as different polyp forms have different malignant potential. Features such as central depression may also indicate malignant submucosal invasion (Participants in the Paris Workshop, 2003).

The surface appearance of a polyp can be characterized by a classification system based the appearance of pits and vessels. This system, known as the 'Kudo pit pattern', can allow discrimination of hyperplastic from adenomatous polyps, and identify possible malignant lesions (*Table 2*). For example, polyps with type V pit pattern are strongly associated with malignant submucosal invasion (Kudo et al, 1994).

The morphology and surface characteristics of a polyp can therefore determine suitability for endoscopic removal by the exclusion of malignant features.

How are colonic polyps managed?

Small adenomas of 5 mm or less can be managed in a number of ways, primarily either by removal with biopsy forceps or the use of a metal snare (snare polypectomy). Lesions can be removed with or without electric current (diathermy). Larger polyps are usually removed with a diathermy snare. Such polyps are more challenging to remove than smaller lesions, with an increased risk of complications. Image enhancement techniques are available that are superior to conventional white light endoscopy in the detection of polyps and visualization of surface characteristics such as pit pattern to improve diagnostic accuracy (Machida et al, 2004). Commonly used forms of image enhancement include:

- High definition magnification endoscopy
- Chromoendoscopy using the spraying of a dye such as indigocarmine or methylene blue
- Narrow band imaging where modified optical filters are used in the endoscope light source system to give a blue light. This is sometimes called digital chromoendoscopy and has equivalent accuracy to chromoendoscopy (Machida et al, 2004; Iwatate et al, 2012).

With lesions over 1cm in size, placing a tattoo using an indelible marker such as India Ink is recommended. This enables the site of a previous polypectomy to be identified on endoscopic follow up and also helps localize the polyp in the event of a surgical resection. Tattooing is often not required for polyps in the caecum or rectum as these can be localized more easily (NHS Bowel Cancer Screening Programme, 2011).

The major complications of endoscopic polypectomy are haemorrhage and perforation, with increasing polyp size and caecal location identified as major risk factors (Rutter et al, 2014). Perforation may occur as a result of thermal injury to the colonic wall from the use of diathermy, barotrauma, mechanical stress from the endoscope or the entrapment of deeper layers of the colonic wall (deeper submucosa or muscularis) when closing a snare around a polyp (Fyock, 2010). There is increased risk of caecal perforation because the caecum is the thinnest and most distensible part of the colon (Parra-Blanco et al, 2000; Rutter et al, 2014). Post-polypectomy perforation in the endoscopic management of lesions of at least 20 mm has been reported in up to 1% of cases, which is considerably higher than for polyps of all sizes (approximately 1 in 1100) (Moss et al, 2011; Rutter et al, 2014). A perforation can range in severity from a localized perforation with a serosal burn causing localized tenderness (post-polypectomy syndrome) to a full thickness bowel wall tear causing peritonitis. Peritonitis requires urgent surgical intervention whereas a localized perforation may often be managed conservatively (Christodoulou et al, 2007). Perforation seen at the time of endoscopy can sometimes be managed with endoscopic clip and loop placement, but in this setting, patient admission and a period of observation is required (Buchner et al, 2012).

Post-polypectomy haemorrhage is the most common complication associated with endoscopic mucosal resection and can occur immediately or be delayed as a result of ulceration at the polypectomy site, occurring up to 14 days after a procedure. A large volume study featuring polyps of at least 20 mm in size reported an incidence of approximately 3%, but the mechanism for an increased haemorrhage risk in the caecum is not understood (Lee et al, 2013).

Historically, surgical intervention has been used to remove some larger polyps. However, modern endoscopic methods such as endoscopic mucosal resection and more recently, endoscopic submucosal dissection have been developed, allowing safe removal of even very large lesions, thus reducing the need for surgery (Moss et al, 2011).

