Case report

Management of incidentally detected idiopathic pneumoperitoneum: A case report and literature review

Tatsuma Sakaguchi* , Masaya Kotsuka, Keigo Yamamichi, Mitsugu Sekimoto

Department of Gastrointestinal Surgery, Medical Center, Kansai Medical University, 10-15 Fumizono-cho, Moriguchi-city, Osaka 570-8507, Japan

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ABSTRACT

Introduction: Pneumoperitoneum usually requires emergency surgery. Asymptomatic idiopathic pneumoperitoneum is a rare subgroup of pneumoperitoneum for which a management algorithm has not been established.

Presentation of case: In an 88-year-old female patient, pneumoperitoneum was found incidentally by chest computed tomography during a periodic follow-up for sarcoidosis. Emergency admission was ordered for conservative treatment. Upper gastrointestinal endoscopy revealed edematous mucosa in the entire gastric vestibule. After being discharged on the 7th day, her clinical course was uneventful over 2 months of follow-up.

Discussion: The initial clinical manifestations of pneumoperitoneum are variable and range widely from asymptomatic to septic shock. The etiology of pneumoperitoneum in our patient implied a subclinical visceral perforation that resolved without treatment. We advocate an algorithm for the initial management of pneumoperitoneum according to the extent of peritonitis and impaired conditions.

Conclusion: Incidentally found asymptomatic pneumoperitoneum does not always require intervention. Careful and repeated physical assessment with investigation of underlying etiology is important in the management of pneumoperitoneum.

1. Introduction

Pneumoperitoneum is mainly caused by perforation of the gastrointestinal (GI) tract, usually requiring emergency surgery. However, there is a subgroup that can be managed conservatively, termed “spontaneous” or “non-surgical” pneumoperitoneum, which has various manifestations arising from abdominal, thoracic, gynecologic, or iatrogenic etiology [1,2]. Idiopathic pneumoperitoneum (IP) is a diagnosis of exclusion that should only be made after surgical and non-surgical causes of pneumoperitoneum have been ruled out. The management of incidentally detected asymptomatic IP has yet to be established, not only because of its rarity but also the diversity of the clinical presentations. To the best of our knowledge, there have been two published case reports in the English literature describing asymptomatic IP [3,4]. We report herein a case of incidentally detected asymptomatic IP. In addition, we performed a literature review to help construct an algorithm for the initial management of pneumoperitoneum. The present case is reported in accordance with the SCARE criteria [5].

2. Case presentation

An 88-year-old female patient visited our medical center to undergo a periodic examination for sarcoidosis at the Department of Respiratory Medicine. She had developed ocular sarcoidosis 11 years earlier, since when a chest lesion had been checked regularly. After developing pulmonary embolization 4 years previously, she had taken apixaban orally. She did not have any clinically relevant genetic information and psychosocial history in particular.

On thoracic computed tomography (CT), ground-glass opacity in the left lower lung was reduced, but a slight increase in the longitudinal lymph nodes was observed. The chest lesion of sarcoidosis was generally mild and subdued. However, when a radiologist found a small amount of free air in the upper abdomen (Fig. 1), the patient was immediately transferred to the emergency room. She had no untoward symptoms, with a good appetite after an ordinal meal. She was afebrile with blood pressure of 145/106 mmHg. Her abdomen was flat without tenderness. The results of laboratory tests were unremarkable (Table 1). A duty surgeon ordered emergency admission, insertion of a nasogastric tube,
and fasting, given the possibility of gastroduodenal perforation. A proton-pump inhibitor and antibiotics (cefa-zolin, 2 g/day) were administered. On the next day the patient's condition was stable, so the nasogastric tube was removed and water drinking was resumed. On questioning for details, the patient reported epigastic pain 2 months earlier and a subsequent plain X-ray examination by her general physician, which produced no specific findings. On the fourth day of admission, she underwent upper gastrointestinal endoscopy (Fig. 2). Although edematous mucosa was found in the entire gastric vestibule, there were no ulcer scars and no obvious contrast leakage, so the oral diet was resumed. Intra-abdominal free air was reduced on CT performed on the 6th day (Fig. 3), and she was discharged on the 7th day. There was no problem with the patient's adherence to and tolerability of each treatment, and her clinical course remained uneventful during the follow-up period of 2 months.

