Descending necrotizing mediastinitis: a retrospective surgical experience

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Received 21 September 1998; received in revised form 19 April 1999; accepted 4 May 1999

Abstract

Objective: Descending necrotizing mediastinitis (DNM) is a primary complication of cervical or odontogenic infections that can spread to the mediastinum through the anatomic cervical spaces. We reviewed the last 10 years of our surgical experience in DNM and commented on early diagnosis and aggressive surgical treatment in these patients. Methods: Five males (71%) and two females (29%), mean age 34 years, with DNM, were surgically treated. Primary oropharyngeal infection occurred in three (43%) and odontogenic abscess in four (57%) patients. All had serious cervical and mediastinal infections with severe respiratory and hemodynamic repercussions, i.e. bacteremia, systemic arterial hypotension and obtundation. Diagnosis was confirmed by computerized chest tomography. Results: All patients underwent surgical drainage of the cervical region by bilateral transverse cervicotomy with debridement of the necrotic and infected tissues, associating ample mediastinal drainage with or without thoracotomy. Six patients (86%) evolved well and were discharged after a mean of 35 days. Two patients (29%) required reoperation due to local surgical complications: empyema and dehiscence of the sternum. One patient (14%) died on the second postoperative (p.o.) day due to renal and respiratory insufficiency. Cultures of DNM showed the development of associated aerobic and anaerobic flora in 71% of the operated patients and only aerobic in 29%. Conclusion: Early diagnosis by CAT scan of the neck and thorax aids in rapid indication of a surgical approach of DNM. Performing ample cervicotomy with mediastinal drainage generally associated with thoracotomy can significantly reduce the mortality rate for this condition to 14%. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Descending necrotizing mediastinitis; Mediastinitis; Necrotizing fasciitis

1. Introduction

Acute mediastinitis is a severe infection of the mediastinal connective tissue which fills the interpleural mediastinal space and its thoracic anatomic structures. It is most often caused by perforation of the esophagus or infection after sternotomy in cardiac surgery [8] and can also occur as a complication of primary oropharyngeal infection progressing to the cervical region and spreading through the fascia to the mediastinum. In the latter case, the disease is known as descending necrotizing mediastinitis (DNM) [5,7]. Diagnostic criteria for DNM were defined by Estrera et al. [5] in 1983. DNM is a rare disease, but, highly fatal in all its clinical forms. Various reports place the mortality rate as high as 50% [4,6–8,13]. We recently reviewed our 10 years experience of surgical management of DNM. Utilization of computerized tomography for early diagnosis of DNM and aggressive surgery for ample mediastinal drainage chiefly using thoracotomy has also significantly reduced our mortality rate to 14%.

2. Patients and methods

Between 1986 and 1997, seven patients with DNM were managed at this institution. Estrera and colleagues criteria were applied in all patients [5] and included: clinical manifestations of a severe oropharyngeal infection; radiological demonstration of mediastinitis; demonstration of necrotizing mediastinal infection at operation or autopsy or both; proof of a relationship between oropharyngeal infection and DNM.

Five males (71%) and two females (29%) ranging in age from 9 to 71 years were treated. The primary oropharyngeal infection was 57% (4/7) for odontogenic abscesses and 43%
for peritonsillar abscesses (Ludwig Angina). Mean interval between onset of the oropharyngeal infection and hospitalization was 10 days. All patients were referred to our service without prior treatment at other services. Only three out of the seven were empirically given non-hormone antiinflammatory medications prescribed by laymen.

On admission to our service four blood cultures were collected during the first 12 h. The patients were immediately placed on broad spectrum antibiotics preoperatively for gram positive aerobic and anaerobic bacteria. Medication included 20 million IU crystalline penicillin/day and 2.4 g/day of clindamycin, at least 24 h prior to surgery. Tissue specimens from the cervical and mediastinal regions obtained intraoperatively were cultured for aerobic and anaerobic germs and the results used for specific antibiotic therapy.

