



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

ARTICLE INFO

Keywords:

Asymptomatic idiopathic pneumoperitoneum
Conservative treatment
Management algorithm
Case report

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,

^{*} Corresponding author.

E-mail address: sakaguchi.tatsuma@gmail.com (T. Sakaguchi).

<https://doi.org/10.1016/j.ijscr.2021.106463>

Received 15 September 2021; Received in revised form 26 September 2021; Accepted 27 September 2021

Available online 1 October 2021

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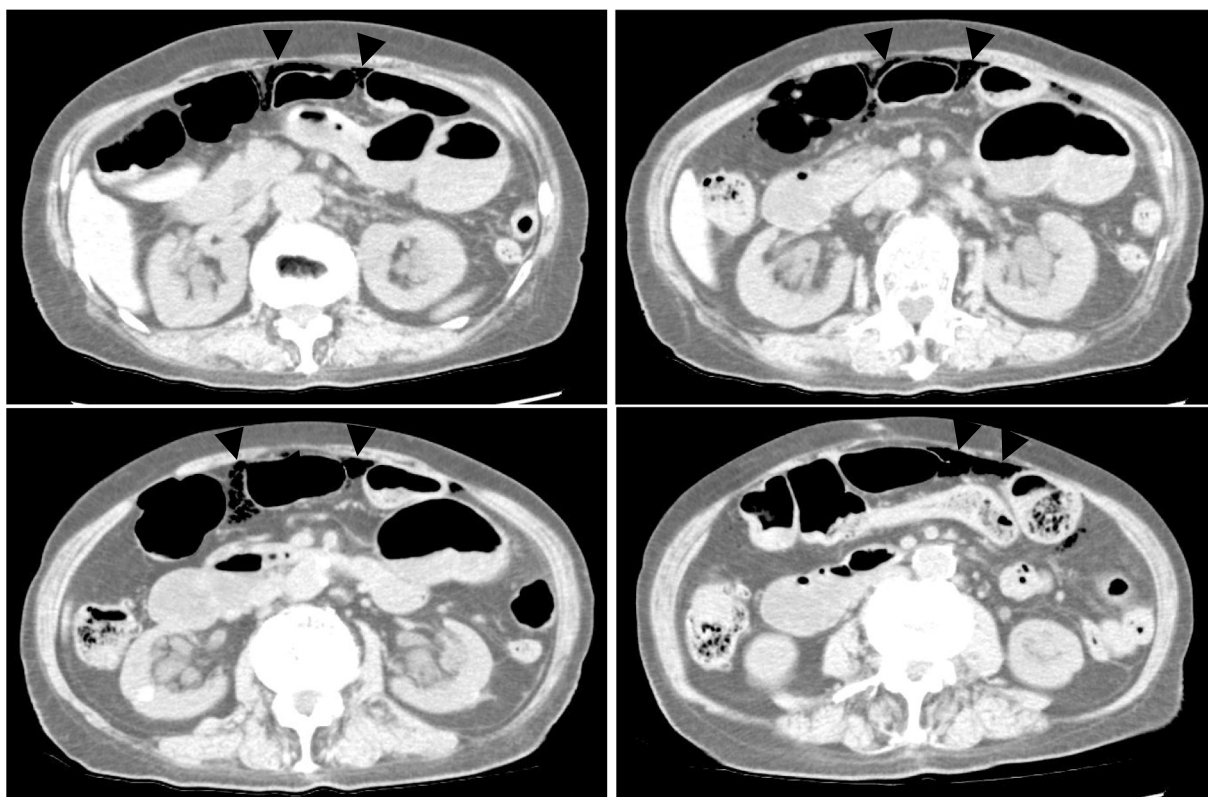


Fig. 1. Contrast-enhanced computed tomography of upper abdomen on the first day of admission. Arrowheads indicate a small amount of intra-abdominal free air above the duodenal and transverse colon.

Table 1

Laboratory testing.

