

Case Report

Tension Pneumothorax and Pneumoperitoneum after Endoscopic Submucosal Resection of a Rectal Adenoma

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Abstract

Advanced procedures for resection of large adenomas in the rectum are performed by Endoscopic Mucosa Resection (EMR), Endoscopic Submucosal Dissection (ESD) or Transanal Endoscopic Microsurgery (TEM). The two first procedures are performed with a fixed carbon dioxide flow rate of 1 - 1.5 liters per minute, whereas TEM is regulated to a maximal pressure of 12 mm mmHg. TEM procedures are often performed through all rectal layers to the mesorectum or peritoneum which is not considered problematic. The intention of EMR and ESD is to respect the lamina muscularis propria of the rectal wall. A life-threatening tension pneumothorax together with pneumo-mediastinum, pneumo-peritoneum and subcutaneous emphysema occurred immediately after a long lasting ESD procedure (75 minutes). Two penetration holes to the mesorectum was noted during the procedure, but left untreated. The condition was resolved with a pleural drainage and antibiotics, and the patient was discharged after 3 days without further complications. All layer penetration during colonoscopic procedures should be closed immediately as the pressure during the procedure is uncontrolled and might be high.

Introduction

The use of advanced colorectal polypectomy procedures is increasing because of more widespread use of population screening and more surveillance for suspected colorectal neoplasia. The three prevailing advanced polypectomy procedures are EMR, ESD and TEM. Expert endoscopists can radically treat advanced benign and early malignant tumors trans-anally and save some patients from major surgery. The recurrence rate after polypectomy is reduced by the use of advanced procedures as compared to ordinary snare resection. During the last 5 years, the number of colonoscopies and advanced endoscopic colorectal procedures has tripled in our unit.

EMR is indicated for medium size colonic and rectal adenomas. The rate of colonic perforations is low, except in the cecum where 10 % of procedures lead to an all layer penetration; most of them to the retroperitoneum [1]. The majority of EMR and ESD perforations can be handled endoscopically and most

penetrations to the peritoneal cavity during TEM are also managed endoscopically.

Never the less, penetrations like that occur while the intracolonic pressure is positive and CO₂ leak to the peritoneum or retroperitoneum is expected. ESD is being used for larger adenomas. The resection depth is deeper and the reported all layer perforation rates are significantly higher than after EMR [2]. TEM is used in the rectum only, and the depth of resection can be varied. All layer resections by TEM are commonly performed and often lead to penetration into the mesorectum or the peritoneal cavity. TEM is performed under positive pressure in the rectum and the open cavity often persists for more than an hour during surgery. Complications from retroperitoneal and mediastinal emphysema is a very rare event, only described in a few case reports. Pneumoperitoneum, on the other hand is frequently experienced, but major complications from this has not been described. The TEM equipment deliver a pressure regulated CO₂ insufflation (maximally 12 mmHg) whereas the colonoscopic procedures;

EMR and ESD are performed with a fixed flow rate of about 1.0 - 1.5 liters CO₂/minute without pressure control.

Case Report

A 71 years old healthy female had a flexible sigmoidoscopy at day 1 for hematochezia. She had a previous knee operation some years earlier and was medically well treated for moderate hypertension. American Association of Anesthesiologists score was 2. A 5 x 6 cm sessile neoplasm was found in the rectum 5 cm from the anal verge at 4-7 o'clock in the supine position (Figure 1). Colonoscopy revealed no further pathology. At day 10 Transanal Ultrasonography showed a T0 tumor which was verified by ultrasound based elastography. No biopsies were taken. Clinically, the tumor was also judged benign and an ESD procedure was performed at day 35. Procedure was undertaken on an Olympus platform (Evis Exera III videocolonoscope CF-HQ190). Two all layer perforations of 2 and 3 mm occurred after 22 minutes (Figure 2). It was noted that the perforation was to the mesorectal fat, and no intraperitoneal penetration was suspected. Consequently, the procedure was continued without closure of the perforations. The total procedure time was 75 minutes.

