

Descending necrotizing mediastinitis

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ABSTRACT

يعتبر التهاب المنصف التنازلي الناخر أحد المضاعفات النادرة و لكن شديدة الخطورة للالتهابات بمنطقتي الفم و البلعوم. وفي هذا التقرير نستعرض حالة سيدة شابة أصيبت بالتهاب بالبلعوم، امتد الى مقدمة الرقبة ثم تطور الى التهاب ناخر شديد بمنطقة المنصف. و قد تعقدت الحالة نتيجة لمضاعفات خطيرة، حيث أصيبت بصدمة اتنائية وفشل حاد بوظائف الكلى وناصور رغامي مريئي واعتلال الاعصاب والعضلات المرتبط بالأمراض الحرجة. وقد كان هناك تأخير كبير في تشخيص الحالة إلا أن المريضة شفيت وذلك بعد التدخل الجراحي المكثف والمضادات الحيوية واسعة الفعالية والعناية المركزة الملائمة. وقد كان للتصوير الشعاعي للصدر باستخدام الأشعة المقطعية دور كبير في تشخيص ومتابعة تطور الحالة. لذا فإن هناك حاجة لزيادة وعي الأطباء بهذه الحالة المرضية الخطيرة التي قد تنتج عن التهابات أو إجراءات أو إصابات بالفم أو الاسنان أو البلعوم.

Descending necrotizing mediastinitis (DNM) is a rare but severe life threatening complication of oropharyngeal infections. We report a young lady who had severe pharyngitis complicated by anterior neck infection that descended to the mediastinum causing necrotizing mediastinitis. The course of her illness was complicated with septic shock, acute kidney injury, tracheo-esophageal fistula, and critical illness polyneuropathy. There was considerable delay in her diagnosis; however, she survived after aggressive surgical intervention, wide spectrum antibiotics, and appropriate intensive care management. Early and repeated chest imaging using computed tomography was vital for the detection and follow up of this case. There is a need to increase physicians' awareness of this condition that can complicate odontogenic or pharyngeal infection, procedures, or trauma.

Saudi Med J 2014; Vol. 35 (9): 1123-1126

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Received 18th February 2014. Accepted 23rd June 2014.

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Descending necrotizing mediastinitis (DNM) is a rare but severe life threatening complication of infection in the oropharyngeal region that descends to the mediastinum through the connecting deep and superficial cervical fascial planes.¹ The primary origin of the infection can be an odontogenic infection, pharyngeal soft tissue infection, sinusitis, or following cervical trauma.^{2,3} It is associated with high mortality unless it is diagnosed and treated promptly.⁴ Old age and chronic medical conditions are important predisposing factors.^{2,3} We report a young patient with DNM who survived despite a considerable delay in diagnoses and a complicated course in the intensive care unit (ICU). We report this particular case to draw the clinician's attention to this rare, but potentially fatal complication of common odontogenic and cervical infections, and emphasize the importance of early recognition and prompt management.

Case Report. A previously healthy 22-year-old female presented to the outpatient clinic in a peripheral hospital with fever and sore throat. She was treated as acute bacterial pharyngitis by oral antibiotics with no improvement. Ten days later, she was brought to the emergency room due to persistent fever, confusion, and dyspnea. On physical examination she was found cyanosed with basal crackles heard in both lungs. A small anterior infrahyoid soft neck swelling was also noted. She was emergently intubated and admitted to ICU. Laboratory findings showed leukocytosis with absolute neutrophilia, mild increase in creatinine, high blood sugar, and positive acetone in urine.

Chest x-ray and computed tomography (CT) chest showed wide mediastinum, moderate bilateral pleural effusion with adjacent sub pleural atelectasis, bilateral basal lung infiltrates, and mild pericardial effusion but no signs of pulmonary embolism. Intercostal tubes were inserted in both pleural spaces. Pleural fluid analysis was consistent with exudate with pH of 7.1 and high white blood cell count, predominantly neutrophils. Initial cultures of blood, sputum and pleural fluid were negative. She was diagnosed as community acquired pneumonia with secondary bilateral empyema, diabetic

ketoacidosis with newly diagnosed diabetes mellitus, and septic shock complicated by acute kidney injury.

During her ICU stay, she developed progressive edema in all limbs with increase in the size of the anterior soft neck swelling. She was managed for 2 weeks with mechanical ventilation, intravenous fluids and insulin, vasopressors, broad spectrum antibiotics, and antifungals but without improvement; therefore, she was referred to King Khalid University Hospital (KKUH), Riyadh, Kingdom of Saudi Arabia. Clinical evaluation upon admission revealed a sick patient with high fever, hypotension, tachycardia, hypoxemia on mechanical ventilation, and bilateral intercostal chest tubes, generalized edema and anterior infrahyoid soft neck swelling. Repeated CT chest and neck in KKUH showed a high density fluid collection in the prethyroid region extending down to the sternoclavicular joint and multiple small mediastinal, pretracheal, paratracheal, and prevascular lymph nodes.

