Can endoscopy and laparoscopy be combined to remove complex polyps?

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The adenoma–carcinoma sequence describes a well-established progression from normal mucosa to dysplastic epithelium leading to invasive cancer. Any polyp left untreated has the potential to become a cancer. The diagnostic and therapeutic capability of endoscopy has been proven recently in a large study demonstrating a 53% reduction in mortality in patients undergoing regular colonoscopy [1]. The number of individuals set to undergo screening for polyps is to increase with programs incepted worldwide. As specialists in the field, we will see more and do more in the coming years.

A certain percentage of polyps encountered by the clinician will be termed ‘complex’ or ‘complicated’ and are therefore not amenable to simple removal techniques. Such polyps require additional intervention in light of the adenoma–carcinoma sequence and the fact that at least 15% of polyps that are not removable endoscopically actually harbor cancer. Advanced techniques for removal can be classed as

luminal (endoscopic mucosal resection [EMR]/endoscopic submucosal dissection [ESD]) or segmental full-thickness resection through surgery. Surgical resection with its inherent risks is often performed, although we understand that over 80% of these patients will have a benign lesion. More recently, combined endoscopic laparoscopic surgery (CELS), a new combined approach to tackling complex polyps has evolved. This article attempts to consolidate the available literature regarding the feasibility of this technique, in addition to providing guidance on how teams may embark on such a treatment.

Evolution of the technique (EMR, ESD to CELS)

The use of combined laparoscopic and endoscopic techniques has been employed for some time now, with the first report on sequential combined endoscopic and laparoscopic procedures for biliary choledocholithiasis described in 1994 [2].

“...combined endoscopic laparoscopic surgery can and should eventually be offered to all patients with polyps nonamenable to simple endoscopic polypectomy.”

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Karanfilian *et al.* then reported resection of a gastric vascular malformation through a CELS approach [3]. In 2003, Walsh *et al.* published a series of 14 gastric stromal tumor resections utilizing the CELS technique [4]. The evolution of lesion treatment began within the gastric field and with the tools in place, specialists transferred their skills from upper to lower intestinal disease; however, the use of this technique within the colorectal field is one of relative novelty.

Simple snare polypectomy was unsuitable for complex polyps, so EMR was developed. The key differentiating step in the procedure was the use of a submucosal injection (an injection of various components in solution). This injection provided a cushion, allowing piecemeal band or snare ligation with or without suction into an endoscopic cap (placed on the endoscope tip). However, piecemeal removal is imprecise and the adequacy of resection margins is important in the context of neoplastic disease. Presently, EMR has been used for lesions up to T1 (sm1) with a failure rate quoted as up to 10% [5]. The en-bloc resection rate is quoted as circa 58%, recurrence rate 14% and a perforation rate of 1.3% [5,6]. Average procedural time is quoted as 29 min [7].

ESD developed from EMR, representing a logical progression that attempted to ameliorate the imprecise nature of piecemeal resection through endoscopic dissection in the submucosal plane [8]. Specialist instruments were developed that transferred cautery energy through the working channel of the endoscope. Again, using a cap and submucosal injection, burns/marks are made around the lesion for demarcation purposes. From this, the submucosal plane is entered and using the cap as a retractor, submucosal fibers are divided. Piecemeal resection is obviated, providing larger surface area removal. If we compare ESD with EMR, the en-bloc resection rate is quoted as 84% and the recurrence rate 2% [9]. However, in expert hands the ESD technique gives a perforation rate of 6.2% with an average procedural time of 108 min [10]. These figures provide a key insight into why uptake in the western world has been slow.

Combined approach

From the inception of laparoscopic cholecystectomy, laparoscopic-assisted procedures have become ubiquitous. The limitations of ESD have the potential to be eased through the help of an extramural assistant. External manipulation of the bowel presents the lesion in a favorable fashion to the endoscopic operator. The expected outcome

is one of reduced operating time and lower risk of perforation. If a perforation does occur, rapid diagnosis can be made through direct observation and sutures placed.

■ Patient/polyp selection

Anesthetic safety as well as the suitability for an abdominal procedure should be assessed. Patients need to be counseled and consented for the possible need for a repeat procedure, pending histology. Potential risks and benefits should also be discussed.