Antibiotic therapy was maintained for a minimum of 15 days. In order to discontinue this therapy the patients needed to be without signs of toxemia (fever, tachycardia, and dehydration) for at least 48 h and to display a normal white blood cell count.

The oropharyngeal infection was controlled while the patients was hospitalized and before discharge. Treatment included odontological, drainage of case a cervical abscess and antibiotic therapy similar to that used for DMN.

Diagnosis was obtained by CT scan of the cervical and mediastinal regions. Broad bilateral transverse cervicotomies (Kocher incision) were accomplished, with debride-ment of necrotic infected tissue, leaving the incision open for healing by second intention.

Four patients submitted to mediastinal drainage without opening the chest cavity comprised Group I. Three patients submitted to opening of the chest cavity and drainage through the opening of the mediastinal space consisted of Group II. Underwater sealed drainage was used on all patients realized with no. 38 French multiperforated pleural drainage tubes. Irrigation with saline within the mediastinum as recommended by Marty-Ane et al. [8] and Santos et al. [11] was dispensed with.

3. Results

Mean time between hospitalization on our service and diagnosis of DNM was three days. An oropharyngeal infection was suspected in all patients with marked cervical disease, local pain and widespread inflammatory infiltrate in the skin with crepitation (subcutaneous emphysema), suggestive of infection by gas-producing bacteria in 57% (4/7). The patients also complained of moderate dyspnea and hypoxia with radiological signs suggestive of descending mediastinitis (widening of the mediastinum) in 57% (4/7). All the diagnoses of DNM were made by CT scan. Typical mediastinal abscess images either with air-liquid level or mediastinal emphysema or both (Figs. 1–3) confirmed the diagnosis of DNM. Two of the blood cultures in patient no. 3, demonstrated *Staphylococcus aureus* and *Bacteroides fragilis*. *Staphylococcus aureus* was present in the blood culture of patient no. 7. Blood cultures in the other five patients were negative.

3.1. Operative management

Various surgical approaches were employed for management of DNM in our patients: Group I, closed drainage of the mediastinum without opening the chest cavity 4/7 (57%); Group II, opening of the chest cavity with open drainage of the mediastinum 3/7 (43%). Sternotomy 1/7 (14%) and posterolateral thoracotomy 2/7 (29%) (Tables 1 and 2).

Mean time for underwater sealed drainage was 16 ± 4
days (minimum 13 days and maximum 25 days) and an average of 15 days.

3.2. Bacteriological culture

Eighty-six percent (6/7) of cultures displayed polymicrobial flora (8), with 71% (5/7) demonstrating aerobic and anaerobic bacteria. The most common microorganisms cultured from material obtained from the mediastinum were: *Pseudomonas aeruginosa* in 71% (5/7), *Staphylococcus aureus* in 57% (4/7) and *Enterobacter cloacae* in 43% (3/7), *Acinetobacter caloaceticus* 29% (2/7), *Escherichia coli* in 14% (1/7) and *Serratia marcencis* 14% (1/7) (Table 3). In these cultures, the most common anaerobic microorganism was *Bacteroides fragilis* in 71% (5/7).

3.3. Clinical follow-up

Our mortality rate was 14% (1/7). Patient no. 4 (Table 1) died on the 2nd postoperative (p.o.) day due to respiratory and renal failure secondary to irreversible septic shock. Our morbidity rate was 29% (2/7). Patient no. 6 (Table 1) required resuturing of the sternum on the 12th p.o. day because of its partial dehiscence, without osteomyelitis and with healed mediastinal infection. Patient no. 2 (Table 1) displayed infection of the right pleural cavity on the 10th p.o. day and needed a new closed drainage of this pleural cavity. Except for the one death, the remaining patients progressed satisfactorily and were discharged at 29 ± 14 days, a minimum of 2 days (death) and a maximum of 42, an average of 35 days.
4. Discussion

Nowadays, acute mediastinitis secondary to primary oropharyngeal or odontological infections is very rare. It is more common in developing countries due to the poor economic conditions and consequently lack of medical resources for prevention and treatment of dental and oropharyngeal diseases. Hence, it is still possible to come across cases with DNM secondary to oropharyngeal infections (Ludwig Angina) and lesions of the dental arcades with secondary infections, especially of the second and third lower molars progressing to a descending and rapid mediastinal infection [14,15].