3. Discussion

Pneumoperitoneum, a well-known sign of a surgical emergency, is caused by GI perforation in more than 90% of reported cases [2]. Early diagnosis is essential for GI perforation, and delayed management is reported to increase mortality [6]. However, there are numerous other causes of pneumoperitoneum that do not require urgent surgical intervention (Table 2) [4]. The initial clinical manifestations of pneumoperitoneum are variable and range widely, from asymptomatic to septic shock. Regarding the management of IP, the primary problem is that it is a diagnosis of exclusion. A physician must distinguish the "surgical" pneumoperitoneum immediately with minimal examination. Emergency surgery is needed to control the source of infection in patients with signs of peritoneal irritation or impaired general status, which imply sepsis arising from intraperitoneal infection [7]. By contrast, conservative management should be initially considered for asymptomatic patients who are hemodynamically stable without peritonitis [8,9]. A recent multicenter retrospective study revealed that operative treatment is associated with increased morbidity in patients without peritonitis [10]. With the development of imaging modalities, the chance of encountering asymptomatic IP will rapidly increase. The development of artificial intelligence and a deep-learning algorithm has led to an excellent approach to the detection of abnormalities, including pneumoperitoneum, on chest radiographs [11]. Accordingly, a firm

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### Table 1

| Test | Value |
|------|-------|
| WBC  | 51 ×10^9/μL |
| RBC  | 377 ×10^9/μL |
| Hb   | 11.4 g/dL  |
| HTC  | 34.6 %     |
| PLT  | 25.5 ×10^9/μL |
| Na   | 142 mmol/L |
| K    | 4.3 mmol/L  |
| Cl   | 105 mmol/L  |
| BUN  | 16 mg/dL   |
| Cre  | 0.72 mg/dL |
| eGFR | 57 ml/min/1.73m² |
| TP   | 6.0 g/dL   |
| ALB  | 3.5 g/dL   |
| AST  | 23 U/L     |
| ALT  | 15 U/L     |
| T-Bil| 0.5 mg/dl  |
| ALP  | 85 U/L     |
| GGT  | 10 U/L     |
| AMY  | 68 IU/L    |
| CRP  | 0.065 mg/dl|
| Glu  | 143 mg/dL  |
| Cre  | 0.72 mg/dl |
| eGFR | 57 ml/min/1.73m² |

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Fig. 1. Contrast-enhanced computed tomography of upper abdomen on the first day of admission. Arrowheads indicate a small amount of intra-abdominal free air above the duodenal and transverse colon.
guideline for the management of pneumoperitoneum is warranted.

We performed a literature review of asymptomatic IP and found two cases published in English [3,4] and eight cases in Japanese [12–18] (Table 3). Six men and four women with a mean age of 72.9 (range 52–85) years were reported. Pneumoperitoneum was incidentally found during examination for respiratory symptoms in two patients, at a medical check-up for other diseases in five patients [19], and during a health-screening test in two patients. All patients underwent conservative treatment or careful observation without any problem. Recurrence of pneumoperitoneum was found in two patients at 3 and 5 years after the first detection, respectively, neither of whom required surgery. Sidiqi et al. stated that the presence or absence of peritonitis and determining the underlying cause are both important in deciding the management of pneumoperitoneum, based on a systematic approach.
We advocate an algorithm for the initial management of pneumoperitoneum according to symptoms and aggravating factors, presented in Fig. 4. If patients have severe symptoms (generalized peritonitis, massive ascites, or septic shock) or aggravating factors (uncontrolled infection, impaired general status, or compromised host), emergency surgery should be performed (1). When the symptoms are mild (localized peritonitis, infection, or small amount of ascites), conservative treatment should be started (2). However, if symptoms have changed to severe, emergency surgery should be considered (3). When patients have any symptoms with aggravating factors, they should be treated by close monitoring (4), then, if symptoms have changed to mild or severe, management should be radically changed accordingly (5). When patients are asymptomatic with aggravating factors, we recommend a follow-up (6) or close monitoring according to the patient's condition (7). Although our patient was asymptomatic without any signs of infection or ascites, her advanced age might strongly influence a physician's decision. According to our management algorithm, close monitoring was suitable for this patient, and conservative treatment with nasogastric tube insertion and fasting might have been too radical. Mularski et al. stated that the etiology of IP probably includes subclinical visceral perforations that resolve without surgical intervention [8]. Our patient had edematous mucosa in the entire gastric vestibule and a history of epigastric pain 2 months earlier, which implied a previous peptic ulcer.

