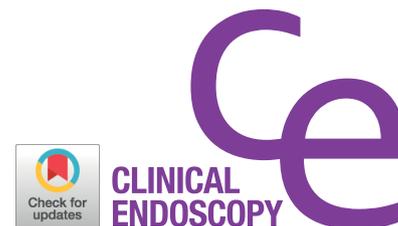


## REVIEW

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# Pneumothorax after Colonoscopy – A Review of Literature

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The purpose of this study was to determine the anatomical aspects, mechanisms, risk factors and appropriate management of development of pneumothorax during a routine colonoscopy. A systematic search of the literature (MEDLINE, Embase and Google Scholar) revealed 21 individually documented patients of pneumothorax following a colonoscopy, published till December 2015. One additional patient treated at our center was added. A pooled analysis of these 22 patients was performed including patient characteristics, indication of colonoscopy, any added procedure, presenting symptoms, risk factors and treatment given. The review suggested that various risk factors may be female gender, therapeutic interventions, difficult colonoscopy and underlying bowel pathology. Diagnosis of this condition requires a high index of suspicion and treatment should be tailored to individual needs.

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**Key Words:** Pneumothorax; Colonoscopy; Perforation

## INTRODUCTION

Colonoscopy is a commonly performed procedure with perforation, although rare, being the most serious complication. The incidence of perforation after diagnostic colonoscopy has been reported to be 0.03% to 0.65% and 0.07% to 2.14%, after a therapeutic manoeuvre.<sup>1,2</sup> A wide variety of clinical manifestations after colonoscopy, due to extra luminal accumulation of air, have been reported including pneumoperitoneum, pneumoretroperitoneum, pneumomediastinum, surgical emphysema and pneumoscrotum.<sup>3-6</sup> In this article, we have described an even rarer complication, pneumothorax, following a diagnostic colonoscopy and have performed a pooled analysis of all individually documented cases from literature including the patient managed at authors' institution to determine the anatomical aspects, mechanisms, risk factors

and appropriate management.

## MATERIALS AND METHODS

A systematic review was performed to identify all relevant literature on pneumothorax after colonoscopy. Two authors (KH, AG) performed systematic Medical Subject Heading (MeSH) search using PubMed, Embase and Google Scholar. The search was limited to Humans and Adults. Time frame for search was from the inception of databases till July 2015 following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Keywords used for search included 'Pneumothorax' AND 'colonoscopy'. Advanced search options including synonyms, partial word and combinations were used. Bibliographies of the retrieved articles were hand searched for further articles.

Studies pertaining to pneumothorax following colonoscopy were included. Exclusion criteria were patients with diaphragmatic hernia resulting in intrathoracic colon and extraperitoneal air leaks without pneumothorax.

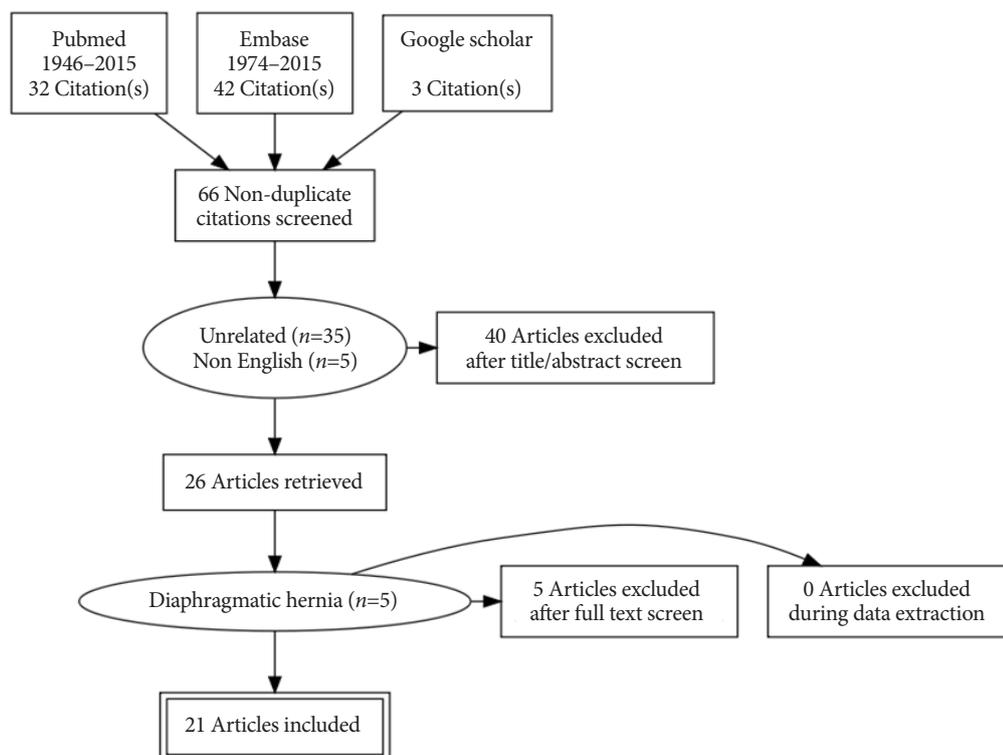
A total of 21 papers met the inclusion criteria out of 66 non duplicate citations identified using PubMed, Embase and Google Scholar databases (Fig. 1).

