

Case Report

Pneumomediastinum and Pneumoretroperitoneum with Perforation in the Sigmoid Colon Diverticulum after Colonoscopy: A Case Report and Literature Review

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Key Words

Colonoscopy;

Primary suture;

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Colonic perforations may occur after colonoscopy and are commonly associated with peritonitis and intraperitoneal free air. Besides pneumoperitoneum, subcutaneous emphysema, pneumomediastinum, and pneumoretroperitoneum may be rare signs of retroperitoneal colonic perforations. This report presents the case of an 80-year-old woman who developed subcutaneous emphysema, pneumothorax, pneumomediastinum, pneumoretroperitoneum, and pneumoperitoneum after a colonoscopic examination. The patient underwent an emergency laparoscopic repair of a retroperitoneal colonic perforation in the sigmoid colon diverticulum. Consequently, she had uneventful postoperative recovery and was discharged nine days postoperatively. Pros and cons of possible treatment options for colonic perforation during colonoscopy, such as primary suture by surgeons, endoscopic clipping or conservative treatment, were also addressed in this report.

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According to a 2017 census in Taiwan, colorectal cancer (CRC) is the most and second most common form of cancer in men and women, respectively.¹ People often opt to undergo colonoscopic examinations to detect CRC early, and most of these procedures proceed well. However, some patients experience colonic perforations after colonoscopy, with an incidence rate of 0.016% to 5%.² Pneumoperitoneum is commonly observed after colonic perforations, but retroperitoneal air accumulation, extensive subcutaneous emphysema, and pneumomediastinum have been rarely reported after retroperitoneal perforations.³ Overall, prompt diagnosis and treatment of retroperitoneal

colonic perforations are challenging, and colonic perforations are usually managed with antibiotic treatment, endoscopic clipping, and surgery. Surgical repair is generally preferred to endoscopic clipping, because it offers a higher complete bowel repair rate and a lower risk of postoperative peritonitis.⁴

Case Report

An 80-year-old woman underwent elective colonoscopy to evaluate colon polyps. The patient presented with multiple comorbidities, including hyper-

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tension, hyperlipidemia, stage IIIb chronic kidney disease, and cervical and lumbar spondylolisthesis. During the procedure, one large sigmoid colon diverticulum was identified, but the procedure proceeded normally. Two polyps were detected in the transverse colon, and polypectomy was performed. Shortness of breath gradually developed. No abdominal sharp pain was complained. After the colonoscopy, the patient developed hoarseness, breathlessness, chest pain, and abdominal pain. She also developed swelling on her face, neck, and upper chest wall, associated with subcutaneous crepitus. Therefore, she was immediately referred to the hospital's emergency department. Physical examination showed clear breath sound with symmetric chest expansion, and the abdomen presented with no tenderness but distension. Laboratory examination showed elevated white blood cell count (WBC: 13850/mcL) with neutrophil predominance (neutrophil: 91.2%). The CT scan results revealed a bowel wall defect (Fig. 1) in the sigmoid colon, along with pneumoperitoneum and pneumoretroperitoneum (Fig. 2). Extensive free air was also detected in the right retroperitoneal space. Moreover, pneumothorax, pneumomediastinum, and a subcutaneous emphysematous

change were observed in the bilateral superficial and deep soft tissue of the neck, thorax, abdomen, and pelvis. In order to identify the location of bowel perforation and to perform bowel repair, an emergent laparoscopic surgery was performed.

During the operation (Fig. 3), small bloody ascites without fecal content were noted in the abdominal cavity. In addition, some gas bubbles were observed to be distributed on the greater omentum along the whole transverse colon. However, no perforation was obser-



Fig. 1. CT scan of pelvis showed intra-abdominal free air associating with bowel wall defect at sigmoid colon (marked as ▲).

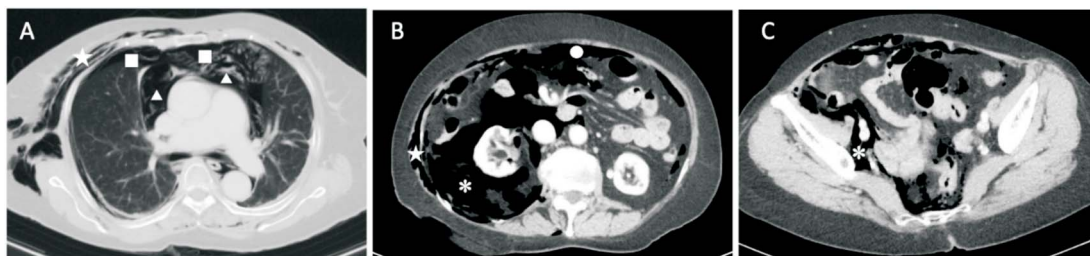


Fig. 2. CT scan from the chest to the pelvis revealing pneumomediastinum (marked as ▲) and bilateral pneumothorax (marked as ■) in the chest (panel A). Extensive subcutaneous emphysema (marked as ★) was observed from the neck to the trunk (panels A and B). Diffuse pneumoperitoneum (marked as ●) associated with right-side pneumoretroperitoneum (marked as *) was observed in the abdominal cavity (panels B and C).

