Descending necrotizing mediastinitis: Ten years' experience

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Abstract

Descending necrotizing mediastinitis is a rare disease that is usually caused by a spreading, diffuse inflammatory reaction (phlegmon) to an odontogenic infection or peritonsillar abscess. Reported mortality rates range from 25 to 40%. The use of antibiotics and advances in resuscitation procedures and critical care techniques have not essentially improved survival, and an effective treatment has not been clearly established. We report the findings of our 10-year study of 21 patients affected by phlegmon and/or fasciitis of the neck. The aim of our contribution is to help define the clinical criteria and diagnostic procedures that will improve the early diagnosis of mediastinal sepsis secondary to neck fasciitis and to suggest optimal treatment approaches. Our experience indicates that (1) cervical drainage alone is sufficient for cases of cervical phlegmon or mediastinal involvement that are limited to a single superior mediastinal space and (2) thoracotomy and drainage of mediastinal collections is necessary when mediastinal sepsis is more extensive.

Introduction

Descending necrotizing mediastinitis is a rare disease that is usually caused by a spreading, diffuse inflammatory reaction (phlegmon) to an odontogenic infection or peritonsillar abscess.[1] Less often, it is caused by posttraumatic sepsis of the neck, suppurative parotitis, or Ludwig's angina.[2,3] When infection is the culprit, it is usually caused by bacteria (both aerobic and anaerobic), and it is rapidly progressive. Infection often spreads to the mediastinum, the pleural cavities, and the pericardium through the fascial planes.[4] Clinical and pathologic criteria for the diagnosis of descending necrotizing mediastinitis have been described by Estrera et al.[5]

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In 1938, during the preantibiotic era, Pearse studied 21 patients with descending necrotizing mediastinitis and reported that the mortality rate exceeded 50% (11 of 21 patients).[6] The use of antibiotics and advances in resuscitation procedures and critical care techniques have not essentially improved survival. Mortality rates reported in recent decades range from 25 to 40%.[7] In 1983, Estrera et al described 10 cases that they had followed between 1975 and 1981 and reported a mortality rate of 40%.[5] In 1990, Wheatley et al published their analysis of 43 cases reported in the literature since 1960.[8] They reported that the global mortality rate was 33% from 1960 through 1983, 40% from 1984 through 1992, and 36% overall. More recently, Freeman et al reviewed 96 cases that occurred between 1970 and 1999 and found that the mortality rate was 29%.[9]

No definitive treatment for descending necrotizing mediastinitis has been clearly established. Currently, the primary treatment is drainage via a combined cervical and thoracic approach, although some authors contend that cervical drainage alone is sufficient to control both cervical and mediastinal sepsis.[10]

In this article, we describe our effort to help define the clinical criteria and diagnostic procedures that will improve the early recognition of mediastinal sepsis secondary to neck fasciitis and to suggest optimal treatment approaches.

Patients and methods

Our study was made possible by the cooperation of otorhinolaryngologists and thoracic surgeons in Genoa, Italy. Between February 1993 and February 2003, we observed 21 patients—15 men and 6 women, aged 19 to 77 years (mean: 45.8)—with phlegmon and/or necrotizing cervical and mediastinal fasciitis in different stages of clinical and pathologic evolution.

In addition to demographic data, we recorded the original pathology, the length of time between the initial outpatient presentation with symptoms and hospitalization, findings on hospital admission (according to clinical, anatomic, and radiologic examinations), the type and duration of antibiotic therapy, the type of pathogen, the type of surgery, the need for postoperative ventilation, the incidence and

type of postoperative complications, the incidence and type of reoperation, and the length of hospital stay (table). We compared our findings with those of others that have been reported in the literature.

Results

Original pathology. Dental abscess had preceded the onset of symptoms in 16 patients, left peritonsillar abscess in 2 patients, posttraumatic sepsis of the left sternoclavicular joint in 2, and both pharyngeal and cervical lymphadenitis in 1.

Hospital admission. Patients were hospitalized between 5 and 15 days (mean: 8) following their initial outpatient presentation with symptoms and the initiation of antibiotic treatment. Admission was necessitated by the failure of antibiotic therapy to prevent ongoing and progressive cervical phlegmon.

