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Albumin and leukocyte: pre-operative factors for advanced management in pleural empyema?



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ABSTRACT

Background: Surgical intervention such as video-assisted thoracoscopic surgery (VATS) has shown the benefit of reducing morbidity and mortality in the management of pleural empyema. The objective of the study was to investigate preoperative factors that could predict the need for VATS rather than chest tube thoracostomy.

Methods: This is retrospective observational study of consecutive patients diagnosed with pleural empyema admitted to the Dr. Zainoel Abidin Hospital, Banda Aceh in period of 2015 to 2017. The demographic, clinical dan laboratory data of the patients were evaluated from hospital medical records.

Results: A total of 48 consecutive patients were identified. The mean age of the patients was 34.3 ± 20.4 years; and 31 (64.6%) were male. Twenty-six patients underwent VATS decortication and

twenty-two patients underwent chest tube thoracostomy. Patient demographics were similar between VATS decortication and chest tube thoracostomy group. The significant preoperative factors associated with the VATS were serum albumin level and leukocytes ($p < 0.05$). The mean serum albumin level was 2.81 ± 0.44 g/dL for the VATS decortication group vs 3.06 ± 0.41 g/dL for the chest tube thoracostomy group ($p = 0.047$). In addition, serum leukocyte level was higher in VATS decortication group compared to chest tube thoracostomy group ($21,600 \text{ mm}^{-3}$ vs $12,900 \text{ mm}^{-3}$; $p = 0.024$).

Conclusion: We demonstrate that a low serum albumin level or an elevated leukocyte level may represent as preoperative factors in which surgical treatment may be required in the management of pleural empyema.

Keywords: video-assisted thoracoscopic surgery, pleural empyema, albumin, leukocytes.

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INTRODUCTION

Pleural empyema is a serious infectious disease that significantly increases the morbidity and mortality.^{1,2} Treatment modalities range from antibiotics, thoracocentesis, chest tube thoracostomy or intrapleural fibrinolysis, and for more advanced stages surgical intervention can be performed using minimally invasive techniques including video-assisted thoracic surgery (VATS) or an open thoracotomy.³ Studies have shown VATS is a safe and effective procedure for the management pleural empyema, and may also produce better clinical results on early intervention.⁴⁻¹⁰

Early surgical intervention using VATS is required to achieve better clinical result.^{5,11-14} However, surgical approaches are often delayed and usually becoming reserved option following failed conservative treatment.^{15,16} The identification of predictive factors for patients who are at risk for severe pleural empyema is necessary to promote early drainage of infected pleural space, hence would benefit from early surgical interventions and improve clinical outcome.^{11,15} There are several

clinical, laboratory findings that could be predictive factors for the development of severe pleural empyema or the failure of medical treatment.^{5,15,17,18}

The objective of this study was to review our experience of patients with pleural empyema who underwent VATS or chest tube thoracostomy and to investigate preoperative factors that could predict the need for VATS rather than chest tube thoracostomy.

METHODS

This is a retrospective observational study that comprising patients with pleural empyema who were admitted to our tertiary referral center the dr. Zainoel Abidin General Hospital, Banda Aceh in period of January 2015 to June 2017. Data were collected from hospital medical records.

This study included patients who had preoperative diagnosis of pleural empyema, loculated or complex pleural effusion, recurrent pleural effusion and underwent VATS or chest tube thoracostomy. The diagnosis was established on clinical examination (fever, cough, dyspnea, and

chest pain), chest x-ray, computed tomography (CT) scan. Patients who underwent VATS procedures and were converted to open thoracotomy during the operation were also included in the study group. All patients received standard broad-spectrum antibiotics initially, which were later adjusted according to the microbiological culture result.

The analysis excluded patients with post-traumatic pleural infection, tuberculous pleural infection, malignancy-related empyema, HIV, previous thoracic surgery, destroyed lung, diagnosed bronchopleural fistulas, a shrunken hemithorax on CT scan.

The main outcome parameter in our study was to analyze laboratory workup of preoperative blood serum of patients who underwent VATS or chest tube thoracostomy in the management of pleural empyemas, such as complete blood count, albumin, urea, creatinine, and electrolytes (sodium, potassium, and chloride).

Statistical analyses

Statistical analyses were performed using SPSS (IBM, USA). Continuous variables were expressed as mean \pm standard deviation (SD) or median and interquartile range (IQR). Categorical variables were expressed as absolute numbers and percentages. Bivariate analyses were performed using Chi-square test, Student's t-test, Mann-Whitney U test, where appropriate. A two-sided p-value of <0.05 was considered statistically significant.

