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The Diagnostics and Treatment of Acute Mediastinitis: A Single-Centre Experience in Vietnam

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Abstract

Background: Acute mediastinitis is a life-threatening condition requiring urgent intervention.

Objectives: This study aims to describe the clinical, laboratory, imaging, and microbiological characteristics, as well as treatment outcomes, of acute mediastinitis cases.

Methods: A retrospective, descriptive study was conducted on 32 patients treated at the University Medical Center Ho Chi Minh City from February 2016 to April 2024. Data were collected on patient demographics, clinical features, laboratory results, imaging findings, microbiological cultures, and treatment outcomes.

Results: The mean age was 55.7 years, with males comprising 59.4% of cases. Fever and chest pain were the most common symptoms. *Staphylococcus aureus* was the most frequently identified organism. Computed tomography (CT) scans typically showed mediastinal air-fluid levels and fat stranding. Surgical interventions included neck drainage and thoracotomy. Complications included severe sepsis, septic shock, and pneumonia, with a mortality rate of 9.4%.

Conclusions: Acute mediastinitis predominantly affects older males and presents significant clinical and diagnostic challenges. Effective multidisciplinary management is crucial for improving patient outcomes. This study provides valuable insights into the characteristics and treatment of acute mediastinitis in a Southeast Asian region.

Keywords: Acute Mediastinitis, Descending Necrotizing Mediastinitis, Esophageal Perforation

1. Background

Acute mediastinitis is an inflammation of the connective tissue and structures in the mediastinum (1). Due to the presence of many vital structures within the mediastinum, this condition is life-threatening, has a severe prognosis, a high mortality rate, and requires urgent intervention and treatment (1-4). Secondary infections from adjacent organs are the most common causes of acute mediastinitis. The origins of infection are typically categorized into three groups: Cervical infections spreading to the mediastinum, oesophageal perforation, and other causes such as postoperative thoracic surgery and infections from other organs (5-8). Among these, oesophageal perforation is frequently reported as the most common cause. Mediastinitis following thoracic surgery, particularly cardiac surgery, and mediastinal tumors also contribute significantly, with a high mortality rate despite low complication rates (0.5 - 5%) (9). Cervical infections spreading to the mediastinum have shifted from dental origins to predominantly oropharyngeal infections due to advancements in oral care (3, 8, 10).

Diagnosis of acute mediastinitis relies on patient history, physical examination, computed tomography (CT), and oesophagoscopy (8). Common presentations include fever, chest pain, and respiratory distress, but clinical features can vary with the infection's cause and origin (5, 11). Given the nonspecific clinical presentation, combining clinical evaluation with imaging is crucial for effective management (12). Computed tomography scans are particularly valuable, revealing air-fluid levels and soft tissue infiltration, which aid in assessing the extent of spread and guiding treatment (4, 10, 11, 13). Understanding the diverse microbiological characteristics of acute mediastinitis is essential for appropriate antibiotic therapy (14, 15).

Managing acute mediastinitis necessitates a multidisciplinary approach to control the infection source and administer suitable antibiotics (15, 16). Treatment strategies depend on the etiology, origin, and extent of the infection and are guided by clinical and imaging findings (4, 8). Prompt antibiotic treatment is critical and should follow empiric principles before being adjusted based on microbiological results (1). Surgical intervention varies according to the infection's source: For cervical-origin mediastinitis, the extent of spread dictates the surgical method, while oesophageal perforations may require endoscopic support for diagnosis and foreign body removal, followed by mediastinal clearance and oesophageal repair. Treatment options are highly individualized based on the patient's condition (8, 9, 11).

2. Objectives

Our study aims to retrospectively describe the clinical, laboratory, imaging, and microbiological features, as well as treatment outcomes, in cases of acute mediastinitis over an eight-year period at our center.

3. Methods

3.1. Study Settings and Design

From February 2016 to April 2024, a retrospective, descriptive study was conducted among acute mediastinitis patients at the University Medical Center Ho Chi Minh City (UMC HCMC) in Vietnam. All procedures in the study adhered to the Declaration of Helsinki. This study was approved by the Ethics Committee in Biomedical Research at the University of Medicine and Pharmacy, Ho Chi Minh City, on March 1, 2023 (approval No. 23188-DHYD).

