DETECTION AND REMOVAL OF FLAT POLYPS, BIG POLYPS AND UGLY POLYPS
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Colonoscopy for colon polyp detection and removal has become one of the major clinical activities of most gastroenterologists. The objective of screening colonoscopy is to detect precancerous lesions and remove them with a resultant reduction in the development of colon cancer and lives lost to colon cancer. To be effective, colon cancer screening must identify and remove all premalignant lesions that are present in the colon and identify those individuals who require more frequent colonoscopies for advanced or multiple lesions.

There is significant variability in the quality and effectiveness of colon cancer screening, polyp detection, and polypectomy in practice today. The purpose of this lecture is to discuss the clinical and evidence based practice of flat and large polyp detection and removal that will hopefully provide useful information to even the most clinically advanced practitioner.

Polyp Detection
Polyp detection requires an optimum bowel preparation, quality visualization of the mucosa with endoscopic platforms, and operator expertise to examine the entire colon, behind folds and areas of suboptimal preparation during colonoscopy. This is especially true if flat polyps are to be detected.1

As many of the flat lesions are sessile serrated adenomas, they can be difficult to differentiate from the normal mucosa if the preparation is not pristine. Classically, they will have a mucoid surface layer that can be discolored and be easily hidden if there is discolored fluid in the same colon segment. Excellent colon preparation followed by meticulous washing of the mucosa is necessary to exclude these important lesions.

It is more unusual to miss large or ugly polyps as long as the colon preparation is good and only a thin layer of discolored fluid is left. Rarely, a large pedunculated polyp can be mobile enough to evade detection initially if there is motility or areas of spasm in the left colon. With careful withdrawal techniques these lesions should be readily detected.

Performing a complete colonoscopy is also key in polyp detection. Careful examination of the cecum and ileocecal valve is essential to avoid missing flat polyps that can easily evade detection in the base of an angulated cecum or behind a lipomatous IC valve. Careful examination and photo documentation of the appendiceal orifice and terminal ileum can be useful in confirming that the entire colon was examined.

Retroflexion in the cecum and right colon may be associated with increased polyp detection and has been used by some individuals routinely. Retroflexion in the cecum allows rapid inspection of the mucosa behind folds. It may also assist detection of lesions in the hepatic flexure as well. It is a technique that is useful to use to inject the upstream margin of large colon polyps prior to resection.3 In the left colon, we will sometimes use an upper endoscope for resection as this scope can be more easily retroflexed in the sigmoid and descending colon to facilitate resection.

Polyp Examination
Once located, a lesion should be carefully examined to characterize its nature and plan resection. Since most lesions are less than 10 mm, they can be quickly examined and unless depressed, resected with typical snare or forceps techniques. Larger lesions should be carefully examined to identify areas of concern that may harbor carcinoma in situ or more invasive carcinoma. In our practice, if the lesion is clearly malignant appearing, it will be biopsied and tattooed but not resected. If the lesion is large and not an obvious cancer then the trend has been to examine and classify the lesions using the Paris Classification.0-Is lesions are raised > 2.5mm above the mucosa. Non-polypoid lesions are either slightly elevated, termed 0-IIa (elevation < 2.5 mm above the level of the mucosa), completely flat (0-IIb), or slightly depressed (0-IIc). 0-IIa and 0-IIb lesions >10 mm in diameter with a low vertical axis but extending laterally along the interior luminal wall are termed laterally spreading tumors (LSTs).

LSTs are further sub-classified according to their surface morphology as either granular (G, nodular surface) or non-granular (NG, smooth surface). The Paris and granular classification have important implications in terms of submucosal invasion of cancer.4 The great majority of these lesions will be granular with Is and or 0-IIa morphology and have a low risk of submucosal invasion (perhaps 1%). A lesion with a 0-IIc component that is also nongranular has the highest risk of submucosal invasion of cancer that approaches 67%.4 The risk of submucosal invasion in 0-IIa NG lesions without a depressed component is intermediate at 15-20%. Among 0-IIa + Is NG lesions, the risk of submucosal invasion is 10% and if it occurs, it is most frequently beneath the Is NG component. The focal risk of SMI is significantly increased within a large nodule or depressed area or within the center of a NG lesion.5 These areas require preferential resection in the descending colon to facilitate resection.
the U.S. to characterize the depth of invasive cancer if it is present. Our strategy has been to resect the most worrisome area of the lesion and if possible, keep this in a separate jar. The remaining lesion is then resected piecemeal using various types of snares and saline or a plasma expander for elevation as described below. In our practice, surgical referral is made for all lesions with submucosal invasion and any mucosal lesion with lympho-vascular invasion or unclear margins.

Resection Tools and Techniques
Flat, large and ugly polyp resection often requires a special set of tools and approaches that should be readily available in the endoscopy facility. In an ideal situation, these lesions are approached in a well prepared patient who understands the increased risks of bleeding and perforation with large lesion resection. Many facilities have policies of deferring large lesion resection to a subsequent colonoscopy so that the risks benefits and alternatives can be more fully discussed with the patient once the lesion is identified.

