Neuroendocrinology Letters Volume 40 No. 6 2019
ISSN: 0172-780X; ISSN-L: 0172-780X; Electronic/Online ISSN: 2354-4716
Web of Knowledge / Web of Science: Neuroendocrinol Lett
Pub Med / Medline: Neuro Endocrinol Lett

ORIGINAL ARTICLE

A multidisciplinary approach to the management of descending necrotizing mediastinitis – case series

Anton Dzian[1], Marek Malík[1], Ivan Fučela[1], Michaela Skaličanová[1], Peter Stiegler[1], Andrej Hajtman[2], Gabriela Bugová[2], Beata Drobná Sániová[3]

1 Department of Thoracic Surgery, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, University Hospital in Martin, Slovak Republic
2 Department of Otorhinolaryngology and Head and Neck Surgery, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, University Hospital in Martin, Slovak Republic
3 Department of Anaesthesiology and Intensive Care, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, University Hospital in Martin, Slovak Republic

Correspondence to: Marek Malík., MD.
Department of Thoracic Surgery, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, University Hospital in Martin, Slovak Republic
Kollarova str. 4248/2, 036 59 Martin, Slovak Republic
TEL.: +421 915 284 759; E-MAIL: marekmaliksk@gmail.com

Submitted: 2019-11-22 Accepted: 2019-12-05 Published online: 2019-12-13

Key words: **mediastinal infection; multidisciplinary approach; surgical treatment; minimally invasive surgery; thoracotomy**

Neuroendocrinol Lett 2019; **40**(6):284–288 **PMID:** 32200587 NEL400619A09 © 2019 Neuroendocrinology Letters • **www.nel.edu**

Abstract

OBJECTIVES: Descending necrotizing mediastinitis (DNM) is a severe potentially fatal disease of the mediastinum which spreads downwards from oropharyngeal region. Mortality varies from 11 to 40%. There is agreement on the importance of early diagnosis, aggressive surgical treatment and the need for a multidisciplinary approach.
DESIGN: Retrospective study of series of patient treated for DNM regarding multidisciplinary approach and surgical treatment.
PATIENTS AND METHODS: Sixteen patients that were surgically treated for DNM from 2008 to 2017 at our hospital were consecutively enrolled in observational descriptive study.
RESULTS: Twelve patients had disease localised above tracheal bifurcation level. Nine of them underwent transcervical drainage, three patients underwent more extensive treatment. Four patients with disease spread below the treacheal bifurcation level were treated with transcervical drainage in combination with posterolateral thoracotomy or videothoracoscopy. Three patients underwent videothoracoscopy – two of them as primary surgical treatment with need of one reoperation – contralateral videothoracoscopy. The third patient was initially treated with a transcervical approach and videothoracoscopy was indicated as a reoperation because of the progression of the disease. One patient died (mortality 6.25%).
CONCLUSION: In management of descending necrotizing mediastinitis, early diagnosis, aggressive surgical treatment and use of broad-spectrum antibiotics and nowadays also multidisciplinary approach are crucial. Transcervical drainage combined with posterolateral thoracotomy or videothoracoscopy were used with good results.

Abbreviations:
CT - computed tomography
DNM - descending necrotizing mediastinitis

INTRODUCTION

Descending necrotizing mediastinitis (DNM) is an acute, potentially fatal disease of the mediastinum, which spreads downwards from the oropharyngeal region because of the absence of anatomical barriers between fascial spaces of the neck and the mediastinum (Pearse, 1938). Despite modern antibiotics and better computed tomography (CT) availability the mortality for DNM is from 11 to 40% (Freeman *et al.* 2000; Sandner & Börgermann, 2011). The diagnostic criteria are as follows:

1. clinical manifestation of severe infection in the oropharyngeal region,
2. signs of mediastinitis on the CT scan,
3. confirmation of the diagnosis during surgical procedure or autopsy,
4. connection between the oropharyngeal infection and mediastinitis (Estrera *et al.* 1983).