3.2. Study Participants, Data Collection, and Variables

We retrospectively investigated 32 cases of acute mediastinitis treated at the UMC HCMC. All patients included in the study were diagnosed with mediastinitis according to the centers for disease control and prevention guidelines and the European Association for Cardio-Thoracic Surgery expert consensus statement on the prevention and management of mediastinitis. The definition of mediastinitis requires at least one of the following criteria: (1) The patient has organisms cultured from mediastinal tissue or fluid; (2) the patient has evidence of mediastinitis on gross anatomical or histopathological examination; (3) the patient has at least one of the following signs or symptoms: Fever, chest pain or sternal instability and at least one of the following: Purulent drainage from the mediastinal area, mediastinal widening on imaging (17, 18).

We selected patients who matched the criteria, collected data from electronic medical records, and described patient characteristics, clinical and subclinical features, methods, and treatment results based on the following variables: General characteristics of the patient (gender, age, weight, height, Body Mass Index, comorbidities); clinical and subclinical features (signs and symptoms on admission, case history, test results, imaging features, microbiological cultures, gastroscopy); etiology (descending necrotizing mediastinitis (DNM), oesophageal perforation, and other causes); and treatment methods and results (treatment methods, complications, and outcomes).

3.3. Statistical Analysis

The research data were analyzed using STATA 16.0. We described qualitative and quantitative variables in terms of patients' general characteristics, clinical and subclinical characteristics, treatment methods, and results.

4. Results

4.1. Clinical and Laboratory Characteristics of the Patients with Acute Mediastinitis

Table 1 describes some of the general characteristics and comorbidities of patients with acute mediastinitis. The mean age of patients was 55.7 ± 13.2 years, ranging from 23 to 84 years old. Male patients constituted 59.4% of the study population, while females made up 40.6%. Common comorbidities included hypertension (21.9%) and diabetes (18.8%).

Table 1. Clinical and Laboratory Characteristics of the Patients with Acute Mediastinitis

Variables	Mean ± SD or No. (%)
Mean age (y), (min: 23; max: 84)	55.7 ± 13.2
Gender	
Male	19 (59.4)
Female	13 (40.6)
Comorbidities	
Hypertension	7 (21.9)
Diabetes	6 (18.8)
Stroke	1 (3.1)
Body Mass Index (kg/m²)	22.4 ± 3.4
Pre-obesity	7 (21.9)
Obesity	3 (9.4)
Malnutrition	3 (9.4)
Clinical features	
Fever	29 (90.6)
Neck swelling and pain	16 (50.0)
Painful swallowing	19 (59.4)
Chest pain	21 (65.6)
Dyspnea	8 (25.0)
Subcutaneous emphysema	1 (3.1)
Shock	0 (0.0)
Median length of symptoms (days)	5.6 ± 5.4
Laboratory characteristics	
White blood cell count ($\times 10^9$/L)	16.7 ± 6.5
Neutrophil (%)	82.0 ± 10.7
C-reactive protein (mg/L)	213.1 ± 133.7
Pro-calcitonin (ng/mL)	5.2 ± 10.8

Table 1 also illustrates the clinical and laboratory characteristics of the patients with acute mediastinitis on admission. Fever was the most common symptom, accounting for 90.6%, followed by chest pain (65.6%), painful swallowing (59.4%) and neck swelling/pain (50.0%). Dyspnoea was observed in 25.0% of cases, with subcutaneous emphysema in 3.1%.

4.2. Microbiological Characteristics

Microbiological characteristics of patients are detailed in Table 2. Among 32 patients, six cases had no microbiological culture, and six cases showed no bacterial growth, both accounting for 18.8%. Of the remaining 20 patients with microbiological results, 17 (53.1%) had one organism, and three (9.4%) had more than one organism. *Staphylococcus aureus* was the most common organism, accounting for 28.6%.

4.3. Imaging Features and Etiology of Acute Mediastinitis

Table 3 shows the imaging findings from X-ray, CT, and gastroscopy. Chest radiographs showed effusion or pneumothorax in 44.4% of patients. The CT scans revealed mediastinal fat stranding in 100% of cases and mediastinal air-fluid levels in 81.3%. Other imaging signs included cervical fluid and air collections, cervical soft tissue swelling, and cervical lymph node enlargement. Regarding the causes of acute mediastinitis, 14 (43.8%) were due to DNM, and 11 (34.4%) had oesophageal perforation. Other causes accounted for 21.8%.

4.4. Treatment and Outcomes

Table 4 shows the statistics concerning the treatment methods of patients with acute mediastinitis. Among 32 patients, five cases received non-surgical treatment, accounting for 15.6%. Regarding the surgical treatment methods, 16 (50%) patients had neck drainage surgery, four (12.5%) had local drainage of the abscess, and 14 (43.8%) had thoracotomy to drain the mediastinum. The remaining account for a small number of surgeries to solve oesophageal problems such as suturing, esophagectomy, gastrostomy, or jejunostomy feeding.

