CASE REPORT

Bali Medical Journal (*Bali MedJ*) 2021, Volume 10, Number 1: 89-94
P-ISSN.2089-1180, E-ISSN: 2302-2914

Bali Medical Journal
www.BaliMedicalJournal.org
Published by Bali Medical Journal

Video-assisted thoracoscopic surgery in the treatment of empyema: a case series

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Received: 2020-12-08
Accepted: 2021-03-16
Published: 2021-04-01

ABSTRACT

Background: Empyema is a condition that can be treated depending on the etiology of the empyema and the phase of empyema development. Open thoracotomy surgery is a conventional technique commonly used in empyema that has greater risk and more extended postoperative hospital stay. This case series aims to evaluate Video-Assisted Thoracoscopic Surgery (VATS) to shorten postoperative hospital stay and lower the risk during the surgery.

Case Presentation: We describe a case series of empyema in five patients, each with a different presentation, clinical course, and outcome. All of our patients were performed VATS procedures under General Anesthesia and evaluated for postoperative hospital stays and complications that occur after the surgery. Most of the patients experienced tolerable pain on the site of surgery and only need 3 – 4 days post-operation hospital stays after VATS before being discharged. Only one patient with a poor prognosis after VATS in this case series caused the patient to be admitted to the Intensive Care Unit and using a mechanical ventilator.

Conclusion: In this case series, VATS has a promising result for the patient and can become a choice of treatment for empyema.

Keywords: Video-Assisted Thoracoscopic Surgery, Empyema, Case Series.
Cite This Article: Wirawan, Y.R., Tansil, C.J. 2021.Video-assisted thoracoscopic surgery in the treatment of empyema: a case series. *Bali Medical Journal* 10(1): 89-94. DOI: 10.15562/bmj.v10i1.2121

INTRODUCTION

Empyema is a condition where there is a buildup of fluid and purulent material within the visceral and parietal pleura caused by pulmonary infection, extrathoracic infection, tumor, trauma, and iatrogenic cause.[1,2] The incidence of pleural empyema continues to increase from year to year, with most patients being children and elderly, of which 40% of the case require surgical intervention for decontamination of pleural space.[3-6] Despite optimal modern management has been used, it is still associated with significant morbidity and mortality, apart from the underlying disease.[7]

The development of empyema takes 3-6 weeks and has been divided into 3 stages, which are exudative stage (stage I), fibro purulent and loculated stage (stage II), and chronic, organizing, cortical stage (stage III).[8] The choice of treatment for empyema depends on the etiology and stage of empyema. The purpose of empyema therapy is to control the source of infection, evacuation of fluid and pus, and re-expansion of the lungs either by chest tube drainage, intra-thoracic fibrinolysis surgery, open thoracotomy or VATS, for fluid evacuation and decortication.[9] Radiography, Computed Tomography (CT) scan with contrast, can provide a clear image of the pleura, reconstruct images of the chest cavity, determine the loculation, pleural thickening, and lesions of the underlying lung disease.[10] So that, a CT scans must be done prior to surgery.[11]

Adequate therapy for empyema is stage-dependent, with surgery as an option if antibiotic therapy and fluid drainage do not achieve infection source control and re-expansion of the lung. Open thoracotomy decortication is still the gold standard for surgery approaches in stage II and III empyema.[12] According to the European Association for Cardio-Thoracic Surgery (EACTS) in 2015 and previous studies that have been conducted, it states that VATS has been recommended for the management of surgery in patients with empyema of all grades.[9,13] VATS is a safe and effective management approach both for acute and chronic empyema. The VATS procedure provides an adequate assessment of the pleural cavity, specimen collection, and lung re-expansion.[13] According to studies that have been conducted, compared to open thoracotomy, VATS has been shown to require less operative time, minimal bleeding on surgery, shorter duration of postoperative chest tube insertion, and shorter duration for a postoperative hospital stay.[14-16]

Based on those mentioned above, this case series will discuss 5 cases of Empyema at Dr. (HC.) Ir. Soekarno Bangka Belitung Islands Province Regional Hospital where VATS has been performed at General Surgeon in Hospital.