Ultrasound guided aspiration of fluid collection in prethyroid region yielded frank pus. Thoracic surgery team was consulted and advised conservative management. Sputum culture revealed *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*, so antibiotics were adjusted accordingly. However, her condition did not improve. Fever and hypotension persisted and further deterioration in renal function occurred necessitating renal replacement therapy. Therefore, neck and chest CT scan were repeated again and showed a multi loculated collection in the middle part of the neck extending down to the sternum, which became larger and more defined than before. A large well defined loculated cystic lesion was seen at the anterior mediastinum, which was not present in the previous CT exam, in addition the size of the pericardial effusion and the bilateral pleural effusion had increased with subsequent basal atelectasis and bilateral consolidation (Figures 1 & 2).

Based on the new CT result, surgical intervention was decided and she underwent cervical dissection, debridement and drainage of pus and left thoracotomy with debridement and drainage of mediastinal and left pleural collection and pleuropericardial window. Four days later, right thoracotomy with debridement and

drainage of right pleural collection was performed. Samples were sent for bacterial, fungal, and mycobacterial stains and cultures but there was no bacterial growth as she was on broad spectrum antibiotics. Histopathology revealed an acute inflammatory process.

After surgery, there was gradual improvement in her hemodynamics, conscious level, renal functions, and inflammatory markers. However, weaning from mechanical ventilation was difficult due to generalized weakness. Tracheostomy was postponed until infection and inflammation in the anterior neck and the anterior mediastinum subsided.

Two weeks after the surgery, she again developed high fever, tachycardia, and hypotension requiring

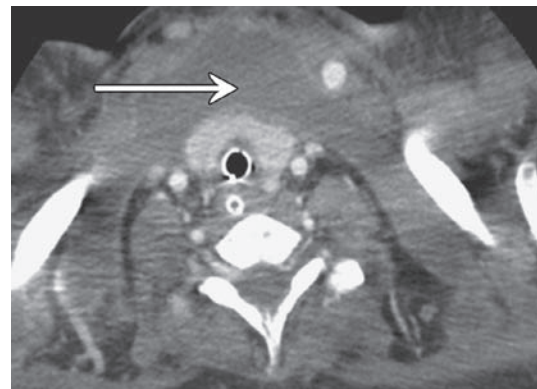


Figure 1 - Computed tomography of the neck showing significantly enhancing multiloculated collection in the neck, anterior to the trachea (arrow).

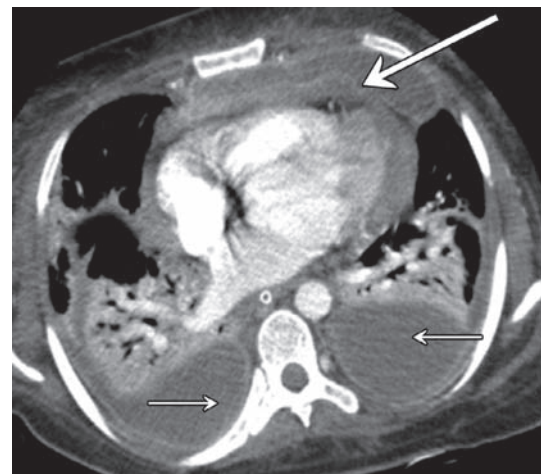


Figure 2 - Computed tomography of chest showing large well defined loculated cystic collection in the anterior mediastinum, anterior to the heart (big arrow). Bilateral pleural collection (small arrows).

Disclosure. This work was partly supported by the College of Medicine Research Center, and Deanship for Scientific Research, King Saud University, Riyadh, Saudi Arabia.

vasopressors. Repeat CT neck and chest showed interval reduction in the size of the previously noted collections and loculated pleural effusion; however, there was interval development of bilateral lateral loculated fluid collections beneath the thoracotomy sites which were drained by CT guided aspiration (Figures 3 & 4).

The ICU course was further complicated by critical illness polyneuropathy and myopathy, and the development of tracheo-esophageal fistula; which was managed conservatively by tracheostomy and feeding gastrostomy. Eighty-two days after admission to the ICU, successful weaning from the mechanical ventilation was achieved. She was then transferred to the general ward where she stayed for another 6 weeks. After healing of the tracheo-esophageal fistula, oral feeding

was resumed, the tracheostomy and gastrostomy tubes were removed and she was discharged from the hospital.