The definition of a complex or difficult polyp is an individual one. Owing to this lack of consensus, arbitrary categories have been proposed. These include (but by no means are exhaustive) a polyp greater than 3 cm, a broad base, crossing two or more haustral folds and other difficult locations. Intrinsically, the colon with its folds and tortuosity can provide some of the most difficult locations and landscapes of the GI tract.

■ Technique

Laparoscopic instruments are used to manipulate and compress the bowel favorably presenting the lesion to the endoscopic operator. Two operators are therefore needed, capable in each technique. CO₂ insufflation is used both endoscopically and laparoscopically. Nakajima *et al.* have published an article about the endoscopic benefits of CO₂, primarily attributed to the rapid rate of absorption compared with room air (150× faster) [10,11]. Briefly, our technique is as follows. The patient is first prepared, draped and placed in lithotomy and a screening colonoscopy is performed to identify and mark the lesion as necessary. Once the lesion is identified and assessed (through ancillary techniques such as narrow-band imaging), an umbilical port is placed using the open technique and pneumoperitoneum is established. Next, the position of the lesion is reconfirmed endoscopically and laparoscopically, at which point, further ports are placed according to lesion location and operator preference. In some cases adhesiolysis or mobilization will need to be performed for lateral or retroperitoneal lesions. Once the lesion position has been identified, the base is presented favorably to the endoscopic operator by the laparoscopic operator. At this point, the method of endoscopic removal of the lesion is a personal one. Whether it be through simple snare, EMR or ESD, the choice will depend on the morphology of the lesion (further information on the CELS technique can be found in [12]).

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■ Literature review of existing data

To date a number of papers have published outcomes following colonic CELS procedures. A direct randomized comparative study between CELS and segmental resection remains elusive and may be impossible to perform [13]. In 2009, two relatively large series were published outlining colonic CELS outcomes [14,15]. Wilhelm *et al.* demonstrated that CELS performed on 146 patients gave a successful resection in 82%. A total of 17 of the polyps removed were found to be carcinomas (11%). A formal resection was required in 18% of the cases [13]. Another study by Franklin *et al.*, reporting 160 patients, showed a successful resection margin in 91% of the cases. A total of 7% of polyps were found to be carcinoma and a formal resection was required in 14% of the cases [14]. Smaller series have reported their respective outcomes varying from a resection rate of 26–91%, with a formal resection required in 9–32% [16–19]. Our own centers have also published data in the field. Whereas a randomized comparative study is not available, a comparative study was performed by J Yoo (Ronald Reagan UCLA Medical Center, CA, USA). Outcomes for five patients having CELS procedure were compared with that of nine having resection. All patients had successful resection. No conversions in the CELS group were required. No complications occurred in the CELS group, whereas the resection group had two patients having a post-operative wound infection as well as one case of ileus. On follow-up colonoscopy, two patients exhibited residual polyp and two patients had new polyps in different locations [20]. Lee *et al.* recently published long-term CELS results [21]. A total of 65 patients underwent the CELS procedure with 74% of the interventions classed as successful. Importantly, both studies identified a significantly reduced in-patient stay with CELS, at 1 day, compared with resections (circa 5 days).

■ Potential benefits/complications

Reducing the need for a colonic resection is the most fascinating potential benefit, along with obviating the complications and costs this method potentiates. Other benefits include the costs to the institution and the patient, although a formal cost analysis has not been performed to date. As data have demonstrated, length of stay is significantly reduced using the CELS technique compared with segmental resection. These cost benefits may be tempered by the requirement of having two skilled operators performing one surgery.

Surgery-specific complications, as with any laparoscopic procedure, include trocar injury, bleeding, infection and incisional hernias. Possible need for a repeat procedure pending histology is an unwanted consequence; however, from published series the number of polyps removed containing carcinomatous disease is small [14–19].

Recommendation

The vast majority of studies in the field, including the authors' own early experience, have concluded that CELS should be offered to a select subgroup of patients with favorable characteristics. We now envisage that with continuing development of tools, techniques and expertise, CELS can and should eventually be offered to all patients with polyps nonamenable to simple endoscopic polypectomy.

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