CASE SERIES

Case 1 is a 51 years-old male patient with good nutritional status. A pulmonologist consulted the patient with a history of pain on the chest's right side for 25 days. The pain was pleuritic pain and was associated with dyspnea, fever, and productive cough. The patient was looking ill, with

tachypnea, febrile, and chest pain. Blood pressure 135/83 mmHg, pulse 104x/min, respiratory rate 24x/min, temperature 38.2°C, and SpO_2 92% in room air. The right side of the chest revealed decreased air entry on auscultation with dull percussion. Chest X-ray showed opacity pleural effusion of right hemithorax with consolidation on the perihilar - lower lobe of the right lung. Chest CT scan with contrast showed consolidation on the lower lobe of the right lung with pleural effusion and multiple encapsulated fluid with the air-fluid level on the lower lobe of the right lung. The patient underwent right VATS decortication and purulent material evacuation under General Anesthesia (GA) with Left Lateral Decubitus (LLD) position.

The single optical port (12mm) was introduced in the 5th intercostal space in the anterior axillary line. The optical port position was based on studying the CT scan and introducing it through a safe area. There was a problem during the surgery, the right lung could not be fully collapsed and the surgery needed to be stopped. A 24 Fr chest tube was inserted through the single incision. The lung then inflated after the procedure and there was no leak. The total duration of the procedure was 80 minutes with 20 cc amount of bleeding. The patient was then admitted to the surgical ward. Postoperative recovery was satisfactory. There was no complication found in the patient apart from mild pain on the chest tube insertion. There was no bubble in the water-sealed drainage with good undulation. A chest X-ray was performed on the 3rd Postoperative day (POD) and it showed reduced pleural effusion with the improved clinical condition and the chest tube was removed after that. The patient was discharged the following day and evaluated in the clinic for 1 week to complete his clinical condition.

Case 2 is a 4 years-old male patient with low nutritional status known as Spastic Cerebral Palsy, Pneumonia, Abdominal Tuberculosis, Laryngomalacia, and Marasmus. The patient was referred from a private hospital with a worsening condition caused by shortness of breath, fever, and cough. The patient was looking in poor condition, tachypnea, cough, microcephaly, and stiff body.

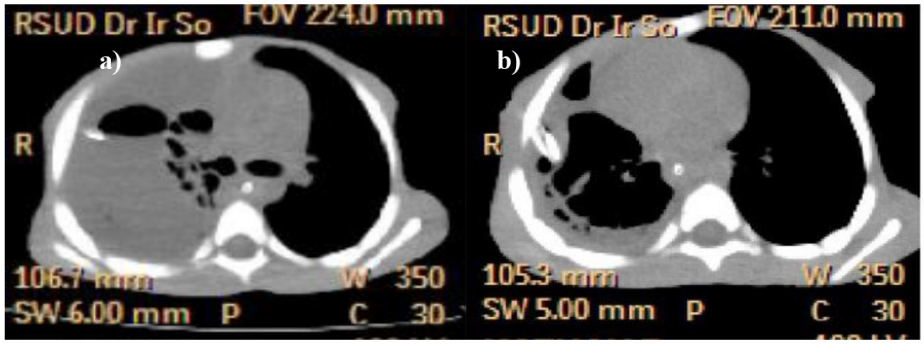

Figure 1. Chest CT Scan without contrast a) Pre-operative with massive pleural effusion, multiple air bubbles, and septa on right hemithorax b) Postoperative with pleural effusion considerably reduced and the right lung began to expand.

Blood pressure 107/65 mmHg, pulse 167x/min, respiratory rate 40x/min, temperature 37.0°C, and SpO_2 100% with 2 liters per minute Nasal Cannula. Both sides of the chest revealed decreased air entry on auscultation, but only the chest expansion's right side looked reduced in chest expansion followed by dull percussion. Chest CT scan without contrast showed tension pneumothorax with massive pleural effusion on right hemithorax followed by shifts of the heart to the left side. The patient underwent chest tube insertion in the surgery room. Chest X-ray examination done two days after chest tube inserted showed opacity filled right hemithorax with a decrease in pleural effusion volume.