Discussion. Descending necrotizing mediastinitis is a severe, potentially fatal form of mediastinitis, which can complicate odontogenic or deep cervical infections. We describe a young, previously healthy lady who had pharyngitis complicated by anterior neck infection that eventually descended to the mediastinum causing DNM. She survived despite considerable diagnostic and therapeutic delay and acute presentation with diabetic ketoacidosis, acute kidney injury, and septic shock.

Early case reports and series reported a high mortality rate due to DNM up to 40%.³⁻⁵ Recently, a better prognosis was described^{6,7} and attributed to early diagnosis using CT scan, early aggressive surgical intervention, proper antibiotic therapy, and advanced ICU management. Prolonged ICU and hospital length of stay is the rule for most patients.^{2,3,6}

The optimal surgical approach for drainage and debridement in DNM depends on the level of mediastinitis; type 1-DNM is localized in the upper mediastinum above the tracheal bifurcation, type 2A-DNM extends to the lower anterior mediastinum and type 2B-DNM extends to the lower anterior and posterior mediastinum as the case in our patient. This type requires complete mediastinal drainage, unilateral or bilateral thoracotomy together with cervicotomy.⁸ Frequently, there is a need for repeated drainage either surgically or by percutaneous route as reported in most of published series.^{4,5} Other transthoracic approaches such as sternotomy, clamshell incision, a subxiphoid approach, and video-assisted thoracic surgery have been described.^{5,9}

In this case, surgical intervention was aggressive via cervical dissection, debridement, and drainage of pus with bilateral thoracotomy, pleuropericardial window for debridement and drainage of mediastinal and pleural collections and repeating the drainage of the remaining or newly formed collections by a less invasive percutaneous CT guided aspiration.

The diagnosis of DNM was made based on the diagnostic criteria which were described early in 1983,¹⁰ and are still widely accepted and used. These include: clinical manifestation of severe or pharyngeal infection, radiologic features of mediastinitis on CT scan, documentation of necrotizing mediastinal infection at operation or postmortem, and established relationship between oropharyngeal infection and development of DNM.⁹

The most common reported primary site of infection is odontogenic infection arising from the second or third molar. Other less common infections

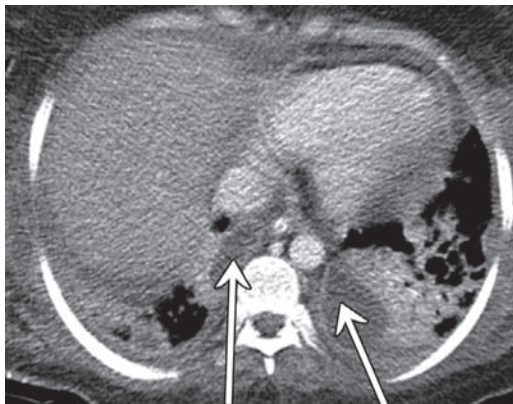


Figure 3 - Computed tomography of chest 2 weeks after the surgery showing bilateral lateral thoracic loculated fluid beneath the thoracotomy sites (arrows).

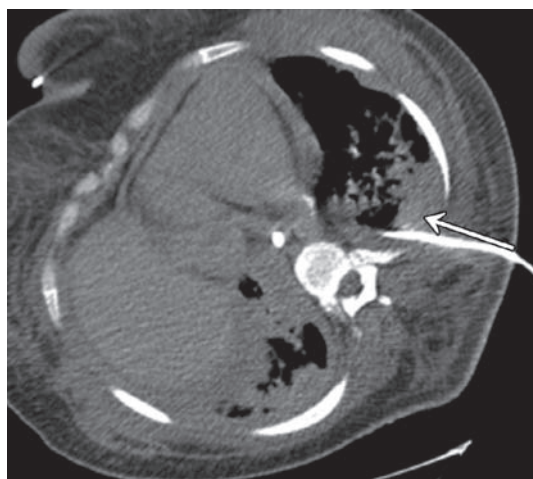


Figure 4 - Computed tomography guided aspiration of lateral thoracic loculated fluid (arrow).

include acute tonsillitis, as in this case, retropharyngeal, and peritonsillar abscess. These can rupture into the submandibular and parapharyngeal spaces and reach the mediastinum mainly along the retropharyngeal space, but spread can also occur along the perivascular and pretracheal spaces.^{1,5} The etiological organisms are mostly mixed polymicrobial aerobic and anaerobic infections.^{3,11} The effect of gravity and the negative intrathoracic and pleural pressure during inspiration, and the absence of barriers in the fascial planes are important pathophysiological factors in the extension of deep neck infections to the mediastinum.⁵ In addition the presence of coexisting morbidities that such as diabetes mellitus (DM), alcoholism, smoking, chronic renal failure, and liver cirrhosis can further facilitate this rapid extension and increase the occurrence of complications. Our patient was newly diagnosed with DM, and she presented with diabetic ketoacidosis, and septic shock, which was found to be independent predictors of mortality in DNM.¹¹

