

## A STUDY AND REVIEW OF NON-SURGICAL CAUSES OF PNEUMOPERITONEUM (SPONTANEOUS PNEUMOPERITONEUM) IN TERTIARY CARE CENTRE, GOVERNMENT VELLORE MEDICAL COLLEGE HOSPITAL, VELLORE

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### ABSTRACT

#### BACKGROUND

Air in the peritoneal cavity is called as Pneumoperitoneum. Not all the cases of pneumoperitoneum are due to hollow viscus perforation. Most common cause of pneumoperitoneum is due to hollow viscus perforation in 90% cases, mostly due to duodenal ulcer perforation or gastric perforation. In 10% of the cases, the pneumoperitoneum does not indicate the perforation nor warranted the surgery. Pneumoperitoneum that is non-iatrogenic that does not need surgery is called as spontaneous pneumoperitoneum.

#### MATERIALS AND METHODS

This study analyses the spontaneous/non-surgical causes of pneumoperitoneum and our experience in our institute for the past 5 years that is from June 2011 to May 2016 and also aims to create awareness about the non-surgical causes of pneumoperitoneum, identifying cases for which negative laparotomy can be avoided.

#### RESULTS

In this period 11 patients were identified with nonsurgical causes of pneumoperitoneum, from that 2 patients underwent emergency laparotomy which was negative and 9 patients were managed conservatively.

#### CONCLUSION

In our study totally 11 patients were presented with pneumoperitoneum, out of which 9 patients were managed conservatively and 2 patients underwent negative laparotomy. Most common cause of spontaneous pneumoperitoneum in our study is thoracic cause.

#### KEYWORDS

Spontaneous Pneumoperitoneum, Non-Surgical Causes of Pneumoperitoneum.

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#### BACKGROUND

Patients with acute abdominal pain are commonly encountered problem in a day-to-day practice. Most of the patients with acute abdominal pain underwent x-ray abdomen as part of the routine investigations for the diagnosis. Pneumoperitoneum is a condition where air is present in the peritoneal cavity; it is a mostly radiological diagnosis. Abdominal x-ray detects 85 - 90% of the cases of hollow viscus perforation with free air under the diaphragm. CT scan of the abdomen is the most sensitive investigation in detecting air under the diaphragm. In 90% of cases the pneumoperitoneum is due to hollow viscus perforation, which warrants emergency surgical intervention, failure of intervention leads to potential lethal complications. However,

not all the cases of pneumoperitoneum is due to hollow viscus perforation. In 10% of cases, there was no identifiable such cause was found called as spontaneous pneumoperitoneum or non-surgical pneumoperitoneum.<sup>1</sup> The term spontaneous or non-surgical pneumoperitoneum was found since the first description of pneumoperitoneum on abdominal x-ray.

Even now-a-days not all the physicians are aware of the entity called spontaneous pneumoperitoneum and often unnecessary laparotomy can be avoided.

#### Objectives of the Study

1. This study analyses cases of the Negative Laparotomy with no surgical cause.
2. Review the causes of non-surgical pneumoperitoneum.
3. To identify the cases of pneumoperitoneum for which negative laparotomy can be avoided.

#### MATERIALS AND METHODS

##### Study Design

This study is undertaken in the patients with pneumoperitoneum in Government Vellore Medical College, Vellore for the period from June 2011 to May 2016, which is taken as retrospective study.

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Inclusion Criteria as illustrative cases from GVMCH, Vellore.

1. Successful management by observation and supportive care without surgical intervention was defined as the diagnostic feature of non-perforation.
2. Failure of a laparotomy to delineate a surgical cause or to result in a reparative procedure is congruent with a nonsurgical cause of pneumoperitoneum.

**Exclusion Criteria**

Patients with pneumoperitoneum with identifiable cause.

**RESULTS**

For the above period, 11 cases were observed. Out of the 11 cases 2 cases underwent laparotomy, which shows no evidence of perforation. Out of the 11 cases, 9 patients were males and 2 patients were females.

