

COLONOSCOPIC POLYPECTOMY AND

ENDOSCOPIC MUCOSAL RESECTION:

A PRACTICAL GUIDE

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Introduction

Colorectal cancer is the third most common cancer in the United Kingdom with approximately 35,000 new cases diagnosed each year. The lifetime risk of being diagnosed with bowel cancer is about 1 in 20 for women and 1 in 18 for men. Most colorectal cancers are thought to arise in adenomatous polyps through the adenoma-carcinoma sequence and the removal of adenomas during colonoscopy has been shown to decrease the subsequent development of colorectal cancers.

Polypectomy is the most commonly performed therapeutic intervention and all colonoscopists should be able to perform the procedure safely and effectively. Practice has evolved considerably in recent years and there is now a range of equipment and techniques available for different clinical settings. Despite a wealth of clinical experience however, the practical application of polypectomy techniques has been subject to few controlled studies.

These guidelines are based on a Medline literature search and on expert opinion and review. Their purpose is to highlight areas of good practice and promote the use of standardised protocols within and between centres.

Information and Consent

Patients should receive written information giving details of the colonoscopy and the potential for polypectomy prior to the procedure. It is particularly important that patients are aware of the

risks of perforation and bleeding, that complications may be delayed and that surgical intervention may be required. The magnitude of risk should be clearly documented. Patients should also be aware of the alternatives to endoscopic polypectomy. Written consent should be obtained in line with local hospital policy.

Patient Preparation

Adequate bowel preparation is an essential pre-requisite to safe and effective colonoscopy. Poor bowel preparation increases the likelihood that polyps will be missed and may worsen the outlook should perforation occur.

A variety of bowel preparations are available. PEG and sodium phosphate-based preparations have been most often studied. Although there appears to be no significant difference in efficacy, sodium phosphate is better tolerated but is associated with a higher risk of clinically significant electrolyte disturbances [1]

Iron supplements and constipating drugs should be discontinued in the week prior to colonoscopy.

Optimising Polyp Detection

There is no doubt that polyps, even large polyps, may occasionally be missed during colonoscopy. Polyps are most frequently detected during colonoscope withdrawal and the

endoscopist should not rush the process. Withdrawal times of at least 6-7 minutes correlate with higher polyp detection rates [2,3].

A structured approach is recommended with the endoscopist examining all aspects of each colonic segment before withdrawing to the next. If the scope falls back too quickly, it must be re-inserted. Luminal residue should be cleared by flushing, suctioning and/or position change. Views may be particularly limited at flexures, on the proximal sides of folds and the ileo-caecal valve.

Both inflation and deflation can improve visualisation in different circumstances. Patient position change is also helpful if views are limited. The segment or flexure being examined should be positioned uppermost. Retroflexion in the rectum should be routine unless contraindicated and has been shown to increase polyp detection rates [4].

Morphological Features

Colonic epithelial lesions may be simply classified as pedunculated (stalked), sessile, flat or depressed. Epithelial lesions may be adenomatous, hyperplastic, serrated, inflammatory, and juvenile or hamartomatous. Adenomas (70% of all polyps) and hyperplastic polyps are the most frequently found. Adenomas have a variable appearance and are usually redder than the surrounding tissue but may be normal in colour or even yellow. There may be pedunculated, sessile, flat or carpet-like and the surface smooth, velvety/villous, lobular or nodular.

Hyperplastic polyps, on the other hand, tend to be pale and smooth and often have small vessels visible on their surface. They are usually flat or sessile but may be pedunculated. They may disappear on luminal distension.

Differentiating between adenomas and hyperplastic polyps using standard endoscopic appearances has an accuracy of approximately 80%[5] Magnifying chromoendoscopy (pit patterns) and narrow band imaging may give better results, but are not routinely available.

Although pedunculated and sessile lesions are usually easy to detect during endoscopy, flat and depressed lesions are readily overlooked. The endoscopist should be vigilant as the macroscopic appearance of such lesions is often subtle. Minor colour change, petechiae, interruption of the vascular pattern, a change in the texture of the mucosa and slight elevation or depression may sometimes be the only indication and are difficult to distinguish from localised inflammation or mucosal trauma. Fortunately, the application of indigo carmine dye readily demonstrates the interruption of the innominate groove pattern characteristic of a polyp.

A number of other pathologies may mimic polyps. Mucosal prolapse in the sigmoid colon may be confused with an adenomatous polyp. Punctuate erythema and petechiae and the gradual change in colour from the tip to the base suggests this diagnosis. Lipomas are pale, yellowish and often demonstrate the pillow sign. Removal should not be attempted unless the patient is symptomatic. Submucosal lesions can usually be identified by the normal overlying mucosa, by dye spray, and if doubt persists, by biopsy. An inverted appendix or appendix stump may also

catch the unwary. Simple biopsy is prudent if doubt exists. An inverted diverticulum may also masquerade as a polyp and ‘polypectomy’ will result in perforation.