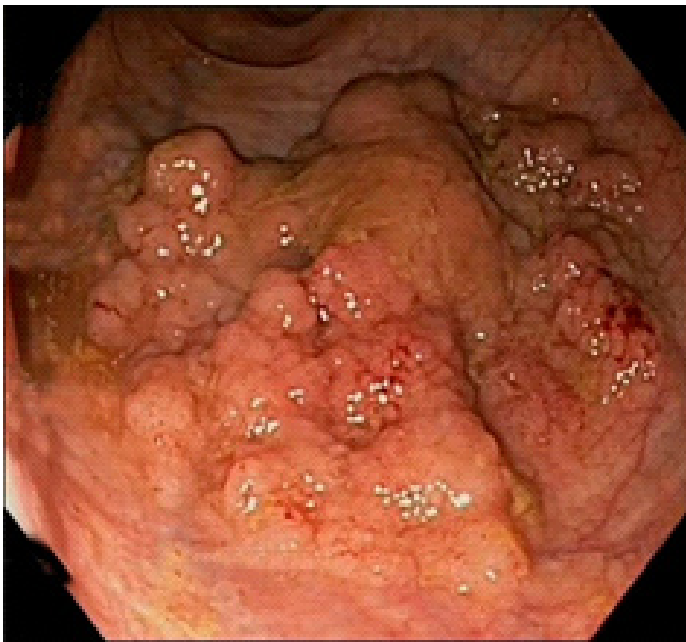


Figure 1: The resected benign rectal adenoma, before ESD.

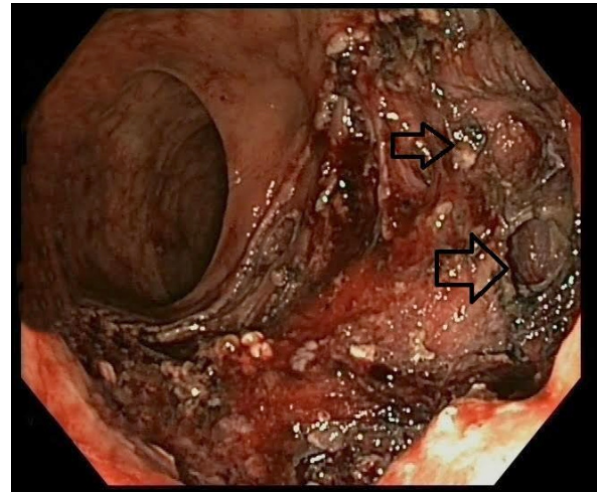


Figure 2: After the ESD resection, note the arrows are being the 2 sites of perforation to the mesorectum occurred.

No further complications or problems occurred during the procedure. 2 mg midazolam and a total of 30 mg pethidine were administered intravenously during the procedure and the patient was hemodynamically stable during the entire procedure. Blood pressure and pulse was monitored every 10 minutes and was in the interval of 160/80 to 130/70 mmHg. Immediately after the procedure rapidly developing subcutaneous emphysema was noted and the patient's voice changed character. She was transferred to the intensive care unit and an X-ray of the thorax was taken. The blood pressure was 85/50 mmHg, 20 minutes after the procedure. Mean Arterial Pressure was 50 mmHg and O₂ saturation was 80 %.

X-ray of the thorax showed a left sided pneumothorax with moderate mediastinal displacement (Figure 3). Computed Tomography of the thorax and abdomen showed massive pneumoperitoneum, mediastinal and retroperitoneal emphysema (Figure 3 and 4). A pleural drainage was inserted and antibiotic prophylaxis with cefuroxime 1500 mg and metronidazole 500 mg 3 times a day for 3 days was initiated. She immediately recovered with an O₂ saturation of 96 % and blood pressure of 140/80 mmHg. The pain score was 4/10 on a visual analogue scale. The pleural drainage was removed the next day, the subcutaneous emphysema reduced rapidly and the patient was discharged after 3 days. At 3 months follow up she was doing well and only a minor scar was seen in the rectum. Histology revealed a tubulovillous adenoma with high grade dysplasia.