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**Fig. 1.** Preferred reporting items for systematic reviews and meta-analyses flow diagram for literature search.

## RESULTS

A literature search revealed a total of 22 reported cases<sup>7-27</sup> of pneumothorax following a colonoscopy, including the one case presenting at authors' institution, since the first case was reported in 1975<sup>7</sup> (Table 1). Of these patients, majority were females (Female:Male=17:5). The median age was 65 years (47-89 years). Eight of these procedures were colonoscopy only without any biopsies or intervention, whereas in thirteen cases either biopsies ( $n=3$ ) or some form of intervention was carried out (sigmoid polypectomy [ $n=5$ ], caecal polypectomy [ $n=2$ ], multiple polypectomy [ $n=2$ ], balloon dilatation [ $n=1$ ], evacuation of impacted stools [ $n=1$ ]). Pneumothorax was right sided in 11 cases, left sided in 4 cases and bilateral in 7 cases. The most common presenting symptoms were chest pain, dyspnoea, surgical emphysema and abdominal pain. Simple chest drainage was used in 9 patients, chest drain and laparotomy was performed in 11 patients and conservative management was successful on 2 occasions. In 8 patients the colon was normal whereas in the other 14 patients some form of underlying bowel pathology was present (Table 2).

## DISCUSSION

Colonoscopic complications including perforation and

massive bleeding are infrequent, but can cause very serious consequences and even lead to a fatal outcome. Various mechanisms resulting in colonoscopic perforations include direct mechanical trauma, thermal injury from electrocautery and pneumatic barotrauma from excessive air insufflation. Excessive pressure causes splitting of the serosa and muscularis propria fibres with resulting herniation of mucosa. This herniated mucosa may perforate leading to overt perforation or become permeable to air and thus resulting in extraluminal air without actual perforation.<sup>11</sup> An investigative study in cadaveric specimens by Brayko showed that these serosal tears occur at a pressure of  $202\pm 15$  mm Hg and mucosal ruptures can happen at pressures of  $226\pm 14$  mm Hg.<sup>28</sup>

Pneumothorax and extraperitoneal accumulation of air after colonoscopy is very rare. The anatomical basis of this phenomenon can be explained by the fact that continuity exists between the visceral space of the neck, thorax and abdomen via a fascial compartment. An air leak in any one of these areas, for instance from retroperitoneal colon or rectal perforation, can potentially reach these intercommunicating areas along the fascial/perivascular planes, resulting in pneumomediastinum, pneumopericardium and surgical emphysema over the torso and the neck.<sup>29</sup> A pneumothorax can result when pneumomediastinum decompresses through the mediastinal pleura into the pleural cavity. Alternatively, free intraperitoneal air can enter the pleural cavity via small