Pearse [10] in 1938, was the first author to describe this type of mediastinitis secondary to oropharyngeal infections reporting a mortality rate of up to 50%. According to Moncada et al. [9], 70% of cervical infections depend on the toxicity of the infecting bacteria and their inroad through the retropharyngeal space, spreading with the help of gravity, ventilation and negative intrathoracic pressure [12]. In patients in poor physical conditions suffering from malnutrition, diabetes mellitus, alcoholics, drug addicts, and in the immunosuppressed, the incidence of DNM is much greater than in the general population [7]. Late diagnosis is the principal reason for the high mortality in DNM. The diagnosis is suspected when the patient complains of chest pain, dyspnea and fever with marked associated toxemia. Radiological study frequently demonstrates widening of the upper mediastinum, pneumomediastinum or abscess which obliterates the retrosternal space and the retrocardiac silhouette but frequently these clinical findings appear in the late stage of the infection. Possible chest or mediastinal drainage and tracheostomies prior to the infection can render the interpretation of these tomographic images difficult.

CT scan is useful for early diagnosis of DNM demonstrating gas infiltration or edema in soft tissues of the mediastinum and the presence of fluid collections typical of mediastinal abscess with or without gas bubbles (Figs. 1–3). Preoperative cervicothoracic tomography exhibits the extent of the necrosis and locates these lesions for orienting surgical drainage. It is also useful for p.o. follow-up, as exemplified by our study. Immediately p.o., one of our patients developed fever and the tomogram demonstrated

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### Table 1

Series of seven patients with DNM

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age</th>
<th>Gender</th>
<th>Infection origin</th>
<th>Infection dissemination</th>
<th>Operative treatment</th>
<th>Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1†</td>
<td>19</td>
<td>Female</td>
<td>Ludwig Angina</td>
<td>Bilat. cervical abscess and retropharyngeal space with posterior mediastinitis</td>
<td>Bilateral cervicotomiy with posterior mediastinal drainage</td>
<td>Good evolution at 3 months follow-up</td>
</tr>
<tr>
<td>2‡</td>
<td>34</td>
<td>Male</td>
<td>Dental abscess</td>
<td>Bilateral cervical abscess with anterior mediastinitis</td>
<td>Bilateral cervicotomiy with retropharyngeal space and anterior mediastinal drainage</td>
<td>Complicat. on 11th p.o. day. Closed right pleural. Drainage. Good evolution at 3 months follow-up</td>
</tr>
<tr>
<td>3‡</td>
<td>49</td>
<td>Male</td>
<td>Dental abscess</td>
<td>Bilateral cervical abscess with anterior mediastinitis</td>
<td>Bilateral cervicotomiy with anterior mediastinal drainage via subxiphoid</td>
<td>Good evolution at 3 months follow-up</td>
</tr>
<tr>
<td>4‡</td>
<td>71</td>
<td>Male</td>
<td>Ludwig Angina</td>
<td>Right cervical abscess with anterior mediastinitis</td>
<td>Bilateral cervicotomiy with mediastinal drainage via anterior mediastinoscopy</td>
<td>Death on 2nd p.o. day/respiratory and renal failure</td>
</tr>
<tr>
<td>5‡</td>
<td>09</td>
<td>Female</td>
<td>Dental abscess</td>
<td>Bilateral cervical abscess and posterior mediastinitis</td>
<td>Bilateral cervicotomiy with rt. thoraectomy and posterior mediastinal drainage</td>
<td>Good Evolution at 3 months follow-up</td>
</tr>
<tr>
<td>6‡</td>
<td>29</td>
<td>Male</td>
<td>Dental abscess</td>
<td>Left cervical abscess and anterior mediastinitis</td>
<td>Bilateral cervicotomiy with total sternotomy and mediastinal drainage</td>
<td>Complicat. on day 12 p.o., partial sternal dehiscence. Good evolution at 3 months follow-up</td>
</tr>
<tr>
<td>7‡</td>
<td>39</td>
<td>Male</td>
<td>Ludwig Angina</td>
<td>Bilateral retropharyngeal abscess with anterior and posterior mediastinitis</td>
<td>Bilateral cervicotomiy; right posterolateral thoracotomy</td>
<td>Good evolution at 3 months follow-up</td>
</tr>
</tbody>
</table>

