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DOI:

10.4103/tjem.tjem_75_26

A rare cause of pneumomediastinum and descending necrotizing mediastinitis: Untreated odontogenic abscess

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Submitted: 11-02-2026

Revised: 25-04-2026

Accepted: 02-05-2026

Published: 10-10-2026

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Abstract:

Pneumomediastinum is the presence of free air within the mediastinum and may be primary or secondary. Secondary pneumomediastinum typically follows trauma, invasive procedures, mechanical ventilation, or dental interventions using pressurized air; odontogenic causes without prior intervention are exceptionally rare. We report the case of a 52-year-old male with liver cirrhosis who presented with chest and neck pain 2 days after being diagnosed with a dental abscess and receiving antibiotics, with no dental procedure performed. He had fever, cervical swelling with crepitus, odynophagia, and dysphagia. Computed tomography revealed extensive subcutaneous emphysema tracking from the cervical region into the mediastinum, and inflammatory markers were elevated. He was diagnosed with secondary pneumomediastinum complicated by descending necrotizing mediastinitis and underwent mediastinal exploration and surgical drainage. Cultures grew *Parvimonas micra*. Postoperatively, he required intensive care and mechanical ventilation for 8 days. With culture-directed antibiotics and multidisciplinary management, he recovered fully and was discharged without sequelae. Anaerobic bacterial gas production may contribute to this rare complication. Clinicians should consider secondary pneumomediastinum in patients with chest and neck pain in the setting of odontogenic infection, even without preceding dental procedures, as early recognition, prompt imaging, surgical drainage, and definitive source control are critical for favorable outcomes.

Keywords:

Dental abscess, descending necrotizing mediastinitis, odontogenic infection, *Parvimonas micra*, pneumomediastinum

Introduction

Pneumomediastinum is a rare clinical condition defined by the presence of free air within the mediastinum. It is categorized as either primary (spontaneous pneumomediastinum [SPM]) or secondary pneumomediastinum. SPM usually occurs

in young adults without a history of trauma or invasive procedures.^[1] In contrast, secondary pneumomediastinum arises from underlying causes such as trauma, invasive procedures, mechanical ventilation, esophageal rupture, or infections, and it may carry a more severe, potentially life-threatening course.^[1]

Dental procedures, particularly those involving pressurized air devices,

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How to cite this article: Fettahoglu ST, Akbiyık-Az ZA, Saricicek T, Haciosman O, Az A. A rare cause of pneumomediastinum and descending necrotizing mediastinitis: Untreated odontogenic abscess. Turk J Emerg Med 2026;26:345-50.

tooth extractions, and endodontic treatments, have been reported as the potential causes of secondary pneumomediastinum.^[1,2] Odontogenic infections can also spread through the deep cervical fascial spaces, leading to life-threatening complications such as Ludwig's angina or descending necrotizing mediastinitis (DNM).^[2,3] Additional serious outcomes such as cervicofacial emphysema, mediastinal abscess, or sepsis may also occur, often with high mortality.^[4] However, pneumomediastinum occurring solely as a consequence of a dental abscess without any preceding dental procedure is exceedingly rare, with only a few cases reported in the literature to our knowledge. Recognizing these cases is clinically important, as progressive infections may necessitate surgical drainage, underscoring the importance of early diagnosis and appropriate management. Moreover, pneumomediastinum is most often associated with trauma or procedural complications; when it arises from a dental abscess, it may mislead clinicians and should therefore be included in the differential diagnosis.

Here, we present the case of a 52-year-old male patient who developed secondary pneumomediastinum due to a dental abscess, without any preceding trauma or dental procedure.

Case Report

A 52-year-old male with a known history of hepatitis B virus-related liver cirrhosis presented to the emergency department with complaints of neck and chest pain. He had no other known chronic medical condition and was not using any regular medication. There was no relevant family history. Psychosocial history was notable for smoking. Two days earlier, he had been diagnosed with a dental abscess at another facility and prescribed ceftriaxone 2 g once daily intravenously in the outpatient setting; no interventional dental procedure was performed. The patient reported initial sublingual swelling, which had regressed after antibiotic therapy. On the day of admission, he developed progressive chest pain and sore throat.