Table 1. Paris Workshop guidelines for the morphological classification of colorectal lesions

Endoscopic appearance	Paris classification	Description	Visual description
Protruded lesions	Ip	Pedunculated polyp	
	Ips	Subpedunculated polyp	
	Is	Sessile polyp	
Flat elevated lesions	0–IIa	Flat elevation of mucosa	
	0–IIa/c	Flat elevation with central depression	
Flat lesions	0–IIb	Flat mucosal change	
	0–IIc	Mucosal depression	
	0–IIc/IIa	Mucosal depression with raised edge	

Adapted from Participants in the Paris Workshop (2003)

Table 2. Kudo pit pattern classification

Pit pattern	Description	Image	Expected histology
I	Round pits		Normal histology
II	Asteroid pits		Hyperplastic or serrated adenoma
III_S	Tubular or round pits smaller than normal pits		Adenoma
III_L	Tubular or round pits larger than normal pits		Adenoma
IV	Gyrus, branched, dendritic-like pits		Tubulovillous adenoma
V	Irregular, non-structural pits		Malignancy (adenocarcinoma)

Adapted from Kudo et al (1994), Kanao et al (2008)

Endoscopic mucosal resection is a technique where a mucosal lesion is lifted away from the underlying submucosa by injecting fluid around and underneath it to create a 'submucosal cushion'. The polyp is then removed using an electrocautery snare in either an en bloc (removal in one piece) or piecemeal fashion (multiple smaller pieces of a lesion are sequentially removed to achieve complete resection) (*Figures 1–5*). Failure of a polyp to lift in response to submucosal injection is known as the 'non-lifting sign', and these lesions are strongly associated with malignancy (Han et al, 2008). En-bloc removal is preferable as it allows more accurate histopathological assessment and has a lower rate of lesion recurrence (Woodward et al, 2012). Owing to the higher level of lesion recurrence associated with the piecemeal technique, frequent endoscopic follow-up and repeated therapy is often required to ensure complete polyp resection (Hotta et al, 2010). However, piecemeal removal is generally recommended for lesions of at least 20 mm in size because of concerns about the risk of perforation (Mannath and Ragunath, 2010).

Endoscopic submucosal dissection is a more advanced and technically challenging technique than endoscopic mucosal resection that allows en-bloc retrieval of larger lesions. Following the creation of a submucosal cushion, an electrosurgical knife is used to circumferentially cut the mucosa surrounding a lesion with subsequent dissection of the lesions away from the underlying submucosa. While endoscopic submucosal dissection has a lower recurrence rate than piecemeal endoscopic mucosal resection and allows more accurate histological assessment, the procedure takes longer and has significantly higher complication rates with the incidence of perforation up to 8.2% (Hotta et al, 2010). It is also not readily available in the UK.

Figure 1. Large sessile polyp identified.

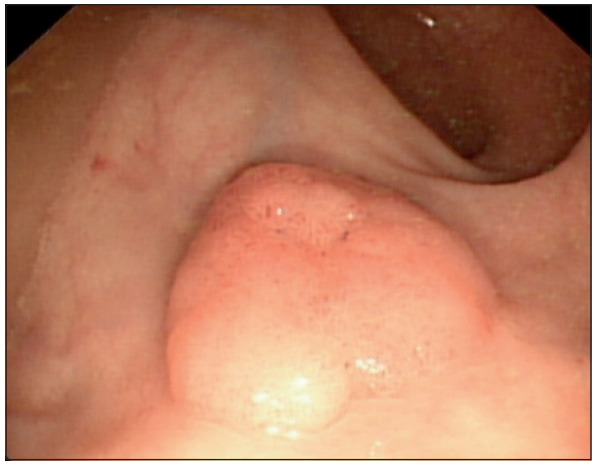


Figure 2. Submucosal injections made to lift lesion.

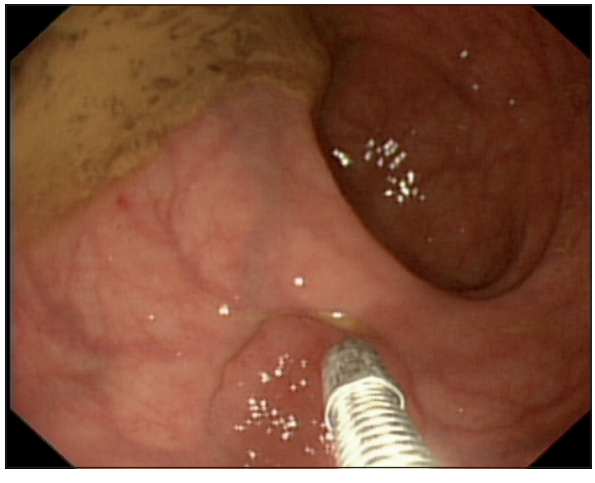


Figure 3. Sessile adenoma with submucosal lift.

