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**Title page*****Title***

Laparoscopic assisted endoscopic mucosal resection reduces the need for bowel resection for complex colonic polyps – long term outcomes

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## **Abstract**

### ***Background***

The size or position of complex polyps may restrict their endoscopic removal. Our aim was to assess short and long term outcomes of complex colonic polyps managed by laparoscopic assisted endoscopic mucosal resection (Lap EMR).

### ***Method***

This was a retrospective review of Lap EMRs performed between 2008 and 2018. All patients were managed by a complex polyp MDT.

### ***Results***

Lap EMR was performed in 55 patients with a median polyp size of 37.5mm. Four patients had complications and the median length of stay was 1 day. Malignancy was confirmed in 6 polyps of which 3 were unsuspected (5.5%). Residual or recurrent disease occurred in 15.9% over a median follow-up of 76 months and all were successfully treated endoscopically. In total 11 (20%) of these patients required bowel resection.

### ***Conclusion***

Lap EMR avoided bowel resection in 80% of selected patients. This technique is safe with excellent long term outcomes for complex polyps where surgery may otherwise be required.

## **Introduction**

Complex polyps are defined as those with an increased risk of malignancy, incomplete resection, adverse events or with a site morphology site access (SMSA) level of 4 (1). They can be challenging to treat and have a 10-15% risk of developing into cancer (1). Patients perceived to have endoscopically unresectable polyps may be offered surgery. Combined procedures can avoid bowel resection and use laparoscopic colonic mobilisation to improve access for safe endoscopic resection. A systematic review reported reintervention in 9.5%, adenocarcinoma incidence of 10.5% and a complication rate of 7.9% (2) for these procedures. Significant heterogeneity exists in these studies with variability in terminology, selection criteria and procedure technique.

Our tertiary centre coordinates a complex polyp MDT. Our aim was to assess short and long term outcomes of Lap EMR procedures managed through the MDT pathway.

## **Methods**

A retrospective review was performed of all Lap EMR procedures between September 2008 and October 2018. The IDEAL framework recommendations (3) and STROBE checklists (4) were applied. Outcomes included need for bowel resection, procedure duration, blood loss, complications, length of stay, readmissions, cancers detected, residual or recurrent disease and mortality.

Our complex polyp MDT was established in 2008 and discusses approximately 250 cases annually. Referral criteria and decision making pathways are based on national guidance (5). Lap EMR was considered when endoscopic intervention alone would unlikely be feasible due to size or access difficulties, would not achieve complete resection or had been previously unsuccessful. Exclusion criteria included patients unfit for general anaesthetic, polyps with clear evidence of malignancy and those declining treatment.

All procedures were performed at the national referral centre in Cardiff. Patients were pre-operatively assessed and fully consented including the possibility of conversion or second operation. Procedures were performed by an advanced endoscopist and one of two colorectal surgeons. All were active members of the MDT. Patients received standard bowel preparation, thromboprophylaxis, a urinary catheter and antibiotic prophylaxis.

A laparoscopy was performed and the bowel mobilised sufficiently to aid the colonoscopic procedure. A tape was tied around the terminal ileum to prevent small bowel distension during colonoscopy. Lesions were assessed for signs suggesting malignancy and converted to bowel resection in this scenario. An EMR technique was mostly used but a hybrid EMR ESD technique was used where necessary. EMR involved injection of lifting solution and whole or piecemeal polypectomy using a hot snare. The bowel was simultaneously manipulated by the surgeon to facilitate removal. For peri-appendiceal lesions, invagination of the appendix by the surgeon allowed full polyp excision. If too extensive, an appendicectomy was performed. Haemostasis was ensured and mucosal defects were closed with endoscopic clips. Laparoscopic inspection was performed to confirm bowel wall integrity before removal of the tape and closure. First colonoscopic surveillance was performed 3 months after treatment.

As a retrospective service evaluation, Cardiff University Research Integrity, Governance and Ethics Team confirmed ethical approval was not necessary.

## Results

During the study period, 55 patients were treated with Lap EMR (table 1) and an overview is shown in figure 3. There were no intra-operative perforations and estimated blood loss was minimal in 50 (90.9%) cases. Median duration of procedure was 156 minutes (IQR 127.5 to 185).

Median length of post-operative stay was 1 day (IQR 1 to 2). There were five complications in four patients (7.3%). One patient had a post-operative rectal bleed requiring blood transfusion and a right hemicolectomy. He was subsequently diagnosed with a coagulation disorder. Other complications included urinary retention (n=2), chest infection (n=1) and a wound haematoma (n=1). There were no readmissions.

