

**Fig. 1 – CT scan: (A) metastasis of the right liver; (B) metastasis of the left lateral section; (C) laparoscopic resection.**

stay, tumor staging, etc., as well as no increase in morbidity or mortality and shorter hospital stay. Even so, it has not become popular.<sup>5,8-10</sup>

In conclusion, the laparoscopic approach of the first stage in two-stage liver surgery is feasible and provides certain benefits. The combination of colon surgery and minor laparoscopic hepatectomy is safe and also provides certain advantages.

#### REFERENCES

- Machado MA, Makdissi FF, Surjan RC, Kappaz GT, Yamaguchi N. Two-stage laparoscopic liver resection for bilateral colorectal liver metastasis. *Surg Endosc.* 2010;24:2044-7.
- Ayiomamitis GD, Low JK, Alkari B, Lee SH, Ammori BJ. Role of laparoscopic right portal vein ligation in planning staged or major liver resection. *J Laparoendosc Adv Surg Tech.* 2009;19:409-13.
- Abu Hilal M, di Fabio F, Abu Salameh M, Pearce NW. Oncological efficiency analysis of laparoscopic liver resection for primary and metastatic cancer: a single-center UK experience. *Arch Surg.* 2012;147:42-8.
- Jain G, Parmar J, Mohammed MM, Bryant T, Kitteringham L, Pearce N, et al. Stretching the limits of laparoscopic surgery: two stage laparoscopic liver resection. *J Laparoendosc Adv Surg Tech.* 2010;20:51-4.
- Karoui M, Viganò L, Goyer P, Ferrero A, Aglietta M, Delbaldo C, et al. Combined first stage hepatectomy and colorectal resection in a two-stage hepatectomy strategy for bilobar synchronous liver metastases. *Br J Surg.* 2010;97:1354-62.
- Di Fabio F, Whistance R, Rahman S, Primrose JN, Pearce NW, Abu Hilal M. Exploring the role of laparoscopic surgery in two-stage hepatectomy for bilobar colorectal liver metastases. *J Laparoendosc Adv Surg Tech.* 2012;22:647-50.
- Adam R, Laurent A, Azoulay D, Castaing D, Bismuth H. Two-stage hepatectomy: a planned strategy to treat irresectable liver tumors. *Ann Surg.* 2000;232:777-85.
- Robles R, Marín C, Lopez-Conesa A, Capel A, Perez-Flores D, Parrilla P. Comparative study of right portal vein ligation versus embolisation for induction of hypertrophy in two-stage hepatectomy for multiple bilateral colorectal liver metastases. *Eur J Surg Oncol.* 2012;38:586-93.
- Polignano FM, Quyn AJ, Sanjay P, Henderson NA, Tait IS. Totally laparoscopic strategies for the management of colorectal cancer with synchronous liver metastases. *Surg Endosc.* 2012;26:2571-8.
- Hatwell C, Bretagnol F, Farges O, Belghiti J, Panis Y. Laparoscopic resection of colorectal cancer facilitates simultaneous surgery of synchronous liver metastases. *Colorectal Dis.* 2013;15:e21-8.
- Pessaux P, Panaro F. Advantages of the first-step totally laparoscopic approach in 2-staged hepatectomy for colorectal synchronous liver metastases. *Surgery.* 2008;145:453.

José Manuel Ramia\*, Farah Adel, Roberto de La Plaza, Pilar Veguillas, Jorge García-Parreño

Unidad de Cirugía Hepatobiliopancreática, Servicio de Cirugía General y Aparato Digestivo, Hospital Universitario de Guadalajara, Guadalajara, Spain

\*Corresponding author.

E-mail address: jose\_ramia@hotmail.com (J.M. Ramia).

2173-5077/\$ – see front matter

© 2013 AEC. Published by Elsevier España, S.L.U. All rights reserved.

## Conservative “In Situ” Treatment of Pneumoperitoneum<sup>☆</sup>

### Tratamiento conservador «in situ» del neumoperitoneo

The radiological finding of free air in the abdominal cavity is generally considered a surgical emergency. It is associated with perforated abdominal viscus in more than 90% of

cases.<sup>1-3</sup> Nevertheless, the remaining 10% are not caused by perforation; these cases of non-surgical, asymptomatic, benign, idiopathic pneumoperitoneum are a diagnostic and therapeutic dilemma.<sup>2</sup>

We present the case of a 77-year-old woman with amyotrophic lateral sclerosis (ALS) who presented dysphagia and nocturnal hypoventilation, so she was admitted to the

<sup>☆</sup> Please cite this article as: Gutiérrez Andreu M, Yuste García P, Gómez Rodríguez P, de la Cruz Vigo F. Tratamiento conservador «in situ» del neumoperitoneo. *Cir Esp.* 2015;93:127-129.

