ACTA MEDICA LITUANICA. 2015. Vol. 22. No. 2. P. 102–110

Video-assisted thoracic surgery in pleural empyema: predictors of complications and treatment failures

Žymantas Jagelavičius[1, 2],

Vytautas Jovaišas[2],

Mindaugas Matačiūnas[3],

Narimantas Evaldas Samalavičius[4],

Ričardas Janilionis[1, 2]

[1] *Centre of General Thoracic Surgery, Clinic of Infectious and Chest Diseases, Dermatovenerology and Allergology, Faculty of Medicine, Vilnius University*

[2] *Department of General Thoracic Surgery, Vilnius University Hospital Santariškių Klinikos*

[3] *Radiology and Nuclear Medicine Centre, Vilnius University Hospital Santariškių Klinikos*

[4] *Clinic of Internal Diseases, Family Medicine and Oncology, Faculty of Medicine, Vilnius University, Vilnius, Lithuania*

Background. Empyema remains a challenging entity for thoracic surgeons. The aim of this study was to evaluate preoperative predictors for unsuccessful thoracoscopic empyemectomy and postoperative complications.

Materials and methods. There were 71 patients prospectively included in the study during the period from January 2011 to June 2014 in whom we performed thoracoscopic empyemectomy. Two main outcomes were evaluated: conversion and complications. Preoperative factors that could predict these outcomes were analyzed.

Results. Conversion to open thoracotomy was required in 25.4% of cases. Fourteen (19.7%) patients had postoperative complications. The multivariate analysis showed that the time of illness (odds ratio 1.1; confidence interval 1.1–1.2), normal temperature on admission (odds ratio 11.2; confidence interval 1.5–85.4) and frank pus found on thoracocentesis (odds ratio 6.9; confidence interval 1.6–29.4) had a significant influence on conversion from thoracoscopy to open thoracotomy. Pain (odds ratio 0.01; confidence interval <0.01–0.6), subfebrile temperature on admission (odds ratio 10.1; confidence interval 1.4–73.5), positive pleural culture (odds ratio 8.5; confidence interval 1.0–70.1), Charlson comorbidity index (odds ratio 2.3; confidence interval 1.1–4.8), empyema volume (odds ratio 1.002; confidence interval 1.000–1.005) and empyema density (odds ratio 0.8; confidence interval 0.6–1.0) had a significant influence on postoperative complications.

Conclusions. Longer time of illness, normal temperature on admission and frank pus in pleural aspiration increase probability of conversion. No pain, subfebrile temperature, higher Charlson comorbidity index on admission, positive pleural culture, higher volume and lower density of empyema on computed tomography scan increase probability of postoperative complications.

Key words: pleural empyema, video-assisted thoracic surgery, treatment failure, complication

Correspondence to: Žymantas Jagelavičius, Centre of General Thoracic Surgery, Clinic of Infectious and Chest Diseases, Dermatovenerology and Allergology, Faculty of Medicine, Vilnius University, Birutės St. 1/20, LT-08117 Vilnius, Lithuania. E-mail: zymant@yahoo.com

BACKGROUND

Despite modern diagnostic methods and appropriate treatment, pleural empyema remains a serious problem in terms of morbidity and mortality. The principal aims managing pleural empyema are to control the infection and to evacuate the infected material (1). For the evacuation of infected material and refiling residual space with the lung we usually need to perform any form of surgical intervention. Hence, surgical management of pleural empyema plays an important role in the treatment of this disease, described already by Hippocrates (2–4). Traditionally, open thoracotomy represented the main stay of treatment for this condition, but recently numerous attempts have been performed to replace it by a minimally invasive approach (2, 5–7). The precise role of video-assisted thoracic surgery (VATS) in the management of pleural empyema remains controversial and no consensus is currently in place on which surgical option and for what the patient is the first line (8–10). Some recent studies suggest that VATS and open thoracotomy are showing similar treatment success rates and are equally effective. Successfully done VATS, being less invasive, provides the additional advantages of decreased postoperative discomfort, pain, better cosmetics, higher patient satisfaction and shorter hospitalization time, especially if performed relatively early (5, 8, 9, 11). However, in up to 59% of patients VATS is inadequate and conversion to open thoracotomy is necessary during the same operation (12, 13). Re-do surgery after VATS (when disease remains or complication occurs) reaches up to 11.5% and is higher compared to direct open thoracotomy (5, 9). So, failed VATS empyemectomy results in longer operating time, prolonged hospital stay, higher need of additional surgery, of a treatment at the Intensive Care Unit (ICU) and therefore increases treatment costs. The identification of preoperative factors that will allow surgeons to select the type of operation (VATS or open thoracotomy) could be of great interest in clinical practice.