One limitation in constructing the management algorithm for pneumoperitoneum is that we have no evidence from prospective trials or large case series. However, regardless of era, physicians should bear in mind that careful and repeated physical assessment with successful investigation of underlying etiology plays a pivotal role in the management of pneumoperitoneum.

4. Conclusions

A case of incidentally detected asymptomatic IP treated conservatively is presented. We advocate an initial management algorithm for pneumoperitoneum according to symptoms of peritonitis and the patient's condition. Asymptomatic IP should be managed by close monitoring or careful follow-up according to the patient's status.

Table 2
Common causes of non-surgical pneumoperitoneum.

| Type               | Cause                                                                 |
|--------------------|----------------------------------------------------------------------|
| **Abdominal causes** | Laparotomy/laparoscopy                                              |
|                    | Endoscopy                                                            |
|                    | PEG tube placement                                                   |
|                    | Peritoneal dialysis                                                  |
|                    | Spontaneous bacterial peritonitis                                    |
|                    | Blunt abdominal trauma                                               |
|                    | Pneumatosis cystoides intestinalis                                   |
| **Thoracic causes** | Barotrauma                                                           |
|                    | Pneumothorax                                                         |
|                    | Pneumomediastinum                                                   |
|                    | Cardiopulmonary resuscitation                                        |
| **Gynecological causes** | Pelvic manipulation or insufflation                                |

Table 3
Literature review of asymptomatic idiopathic pneumoperitoneum.

| Year | Gender | Age | Modality   | Treatment               | Recurrence |
|------|--------|-----|------------|-------------------------|------------|
| 2000 | F      | 52  | Chest X-ray| Conservative treatment  |            |
| 2009 | M      | 66  | Abdominal CT| Conservative treatment |            |
| 2011 | M      | 77  | Abdominal CT| Conservative treatment |            |
| 2012 | M      | 77  | Chest X-ray| Conservative treatment | After 3 years |
| 2012 | M      | 85  | Chest X-ray| Conservative treatment | After 5 years |
| 2018 | F      | 81  | Chest X-ray| Conservative treatment |            |
| 2019 | F      | 59  | Chest X-ray| Follow by outpatient |            |
| 2019 | M      | 71  | Chest CT   | Closely observation    |            |
| 2020 | M      | 76  | Chest CT   | Conservative treatment |            |

with a detailed history and examination [4]. We advocate an algorithm for the initial management of pneumoperitoneum according to symptoms and aggravating factors, presented in Fig. 4. If patients have severe symptoms (generalized peritonitis, massive ascites, or septic shock) or aggravating factors (uncontrolled infection, impaired general status, or compromised host), emergency surgery should be performed (1). When the symptoms are mild (localized peritonitis, infection, or small amount of ascites), conservative treatment should be started (2). However, if symptoms have changed to severe, emergency surgery should be considered (3). When patients have any symptoms with aggravating factors, they should be treated by close monitoring (4), then, if symptoms have changed to mild or severe, management should be radically changed accordingly (5). When patients are asymptomatic with aggravating factors, we recommend a follow-up (6) or close monitoring according to the change of patients' condition (7). Although our patient was asymptomatic without any signs of infection or ascites, her advanced age might strongly influence a physician's decision. According to our management algorithm, close monitoring was suitable for this patient, and conservative treatment with nasogastric tube insertion and fasting might have been too radical. Mularski et al. stated that the

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4. Conclusions

A case of incidentally detected asymptomatic IP treated conservatively is presented. We advocate an initial management algorithm for pneumoperitoneum according to symptoms of peritonitis and the patient's condition. Asymptomatic IP should be managed by close monitoring or careful follow-up according to the patient's status.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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CRediT authorship contribution statement

T.S., M.K., K.Y., and M.S. contributed equally.

Declaration of competing interest

The authors declare that they have no competing interests.
Algorithm for the initial management of pneumoperitoneum

| Symptoms       | Aggravating factors                        |
|---------------|-------------------------------------------|
| Peritonitis   | Uncontrolled infection                     |
| Ascites       | Impaired general status                    |
| Sepsis        | Compromised host                           |

Management

1. **Severe symptoms**
   - **Severe**
   - Operation room

2. **Mild symptoms**
   - **Mild**
   - Conservative treatment

3. **Any symptoms**
   - **Any**
   - Close monitoring

4. **Any symptoms**
   - **Any**
   - Careful follow-up

Yes; one or more symptoms or conditions are applicable

No; none of them are applicable

**Fig. 4.** Algorithm for the initial management of pneumoperitoneum.

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