Table 2. Microbiological Characteristics of the Patients with Acute Mediastinitis

Variables	No. (%)
Culture results	
None of the microbiological culture	6 (18.8)
None of the bacteria growth	6 (18.8)
One organism	17 (53.1)
More than one organism	3 (9.4)
Species	
Staphylococcus aureus	8 (28.6)
Streptococcus sp.	4 (14.3)
Acinetobacter baumannii	2 (7.1)
Klebsiella pneumoniae	2 (7.1)
Pseudomonas aeruginosa	2 (7.1)
Prevotella sp.	4 (14.3)
Bacteroides sp.	3 (10.7)
Staphylococcus epidermidis	1 (3.6)
Escherichia coli	1 (3.6)
Porphyromonas sp.	1 (3.6)
Yeasts	3 (9.4)

Table 3. Imaging Features and Aetiology of Acute Mediastinitis

Variables	No. (%)
X-ray findings	
Widened mediastinum	1 (3.7)
Mediastinal air-fluid levels	0 (0.0)
Pneumomediastinum	1 (3.7)
Pneumothorax/pleural effusion	12 (44.4)
Cervicothoracic CT findings	
Cervical soft-tissue swelling	16 (50.0)
Cervical lymph node enlargement	19 (59.4)
Cervical fluid and/or air collections	17 (53.1)
Mediastinal air-fluid levels	26 (81.3)
Mediastinal fat stranding	32 (100.0)
Pneumothorax/pleural effusion	18 (56.3)
Gastroscopy (n = 8)	
Oesophageal foreign bodies	4 (50)
Oesophageal tumors	3 (37.5)
Other causes	1 (12.5)
Aetiology of acute mediastinitis	
DNM	14 (43.8)
Oesophageal perforation	11 (34.4)
Other causes	7 (21.8)

Abbreviations: DNM, descending necrotizing mediastinitis; CT, computed tomography.

The outcomes and complications of the patients are also shown in Table 5. Among 32 patients, the mean length of ICU and hospital stay was 16.2 and 22.2 days, respectively. In the cases with thoracotomy to drain the mediastinum, the average time for mediastinal and pleural irrigation was 15.3 days, and the longest case was up to 35 days. Seventeen cases experienced complications, accounting for 53.1%, of which pneumonia accounted for 15.6%, and meningitis accounted for 3.1%. Moreover, there were high rates of

Table 4. Treatment Methods and Outcomes for 32 Patients with Acute Mediastinitis

Treatments	No. (%) or Mean ± SD
DNM (14 cases)	
Cervical mediastinotomy	6 (42.9)
Cervico-thoracotomy and mediastinotomy	8 (57.1)
Oesophageal perforation (11 cases)	
Non-surgical treatment	3 (27.2)
Cervical mediastinotomy (± gastrostomy/jejunostomy feeding)	2 (18.2)
Thoracotomy and mediastinotomy (± gastrostomy/jejunostomy feeding ± oesophagectomy or oesophageal suture)	4 (36.4)
Gastrostomy/jejunostomy feeding	2 (18.2)
Other causes (7 cases)	
Non-surgical treatment	2 (28.6)
Cervical mediastinotomy	3 (42.8)
Other surgeries	2 (28.6)
Complications and outcomes	
Pneumonia	5 (15.6)
Meningitis	1 (3.1)
Sepsis	3 (9.4)
Severe sepsis	7 (21.9)
Septic shock	5 (15.6)
Death	3 (9.4)
Median length of drainage (days) (min: 5 days; max: 35 days)	15.3 ± 8.8
Median ICU length of stay (days), (min: 3 days; max: 36 days)	16.2 ± 11.7
Median length of hospitalization (days), (min: 6 days; max: 48 days)	22.2 ± 10.3

Abbreviations: ICU, intensive care unit; DNM, descending necrotizing mediastinitis.

infectious complications such as sepsis, severe sepsis, and septic shock, with 9.4%, 21.9%, and 15.6%, respectively. Three deaths occurred during hospitalization, with an overall mortality rate of 9.4%.

Table 5 includes information about each case. The etiologies are categorized into DNM, oesophageal perforation, and other causes. The table highlights that DNM and EP are the most common causes, accounting for 43.8% and 34.4% of cases, respectively. Complications such as sepsis, severe sepsis, septic shock, and pneumonia are documented, with three cases resulting in death.