Findings on admission. Computed tomography (CT) of the neck and the thorax was performed on all patients, regardless of the strength of the clinical evidence of mediastinal involvement:

- Mediastinitis was evident in 15 of the 21 patients; 13 also had an abscess. Six patients presented with an abscess alone—2 cases of right cervical abscess, 2 cases of right cervical and retropharyngeal abscess, and 2 cases of left cervical and retropharyngeal abscess.
- Pleural effusion was seen in 7 patients.
- Despite mediastinal infection, 3 patients were afebrile at presentation and remained so throughout the course of their disease.

One of the female patients had an atypical presentation. Among her symptoms was a severe, painful, and erythematous edema of the left side of the neck that had developed 15 days earlier. This woman had originally gone to another hospital, where she had experienced a partial recovery. However, her condition worsened and she was transferred to our department for management of shortness of breath and hypoxia. CT detected the edema of the neck tissues, but no suppurative or gangrenous collections. Mediastinal sepsis was observed spreading below the carinal plane. She also had confluent bronchopneumonic foci of the right lung and a right pleural effusion.

Antibiotic therapy. Upon admission, all patients were given intravenous broad-spectrum antibiotic therapy; each received 20 million IU of penicillin once a day and 2.4 g/d of clindamycin. This regimen was maintained for at least 12 days or until we isolated an organism that is susceptible to a different antibiotic.

Type of pathogen. Cultures identified beta-hemolytic group A streptococci, anaerobic streptococci, anaerobic enterococci, *Staphylococcus aureus*, and *Bacteroides fragilis*. Most patients harbored more than one pathogen.

Type of surgery. All patients underwent cervicotomy and/or thoracotomy:

- Seventeen patients underwent bilateral cervicotomy (surgical drainage of cervical collections via a wide [Kocher's] incision), and 2 others underwent unilateral cervicotomy. Necrotic tissues were removed and the wounds were repeatedly washed with saline solution and hydrogen peroxide. Wounds were left open and soft drains and/or gauzes were used. Cervical drainage was not performed in the patient with the atypical presentation.
- Of the 15 patients with mediastinal involvement, only 4 underwent cervicotomy alone.
- Thoracotomy (anterolateral pleural drainage) was performed on 15 patients to remove necrotic tissue in all mediastinal areas and to place at least two drains. Samples of septic drainage were collected from both the neck and the mediastinum for culture. A maxillofacial surgeon was consulted for adequate treatment of the initial septic foci in those patients whose infections were odontogenic.
- Only 2 patients underwent thoracotomy alone; both had mediastinal involvement.
- Immediately following surgery, 6 patients required tracheotomy to relieve glottic edema and acute respiratory failure.

Postoperative ventilation. Four patients (all with mediastinitis) required assisted ventilation following surgery. Two of them died from septic shock and multiorgan failure; the other 2 were released from the critical care unit within 2 days.

Complications. Severe postoperative complications occurred in 8 patients, including 6 who had mediastinitis:

- Two patients experienced septic shock and necrotizing fasciitis, and both died.
- Two patients experienced renal failure. Both recovered in 1 week.
- Two patients developed a bleeding duodenal ulcer that required the infusion of 6 units of blood and 20 days of antiulcer therapy.
- Two patients developed a cutaneous reaction. One of these patients also experienced acute hypotension as a reaction to penicillin; this patient improved in 10 days. The other patient was given cortisone and improved in 4 days.

Reoperation. Six patients, including 4 who had mediastinitis, required reoperation:

Table. Selected clinical data on 21 patients with descending necrotizing mediastinitis

