Results of endoscopic thoracic for Post-traumatic pleural empyema treatment at Viet Duc University Hospital

Tran Tuan Anh[1,3], Nguyen Huu Uoc[2,3]

1. Hai Duong General Hospital, 2. Viet Duc University Hospital, 3. Hanoi Medical University

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Corresponding author:
Tran Tuan Anh,
Hai Duong General Hospital
225 Nguyen Luong Bang Str., Ward Thanh Trung, Hai Duong City
Mobile: 0981 707 797
Email: trantuananhbvhd@gmail.com

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Abstract

Introduction: Post-traumatic pleural empyema tends to increase in recent years, related to the severity of chest trauma and postoperative care. There are very few studies on this type of disease. The study aims to describe some etiological, clinical, and paraclinical characteristics and evaluate early results of endoscopic thoracic surgery to treat this disease.

Patients and Methods: A retrospective descriptive study of cases with a confirmed diagnosis of post-traumatic empyema and treated by thoracoscopic surgery, at the Cardiovascular and Thoracic Center, Viet Duc university hospital, from January 2017 to April 2021.

Results: Including 52 patients, with 46 men - 6 women, the average age was 44.87 years old; the average time from accident to surgery was 31.17 days, the average surgery time was 86.83 minutes; thoracoscopic surgery was 100% successful. Intensive respiratory physiotherapy was performed in 100% of patients; the average postoperative hospital stay was 8.13 days; the most common postoperative complication was wound infection (3.8%); 100% of patients discharged from the hospital were stable, with no mortality.

Conclusion: Endoscopic thoracic surgery combined with intensive respiratory physiotherapy after surgery is an effective solution in treating post-traumatic pleural empyema.

Introduction

Chest trauma is a typical surgical emergency that can form a post-traumatic pleural empyema if left untreated or poorly treated. Different from pleural empyema - caused by an infection of the pleura, post-traumatic pleural empyema appears after chest trauma (with pleural drainage or without drainage), formed by two main factors: collapsed lung (create a space in the pleura) and blood clot + fibrin in the pleural space degenerates covering the collapsed lung.[1] Therefore, the treatment of post-traumatic pleural empyema requires early surgery to clean the deposits; pleural removal, postoperative intensive respiratory physiotherapy to help expand the lungs are the leading solutions. In the solutions to approach the lesions, endoscopic thoracic surgery shows superiority over classical open surgery due to its minimally invasive nature, reducing the risk of postoperative complications while still creating the necessary surgical field to perform surgery. At Viet

Duc University Hospital, endoscopic thoracic surgery is a routine treatment method for most thoracic surgical diseases, including post-traumatic pleural empyema. This report describes some etiological, clinical, and subclinical characteristics and evaluates the early results of endoscopic thoracic surgery for post-traumatic pleural empyema treatment.

Patients and Methods

The study subjects include all patients with a confirmed diagnosis of trauma - chest wound (with pleural drainage removed, with pleural drainage, or without drainage), diagnosis before and after surgery is post-traumatic pleural empyema, treated by thoracoscopic surgery (successful or converted to open surgery) at the Cardiovascular and Thoracic Center, Viet Duc university hospital, in the period from January 2017 to April 2021. Exclude cases of primary empyema due to pleural infection.

Methods: A retrospective study was conducted on post-traumatic pleural empyema patients. They were treated by thoracoscopic surgery (entire endoscope, video-assisted thoracic surgery, multiport, single hole). The convenience sample size included all eligible patients during the study period. The study variables included some epidemiological characteristics, clinical and laboratory characteristics, surgical methods, and treatment results. Data were processed using SPSS 20.0. The difference was statistically significant when $p < 0.05$.

Results

Including 52 patients, with 46 men - 6 women, age range 18 – 60 (78,8%); 46.2% are farmers and traffic accidents are the main cause of chest trauma (63.5%).

About clinical characteristics: 100% of patients have chest pain; 46.2% had symptoms of shortness of breath. Fever symptoms accounted for only 26.9%, mainly mild - moderate fever (37,5 - 39^{0}C). All had symptoms of reduced alveolar murmur in the affected lung.

Table 1. Combined injuries due to trauma (n=52)

Combined injury		n		Ratio (%)
Yes	Abdominal trauma	21	5	9,6
	Spinal cord injury		4	7,7
	Traumatic brain injury		2	3,8
	Others		10	19,2
No		31		59,6

Closed chest trauma has 46 cases (88.5%), open chest wound has 6 cases (11.5%). Initial treatment is shown in Table 2. The average time from accident to surgery was 31.17 ± 52.78 days (7 – 370).

