

Case Report

# Pneumoperitoneum, Pneumoretroperitoneum, Pneumomediastinum, Pneumothorax, and Subcutaneous Emphysema after Colonoscopic Polypectomy: A Case Report and Literature Review

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Iatrogenic colonic perforations constitute an uncommon but potentially fatal complication of colonoscopy. Most of the perforations are intraperitoneal, but retroperitoneal perforations are relatively rare. Management strategies for iatrogenic colonic perforations could be divided into surgical and nonsurgical treatments depending on the type of injury, quality of the bowel preparation, underlying colonic pathology, size of the defect, time lapse of perforation, and clinical stability of the patient. Herein, we present a rare case of colonic perforation complicating with intraperitoneal and retroperitoneal free air. Literature review rendered such a production.

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## Key Words

Colonoscopy;  
Colonic perforation;  
Pneumoretroperitoneum

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**A** colonoscopy is a commonly performed diagnostic and therapeutic procedure for colorectal disorders, particularly for the diagnosis of colorectal cancer. Although the procedure is considered to be relatively safe, complications following colonoscopy are not uncommon.

Bleeding and perforation are the two main complications of colonoscopies. Iatrogenic colonic perforations may lead to life-threatening conditions. The

incidence of iatrogenic colonic perforations is 0.016%-0.8% for diagnostic colonoscopies and 0.02%-8% for therapeutic colonoscopies.<sup>1-4</sup> The complication rates of colonoscopies are increasing because of the focus on the prevention, early diagnosis, and treatment of colorectal cancer, in addition to the expansion of the indications for endoscopic resection of precancerous and malignant lesions.<sup>5</sup> A colonic perforation is defined as a full-thickness tissue defect involving all

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four layers (mucosa, submucosa, muscularis propria, and serosa) of the colonic wall.<sup>5</sup> The majority of iatrogenic colonic perforations are intraperitoneal perforations, but retroperitoneal perforations are extremely rare.<sup>6,7</sup>

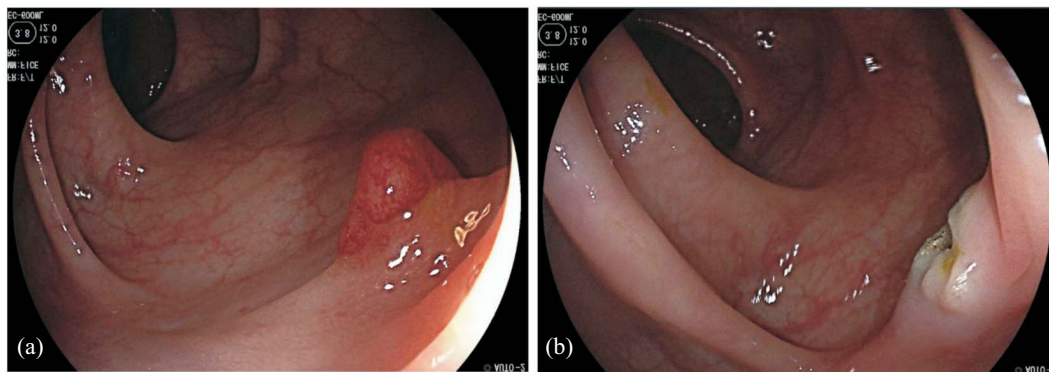
The treatment of iatrogenic colonic perforations varies on the basis of the causes of the perforation; characteristics and general condition of the patient; leakage of contaminants; time lapse, size, and location of the perforation; and clinical symptoms after perforation.<sup>2,5,8</sup> Traditionally, surgery was the standard treatment; however, endoscopic clip closure has become popular as a noninvasive method for closing the site of iatrogenic colonic perforation with clean bowel preparation.<sup>5,8</sup> Nevertheless, the efficacy and potential complications of endoscopic clip closure for iatrogenic colonic perforations have not been fully elucidated. Endoscopic clip closure may lead to delayed surgical intervention. For cases where surgical treatment is delayed, more invasive surgery including open colon resection with diversion may be necessary.<sup>8</sup> Although guidelines have not been created to standardize the management of iatrogenic colonic perforations, we present this rare case and review the relevant literature to share our treatment experience.