On examination, he was febrile (38.1°C) but otherwise had stable vital signs, with a blood pressure of 120/70 mmHg, heart rate of 82 bpm, respiratory rate of 16/min, and oxygen saturation of 95% on room air. Neck swelling with palpable crepitus was detected, accompanied by restricted neck mobility, odynophagia, and dysphagia. Otoscopic and anterior rhinoscopic examinations were unremarkable. Oral examination revealed multiple dental caries, and the odontogenic source was identified as an abscess associated with an impacted right mandibular third molar. The clinical presentation was consistent with bilateral submandibular and sublingual space abscesses secondary to this odontogenic infection. Although the initial swelling had regressed with antibiotics, purulent postnasal discharge was observed. Indirect laryngoscopy demonstrated symmetrical, mobile vocal cords with an open glottis; however, the posterior pharyngeal wall was noted to be protruding into the lumen. Airway patency was preserved.

Laboratory tests revealed leukocytosis (white blood cell count: $11.74 \times 10^3/\mu\text{L}$ and neutrophils: 86.9%), markedly elevated C-reactive protein (341.39 mg/L; reference range: <5 mg/L), and increased procalcitonin (1.11 ng/mL; reference range: <0.1 ng/mL); all other parameters were within the normal limits.

Cervical [Figure 1] and thoracic [Figure 2] computed tomography (CT) demonstrated subcutaneous emphysema in the bilateral cervical regions, with free air extending into the anterior and middle mediastinum, and air tracking along the deep cervical fascial spaces. No pericardial effusion, vascular abnormalities, or mediastinal lymphadenopathy were identified. Lung parenchyma showed mosaic perfusion areas, linear atelectasis, pleuroparenchymal bands, and fibrotic changes. Importantly, both imaging findings and detailed history confirmed the absence of trauma or prior invasive dental procedures. Moreover, CT revealed no evidence of esophageal or tracheobronchial injury, air leak, or periesophageal fluid collections. According to the Endo classification, the mediastinal involvement in this case was considered consistent with Endo type IIA DNM.

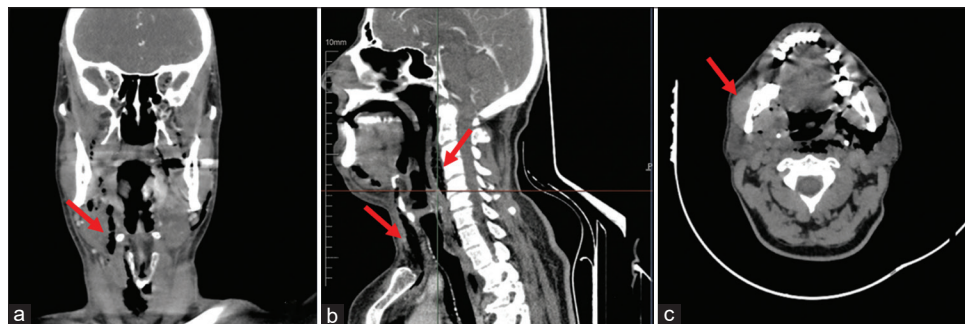


Figure 1: Coronal (a), sagittal (b), and axial (c) cervical computed tomography images. The arrows indicate the relevant radiological findings: (a) multiple air locules within the cervical soft tissues; (b) air tracking along the deep cervical fascial planes, extending inferiorly toward the mediastinum; and (c) the odontogenic infectious focus adjacent to the impacted right mandibular third molar