Contrast-enhanced CT scan of the chest and the neck is the gold standard in diagnostics of mediastinitis and for monitoring the disease's progress (Exarhos *et al.* 2005; Freeman *et al.* 2000). CT scan of chest and neck plays important role in the extent of the mediastinitis evaluation. For the extent of the disease and radicality of the treatment the Endo classification was created. Endo type I. describes disease which is located above the level of bifurcation of the trachea. In Endo type IIa the disease extends below the level of tracheal bifurcation into the anterior mediastinum, while Endo type IIb is infection in the whole, the anterior and the posterior mediastinum (Endo *et al.* 1999).

In the past, the aetiology of DNM was, in most patients, odontegenic infection. Nowadays a pharyngeal infection such as a peritonsillar abscess or a parapharyngeal abscess are more frequent (Kocher *et al.* 2012; Sandner & Börgermann, 2011). There is general agreement on the need for early diagnostics, broad-spectrum antibiotics treatment, a multidisciplinary approach and aggressive surgical treatment. Controversies exists regarding the extent of surgical approach. Less invasive approaches are the transcervical approach – transverse or lateral (Rider *et al.* 2012), parasternal mediastinotomy (Tanaka *et al.* 2007) or paravertebral approach (Dzian *et al.* 2013). Endoscopic surgery includes mediastinoscopy (Chen *et al.* 2008; Shimizu *et al.* 2006), videothoracoscopy (Hsin & Yim 2011). The classic approach is thoracotomy for Endo type II (Kocher *et al.* 2012). Some departments use sternotomy (Stella & Petrella, 2005) or clamshell thoracotomy (Ris *et al.* 1996).

MATERIAL AND METHODS

From January 2008 to December 2017, sixteen patients with DNM were treated at the Department of Thoracic Surgery and the Department of Anaesthesiology and Intensive Medicine at our hospital. These patients met the criteria for DNM (Estrera *et al.* 1983) and were enrolled consecutively to retrospective descriptive study (Table 1). Clinical presentation, patient's history, early contrast-enhanced CT scan of the neck and the chest and intraoperative findings were important for diagnosis. Age, sex, aetiology of the disease, CT scan surveillance, extent of the disease according to Endo classification, surgical management and surgical approach, antibiotic treatment, hospital length of stay and mortality were recorded. The basic principle of surgical treatment was the elimination of infection, mediastinotomy, debridement and mediastinal drainage. Thoracic surgeon, otorhinolaryngologist, and stomatologist in odontogenic DNM play the key role in surgical treatment. A surgical approach was chosen according to the extent of the disease (Endo classification) on the CT scan of the chest and the neck.

This study was approved by the Hospital Ethics Committee on 23rd of november 2017 with file number EK UNM no.132/2017. Since it is a retrospective study the need for patient consent is waived. The work was performed in accordance with the principles of the 1983 Declaration of Helsinki.

RESULTS

The average age was 48.6 years (ranged from 22 to 69 years; median 49.5 years). Eleven patients were male (68.75%) and five females (31.25%). In six patients the primary infection was odontogenic. In three patients the origin was peritonsillar abscess and parapharyngeal abscess in three patients. Inflamed carcinoma of the thyroid gland was the cause of DNM in one patient. In one patient the infection spread downwards from purulent arthritis of the left sternoclavicular joint. Complication after medial cervical cyst operation was recorded in one patient. Cervical vertebrae osteomyelytis around the osteosynthetic material, six years after surgical stabilisation after injury, and paravertebral abscess was the aetiology of DNM in one patient.

Twelve of 16 patients (75%) had disease localized above the bifurcation of the trachea (Endo type I). In four cases (25%) the infection spread also in anterior and posterior mediastinum below the trachea bifurcation (Endo type IIb). 3.6 was the average CT scan count per patient with a range from two to six. 4.3 days was the average time between surgical procedure and control CT scan, the range was from two to six days.