The following day, a Chest CT scan without contrast was done. It showed massive pleural effusion with multiple air bubbles might be caused by septation on the right hemithorax and atelectasis of the right lung with numerous cavitations (Figure 1A). The patient underwent right VATS decortication and purulent material evacuation under GA with Left Lateral Decubitus position. The incision was made in the 5th intercostal space in the mid-axillary line then inserted with a 5 mm optical trocar. The port positioned was based on studying the CT scan and introducing the port through a safe area. There was schwarte found in the pleura during surgery. The surgery went well. A 28 Fr chest tube was inserted through an incision in the 5th intercostal space.

The lung then inflated after the procedure and there was no leak. The total duration of the procedure was 130 minutes with 10 cc amount of bleeding. The patient was then admitted to the pediatric ward. Postoperative recovery was satisfactory. There was no complication found in this patient. The patient felt comfort after surgery with a chest tube attached. There was no bubble in the water-sealed drainage with good undulation. A chest x-ray was performed on the 1st POD and it showed pleural effusion opacity on the right hemithorax was reduced from the last examination. CT scan thorax without contrast was conducted on 3rd POD, it showed pleural effusion considerably reduced and the right lung began to expand (Figure 1B). A chest tube was removed after that procedure. The patient was discharged the following day and evaluated in the clinic for 1 week with an improved clinical condition.

Case 3 is a 70 years-old male patient with low nutritional status known for Lung Tuberculosis's history of anti-TB drugs. The patient was consulted by a pulmonologist with a history of pain on the right side of the chest and was associated with pleuritic pain. The patient was looking ill, with tachypnea and chest pain. Blood pressure 150/84 mmHg, pulse 98x/min, respiratory rate 28x/min, temperature 36.6°C, and SpO_2 98% in room air. The right side of the chest revealed decreased air entry on auscultation with dull percussion. Chest CT scan with contrast showed pleural effusion and multiple encapsulated fluid on the lower lobe of the right hemithorax with consolidation around it. The patient underwent right VATS decortication and

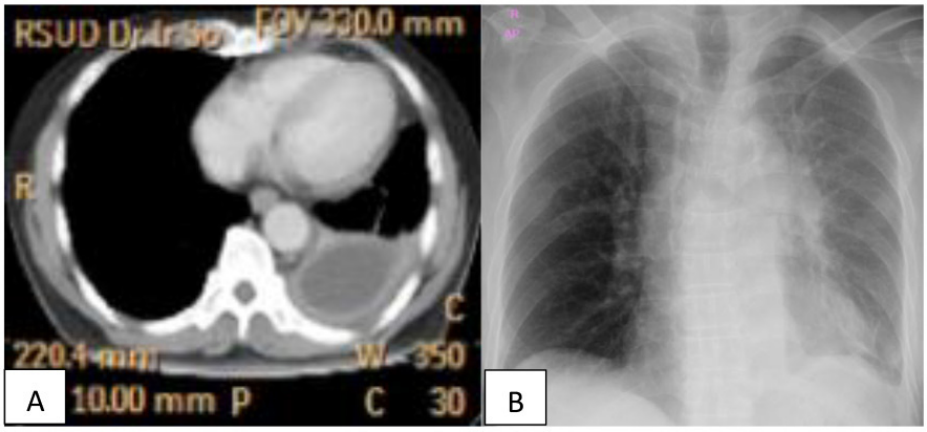

Figure 2. A) Chest, CT Scan with contrast, showed empyema on the posterobasal of left hemithorax with pleural thickening; B) Chest X-ray Postoperative showed a reduction in empyema

