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Case Report

COMPLICATIONS ARISING FROM ODONTOGENIC INFECTION: A CASE INVOLVING DEEP NECK SPACE AND MEDIASTINAL IMPLICATIONS

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ABSTRACT

Odontogenic infections are a frequent illness that, if not treated right away, can swiftly spread to the rest of the body, and turn into infections that are life-threatening. As these infections may result in life-threatening consequences such airway obstruction, mediastinitis, sepsis, and respiratory distress syndrome, early identification and knowledge of the deep neck areas and fascial planes are essential. The use of regular therapy for localized or severe odontogenic infections with little risk is now possible because to advancements in medical treatments and antibiotics that have decreased morbidity and death rates. Here we report, a lower right canine abscess that started as a phlegmonous neck collection with mediastinal involvement in a 70-year-old man with multiple comorbidities. To control the infection and protect the airways, prompt surgical treatments were necessary. This included drainage, tracheostomy placement, and tooth extraction. In managing life-threatening deep-neck infections, the case emphasizes the value of early discovery, vigorous

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treatment, and multidisciplinary management. Accurate diagnosis and prompt treatments depend greatly on knowledge of and use of trustworthy diagnostic techniques like CT scans and laboratory markers. To shorten hospital stays and speed patients' recovery without raising risks, it is crucial to use broad-spectrum antibiotics, early surgical drainage, and adequate airway care.

KEYWORDS: *odontogenic infection, oral health, oral surgery, dental abscess, dental infection control, phlegmon, head and neck infection, imaging, deep neck space infection*

INTRODUCTION

Odontogenic infections are among the most common in the mouth and are usually caused by periodontal disease and dental cavities (1). Numerous odontogenic infections have the ability to self-regulate and may even drain on their own. However, these diseases may spread to anatomical regions close to the oral cavity and across adjacent facial planes (2). Odontogenic infections, like those of the deep fascial spaces of the head and neck, not only hurt and cause discomfort; they can also cross boundaries and have catastrophic outcomes (3-7).

The interaction of the patient's health status and microbiological variables affects the transmission of an infection. The host's capacity to fend off infection depends on the strength of the germs as well as the patient's general local and systemic circumstances. Infections can spread due to systemic changes brought on by disorders like alcoholism, uncontrolled diabetes, immunological suppression, HIV/AIDS, or weakening of the immune system (8-12).

Suppurative odontogenic infections can travel to potential fascial gaps deep inside the head and neck. Examples of such infections include orofacial space infections and peripharyngeal space infections (3).

The upper aerodigestive tract is the first part of the neck that might be affected by deep neck space infections(13). Infections of the tonsils, pharynx, and upper respiratory tract are the next most common sources, after dental infections. Submandibular locations account for 36% of the locales, whereas 13% are sublingual, 12% are para-pharyngeal, and 3% are retropharyngeal (14-16). Oral pathogen infections have three crucial stages: Stage 1 (lasting 1 to 3 days) with modest swelling, Stage 2 (lasting 2 to 5 days) with excruciatingly painful and red swelling, and Stage 3 (lasting 5-7 days) with the formation of an abscess (17). The danger of disease and death from deep neck infections is particularly high when they coexist with conditions that impair the body's immune system. It is essential to comprehend the deep neck spaces and fascial planes because they are key to how the illness develops. Consequences that are frequent and potentially fatal include airway obstruction, jugular vein thrombosis, descending mediastinitis, sepsis, acute respiratory distress syndrome, and disseminated intravascular coagulation (18). The morbidity and mortality rates of odontogenic infections have significantly decreased over the past seven decades as a result of breakthroughs in antibiotics, better public health standards, and improved medical and surgical treatments. Today, standard treatment for localized or severe odontogenic infections is available with little risk of adverse events or mortality (19-21).

Securing the airway, maintaining efficient drainage, giving the right antibiotics, and boosting the immune system continue to be the main focuses of treatment. Additionally, patients should be ready for a lengthy hospital stay (18). The case of a 70-year-old man with lower right canine abscess-related unilateral phlegmonous neck collection and mediastinal involvement who also had diabetes, obesity, hypertension, ischemic heart disease, and a history of prior TIA is discussed in this paper. A distinguishing characteristic is the appearance of heterogeneous tissue with many gas bubbles in the right submandibular plane.