The aim of this study was to determine potential preoperative features that might help to predict VATS conversion to open thoracotomy and postoperative complications.

METHODS

In this study we prospectively included patients with pleural empyema irrespectively of chronicity who had been treated in the period from January 2011 to June 2014.

The diagnosis of empyema was confirmed in all cases finding at least one of the following features: purulent or opaque pleural fluid, positive fluid culture, loculations at CT scan or specific findings in pleural fluid (pH < 7.3, glucose < 2.22 mmol/l, LDH > 1000 IU/l, protein > 10 g/l, WBC > 500/μl) and general clinical signs of infection. We excluded patients with bronchopleural fistula, "empyema necessitatis", mediastinitis, pulmonary or pleural malignancy or previous thoracic surgery.

Surgical operations in all patients in this study were started as VATS. All surgical procedures have been performed under general anesthesia using a double-lumen endotracheal tube for single lung ventilation. Usually two or three ports have been used. All infectious material (fluid, loculations, septa, solid debris and adherent peel from pleura) was removed, the lung was completely mobilized and decorticated. Material for microbiological analysis was collected in all patients. At the end of the procedure, usually two 32 French gauge size chest tubes were inserted. Sometimes during the operation we assessed that it was impossible to perform operation by VATS successfully. In these cases, when it was impossible to enter the pleural cavity safely due to firm adhesions or to remove completely all debris from the underlying pulmonary surface in order to reach sufficient lung reexpansion, conversion to the open thoracotomy was considered.

Two main outcomes have been evaluated. The first was failure of VATS surgery in terms of conversion to open thoracotomy. Here we had two groups: a successful VATS group (operation ended by VATS) and a conversion group (VATS operation was converted and ended as open thoracotomy). The second outcome was early postoperative complications: complicated and uncomplicated groups. Prolonged air leak (>5 days), wound infection, hemothorax, persistence of disease (when clinical signs remained and a significant amount of effusion in the chest cavity was observed) and death were considered as complications. We looked for preoperative factors that could predict these outcomes. We analyzed the following variables:

age, sex, living place, the delay of surgery (the time from onset of symptoms till the operation), previous antibacterial treatment and therapeutic thoracocentesis or intercostal drainage, symptoms and presence of fever on admission, presence of frank pus in pleural cavity, comorbidities calculating the Charlson comorbidity index (CCI) (14). The laboratory variables assessed were preoperative blood hemoglobin concentration, white blood cell (WBC) counts, serum C-reactive protein (CRP) levels; pleural fluid bacteriology, pH, protein, glucose, lactate dehydrogenase (LDH) levels, WBC counts and leukogram. Radiological variables were collected on CT scan images: number of loculations, total volume of empyema, density of pleural fluid collection (in Hounsfield units), thickening of parietal pleura, and presence of air bubbles in the empyema cavity.

The hospital stay, postoperative hospital stay, time at the Intensive Care Unit (ICU), operating time, postoperative morbidity and mortality were also recorded.

Statistical analysis was performed using SPSS 19.0 for windows (SPSS Inc. Chicago, Illinois, USA). Categorical data were presented as frequency (%) and continuous variables were expressed as a mean ± standard deviation (SD) if there was a normal distribution, otherwise as median and quartile range (QR). Normal distribution of continuous data was tested by the Shapiro-Wilk test. Potential outcome predictive factors were evaluated using an univariate binary logistic regression analysis. The factors with p-value <0.4 were included in the multivariate binary logistic regression analysis model. A statistical significance level was set at 0.05.

RESULTS

We evaluated 71 consecutive cases where thoracoscopic empyemectomy had been performed. There were 62 males and nine females, having a mean age of 52 ± 16 years. The main symptoms presented on admission are shown in Table 1.

Table 1. Main symptoms presented on admission

Symptom	n (%)
Fever	65 (91.5)
Chest pain	60 (84.5)
Dyspnea	50 (70.4)
Weakness	38 (53.5)
Cough	30 (42.3)

A video-assisted thoracoscopic procedure was successfully performed in 53 (74.6%) cases, whereas in 18 (25.4%) cases conversion to the open thoracotomy during the same operation was required. The obliterated pleural space by dense adhesions (in 12 patients) and the inability to achieve total lung re-expansion (in five patients) were the main reasons for conversion. The last patient was converted to an open thoracotomy for severe obesity, when the standard trocars and instruments were too short to reach the pleural space. The preoperative features of patients are shown in Table 2.