Table 2. Initial management of chest trauma (n=52)

Initial management	n	Ratio (%)
Internally medical treatment	3	5,8
Pleural drainage	43	82,7
Endoscopic thoracic surgery	2	3,8
Classic open surgery	4	7,7

About the subclinical characteristics: 100% have blurred image of lung bottom on chest X-ray, 76.9% have a rib fracture on the same side of injury. The pleural ultrasound showed large outbreaks ≥ 30 mm (55.8%) and small outbreaks < 30 mm (44.2%). Computed tomography showed clear atelectasis in 42 patients (80.8%) and was common in the lower lobes.

Surgical characteristics and early postoperative results

Full endoscopic thoracic surgery is 36,5% (19/52), remaining is video-assisted thoracic surgery (VATS) (33/52 – 63,5%). Most full endoscopic thoracic surgery for post-traumatic pleural empyema came within one month of injury, with a mean operative time of 76.05 ± 23.84 minutes (30 - 120). VATS is mainly for difficult cases and more pleural adhesions, which cannot be resolved well by full endoscopic thoracic surgery, i.e., cases that come late > 1 month

after injury, with an average operative time of 93.03 ± 30.36 minutes (50 - 170). The difference is statistically significant with p=0.031. The common surgery time for both groups of laparoscopic surgery was 86.83 ± 29.1 (30 - 170).

At the end of the operation, the majority (45/52 - 86.5%) were placed in two pleural drains, even 3 (2/52 - 3.8%); There were only 5 cases where one drainage was placed because there was no air leak from the lung parenchyma (9.6%). The average time for postoperative pleural drainage was 6.6 ± 2.96 days, in which the VATS group needed to drain longer (7.18 ± 3.49 days), which was statistically significant compared with the whole endoscopic group (5.58 ± 1.22 days) with p=0.021.

Table 3. Bacterial culture results of pleural fluid (n=49)

Culture results			n*	Ratio (%)
Yes	Negative		31	63,3
	Positive	With pleural drainage	18	36,7
		No pleural drainage	0	0

* There are 3 cases of not cultivating fluids for bacterial testing.

Table 4. Postoperative complications and management (n=52)

Complication type	n	Ratio (%)	To solve
Bleeding from the incision	1	1,9	Stop bleeding, stitch the incision
Surgical wound infection	2	3,8	Change the dressing, stitch the incision
Purulent pleurisy	1	1,9	Pleural lavage pump

The average postoperative hospital stay was 8.13 ± 4.2 days (3 – 27), the difference was statistically significant with p=0.029, full endoscopic group was 6.47 ± 1.7 days (5 – 27) and VATS group was 9.09 ± 4.9 days (3 – 22). There were 51 out of 52 cases considered cured (damage to the chest progressed well, excluding other organ injuries) and discharged from the hospital, only 1 temporary stable case (collapsed lungs in the area of scum incision) were transferred to the lower glands for further treatment.

Discussion

In terms of general characteristics:

The majority are men (46/52).

The age range is between 18-60 years of age (78.8%).

Farmers accounted for 46.2%.

Traffic accidents were the leading cause of chest trauma (63.5%).

This result has the same with another author in Vietnam also on the world.[2,3] This is the gender and age group participating in work, life, and traffic the most, so accidents, especially traffic accidents, often occur in this age group, from which the rate of chest injuries and post-traumatic pleural empyema is also higher than other age groups.

Regarding clinical and subclinical characteristics: due to the occurrence after trauma, chest wounds with many combined lesions (Table 1), signs of chest pain are still present in 100% of patients, 46.2% had symptoms of shortness of breath. Symptoms of mild-moderate fever only accounted for 26.9% - mainly due to the inflammatory response from post-traumatic pleural empyema— signs of reduced alveolar murmur in the affected lung. Research by Dinh Van Luong - due to both infectious and traumatic diseases, there are many differences: chest pain 73.1%, shortness of breath 75.8%, fever 51.1%.[4] Because the mechanism of injury of post-traumatic pleural empyema is not from purulent pleurisy but atelectasis + deposition - fibrinolysis and blood clots, the signs of infection are often unclear. Bacterial culture results of the intraoperative pleural fluid showed that only 18/49 cases (36.7%) were positive, and all were in patients who had previously had pleural drainage with a high probability of bacterial superinfection through pleural drainage care. The combined injury