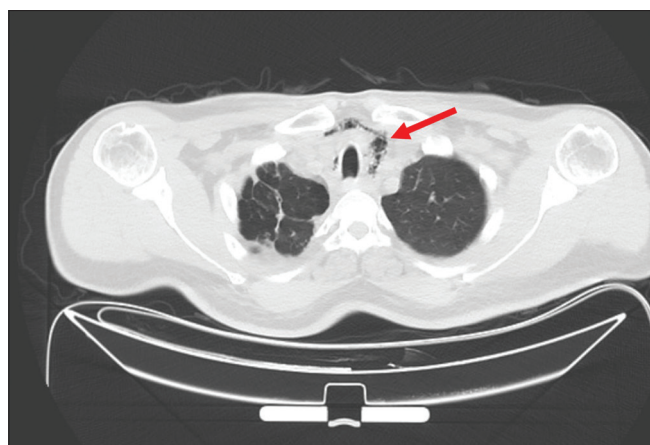


Figure 2: Axial chest computed tomography demonstrating continuation of free air dissection from the cervical fascial planes into the anterior and middle mediastinum, with associated subcutaneous emphysema (arrows)

The patient was evaluated by both otolaryngology and thoracic surgery teams. Based on clinical, physical, and radiological findings, he was diagnosed with secondary pneumomediastinum associated with a dental abscess. Broad-spectrum intravenous antibiotics were initiated, and he was admitted to the thoracic surgery service. Definitive source control of the odontogenic focus could not be achieved during the acute phase because marked swelling and limited mouth opening prevented adequate access to the impacted right mandibular third molar. Therefore, immediate tooth extraction was not feasible, and extraction was planned after regression of the swelling and abscess. He subsequently underwent mediastinal exploration by the thoracic surgery team, including thoracic drainage, surgical drainage of the infected mediastinal collection, and irrigation. Cultures obtained from the drained material grew *Parvimonas micra* (formerly *Peptostreptococcus micros*). Blood cultures obtained upon admission were negative. The antibiogram revealed that the isolate was sensitive to the empirically initiated broad-spectrum antibiotic therapy; therefore, the regimen was continued without modification. Postoperatively, he was managed in the intensive care unit with close monitoring, culture-directed antibiotics, fluid and electrolyte management, and organ support. He required mechanical ventilation for 8 days, after which he was successfully extubated. The total duration of hospitalization was 14 days. The patient recovered completely and was discharged in good condition without sequelae. Written informed consent for the publication was obtained from the patient. A detailed timeline of the patient's clinical course is provided in Table 1.

Discussion

DNM is a rare but life-threatening complication of odontogenic and oropharyngeal infections, with mortality

Table 1: Timeline of the clinical course

Time point	Clinical event
Day -2	The patient was diagnosed with a dental abscess at another facility and received ceftriaxone 2 g once daily intravenously in the outpatient setting. No dental intervention was performed at that time
Day 0	The patient presented to the emergency department with progressive chest pain, sore throat, dysphagia, and neck swelling. Physical examination revealed fever, cervical swelling, palpable crepitus, and restricted neck mobility
Day 0	Laboratory evaluation showed leukocytosis, elevated C-reactive protein, and increased procalcitonin levels
Day 0	Cervical and thoracic CT demonstrated subcutaneous emphysema in the bilateral cervical regions, air tracking along the deep cervical fascial planes, and free air extending into the anterior and middle mediastinum
Day 0	The patient was evaluated by the otolaryngology and thoracic surgery teams, diagnosed with secondary pneumomediastinum associated with odontogenic infection and descending necrotizing mediastinitis, and started on broad-spectrum intravenous antibiotics
Day 0	Definitive dental source control could not be achieved during the acute phase because marked swelling and limited mouth opening prevented access to the impacted right mandibular third molar
Hospital course	The patient underwent mediastinal exploration with surgical drainage. Culture of the drained material grew <i>Parvimonas micra</i> , and antibiotic therapy was continued according to the antibiogram
Postoperative period	The patient was followed in the intensive care unit and required mechanical ventilation for 8 days
Hospital day 14	The patient recovered without sequelae and was discharged in the good condition

CT: Computed tomography

rates reported as high as 40% if diagnosis and treatment are delayed.^[4] Approximately 60%–70% of DNM cases originate from dental or cervicofacial sources.^[5] The polymicrobial flora of the oral cavity, including aerobic and anaerobic bacteria such as *Streptococcus anginosus* group, *Fusobacterium*, and *Peptostreptococcus* species, is most frequently implicated.^[6,7]