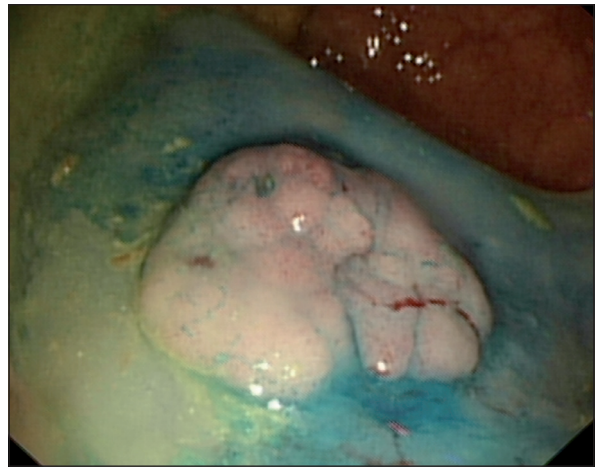
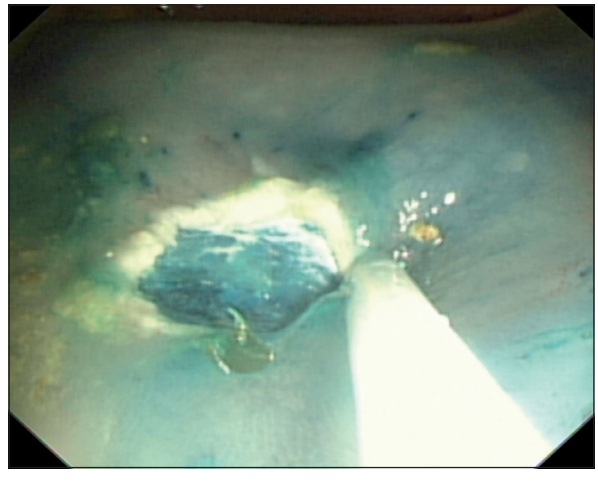


Figure 4. Snare passed around adenoma.

Figure 5. Post polypectomy site with clear base.



How is surgery used to manage large colonic polyps?

Historically, surgical intervention has been required for the removal of large colonic polyps but its use has reduced markedly with the establishment of endoscopic mucosal resection as an effective modality. Endoscopic resection has a significant financial benefit compared to surgery, with reduced length of hospital stay and procedural cost (Swan et al, 2009; Hotta et al, 2010). In addition, surgery, both open and laparoscopic, is associated with greater morbidity (Swan et al, 2009). Nonetheless, surgical intervention retains an important role in the removal of large polyps not amenable to endoscopic techniques, or where there are features that raise a concern about malignancy (*Table 3*). Submucosal invasion defines malignancy and such lesions are commonly associated with lymph node metastases. Endoscopic therapy may leave residual malignant cells and cannot sample or remove the lymph node basin and is therefore an ineffective treatment modality in this scenario (Williams et al, 2013). Laparoscopic resection occurs in approximately 40% of colorectal cancer resections. It is less invasive than open surgical resection and is associated with reduced length of hospital stay, pain scores and return to function with no difference in oncological outcomes (Bonjer et al, 2007; Vlug et al, 2011).

Laparoscopic surgery may also be used in combination with endoscopic polypectomy. The use of laparoscopic-assisted endoscopic polypectomy has been described for polyps where endoscopic removal was previously considered too difficult. Reported benefits include the potential to manipulate polyps into a more favourable position for resection while a visible perforation may be sutured immediately. While there is a view that laparoscopic-assisted endoscopic polypectomy may reduce surgical bowel resection, its use has only been described in small numbers (Wood et al, 2011).

In certain circumstances surgery may be considered suitable primary therapy for benign polyps. Trans-anal endoscopic microsurgery is a surgical technique performed under general anaesthetic that allows en-bloc removal of rectal lesions using submucosal dissection via a transanal approach (Papagrigoriadis, 2006). Trans-anal endoscopic microsurgery can treat large but superficial rectal adenomas which might otherwise require resection. This carries greater morbidity and mortality. The en-bloc method of removal ensures a lower recurrence rate than piecemeal endoscopic mucosal resection while also enabling better histological analysis (Barendse et al, 2012).