The endoscopist should always consider the possibility of malignancy within the lesion to be resected. Ulceration, surface irregularity with depression and friability suggest invasion, as do convergence of folds or expansion of the normal tissue adjacent to the lesion. A failure of the lesion to lift away from the colonic wall (the non-lifting sign) following submucosal injection is suggestive of invasive malignancy [6], although an intense desmoplastic reaction and fibrosis from previous interventions may also tether the lesion to the deeper submucosal and muscle layer.

Indications and Contraindications

It is important to remember that most polyps identified at colonoscopy will never cause the patient harm. In most cases the adenoma-carcinoma sequence progresses slowly. The endoscopist should therefore always consider the likely natural history of the lesion, the age and co-morbidity of the patient and the risks of the intervention, prior to the procedure. However, the malignant potential of individual polyps is never known and even small/diminutive polyps can occasionally harbour cancer. It is therefore advisable that all polyps (even diminutive rectal polyps) should be removed unless they are obviously non-neoplastic.

Polypectomy should not be attempted on a lesion that does not lift following submucosal saline injection. Non-pedunculated polyps with overt signs of invasion are also best tattooed and biopsied.

Although some specialists are resecting larger and larger mucosal lesions, the endoscopist should only consider removing lesions within their level of experience. Polyps greater than a third of the luminal circumference, those crossing two haustral folds and those involving the base of the appendix or ileo-caecal valve are often best referred for segmental resection or to a specialist endoscopist.

Polyps found in close proximity to colorectal cancers should be documented rather than removed since polypectomy adds an unnecessary risk if the polyp lies within the resection margins of the tumour. Moreover, some have raised concerns that tumour seeding may occur into recent polypectomy sites and suggest that synchronous polyps be removed after appropriate surgical resection of the tumour.

Polypectomy should not be undertaken in patients with uncorrected bleeding disorders. The endoscopist should follow BSG guidelines on the management of anticoagulation. Although aspirin and non-steroidal anti-inflammatory drugs do not appear to increase the risk following standard polypectomy, these agents are probably best discontinued for one week before planned removal of large or complex lesions. Platelet aggregation inhibitors e.g clopidogrel are felt to pose a particular risk and are also best discontinued one week before polypectomy providing this will not put the patient at particularly increased vascular risk.

Good bowel preparation is not only critical for polyp detection but reduces the risk of poor outcome should perforation occur following polypectomy. Re-scheduling the procedure should be considered if the endoscopist finds a large or difficult lesion in the presence of poor bowel preparation.

The Practical Technique of Polypectomy

General considerations

Prior to polypectomy and endoscopic mucosal resection, the endoscopist should pay particular attention to the following points:

1. **The nature of the lesion.** The lesion to be removed should be fully characterised prior to removal. Its size and shape should be noted and if its boundary is unclear, indigo carmine dye should be applied. Photographic documentation is recommended. The nature of the lesion's attachment to the colonic wall is particularly important. Gentle probing with a snare or biopsy forceps will often improve the view when assessing larger polyps and may sometimes give the impression that the lesion is fixed to the muscle layer. Submucosal saline injection to assess lifting of the lesion away from the muscle layer may be helpful.
2. **Optimising the luminal view.** Luminal residue should be removed by flushing and/or suctioning or position change. The lumen should be adequately distended with air or

CO_2 . Over distension may occasionally reduce the view. Anti-spasmodics may also be helpful immediately prior to polypectomy.

3. **Colonoscope position and manipulation.** Polypectomy usually requires fine manipulation of the endoscope tip. Both torque and tip steering may be necessary prior to and during the procedure. If the scope position is unstable, loops should be removed and the patient's position optimised. It may also be helpful for the assistant to hold the shaft of the endoscope adjacent to the anus (sometimes with a degree of torque to anchor the scope in a stable position). It should be remembered that accessories emerge from the instrument in the 5 o'clock position. It is therefore usually helpful to rotate the scope (occasionally also the patient) such that the polyp base is in the 5 o'clock position and therefore in close proximity to the accessory channel.
4. **Accessories and diathermy unit.** The endoscopist should be familiar with all endoscopic accessories and the diathermy unit. Adequate opening and closure of the snare should be checked. The closure point should be marked clearly on the snare handle in order to avoid cheese wiring of the polyps and to give the endoscopist an estimate of the amount of tissue caught within the snare loop when resistance is encountered during closure. Diathermy settings should be agreed and checked with the assistant prior to the procedure. If the patient develops pain during the procedure transmural damage is likely to be occurring. The endoscopist should stop and reassess the situation.
5. **Communication with the assistant.** Communication with the assistant is an essential component of safe polypectomy. Rehearsing the procedure with the accessories outside the patient is helpful, particularly when the endoscopist and assistant have not worked together regularly. Clear, unambiguous instruction ('half/fully open snare', 'close snare',

'close to the closure point or point of resistance', 'needle out/back', 'inject x ml') with the assistant repeating the instructions once they have been performed reduces the risk of confusion.