Table 2. Preoperative features of 71 patients

Variable	N (%), mean (±SD) or median (QR)
Sex: male	62 (87.3%)
Age, years	52 ± 16
Living place: city	55 (77.5%)
Delay of surgery, days	19 (10–25)
Prior treatment at the hospital	58 (81.7%)
Prior antibiotic therapy	59 (83.1%)
Prior therapeutic thoracocentesis or chest tube	21 (29.6%)
CCI score	0 (0–1)
Fever, °C	38.0 ± 0.7
Blood	
hemoglobin, g/l	120.5 ± 19.9
WBC count, u/µl	12.2 (8.9–16.6)
serum C-reactive protein, mg/l	143.6 (91–203)
Pleural fluid	
frank pus in aspiration	23 (32.4%)
pH	7.1 ± 0.3
protein, g/l	44.6 (41.9–49.7)
glucose, mmol/l	1.9 (0.3–3.5)
LDH, u/l	4352 (751–8206)
WBC count, u/µl	4120 (1030–28400)
neutrophils, %	85 (59–91)
lymphocytes, %	13 (6–36)
monocytes, %	1 (1–2)
positive culture	17 (23.9%)
CT density of empyema, HU	14.8 ± 5
CT parietal pleura thickening, mm	4 (3–5)
CT volume of empyema, ml	780 (618–1121)
CT number of loculations	2 (1–3)
CT air bubbles in empyema cavity	21 (29.6%)

SD – standard deviation; QR – quartile range; CCI – Charlson comorbidity index; WBC – white blood cell; LDH – lactate dehydrogenase; CT – computed tomography; HU – Hounsfield unit.

The median duration of hospital stay was 11 days (QR 9–16). The mean operating time was 82 ± 26

minutes and the median postoperative hospital stay was 7 days (QR 6–10). There was a significant difference in the operating time comparing successful VATS and conversion groups: 76 ± 22 and 100 ± 28 minutes, respectively, $p < 0.001$. Converted cases more often required treatment at the ICU, the mean duration was 0.62 ± 0.66 vs 0.94 ± 0.54 days, $p = 0.045$.

Fourteen patients (19.7%) had postoperative complications (Table 3). Six of them required additional surgery: three due to postoperative hemothorax and three due to persistence of disease. All six patients who required re-do surgery in the early postoperative period after primary operation were patients from the successful VATS group. And there were no patients who required re-do surgery in the conversion group. The reason of single death (hepatic cirrhosis) was not associated with pleural empyema and it was in the conversion group.

Table 3. Postoperative complications

Complication	Successful VATS n = 53	Conversion n = 18	p-value
Total	10 (18.9%)	4 (22.2%)	0.742
Persistence of disease	4 → 3*	0	
Prolonged air leak	2	1	
Wound infection	1	2	
Hemothorax	3 → 3*	0	
Death	0	1	

* Cases that required re-do surgery in the early postoperative period; VATS – video-assisted thoracic surgery.

Complications were associated with longer hospitalization time (11 (QR 8–13) days in the uncomplicated group vs 23 (QR 18–29) days in the complicated group, $p < 0.001$), postoperative time (7 (QR 6–8) vs 20 (QR 14–25) days, $p < 0.001$) and ICU time (1 (QR 0–1) vs 1 (QR 1–2) day, $p = 0.028$).

According to the univariate binary logistic regression analysis on the factors that make influence on conversion, we have found that delay of surgery and frank pus in aspiration significantly increase the conversion rate. Searching for independent predictors of conversion on the multivariate logistic regression analysis we have found that each day of illness before surgery significantly increased the chance of conversion by 1.1 times, frank pus in aspiration by 6.9 times and normal temperature on arrival by 11.2 times (Table 4).

Analyzing the factors that make influence on complications according to the multivariate logistic regression analysis we have found that no pain, subfebrile temperature on admission, positive pleural fluid culture, higher CCI score, lower density and higher volume of empyema on the CT scan significantly increased the chance of complications. These factors are independent predictors of complications (Table 5).