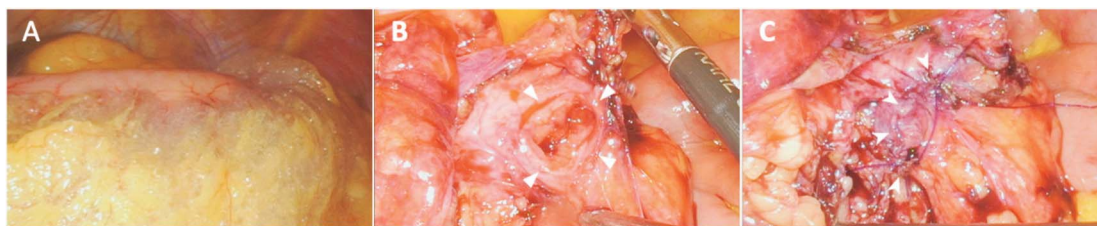


Fig. 3. Intraoperative findings. Some gas bubbles were noted on the greater omentum along the whole transverse colon (panel A). A 1 cm perforation was identified in the sigmoid colon (panel B). The perforation was primarily closed using a 3-0 Monocryl continuous suture (panel C).

ved after complete dissection of the ascending and descending colon. Congested pericolic fat was noted around the antimesenteric side of the sigmoid colon. After the pericolic fat was dissected, a 1 cm perforated diverticulum was identified in the sigmoid colon. The perforation was primarily closed using a 3-0 Monocryl (poliglecaprone 25) continuous suture, and the whole abdominal cavity was irrigated with warm normal saline. Then, a Jackson–Pratt drain was placed at the Douglas pouch to drain the intra-abdominal fluid and monitor any delayed leakage.

The patient was transferred to the surgical intensive care unit to observe her respiratory pattern after extensive pneumomediastinum was identified. She required 7 days to be disconnected from the ventilator until chest X-ray (CXR) indicated the resolution of the pneumomediastinum. Serial postoperative CXR revealed spontaneous resolution of the pneumomediastinum (Fig. 4). A conservative strategy for diet management was followed, including nothing per os along with peripheral parenteral nutrition for the first 3 days after the operation, followed by a gradual introduction of a clear liquid diet and soft diet. Consequently, the patient had an uneventful postoperative course and was discharged 9 days postoperatively.

Discussion

Generally, pneumomediastinum occurs under cer-

tain circumstances, including pulmonary diseases (e.g., asthma or respiratory tract infections), Valsalva maneuver (e.g., severe vomiting or coughing), and invasive procedures (e.g., foreign body aspiration, esophageal rupture, or bowel perforation).⁵ Some patients may also develop pneumomediastinum, pneumoretroperitoneum, pneumoperitoneum, and subcutaneous emphysema after a colonic or anal injury without bowel perforation^{2,3,6-9} or after colonoscopy.^{3,6,7} Once air leaks into the peritoneal cavity, it may pass to the thorax through the weak points of the diaphragm, a condition that may be congenital or related to a disease mechanism.^{2,8} If gas leaks into the retroperitoneal space during the procedure, this gas passes along the large vessels into the mediastinum, which may further result in pneumomediastinum and pneumothorax. Pneumothorax is generally pathological and warrants prompt treatment, whereas pneumomediastinum usually lasts for days and requires conservative treatment only, because it is mostly benign and asymptomatic.¹⁰

Colonic perforation is a common complication associated with colonoscopy and may result from barotrauma or direct trauma by either the colonoscope or the polypectomy procedure.¹¹ Among the risk factors associated with colonic perforations after colonoscopy are colon diverticulum, inflammatory bowel disease, and a history of colonic surgery or radiotherapy.¹² Both older adult patients and patients undergoing systemic steroid therapy are susceptible to perforation because of their poor bowel wall strength.¹³ In addi-