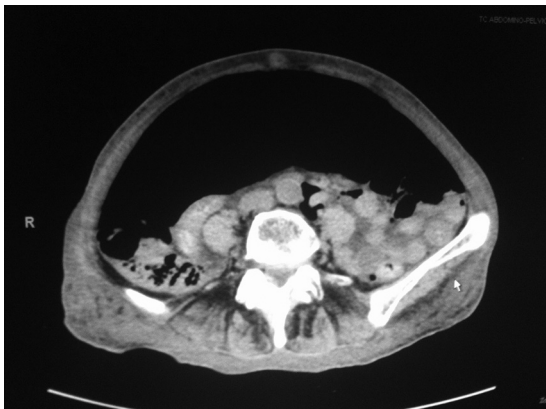
pneumology department for percutaneous endoscopic gastrostomy (PEG) and adaptation to non-invasive mechanical ventilation (NIMV).

During PEG placement, we observed a superficial tear in the cardias with a small amount of self-limited bleeding. The general surgery department was called in 7 days later due to the appearance of pneumoperitoneum on a chest radiograph, accompanied by increased abdominal perimeter and pain. Given the clinical and hemodynamic stability of the patient, an abdominal CT scan was done to rule out complications. The scan showed abundant pneumoperitoneum that was displacing and compressing the abdominal viscera in the caudal direction. The gastrostomy catheter was well placed, and no free fluid was observed (Fig. 1). With the diagnostic suspicion of benign pneumoperitoneum, we decided upon non-surgical treatment. Because of the distension, abdominal pain and risk for compartment syndrome, percutaneous drainage of the pneumoperitoneum was carried out with an Abbocath in the left flank, leaving in a 8 F pigtail catheter (Fig. 2). After a large amount of air was released, the distension disappeared and the patient reported an improvement in symptoms. The follow-up radiograph showed that the pneumoperitoneum was largely reduced.

The patient currently remains asymptomatic, with NIMV and enteral nutrition through the gastrostomy. The PEG is kept open during NIMV and abdominal drainage is continuous.

The most frequent cause of pneumoperitoneum is previous surgery due to the postoperative retention of air, which is usually resolved during the first week after surgery.<sup>4-6</sup> Benign pneumoperitoneum can be classified according to the source of the air, the most frequent of which is the thoracic cavity, followed by the gastrointestinal tract and the female genital apparatus.<sup>4,5</sup>

Mechanical ventilation is the most frequent thoracic cause of pneumoperitoneum due to the increased intra- and extra-alveolar pressure.<sup>4-7</sup> The passage of air from the thorax to the abdomen is explained by the presence of anatomical orifices or porous diaphragm syndrome,<sup>2,8</sup> which usually occur in areas of weakness, such as the posterolateral and parasternal regions.<sup>9</sup> Risk factors include high pressure in the respiratory tract, high tidal volumes, unexpandable lung, preexisting pulmonary disease and respiratory distress syndrome.<sup>9</sup> In our case, mechanical ventilation with positive pressure at



**Fig. 1 – Abdominopelvic CT scan with abundant pneumoperitoneum and caudal organ displacement.**



**Fig. 2 – Percutaneous drainage with Abbocath and placement of a pigtail catheter.**

the end of expiration increases intrathoracic pressure and the risk for dissection of the peritoneal cavity.<sup>4-8</sup>

Pneumoperitoneum is also associated with gastrointestinal endoscopic processes: after polypectomy with electrocautery,<sup>10</sup> microperforations, air dissection through the lymph nodes or submucosal channels into the peritoneal cavity, and air filtration through the thin, intact walls of the intestine, with no perforation.<sup>9</sup> Instrumental perforations represent between 0.1 and 1% of diagnostic explorations and 3% of therapeutic procedures.<sup>10</sup>

The incidence of pneumoperitoneum after the placement of a percutaneous gastrostomy is approximately 25%. The cause is usually the insufflation of high-pressure air in the gastric chamber, associated with microperforations.<sup>9</sup> In our case, the placement of the gastrostomy but, above all, the lesion in the cardias seems to be the origin of the pneumoperitoneum, which increased due to the NIMV.

Cystic pneumatosis of the colon would be the most frequent cause of non-surgical pneumoperitoneum if we excluded the causes related with therapeutic procedures.<sup>2-9</sup> In 30% of cases, the presentation of pneumoperitoneum is spontaneous. Its benign etiology makes for a positive prognosis and the treatment of choice is conservative.

Other more anecdotal causes of pneumoperitoneum are gynecological. These occur when the air passes into the abdominal cavity through the vagina and the Fallopian tubes.<sup>2</sup>

In our case, the cause of the pneumoperitoneum was the adaptation to NIMV associated with the placement of a gastrostomy and the lesion of the cardias. Given the hemodynamic stability of the patient and because CT scans had not detected any complications, a conservative approach was the

most appropriate. Bedside abdominal decompression was necessary to avoid compartment syndrome.<sup>9</sup>

We can conclude that, when given the presence of pneumoperitoneum, a suspected perforated abdominal viscus is the first diagnosis and, therefore, urgent laparotomy should be done. Nevertheless, in selected cases where the pathologic/medical history, physical examination and complementary techniques do not suggest peritonitis, non-surgical management with close patient monitoring can be considered.<sup>2</sup> Within the conservative treatment for this type of cases, percutaneous drainage should be assessed in order to avoid compartment syndrome.