Table 4. Influence of different preoperative factors on conversion (univariate and multivariate logistic regression analysis)

Factor	Univariate analysis*		Multivariate analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Living place: city	0.5 (0.1–1.5)	0.210		
Delay of surgery, days	1.1 (1.0–1.2)	0.003	1.1 (1.0–1.2)	0.003
Symptoms: pain	4.0 (0.5–33.3)	0.206		
cough	0.6 (0.2–1.9)	0.378		
dyspnea	0.6 (0.2–1.7)	0.320		
fever	0.3 (0.1–1.6)	0.165		
Prior treatment at the hospital	0.5 (0.1–2.4)	0.369		
Normal temperature on admission	4.8 (1.0–23.8)	0.057	11.2 (1.5–85.4)	0.02
Blood WBC count on admission	0.9 (0.8–1.0)	0.261		
CRP level on admission	0.99 (0.99–1.00)	0.093		
Frank pus in aspiration	3.8 (1.3–11.8)	0.018	6.9 (1.6–29.4)	0.009
LDH in pleural fluid	1.0 (1.0–1.0)	0.190		
Monocytes (%) in pleural fluid	1.1 (0.9–1.5)	0.334		
Positive pleural fluid culture	1.9 (0.6–6.2)	0.284		
Prior thoracocentesis or chest tube	0.4 (0.1–1.5)	0.175		
CT parietal pleura thickness, mm	1.3 (0.7–2.4)	0.360		
CT air bubbles in empyema cavity	1.8 (0.6–**5**.5)	0.320		

* Showed only factors (with $p < 0.4$) included in the multivariate logistic regression analysis model; OR – odds ratio; CI – confidence interval; WBC – white blood cell; CRP – C-reactive protein; LDH – lactate dehydrogenase; CT – computed tomography.

Table 5. Influence of different preoperative factors on complications (univariate and multivariate logistic regression analysis)

Factor	Univariate analysis*		Multivariate analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age, years	1.02 (0.98–1.06)	0.292		
Delay of surgery, days	1.03 (0.98–1.08)	0.203		
Symptoms: pain	0.4 (0.1–1.4)	0.143	0.01 (<0.001–0.6)	0.026
Prior treatment at the hospital	3.5 (0.4–29.2)	0.253		
Prior antibiotic therapy	3.1 (0.4–26.4)	0.298		
CCI score	1.6 (1.0–2.6)	0.064	2.3 (1.1–4.8)	0.032
Subfebrile temperature on admission	3.1 (0.9–10.3)	0.069	10.1 (1.4–73.5)	0.022
Febrile temperature on admission	0.4 (0.1–1.3)	0.137		
Hemoglobin on admission	0.99 (0.96–1.02)	0.329		
Frank pus in aspiration	1.8 (0.5–5.9)	0.354		
Protein in pleural fluid	1.03 (0.97–1.10)	0.356		
LDH in pleural fluid	1.0 (1.0–1.0)	0.114		
Monocytes (%) in pleural fluid	1.1 (0.9–1.5)	0.342		
Positive pleural fluid culture	3.1 (0.9–10.9)	0.072	8.5 (1.0–70.1)	0.046
CT density of empyema, HU	0.9 (0.8–1.0)	0.198	0.8 (0.6–1.0)	0.037
CT volume of empyema, ml	1.001 (0.999–1.002)	0.302	1.002 (1.000–1.005)	0.031
CT number of encapsulates	0.7 (0.4–1.3)	0.320		
CT air bubbles in empyema cavity	2.1 (0.6-7.1)	0.230		

* Showed only factors (with $p < 0.4$) included in the multivariate logistic regression analysis model; OR – odds ratio; CI – confidence interval; LDH – lactate dehydrogenase; CCI – Charlson comorbidity index; CT – computed tomography; HU – Hounsfield units.

DISCUSSION

Pleural empyema is a complex clinical entity that has defied randomized controlled trials and efforts to define the best clinical practices because of the multitude of patient factors that determine treatment outcomes (3, 15). Even with moderate or minimal infectious or respiratory symptoms, pleural empyema exposes the patient to devastating morbidity if neglected or operated on too late (8).

This study was not a randomized comparative trial of different therapeutic options. However, understanding of preoperative prognostic factors for conversion and complications is, nevertheless, critical to choosing the best therapeutic attitude.

The clinical manifestations of pleural empyema vary according to the underlying infection, general status of patient, etiology and chronicity of the disease. Usually clinical findings are fever (60–86% of patients), chest pain (60%), dyspnea (47–74%), cough (31%), sputum production, poor appetite, weight loss (1, 6, 8). In our patients the main symptoms were fever, chest pain, dyspnea and cough.