WBC	51	$\times 10^2/\mu\text{L}$	TP	6.0	g/dL
RBC	377	$\times 10^4/\mu\text{L}$	ALB	3.5	g/dL
Hb	11.4	g/dL	AST	23	U/L
HTC	34.6	%	ALT	15	U/L
PLT	25.5	$\times 10^4/\mu\text{L}$	T-Bil	0.5	mg/dL
Na	142	mmol/L	ALP	85	U/L
K	4.3	mmol/L	GGT	10	U/L
Cl	105	mmol/L	AMY	68	IU/L
BUN	16	mg/dL	CRP	0.065	mg/dL
Cre	0.72	mg/dL	Glu	143	mg/dL
eGFR	57	mL/min/1.73m ²			

and fasting, given the possibility of gastroduodenal perforation. A proton-pump inhibitor and antibiotics (cefazolin, 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 epigastric 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

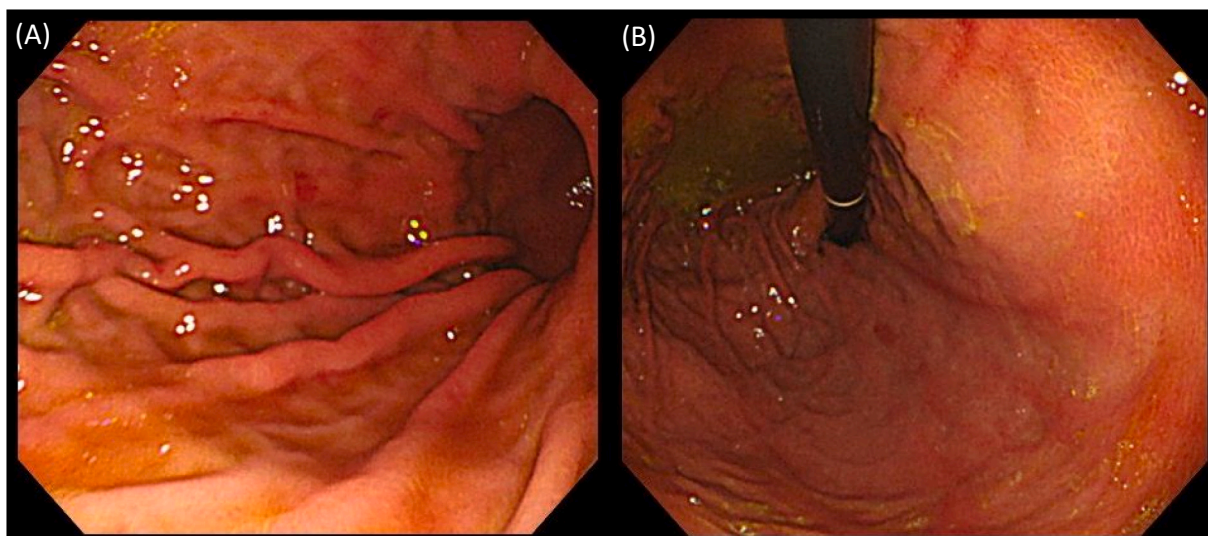


Fig. 2. Upper gastrointestinal endoscopy. (A) From gastric body to vestibule. (B) From upper gastric body to cardia.



Fig. 3. Plain computed tomography on the 6th day of admission. Arrows indicate reduced bubble of intra-abdominal free air. No contrast leakage from the gastrointestinal tract was detected.

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

Table 2
Common causes of non-surgical pneumoperitoneum.

<ul style="list-style-type: none"> • Abdominal causes Laparotomy/laparoscopy Endoscopy PEG tube placement Peritoneal dialysis Spontaneous bacterial peritonitis Blunt abdominal trauma Pneumatosis cystoides intestinalis
<ul style="list-style-type: none"> • Thoracic causes Mechanical ventilation Barotrauma Pneumothorax Pneumomediastinum Cardiopulmonary resuscitation Post-heart transplant
<ul style="list-style-type: none"> • 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	
2012	M	85	Chest X-ray	Conservative treatment	After 3 years
2012	F	85	Abdominal CT	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

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.

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.

Availability of data and materials

Not applicable.

Funding

Not applicable.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Registration of research studies

Not applicable.

Guarantor

Tatsuma Sakaguchi.

