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Thoracic empyema after gallstone spillage in times of Covid

Ariel Nicolas Tchercansky [a,*], Joaquin Fernandez Alberti [b], Nicolas Panzardi [b], Rodolfo Auvieux [a], Agustin Buero [a]

[a] Thoracic Surgery Department, British Hospital of Buenos Aires, Argentina
[b] General Surgery Department, British Hospital of Buenos Aires, Argentina

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ABSTRACT

INTRODUCTION: Laparoscopic cholecystectomy has become the gold standard for gallbladder disease. Although gallbladder perforation and spilled gallstones during surgery are common complications, thoracic consequences are rare.
PRESENTATION OF CASE: We describe a case of a pleural empyema developed in an immunosuppressed patient five months after laparoscopic cholecystectomy, as a result of spilled gallstones. Decortication via video assisted thoracoscopy resulted in retrieval of stone remnants, biliary sludge and diagnosis of a diaphragmatic defect.
DISCUSSION: Iatrogenic perforation of the gallbladder is the most common complication after laparoscopic cholecystectomy. Despite this, thoracic consequences derived from spilled gallstones are rare, but they represent significant morbidity.
CONCLUSION: Thoracic complications after spilled gallstones are rare. Documentation of iatrogenic perforation of the gallbladder and a high index of suspicious are fundamental to speed diagnosis and treatment.

1. Introduction

Laparoscopic cholecystectomy (LC) is the treatment of choice for symptomatic cholelithiasis. The incidence of gallstone spillage during LC varies between 6 % and 40 % [1]. Surgery during acute cholecystitis, increasing age, male sex, high BMI and adhesions are all associated with increased risk of stone spillage [2].

Complications from dropped stones are infrequent and often delayed including abscesses, sinus tract formation, septicemia, and adhesions. Occasionally, the stones may erode through the diaphragm or may migrate through preexisting defects in the diaphragm and present with unusual complications, including empyema and cholelithoptysis [3]. There have been very few reported thoracic complications caused by gallstone spillage. We present a case of delayed empyema in an elderly man after laparoscopic cholecystectomy, during Covid-19 outbreak. The work has been reported in line with the SCARE criteria [4].

2. Presentation of case

A 69-year-old male presented with thoracic pain, cough and fever. Past medical history consisted of diabetes mellitus, hypertension, kidney transplant (immunosuppressive regimen consisting of betalacept and sirolimus), myocardial infarction requiring the placement of a coronary stent, dual chamber pacemaker, anticoagulation for deep venous thrombosis and a laparoscopic cholecystectomy performed five months earlier in the setting of gallbladder empyema (Fig. 1).

Clinical examination revealed a blood pressure of 100/80 mmHg and a heart rate of 91 bpm. Auscultation showed decreased air entry at the right pulmonary base. Abdominal and neurological exam were normal.

Chest X-ray showed moderate sized right pleural effusion (Fig. 2). Computed tomography (CT) of the chest and the abdomen revealed right loculated pleural effusion associated with passive collapse of the lung and mediastinal pleural thickening. Nodular structures with peripheral calcifications of 23 mm and 31 mm were observed in relation with the right hepatic lobe and below the posterior costo-diaphragmatic recess respectively (Fig. 3).

Fortunately, the operative report informed iatrogenic perforation of the gallbladder and stone spillage. Furthermore, we retrieved the surgical video, so we had a high index of suspicion of complications due to spilled gallstones (Fig. 1).

Transthoracic ultrasound guided aspiration of the pleural effusion was performed. Gram negative bacteria grew in cultures. Due to patientś frailty we opted for a minimally invasive approach placing a thoracic drain guided by CT (Fig. 4). Because of the persistence of the loculated pleural effusion and the lack of clinical improve-

* Corresponding author at: Caracas 1411, Ciudad Autonoma de Buenos Aires (CABA), 1416, Argentina.
E-mail address: atchercansky@hbritanico.com.ar (A.N. Tchercansky).