The multidisciplinary team consisted of a thoracic surgeon, otorhinolaryngologist, an anaesthetist, a radiologist and infectious disease specialist. In patients with odontogenic infection a stomatologist was part of the

Tab. 1. Table describing each patient case regarding age, aetiology and extension of descending necrotizing mediastinitis, surgical approach and outcome

Case no.	Age	Aetiology	Endo	Surgical approach	Reoperation	Outcome
1.	36	Odontogenic	I	Transcervical	-	Survival
2.	41	Cervical cyst surgery complication	I	Transcervical	Parasternal mediastinotomy	Survival
3.	64	Parapharyngeal abscess	I	Transcervical	-	Death
4.	36	Prevertebral neck abscess	IIb	Paravertebral	Left thoracotomy*	Survival
5.	48	Peritonsillar abscess	I	Transcervical	-	Survival
6.	53	Odontogenic	IIb	Transcervical + right thoracotomy	-	Survival
7.	57	Peritonsillar abscess	I	Transcervical	Left thoracotomy*	Survival
8.	57	Left sternoclavicular joint arthritis	I	Transcervical	-	Survival
9.	51	Inflamed thyroid gland carcinoma	I	Transcervical	-	Survival
10.	28	Odontogenic	I	Transcervical + right thoracotomy	-	Survival
11.	47	Parapharyngeal abscess	I	Transcervical	Right thoracotomy	Survival
12.	59	Parapharyngeal abscess	I	Transcervical + left thoracotomy	-	Survival
13.	41	Odontogenic	IIb	Transcervical + right videothoracoscopy	-	Survival
14.	69	Odontogenic	I	Transcervical	Right videothoracoscopy	Survival
15.	68	Peritonsillar abscess	IIb	Transcervical + right thoracotomy	-	Survival
16.	22	Odontogenic	I	Transcervical + right videothoracoscopy	Left videothoracoscopy	Survival

*Reoperation indicated because of thoracic empyema

team. Six patients (37.5%) with odontogenic DNM uwnderwent stomatologic intervention – tooth extraction, incision and drainage of submandibular abscesses. Parapharyngeal and peritonsillar abscesses were evacuated by otorhinolaryngologist through neck incisions. In 11 patients (68.75%) a lateral neck incision was performed – on the right in two patients (12.5%); on the left in six patients (37.5%) – in one of them in combination with a transverse neck incision. Three patients (18.75%) underwent lateral neck incision on both sides. Four patients (25%) underwent transverse neck incision. Nine of twelve patients (56.25%) with localized disease Endo type I underwent primary only neck incision – four of them (25%) transverse neck incision and five lateral incision (31.25%). There was a need for reoperation in five patients of this group. One patient underwent right posterolateral thoracotomy, one patient right videothoracoscopy and another one parasternal mediastinotomy. In two patients left thoracotomy was indicated because of empyema of the left thoracic cavity. Three patients with Endo type I were treated more extensively from the beginning, two of them with transcervical drainage and posterolateral thoracotomy (one left and one right) with no need for reoperation. The third patient underwent transcervical drainage and videothoracoscopy on the right primarily, and because of progression of DNM – retrosternal abscess – left videothoracoscopy was indicated. All four patients (25%) in Endo type IIb group underwent extensive surgical treatment primarily. Two of them underwent transcervical drainage and right thoracotomy and one patient underwent transcervical drainage and right videothoracoscopy. There was no need for reoperation in this group. The last patient was treated unusually with paravertebral mediastinotomy. He was reoperated – left thoracotomy was indicated because of thorax empyema on the left. Tracheostomy was indicated in 12 patients (75%). An immunologist participated in the treatment of ten patients (62.5%). In nine of them (56.25%) secondary immunodeficiency was proved from blood tests and the immunomodulating treatment was indicated. In one patient, the gynaecologist was a part of the team. Because of the 36th week of gravidity a section was indicated in the beginning of the treatment. The average length of stay in hospital was 29.16 days with a range from 14 to 50 days. One patient (6.25%) died of severe

septic shock and multiple organ dysfunction syndrome due to delayed diagnosis.