Patient selection for and timing of surgical intervention usually remain a matter of expert opinion and varies widely between institutions (10, 16). Despite the advantages of VATS, according to different authors including different groups of patients, it is associated with up to 59% of conversion to open thoracotomy (1, 3, 5–7, 9, 11–13, 15, 17–25). The conversion rate in our study, according to the fact that we also included advanced (stage III) cases of empyema, was not very high – 25.4%. Conversion to the thoracotomy is usually considered if there is impossible to enter the pleural cavity due to firm adhesions, completely dissect the peel from the underlying lung surfaces to achieve enough lung reexpansion or in cases of severe bleeding or significant air leak (12, 18–21, 23). The first two were the main reasons for conversion in our study. The last patient was converted due to severe obesity. Because of a higher rate of conversion to open thoracotomy and technical difficulties during the surgery, VATS empyemectomy would clearly show better results when applied at the appropriate time. The timing of surgery is very important because it is expected to be a major prognostic factor in postoperative outcomes (8, 26). Unfortunately, there is a lack of data

regarding the optimal timing of surgical intervention, so there is no consensus regarding this issue. Some recent studies identified that delayed referral to surgery or longer anamnesis lead to higher conversion rate and consequently increases morbidity and mortality (1, 3, 12, 15, 21, 24, 25, 27). Chung and colleagues in their recent retrospective analysis of 120 cases of VATS empyemectomies stated that patients with the symptom duration of less than four weeks showed better early results compared to those with the symptom duration greater than four weeks (16). In other study done by Lardinois and colleagues, it was suggested to use conversion thoracotomy when the symptom duration is more than two weeks before surgery (25). However, Waller and colleagues stated that the success of VATS decortication is not related to either the delay between onset of symptoms or hospital admission and surgery (19). In our study we have found that longer anamnesis, normal temperature on arrival and frank pus in pleural aspiration (signs showing more advanced disease) significantly increased the conversion rate. On the basis of our results the importance of early VATS in the management of pleural empyema, which was also reported in other previous studies (16, 17, 24, 28), seems to be more justified. Clinically it may provide better clues for the decision to perform the early surgical approach.

The positive culture from the pleural space is assessed by different authors in 10–60% of patients (5, 6, 8, 15, 24, 25, 28–32). Such a low percentage of positive cultures may represent an effective antibiotic treatment prior to sample collection. It may also suggest that continual presence of bacteria is not necessary to sustain the ongoing inflammatory response after the initial bacterial invasion (1). In our study the positive pleural fluid culture was observed only in 23.9% of patients. The sterility of pleural fluid may reflect the chronicity of the process as well as may be associated with the prior antibacterial treatment, which was used in 83.1% of our patients. According to our data, the positive culture did not have a significant influence on the rate of conversion. Stefani and colleagues also have not found any significant influence of positive culture on conversion (24). Lardinois and colleagues stated that only Gram-negative bacteria significantly increased the rate of conversion but in general the positive culture had no influence on conversion (25). On the other hand, according to our data and to the Okiror and colleagues study (31), the positive culture significantly increased the risk of postoperative complications.

The average length of hospitalization varies from 5.7 to 18.5 days, but is significantly longer if VATS fails or if complications occur (3, 6, 8, 9, 17, 32–34). Postoperative stay, as stated by Waller and colleagues, is significantly longer in the conversion group vs the successfully done VATS group (8.5 and 5.5 days) (19). In our study, as well as in Stefani and colleagues work (24), the postoperative time did not differ significantly between the successful VATS and conversion groups. We have found a significant difference in the postoperative time only if complications occurred. However, time spent at the ICU after the operation was significantly higher in the conversion group.

In our study the mean operating time was 82 ± 26 min. However, this time was significantly longer if operation was converted to thoracotomy (76 ± 22 vs 100 ± 28 min, $p < 0.001$). Similar significant differences are shown in the studies made by Waller and colleagues (19) and Stefani and colleagues (24), where the operating time was significantly shorter in the successful VATS group compared to the conversion group.