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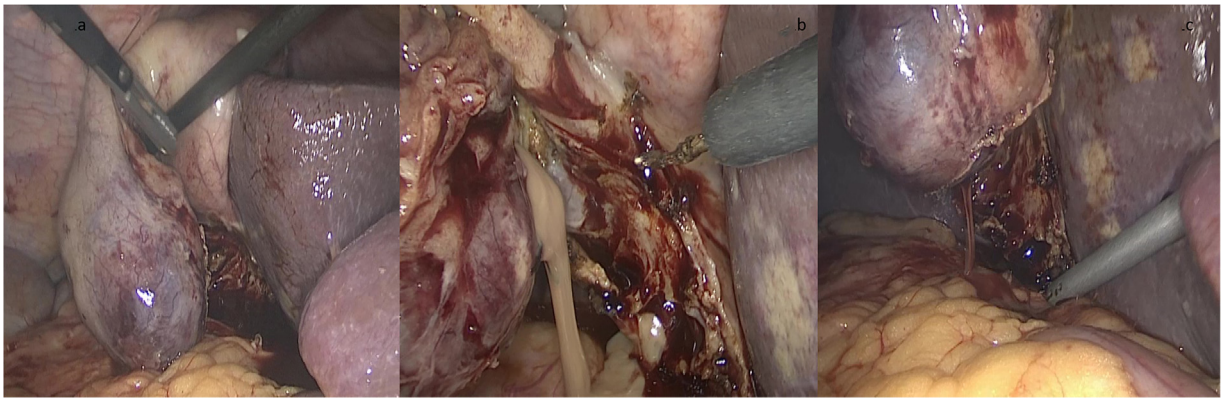

Fig. 1. Laparoscopic cholecystectomy. a) Acute cholecystitis. B) Iatrogenic perforation of the gallbladder and pus spilt. C) Pus aspiration.

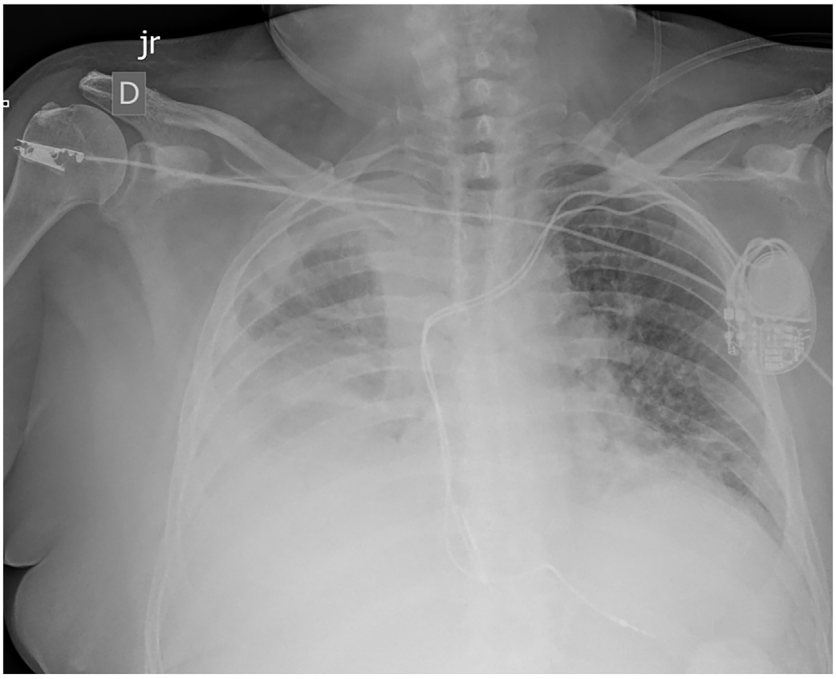

Fig. 2. Chest X-ray: right pleural effusion.

ment we decided to perform a lung decortication by video assisted thoracoscopy (VATS).