Initial empiric antibiotic treatment consists of broad-spectrum antibiotics covering both aerobic and anaerobic bacteria spectrum. Most of the patients were send from local hospitals to our hospital with combination of amoxicilin/clavulanate (nine patients, 56.25%) or sultamicilin (seven patients, 43.75%) with metronidazol (13 patients, 81.25%). According to intraoperative microbiological test results, initial antibiotic treatment was combined with or changed to the following: meropenem (eight patients, 50%), ciprofloxacin (eight patients, 50%); vancomycin (six patients, 37.5%), piperacilin/tazobaktam (five patients, 51.25%). Microbiological tests, in agreement with the literature, confirm polymicrobial flora containing G+ aerobic and anaerobic cocci, G+ and G- bacteria and *candida* species (Brook & Frazier, 1996; Costalonga & Herzberg, 2014; Freeman *et al.* 2000). Most of the patients (14 patients, 87.5%) were also treated with antimycotics (fluconazole in 13 patients 81.25%; ketoconazole in three patients = 18.75%, caspofungin in 1 patient = 6.25%) because of proved mycotic infection from inpraoperative cultures.

DISCUSSION

In recent literature a shift from odontogenic to pharyngeal aetiology is described (Kocher *et al.* 2012; Sandner & Börgermann, 2011). In our group, we have the same number of patients with odontogenic aetiology as well as with pharyngeal aetiology. Other aetiology of DNM such as sternoclavicular arthritis, complications of surgery, perforations of airways and oesophagus, thyroid gland inflammation etc. is very rare (Dzian *et al.* 2013; Kocher *et al.* 2012; Smolár *et al.* 2017).

According to CT scan surveillance recommendation, this should be done 48–72 hours after surgical intervention to check for progression of mediastinitis that is not clinically manifested yet. In our group the average time between surgical intervention and CT scan was 4.3 days with a range from two to six days.

In nine from 12 patients with Endo type I, in agreement with the literature, we used only transcervical drainage as the surgical approach for mediastinotomy. It was performed by otorhinolaryngologist. This was sufficient for five patients (55.5%). In four cases reoperation was indicated. Three patients were treated more radically from the beginning – two thoracotomies and one videothoracoscopy were performed with good results and with no need for reoperation. Patients with Endo type II were treated more radically. In two patients with Endo type IIb the transcervical drainage was combined with thoracotomy. One patient underwent videothoracoscopy from this group. These patients did not require reoperation. The fourth patient was admitted to our hospital in prolonged sepsis. According to this fact and according to the patient´s status we decided to perform unusual paravertebral mediastinotomy. As a result of control CT scan, left thoracotomy was indicated afterwards because of the empyema of the left thorax.

More studies declare the benefit for patients with extended Endo IIa and Endo IIb disease of a more radical approach in treatment of DNM (Corsten *et al.* 1997; Misthos *et al.* 2007). The possibilities vary from endoscopical approaches (subxiphoideal mediastinoscopy, video-assisted thoracic surgery – VATS) (Chen *et al.* 2008; Cho *et al.* 2008), through classic posterolateral thoracotomy (Freeman *et al.* 2000; Marty-Ane *et al.* 1999; Papalia *et al.* 2001), to extensive approaches like sternotomy for Endo type IIa (Gorlitzer *et al.* 2007; Kocher *et al.* 2012; Misthos *et al.* 2007) or clamshell thoracotomy for Endo type IIb (Kocher *et al.* 2012; Ris *et al.* 1996). Transcervical drainage in combination with posterolateral thoracotomy or videothoracoscopy were successfully used in our group. We do not have experience with sternotomy and clamshell thoracotomy in mediastinitis indication.