Odontogenic infections may extend into the mediastinum through two main mechanisms. The first is direct infectious spread, in which abscesses originating in the oral cavity or pharynx descend via the retropharyngeal and parapharyngeal spaces, providing an anatomical pathway into the mediastinum; this process primarily results in mediastinal abscess formation and DNM.^[6] The second mechanism is air dissection, where dental procedures involving pressurized air, tooth extractions, or restorative interventions introduce air into cervicofacial tissues, which can then dissect along fascial planes into the mediastinum, leading to cervicofacial emphysema and pneumomediastinum.^[2,6] Thus, dental infections

involving the mediastinum typically present either as infectious complications, such as abscesses, DNM, or sepsis, or as noninfectious air dissection following dental procedures.

Previous reports have predominantly described pneumomediastinum following dental procedures involving pressurized air or trauma.^[1,2,6] Fukuchi *et al.* documented DNM originating from a periapical abscess but without pneumomediastinum.^[4] Similarly, de Figueiredo *et al.* reported DNM after a simple extraction, again without evidence of air leakage.^[8] Kumbasar *et al.* described three unusual mediastinal complications of dental origin – two pneumomediastinum cases due to air dissection and one DNM with abscess formation without pneumomediastinum.^[6] More recently, Sepsick *et al.*^[9] reported pneumomediastinum with mediastinitis after third molar extraction using a high-speed air handpiece, representing an iatrogenic mechanism of mediastinal air extension, whereas Soylu *et al.*^[10] described mediastinitis secondary to odontogenic infection in the absence of prior dental instrumentation, reflecting direct spread along the deep cervical fascial planes. Collectively, these cases indicate that pneumomediastinum coexisting with odontogenic DNM, in the absence of prior dental procedures, is exceptionally rare. Previous reports of odontogenic mediastinitis with or without pneumomediastinum are summarized in Table 2.

In our case, *P. micra*, a Gram-positive anaerobic coccus commonly present in oral flora and frequently isolated from odontogenic abscesses, was cultured. This organism

has also been reported in pleural and other deep-seated infections.^[11] Recent literature describes *P. micra* as a pathogen with hydrogen sulfide (H₂S)-related virulence, and it has been implicated in some gas-containing infections.^[12,13] Earlier experimental work also showed that, among 37 oral species, *P. micra* exhibited a glutathione-dependent H₂S production rate at least five times higher than other species.^[14] Accordingly, bacterial gas formation may have contributed to the free air observed on imaging; however, the exact extent of this contribution cannot be determined with certainty. In a reported case of odontogenic abscess with DNM, CT also demonstrated gas dissection along fascial planes from the neck into the mediastinum.^[7] Such findings may partly reflect anaerobic bacterial gas formation (e.g., *P. micra*, *Fusobacterium*, and *Bacteroides*). Thus, in our case, pneumomediastinum may not have been solely due to mechanical air dissection but may also have been influenced by bacterial gas production. To our knowledge, this is among the few reported cases of pneumomediastinum secondary to a dental abscess without prior dental procedures.

An additional factor that may have contributed to the fulminant course in our patient was underlying liver cirrhosis. Cirrhosis is associated with immune dysfunction and increased susceptibility to bacterial infections; therefore, this may have facilitated the rapid progression of an initially localized odontogenic infection into deep neck space infection and DNM.^[15] At the same time, odontogenic mediastinitis is not restricted to immunocompromised hosts and can also occur in

Table 2: Selected representative reports of odontogenic mediastinitis with or without pneumomediastinum