The patient was operated under general anesthesia, using a double-lumen tube. The surgical team was formed by a thoracic surgery resident (operating surgeon) and a staff surgeon as an assistant. We used two 12 mm incisions and performed an extension over the place where the previous thoracostomy tube was inserted for the use of an Alexis® retractor device. After decorticating the lung, we exposed the fissure and drained a collection in the posterior costo-diaphragmatic recess, seen in the CT. During the procedure a 1 cm defect was observed in the diaphragm (Fig. 5). Remnants of gallstones were retrieved from the subphrenic space and sent for bacteriological study. We performed the closure of the diaphragm defect with a non-resorbable suture and placed two chest tubes. The procedure was well tolerated by the patient and recovered in the intensive care unit (ICU) until post-operative day 3 when he was transferred to the general ward. Bacterial culture was positive for Extended Spectrum Beta-Lactamase (ESBL)-positive *Escherichia coli*, susceptible to erythromycin, imipenem, meropenem and tigecycline.

Chest tubes were withdrawn on days 5 and 7 respectively. Post-operative was uneventful until day 13, when the patient breakthrough with fever. A chest CT scan and a Covid 19 test (reverse-transcription polymerase chain reaction) were performed. The chest CT revealed persistence of the right pleural effusion with spontaneous hyperdense content, suggestive of hemothorax (Fig. 6). The Covid test result was positive.

After analyzing the case in a multidisciplinary team, we decided to perform a second VATS lung decortication to evacuate clotted blood and prevent further consequences. No active bleeding was found. Chest tubes were withdrawn on day 4 and 5 respectively. Chest x ray showed no pleural effusion or pneumothorax (Fig. 7).

On post-operative day 7 the patient developed type 1 respiratory failure, with elevated breathing rate and requirement of a venturi mask at 40 % O2 to maintain blood saturation over 93 %.