Actual recommendation for initial empiric antibiotic treatment of DNM, because of polymicrobial flora, are broad-spectrum antibiotics like the I. group carbapenems (ertapenem), II. group carbapenems (imipenem, meropenem), acylaminopenicilin with β-lactaminhibitor or piperacilin/tazobactam as initiation antibiotics therapy. An alternative are cefalosporines of third (ceftriaxon, cefotaxim) or fourth generation (cefepim) in combination with metronidazole (Ambrosh, 2016). In our series, the initial ATB therapy was a combination of amoxicilin/clavulanate resp. sultamicilin and metronidazol. Most of the patients were admitted to our hospital from local hospitals. During the hospital stay the antibiotics therapy was changed according to intraoperative microbiological cultures.

In recent studies the mortality varies from 11 to 40%. Estrera *et al.* referred to a 40% mortality (Estrera *et al.* 1983). This study is from '70s–'80s, when the surgical approach was not so radical. Newer studies presented lower mortality. Ridder et al presents a mortality of 11.1% (Ridder *et al.* 2010), with higher mortality associated with Endo type II disease (Endo type I with 6.1% mortality and Endo type II with 25% mortality). Kocher's *et al.* study contained a meta-analysis with mortality 9.8% for Endo type I and 31.5% for Endo type II (Kocher *et al.* 2012). One patient died in our group (6.25%). He was admitted with Endo type I disease but with severe septic shock and multiple organ dysfunction syndrome. Diagnostic delay could play a role in this case, because in local hospital, the diagnosis was established 4 days after the first symptoms and signs of the disease occured. Our mortality for Endo I is 6.25% and 0% for Endo II.

In conclusion, despite modern broad-spectrum antibiotics and better CT scan availability, early diagnosis, aggressive surgical treatment and multidisciplinary approach play the key role in management of DNM.

Surgical treatment is based on mediastinotomy, debridement and mediastinal drainage. In our study we have good experience with thoracotomy and videothoracoscopy also for extended – Endo type II disease. Optimistic results including the 6.25% mortality in our case series needs to be judged with the knowledge of small number of patients.

ACKNOWLEDGMENTS

None. No conflict of interest.

