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Postoperative pneumoperitoneum: is it normal or pathologic?

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ABSTRACT

Background: Pneumoperitoneum on computed tomography (CT) after abdominal surgery is common, but its incidence, duration, and clinical significance is widely debated.
Materials and methods: A retrospective, cohort study of patients who underwent abdominal CT within 30 days of abdominal surgery.
Results: Among 344 patients, pneumoperitoneum was found in 39% (135/344) of patients on postoperative days 0–6 in 53%, 7–13 in 41%, 14–20 in 23%, 21–27 in 13%, and 28–30 in 0%. Pneumoperitoneum was associated with the presence of a drain ($P = 0.014$) but not with age, gender, body mass index, smoking history, lung disease, or open *versus* laparoscopic surgery ($P > 0.05$ for all variables). Eight patients required intervention (6%), most commonly for anastomotic leak (4 patients, 50%).
Conclusions: Postoperative pneumoperitoneum on abdominal CT can be seen in up to 23% of patients 3-weeks postoperatively; however, only 6% of the patients required intervention emphasizing the typically benign consequences of postoperative free air.

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1. Introduction

Plain radiographs and computed tomography (CT) are frequently performed for suspected intra-abdominal complications after abdominal operations. A common finding on imaging is pneumoperitoneum. The prevalence and duration of postoperative abdominal free air is dependent on which imaging modality is used. Most free air on plain radiographs resolves within 48 h and rarely occurs more than 5 d after surgery [1]. CT has been shown to be more sensitive in identifying free air. Pneumoperitoneum can be seen on 87% of CT scans and 53% of plain radiographs 3 d after uncomplicated abdominal surgery and on 50% of CT scans and 8% of plain radiographs obtained 6 d after surgery [2]. The quandary that the clinician faces with the finding of pneumoperitoneum on a postoperative CT scan is whether this is a pathologic finding, which requires surgical intervention, or simply a normal finding after abdominal operation.

The objective of this study was to characterize the incidence and duration of postoperative pneumoperitoneum in patients undergoing CT of the abdomen and pelvis and its impact on the need for additional surgical interventions in a large patient population. We hypothesize that postoperative pneumoperitoneum will be a common finding that will decrease in a linear fashion from time of surgery and will rarely result in surgical intervention.

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2. Materials and methods

2.1. Patients

Using key search words "free air", "pneumoperitoneum", and/or "intraperitoneal gas," a retrospective review identified all patients who had an abdominal CT examination of the abdomen and pelvis at the University of Colorado Hospital from September 1, 2011–August 27, 2013.

2.1.1. Patient demographics

Patient demographics recorded included age, gender, body mass index, current or history of smoking, and history of pulmonary disease including obstructive sleep apnea, asthma, chronic obstructive pulmonary disease, and lung cancer. This study was approved by COMIRB protocol 13-2975.

2.1.2. Surgical specialties

We identified patients of all surgical specialties operating in the abdomen, including general surgery, transplant, neurosurgery, gynecology, and urology patients, who had undergone open or laparoscopic intraperitoneal operations and had abdominal CT examination within 30 postoperative days (PODs) of the operation.

2.2. Radiology reports

Radiology reports dictated by board-certified radiologists were reviewed individually for the presence or absence of "free air," "pneumoperitoneum," and/or "intraperitoneal gas," presence of an intra-abdominal drain, and the indication for imaging. If present, the magnitude of pneumoperitoneum quantified by the radiologist ordinally as tiny and/or scant, small, moderate, or large was recorded.

2.3. Operative notes

Operative notes were reviewed for surgical specialty, surgical operation, open *versus* laparoscopic, and indication for surgery. To determine how many patients required an operation after imaging findings of pneumoperitoneum, operative notes within 30 d of initial surgery were reviewed. Among these patients, intraoperative findings were recorded.