RESULTS

Between January 2015 and June 2017, A total of 48 consecutive patients who underwent surgery

for pleural empyema in The Dr. Zainoel Abidin generalhospital were identified. These are who fulfill inclusion criteria were included in this study. There were 31 males and 17 females, with mean age of the patients was 34.3 ± 20.4 years (Table 1). A total of 26 underwent VATS decortication and 22 underwent chest tube thoracostomy. Patient demographics were similar between VATS decortication and chest tube thoracostomy group (Table 2). The significant preoperative factors associated with the VATS were serum albumin level and leukocytes ($p < 0.05$). The mean serum albumin level was lower in VATS decortication group, 2.81 ± 0.44 g/dL, compared to chest tube thoracostomy group, 3.06 ± 0.41 g/dL ($p = 0.047$). In addition, serum leukocyte level was higher in VATS decortication group compared to chest tube thoracostomy group ($21,600 \text{ mm}^{-3}$ vs $12,900 \text{ mm}^{-3}$; $p = 0.024$) (Table 3).

DISCUSSION

The concern of early surgical intervention in the management of pleural empyema has been reported in many recent studies. According to these studies, early surgical intervention of VATS drainage or decortication has shown better clinical results compared to other treatment modalities.^{4-6,8-12,14}

However, the optimal timing of surgical intervention in the management of pleural empyema is absent due to insufficient data. Patient's clinical status, physician's clinical experience and subjective opinion were determinant factors in most clinical situations in deciding for surgical intervention. Consequently, the patient's status may deteriorate and postoperative outcome worsen if delays in performing surgical intervention.^{5,11,12}

A lower serum albumin level had been associated with more severe pleural empyema with regard to greater amount of pleural fluid volume or longer hospital stay.^{17,18} In this study, lower preoperative serum albumin was associated with more advanced treatment in management of pleural empyema, VATS in our case. In other words, severe pleural empyema condition may require more advanced surgical intervention. The pathophysiology of hypoalbuminemia might be due to albumin shift from intravascular space to pleural fluid. The feasible causes of these low levels of albumin may have been inflammation, decreased protein synthesis, low energy intake, decreased protein synthesis, and catabolic state.¹⁸

Leukocytosis was also associated with more severe pleural empyema. An elevated leukocyte level might be featured for the presence of more aggressive microorganisms. Alternatively, this abnormality could be related to a more severe condition.¹⁷ According to our study, it may also

Table 1. Baseline characteristics of patients.

Variables	Population (n=48)
Age (years), mean \pm SD	34.3 \pm 20.4
Gender, n (%)	
Male	31 (64.6)
Female	17 (35.4)
Treatment, n (%)	
VATS + Decortication	26 (54.2)
Chest tube thoracostomy	22 (45.8)

Table 2. Treatment procedure and demographic.

Variables	VATS (n=26)	Chest tube thoracostomy (n=22)	p-values
Age (years), mean \pm SD	32.6 \pm 19.8	36.2 \pm 21.4	0.556
Gender, n (%)			
Male	15 (57.7)	16 (72.7)	0.278
Female	11 (42.3)	6 (27.3)	

Table 3. Treatment procedure with laboratorium findings.

Variables	VATS (n=26)	Chest tube thoracostomy (n=22)	p-values
Hemoglobins (g/dL), mean ± SD	10.6 ± 1.9	10.9 ± 2.2	0.588
Hematocrits (%), mean ± SD	32.7 ± 5.8	33.6 ± 6.9	0.646
Erythrocytes (10 ⁶ /mm ³), mean ± SD	4 ± 0.8	4.3 ± 1	0.405
Leukocytes (10 ³ /mm ³), median (range)	21.6 (4.8-39.8)	12.9 (3.9-78.4)	0.024
Thrombocytes (10 ³ /mm ³), mean ± SD	447.3 ± 114.6	425.9 ± 142.1	0.568
Albumins (g/dL), mean ± SD	2.81 ± 0.44	3.06 ± 0.41	0.047
Sodium (mmol/L), median (range)	137 (127-142)	137 (121-153)	0.479
Potassium (mmol/L), median (range)	4 (2.7-6.8)	4.35 (3.2-9.4)	0.367
Chloride (mmol/L), mean ± SD	102.4 ± 4.7	102.2 ± 5.3	0.910
Urea (mg/dL), median (range)	21 (4-106)	25.5 (11-236)	0.182
Creatinine (mg/dL), median (range)	0.68 (0.23-2.74)	0.69 (0.22-9.20)	0.192

explain the need of VATS in the management of advanced pleural empyema condition regarding elevated serum leukocyte level. In another study, early surgical intervention might lead to better clinical results with symptom durations of less than 4 weeks wherein according to this period the serum leukocyte level was higher compared to longer symptom durations.⁵

It is importance to determine the predictive factors for patients who are at risk for severe pleural empyema to promote early drainage of infected pleural space, hence would benefit from early surgical interventions and improve clinical outcome.^{11,15}

CONCLUSION

We demonstrate that a low serum albumin level or an elevated leukocyte level may represent as preoperative factors in which surgical treatment may be required in the management of pleural empyema.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the manuscript.

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AUTHOR CONTRIBUTION

All authors are contributed equally to the content of the study, including data gathering, statistical analysis and data synthesis.

ETHICAL STATEMENT

All data were collected using medical record, and patient had received signed inform consent regarding publication of their respective medical data prior to any data collection.

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