Following resection the endoscopist should carefully check the site to ensure all pathology has been adequately removed or treated and to look for signs of bleeding or perforation. Photographic documentation is again helpful.

Specific Polypectomy Techniques

1. **Cold biopsy.** A simple cold biopsy technique is useful for removal of diminutive polyps and avoids the risks associated with thermal methods of removal. The open jaws should be targeted carefully to efficiently remove all abnormal tissue. Large cup biopsies are helpful. The technique has three disadvantages. First, it is likely to leave residual tissue unless the endoscopist is particularly vigilant. Second, it is inefficient when more than 2 or 3 biopsies are required. Thirdly, the field may become obscured with blood with subsequent biopsies necessitating flushing. The technique is probably best reserved for the smallest of polyps.
2. **Cold snare.** Cold snaring is a useful technique which is safe and effective in removing polyps up to 7 mm in diameter [7]. It is more effective than biopsy at completely removing polyp tissue [8]. It may be best used for sessile polyps as pedunculated polyps are thought to have larger blood vessels. Smaller snares are generally easier to manipulate

over diminutive and small polyps. The closure point should be marked on the snare handle in the usual way. The closed snare should then be passed down the colonoscope's channel and opened (some experts recommend opening the snare within the channel to give the endoscopist control of snare opening as it emerges from the endoscope). As with all snare resections, the V of the open snare should be positioned at the point at which the endoscopist wants the snare loop to close. This is usually at the junction between the polyp and the adjacent normal tissue, although some recommend also taking a 1-2 mm rim of normal tissue when undertaking cold snaring. Deflating the colonic lumen, to reduce wall tension, sometimes helps the polyp enter the polypectomy snare. Once the snare has been closed, the polyp should be moved around to ensure only the mucosal surface and lesion has been ensnared before the endoscopist or assistant finally cheese-wires the polyp prior to retrieval.

3. **Hot biopsy.** Hot biopsy is an alternative technique for removing diminutive polyps. Because of the risks of transmural thermal injury, it is best avoided in the right colon where the colonic wall is thin. It is now less commonly used and like cold biopsy, may leave residual tissue as the central portion of the polyp may not be fully destroyed [9]. There is also some anecdotal evidence to suggest delayed post polypectomy bleeding may be more frequent following hot biopsy [10]. During the procedure the tip of the polyp is grasped and then tented away from the wall to create a pseudo stalk. Electrocautery is then applied and, since current density concentrates at the narrowest point, the pseudo stalk is cauterised and the tip is then avulsed for histological analysis. The endoscopist

should watch carefully during electrocoagulation to avoid the excessive spread of thermal injury to the bowel wall.

4. **Hot snaring.** The technique of hot snare polypectomy is similar to that of cold snaring up to the point of snare closure. Tenting of the ensnared polyp is recommended prior to the application of electrocautery to lift the point of diathermy away from the muscle layer and minimise the risk of transmural injury. Some endoscopists prefer to operate the snare handle themselves during the application of cautery current to avoid the problems relating to communication with an assistant. Most experts recommend low power coagulation (25 watts) for both hot biopsy and snare polypectomy, but both blended current and the more recently introduced Endocut system can be reasonably employed. Snare closure is a more important determinant of tissue heating than both time and power setting. The endoscopist should therefore exert firm squeeze pressure during the application of the cautery current.

5. **Endoscopic mucosal resection.** Submucosal injection beneath a flat or sessile mucosal lesion lifts it away from the muscle layer. This has three potential benefits. Firstly, it identifies lesions invading or tethered to the deep submucosa or muscle layer (the non-lifting sign) which are unlikely to be suitable for endoscopic removal. Secondly, it raises a flat lesion onto a sessile dome which is more readily ensnared and, finally, lifting the lesion away from the muscle layer reduces the risk of transmural thermal injury as the point of polypectomy is moved away from the muscle layer [11].