## Case Presentation

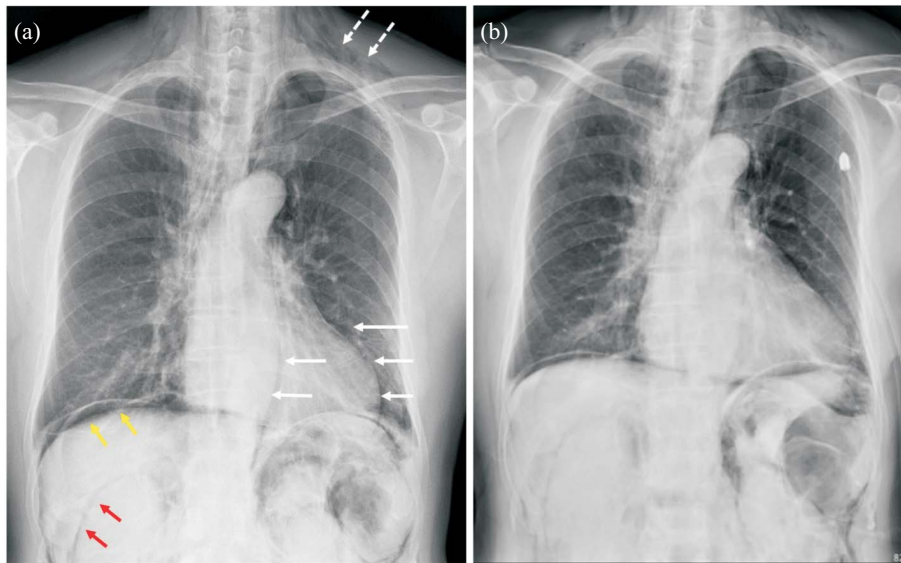
A 59-year-old male patient was referred to the emergency department with a report of chest tightness. He had a history of diagnostic colonoscopy per-

formed half a day before. The colonoscopy was indicated due to he had a positive fecal occult blood test. The gastroenterologist who had performed the procedure indicated that the colonoscopy was not complex and was performed safely. During the colonoscopy, several polyps were found at sigmoid colon and rectum; biopsy and polypectomy were performed successfully. One 0.4 cm size sessile polyp over sigmoid colon (Fig. 1a) was performed by hot snare polypectomy (Fig. 1b) which was the possible lesion of colonic perforation mentioned by operator during the colonoscopy. Room air was used for inflating the colon. Chest discomfort combined with abdominal distention was reported by the patient at the end of the colonoscopy and was resolved gradually when inflating was stopped. Several hours later, chest tightness, dyspnea, slight upper abdominal pain, distension, and chest and neck subcutaneous emphysema were detected through physical examination.

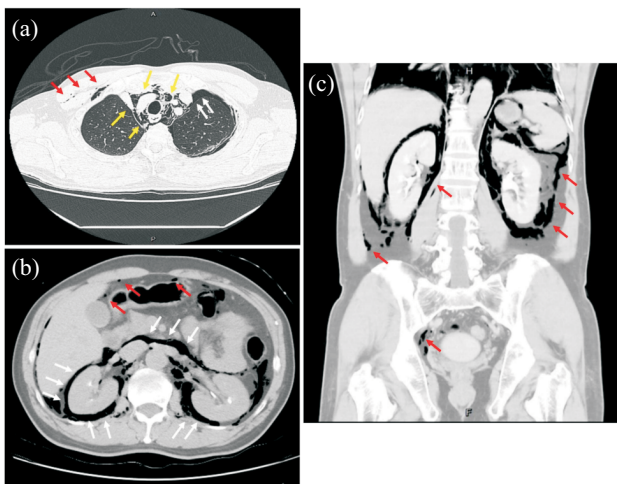
Laboratory findings were as follows: leukocytes, 15200/mm<sup>3</sup>; hemoglobin, 16.6 gr/dL; hematocrit, 47.9%; C-reactive protein: 22.6 mg/L; and Troponin I: 0.0122 ng/mL. Free air was detected on plain films of the chest (Fig. 2a). An abdominal computed tomography (CT) scan revealed pneumoperitoneum, pneumoretroperitoneum, pneumomediastinum, pneumothorax, and subcutaneous emphysema without fluid accumulation in the abdominal cavity (Figs. 3a, 3b, and 3c). Conservative treatment was first adopted under the patient's general condition stabilized. However, the symptoms of dyspnea and chest tightness gradually worsened. A left tension pneumothorax was



**Fig. 1.** Colonoscopy. (a) A 0.4 cm sessile polyp over posterior side of sigmoid colon; (b) Post hot snare polypectomy (suspected site of perforation).