rate as high as 40% (Table 1) is a factor that causes many difficulties in respiratory physiotherapy, increasing the rate of atelectasis complications leading to post-traumatic pleural empyema, as well as prolonging the postoperative treatment time. The results in Table 2 show that, on the one hand, there is an improvement in the diagnosis and treatment of chest trauma – with more than 94% having surgical intervention in the thoracic cavity after trauma, but also demonstrating surgery on the other hand, which is not the only factor to cure the injury, avoid complications including post-traumatic pleural empyema. However, in the care of pleural drainage, respiratory physiotherapy also plays a significant role. However, it is necessary to appoint early surgery when it is confirmed that there is a complication of post-traumatic pleural empyema. That was many benefits, such as more favorable surgical technique due to the pleura, fibrin is not adhered tightly to the lung parenchyma - easy to remove with simple movements; early recovery of the collapsed lung; reduced inflammatory-infectious responses. Post-traumatic pleural empyema at Viet Duc University Hospital is often prioritized for surgery soon after diagnosis, usually 3-5 days after admission. However, the study showed that the average time from accident to surgery was very long, up to 31.17 ± 52.78 days, because most of the patients received initial surgical intervention at other medical levels, the monitoring and postoperative care were not good, so they were transferred to Viet Duc University Hospital. This time is much longer than O'Connor (12.1 days); 5 is a factor leading to more complicated lung-pleural damage, making it difficult for radical treatment by endoscopic surgery. To definitively diagnose traumatic post-traumatic pleural empyema and accurately assess the extent of damage, imaging studies play an essential role. Pleural ultrasound is a precious non-invasive method. When the amount of pleural fluid over 30mm is considered a lot, it can be aspirated to take the fluid for testing. Ultrasound also helps to detect residual fluid after pleural drainage.[5] Ultrasound and chest radiographs have practical value in monitoring and evaluating the results after surgery for post-traumatic pleural empyema. Computed tomography is a precious exploratory method, the gold standard for diagnosing post-traumatic pleural empyema. In addition, it also allows measurement of pleural fluid volume, with or without septum, with lesions attached or not.[6,7]

About the method of surgery and treatment results: post-traumatic pleural empyema is almost impossible to treat with pleural drainage alone, but thoracoscopy is a widely accepted solution. Depending on the clinical situation, it is possible to apply complete single-hole, multi-port endoscopic (not many pleural adhesions), or supportive endoscopy (complicated lesions, many pleural adhesions). The study results showed compatibility with a long incubation period, with 63.5% requiring endoscopic support. However, no case had to be converted to open surgery, demonstrating the capacity of thoracic surgery and the level of the hospital's medical staff because an essential factor in choosing the surgical method is the capacity and surgeon's experience. The average surgical time was 86.83 ± 29.1 minutes, somewhat shorter than the studies on pleural empyema at home and abroad[8,9]. For placing a pleural drain in surgery for pleural empyema, it is almost mandatory to have two drains in place (1 air, one drain). However, with post-traumatic pleural empyema - especially in early surgery, it is easy to remove the fibrin covering the collapsed lung without causing tearing of the lung parenchyma, so in some "sure" cases, the surgeon can decide to determine the number of drains. In the study, 90.3% of patients have placed two drains. Rafael Andrade-Alegre also recommends placing two pleural drains after surgery because most of them have torn shells, the lung parenchyma during dissection causes much pneumothorax into the pleura.[10] Postoperative care in these patients is critical, helping to avoid recurrence and restore respiratory function, including two main issues:

pleural drainage care and respiratory physiotherapy. [1] 100% of patients were prescribed respiratory physiotherapy clearly in the record. The time for postoperative pleural drainage was 6.6 ± 2.96 days. The laparoscopic-assisted group was longer than the entire endoscopic group - corresponding to a more complex lesion in the endoscopic-assisted group. This time is longer than pleural drainages due to common chest trauma, two but it is shorter than surgery for pleural deposits due to many reasons according to Dinh Van Luong (11.2 ± 10.1 days)4 and a group of patients with chronic pleural empyema of Nguyen Van Quang and Nguyen Cong Minh.8 In terms of pleural fluid infection, this is an essential distinction between traumatic and pathological pleural deposits. While for pathological pleural deposits, pleural infection (empyema) is the initiating factor of the pathological cycle; in the case of post-traumatic pleural empyema, the triggering factor is atelectasis + fibrin deposition and blood clots due to hemothorax - pneumothorax, the presence of bacteria is mainly due to superinfection from the drainage process. pleural effusion and post-drainage care.1 Research results in 18 positive culture specimens (34.6%) proved this point. Studies are showing a higher positive rate (55.8%), but the exact pathogenesis is the same.3 For pathological pleural deposits, all studies have shown that the positive bacterial culture rate is consistently above 60%.4,8 All negative cases occurred in patients who received high-dose and long-term antibiotics. Complications after surgery are not many, not too severe, and all occur in the group of complex lesions (endoscopy-assisted), successfully treated conservatively - without re-operating. After surgery, the overall outcome is excellent, with 98.1% of patients being discharged home, only 1 case of a referral to a lower level for further treatment. The postoperative hospital stay in the VATS group was more extended (9.09 ± 4.9 days) but still shorter than the study on pleural adhesions by Nguyen Van Quang and Nguyen Cong Minh (12.36 ± 7.89 days).[8]

Conclusion

Post-traumatic pleural empyema is a fairly common complication after initial treatment of trauma and chest wounds. Thoracic surgery is a safe and effective radical treatment solution for this group of diseases. Indication for early surgery will lead to more favorable outcomes.

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