Pt.	Original pathology	Findings on admission	Type of surgery	Complication	Reoperation	Length of stay
1	Dental abscess (RIM)	Anterior mediastinitis; B cervical and retropharyngeal abscess	R thoracotomy; B cervicotomy; tracheotomy	Septic shock; necrotizing fasciitis	R cervical lymphadenectomy	30*
2	Dental abscess (RIM)	Anterior mediastinitis; B cervical and retropharyngeal abscess	R thoracotomy; B cervicotomy; tracheotomy	Septic shock; necrotizing fasciitis	R cervical lymphadenectomy	30*
3	Dental abscess (RIM)	Anterior mediastinitis; B cervical abscess	R thoracotomy; B cervicotomy; tracheotomy	Renal failure	B cervicotomy	52
4	Dental abscess (RIM)	Anterior mediastinitis; B cervical abscess	B cervicotomy	None	None	40
5	Post-traumatic sepsis (LSCJ)	Anterior mediastinitis; LSCJ abscess; L pleural effusion	L thoracotomy; B cervicotomy	None	None	35
6	L peri-tonsillar abscess	Anterior mediastinitis; LSCJ abscess; L pleural effusion	B cervicotomy	None	None	35
7	Dental abscess (RIM)	Anterior and middle mediastinitis; B cervical abscess; R pleural effusion	R thoracotomy; B cervicotomy; tracheotomy	Renal failure	B cervicotomy	52
8	Dental abscess (RIM)	Anterior and middle mediastinitis; B cervical abscess; R pleural effusion	R thoracotomy; B cervicotomy	None	None	40
9	Dental abscess (LIM)	Anterior and middle mediastinitis; R pleural effusion	R thoracotomy	None	None	18
10	Dental abscess (LIM)	Anterior and middle mediastinitis; R pleural effusion	R thoracotomy	None	None	18
11	Pharyngeal and cervical lymph-adenitis	Anterior and middle mediastinitis; R cervical and retropharyngeal abscess; R pleural effusion	R thoracotomy; R cervicotomy	None	None	34

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Table (continued)

Pt.	Original pathology	Findings on admission	Type of surgery	Complication	Reoperation	Length of stay
12	L peri-tonsillar abscess	Anterosuperior mediastinitis; L cervical abscess	B cervicotomy	Duodenal stress ulcer	None	38
13	Dental abscess (LIM)	Anterosuperior mediastinitis; L cervical abscess	B cervicotomy	Duodenal stress ulcer	None	38
14	Dental abscess (LIM)	Anterosuperior mediastinitis; B cervical and retropharyngeal abscess	B thoracotomy; L cervicotomy	None	None	32
15	Post-traumatic sepsis (LSCJ)	Posterior and middle mediastinitis; R cervical and retropharyngeal abscess	L thoracotomy; B cervicotomy	None	None	34
16	Dental abscess (LIM)	R cervical abscess	R thoracotomy; B cervicotomy	Hypotension; cutaneous reaction	L cervical and posterior lymphadenectomy	26
17	Dental abscess (LIM)	R cervical abscess	R thoracotomy; B cervicotomy; tracheotomy	Cutaneous reaction	L cervical and posterior lymphadenectomy	26
18	Dental abscess (RIM)	R cervical and retropharyngeal abscess	R thoracotomy; B cervicotomy	None	None	20
19	Dental abscess (RIM)	R cervical and retropharyngeal abscess	R thoracotomy; B cervicotomy; tracheotomy	None	None	20
20	Dental abscess (LIM)	L cervical and retropharyngeal abscess	B cervicotomy	None	None	16
21	Dental abscess (LIM)	L cervical and retropharyngeal abscess	B cervicotomy	None	None	16

* *Patient died.*

Key: LIM = left inferior molar; RIM = right inferior molar; R = right; L = left; B = bilateral; LSCJ = left sternoclavicular joint.

- Two patients underwent right cervical lymphadenectomy.
- Two patients underwent bilateral cervicotomy via two small incisions at the midline of the neck.
- Two patients underwent left cervical and posterior lymphadenectomy.

The remaining 15 patients were maintained on medication and irrigation.

Length of hospital stay. The length of stay ranged from 16 to 52 days (mean: 31).

Based on our experience, we conclude that (1) cervicotomy alone is sufficient for drainage in cases of cervical phlegmon or mediastinal involvement that are limited to a single superior mediastinal space and (2) thoracotomy and drainage of mediastinal collections is necessary when mediastinal sepsis is more extensive.

Discussion

Descending necrotizing mediastinitis is a serious disease, and early diagnosis and treatment may lower the high mortality rate associated with it.

Clinical and radiologic features. The length of time required for sepsis to descend from the neck to the mediastinum is variable. Hyperacute forms progress in only a few hours, but most cases progress over a period of days, probably because patients undergo antibiotic treatment at the onset of symptoms.[11] In our study, the time to the spread of infection ranged from 5 to 15 days (mean: 8).