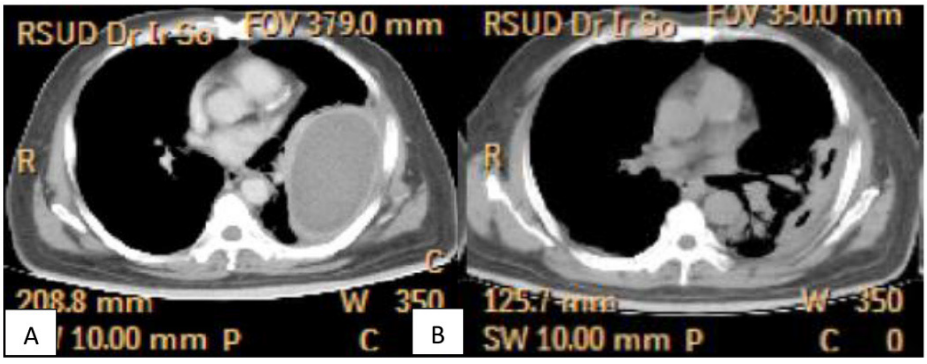

Figure 3. A) Preoperative Chest CT scan with contrast showing fluid collection and pleural thickening; B) Postoperative Chest CT scan without distinction showing consolidation on basal of the left lung without fluid collection

purulent material evacuation under GA with LLD position. An incision was made in the 8th intercostal space in the posterior axillary line, then inserted with 5 mm optical trocar and 7th intercostal space in posterior axillary line then inserted with 11 mm optical trocar.

The port positioned was based on studying the CT scan and introducing the port through a safe area. The surgery went well. A 28 Fr chest tube was inserted through an incision in the 7th intercostal space, then the lung was inflated after the procedure and there was no leak. The total duration of the procedure was 135 minutes with 25 cc amount of bleeding. The patient was admitted to the surgical ward. Postoperative recovery was satisfactory. There was swelling in the chest tube insertion and the patient felt mild pain on the chest tube insertion. There was no bubble in the water-sealed drainage with good undulation. A chest x-ray was performed on 3rd POD, it showed fibroinfiltrat both of lung with reduced opacity in the basal right hemithorax, and the chest tube was removed the following day. The patient was discharged on the same day after the chest tube was removed and evaluated in the clinic at 1 week with improvement in clinical condition but not entirely resolved.

Case 4 is a 74 years-old male patient with good nutritional status. The patient was consulted by a pulmonologist with a history of pain on the chest's left side and was associated with pleuritic pain. The patient was looking ill, tachypnea, cough, weight loss, and chest pain since 1 month ago. Blood pressure 100/60 mmHg, pulse 88x/min, respiratory rate 2 4x/min, temperature 36.7°C, and SpO_2 95% in room air. The left side of the chest revealed decreased air entry on auscultation with dull percussion. Chest CT scan with contrast showed empyema on the posterobasal, tumor mass in 3rd superior segment and segmental atelectasis, which adhere to pleural of left hemithorax with thickening of pleura (Figure 2A). The patient underwent left VATS decortication and purulent material evacuation under GA with Right Lateral Decubitus position. The incision was made in the 7th intercostal space in the posterior axillary line then inserted with a 5 mm optical trocar.

The port positioned was based on studying the CT scan and introducing the port through a safe area. The surgery went well. A 28 Fr chest tube was inserted through an incision in the 7th intercostal space. The lung then inflated after the procedure and there was no leak. The total duration of the procedure was 120 minutes with 30 cc amount of bleeding. The patient was admitted to the surgical ward after that procedure. Postoperative recovery was satisfactory. There was no complication found in the patient apart from mild pain on the chest tube insertion. There was no bubble in the water-sealed drainage with good undulation. A chest X-ray was performed on the 2nd POD and it showed a reduction in Empyema (Figure 2B). A chest tube was accidentally pulled out in the surgery ward after a chest x-ray, the patient underwent another chest x-ray with the same result as before and there was no pneumothorax sign. The patient was discharged the following day and evaluated in the clinic for 1 week with an improved clinical condition.

Case 5 is a 52 years-old overweight male patient. A pulmonologist consulted the patient with a history of the serial pleural tap (needle thoracostomy) with thick yellowish discharge since 6 months before admission. The patient was looking ill, with tachypnea, cough, and chest pain. Blood pressure 145/97 mmHg, pulse 115x/min, respiratory rate 24x/min, temperature 36.7°C, and SpO_2 97% in room air. The left side of the chest revealed decreased air entry on auscultation with dull percussion. Chest X-ray showed consolidation in the basal of the left lung. Chest CT scan with contrast showed a fluid collection with pleural thickening in the left lung's basal with consolidation around it (Figure 3A).