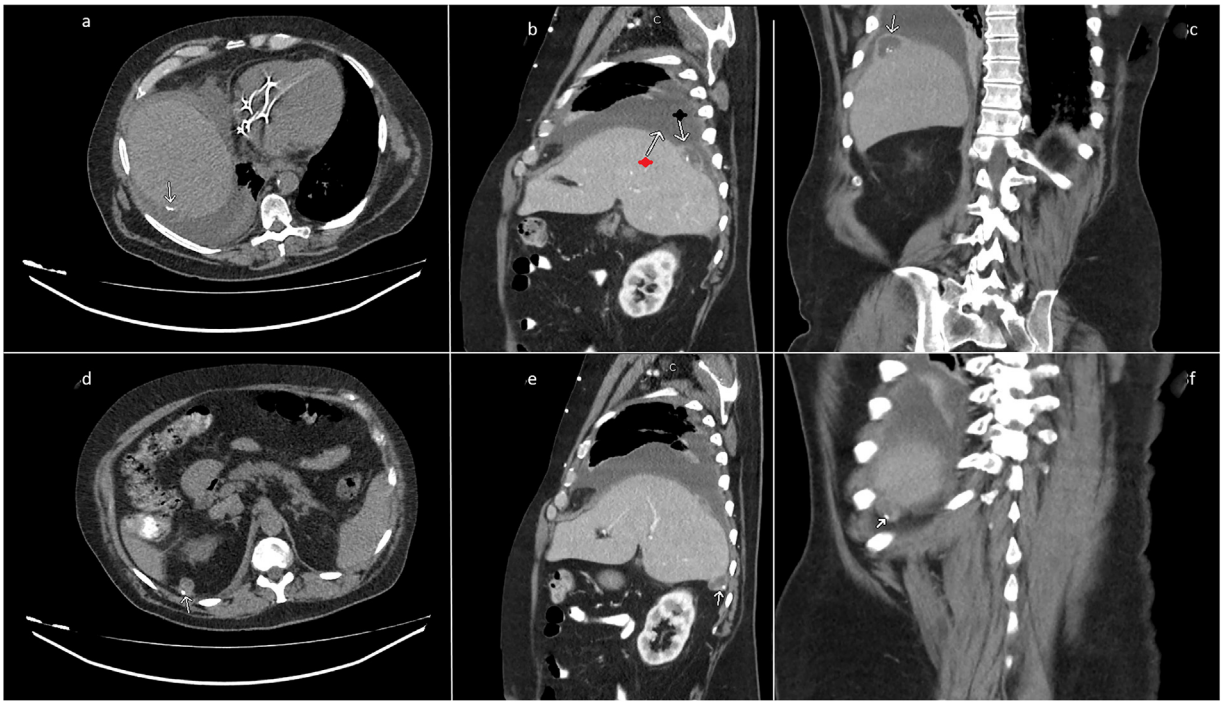

Fig. 3. Pre-operative Chest CT. A) Axial view. Right loculated pleural effusion associated with passive collapse of the lung and a 31 mm gallstone bellow the right diaphragm. B) Sagittal view. Red mark: Diaphragm. Black mark: A 31 mm gallstone below the diaphragm, in relation to the liver capsule. C) Coronal view. D) Axial view. 23 mm stone located in the relation with the right hepatic lobe. E) Sagittal view. Right loculated pleural effusion and the previous mentioned 23 mm gallstone below the right hepatic lobe F) Axial view (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

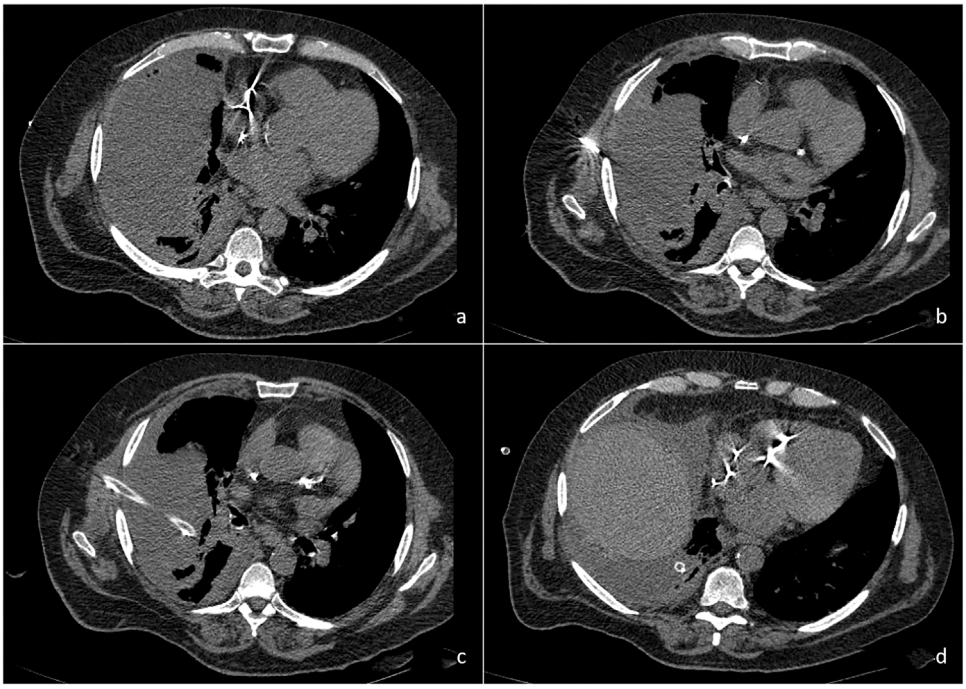

Fig. 4. CT guided thoracostomy tube placement. A) CT guidance and skin mark. B) Thoracentesis needle advancing into the pleural space. C, D) Chest tube placement.

A new chest CT revealed multifocal ground glass patterns with thickened interlobular and intra lobular lines (Fig. 8).

The patient was presented to the palliative care specialists and the ethics committee. Due to Covid-19 outbreak and the risk of aerosolization, non-invasive positive pressure ventilation (NIPPV) was not an option. Also, the patient was tagged as "low priority" for admission to ICU, since the scarce of beds and the few chances to benefit from the ICU.

After considering the patientś preferences with his surrogates, the comfort-focused care was opted. The patient died on post-operative day 11.