5. Discussion

This study retrospectively examined 32 cases of acute mediastinitis treated over eight years at the UMC HCMC. Consistent with previous studies, we found that acute mediastinitis is more common in males. Tri VM reported that 80% of patients at Cho Ray Hospital in 2004 were male (19). Jablonski et al. (20) found that 70.5% were males, and Vodicka (8) found that 66.3% were males. In our study, 59.4% were male, possibly due to men's lower pain tolerance and less health-conscious behavior leading to delayed treatment. The mean age in our study was 55.7 ± 13.2 years, similar to findings by Van Minh (19) (44.5 years), Jablonski et al. (20) (52.5 years), and Vodicka et al. (8) (56 years). Chronic conditions that can weaken the immune system and increase infection risks were common.

Depending on the cause and severity, patients may experience many symptoms. Nhat et al. (4, 21) found that swelling and neck pain occurred in 100% of 30 patients with mediastinitis due to cervical abscesses. In our study, these symptoms were present in 50% of cases. Chest pain was observed in 57.5% of cases by Van Minh (19), 63.3% by Nhat et al. (4, 21), and 65.6% in our study. Dyspnoea can result from multiple causes, including cervical abscesses, oesophageal compression of the airway, pneumothorax, pleural effusion leading to hypoventilation, pneumonia, or severe infection causing respiratory failure.

Imaging plays a crucial role in diagnosing and guiding the treatment of acute mediastinitis. Chest CT is the most valuable and commonly performed modality. The CT scans can reveal mediastinal air-fluid levels, accumulations in the neck, and soft tissue swelling. The Van Minh study in Vietnam recorded 100% air accumulation and mediastinal fluid and 42.5% pneumothorax or pleural fluid (19). In our study, 81.3% of

Table 5. Summary of Cases

Aetiology	No.	Gender	Age	Microbiological Culture	Procedures	Complications	Outcome
DNM	1	Female	59	*Staphylococcus aureus*	CM	Sepsis, meningitis	-
	2	Male	73	*Prevotella* sp.	CM; RT	Septic shock	Death
	3	Female	65	*Klebsiella pneumoniae*	CM	Severe sepsis	-
	4	Male	55	-	CM	-	-
	5	Male	46	*Bacteroides* sp.	CM; RTM	-	-
	6	Female	60	*Pseudomonas aeruginosa*, *Bacteroides* sp., *Porphyromonas* sp., *Acinetobacter baumannii*	CM; RTM + LTM	Septic shock	Death
	7	Female	57	-	CM	Septic shock	-
	8	Male	66	*Klebsiella pneumoniae*	CM; RTM	-	-
	9	Male	35	-	CM; RTM + LT	-	-
	10	Male	34	*Staphylococcus aureus*	CM; LTM	Septic shock	-
	11	Male	51	*Streptococcus* sp., *Bacteroides* sp., *Prevotella* sp., yeast	CM; RTM + LTM	Septic shock	Death
	12	Male	60	*Streptococcus* sp.	CM; RTM	Severe sepsis, pneumonia	-
	13	Male	58	*Staphylococcus aureus*	CM	-	-
	14	Female	49	*Escherichia coli*, *Prevotella* sp.	CM; RTM	Severe sepsis, pneumonia	-
EP	15	Female	84	-	-	-	-
	16	Female	59	*Streptococcus* sp., *Staphylococcus epidermidis*	RTM; JF	-	-
	17	Male	74	-	GF	Pneumonia	-
	18	Male	66	Yeast	RTM; JF + E	Severe sepsis	-
	19	Male	50	-	-	-	-
	20	Male	51	*Streptococcus* sp.	-	-	-
	21	Male	57	-	CM	-	-
	22	Male	53	-	ES; LPM	-	-
	23	Male	68	-	ES	-	-
	24	Female	48	*Acinetobacter baumannii*	CM; JF	Severe sepsis, pneumonia	-
	25	Male	69	-	GF	-	-
Other causes	26	Male	23	*Staphylococcus aureus*	-	Pneumonia	-
	27	Female	39	*Staphylococcus aureus*	AID	Sepsis	-
	28	Female	53	*Staphylococcus aureus*	AID	Sepsis	-
	29	Male	68	*Pseudomonas aeruginosa*, yeast	RTM; RUL; ES + JF	-	-
	30	Female	44	*Staphylococcus aureus*	AID	Severe sepsis	-
	31	Female	68	*Staphylococcus aureus*	AID; LTM	Severe sepsis	-
	32	Female	39	-	-	-	-