**Fig. 2.** Chest radiograph. (a) Air in the perirenal space (red arrow), subphrenic area (yellow arrow), pneumomediastinum (white arrow), and subcutaneous emphysema (white dotted arrow); (b) Progressed left side pneumothorax following closed thoracocentesis.



**Fig. 3.** Abdominal computed tomography. (a) Chest section showed subcutaneous emphysema (red arrow), pneumomediastinum (yellow arrow) and left pneumothorax (white arrow); (b) Abdominal section showed pneumoretroperitoneum (white arrow) and minimal free intraperitoneal air (red arrow); (c) Coronal section showed air in the retroperitoneal space (red arrow).

diagnosed through an imaging study, and thoracocentesis was subsequently performed (Fig. 2b).

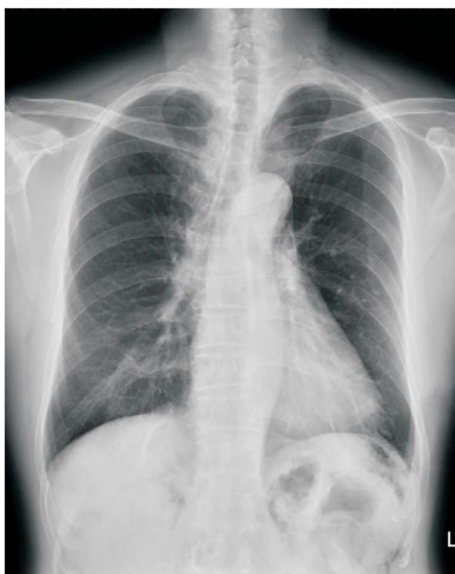
Conservative treatment included nil per os and intravenous nutrition, fluid, and antibiotics. The patient's condition gradually improved. We removed the

left chest tube after the amelioration of the pneumothorax, pneumomediastinum, pneumoperitoneum, pneumoretroperitoneum, and subcutaneous emphysema (Fig. 4). Subsequently, we gradually advanced the patient's diet, and he was able to tolerate it well without any discomfort. After 10 days of hospitalization, he was discharged with home health care and follow-up visits to the clinic.

## Discussion

The mortality rates of colonic perforations after colonoscopies are not considerably high; nevertheless, several studies have demonstrated that the complication rates of therapeutic colonoscopies are considerably higher than those of diagnostic colonoscopies.<sup>1-4</sup> In the case presented herein, pneumoperitoneum, pneumoretroperitoneum, pneumomediastinum, and pneumothorax were noted, demonstrating the combined presence of intraperitoneal and retroperitoneal perforations.

The literature presents several mechanisms underlying colonic perforations, including barotrauma (excessive air insufflation), direct mechanical trauma (the forward movement of the tip of the colonoscope,



**Fig. 4.** Chest radiograph showed successful treatment (reduction of subphrenic air, pneumomediastinum, and subcutaneous emphysema and improved left side pneumothorax).

lateral pressure against the bowel wall caused by the bowing of a loop of the scope, and the passage of the endoscope through areas of pathology), and the therapeutic procedure itself (e.g., polypectomy, endoscopic submucosal dissection, and stenting).<sup>1,5</sup> Air inflation-related perforations are usually associated with underlying morbidities, such as diverticulosis or inflammatory intestinal disease. Instrument-related perforations caused by the sharp tip of the endoscope during manipulation are responsible for most perforations, especially those involving kinks or adhesions to the colon. Therapeutic procedures have a higher rate of perforation, particularly in polypectomy for large polyps, multiple polypectomies, and pneumatic dilatation for Crohn's stricture. The rate of perforation varies by location; the sigmoid colon (53%-65%) seems to be the most common location for perforation, followed by the caecum (14%-24%), ascending colon (9%-17%), transverse colon (7%-9%), descending colon (5%-8%), and rectum (1%).<sup>2,4,9,10</sup> The most convincing reasons for this are the angulation of the sigmoid colon combined with the higher incidence of diverticula and the fact that the caecum walls are thinner and more fragile.