The patient underwent left VATS decortication and purulent material evacuation under GA with Right Lateral Decubitus position. The incision was made in the 5th intercostal space in the mid-axillary line, then inserted with 12 mm optical trocar and 6th intercostal space in posterior axillary line then inserted with 5 mm optical trocar. The port positioned was based on studying the CT scan and introducing the port through a safe area. There was a problem during the surgery, and the right lung could not be collapsed and desaturated, so the surgery needed to be stopped. A 24 Fr chest tube was inserted through an incision in the 5th intercostal space. The lung then inflated after the procedure and there was no leak. The total duration of the procedure was 135 minutes with 10 cc amount of bleeding. Patient saturation can be stabilized by an anesthetist and needs to be monitored in the Intensive Care Unit (ICU) and uses a ventilator. Postoperative recovery went well. The patient was extubated after 35 hours and moved to the surgery ward after 46 hours in ICU. There was no complication found in the patient apart from mild pain on the chest tube insertion. There was no bubble in the water-sealed drainage with good undulation. A chest x-ray was performed on the 2nd POD and it showed opacity on the left lung suspiciously cavity on lung (Figure 4). Chest CT scan without contrast was performed on the 3rd POD and it showed consolidation on the left basal lung and there was no sign of fluid collection (Figure 3B). A chest tube was removed on the 4th POD. The patient was discharged on the same day and evaluated in the clinic at 1 week with improvement in clinical condition. A summary of case series was presented in Table 1.

Figure 4. Chest X-ray Postoperative showed opacity on the left lung suspiciously cavity on lung

DISCUSSION

Patients who have undergone VATS decortication at this hospital are all male, with a distribution of 1 pediatric, 2 adults, and 2 elderly patients (Table 1). Empyema incidence continues to increase, especially in pediatric and elderly groups in which the cause cannot be explained but appears to be multifactorial.[4,15] The most common underlying disease that causes empyema in pediatrics is tuberculosis and followed by pneumonia.[17] Dominated by male gender, which is also found in previous studies.[18] Pleuritic pain and shortness of breath were the main complaints by patients when they were first examined. The majority of the patients reported typical chest pain at the site of empyema.

A diagnostic imaging test, x-ray, and CT scan, before surgery, was performed in this serial case. Diagnostic imaging is very useful for determining pleural thickening, the number of pleural effusions, loculations, adhesions, septa, the underlying disease, and can be used to determine the incision's VATS location. The discovery of CT loculations and pleural thickness is significantly associated with a higher stage of Empyema.[19]

VATS decortication and purulent evacuation were done in this case series. There were 2 techniques of VATS that were used by our surgeon, which are one port technique or U-VATS and two-port techniques (Table 1). Choosing to use a port or two-port technique is based on multifactorial, such as the stage of empyema, location and amount of empyema, abscess wall thickness, availability of tools, and operator experience. Open thoracotomy and VATS are the choice of therapy for advanced empyema (stage II and III). It has been agreed that treatment for stage II empyema is safe to use VATS.[9] However, the gold standard for stage III empyema is still Open Thoracotomy.[12] On the other hand, many studies have compared the use of VATS with open thoracotomy as the primary modality in the management of empyema.

The procedure time required for VATS in this serial case was 80 – 135 minutes, with the meantime of the procedure was 120 minutes (Table 1). While the amount of bleeding intraoperative was 10 – 30 cc, with a mean of 19 cc (Table 1). A previous study shows that open thoracotomy takes a mean of 172.4 minutes with a total bleeding mean of 779.9 cc.[14] Procedure time is significantly shorter at VATS compared to open thoracotomy. This may be due to a more prolonged procedure (pulmonary resection for a lung abscess or lymph node dissection or inflammation that destroys the lung parenchyma) in patients undergoing an open thoracotomy.[14] Shorter procedure time in VATS leads to fewer surgical complications and shorter postoperative hospital stay.[18]

The surgery was well tolerated by almost all patients with minimal postoperative complications. In case 1 and case 5, there were problems during surgery, and the lungs could not be fully collapsed, so the