Cancer was found in 6 polyps (10.9%) three of which were converted to resection during their procedure due to the suspicion of malignancy. The three diagnosed on final histology all had uncomplicated laparoscopic bowel resections at a later date.

Endoscopy and histology records were assessed for a median follow-up of 76 months (IQR 62 to 91). Of those without a bowel resection, seven patients (15.9%) had either residual (at 3 months) or recurrent disease (after 3 months) at their polypectomy site. All were benign and treated successfully endoscopically.

## Discussion

Lap EMR for complex polyps avoided surgery in 80% of patients selected through our MDT with a low complication rate and short stay. Our paper has the longest follow-up reported and is the first describing outcomes for patients managed with a systematic and objective criteria case selection by an MDT.

Our intra-operative conversion to resection (12.7%) was lower than comparable studies with some describing rates exceeding 20% (6-8) but complications (7.3%) were similar (4.4 to 15.3% (6-9)). We reported a lower number of unsuspected cancers (5.5% vs 3.3 to 10.2%).

Lap EMR is not widely utilised. Explanations may include lack of awareness, concerns regarding unrecognised malignancy or access to advanced endoscopy. A recent systematic review on surgically treated benign polyps reported unfavourable outcomes in terms of complications (24%) and mortality (0.7%) (10). Lap EMR is an effective long term treatment of selected complex polyps with minimal need for reintervention. Compared to bowel resection this technique potentially benefits patient recovery, functional outcomes and cost effectiveness.

Limitations of this study include its single centre, retrospective and observational design. There are logistical challenges of Lap EMR including equipment requirements and the need for two consultants. This may be offset by the avoidance of bowel resection and cost reduction but further evidence regarding quality of life and economic outcomes are required. Considering study heterogeneity, we support utilisation of the IDEAL recommendations for future research.

Lap EMR provides a safe option for complex polyps with benefits of low morbidity, short stay and excellent long term outcomes. It should be considered for selected polyps which may otherwise require surgery.

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Patient characteristics	
<b>Age (years)</b>	
Median (IQR*)	65 (62.5-69)
<b>Gender (%)</b>	
Male	37 (67.3)
Female	18 (32.7)
<b>ASA Grade (%)</b>	
1	30 (36.4)
2	27 (49.1)
3	8 (14.5)
<b>BMI (kg/m<sup>2</sup>)</b>	
Median (IQR)	28.6 (26.2-32.8)
<b>Smoker (%)</b>	
No	46 (83.6)
Yes	9 (16.4)
<b>Mode of presentation (%)</b>	
Bowel screening	35 (58.2)
Symptomatic	15 (27.3)
Colorectal cancer surveillance	4 (7.3)
Polyp surveillance	4 (7.3)
<b>Indication for Lap EMR (%)</b>	
Difficult polyp access	28 (50.9%)
Polyp size	13 (23.6%)
Polyp size and difficult access	11 (20%)
Previously unsuccessful endoscopic excision	3 (5.5%)
Polyp characteristics	
<b>Size (mm)</b>	
Median (IQR)	37.5 (20-48.8)
<b>Location (%)</b>	
Caecum	12 (21.8)
Caecum – appendix orifice	11 (20)
Caecum – ileocaecal valve	5 (9.1)
Ascending colon	5 (9.1)
Hepatic flexure	8 (14.5)
Transverse colon	3 (5.5)
Splenic flexure	5 (9.1)
Sigmoid colon	6 (10.9)
<b>Site Morphology Site Access (SMSA) Level (%)</b>	



1	0
2 **	5 (9.1)
3	11 (20)
4	39 (70.9)
<b><i>Final histology (%)</i></b>	
Villous/tubular/tubulovillous adenoma	44 (80)
Hyperplastic or serrated polyp	5 (9.1)
Adenocarcinoma	6 (10.9)
<b><i>Dysplasia (%)</i></b>	
Low grade	39 (70.9)
High grade	8 (14.5)
Not documented on report	2 (3.6)
<b>Table 1 – Patient and polyp characteristics</b> * Interquartile range ** The indications for Lap EMR in these polyps were extension into the appendix orifice (n=3), a lesion proximal to a sigmoid stricture not passable without laparoscopic assistance (n=1) and a previously unsuccessful endoscopic excision (n=1)	

**Figure 1 - Flow diagram of patients included in the study**

There was one mortality during the follow up period. This was 18 months after the procedure and unrelated to the complex polyp diagnosis.

\* Indications for appendicectomy included deep extension into the appendix lumen (n=3) and failure to lift after injection of EMR solution due to previous removal attempts (n=1)

\*\* All malignancies suspected during the procedure were subsequently confirmed as cancer on histology