Age/Sex	Patient Complaint	Past History	X-Ray	Management	Followup after 2 Weeks
54 yrs/M	Epigastric Pain	Tuberculosis	Pneumoperitoneum	Laparotomy - Negative	-
70 yrs/M	Diffuse Abdominal Pain	COPD	Pneumoperitoneum	Conservative	Air disappears
65 yrs/M	On Mechanical Ventilator	COPD/ Respiratory failure	Pneumoperitoneum	Conservative	Air disappears
55 yrs/M	Abdominal Pain with F/O Peritonitis	HIV 1 positive, K/C PT	Pneumoperitoneum	Laparotomy - Negative	-
35 yrs/F	Nil	Gynaecologic examination	Pneumoperitoneum	Conservative	Air disappears
64 yrs/M	Difficulty in Breathing	COPD	Pneumoperitoneum	Conservative	Air disappears
67 yrs/M	Abdominal pain	-	Pneumoperitoneum	Conservative	Air disappears
42 yrs/F	Difficulty in Breathing	Scleroderma	Pneumoperitoneum	Conservative	Air disappears
61 yrs/M	Post CPR for cardiac arrest in case of IHD	HT, DM,IHD	Pneumoperitoneum	Conservative	Patient Expired After 2 days
69 yrs/M	Abdominal pain	COPD	Pneumoperitoneum	Conservative	Air disappears
72 yrs/M	Trauma	PT	Pneumoperitoneum, Rt Pneumothorax and Pneumomediastinum	Conservative ICD done	Air disappears

**Table 1. Depicts the Details of the Patient and Management**

Table 1 depicts the patients presenting, the age and sex distribution of the patients, patients presenting complaint to the hospital and past history, management and followup.

Sl. No.	Age/Sex	Associations	Cause	Category
1.	54 yrs./M	Tuberculosis	Increased Intrathoracic Pressure	Thoracic
2.	70 yrs./M	COPD	? Bullous Rupture	Thoracic
3.	65 yrs./M	On Mechanical Ventilator	IPPV	Thoracic
4.	55 yrs./M	HIV 1 Positive, Tuberculosis	Pneumatosis Cystoides Intestinalis (PCI)	Abdominal
5.	35 yrs./F	Gynaecologic Examination	Air Insufflation	Pelvic
6.	64 yrs./M	COPD	Increased Intrathoracic Pressure	Thoracic
7.	67 yrs./M	? Peptic Ulcer Disease	Subclinical perforation	Abdominal
8.	42 yrs./F	Scleroderma	Collagen Vascular Disease with? PCI	Abdominal
9.	61 yrs./M	Post CPR	CPR	Thoracic
10.	69 yrs./M	COPD	Increased Intrathoracic Pressure	Thoracic
11.	72 yrs./M	Trauma	Trauma	Thoracic

**Table 2. Shows Association, Cause and Category of Spontaneous Pneumoperitoneum**

Table 2 shows out of the 11 cases, we observed 7 cases belongs to the category of Thoracic and 3 cases to the Abdominal and one patient to the Pelvic that is gynaecologic.

**DISCUSSION**

Spontaneous pneumoperitoneum has many number of causes, which is listed below as table in Table 3.

Category	Mechanism
Postoperative	Retained air from open laparotomy
	Retained air from laparoscopy
Thoracic	Intermittent positive-pressure ventilation

	Barotrauma
	Increased intrathoracic pressure - cough, retching
	Valsalva manoeuvre
	Asthma
	Bronchoscopy
	Cardiopulmonary resuscitation and mouth-to-mouth ventilation
	Adenotonsillectomy

	Pulmonary tuberculosis
	Blunt trauma
	Bronchopulmonary fistula
	Spontaneous rupture of pulmonary blebs
Abdominal	Pneumatosis cystoides intestinalis
	Endoscopic procedures
	Post-polypectomy syndrome
	Peritoneal dialysis
	Collagen vascular disease
	Pneumocholecystitis
	Jejunal and sigmoid diverticulosis
	Distended hollow viscus
	Subclinical perforated viscus
Gynaecologic	Vaginal insufflation
	Knee-chest exercises
	Pelvic inflammatory disease
	Coitus
	Gynaecologic examination procedures
	Vaginal douching
Idiopathic	

**Table 3. Causes of Spontaneous Pneumoperitoneum<sup>2,3</sup>**

**Post-Operative**

Free air in the peritoneal cavity following an abdominal procedure is an expected occurrence. Usually, the free air following procedure completely absorbed within a week's time (7 days), but may persist as long as 4 weeks and detected on x-rays.

So in a patient with abdominal pain, recent history of abdominal or pelvic surgical history to be elicited. In a case of air due to postoperative, decreasing amount of air is expected. But in case of hollow viscus perforation, protracted increasing amount of air is present.

**Thoracic**

Intrathoracic causes are most frequent cause of spontaneous/non-surgical pneumoperitoneum.

**In Patients with Intermittent Positive-Pressure Ventilation**

Air is directly introduced into peritoneal cavity through microscopic defects in pleura and diaphragm, which causes free air in the peritoneal cavity.