Many endoscopists use saline with or without adrenaline but a wide variety of solutions are available and may result in longer lasting cushions. A first injection just proximal to the margin of the lesion is often advantageous as the resulting dome tilts the lesion towards the endoscope making it easier to snare. If difficulty is encountered finding the submucosal layer, starting the injection whilst the needle is still in the colonic lumen may be helpful. As the needle passes into the loose areolar connective tissue of the submucosa, the saline rapidly expands the space producing the characteristic dome. The endoscopist should be liberal with the injection volume, ensuring adequate separation between the lesion and the muscle layer.

Before performing EMR, the endoscopist should clearly identify the margins of the lesion in order to avoid incomplete resection. The application of indigo carmine may help and some recommend marking the periphery of the lesion with electrocautery spots.

A barbed or toothed snare may be used to gain additional purchase on the resulting dome. Reducing wall tension by aspirating air also helps to draw the lesion into the loop of the snare. Some recommend taking a rim of normal tissue with the lesion. The entrapped lesion should be moved to ensure the muscle layer has not been snared and then diathermy applied in the usual way.

Cap-assisted techniques are available but are used only in special circumstances

Choosing the Appropriate Technique

The endoscopist should consider the size, morphological characteristics and the position within the colon (right versus left) before choosing the appropriate technique.

For diminutive and small polyps, a number of the above techniques may be appropriate.

Diminutive polyps up to 3mm in diameter may be removed by cold biopsy irrespective of morphology from anywhere in the colon, although some recommend hot biopsy in the left colon. Slightly larger sessile polyps (up to 7mm) are best removed from the right colon by cold snare or EMR but in the left colon hot biopsy (up to 5mm) and hot snare (over 5mm) are also acceptable.

Large pedunculated polyps are best removed by hot snare. Ideally the stalk should be transected such that this leaves some residual stalk which can be re-grasped should bleeding occur.

However, it should be remembered that a longer length of stalk attached to the polyp head increases the chance of successful endoscopic resection if cancer is subsequently found [12].

Pedunculated polyps are more common in the sigmoid colon where the lumen tends to be narrower. Opening the snare with the colonoscope proximal to the polyp and then withdrawing the scope and open snare over the polyp head is sometimes necessary. Pre-treatment of thicker (>1 cm) polyp stalks to reduce the risk of immediate bleeding may be of value. Adrenaline, loops and clips have all been employed [13,14].

Larger sessile polyps may be removed by standard hot snaring but endoscopic mucosal resection is growing in popularity, and is probably safer, especially when removing lesions from the right colon. The endoscopist should aim to remove the whole polyp at a single sitting but should consider piecemeal resection for lesions >2 cm. When resecting larger lesions the submucosal

layer may need to be re-injected if saline is used. There is no limit to the volume that can be injected. The procedures may be time consuming so it is important for the endoscopist to allocate sufficient time.

Flat and depressed lesions should be removed by endoscopic mucosal resection. It should be remembered that depressed lesions have a particularly high incidence of submucosal invasion so may not lift away from the muscle layer..

When to Remove Polyps During Colonoscopy

Diminutive polyps, proximal to the rectum, seen during insertion, should be removed at the time since they may not be seen again during withdrawal. Furthermore, such resected specimens will readily pass down the suction/biopsy channel of the colonoscope. Larger polyps, on the other hand, are probably best removed on withdrawal, unless they are distal, and negotiation of the sigmoid has been rapid and uneventful. It is always prudent to mark the site of the polyp seen on insertion by taking a biopsy from the contra-lateral wall, to avoid the embarrassment of being unable to find the polyp again on withdrawal. The slight oozing and oedema induced by the biopsy are usually readily apparent even when the polyp being marked is not immediately visible.

If two or more significant polyps are detected in the same segment of colon, it is reasonable to tattoo the most distal site, resect the polyps and retrieve all in a Roth net, since if invasive

malignancy is found, the appropriate segment has been identified for resection. If two or more significant lesions are found in different segments of the bowel, each requires tattooing and separate retrieval. The endoscopist must decide, with patient consultation, whether to reinsert the colonoscope a second or third time or re-schedule a further examination.

Tattooing

Endoscopic tattooing of colonic polyps and polypectomy sites facilitate localisation if surgery or post polypectomy surveillance is required. Endoscopically unresectable polyps, malignant looking and larger (>1 cm) polyps should be tattooed. Tattoos should be placed submucosally at 3 radial points 1-2 cm distal to the site of polyp or polypectomy site. Small volumes should be employed and care taken to avoid transmural injection. Some experts recommend raising a small submucosal bleb of saline before switching to the tattoo ink thereby reducing the risk of transmural injection which can make subsequent surgery difficult.