The complication rate after VATS empyemectomy varies from 9% to 40.2% (5, 6, 8, 9, 11, 17, 18, 20, 24, 25, 32). Prolonged air leak, bleeding, recurrence or persistence of the disease, surgical wound infection and residual pleural space are the most common complications. However, renal insufficiency, deep venous thrombosis, chylothorax, lesion of diaphragm, high response atrial fibrillation by some authors are also mentioned (5, 6, 8, 9, 11, 18, 20, 22). In our series the complication rate was 19.7% (14 out of 71 patients): recurrence of disease (four patients), prolonged air leak (three), wound infection (three), hemothorax (three) and in-hospital death (one). Terra and colleagues (5) as well as Stefani and colleagues (24) in their studies mentioned that VATS is associated with a significantly lower rate of postoperative complication compared with converted to open thoracotomy cases. Differently from these authors, we have not found any difference in the complication rate between the successfully done VATS and converted cases. However, analyzing the treatment that was necessary to cure complications we have found that all six patients (8.5%) who required surgical reintervention

(three for recurrence of disease and three due to hemothorax) were patients from the VATS group. According to Lardinois and colleagues, recurrence of empyema that required re-do surgery was found in 2.4% of cases and did not differ between the VATS and open thoracotomy groups (25). Marra and colleagues identified 6.5% of recurrence after VATS empyemectomy that required re-do surgery (32). Terra and colleagues, similarly to our data, have found that the reintervention rate not significantly but was higher in the VATS group compared with the open thoracotomy group (11.5% (13/113) vs 6.5% (6/93)) (5). According to other authors, treatment failures requiring any reintervention post VATS occur in 2.4–9.2% (5, 9, 25).

In our study one patient died postoperatively (1.4%). The reason of death, similarly to Marra and colleagues data (32), was not associated with pleural empyema. Postoperative mortality in literature varies from 0% to 5.6% (17–19, 21, 32).

Recent studies indicate a poor association of imaging results with patient outcomes with therapy (10). Abnormalities on CT scan do not predict the stage of empyema nor its likelihood of requiring surgical intervention (1). Furthermore, radiological features on CT are not predictive of what patients require conversion to thoracotomy from VATS (6, 7, 35). That was also confirmed in our study: radiological features on CT scan had no influence on the rate of conversion. However, lower density and higher volume of empyema on CT scan significantly increase complication rate.

Finally, empyema is a pleural space infectious disease with a broad clinical spectrum. It is essential to fully understand its dynamic process and approach with the most efficient treatment modality at the most appropriate time.

CONCLUSIONS

Patients presenting with frank pus in the pleural cavity and without fever will likely require thoracotomy. Each day of surgery delay significantly increases the need of thoracotomy. So, early surgical referral is mandatory for a successful VATS empyemectomy. No pain, subfebrile temperature, higher CCI score on admission, positive pleural culture as well as higher volume and lower density of empyema on CT scan increase the probability of postoperative complications. VATS empyemectomy is associated with higher risk of re-do surgery in the early postoperative period compared with open empyemectomy.

Received 4 May 2015
Accepted 26 May 2015

References

1. Brims FJH, Lansley SM, Waterer GW, Lee YCG. Empyema thoracis: new insights into an old disease. Eur Respir Rev. 2010; 19: 117, 220–8.
2. Zahid I, Nagendran M, Routledge T, Scarci M. Comparison of video-assisted thoracoscopic surgery and open surgery in the management of primary empyema. Curr Opin Pulm Med. 2011; 17: 255–9.
3. Petrakis IE, Heffner JE, Klein JS. Surgery should be the first line treatment for empyema. Respirology. 2010; 15: 202–7.
4. Shiraishi Y. Surgical treatment of chronic empyema. Gen Thorac Cardiovasc Surg. 2010; 58: 311–6.
5. Terra RM, Waisberg DR, Jesus de Almeida JL, Devido MS, Pego-Fernandes PM, Jatene FB. Does videothoracoscopy improve clinical outcomes when implemented as part of a pleural empyema treatment algorithm? Clinics. 2012; 67(6): 557–63.
6. Cassina PC, Hauser M, Hillejan L, Greschuchna D, Stamatis G. Video-assisted thoracoscopy in the treatment of pleural empyema: stage-based management and outcome. J Thorac Cardiovasc Surg. 1999; 117: 234–8.
7. Striffeler H, Gugger M, Hof VI, Cerny A, Furrer M, Ris HB. Video-assisted thoracoscopic surgery for fibrinopurulent pleural empyema in 67 patients. Ann Thorac Surg. 1998; 65: 319–23.
8. Kalfa N, Allal H, Lopez M, Saguintaah M, Guibal MP, Sabatier-Laval E, et al. Thoracoscopy in pediatric pleural empyema: a prospective study of prognostic factors. J Pediatr Surg. 2006; 41: 1732–7.
9. Chambers A, Routledge T, Dunning J, Scarci M. Is video-assisted thoracoscopic surgical decortication superior to open surgery in the management of adults with primary empyema? Interact Cardiovasc Thorac Surg. 2010; 11: 171–7.
10. Heffner JE. Empyema as an orphan disease: so many approaches and so few data. J Infect Pub Health. 2009; 2: 1–3.