3. Discussion

Laparoscopic cholecystectomy has become the gold standard for gallbladder disease. Iatrogenic perforation is the most com-

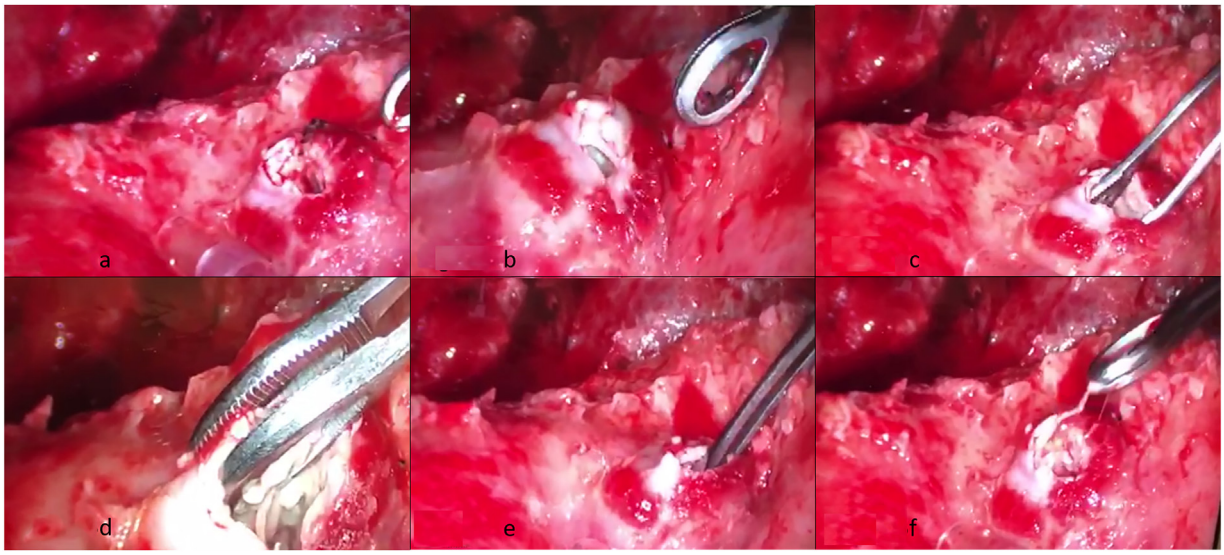

Fig. 5. Decortication via video assisted thoracoscopy. A, B) Identification of a 1 cm diaphragm defect. C, D, E) Exploration of the sub-diaphragmatic space. F) Retrieval of stone remnants and biliary sludge.

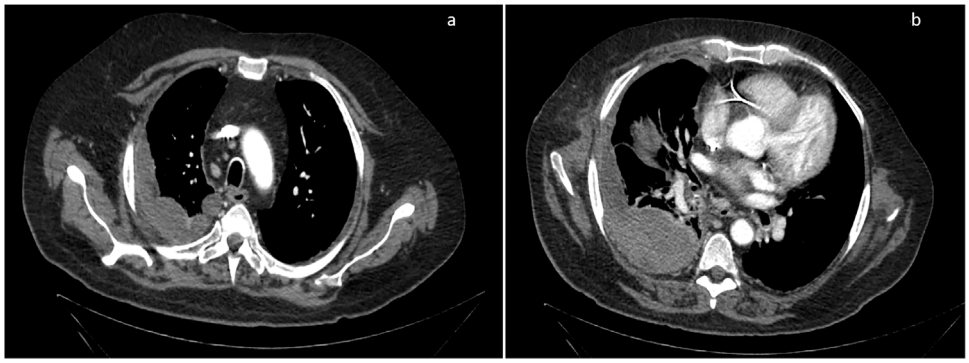

Fig. 6. Post-operative chest CT. A, B) Axial view. Right pleural effusion with spontaneous hyperdense content.

