

## Descending necrotizing mediastinitis: minimally invasive thoracic surgical treatment\*

Mediastinite descendente necrosante:  
tratamento cirúrgico torácico minimamente invasivo

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### Abstract

**Objective:** To report a case series of patients with descending necrotizing mediastinitis (DNM) who were treated with minimally invasive thoracic surgery. **Methods:** We report three cases of male patients with DNM who underwent mediastinal debridement by video-assisted thoracic surgery at the *Hospital São Paulo*, located in the city of São Paulo, Brazil, from admission to the final outcome. **Results:** The postoperative evolution was favorable in all three cases. The mean length of hospital stay was 16.7 days. **Conclusions:** We conclude that video-assisted thoracoscopy is an effective technique for mediastinal drainage in the treatment of DNM, with the benefits common to minimally invasive surgery: less postoperative pain, lower production of inflammatory factors, earlier return to activities of daily living, and better aesthetic results.

**Keywords:** Mediastinitis; Thorax; Thoracic surgery, video-assisted.

### Resumo

**Objetivo:** Relatar uma série de casos de pacientes com mediastinite descendente necrosante (MDN) tratados com cirurgia torácica minimamente invasiva. **Métodos:** Relatamos os casos de três pacientes com MDN submetidos à desbridamento mediastinal através de cirurgia torácica videoassistida no Hospital São Paulo, São Paulo (SP), desde a sua admissão até o desfecho final. **Resultados:** Os três pacientes apresentaram boa evolução pós-operatória, com tempo médio de internação de 16,7 dias. **Conclusões:** Concluímos que a videotoroscopia é uma técnica efetiva para a drenagem mediastinal no tratamento da MDN, com os benefícios da cirurgia minimamente invasiva: menos dor pós-operatória, menor liberação de fatores inflamatórios, retorno precoce às atividades diárias e melhores resultados estéticos.

**Descritores:** Mediastinite; Tórax; Cirurgia torácica vídeo-assistida.

### Introduction

Acute infectious mediastinal processes are severe, therefore requiring rapid diagnosis and appropriate management for their satisfactory resolution. They are more commonly found after esophageal perforation or following trans-sternal cardiac procedures.<sup>(1,2)</sup> An uncommon but equally lethal cause of mediastinitis is represented by oropharyngeal and cervical foci of infections that spread into the mediastinal space through the pretracheal fascia, the perivascular fascia, and the retropharyngeal space, being

aided by gravity and negative chest pressure during inhalation—descending necrotizing mediastinitis.<sup>(3-6)</sup>

Although there is a consensus that mediastinitis should be treated surgically, there is still controversy regarding the optimal surgical access. Most authors advocate ample access, combining the cervical approach with the thoracic approach (sternotomy, lateral thoracotomy, or clamshell incisions).<sup>(7-11)</sup> Recent studies have explored the use of minimally invasive surgery

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for the treatment of descending necrotizing mediastinitis; the authors of those studies sought to show that cervicotomy combined with video-assisted thoracoscopy allows ample and efficient access to the mediastinum, thereby making it possible to perform mediastinal exploration, debridement, and drainage, which collectively constitute the *sine qua non* for the treatment of this disease.<sup>(4,7,12-14)</sup>

The objective of the present study was to report a case series of patients with descending necrotizing mediastinitis who were satisfactorily treated with minimally invasive thoracic surgery.

## Methods

We describe a case series of patients diagnosed with descending necrotizing mediastinitis who were treated at the Federal University of São Paulo/Paulista School of Medicine *Hospital São Paulo*, located in the city of São Paulo, Brazil. The patients underwent clinical treatment and thoracic surgery, the latter involving minimally invasive techniques.