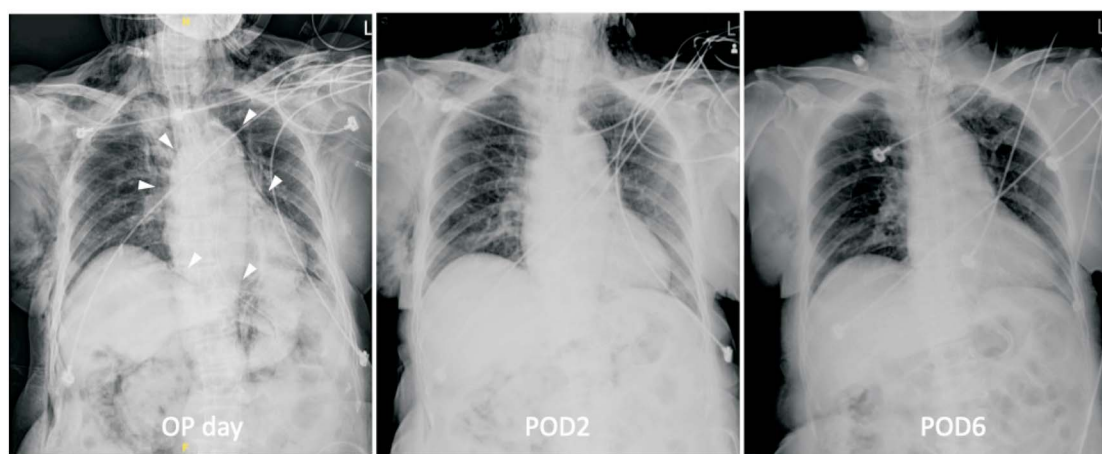


Fig. 4. Spontaneous resolution of pneumomediastinum and subcutaneous emphysema was noted on serial CXR from the day of operation to postoperative day 2 (POD2) until postoperative day 6 (POD6).

tion to relying on clinical symptoms and signs, a prompt diagnosis of colonic perforation after a colonoscopy usually requires a radiological examination, such as a CT scan. However, the management of colonic perforations varies depending on expertise and the physician's experience once a diagnosis is established. Among the treatment options for colonic perforations are conservative treatment with antibiotics only,⁹ endoscopic clipping,¹⁴ and primary repair or bowel resection.¹³

Endoscopic clipping can be used for patients without peritoneal signs.¹³ Instead of threads and needles, through-the-scope endoscopic clips are used to close the perforated bowel wall only if the perforation is less than 30 mm in diameter, that is, not wider than the clip.¹⁵ To increase the success rate of perforation repair, the seromuscular layer of the gastrointestinal tract is approximated.¹⁶ However, because the safety of endoscopic clipping is controversial, high rates of shifting from endoscopic clipping to surgical treatment have been reported. For example, in their review, Kim et al. reported that the number of patients requiring a shift to surgery is 3 out of every 16 patients (19%).¹¹ In another study, Magdeburg et al. reported a rate of shifting of four out of every nine patients (44%).¹⁷ Later, Lopez et al. expressed uncertainty toward the exceptionally high success rate of endoscopic clipping, stating that prolonged complications, such as fecal peritonitis, can occur even after 2 weeks of endoscopic clip closure.⁴

Primary closure is considered to be better than endoscopic clipping and is believed to be a safe and effective measure because it involves the full closure of all bowel layers. Generally, primary closure is feasible when the circumference of the defect is smaller than half that of the bowel and when the tissue is healthy and not contaminated with feces.¹² In their case series, Kang et al. concluded that if a patient develops peritonitis after undergoing endoscopic submucosal dissection for a large tumor, then surgical intervention may help shorten the postperforation fasting time and hospital stay.¹⁸ Colon resection is indicated for the treatment of patients who are suspected to have a colonic malignancy.¹² However, the consequences of a failed conservative treatment outweigh the risks of the pro-

cedure, with the complication rates and length of hospitalization being considerably high. Therefore, without a timely definitive treatment, the rate of peritonitis and diffuse inflammation in the intestine negatively affects the patient's prognosis.¹⁹

Conclusion

Along with having pneumoperitoneum, some patients may have pneumothorax, pneumoretroperitoneum, and extensive subcutaneous emphysema due to a colonic perforation after colonoscopy. Accurate diagnosis and prompt treatment are crucial to improving patient outcomes. Although some reports have indicated positive outcomes with endoscopic clipping for colonic perforation, surgery with primary closure may be the preferred treatment option. This is because primary closure minimizes the possibility of developing peritonitis as well as the need for further pathologic examinations for patients with a suspected malignancy.

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病例報告

結腸鏡檢查後乙狀結腸憩室穿孔導致縱隔腔氣腫和後腹腔氣腫：個案討論及文獻回顧

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結腸腸破裂是進行大腸鏡檢查時可能產生的併發症，後續可能併發腹膜炎以及在影像上發現腹腔內游離氣體。除了腹腔內游離氣體之外，皮下氣腫、縱隔腔氣腫、後腹腔氣腫這些罕見的情況也可能起因於後腹腔結腸破裂。此病例報告將討論一位 80 歲女性，在大腸鏡檢查後出現大量皮下氣腫、氣胸、縱隔腔氣腫、腹腔內氣腫及後腹腔內氣腫，並且進行緊急腹腔鏡乙狀結腸修補，術後第九天順利出院。在大腸鏡檢時發生結腸破裂時的處理方式，如外科手術縫合、內視鏡止血夾閉合破裂處、保守治療等方式的優缺點也在此報告內一併討論。

關鍵詞 大腸鏡、腸道修補、內視鏡止血夾、後腹腔內氣腫、縱隔腔氣腫。