2.4. Statistical analysis

Statistical analysis was used to determine the natural history of postoperative pneumoperitoneum and to compare patients with and without postoperative pneumoperitoneum. Nominal variables are expressed as proportions and percentages; continuous variables are expressed as means and standard deviations. Between groups differences for proportions were tested using two-sided chi-square or Fisher exact tests where appropriate; between groups differences for continuous variables were tested using two-sided t-tests not assuming equal variance.

Outcomes analyzed included the number of days postoperatively on which pneumoperitoneum was identified defined as PODs 0–6, PODs 7–13, PODs 14–20, PODs 21–27, and PODs 28–30. The presence of pneumoperitoneum was correlated with the sex, age, body mass index, smoking history, previous lung disease, presence of intra-abdominal drain, and laparoscopic or open abdominal surgery. The size of the pneumoperitoneum on radiology reports was correlated with need for additional surgical intervention.

3. Results

Three hundred forty-four patients underwent abdominal CT scans up to 30 days after abdominal surgery. The most common rationale for ordering a CT scan were as follows: evaluate abscess (86), abdominal pain (68), fever (26), evaluate obstruction (24), evaluate for anastomotic leak (21), nausea/vomiting (12), evaluate free air (9), leukocytosis (9), tachycardia (6), abdominal distention (5), evaluate bleeding (5), and indication not recorded (73). Overall, postoperative pneumoperitoneum was found in 39% of patients (135 of 344). Pneumoperitoneum was demonstrated on PODs 0–6 in 53% (64 of 120), 7–13 in 41% (56/139), 14–20 in 23% (12 of 53), 21–27 in 13% (3/22), and 28–30 in 0% (0 of 10; $P = 0.0454$ PODs 0–6 *versus* 7–13; $P = 0.0168$ for PODs 7–13 *versus* 14–20; $P = 0.5302$ for PODs 14–20 *versus* 21–27; $P = 0.534$ for PODs 21–27 *versus* 28–30; Figure). No free air (0 of 22 patients) was found on POD 24 or after.

Comparing patients with and without pneumoperitoneum, there was no difference in age ($P = 0.208$), gender ($P = 0.052$), body mass index ($P = 0.068$), smoking history ($P = 0.218$), lung disease ($P = 0.456$), or open *versus* laparoscopic surgery ($P = 0.309$). However, the incidence of pneumoperitoneum was associated with the presence of a drain ($P = 0.014$; Table 1).

Only 6% (8 of 136) of patients required surgery after the diagnosis of pneumoperitoneum. Most of these patients had a combination of free fluid and/or fluid collections and pneumoperitoneum on CT scan. Six of the eight patients requiring an operation had an absolute indication for surgical intervention as follows: 1 large volume hemorrhage from intraperitoneal drain, 2 feculent material from intraperitoneal drain, 1 feculent material from surgical incision, 1 tracheoesophageal fistula, and 1 bowel obstruction failing medical management. The remaining two patients were taken to the operating room based on pneumoperitoneum. Intraoperative findings were the following: 4 anastomotic leaks (PODs 7, 8, 10,

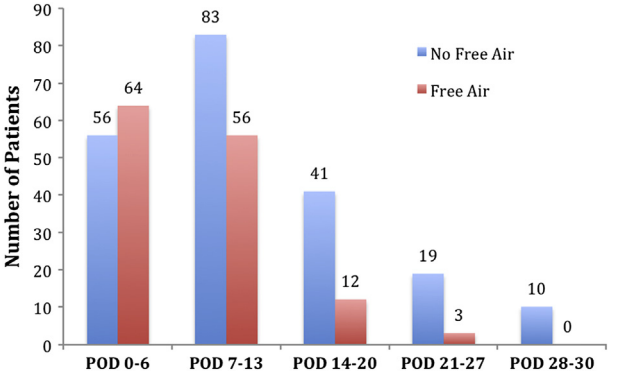

Figure – Incidence of postoperative pneumoperitoneum. (Color version of the figure is available online.)