**Table 1.** Various Studies Reporting Pneumothorax Associated with Colonoscopy

Study	Year	Age	Sex	Primary procedure	Side of pneumothorax	Intervention	Intraoperative finding
Present Case	2014	50	F	Diagnostic	Right	Chest tube+laparotomy	No perforation
Dehal et al. <sup>27</sup>	2014	55	M	Diagnostic+Biopsies	Left	Chest tube+laparotomy	No perforation
Pourmand et al. <sup>26</sup>	2013	84	F	Diagnostic	Right	Chest tube	-
Sheikh et al. <sup>25</sup>	2013	56	F	Diagnostic	Right	Chest tube	-
Duri et al. <sup>24</sup>	2013	65	F	Polypectomy	Bilateral	Chest tube	-
Bonner et al. <sup>23</sup>	2013	50	F	Polypectomy Sigmoid	Right	Chest tube	-
Gorantla et al. <sup>22</sup>	2012	50	F	Polypectomy Caecum	Right	Chest tube	-
Kipple <sup>21</sup>	2010	78	M	Polypectomy Sigmoid	Bilateral	Chest tube+laparotomy	Sigmoid perforation
Thimmapuram et al. <sup>20</sup>	2010	49	F	Biopsies	Bilateral	Chest tube	-
Chan et al. <sup>19</sup>	2010	77	F	Balloon dilatation	Bilateral	Chest tube	-
Ignjatović et al. <sup>18</sup>	2009	54	M	Polypectomy Sigmoid	Left	Chest tube+laparotomy	Sigmoid perforation
Marwan et al. <sup>17</sup>	2007	89	F	Diagnostic	Right	Conservative	-
Lovisetto et al. <sup>16</sup>	2007	75	F	Diagnostic		Chest tube+laparoscopy	Diverticular perforation
Zeno et al. <sup>15</sup>	2006	64	F	Therapeutic colonoscopy for impacted faecolith	Right	Chest tube+laparotomy	Sigmoid perforation
Ball et al. <sup>14</sup>	2006	77	F	Diagnostic	Bilateral	Chest tube+laparotomy	Ileocolic anastomosis perforation
Hearnshaw et al. <sup>13</sup>	2004	80	F	Polypectomy Sigmoid	Right	Chest tube+laparotomy	No perforation
Webb <sup>12</sup>	1998	72	F	Diagnostic	Bilateral	Chest tube	-
Ho et al. <sup>11</sup>	1996	68	M	Polypectomy Caecum	Right	Chest tube+laparotomy	Caecal perforation
Tam et al. <sup>10</sup>	1996	65	F	Polypectomy Sigmoid	Left	Chest tube	-
Schmidt et al. <sup>9</sup>	1986	59	F	Diagnostic	Left	Conservative	-
Thomas et al. <sup>8</sup>	1979	47	F	Diagnostic	Bilateral	Chest tube+laparotomy	Caecal perforation
Meyers et al. <sup>7</sup>	1975	68	M	Polypectomy	-	Chest tube+laparotomy	Sigmoid perforation

diaphragmatic fenestrations or congenital defects.<sup>15</sup> Another possibility is air tracking from perianal fistulas into the retro-peritoneum.<sup>25</sup>

In this review a few potential risk factors for pneumothorax following colonoscopy have been identified. This complication has been found to be more common in females (81% of the cases). This can be explained by the fact that colonoscopy is found to be difficult in females due to a longer colon, deeper pelvis and low pain threshold.<sup>30</sup> Authors feel that this may lead to overinsufflation and pneumatic trauma. Another risk factor may be underlying bowel pathology. In the current analysis, diverticular disease was found to be the most common underlying pathology, followed by inflammatory bowel disease (IBD) and previous colonic resection. Taking a biopsy or intervention in the form of polypectomy was another possible risk factor which was present in 62 percent of patients (Table 2).

Management is individualised in cases of pneumothoraces following colonoscopy and may include conservative management, chest tube alone or surgical intervention. Close observation is mandatory for cases managed conservatively and surgical treatment depends on the patient's overall general condition, bowel preparation, timing of surgery and degree of intra-abdominal contamination. The majority of the patients in this review were treated by chest drain whereas nearly half of the patients underwent laparotomy as well. Two patients were managed conservatively without any intervention.<sup>9,17</sup> Out of the 11 patients who underwent laparotomy, overt perforation was found in eight patients whereas 3 had negative laparotomy<sup>13</sup> including the present case. Described surgical treatments involved simple repair of the perforation,<sup>14</sup> resection and primary anastomosis as well as resection and stoma.<sup>11</sup>

**Table 2.** Summary of Various Patient Characteristics

Characteristics	No. of patients (n=22)
Age (Median)	65 (47–89 years)
Sex	
Male	05
Female	17
Underlying pathology	
Nil	08
Diverticular disease	05
IBD	05
Previous colonic resection	02
Stricture	01
Faecal impaction	01
Procedure	
Diagnostic colonoscopy	08
Colonoscopy with intervention (polypectomy, biopsy, dilatation)	14
Management	
Chest tube alone	09
Chest tube+Laparotomy	11
Conservative	02

IBD, inflammatory bowel disease.

## CONCLUSION

Pneumothorax is an exceedingly rare complication of colonoscopy, a commonly performed diagnostic procedure. Various risk factors may be female gender, any form of intervention, difficult colonoscopy and underlying bowel pathology. We are likely to see more such cases in future as a result of an increasing number of colonoscopies being performed for bowel cancer screening. Diagnosis of this condition requires a high index of suspicion and treatment is tailored to individual needs. Clinical judgement based on the patient's signs and symptoms should be made to proceed with laparotomy, as many of these patients can be managed with simpler interventions such as chest drain.

### Conflicts of Interest

The authors have no financial conflicts of interest.

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