Table 1. A summary of case series

Variable	Case 1	Case 2	Case 3	Case 4	Case 5
Sex	Male	Male	Male	Male	Male
Age (years)	51	4	70	74	52
BMI Status	Normal	Underweight	Underweight	Normal	Overweight
Intra-Operative Duration (minutes)	80	130	135	120	135
Intra-Operative Bleeding (cc)	20	10	25	30	10
VATS Technique (port)	One	One	Two	One	Two
Chest Tube Duration (Days)	3	3	4	2	4
Post-Operative Hospital Stay (Days)	4	4	4	3	4

operator could not continue the surgery optimally and had to be stopped before it finished. In case 5, there was delayed extubation in the patient and had to be admitted to ICU for 46 hours because he was using a mechanical ventilator for 35 hours. Delayed extubation is a complication of surgery. Unlike previous studies, patients post VATS procedure took longer time in the ICU (mean 238 hours) and a mechanical ventilator (mean 371 hours). Meanwhile, patients who needed to be admitted to the ICU after open thoracotomy took an average of 114.6 hours with a mean length of use of the ventilator 71.4 hours.[14] It demonstrated that patients in this case series had an above-average ICU postoperative stay. The post-operation open thoracotomy complication rate reached 57.0%, whereas with VATS, it was not much different but slightly lower at 52.4%. With complications in postoperative bleeding, pneumonia, GI infection, prolonged chest drainage (more than 10 days), and others complication.[14]

Postoperative chest tube insertion has good results, with minimal complications for the patient. Swelling in the chest tube insertion area in case 3 was the only complication besides mild pain felt by all patients at chest tube insertion. There were no bleeding, air leak, infection, emphysema subcutis, and fistula on chest tube insertion.

Chest tube removal in patients was based on lung conditions assessed in advance of water-sealed drainage production, clinical condition, and chest x-rays examination. The mean duration of chest tube placement was 3.2 days (Table 1). The mean chest tube placement in the elderly was 6.6 days and in pediatrics was 5.4 days.[17] This means in this series of cases showed faster chest tube removal after VATS. The mean postoperative hospital stay was 3.8 days (Table 1). According to studies that have been conducted for the postoperative open thoracotomy treatment takes an average of 17 days.[14] Lower postoperative hospital stay makes it more cost-saving.

The in-hospital mortality rate inpatient after open thoracotomy was up to 6% and for VATS 4.6%.[20] In this case series, one patient died during or after surgery in the hospital. The patient was discharged with an improved clinical condition accompanied by improvements from a chest x-ray. Then patients asked for routine medical follow-up. Indonesian have bad habits, if the disease becomes better, they will not do medical follow-up again until the disease becomes worse. In this case series, patients only came once for medical follow-up one week after being discharged. Therefore, the recurrence rate cannot be assessed. We assume that none of these 5 patients experienced a relapse or long-term complications after VATS decortication because there were no readmission data in our medical record hospital.

The use of UVATS or VATS as management of empyema provides advantages over an open thoracotomy in lower morbidity rate, cost-effective, lower hospital stay, good postoperative functional, and better cosmetic outcome. A previous study showed VATS has a high success rate resembled even slightly better with a lower incidence of complications than open thoracotomy.[14,17,21]

CONCLUSION

In this serial case, VATS decortication and purulent material evacuation had been performed in five patients and showed promising results. VATS provide several advantages, which are feasible to use for any age, any nutritional status, minimize chest tube insertion, postoperative hospital stay, risk of infection, scar, and complications. Almost the entire patient felt improved in the clinical condition in the first appointment after discharge. VATS showed very promising results as a modality of surgery for empyema grade II and III. We advocate using U-VATS or VATS, which an experienced surgeon performed as a routine approach in patients with empyema stage II and III.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this article.

FUNDING

The current study doesn't receive any specific grant from the government or any private sector.

AUTHOR CONTRIBUTIONS

YRW was responsible for study design, conceptualization, and data acquisition. CJT was responsible for literature search, manuscript preparation, data analysis, and review. All the authors had reviewed the final manuscript version.

ETHICAL CONSIDERATION

All patients have been signed informed consent and agree to the publication of their data as a case series article.

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