Hospital admission was usually prompted by a sudden worsening of cervical phlegmon along with general deterioration and hyperpyrexia. The typical symptoms of mediastinal involvement (thoracic pain, jugular distention, dyspnea, hypoxia, and respiratory failure) were not always evident in our study. Only 4 of 15 patients with mediastinitis exhibited dyspnea and hypoxia at the time of hospitalization; 4 others developed these symptoms a few hours after admission, but 7 patients never did. However, this finding should not lead us to underestimate this disease, which can be rapidly fatal if not properly treated. Based on our knowledge of the natural history of cervical fasciitis and descending necrotizing mediastinitis, we should always seek to determine at presentation if the necrotizing process has already involved the mediastinum.

CT of the neck and thorax is mandatory. CT is especially important in patients who present with gangrene, extensive subcutaneous emphysema, and tissue necrosis, which frequently involve both the neck and mediastinum. CT helps determine the level of infection by identifying (1) the presence and extension of fluid collections, with or without gas bubbles, and (2) the diffuse soft-tissue infiltration of the mediastinal fat.

Choice of surgical procedure. The choice of surgical procedure should be made with the goal of assuring early, effective, and definitive drainage of purulent and gangrenous collections, which can prevent the onset of systemic toxicity and subsequent multiorgan failure and death.

Bilateral cervicotomy and drainage is the surgical treatment of choice for cervical fasciitis without mediastinitis, as has been widely reported in the literature.[12] Such patients should be closely observed from a clinical and radiologic standpoint (including repeat CTs) in order to confirm that cervical drainage was adequate and that the infection has not spread downward. This was our strategy for the 3 patients who presented with anterosuperior mediastinitis, 2 of whom did not undergo thoracotomy.

The ideal surgical approach to mediastinitis is still controversial:

- Some authors support cervical exploration alone.[8,13-15] Some have advocated that cervical drainage is the gold standard for treating mediastinitis and that thoracotomy should be reserved for use as a second surgery because it is too extreme for patients in critical condition.[8,14,15]
- On the other hand, a review of the literature by Estrera et al found a high rate of morbidity in the postcervicotomy period.[5] Many of those patients required urgent procedures and prolonged ventilation, and some cases were marked by severe complications, such as esophageal fistula, tracheal fistula, and massive hemorrhage. Takao et al reported cases in which cervicotomy patients' clinical conditions progressively worsened; these patients recovered only after they underwent thoracotomy.[7] We believe that the initial surgical approach in these cases did not ensure appropriate cervicomediastinal drainage, which is a fundamental necessity for a rapid recovery.
- Other authors have reported that early thoracotomy to drain septic mediastinal fluid reduces mortality.[16,17] For example, Corsten et al performed a metaanalysis of 24 case reports and 12 series of adults (total number of patients: 69).[17] They reported that the mortality rate was 19% among patients who underwent both cervicotomy and thoracotomy and 47% among those who underwent cervicotomy alone.
- In 1983, Estrera et al suggested that thoracotomy should be performed only when the infectious process has extended below the carina anteriorly and beyond the fourth thoracic vertebra posteriorly.[5] They arrived at this conclusion as a result of experience during the second half of the 1970s.

More than 20 years later—as a result of advances in surgery, anesthesia, and critical care—we are able to perform thoracotomy on seriously ill patients. This is particularly important for the patient's recovery.

Recommendations. Our experience seems to confirm that when more than one mediastinal space is involved, the standard treatment should be a combined cervical and thoracic approach during the same operation, regardless of the cranial-caudal extension of the mediastinitis. This approach ensures an early and definitive resolution of sepsis and, compared with cervicotomy alone, allows for a shorter postoperative course with a lower rate of complications.

In our study, 5 of the 15 patients who underwent thoracotomy improved during the immediate postoperative period; they had less fever, lower leukocyte counts, and a dramatic improvement in hemodynamic and respiratory parameters. Another 4 patients required assisted ventilation postoperatively, 2 of whom were taken off the ventilator within 2 days. The remaining 6 patients who underwent thoracotomy required a repeat neck procedure; the incidence of postoperative complications in the thoracotomy patients (6/15 cases [40%]) was lower than that reported by some others.[18]

The success of our surgical approach also influenced our choice not to routinely perform intraoperative tracheotomy, which is controversial. Some authors believe that tracheotomy should be a part of the therapeutic strategy because patients often require prolonged postoperative assisted ventilation or are likely to have a bronchial obstruction that might require repeated suction.[9,16,17,19] Our experience was different, as only 6 patients required tracheotomy. Postoperative tracheobronchial obstruction occurred in only 1 of our patients, and it was caused by the collection of thick secretions around the cannula. We believe that intraoperative tracheotomy is usually not worthwhile; in fact, it can even be counterproductive if it contributes to the persistence of cervical and mediastinal sepsis. In our opinion, tracheotomy should be carried out only in cases of extreme necessity.