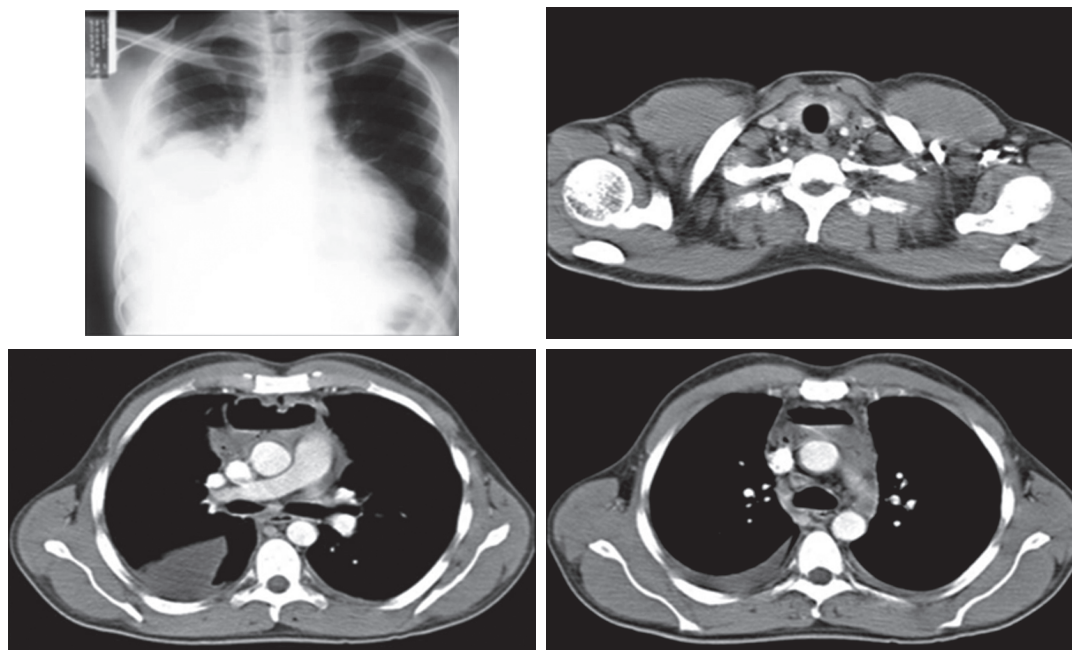
### Case 1

A previously healthy 29-year old male, who used cocaine and alcohol "on weekends", underwent elective extraction of mandibular third molars. The patient had fever, chills, and purulent discharge from the surgical site—left mandibular third molar—three days after the procedure. He sought medical attention, was diagnosed with a peritonsillar abscess, and underwent surgical drainage, which was performed by an otolaryngologist. The patient was discharged after four days of hospitalization and antibiotic therapy (cefuroxime and clindamycin). Five days after discharge, he started experiencing chest pain, fever, and dyspnea, and, on the seventh day following drainage of the abscess, he sought treatment in the emergency room of the *Hospital São Paulo*. The patient presented with cough, greenish sputum, dyspnea on minimal exertion, and severe right-sided pleuritic pain, as well as fever and poorer overall health status.

Physical examination on admission to the emergency room revealed pallor (2+/4+); tachypnea (22 breaths/min); normal blood pressure (110 × 60 mmHg); cervical edema and phlogosis; dullness to percussion over the base of the right hemithorax (RHT); absent breath

sounds in the middle and lower third of the RHT; and tachycardia (124 bpm). However, cardiac auscultation revealed no abnormalities. General laboratory tests showed leukocytosis (16,900/μL), with 9% rods and 81% neutrophils, thrombocytosis (756,000/μL), increased levels of C-reactive protein (225.9 mg/L), and increased ESR (92 mm/h). A chest X-ray revealed upper mediastinal widening, opacification of the lower two thirds of the RHT, and enlarged cardiac silhouette. The patient subsequently underwent CT of the neck and chest, which revealed large gaseous collections, initiating at the cervical region and extending along the left carotid sheath, spreading into the anterior and middle mediastinum, the pericardium, and the right pleural cavity (Figure 1).