Case description

A 70-year-old Caucasian man presented to the Olyclinic of Bari with dyspnea, spontaneous and on-palpation pain, right mandibular edema with increasing volumetric increase, obesity, hypertension, type II diabetes, ischemic heart disease, chronic obstructive pulmonary disease, and prior transient ischemic attack (TIA) are among the patient's medical histories. The rectal swab revealed Klebsiella Pneumoniae Carbapenemase (KPC) infection.

The patient revealed that he had previously been admitted to another hospital where he had received antibiotic therapy with Tazocin and Targosid, followed by Metronidazole. This was after the onset of the right mandibular edema.

He was then quickly transported to the Bari Polyclinic's Intensive Care Unit due to significant mediastinal involvement

brought on by the spread of purulent phlegmon collection.

Leukocytosis was not present according to the most recent blood tests, and the C Reactive Protein (CRP) level was 6 mg/L. Due to the patient's renal insufficiency, a neck-chest Computerized Tomography (CT) was done without contrast material, which revealed signs of inhomogeneous tissue with many contextual air bubbles in the right sub-mandibular plane (Fig. 1). The first diagnosis was an abscess affecting the long muscles of the ipsilateral neck, including the muscles of the hypopharynx, including the common carotid artery, and the sternocleidomastoid muscle (SCM), up to the plane passing through the second cervical vertebrae C2.

Additionally impacted were the right thyroid lobe and the right submandibular gland. A more confined area in the right paraortic/lodge of Barety and an inhomogeneous thickening of the adipose tissue of the prevascular anterior mediastinum were seen. In the left basal site, there was additional evidence of parenchymal thickening with contextual air bronchogram.

Using a 5.2 mm disposable bronchoscope and a strengthened Magill tube under fiberoptic guidance, intubation was carried out. Additionally, both bronchial hemisystems' copious mucous secretions were broncho-aspirated. To stabilize the airways, a surgical tracheostomy, right submandibular gland sialoadenectomy, and laterocervical abscess drainage were also performed (Fig. 2).

The subcutis and platysma muscle were flapped during surgery, which entailed a curvilinear incision from the right mastoid to the chin. Necrosis of the cervical fascia at the level of the right upper and inner parapharyngeal space was associated with abscess collections. It is desirable for the inferior pouch to communicate with the superior mediastinum. The right supraclavicular area contains additional subplatysmatic abscess collections.

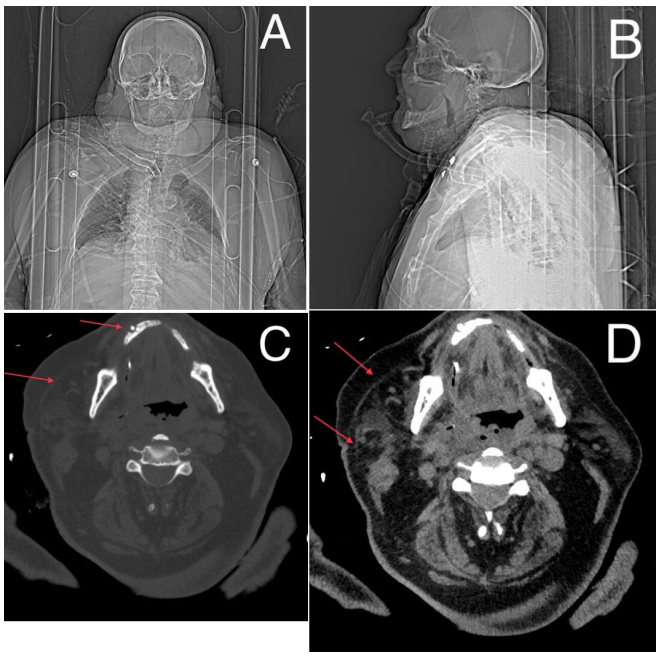

Fig. 1. *CT Chest/Neck/Mediastinum performed after the surgery: front (A), right side (B) and transverse plane (C-D) highlighting the presence of a chronic periapical inflamation at the dental element 4.3 and multiple gas bubbles in corrispondence of the right submandibular plane.*