11. Chan DTL, Sihoe ADL, Chan S, Tsang DSF, Fang B, Lee TW, Cheng LC. Surgical treatment for empyema thoracis: is video-assisted thoracic surgery "better" than thoracotomy? Ann Thorac Surg. 2007; 84: 225–31.
12. Waller DA, Rengarajan A, Nicholson FHG, Rajesh PB. Delayed referral reduces the success of video-assisted thoracoscopic debridement for post-pneumonic empyemas. Respir Med. 2001; 95: 836–40.
13. Kim BY, Oh BS, Jang WC, Min YI, Park YK, Park JC. Video-assisted thoracoscopic decortication for management of postpneumonic pleural empyema. Am J Surg. 2004; 188: 321–4.
14. Birim O, Kappetein AP, Bogers AJJC. Charlson comorbidity index as a predictor of long-term outcome after surgery for nonsmall cell lung cancer. Eur J Cardiothorac Surg. 2005; 28: 759–62.
15. Molnar TF. Current surgical treatment of thoracic empyema in adults. Eur J Cardiothorac Surg. 2007; 32: 422–30.
16. Chung JH, Lee SH, Kim KT, Jung JS, Son HS, Sun K. Optimal timing of thoracoscopic drainage and decortication for empyema. Ann Thorac Surg. 2014; 97: 224–9.
17. Luh SP, Chou MC, Wang LS, Chen JY, Tsai TP. Video-assisted thoracoscopic surgery in the treatment of complicated parapneumonic effusions or empyemas: outcome of 234 patients. Chest. 2005; 127: 1427–32.
18. Cardillo G, Carleo F, Carbone L, Di Martino M, Salvadori L, Petrella L, Martelli M. Chronic postpneumonic pleural empyema: comparative merits of thoracoscopic versus open decortication. Eur J Cardiothorac Surg. 2009; 36: 914–8.
19. Waller DA, Rengarajan A. Thoracoscopic decortication: a role for video-assisted surgery in chronic postpneumonic pleural empyema. Ann Thorac Surg. 2001; 71: 1813–6.
20. Wurnig PN, Wittmer V, Pridun NS, Hollaus PH. Video-assisted thoracic surgery for pleural empyema. Ann Thorac Surg. 2006; 81: 309–13.
21. Bishay M, Short M, Shah K, Nagraj S, Arul S, Parikh D, Jawaheer G. Efficacy of video-assisted thoracoscopic surgery in managing childhood empyema: a larg single-centre study. J Pediatr Surg. 2009; 44: 337–42.
22. Tassi GF, Davies RJO, Noppen M. Advanced techniques in medical thoracoscopy. Eur Respir J. 2006; 28: 1051–9.
23. Lackner RP, Hughes R, Anderson LA, Sammut PH, Thompson AB. Video-assisted evacuation of empyema is the preferred procedure for management of pleural space infections. Am J Surg. 2000; 179: 27–30.
24. Stefani A, Aramini B, Casa G, Ligabue G, Kaleci S, Casali C, Morandi U. Preoperative predictors of successful surgical treatment in the management of parapneumonic empyema. Ann Thorac Surg. 2013; 96: 1812–9.
25. Lardinois D, Gock M, Pezzetta E, Buchli C, Rousson V, Furrer M, Ris HB. Delayed referral and Gram-negative organisms increase the conversion thoracotomy rate in patients undergoing video-assisted thoracoscopic surgery for empyema. Ann Thorac Surg. 2005; 79: 1851–6.
26. Gates RL, Caniano DA, Hayes JR, Arca MJ. Does VATS provide optimal treatment of empyema in children? A systematic review. J Pediatr Surg. 2004; 39: 381–6.
27. Chen LE, Langer JC, Dillon PA, Foglia RP, Huddleston CB, Mendeloff EN, Minkes RK. Management of late-stage parapneumonic empyemas. J Pediatr Surg. 2002; 37: 371–4.
28. Wozniak CJ, Paull DE, Moezzi JE, Scott RP, Anstadt MP, York VV, Little AG. Choice of first intervention is related to outcomes in the management of empyema. Ann Thorac Surg. 2009; 87: 1525–31.
29. Rahman NM, Maskell NA, West A, Teoh R, Arnold A, Mackinlay C, et al. Intrapleural use of tissue plasminogen activator and DNase in pleural infection. N Engl J Med. 2011; 365(6): 518–26.
30. Kho P, Karunanantham J, Leung M, Lim E. Debridement alone without decortication can achieve lung re-expansion in patients with empyema: an observational study. Interact Cardiovasc Thorac Surg. 2011; 12: 724–7.
31. Okiror L, Coltart C, Bille A, Guile L, Pilling J, Harrison-Phipps K, et al. Thoracotomy and decortication: impact of culture-positive empyema on the outcome of surgery. Eur J Cardiothorac Surg. 2014; 46: 901–6.
32. Marra A, Huenermann C, Ross B, Hillejan L. Management of pleural empyema with single-port video-assisted thoracoscopy. Innovations. 2012; 7: 338–45.
33. Sogaard M, Nielsen RB, Norgaard M, Kornum JB, Schonheyder HC, Thomsen RW. Incidence, length of stay, and prognosis of hospitalized patients with