We opted for therapy with broad-spectrum antibiotics (imipenem, cilastatin, and vancomycin) and emergency surgical exploration. The patient was placed in a semi-seated position, with outstretched arms, and his RHT was elevated 30° with the use of cushions. We opted for simple orotracheal intubation. We began with collar cervicotomy at the level of the cricoid cartilage to explore cervical compartments and continued to explore up to the base of the mandible, from where the infectious focus originated. Subsequently, we performed a 1.5-cm thoracotomy incision in the seventh right intercostal space (RIS), introduced a 10-mm fiberoptic bronchoscope (30°), and performed a 6.0-cm accessory anterior minithoracotomy incision in the fourth RIS, through which the entire pleural cavity was cleaned, the mediastinal pleura was opened, and all purulent fluid was drained. We placed an 18 F tube (airtight seal) in the anterior mediastinum and two tubes (water seal) in the pleural cavity—a posterior 18 F tube and an anterolateral 28 F tube. In the cervical region, we placed a Penrose drain, creating communication between the surgical site and the anterosuperior mediastinum, as well between the surgical site and the right pleural cavity, through the pretracheal fascia. Subsequently, the patient was referred to the ICU, where he remained under mechanical ventilation and received low doses of vasoactive drugs. The evolution was favorable, mechanical ventilation and the use of vasoactive drugs were discontinued on postoperative day 2, and the patient was discharged from the ICU on postoperative day 3 (Figure 2). The patient was



**Figure 1** – Initial imaging studies (X-ray and CT scans) revealing right pleural effusion and diffuse mediastinal collection with air-fluid levels, initiating at the left common carotid artery sheath (Case 1). Source: Medical records of the Federal University of São Paulo/Paulista School of Medicine *Hospital São Paulo*.

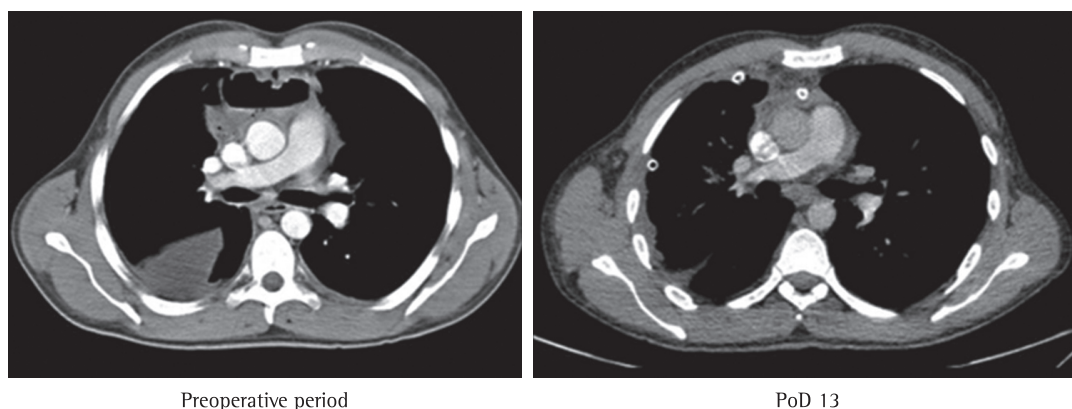
discharged from the hospital in good general health on postadmission day 18, without the need for further surgical intervention (Figures 3a and 3b).