Optimal management of large polyps is dependent on careful assessment of the lesion for suitability of resection. Polyp site, morphology, size and accessibility are important considerations in assessing the most suitable method of lesion removal (Gupta et al, 2013). Discussion of the management of large lesions in a multidisciplinary team meeting may be desirable (Lee et al, 2013).

The NHS Bowel Cancer Screening Programme

History and structure of the Programme

Various trials of faecal occult blood testing-based screening have demonstrated a significant reduction in mortality from colorectal cancer. Three main trials were considered in the design of the English Bowel Cancer Screening Programme, the 'Minnesota Trial' (Mandel et al, 1993), the 'Nottingham Trial' (Hardcastle et al, 1996) and a Danish trial (Kronberg et al, 1996).

As a result of the findings of these trials, the Department of Health commissioned a pilot screening programme to assess the feasibility of using biennial faecal occult blood testing to screen the UK population. Pilot screening programmes were introduced in England and Scotland from 2000 onwards, inviting men and women aged 50–69 years. Initial reports concluded that similar outcomes in terms of test positivity, positive predictive value and shift in stage of screening-detected cancers were observed in the pilot studies as in the Nottingham trial. The report recommended a screening programme of biennial faecal occult blood testing for the UK, anticipating a 16% reduction in colorectal cancer mortality (The UK CRC Screening Pilot Evaluation Team, 2003).

After a second pilot round, the NHS Bowel Cancer Screening Programme for England commenced from July 2006. Scotland, Northern Ireland and Wales have similar (but not identical) separately organized programmes.

The screening programme in England comprises five hubs which manage the initial faecal occult blood testing screening through a call and recall system. Adults aged between 60 and 69 years were initially offered screening with patients over 70 years also able to opt in. After programme extension in 2008, patients aged 60–74 years are invited. Although dietary habits can reduce the specificity of faecal occult blood screening, no restrictions are applied as it was found to affect uptake in the pilot study. Patients receive the kit by post, complete it at home (by obtaining two samples from three consecutive stools), then return it by mail to the screening hub within 14 days of the first sample. Each faecal occult blood kit contains six windows and all faecal occult blood kits are assessed on the day they are received by the hub. An algorithm for follow up based on the faecal occult blood testing results is described in *Table 4* (Lee et al, 2011; Logan et al, 2012).

Table 3. Features favouring malignant polyp change

Larger and/or flat polyps
Ulceration, irregular contours or firmness
Hard consistency and broadening of stalk
Paris type 0–IIc
Kudo pit pattern type V
Laterally spreading tumour (non-granular type or nodule in a granular type)
Presence of non-lifting sign

Adapted from Williams et al (2013)

What are the outcomes of bowel cancer screening?

Figure 6 demonstrates the expected outcomes of the screening programme (NHS Bowel Cancer Screening Programme, 2013). The majority of individuals will receive a normal faecal occult blood testing result and will be returned to routine screening. They will be invited for bowel cancer screening every 2 years if still within the eligible age range (Logan et al, 2012).

As of the end of August 2013, over 18 million invitations to participate in the Bowel Cancer Screening Programme had been sent. The positivity rate of the faecal occult blood testing was 2.03% in all screening rounds. Over 200 000 colonoscopies had been performed with over 16 000 colorectal cancers detected (NHS Bowel Cancer Screening Programme Statistics, 2013, unpublished data).