In a retrospective review of 43 cases of DNM, Deu-Martín et al⁶ reported the mean age at presentation to be 48 years. Similarly, Kang et al⁵ reported the mean age of patients in his series to be 55.6 years. Our patient was much younger, and therefore the clinical suspicion of DNM was initially low. Furthermore, the plain chest x-rays showed wide superior mediastinum and bilateral pleural effusion, which are nonspecific. Additional signs such as widening of retrovisceral space with or without air-fluid level, anterior displacement of trachea and mediastinal emphysema usually appears late.⁹ Therefore, CT scan was of great value not only in the diagnosis, but also to the follow up of the response to therapy and the detection of re-accumulation of collection. Other CT features described in DNM include increased attenuation of mediastinal fat, air-fluid levels, pleural and pericardial effusions, oesophageal thickening, and enlarged lymph nodes.^{8,11}

The lack of familiarity and the rarity of this severe condition resulted in the late diagnosis and management of this case. This in turn led to serious complications including septic shock, bilateral empyema, purulent pericarditis, acute kidney injury requiring hemodialysis and prolonged mechanical ventilation. These were managed successfully by a multidisciplinary approach in the ICU. Other reported complications include cardiac tamponade, vascular erosions, and thrombosis, and pleuro-mediastinal or pleuro-esophageal fistula.¹¹

In conclusion, DNM is a rare but life threatening complication of infection in the oropharyngeal region. Early diagnosis, aggressive surgical intervention, and

close surveillance with serial CT scan are crucial for reducing mortality. In addition, appropriate post-operative care in the ICU is important for managing further complications that may arise due to a prolonged ICU course. Physicians need to be aware of this serious condition and consider it in any patient, regardless of age, who deteriorates following odontogenic or pharyngeal infections, procedures, or trauma.

Acknowledgment. *The authors are very thankful to Dr. Ahmad A. Al-Boukai, Associate Professor and Consultant Radiologist who reviewed and reported the CT figures.*

References

1. Scaglione M, Pinto A, Giovine S, Di Nuzzo L, Giuliano V, Romano L. CT features of descending necrotizing mediastinitis--a pictorial essay. *Emerg Radiol* 2007; 14: 77-81.
2. Christophoros NF, Maria NS. Descending Necrotizing Mediastinitis: Review of the Literature and Controversies in Management. *The Open Surgery Journal* 2011; 5: 12-18.
3. Ridder GJ, Maier W, Kinzer S, Teszler CB, Boedeker CC, Pfeiffer J. Descending necrotizing mediastinitis: contemporary trends in etiology, diagnosis, management, and outcome. *Ann Surg* 2010; 251: 528-534.
4. De Freitas RP, Fahy CP, Brooker DS, Primrose WJ, McManus KG, McGuigan JA, et al. Descending necrotising mediastinitis: a safe treatment algorithm. *Eur Arch Otorhinolaryngol* 2007; 264: 181-187.
5. Kang SK, Lee S, Oh HK, Kang MW, Na MH, Yu JH, et al. Clinical features of deep neck infections and predisposing factors for mediastinal extension. *Korean J Thorac Cardiovasc Surg* 2012; 45: 171-176.
6. Deu-Martín M, Saez-Barba M, López Sanz I, Alcaraz Peñarocha R, Romero Vielva L, Solé Montserrat J. [Mortality risk factors in descending necrotizing mediastinitis]. *Arch Bronconeumol* 2010; 46: 182-187. Spanish
7. Wakahara T, Tanaka Y, Maniwa Y, Nishio W, Yoshimura M. Successful management of descending necrotizing mediastinitis. *Asian Cardiovasc Thorac Ann* 2011; 19: 228-231.
8. Scaglione M, Pinto A, Romano S, Giovine S, Sparano A, Romano L. Determining optimum management of descending necrotizing mediastinitis with CT; experience with 32 cases. *Emerg Radiol* 2005; 11: 275-280.
9. Singhal P, Kejriwal N, Lin Z, Tsutsui R, Ullal R. Optimal surgical management of descending necrotising mediastinitis: our experience and review of literature. *Heart Lung Circ* 2008; 17: 124-128.
10. Estrera AS, Landay MJ, Grisham JM, Sinn DP, Platt MR. Descending necrotizing mediastinitis. *Surg Gynecol Obstet* 1983; 157: 545-552.
11. Weaver E, Nguyen X, Brooks MA. Descending necrotising mediastinitis: two case reports and review of the literature. *Eur Respir Rev* 2010; 19: 141-149.