REFERENCES

1 Ambrosch A (2016). Rationale Antibiotikatherapie der Mediastinitis [(Rational antibiotic treatment of mediastinitis.) (In German with English abstract.)] Chirurg. **87**: 497–503.
2 Brook I, Frazier E (1996). Microbiology of mediastinitis. Arch Intern Med. **156**: 333–336.
3 Chen KC, Chen JS, Kuo SW, Huang PM, Hsu HH, Lee JM, et al (2008). Descending necrotizing mediastinitis: a 10-year surgical experience in a single institution. J Thorac Cardiovasc Surg. **136**: 191–198.
4 Cho JS, Kim YD, I H, Lee SK, Jeong YJ (2008). Treatment of mediastinitis using video-assisted thoracoscopic surgery. Eur J Cardiothorac Surg. **34**: 520–524.
5 Corsten MJ, Shamji FM, Odell PF, Frederico, JA, Laframboise, GG, Reid KR, et al. (1997). Optimal treatment of descending necrotizing mediastinitis. Thorax. **52**: 702–708.
6 Costalonga M, Herzberg MC (2014). The oral microbiome and immunobiology of periodontal disease and caries. Immunol Lett. **162**: 22–38.
7 Dzian A, Stiegler P, Smolár M, Hamzik J, Mistuna D (2013). Posterior mediastinotomy as an unordinary method of mediastinal drainage in patient with descending necrotizing mediastinitis: A case report. Thorac cardiovasc Surg. **61**: 175–177.
8 Endo S, Murayama F, Hasegawa T, Yamamoto S, Yamaguchi T, Sohara Y, et al (1999). Guideline of surgical management based on diffusion of descending necrotizing mediastinitis. Jpn J Thorac Cardiovasc Surg. **47**: 14–19.
9 Estrera AS, Landay MJ, Grisham JM, Sinn DP, Platt MR (1983). Descending necrotizing mediastinitis. Surg Gynecol Obstet. **157**: 545–552.
10 Exarhos DN, Malagari K, Tsatalou EG, Benakis SV, Peppas C, Kotanidou A, et al (2005). Acute mediastinitis: spectrum of computed tomography findings. Eur Radiol. **15**: 1569–1574.
11 Freeman RK, Vallières E, Verrier ED, Karmy-Jones R, Wood DE (2000). Descending necrotizing mediastinitis: an analysis of the effects of serial debridement on patient mortality. J Thorac Cardiovas Surg. **119**: 260–267.
12 Gorlitzer M, Grabenwoeger M, Meinhart J, Swoboda H, Oczenski W, Fiegl N, et al (2007). Descending necrotizing mediastinitis treated with rapid sternotomy followed by vacuum-assisted therapy. Ann Thorac Surg. **83**: 393–396.
13 Hsin MK, Yim AP (2011). Video assisted thoracoscopic surgery is a valuable approach for the management of descending necrotizing mediastinitis. Ann Surg. **253**: 1055–1056.
14 Kocher GJ, Hoksch B, Caversaccio M, Wiegand J, Schmid RA (2012). Diffuse descending necrotizing mediastinitis: surgical therapy and outcome in a single-centre series. Eur J Cardiothorac Surg. **42**: 66–72.
15 Marty-Ane CH, Berthet JP, Alric P, Pegis JD, Rouviére P, Mary H (1999). Management of descending necrotizing mediastinitis: an aggressive treatment for an aggressive disease. Ann Thorac Surg. **68**: 212–217.
16 Misthos P, Katsaragakis S, Kakaris S, Theodorou D, Skottis I (2007). Descending necrotizing anterior mediastinitis: analysis of survival and surgical treatment modalities. J Oral Maxillofac Surg. **65**: 635–639.
17 Papalia E, Rena O, Oliaro A, Cavallo A, Giobbe R, Casadio C, et al (2001). Descending necrotizing mediastinitis: surgical management. Eur J Cardiothorac Surg. **20**: 739–742.
18 Pearse HE (1938). Mediastinitis following cervical suppuration. Ann Surg. **108**: 588–611.
19 Ridder GJ, Maier W, Kinzer S, Teszler CB, Boedeker CC, Pfeiffer J (2010). Descending necrotizing mediastinitis: contemporary trends in etiology, diagnosis, management, and outcome. Ann Surg. **251**: 528–534.
20 Ris HB, Banic A, Furrer M, Caversaccio M, Cerny A, Zbären P (1996). Descending necrotizing mediastinitis: Surgical treatment via clamshell approach. Ann Thorac Surg. **62**: 1650–1654.
21 Sandner A, Börgermann J (2011). Update on necrotizing mediastinitis: causes, approaches to management, and outcomes. Curr Infect Dis Rep. **13**: 278–286.
22 Shimizu K, Otani Y, Nakano T, Takayasu Y, Yasuoka Y, Morishita Y (2006). Successful video-assisted mediastinoscopic drainage of descending necrotizing mediastinitis. Ann Thorac Surg. **81**: 2279–2281.
23 Smolár M, Dzian A, Hamžík J, Saniova B, Laca L (2017). Iatrogenic perforation of hypopharynx as a cause of severe descending necrotizing mediastinitis: A case report. Neuroendocrinol Lett. **38**: 101–104.
24 Stella F, Petrella F (2005). Transsternal transpericardial approach for acute descending necrotizing mediastinitis. J Thorac Cardiovasc Surg. **129**: 212–214.
25 Tanaka Y, ManiwaY, Yoshimura M, Nishio W, Yoshimura M (2007). Successful treatment of descending necrotizing mediastinitis. Gen Thorac and Cardiovasc Surg. **55**: 366–369.