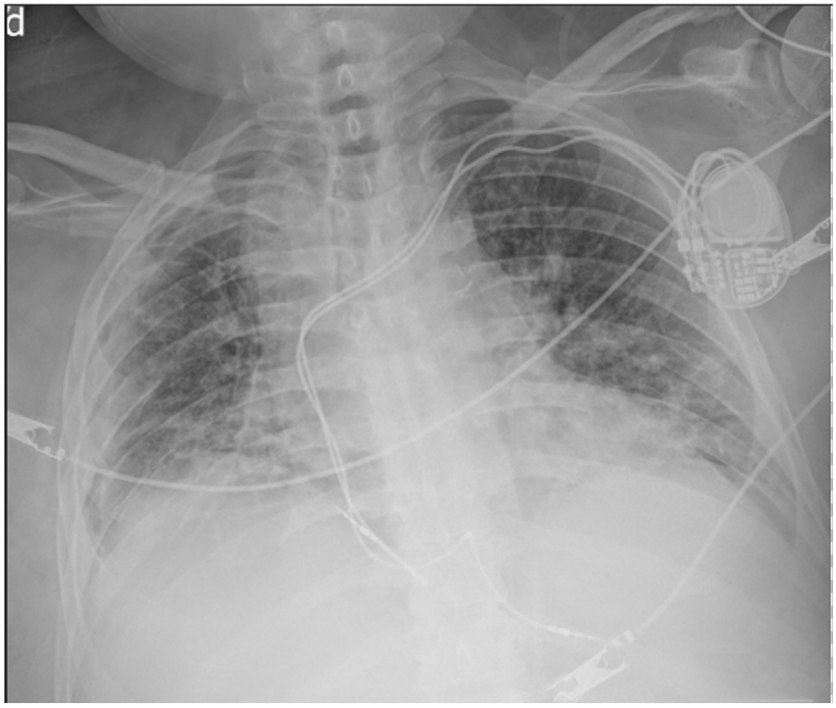

Fig. 7. Post-operative chest X-ray.

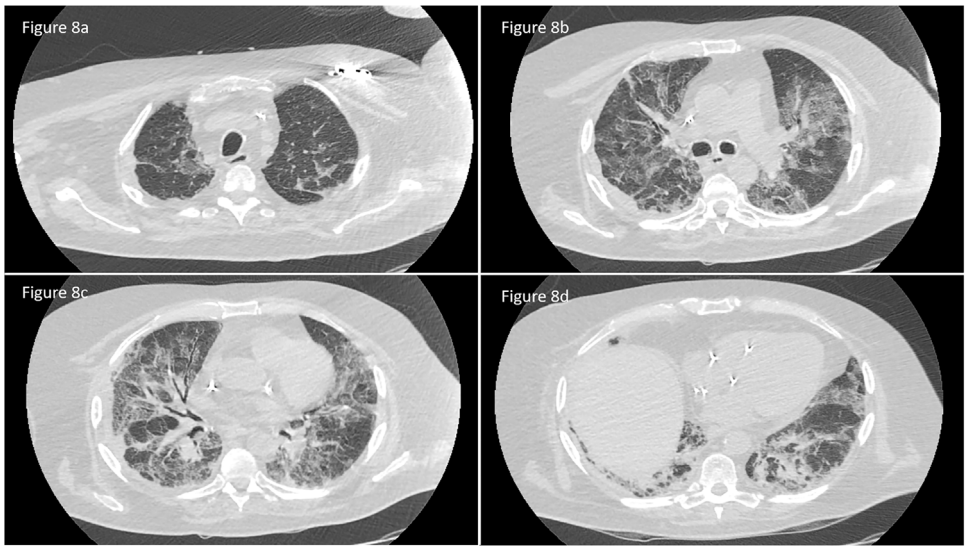

Fig. 8. Post-operative chest CT. A, B, C, D) Axial view. Multifocal ground glass patterns with widening of vessels, thickened interlobular and intra lobular lines (crazy paving).

mon complication, with an incidence of 10–30 % [5] but tends to be higher especially when associated with acute cholecystitis, high BMI, male sex and adhesions [2]. Incidence of spilled gallstones during laparoscopic cholecystectomy accounts for 6–40% of procedures performed, while 13–32% of such operations result in lost stones [1].

Despite this high incidence of gallbladder perforation and spilled gallstones, complications tend to range between from 0,6 % to 0,8 % [6], usually occurring within the first few months with the longest reported delay being 20 years [7].