Araujo indicated that perforations usually occur in

the antimesenteric colonic wall, resulting in pneumoperitoneum.<sup>1</sup> Conversely, perforations over the mesenteric side can lead to retroperitoneal air dissection along the fascial planes into the perivisceral space, visceral space, paravertebral tissue, and subcutaneous tissue;<sup>1,6</sup> these four regions are common to the neck (subcutaneous emphysema), thorax (pneumothorax, pneumomediastinum), and abdomen (pneumoperitoneum, retroperitoneum). The case presented herein involved perforations over the mesenteric side.

Colonic perforation management strategies can be categorized into surgical and nonsurgical treatments depending on the type of injury (intraperitoneal or retroperitoneal), quality of the bowel preparation, underlying colonic pathology, size of the defect, time lapse of perforation, and clinical stability of the patient.<sup>2,5,8,10-12</sup> When the patient presents with signs and symptoms of peritonitis or other unstable conditions, the emergency surgery approach is reasonable and safe. However, in selected patients with localized pain, free air without diffuse free fluids in radiographs, hemodynamic stability, and an absence of fever, non-operative management may be appropriate and is associated with low morbidity, low mortality, and short hospital stays. The overall success rate of conservative treatments for colonic perforation ranges from 33% to 90%.<sup>2</sup> In the present case, the patient had no symptoms or signs of peritonitis and was hemodynamically stable. We also cautiously reviewed all the radiographs and his initial colonoscopy examination results. We first performed conservative management that involved serial clinical and imaging monitoring with absolute bowel rest, intravenous fluids for hydration, intravenous nutrition, intravenous administration of broad-spectrum antibiotics, and a close multidisciplinary team follow-up to promptly detect the development of sepsis and peritoneal signs. The conservative treatment was successful, and the hospital stay duration was 10 days.

Up to 75% of isolated retroperitoneal perforations are treated conservatively, and 60% of combined intraperitoneal and retroperitoneal perforations require surgical intervention.<sup>6</sup> However, occasionally combined perforations can be managed without surgery if the patient is hemodynamically stable with a benign

abdominal examination.

Various methods can be used to manage colonic perforations. Minimally invasive surgery is widely applied in abdominal surgery, is safe and effective in resolving iatrogenic perforation, even in elderly patient.<sup>13-15</sup> There are some studies showed primary colonic repair is safe without requiring resection or diversion.<sup>13,15</sup> Early recognition and intervention are critical for the successful treatment of iatrogenic colonic perforation especially in elderly, morbidly people.<sup>14,15</sup>

Advances in endoscopic techniques have also allowed for the management of complications due to colonoscopy. Clipping, for example, is feasible even for large perforations wider than 3 cm, which could prevent additional surgery.<sup>5,16</sup> The treatment must be individualized and must consider the resources available at the hospital or clinic.

In conclusion, colonic perforation after colonoscopy is an uncommon but life-threatening complication and often difficult to diagnose based on the clinical manifestation only. Physicians should be alert to the possibility of colonic perforation for patients who clinically deteriorate following colonoscopy. Radiographic examinations, particularly abdominal CT, provide excellent diagnostic rates. The choice of surgical or nonsurgical management depends on various factors. Treatment options must be individualized to each patient, and conservative treatment strategies require close follow-up by a multidisciplinary team.