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

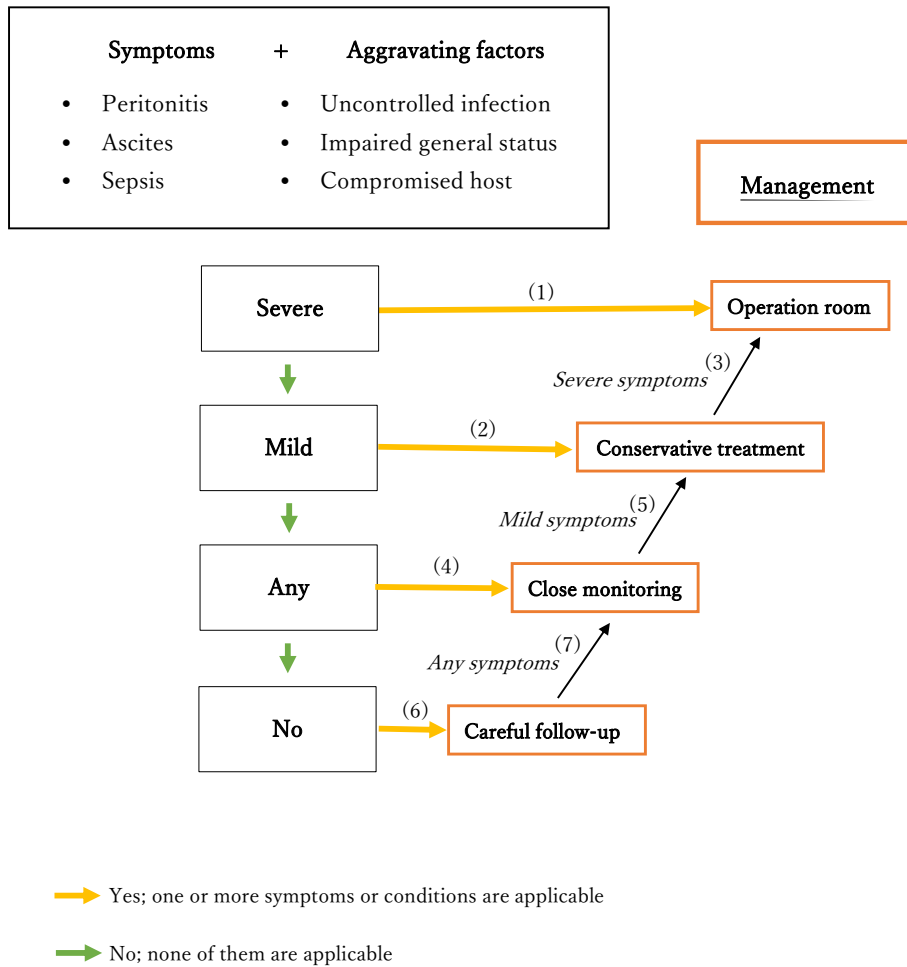


Fig. 4. Algorithm for the initial management of pneumoperitoneum.

Acknowledgement

We thank Hugh McGonigle, from Edanz (<https://www.jp.edanz.com/ac>), for editing a draft of the manuscript.