Abbreviations: DNM, descending necrotising mediastinitis; EP, oesophageal perforation; CM, cervical mediastinotomy; RT, right thoracostomy; LT, left thoracostomy; RTM, right thoracotomy + mediastinotomy; LTM, left thoracotomy + mediastinotomy; LPM, laparotomy + mediastinotomy; RUL, right upper lobectomy; E, oesophagectomy; ES, oesophageal suture; JF, jejunostomy feeding; GF, gastrostomy feeding; AID, abscess incision and drainage.

patients had mediastinal air fluid, and 56.3% had pneumothorax or pleural fluid. Oesophageal endoscopy is essential for diagnosing and treating patients with acute mediastinitis, particularly in cases of oesophageal perforation. In our study, eight cases underwent oesophagoscopy; 50% had perforation due to a foreign body, 37.5% due to a tumor, and 12.5% due to oesophagitis.

Investigation of microbiological characteristics is essential for diagnosis and treatment. Van Minh (19) and Jablonski et al. (20) reported that *Streptococcus* sp. accounted for the highest proportions in their studies, with 35% and 11.4%, respectively. In contrast, our study found that *S. aureus* was the most common, accounting for 28.6%. The prevalence of fungi in our study was 9.4%, which is similar to the findings of Van Minh (19). Staphylococci and streptococci are the two most common aerobic bacteria. While previous studies indicated a higher percentage of streptococci, our study recorded a higher percentage of staphylococci. This difference may be due to variations in aetiological

groups, underlying diseases, and risk factors for specific infections across study populations.

The two most common causes of acute mediastinitis are DNM and oesophageal perforation. Vodicka et al. found that cervical abscesses spreading to the mediastinum accounted for 48.8% and oesophageal perforation for 42.5% (8). Our study showed similar results, with cervical abscesses spreading to the mediastinum accounting for 43.8% and oesophageal perforation for 34.4%.

Acute mediastinitis requires prompt antibiotic treatment, preferably initiated as soon as possible. Severe infections necessitate hospitalization in the ICU. Surgical treatments vary based on the cause and severity of the disease, and clinicians tailor the treatment strategy accordingly. In cases of DNM, Vodicka et al. reported that 61.5% of patients were treated with cervical drainage alone, while 38.5% required both neck drainage and thoracotomy (8). In our study, 42.9% of patients underwent cervical drainage, and 57.1% underwent thoracotomy for mediastinal drainage. All cases of cervical abscess spreading to the mediastinum required surgery, typically involving neck abscess drainage and thoracotomy, depending on the extent of spread and the patient's condition. For oesophageal perforation, a multidisciplinary approach is crucial for optimal outcomes. Minor oesophageal lacerations may be treated non-surgically, while surgical options include gastrostomy or jejunostomy feeding, thoracotomy for mediastinal drainage, or oesophagectomy. Mediastinal and pleural irrigation is a supportive and effective method for treating mediastinitis.

Our study is a descriptive observational study with a relatively small sample size, limiting the ability to analyze factors related to treatment outcomes comprehensively. However, given the rarity of acute mediastinitis, clinical data are scarce. This study provides valuable insights into the clinical, laboratory, imaging, and microbiological characteristics of patients with acute mediastinitis, as well as treatment outcomes. This data is crucial for clinicians as it adds to the limited pool of information available on this disease, particularly in Vietnam. Furthermore, our findings contribute to the global literature database on acute mediastinitis, offering insights from a Southeast Asian country.

5.1. Conclusions

Our study shows that acute mediastinitis mainly affects older adults and males, often presenting with fever and chest pain. CT scans were critical for diagnosis, typically revealing mediastinal air-fluid levels and fat stranding. The primary causes were DNM and oesophageal perforation. Surgical interventions, including neck drainage and thoracotomy, were essential. Significant complications like severe sepsis, septic shock, and pneumonia were common, with a mortality rate of 9.4%. These findings emphasize the need for prompt, multidisciplinary approaches to improve outcomes for acute mediastinitis in Southeast Asia.

Footnotes

Authors' Contribution: T. T. V.: Collected the data and wrote primary draft of the manuscript; P. D. N. T. and H. T. B.: Conceptualized and supervised the study, wrote primary draft of the manuscript; L. V. D. and L. T. C.: Supervised the study, conceptualized the study, and revised the manuscript; L. T. T. N. was physician of the patients, collected the data, and revised the manuscript. All authors read and endorsed the final manuscript.

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Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication.

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