Author (year)	Age	Sex	Comorbidities	Etiology/Trigger	Complication	PNM	Outcome	Notes
Fukuchi <i>et al.</i> (2015) ^[4]	43	Male	None	Periapical abscess (no procedure)	DNM	No	Survived	Managed with mediastinal and cervical drainage plus tooth extraction
de Figueiredo <i>et al.</i> (2019) ^[8]	37	Male	None	Simple tooth extraction	DNM	No	Survived	Persistent mediastinitis requiring prolonged management
Kumbasar <i>et al.</i> (2019) ^[6]	30	Female	Not reported	Dental procedures with air dissection (2 cases)	PNM	Yes	Survived	Both related to iatrogenic air entry after procedures
	31	Female	Not reported					
	54	Male	Not reported	Dental infection (1 case)	DNM with abscess	No		No PNM present
Soylu <i>et al.</i> (2019) ^[10]	22	Male	None	Periapical abscess (no procedure-related emphysema)	Mediastinitis	No	Survived	CT showed spread to the mediastinum through the retropharyngeal space
Pinkston <i>et al.</i> (2022) ^[5]	19	Male	Not reported	Dental extraction	Necrotizing mediastinitis	No	Survived	Progressed rapidly after extraction
Sepsick <i>et al.</i> (2025) ^[9]	19	Male	None	Third molar extraction with a high-speed air handpiece	PNM with mediastinitis and mediastinal abscess	Yes	Survived	Imaging confirmed mediastinal air and abscess formation
Present case (2026)	52	Male	HBV-related liver cirrhosis; smoking	Dental abscess (no procedure)	DNM+PNM	Yes	Survived	Among the very rare reported cases of PNM secondary to dental abscess without prior dental intervention

PNM: Pneumomediastinum, DNM: Descending necrotizing mediastinitis, CT: Computed tomography, HBV: Hepatitis B virus

immunocompetent individuals.^[16] However, because the available evidence is based predominantly on case reports and small case series, the true comparative frequency in immunocompetent versus immunocompromised patients remains uncertain.^[16] Severe presentations may nevertheless be more likely in the presence of underlying comorbidities or immune impairment.

Management of odontogenic DNM requires a multidisciplinary approach involving early imaging, broad-spectrum intravenous antibiotics, and prompt surgical drainage of mediastinal collections.^[6,7] Equally important is the eradication of the primary source through timely extraction of the infected tooth or endodontic treatment.^[17,18] While pneumomediastinum from air dissection alone may resolve with prophylactic antibiotics and close observation, DNM necessitates surgical drainage.^[6,7] In our patient, early mediastinal exploration with drainage, culture-directed antibiotic therapy, and intensive care support resulted in full recovery without sequelae.

In addition, eliminating the primary infection source is crucial in severe odontogenic infections. Even with antibiotics, prompt extraction of the infected tooth or appropriate endodontic therapy is essential. Inadequately treated abscesses can spread along fascial planes into the mediastinum.^[17] Case reports describe odontogenic abscesses managed only with antibiotics progressing within days to deep neck infections and DNM. In particular, untreated mandibular abscesses can lead to Ludwig's angina, rapidly progressing to DNM and sepsis.^[17] Therefore, in dental abscesses with deep space extension risk, early tooth extraction and surgical drainage are life-saving measures. Supporting this, Zhou *et al.* recently emphasized in a systematic review that source control is essential in managing odontogenic DNM.^[18]

Conclusion

Pneumomediastinum secondary to a dental abscess without preceding trauma or dental intervention is exceedingly rare. Our case demonstrates that such infections may not only lead to DNM but can also be complicated by pneumomediastinum, potentially facilitated by gas-producing anaerobes such as *P. micra*. This highlights the importance of considering pneumomediastinum in the differential diagnosis of patients presenting with chest and neck pain in the setting of dental infections.

Early recognition, prompt imaging, multidisciplinary collaboration, surgical drainage, and eradication of the primary source are essential for favorable outcomes. Clinicians should remain vigilant, as relying solely on

antibiotic therapy without addressing the odontogenic source may result in life-threatening complications.

Author contribution statement

Sureyya Tuba Fettahoglu: Conceptualization; Investigation; Data curation; and Writing – original draft. Zeynep Afra Akbiyik Az: Conceptualization; Methodology; Investigation; Formal analysis; Visualization; Writing – original draft; Writing – review and editing; and Supervision. Tugay Saricicek: Investigation; Resources; Data curation; Validation; and Writing – review and editing. Oguzhan Haciosman: Investigation; Data curation; Visualization; Validation; and Writing – review and editing. Adem Az: Supervision; Project administration; Methodology; Formal analysis; and Writing – review and editing. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Conflicts of interest

None declared.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Funding

None.

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