### Case 2

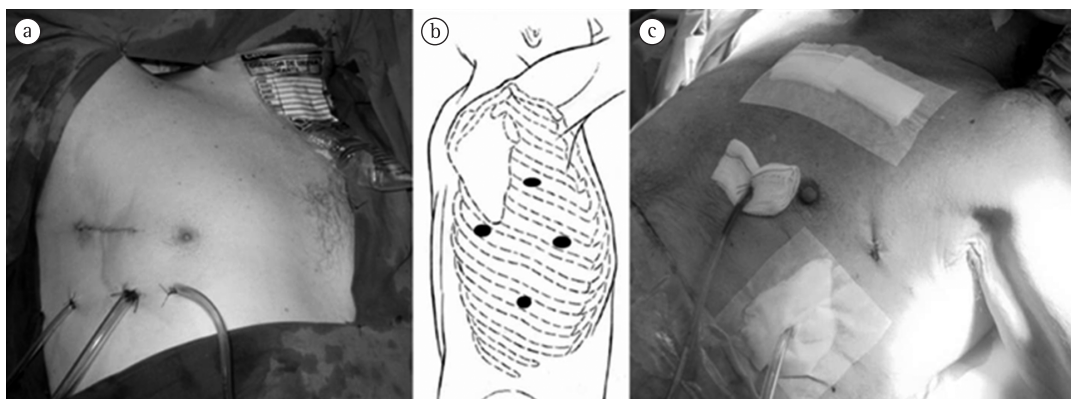
A previously healthy 51-year-old male with no comorbidities was admitted to the emergency room of the São Paulo Hospital with an approximate 12-h history of severe, rapidly

progressing pain in the sternal region and in the base of the RHT preceded by a 1-week history of dysphagia. The patient reported that, one week before the events, he had choked during a meal and had tried to clear his “throat” with a fork, feeling pain at the time of the maneuver, after which he coughed up the piece of food that was suffocating him.

In the emergency room, the patient was found to have fever (axillary temperature: 38.5°C), pallor (2+/4+), tachycardia (HR: 120 bpm), oliguria,



**Figure 2** – CT scans on postoperative day 13 (PoD 13), confirming the favorable evolution in Case 1 after surgical drainage. Source: Medical records of the Federal University of São Paulo/Paulista School of Medicine *Hospital São Paulo*.



**Figure 3** – In a), immediate postoperative appearance of the incisions used for surgical access in Case 1; a median cervicotomy was performed along with a Kocher maneuver, a mini-thoracotomy was performed for instrumentation, and openings were made for ample drainage. In b), schematic illustration of the thoracotomy access sites in the seventh, fifth, and third right intercostal spaces. In c), immediate postoperative appearance in Case 3, showing the thoracotomy incisions made in the third and fifth left intercostal spaces, as well as the parasternal incision for the superficial drainage of the chest wall. Source: Medical records of the Federal University of São Paulo/Paulista School of Medicine *Hospital São Paulo*.

hypotension (arterial pressure: 90 × 50 mmHg), and diminished breath sounds in the lower third of the RHT. There were no abnormalities in the cervical region. General tests showed leukocytosis (21,200/ $\mu$ L). Initially, mediastinal infection was suspected. We initiated fluid resuscitation and required CT of the neck and chest, which showed extensive peri-esophageal collection, from the upper thoracic portion of the esophagus to its base, confirming descending mediastinitis posteriorly, probably due to an injury to the pharynx. As an emergency measure, right video-assisted thoracoscopy was indicated for mediastinal drainage with a minimally invasive approach. The procedure was performed on the same night as the initial examination, after fluid resuscitation and the initiation of broad-spectrum antibiotic therapy with imipenem, cilastatin, and vancomycin. Cervicotomy was not performed, because no cervical collections were detected by the physical examination or the complementary tests.

For the surgical procedure, we opted for selective orotracheal intubation with a double-lumen tube and for the use of the left lateral decubitus position to allow total collapse of the right lung and better exposure of the thoracic esophagus and the posterior mediastinum through the RHT. The procedure was performed through four openings each of approximately 1.0-1.5 cm: one located in the seventh RIS on the midaxillary line, for the introduction of the

10-mm fiberoptic bronchoscope (30°); another two located in the fifth RIS on the anterior and posterior axillary line; and one located in the third RIS on the midaxillary line, allowing debridement of the entire posterior mediastinum.

The cavity was drained with an 18 F tube placed posteriorly to the esophagus, throughout its length, and a 28 F tube placed in the pleural space. The evolution was favorable, and the patient was admitted to the ICU, being weaned from mechanical ventilation on postoperative day 1. In view of the clinical and laboratory improvement, the patient was transferred to the infirmary on postoperative day 2, remaining afebrile and without significant pain complaints. On postoperative day 7, a chest X-ray revealed opacification at the base of the left hemithorax (LHT), and we opted for a second CT examination, which showed moderate pleural effusion in the LHT. We then performed thoracentesis with evacuation of the effusion, which was confirmed to be an uncomplicated exudate, without the need for further intervention. The evolution was favorable, the tubes were removed on postoperative days 9 and 10, and the patient was discharged on postoperative day 17.