The management of large colonic polyps in the Bowel Cancer Screening Programme

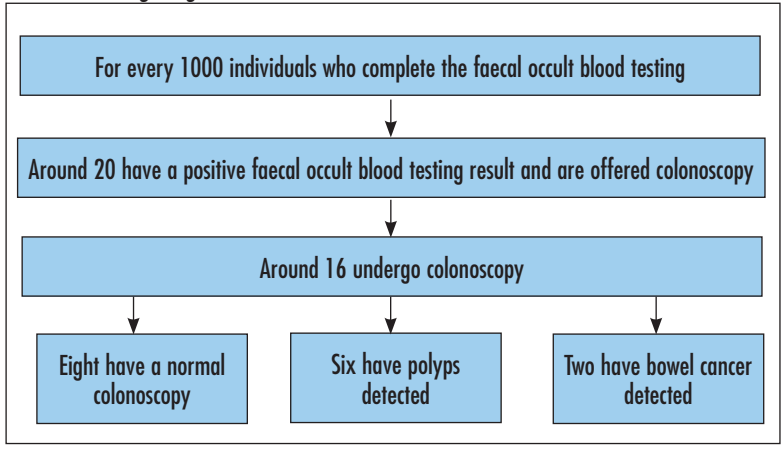
A large number of large colonic polyps are discovered and managed within the Bowel Cancer Screening Programme. This may be explained by the fact that patients undergoing colonoscopy have had an abnormal faecal occult blood testing. Lee et al (2013) reviewed the management of 557 non-pedunculated polyps of at least 20 mm in size diagnosed within the English Bowel Cancer Screening Programme. Of these 78% were initially managed endoscopically with 16.1% of these lesions subsequently requiring surgery. Low rates of endoscopic complications were reported (perforation and haemorrhage 0.5% and 3% respectively). These figures are comparable with other internationally published series and it appears that safe and effective management of large polyps can be delivered within a national screening programme (Lee et al, 2013).

Table 4. Algorithm of faecal occult blood testing results

	Criteria	Action
Normal	No positive windows	Discharge to next screening round in 2 years
Unclear	1–4 positive windows	Patient given up to two further faecal occult blood testing kits. If either subsequent faecal occult blood testing is unclear or abnormal, patient is referred for colonoscopy. These are classified as a 'weak positive' result
		If both subsequent faecal occult blood testing kits are normal, discharge to next screening round
Abnormal	5 or 6 positive windows	Patient referred for colonoscopy
Technical failure or spoilt kit	Lab processing problem or unreadable kit as a result of incorrect use	Further faecal occult blood testing kit sent

adapted from Lee et al (2011)

Figure 6. Predicted outcomes of bowel cancer screening. Adapted from NHS Bowel Cancer Screening Programme (2013).



Are there any new developments in the Bowel Cancer Screening Programme?

As larger adenomas and colorectal cancers bleed only intermittently, the sensitivity of faecal occult blood testing is only around 50%. Changes to the Bowel Cancer Screening Programme protocol have therefore been suggested, e.g. using faecal immunohistochemical testing, a quantitative test which permits adjustment of test sensitivity. Population screening with flexible sigmoidoscopy has also been investigated (Atkin et al, 1992). Although 30–40% of colorectal cancers arise proximal to standard sigmoidoscopy, flexible sigmoidoscopy is a more sensitive and specific test to detect distal cancers and polyps. In addition, the presence of larger adenomas (>1 cm) at flexible sigmoidoscopy is associated with a greater risk of proximal lesions and should prompt full colonoscopy (Atkin et al, 1992, 1996).

A randomized controlled trial of one-off sigmoidoscopy between the ages of 55 and 60 years demonstrated a 23% reduction in colorectal cancer incidence and a 31% reduction in colorectal cancer mortality on intention to treat analysis (Atkin et al, 2010). In light of these findings, one-off flexible sigmoidoscopy screening for patients aged 55 years has been piloted from March 2013 to complement faecal occult blood testing, aiming for roll-out across England by 2017. BJHM

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Conflict of interest: none.

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KEY POINTS

- Colorectal cancer imposes a significant burden on both individuals and society, and early diagnosis brings important survival advantages.
- The majority of colorectal cancers develop from precursor lesions called adenomas.
- Advanced techniques such as endoscopic mucosal resection mean that very few benign polyps need surgical resection. However, the technique is highly skilled and carries a risk of bleeding or perforation. Careful assessment and characterization of lesion to assess suitability for endoscopic resection and the competency of the individual endoscopist is vital to endure an optimal outcome.
- Surgical resection still has an important role in the management of colonic polyps deemed unsuitable for endoscopic removal and in many polyp cancers.
- The NHS Bowel Cancer Screening Programme invites men and women aged 60–74 years to enter a biennial faecal occult blood testing programme with colonoscopy recommended if the faecal occult blood test is abnormal.
- One-off flexible sigmoidoscopy screening for all patients aged 55 years and over is being instigated to complement faecal occult blood testing with roll out expected in England by 2017.