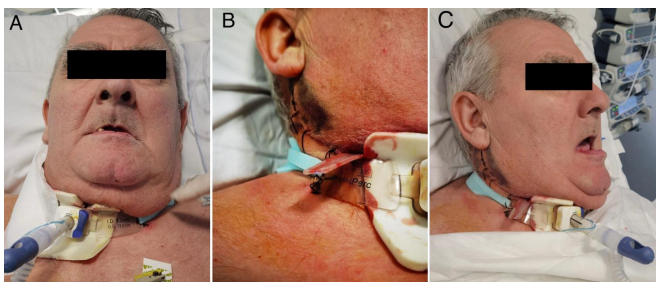

Fig. 2. *Patient photos after the emergency surgery: front (A), right side (C) and a particular of the suture after the abscess drainage (B). Evidence of the tracheotomy and of placement of cannula type Porte n.9.*

These abscess collections underwent drainage. Blood vessels were ligated and dissected to protect the jaw muscle and the right submandibular gland. The nerves were protected while the gland was removed. Additionally, a supra-isthmic tracheotomy was performed, and the incision was patched and secured using a Porte n.9 cannula with a 130 mm cuff. The following antibiotic regimen was recommended: Targosid 400 mg Endovein (Teicoplanina) at 12:00 and 22:00, Rocefin 2 g Endovein (Ceftriaxone) at 8:00 and 22:00, and Desometasone 8 MG at 8:00 and 22:00 + gastroprotectives.

CT chest/mediastinum (without and with contrast) and CT neck (without and with contrast) procedures were carried on the day following the emergency surgery. The examination was conducted both before and after the injection of the contrast agent (Ultravist 370). Many beam hardening artifacts were present, which decreased the exam's ability to accurately diagnose. The neck CT revealed the existence of two contextual drainage catheters and a fluid collection with total measurements of around 8x2x1 cm in the right prevertebral, paratharyngeal, and anterior cervical area. Adipose tissue from the local area was seen to be ingested. From the aforementioned collection, an offshoot with maximal dimensions

of 7x5x1 cm, right parathyroid retroclavicular development, and in the cranial region of the superior mediastinum, appeared to begin in a caudal orientation. Calcific plaques are seen at the carotid bifurcation, especially so on the right. An increased cardiomediastinal shadow, a hazy and inhomogeneous parallel thickening, a minor layer of ipsilateral pleural effusion, and a tracheostomy were all visible on the bedridden patient's chest X-ray. At the carotid bifurcation, which is further to the right, calcific plaques were seen. A bilateral pleural effusion layer was discovered

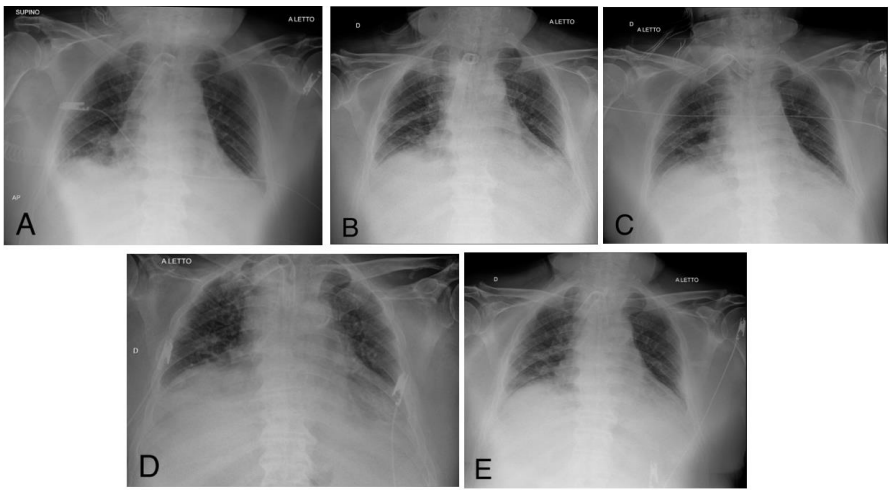

Fig. 3. *Chest X-ray sequence: June 8 (**A**); June 13 (**B**); June 15 (**C**); June 17 (**D**); June 18, 2023 (**E**), that shows a blurred and inhomogeneous parallel and basal right thickening; a minimal layer of ipsilateral pleural effusion and enlarged cardiomediastinal shadow and tracheostomy.*