† Closed drainage of mediastinal space without opening chest cavity.
‡ Opening of chest cavity with drainage by opening mediastinal space.

### Table 2

Types of mediastinal surgeries realized in DNM displaying morbidity and mortality rates

<table>
<thead>
<tr>
<th>Type</th>
<th>Patients</th>
<th>Complications</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>4 (53%)</td>
<td>1 (14%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>Group II</td>
<td>3 (43%)</td>
<td>1 (14%)</td>
<td>None</td>
</tr>
<tr>
<td>Total</td>
<td>7 (100%)</td>
<td>2 (28%)</td>
<td>1 (14%)</td>
</tr>
</tbody>
</table>

* Group I, closed drainage of mediastinal space without opening chest cavity; Group II, opening of chest cavity with drainage through opening of mediastinal space.
Fusobacterium sp. In our experience, bacteria are displayed in 69% of cases as mixed polymicrobial infections. In the review by Wheatley et al. [13], four types of different aerobic bacteria may be found in infections. According to Wills and Vernon [14], three or more aerobic bacteria are found in 88% aerobic polymicrobial infections in 94% of their patients, with 52% of them displaying mixed polymicrobial infections and 88% aerobic polymicrobial infections. Chow et al. [3], report the presence of anaerobic bacteria and anaerobic exemplifying the oropharyngeal flora. We agree that mediastinal drainage for DNM requires aggressive surgical management with a systemic surgical and a transthoracic approach through a right posterolateral thoracotomy. It provides an excellent approach to all the mediastinal spaces: anterior and posterior, pleural cavity and pericardium, permitting excellent local drainage. Various authors [1,4,5,8,13] agree that the best surgical approach for mediastinal drainage in DNM depends on the size of mediastinal necrosis. If only the upper mediastinum above the carina is involved, mediastinal transcervical drainage is sufficient. However, in extensive necroses the latter should be associated with right posterolateral thoracotomy for a better outcome. Estrella et al. [5] have established that if the descending mediastinitis extends below the tracheal bifurcation anteriorly or at the level of the fourth thoracic vertebra posteriorly, mediastinal drainage should be associated with a transthoracic approach.

We agree that mediastinal drainage for DNM requires aggressive surgical management with a systemic surgical and a transthoracic approach through a right posterolateral thoracotomy. It provides an excellent approach to all the mediastinal spaces permitting complete debridement of all necrotic tissue, ample drainage of the pleural cavity and even of the pericardium if necessary using pleural drainage tubes throughout the longitudinal length of the mediastinum.

We do not routinely irrigate the mediastinal cavity for fear of contamination. It is our point of view that this procedure has not been scientifically proven as completely effective. As a matter of fact our rates of morbidity and mortality are comparable to those reported in the literature [8,11,13] of those who use irrigation. Hence we consider irrigation of the mediastinal space an optional procedure.

Currently, we consider CAT scan of the cervical and thoracic regions the diagnostic method of choice for indication and operative strategy as well as for clinical follow-up. In our experience, management of DNM should always be surgical with broad, extensive, open cervicotomy.
together with ample mediastinal drainage and associated thoracotomy whenever possible for adequate drainage of all mediastinal compartments. Antibiotic therapy should always be chosen based on sensitivity results of cervical and tissue cultures obtained from intraoperative mediastinal specimens.

References