In patients with mechanical ventilator risk of pneumoperitoneum is increased if the Positive Inspiratory Pressure is > 40 cm H<sub>2</sub>O and Peak End expiratory pressure is more than 6 cm H<sub>2</sub>O<sup>4</sup>. In a case of COPD the mechanism through which pneumoperitoneum occurs is rupture of alveoli, it causes free alveolar air which in turn produces air entering into the mediastinum; from there air enters into the retroperitoneum along the perivascular sheaths work done by Macklin. From the retroperitoneum, it ruptures into the peritoneal cavity producing the pneumoperitoneum.

In trauma any condition causing increase in intrathoracic pressure leads to pneumoperitoneum, which is a surgical dilemma, absence of associated clinical signs for intra-abdominal pathology or contrast radiological studies to rule out enteric perforation, helpful for the conservative management of the patient.

In mouth-to-mouth, the pneumoperitoneum caused through increased tracheal pressure. In cardiopulmonary resuscitation, the pneumoperitoneum caused through increased airway pressure and blunt force to the chest.

**Abdominal Causes**

**Pneumatosis Cystoides Intestinalis**

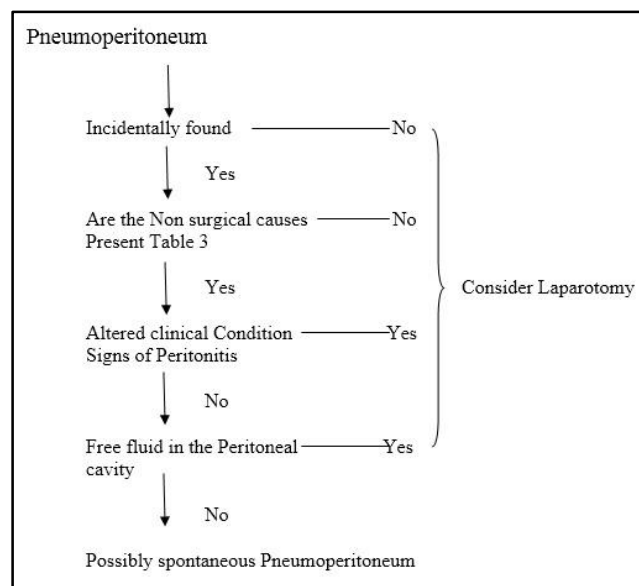
Pneumatosis cystoides intestinalis probably accounts for a significant proportion of those abdominal causes of pneumoperitoneum not resulting from a ruptured abdominal viscus. First pathologic description by DuVernoi from a cadaver dissection in 1730. The condition was characterised by multiple intramural gas-filled cysts, seen throughout the GIT, commonly in terminal ileum. This condition is benign and asymptomatic, presents with nonspecific complaints such as vomiting, nausea, etc. The mechanism of submucosal rupture of free air produces intraperitoneal free air with or without features of peritonitis associated with chronic obstructive pulmonary disease and inflammatory bowel disease.<sup>5</sup> It resolves spontaneously mostly. In immunosuppressed individuals, enteric infection, bowel ischaemia or death can occur.

Other rare causes includes pneumocholecystitis, jejunal and sigmoid diverticulosis, distended hollow viscus. The mechanism for the rare causes, thinned intact bowel wall with increased lumen pressure the air escapes into the peritoneal cavity, produces the pneumoperitoneum.<sup>6,7,8</sup> Sub-clinical perforations allows air to escape through the microperforations without spillage of enteric contents.

**Gynaecologic Causes**

Vaginal insufflations, coitus, vaginal douching the air is entered into the peritoneal cavity via fallopian tubes, the pneumoperitoneum without the signs of peritonitis will be present.<sup>9</sup>

To distinguish spontaneous pneumoperitoneum from surgical cause of pneumoperitoneum, the following algorithm is presented.



Possibly spontaneous Pneumoperitoneum.

**Indications for Laparotomy in Patients with Spontaneous Pneumoperitoneum**

- Onset of abdominal pain.
- Peritonism/peritonitis.
- Tachycardia/Hypotension.
- Rising white cell count.

- Radiology suggests free enteric leak.
- Failure of conservative management.

### CONCLUSION

In our study totally 11 patients were presented with pneumoperitoneum, out of which 9 patients were managed conservatively, 2 patients underwent negative laparotomy. Most common cause of spontaneous pneumoperitoneum in our study is thoracic cause.

Spontaneous pneumoperitoneum is an uncommon well-known entity with number of causes. Although in majority of the patients with pneumoperitoneum is due to hollow viscus perforation, which requires laparotomy. The high index of suspicion is needed if the enumerated causes of pneumoperitoneum is present, in whom the patients not having features of peritonitis. These patients are managed conservatively with followup. If any evidence of clinical deterioration, patient needs laparotomy.

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