While at first, dropped stones were thought to be innocuous, now it is known that there is a low risk of complications but of high morbidity, depending on the patient clinical conditions. In most cases the immune system leads to spontaneous resolution, being infectious complications more frequent in elderly patients because of poorer immunological reaction [8]. Usually complications derived from spilled gallstones take place at the abdominal cavity being the most frequent intraperitoneal abscess, wound sinus or fistula formation [9] and less frequent liver abscess, bowel obstruction, among others [10]. In contrast to intra-abdominal consequences, thoracic complications are rare, but they represent significant morbidity. Most of the times, infectious problems are caused by pigmented stones rather that cholesterol stones. Around 80–90 % of pigment stones contain bacteria such as *Escherichia coli*, *Klebsiella* pneumonia and Enterococcus, promoting local inflammation [11]. This inflammation is thought to cause further erosion through the diaphragm with posterior fistula formation, causing migration of stones and bacteria, resulting in empyema, pleurolithiasis, cholelithoptysis or broncholithiasis [3].

Because of the low incidence and delayed presentation of thoracic complications after spilled gallstones, there might be a period of time without a diagnosis and may not be an obvious relation to the LC at the time of presentation. Diagnosis of complications related to lost stones are often done only after the identification of gallstones on radiological imaging. Nevertheless, a thoracic complication of a spilled gallstone should be considered in every patient with thoracic symptoms and history of cholecystectomy with iatrogenic perforation of the gallbladder, regardless of the time interval. In similar scenarios we recommend performing an abdominal and thoracic CT scan, as it is available, efficient and perhaps the most revealing imaging study. Findings such as intra-abdominal stones, free fluid or fat stranding may orientate the diagnosis. Furthermore, it is essential to take samples for cultures since some bacteria such as *Escherichia coli*, among others, may suggest an abdominal origin. Above all, we believe the most important and helpful element for identification of the problem and diagnosis, is documentation in the operative report. With these considerations it is possible to relate thoracic events with previous abdominal surgeries.

Regarding the intraoperative management, meticulous and precise surgical technique is mandatory to minimize iatrogenic perforation and gallbladder spillage. Despite a pristine technique, stone spillage still occurs. Peritoneal lavage should be done for diluting bile and allowing the stones to be washed up by the suction, without spreading the stones into inaccessible sites. As unretrieved peritoneal gallstones are responsible for infrequent but potentially severe complications, every reasonable effort up to retrieve as many stones as possible should be done. Nevertheless, routine conversion to open surgery is not recommended [9]. Another pitfall when talking about LC, is the retrieval of the gallbladder. Retrieving the surgical specimen via a small incision promotes high pressure on the gallbladder and risk of perforation. The use of a retrieval bag should minimize the incidence of stone spillage [8].

During the Covid-19 outbreak, the ICU is being physically, materially, and emotionally challenged with the associated caseload. An understanding of number of patients and capacity, resource utilization is essential to adequately address the staff, supplies, space to mount a surge response. The COVID-19 epidemic revealed the vulnerability of healthcare systems and how they can rapidly be overloaded in excess of the available ICU bed and ventilator capacity.

For our patient, the ideal scenario would have been noninvasive ventilation (NIV) in the ICU. Considering the risk of aerosolization and the world health organization recommendations for patients infected with covid-19, NIV was not an option [12]. Furthermore, the patient had to stay in general ward due to the lack of ICU support. The idea is that scarce resources are preferentially allocated in a way that exerts the broadest benefit.

4. Conclusions

Spilled gallstones after laparoscopic cholecystectomy rarely cause thoracic complications. They usually occur months after the cholecystectomy but can happen even after several years.

In case of gallstone spillage, we suggest a thorough cleaning but not conversion to an open approach.

Documentation of iatrogenic perforation of the gallbladder and a high index of suspicious are fundamental to speed diagnosis and treatment.

Declaration of Competing Interest

We have no conflicts of interest to disclose.

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Ethical approval

This is exempt from ethnical approval in our institution.

Consent

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.

Author contribution

Ariel Nicolas Tchercansky: Writing- Original draft preparation, investigation and editing.

Fernandez Alberti Joaquin: Investigation and editing.

Panzardi Nicolas: Investigation.

Auvieux Rodolfo: Was the surgeonś assistant. Supervision.

Buero Agustin: Was the operating surgeon. Reviewing and editing.

All the authors have read and agreed to the final manuscript.

Registration of research studies

Not applicable.

Guarantor

Ariel Nicolas Tchercansky.

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