### Conflict of Interest

None.

### REFERENCES

1. Martín Arévalo J, Calvete Chornet J, Torrico Folgado MA, Cassinello Fernández N, Camps Vilatá B, Sabater Ortí L, et al. Neumoperitoneos no quirúrgicos: una difícil decisión terapéutica. *Cir Esp.* 2000;67:292-5.
2. López-Cano M, Vilallonga-Puy R, Lozoya-Trujillo R, Espin-Basany E, Sánchez-García JL, Armengol-Carrasco M. Neumoperitoneo idiopático. *Cir Esp.* 2005;78:112-4.
3. Larrañaga I, Meneu JC, Díaz G, Mendía E, Rey A, Fresneda V. Neumoperitoneo no quirúrgico. *Cir Esp.* 2000;67:514-5.
4. Utrillas-Martínez AC, Martínez-Vallina P, Rebollo-López J, López-Bañeres M, Minguillón-Serrano A, Rivas-Andrés JJ, et al. Neumoperitoneo secundario a cirugía torácica. ¿Qué actitud tomar? *Cir Esp.* 2003;74:301-2.

5. Mezghebe HM, Leffall Jr LD, Siram SM, Syphax B. Asymptomatic pneumoperitoneum diagnostic and therapeutic dilemma. *Am Surg.* 1994;60:691-4.
6. Mularski RA, Ciccolo ML, Rappaport WD. Nonsurgical causes of pneumoperitoneum. *West J Med.* 1999;170:41-6.
7. Olgemöller U, Körber W, Crieé CP. Abdominal free air without signs of perforated abdominal viscus during non-invasive ventilation. *Dtsch Med Wochenschr.* 2012;137:1591-4. <http://dx.doi.org/10.1055/s-0032-1305183>. Epub German.
8. Gutkin Z, Iellin A, Meged S, Sorkine P, Geller E. Spontaneous pneumoperitoneum without peritonitis. *Int Surg.* 1992;77:219-23.
9. Mularski RA, Sippel JM, Osborne ML. Pneumoperitoneum: a review of nonsurgical causes. *Crit Care Med.* 2000;28:2638-44.
10. Menchén BJ, Alcaide F, Campano I, Rodríguez E, Morales C, Sánchez-Bustos F, et al. Una causa rara de neumoperitoneo espontáneo: neumatosis quística. *Cir Esp.* 2002;72:306.

Marta Gutiérrez Andreu\*, Pedro Yuste García, Pilar Gómez Rodríguez, Felipe de la Cruz Vigo

Cirugía General y del Aparato Digestivo A, Hospital Universitario 12 de Octubre, Madrid, Spain

\*Corresponding author.

E-mail address: [Martaguti21@hotmail.com](mailto:Martaguti21@hotmail.com) (M. Gutiérrez Andreu).

2173-5077/\$ – see front matter

© 2013 AEC. Published by Elsevier España, S.L.U. All rights reserved.

## Chronic Sternoclavicular Osteomyelitis: Salvage Surgery With Internal Mammary Artery Perforator Flap<sup>☆</sup>

### Osteomielitis crónica esternoclavicular: cirugía de rescate con colgajo de perforante de arteria mamaria interna

Less than 3% of osteomyelitis cases are osteomyelitis of the clavicle. Depending on the microorganism involved, patients typically present localized or acute pain associated with regional edema and positive blood cultures, or a more chronic and indolent form of the disease. Fever (60%), localized edema or mass (30%) and soft tissue abscesses (30%) are the most frequent symptoms. *Staphylococcus aureus* is the most com-

monly involved microorganism. Nonetheless, other types of microorganisms may be involved, such as gram-negative bacteria or *Mycobacterium tuberculosis*.<sup>1</sup>

Our patient is a 54-year-old male with a personal history of morbid obesity, arterial hypertension, diabetes mellitus and hepatocarcinoma, who was not a candidate for liver transplantation and had been treated with chemoembolizations. One year before, he presented a painful cervicothoracic mass associated with cellulitis. Cervical ultrasound showed a suprasternal soft tissue mass with inflammatory characteristics and gas in its interior. It protruded into the mediastinum and seemed to originate in the acromioclavicular joint.

<sup>☆</sup> Please cite this article as: Lima Sánchez J, Sánchez Medina MT, García Duque O, Fernández-Palacios J. Osteomielitis crónica esternoclavicular: cirugía de rescate con colgajo de perforante de arteria mamaria interna. *Cir Esp.* 2015;93:129-131.