## References

1. Araujo AV, Santos C, Contente H, Branco C. Air everywhere: colon perforation after colonoscopy. *BMJ Case Reports* 2017.
2. de'Angelis N, Di Saverio S, Chiara O, Sartelli M, Martinez-Perez A, Patrizi F, et al. 2017 WSES guidelines for the management of iatrogenic colonoscopy perforation. *World Journal of Emergency Surgery* 2018;13:5.
3. Dehal A, Tessier DJ. Intraperitoneal and extraperitoneal colonic perforation following diagnostic colonoscopy. *JSLs* 2014;18(1):136-41.
4. Lohsiriwat V. Colonoscopic perforation: incidence, risk factors, management and outcome. *World J Gastroenterol* 2010;16(4):425-30.
5. Jung Y. Endoscopic management of iatrogenic colon perforation. *Clin Endosc* 2020;53(1):29-36.
6. Jaafar S, Hung Fong SS, Waheed A, Misra S, Chavda K. Pneumoretroperitoneum with subcutaneous emphysema after a post colonoscopy colonic perforation. *International Journal of Surgery Case Reports* 2019;58:117-20.
7. Luning TH, Keemers-Gels ME, Barendregt WB, Tan AC, Rosman C. Colonoscopic perforations: a review of 30,366 patients. *Surg Endosc* 2007;21(6):994-7.
8. Cho SB, Lee WS, Joo YE, Kim HR, Park SW, Park CH, et al. Therapeutic options for iatrogenic colon perforation: feasibility of endoscopic clip closure and predictors of the need for early surgery. *Surg Endosc* 2012;26(2):473-9.
9. Colak S, Gurbulak B, Bektas H, Cakar E, Duzkoylu Y, Bayrak S, Guneyi A. Colonoscopic perforations: single center experience and review of the literature. *Turk J Surg* 2017;33(3):195-9.
10. Lee SH, Cheong YS. Successful endoscopic repair of an iatrogenic colonic perforation during diagnostic colonoscopy. *J Am Board Fam Med* 2012;25(3):383-9.
11. Angsuwatcharakon P, Prueksapanich P, Kongkam P, Rattanachu-Ek T, Sottisuporn J, Rerknimitr R. Efficacy of the ovesco clip for closure of endoscope related perforations. *Diagn Ther Endosc* 2016;9371878.
12. Ustek S, Boran M, Kismet K. Benign pneumoperitoneum after colonoscopy. *Case Reports in Medicine* 2010;631036.
13. Zhong W, Qiu CG, Liu CY, Fang CF. Efficacy of laparoscopic primary repair in the treatment of colonic perforation after colonoscopy: a review of 40,127 patients. *Surg Laparosc Endosc Percutan Tech* 2016;26:e105-8.
14. Dagmura H, Daldal E, Bakir H, Akbas A. Minimally invasive surgery for the management of iatrogenic colon perforation in the elderly. *Ann Med Res* 2020;27(10):2713-8.
15. Haas EM, Pedraza R, Ragupathi M, Mahmood A. Laparoscopic primary colorrhaphy for acute iatrogenic perforations during colonoscopy. *Hindawi, Minimally Invasive Surgery* Volume 2013, Article ID 823506.
16. Abdalla S, Gill R, Yusuf GT, Scarpinata R. Anatomical and radiological considerations when colonic perforation leads to subcutaneous emphysema, pneumothoraces, pneumomediastinum, and mediastinal shift. *Surg J (N Y)* 2018;4(1):e7-13.

## 病例報告

# 大腸鏡息肉切除術後造成腹腔內積氣、後腹腔積氣、氣胸、氣縱膈及皮下氣腫之 案例報告及文獻回顧

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**摘要** 醫源性結腸穿孔是大腸鏡檢查可能引起的一種少見但卻可能致命的併發症。大多數造成的穿孔位置多位於腹腔內，而後腹腔穿孔則較為少見。醫源性結腸穿孔的治療可分為手術和非手術的方式，要選擇何種治療會取決於穿孔的類型、是否有良好的腸道清潔、本身的結腸疾病、破洞的大小、穿孔後經過多久的時間才開始接受治療和患者的臨床情況是否穩定。因此，我們介紹了這個同時合併腹腔內及後腹腔穿孔並導致氣胸及氣縱膈的少見案例及其相關文獻回顧。

**病例報告** 一名患者接受過大腸鏡息肉切除術後，感到腹脹、胸悶等不適感，且經過一段時間觀察後並無緩解，經由電腦斷層診斷疑似結腸穿孔導致的腹腔及後腹腔積氣，合併左側氣胸、氣縱膈及皮下氣腫。經轉診至本院接受後續評估及治療。經第一時間胸管放置及評估後，給予保守治療並密切觀察病人情況，因恢復良好順利出院。

**結論** 大腸鏡造成的結腸穿孔雖然少見但卻很可能致命，僅僅根據臨床表現往往很難在第一時間診斷出來。以至於大腸鏡檢查後臨床情況惡化的患者，應高度警惕結腸穿孔的可能。影像學的檢查，尤其是電腦斷層掃描，為我們提供了極高的診斷率。而選擇以手術或非手術的方式會取決於各種因素。因此，治療方式必須針對每位患者的情況給予個別的評估，並且對採取非手術治療的患者要進行密切且多團隊的分析評估其治療效果及是否需要手術介入。

**關鍵詞** 大腸鏡、結腸穿孔、後腹腔積氣。