### Case 3

A 61-year-old male patient, who had undergone kidney transplantation 3 years prior and was being treated with mycophenolate

mofetil, tacrolimus, and prednisone, presented to the emergency room with pain and hyperemia from the left cervical supraclavicular region to the parasternal area, at the level of the first left rib. His condition had started approximately three days prior, with progressive folliculitis on the neck. Physical examination at admission revealed fever (axillary temperature: 38°C), chills, tachycardia, tachypnea, and poorer overall health status. Complementary tests showed leukocytosis (16,000/ $\mu$ L), bilateral pleural effusion, mediastinal widening, and pulmonary infiltrate in the left apex. Due to toxemia, the patient was immediately admitted to the ICU, started receiving antibiotic therapy with imipenem and cilastatin, and underwent chest CT. The patient showed signs of mental confusion within the first hours after admission. The CT scan showed bilateral pleural effusion, which was more pronounced on the left; parasternal collections, with destruction of the first left rib; and gaseous collections in the anterior and middle mediastinum, extending up to the base of the heart.

Emergency surgical exploration was indicated. The procedure was performed with simple orotracheal intubation and with the patient in a semi-seated position, with outstretched arms, similar to that reported in Case 1. Initial access was through the wall collection and the suprasternal notch. After debridement of necrotic debris in this area, we explored the left pleural cavity with a 10-mm fiberoptic bronchoscope (30°) in the fifth left intercostal space (LIS) on the midaxillary line and in the third LIS on the posterior axillary line. The finding was of intense pleuropulmonary adhesions between the anterior face of the lung and the anterior mediastinum, adhesions that, when separated, released a large quantity of purulent secretion coming from the anterior mediastinum. We observed that the

sternal cartilage of the first rib was destroyed by the inflammatory process, although there was no sign of osteomyelitis or chronic infection. After debridement, the anterior mediastinum was connected with the debrided area on the chest wall with a 19 F flexible silicone tube (water seal), and the pleural cavity was drained through the incision in the fifth LIS with a 28 F pleural tube (water seal). The right pleural cavity was also approached in the same procedure, through the same video-assisted thoracoscopic incisions (in the third and fifth LIS). Because there was a transudate, we opted for maintaining a 28 F pleural tube (water seal). The patient remained on mechanical ventilation in the first 12 h of the postoperative period and required vasoactive drugs. His condition gradually improved, without the need for further surgical intervention. The pleural tube was removed on postoperative day 7, and the tube in the LHT was removed on postoperative day 10, whereas the left anterior mediastinal tube was maintained until postoperative day 14. The evolution was favorable, and the patient was discharged on postoperative day 15 (Figure 3c).

Results

We reported the course of three patients submitted to clinical and surgical treatment, with the aid of video-assisted thoracoscopy, for debridement of acute mediastinal infection originating from oropharyngeal and cervical foci (descending necrotizing mediastinitis). In this case series, treatment was successful in 100% of the cases, with no deaths and with a mean length of hospital stay of 16.7 days (Table 1).

In Cases 1 and 3, we opted for simple orotracheal intubation for the surgical procedure and for placing the patients in a semi-seated position, with a view to a possible bilateral

**Table 1** – Age of the patients described, as well as source of mediastinal infection, comorbidities, and length of hospital stay.