pleural empyema. A 15-year Danish nationwide cohort study. Chest. 2014; 145(1): 189–92.
34. Drain AJ, Ferguson JI, Sayeed R, Wilkinson S, Ritchie A. Definitive management of advanced empyema by two-window video-assisted surgery. Asian Cardiovasc Thorac Ann. 2007; 15: 238–9.
35. Roberts JR. Minimally invasive surgery in the treatment of empyema: intraoperative decision making. Ann Thorac Surg. 2003; 76: 225–30.

Žymantas Jagelavičius, Vytautas Jovaišas, Mindaugas Matačiūnas, Narimantas Evaldas Samalavičius, Ričardas Janilionis

TORAKOSKOPINĖS PLEUROS EMPIEMOS OPERACIJOS NESĖKMIŲ IR KOMPLIKACIJŲ PROGNOSTINIAI VEIKSNIAI

Santrauka

Tikslas. Nustatyti nesėkmingos torakoskopinės empiemektomijos ir pooperacinių komplikacijų priešoperacinius prognostinius veiksnius.

Medžiaga ir metodai. Į stebėjimo tyrimą buvo įtrauktas 71 ligonis, sirgęs pleuros empiema nuo 2011 m. sausio iki 2014 m. birželio mėn. Visus tiriamuosius buvo siekiama pagydyti atliekant torakoskopinę empiemektomiją. Vertintos dvi išeitys: konversija į atvirą torakotomiją (nesėkminga torakoskopinė operacija) ir pooperacinės komplikacijos. Analizuoti priešoperaciniai veiksniai, galėję turėti įtakos operacijos išeitims.

Rezultatai. Konversijos į atvirą torakotomiją prireikė 18 (25,4 %) ligonių. Keturiolika (19,7 %) ligonių patyrė pooperacines komplikacijas. Daugialype regresine analize nustatyta, kad sirgimo laikas (šansų santykis 1,1; pasikliautinas intervalas 1,1–1,2), normali temperatūra atvykus (šansų santykis 11,2; pasikliautinas intervalas 1,5–85,4) ir pūliai pleuros ertmėje (šansų santykis 6,9; pasikliautinas intervalas 1,6–29,4) reikšmingai lėmė konversiją į atvirą operaciją. Skausmas (šansų santykis 0,01; pasikliautinas intervalas <0,01–0,6), subfebrili temperatūra atvykus (šansų santykis 10,1; pasikliautinas intervalas 1,4–73,5), teigiamas pleuros punktato pasėlis (šansų santykis 8,5; pasikliautinas intervalas 1,0–70,1), Charlson'o gretutinių ligų indeksas (šansų santykis 2,3; pasikliautinas intervalas 1,1–4,8), empiemos tūris (šansų santykis 1,002; pasikliautinas intervalas 1,000–1,005) ir tankis kompiuterinės tomografijos tyrimo duomenimis (šansų santykis 0,8; pasikliautinas intervalas, 0,6–1,0) turėjo reikšmingos įtakos pooperacinėms komplikacijoms.

Išvados. Ilgesnis sirgimo laikas, normali temperatūra atvykus ir pūlių radimas pleuros ertmėje didina nesėkmingos torakoskopinės operacijos galimybę. Skausmo nebuvimas, subfebrili temperatūra, didesnis Charlson'o gretutinių ligų indeksas atvykus, teigiamas pleuros punktato pasėlis, didesnis empiemos tūris bei mažesnis tankis, nustatomas kompiuterinės tomografijos tyrimu, didina pooperacinių komplikacijų galimybę.

Raktažodžiai: pleuros empiema, vaizdo torakoskopinė operacija, nesėkmingas gydymas, komplikacijos