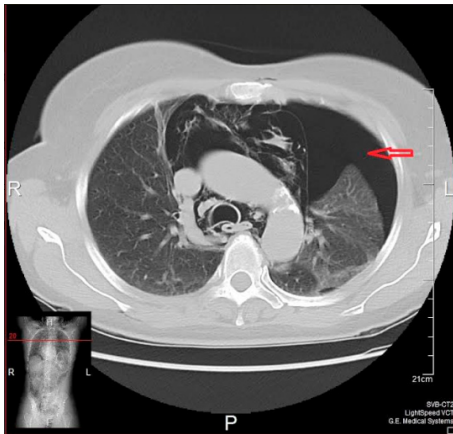


Figure 3: pneumothorax shown on CT scan, red arrow pointing at the collapsed lung.

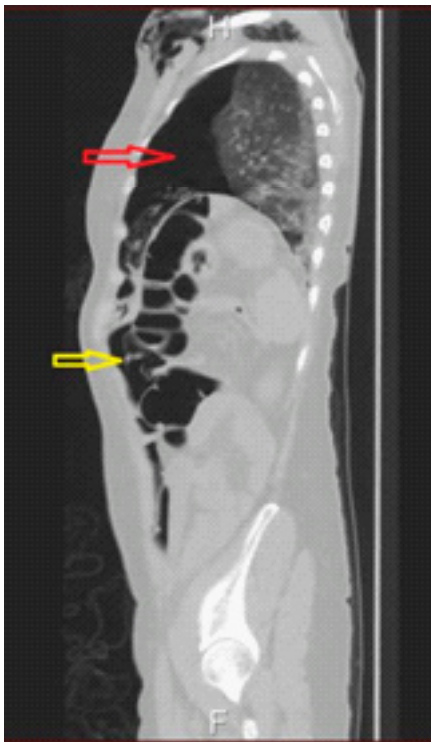


Figure 4: Whole body sagittal CT scan, the yellow arrow pointing at pneumoperitoneum, the red arrow pointing at pneumothorax.

Discussion

Emphysema of the sub-cutis, retroperitoneum and mediastinum has been described before in a few cases following EMR, ESD and TEM [3]. Mediastinal emphysema occurs mostly after upper gastrointestinal therapeutic endoscopy. One case of pneumothorax has also been reported after a rectal ESD procedure

[4]. Pneumo-mediastinum is frequent after upper gastrointestinal ESD and considered to be a minor complication [5]. In this case however, a quickly developing, potentially life threatening tension pneumothorax with mediastinal displacement and severely affected O₂ saturation occurred together with emphysema of the sub-cutis, retroperitoneum, mediastinum, larynx and pneumoperitoneum. The frequency of mediastinal emphysema after lower gastrointestinal endoscopic procedures such as ESD and TEM is unknown. Our unit has a high activity of 10.000 colonoscopies and 500 advanced polypectomy procedures annually (EMR, ESD and TEM) and this has not been observed as a clinical issue before. The use of prophylactic antibiotics after pneumoperitoneum in endoscopic colorectal resections is not evidence based but is routinely given in our unit.

The case illustrates the importance of a post-procedural observational period after advanced local colorectal procedures. Further; access to intensive care was important in the case presented. The frequency of these events is low but unknown and recommendations cannot be made on the basis of this case. We immediately suspected instrument error with too high CO₂ insufflation flow rate leading to an excessive pressure in the bowel. This could not be demonstrated by a technician's check of the insufflation system after the procedure, and it is likely that this happened in spite of a normal insufflation rate. The insufflation rate was as always determined by the endoscopists preference, balancing to obtain visibility and not over distending the bowel.

A case of life threatening CO₂ leak to the mesorectum through 2 minor perforations in the rectum during ESD is described. Even though this complication is rare, one could consider immediate closure of all layer penetrations, clips closure is today standard of care in endoscopic perforations. The reason for not applying clips in this particular case was that the seen perforations were not regarded of importance as they did not lead to any immediate physiological reaction. Furthermore, perforation in the rectum was regarded as an expected adverse event that could be dealt with in a conservative manner with observation with or without post- procedural antibiotics. A pressure control device for CO₂ insufflation during colonoscopy, as present in the TEM equipment, is not commercially available. The endoscopist should avoid unnecessary insufflation as is recommended in guidelines, but an adequate endoscopic treatment should be prioritized and must be balanced to the amount of CO₂ insufflation needed [6].

Acknowledgement

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Conflicts of Interest

None to declare.

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