Finally, the mortality rate in our study was 9.5%, which can be considered encouraging.

References

1. Papalia E, Rena O, Oliaro A, et al. Descending necrotizing mediastinitis: Surgical management. Eur J Cardiothorac Surg 2001;20: 739-42.
2. Endo S, Murayama F, Hasegawa T, et al. Guideline of surgical management based on diffusion of descending necrotizing mediastinitis. Jpn J Thorac Cardiovasc Surg 1999;47:14-19.
3. Wilson JW. Genomics of group A Streptococcus: From computer to benchtop. Trends Microbiol 2001;9:413.
4. Callister ME, Wall RA. Descending necrotizing mediastinitis caused by group A streptococcus (serotype M1T1). Scand J Infect Dis 2001;33:771-2.
5. Estrera AS, Landay MJ, Grisham JM, et al. Descending necrotizing mediastinitis. Surg Gynecol Obstet 1983;157:545-52.
6. Biasotto M, Pellis T, Cadenaro M, et al. Odontogenic infections and descending necrotising mediastinitis: Case report and review of the literature. Int Dent J 2004;54:97-102.
7. Takao M, Ido M, Hamaguchi K, et al. Descending necrotizing mediastinitis secondary to a retropharyngeal abscess. Eur Respir J 1994;7:1716-18.
8. Wheatley MJ, Stirling MC, Kirsh MM, et al. Descending necrotizing mediastinitis: Transcervical drainage is not enough. Ann Thorac Surg 1990;49:780-4.
9. Freeman RK, Vallieres E, Verrier ED, et al. Descending necrotizing mediastinitis: An analysis of the effects of serial surgical debridement on patient mortality. J Thorac Cardiovasc Surg 2000;119: 260-7.
10. Kruyt PM, Boonstra A, Fockens P, et al. Descending necrotizing mediastinitis causing pleuroesophageal fistula. Successful treatment by combined transcervical and pleural drainage. Chest 1996;109: 1404-7.
11. Casanova J, Bastos P, Barreiros F, Gomes MR. Descending necrotising mediastinitis—successful treatment using a radical approach. Eur J Cardiothorac Surg 1997;12:494-6.
12. Brunelli A, Sabbatini A, Catalini G, Fianchini A. Descending necrotizing mediastinitis. Surgical drainage and tracheostomy. Arch Otolaryngol Head Neck Surg 1996;122:1326-9.
13. al-Ebrahim KE. Descending necrotising mediastinitis: A case report and review of the literature. Eur J Cardiothorac Surg 1995; 9:161-2.
14. Civen R, Vaisanen ML, Finegold SM. Peritonsillar abscess, retropharyngeal abscess, mediastinitis and nonclostridial anaerobic myonecrosis: A case report. Clin Infect Dis 1993;16(suppl 4): S299-303.
15. Sakamoto H, Aoki T, Kise Y, et al. Descending necrotizing mediastinitis due to odontogenic infections. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;89:412-9.
16. Leitch HA, Palepu A, Fernandes CM. Necrotizing fasciitis secondary to group A streptococcus. Morbidity and mortality still high. Can Fam Physician 2000;46:1460-6.
17. Corsten MJ, Shamji FM, Odell PF, et al. Optimal treatment of descending necrotising mediastinitis. Thorax 1997;52:702-8.
18. Lavini C, Natali P, Morandi U, et al. Descending necrotizing mediastinitis. Diagnosis and surgical treatment. J Cardiovasc Surg (Torino) 2003;44:655-60.
19. Sancho LM, Minamoto H, Fernandez A, et al. Descending necrotizing mediastinitis: A retrospective surgical experience. Eur J Cardiothorac Surg 1999;16:200-5.