Regardless, if you are going to approach these lesions in your endoscopy facility, I recommend the following:

1. High quality endoscopes with high definition imaging and filtered light for mucosal characterization (narrow band imaging or an equivalent).

2. Well trained staff comfortable with the use of typical polypectomy devices and other accessories for complication management.

3. CO2 insufflation. This seems beneficial in that there is less post procedure pain and theoretically (if not practically) less colon wall distention after a large polyp has been resected.

4. Saline or preferably a more viscous fluid for injection and lifting of the lesion. There is now good evidence that plasma expanders that are available in the U.S. may be effective in this role and have a longer “lift” time than plain saline.6 Most experts prefer that the fluid is tinted with indigo carmine or methylene blue to provide a color differentiation with the normal mucosa and to better define the submucosal plane.

5. A selection of various types of snares, injectors, caps, retrieval devices, clips and other accessories for polypectomy. In our units, we have created an advanced polypectomy kit that can be easily restocked and moved from room to room. It is essentially a storage box that contains all the uncommonly used devices for large polyp resection in one location.

6. A high quality electrosurgical generator that offers automated cutting cycles and argon plasma coagulation for management of residual adenoma after resections.

7. Endoscope caps to assist in polyp manipulation and resection.

Once the lesion had been located and a decision is made to resect it, the grounding pad is placed and all the equipment for the resection is prepared and present in the room. The patient may be repositioned to allow maximal access to the lesion. The endoscope is rotated so the lesion is easily approachable with the resection devices. Injection of a lifting substance is initiated often using a retroflexed scope position so that the upstream margin of the lesion is easily approached. If done in a forward view position, the lesion is elevated from the location furthest from the endoscope so that it can be elevated into view. If the lesion is less than 20 mm, it will be resected en bloc. If the lesion is larger, it will be removed piecemeal starting with the most concerning area of the polyp.

Using a saline or fluid elevation of the lesion creates an infiltrated submucosa that allows the mucosal aspect of the polyp to be encircled with the snare. Then with suction, the lumen is collapsed and the snare retracted causing the mucosa to be entrapped. The lumen is partially inflated and the snare moved to be certain that the wall is not obviously entrapped. Current is then applied to the snare and the piece resected. The piecemeal resection extends forward from the initial defect until all the abnormal mucosa and a small margin of normal tissue has been resected.

The resection site is carefully examined looking for muscularis propria injury or defect. If one is detected, the site is closed with endoscopic clips. The resected pieces can also be examined for a “target sign.”7 This is a small piece of adherent muscularis that does not stain with methylene blue or indigo carmine and appears like a white central target in a background of blue. The site may require visual marking for follow up or surgery. A permanent tattoo is placed in the submucosa with sterile India ink or carbon black to identify the lesion.

Piecemeal resection of large sessile polyps is successful at controlling disease the majority of these patients. Most lesions are followed endoscopically in 3-6 months to be certain that the resection was complete. The site is examined and biopsied to exclude residual adenoma. Follow-up can then proceed in 3 years unless there are special circumstances that would trigger and earlier reexamination.

Special situations
Large pedunculated polyps
These can usually be safely resected from any location using epinephrine injection into the stalk and head of the polyp to reduce it size. The polyp can then be resected with a standard snare technique and the site clipped securely to prevent...
bleeding. Alternatively, a Polyloop™ can be placed around the stalk prior to resection and then the polyp can be resected above the loop so it remains securely in place.

**Polyp Extending in to the Appendiceal Orifice**

Injection into the submucosa can occasionally cause the entire polyp to lift and be resected with reasonable margins. If there is any doubt about the completeness of the resection, a simple extended laparoscopic appendectomy can be offered.

**Polyp Extending into the IC Valve**

Occasionally, a polyp will be detected near or on the IC valve with extension into the valve. This can be problematic due to difficulty in assessing how far into the ileum the polyp extends. Furthermore, the resection may extend circumferentially into the ileum. Fortunately, unlike the appendix, the endoscope can be advanced well past the lesion to be sure no residual adenoma exists.

**Large Sessile Polyps**

Laterally spreading tumors may extend over large areas of the colon making resection challenging. While there is no known limit to piecemeal resection, circumferential lesions are very difficult to completely resect and lesions that extend over 2 haustral folds are considered by many to be best approached surgically.

**Complications**

Advances in endoscopic management of complications of polypectomy has changed our approach and encouraged us to be more aggressive in the resection of these lesions.

**Perforation**

This remains one of the most dreaded complications of polypectomy. Using the techniques described above and elsewhere perforation can usually be avoided. Careful examination of the resection site is key if perforation is to be approached endoscopically. G. S. Ragu et al. nicely summarized new techniques for complication management at colonoscopy in his recent publication.

**Bleeding**

Post polypectomy bleeding remains a significant problem with rates that approach 6% in some series. While some bleeding can be self-limited and observed, patients with hemodynamic instability or any signs of active ongoing bleeding will need to be endoscoped again. Bleeding appears to occur more commonly form lesions resected from the right colon. If endoscopic therapy is necessary in the post polypectomy setting thermal therapy should be avoided to reduce the risk of perforation of an already damaged colon wall.

**REFERENCES**