Polyp Retrieval

Histological examination of the resected specimens is the only reliable way to classify polyps and exclude malignancy and is therefore an essential determinant of the need for further treatment and endoscopic surveillance. An attempt should therefore always be made to retrieve all resected specimens. Retrieval rates should exceed 90% and should be audited regularly.

Small polyps are readily retrieved through the suction/biopsy channel of the endoscope and are collected either in gauze or mesh between the suction port and the suction tubing or in an in-line suction trap. Most polyps remain at the site of injection or fall into the nearest dependent pool. If this is not readily apparent, injecting a small bolus of water and following it through will often lead to the pool and suctioning of the fluid will often retrieve the polyp. Changing patient position may also sometimes reveal a lost polyp.

Polyps are often soft and deformable allowing retrieval of lesions much larger than the diameter of the suction/biopsy channel. If the polyp impacts in the channel at the tip of the endoscope, the channel should be flushed and an alternative retrieval method employed. Larger polyps >1 cm may not pass through the suction/biopsy channel but may be suctioned onto the tip and withdrawn with the colonoscope. However, when using this technique, the polyp is readily dislodged during withdrawal and the view is often so limited that the colon distal to the polyp has to be re-examined.

Polypectomy snares, baskets and grasping forceps are often employed to facilitate removal of larger polyps. The polyp head or stalk should be held tight enough to maintain the grip during withdrawal but not too tight to transect the resected specimen. Care should be taken to avoid capturing adjacent mucosal folds when the specimen is picked up.

Retrieval nets (Roth nets) are particularly helpful in removing larger polyps from the proximal colon and also facilitate retrieval of multiple polyp fragments resected piecemeal [15]. The

resected specimens can be held securely away from the tip of the colonoscope to facilitate visualisation of the distal mucosa.

Multiple polyps may be time consuming and frustrating to resect and retrieve. Small polyps may be suctioned as described above and small polyps from the same region can be reasonably collected together. Multiple large polyps however require multiple reinsertions and occasionally a second examination is necessary to ensure collection of all resected material.

Complications and Follow-Up

Complications may become apparent during or immediately following polypectomy and the BSG guidelines on the management of endoscopy –related complications should be followed. Patients should be made aware that complications may present after they have left the endoscopy department and should be given written instructions detailing who to contact should unexpected symptoms develop.

Polyp surveillance is an essential part of management. The patient and primary care physician should be sent clear guidance once the results of the histological analysis are available. The BSG and BCSP guidelines should be followed as appropriate.

Audit and Skill Maintenance

Each colonoscopist should keep a log detailing polyp detection rate, endoscopic completeness of excision, retrieval rates and both immediate and late complications which should form part of their appraisal process. Skills improvement training should occur if practice falls below agreed standards.

Summary

- Polypectomy is the most commonly performed endoscopic therapy and all colonoscopists should be able to perform the procedure safely and effectively. Practice has evolved considerably in recent years and a range of equipment and techniques are available for different clinical settings.
- Although most pedunculated and sessile lesions are easy to detect during careful withdrawal, flat and depressed lesions often have subtle appearances and may be easily overlooked unless the endoscopist is vigilant.
- Prior to polypectomy patients should be aware of the risks and consequences of perforation and bleeding
- The endoscopist should always consider the likely natural history of the lesion, the age and co-morbidity of the patient and the risks of the intervention, prior to polypectomy. However, the malignant potential of individual polyps is never known and even small/diminutive polyps can occasionally harbour cancer. It is therefore advisable that all polyps (even diminutive rectal polyps) should be removed unless they are obviously non-neoplastic.
- The likelihood that the lesion contains invasive malignancy should be assessed from its morphology and if appropriate by submucosal saline injection. Biopsy and tattooing may be more appropriate than attempted resection

- A range of thermal and non-thermal polypectomy techniques is available. The endoscopist should consider the size, morphological characteristics and the position within the colon (right versus left) before choosing the appropriate technique. The right colonic wall is particularly thin and therefore more susceptible to transmural thermal injury
- Characterising the lesion, particularly its base, optimising the view and scope position, familiarity with the accessories and electrocautery unit and good communication with the assistant are essential for safe and effective polypectomy
- Diminutive polyps should be removed on insertion and will pass down the suction/biopsy channel of the colonoscope. Larger polyps are probably best removed on withdrawal, unless they are distal, and negotiation of the sigmoid has been rapid and uneventful.
- A number of different retrieval techniques are available. Retrieval rates should exceed 90% and should be audited regularly
- Endoscopic tattooing of colonic polyps and polypectomy sites facilitate localisation if surgery or post polypectomy surveillance is required.

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