References

- [1] C.B. Gantt, W.W. Daniel, G.A. Hallenbeck, Nonsurgical pneumoperitoneum, Available from, Am. J. Surg. 134 (3) (1977 Sep) 411–414, <https://linkinghub.elsevier.com/retrieve/pii/0002961077904184>.
- [2] N.M. Williams, D.F. Watkin, Spontaneous pneumoperitoneum and other nonsurgical causes of intraperitoneal free gas, Available from, Postgrad. Med. J. 73 (863) (1997 Sep 1) 531–537, <https://pmj.bmj.com/lookup/doi/10.1136/pgmj.73.863.531>.
- [3] E. Hannan, E. Saad, S. Hoashi, D. Toomey, The clinical dilemma of the persistent idiopathic pneumoperitoneum: a case report, Available from: Int. J. Surg. Case Rep. 63 (2019) 10–12 <https://linkinghub.elsevier.com/retrieve/pii/S221026121930478X>.
- [4] M.M. Sidiqi, D. Fletcher, T. Billah, The enigma of asymptomatic idiopathic pneumoperitoneum: a dangerous trap for general surgeons, Available from, Int. J. Surg. Case Rep. 76 (2020) 33–36, <https://linkinghub.elsevier.com/retrieve/pii/S2210261220308221>.
- [5] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, A. Thoma, et al., The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, Available from, Int. J. Surg. 84 (2020 Dec) 226–230, <https://linkinghub.elsevier.com/retrieve/pii/S1743919120307718>.
- [6] C. Holmer, C.A. Mallmann, M.A. Musch, M.E. Kreis, J. Gröne, Surgical Management of Iatrogenic Perforation of the gastrointestinal tract: 15 years of experience in a single center, Available from, World J. Surg. 41 (8) (2017 Aug 21) 1961–1965, <http://link.springer.com/10.1007/s00268-017-3986-7>.
- [7] O. Nishida, H. Ogura, M. Egi, S. Fujishima, Y. Hayashi, T. Iba, The Japanese clinical practice guidelines for management of sepsis and septic shock 2016 (J-SSCG 2016, Available from: J. Intensive Care 2018 Dec 2 (1) (2018 Dec 2) 7 <https://jintensivecare.biomedcentral.com/articles/10.1186/s40560-017-0270-8>.
- [8] R.A. Mularski, J.M. Sippel, M.L. Osborne, Pneumoperitoneum: a review of nonsurgical causes, Available from, Crit. Care Med. 28 (7) (2000 Jul) 2638–2644, <http://journals.lww.com/00003246-200007000-00078>.
- [9] A.J. Fernández-López, F.M. González Valverde, M. Méndez Martínez, Management of non-surgical pneumoperitoneum, Available from: Rev. Esp. Enferm. Dig. 108 (2016) 444 <https://online.reed.es/fichaArticulo.aspx?iarf=283464736795-159348583169>.
- [10] B. Udelsman, K. Lee, M. Qadan, K.D. Lillemoie, D. Chang, C. Lindvall, et al., Management of Pneumoperitoneum, Available from, Ann. Surg. 274 (1) (2021 Jul) 146–154, <https://journals.lww.com/10.1097/SLA.0000000000003492>.
- [11] J.G. Nam, M. Kim, J. Park, E.J. Hwang, J.H. Lee, J.H. Hong, Development and validation of a deep learning algorithm detecting 10 common abnormalities on chest radiographs, Available from: Eur. Respir. J. 57 (5) (2021 May), 2003061 <http://erj.ersjournals.com/lookup/doi/10.1183/13993003.03061-2020>.
- [12] K. Kosami, N. Mizutani, T. Kenzaka, Spontaneous pneumoperitoneum detected incidentally by secondary examination after health checkup, Available from: An. Off. J. Japan Prim Care Assoc. 42 (4) (2019 Dec 20) 205–208 https://www.jstage.jst.go.jp/article/generalist/42/4/42_205/_article-char/ja/.
- [13] M. Sahara, M. Oka, H. Terasawa, Y. Fujita, J. Kitatani, K. Takefuji, A case of idiopathic pneumoperitoneum which improved after repairing an abdominal incisional hernia (in Japanese), Rinhogeka 73 (5) (2018) 627–631.
- [14] K. Yoshino, D. Manaka, S. Kantou, S. Hamasu, S. Konishi, R. Nishitai, A case of adult spontaneous Pneumoperitoneum, Available from: J. Jpn. Surg. Assoc. 74 (8) (2013) 2119–2122 https://www.jstage.jst.go.jp/article/jjsa/74/8/74_2119/_article-char/ja/.
- [15] N. Sato, K. Iwai, K. Hazama, N. Kyougoku, H. Hosoi, T. Mizota, Five cases of non-surgical pneumoperitoneum, Available from: J. Jpn. Surg. Assoc. 2013 (2) (2013) 346–351 https://www.jstage.jst.go.jp/article/jjsa/74/2/74_346/_article-char/ja/.

- [16] M. Kochi, S. Fukuda, S. Akimoto, I. Nakashima, H. Sakimoto, T. Eto, Three cases of adult idiopathic pneumoperitoneum, Available from: Nihon Rinsho Geka Gakkai Zasshi 73 (2) (2012) 475–480 https://www.jstage.jst.go.jp/article/jjsa/73/2/73_475/_article/-char/ja/.
- [17] S. Suzuki, K. Kameda, K. Goto, K. Yoshida, K. Nagamine, A. Kubo, Two cases of incidentally detected idiopathic pneumoperitoneum (in Japanese), Rinshogeka 66 (12) (2011) 1559–1562.
- [18] A. Furutani, Y. Kimura, R. Sougawa, O. Kinoshita, K. Nagata, S. Nakashima, K. Fukuda, M. Masuyama, Idiopathic pneumoperitoneum in an adult found during a medical examination: a case report (in Japanese), J. Abdom. Emerg. Med. 29 (1) (2009) 103–106.
- [19] S. Naomi, K. Einami, M. Taruishi, K. Yamagata, S. Takeuchi, M. Sotokawa, M. Yoshida, A. Matsumoto, Y. Shibata, S. Takeda, H. Ogasawara, Spontaneous pneumoperitoneum: report of a case. (in Japanese) Jpn. J. Gastro-enterology. 97(7):914–9.