Patient	Age (years)	Source of infection	Comorbidity	Discharge (PaD)
1	29	Dental abscess	Illicit drug user (cocaine)	18
2	51	Perforation of the oropharynx		17
3	61	Folliculitis on the neck and chest (wall)	Renal transplant recipient	15
Mean	47			17

PaD: postadmission day. Source: Medical records of the Federal University of São Paulo/Paulista School of Medicine Hospital São Paulo.



thoracic approach being necessary, which occurred only in Case 3. Due to our experience with video-assisted thoracic sympathectomy, we noticed that, with the patient in this semi-seated position, it is possible to obtain satisfactory lung collapse simply by using lower ventilatory volumes during anesthesia, and this was sufficient to allow access to the entire pleural cavity. Therefore, we simplified the anesthetic procedure without compromising the exposure of the surgical field due to the lack of selective tracheobronchial intubation.

## Discussion

Descending necrotizing mediastinitis is a rare form of mediastinal infection. However, it is extremely severe and lethal if not treated properly. In 1983, one group of authors defined the criteria for the diagnosis of descending necrotizing mediastinitis, which included radiographic abnormalities suggestive of mediastinitis, signs of severe infection, and the documented correlation with infections of oropharyngeal origin.<sup>(5)</sup> In the pre-antibiotic era, descending necrotizing mediastinitis had extremely high mortality rates, which reached 86% in patients submitted to clinical treatment alone, whereas, in those submitted to any surgical intervention, these rates dropped to 35%, overall mortality being 55%.<sup>(5)</sup> Currently, the incidence of descending necrotizing mediastinitis remains low. However, despite advanced surgical techniques and intensive care, mortality rates remain significant, being as high as 40% in some case series<sup>(3,7)</sup>

Surgical treatment has become a consensus among authors, given the aggressiveness of the infection and its potential for lethality. However, the surgical access for the treatment varies. In 1999, one group of authors defined three forms of descending mediastinitis: form I, located in the anterior mediastinum and superior to the carina; form IIA, extending to the lower anterior mediastinum; and form IIB, extending to the anterior and posterior mediastinum. Those authors stated that, based on the location of the infection, it was possible to determine the surgical approach: cervicotomy to treat forms I and IIA; and the combination of cervicotomy and posterolateral thoracotomy to treat the posterior mediastinum in form IIB.<sup>(10)</sup> In 1990, the authors of another study stated that cervicotomy alone

was not sufficient for the treatment of the infection, because, in their sample, 20 (46%) of the 43 patients initially submitted to cervicotomy subsequently required thoracotomy to control mediastinitis.<sup>(15)</sup> Other surgical approaches, such as clamshell thoracotomy, median sternotomy, anterolateral thoracotomy, and bilateral thoracotomy, have been proposed.<sup>(8-11)</sup>

Currently, minimally invasive intervention with the aid of video-assisted thoracoscopy is widely used. The first report of this surgical approach for the treatment of descending mediastinitis, describing the first cases treated with the combination of cervicotomy and video-assisted thoracoscopy, was published in 1997.<sup>(13)</sup> The importance of the concept "minimally invasive" approach is that, for patients with descending mediastinitis, who usually have severe systemic infection, it offers advantages such as less surgical trauma, lower production of inflammatory cytokines, and less postoperative pain. Therefore, we observed a greater capacity for recovering hemodynamic stability and respiratory capacity after the surgical procedure, not to mention the aesthetic effect. Other reports, documenting the excellent rate of resolution of the infection, without the need for further surgical intervention, have followed.<sup>(4,7,12)</sup>

The postoperative evolution should be rigorously monitored, imaging studies being conducted only when there is suspicion of smaller but septate collections; these collections can and should, whenever possible, be approached by techniques of tomography-guided drainage under local anesthesia, coinciding with the aforementioned concept.

We conclude that descending necrotizing mediastinitis is a rare and potentially lethal pathology and that it should always be considered, especially in patients with a history of recent dental manipulation followed by severe systemic infections. An aggressive approach with broad-spectrum antibiotic therapy and timely surgical intervention should be used to treat this condition. Recently, we have witnessed the rise of video-assisted thoracoscopy as a safe and effective method for resolving infection, with the advantage of resulting in less postoperative pain, lower production of inflammatory factors, earlier return to activities of daily living, and better aesthetic results.

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