along with lower lobe dysplasia in the right and left lungs (Fig. 3).

The patient's rectal and pharyngeal swabs, as well as the tracheobronchial aspirate, all tested positive for the bacterium Klebsiella Pneumoniae. Additionally, blood tests revealed that he had Staphylococcus hemolyticus. Three Penrose drains were present, and Rifocin flushing was carried out through the Penrose drains. The dressing was periodically changed, and the surgical incision was cleansed with betadine and H_20_2. Chest X-rays taken afterwards indicated no difference from those taken before.

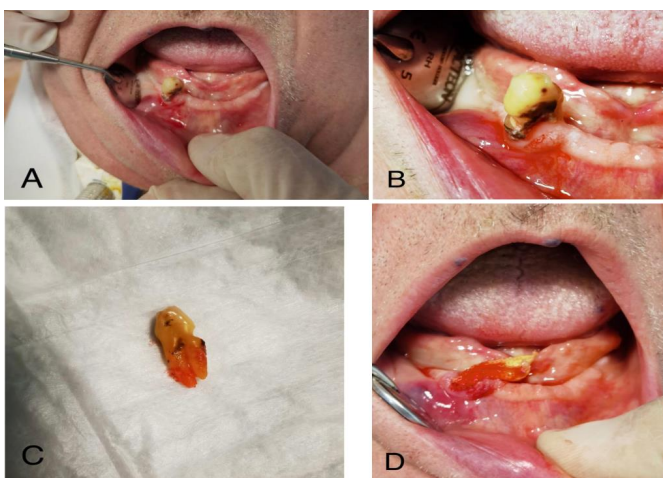

Fig. 4. *Intraoral photo (A) and a detail of the dental element 4.3 (B) before the extraction; extracted 4.3 (C) and intraoral photo after the extraction in which haemostis with Tabotamp was performed.*

The patient underwent dental surgery to have the infected tooth extracted ten days following the emergency. The lone tooth in the oral cavity, tooth 4.3, was extracted under local anesthetic without the use of a vasoconstrictor. Volkmann spoons were used to execute alveolar curettage and phlegmon debridement. Hemostasis was carried out using Tabotamp (oxidized regenerated cellulose gauzes) after washing with a physiological solution. Fig. 4 shows the surgical extraction.

Five days following the tooth extraction, the CT Neck (without contrast) and CT Chest (with contrast) were done. After the elimination of two of the three laterocervical-submandibular drainages on the right, there was a volumetric reduction of the mediastinal and prevertebral components as compared to the prior CT scan. On the other hand, the right submandibular-jugulodigastric component (now measuring around 55x25x15 mm) appeared more structured and expanded in volume. With the pleural effusion resolved, bilateral pulmonary ventilation improved. The remaining conclusions remained mostly unchanged. The patient in Fig. 5 is shown without the requirement for assisted ventilation.

DISCUSSION

Fig. 5. *Patient without assisted ventilation.*

Prescription antibiotics are an excellent way to treat dental infections, which happen frequently. These infections can progress to the cervical and mandibular region, offering serious hazards to patients, if they are not properly treated. These side effects may eventually result in death, such as Ludwig's angina, respiratory obstruction, facial deep neck abscesses, cellulitis, cervical necrotizing fasciitis (CNF), aspiration pneumonia, septicemia, brain abscess, endocarditis, disseminated intravascular coagulation (DIC), jugular thrombophlebitis, and abnormalities in blood coagulation (22-24). The pharynx and oral cavity, particularly the teeth, are the most frequently affected areas by infection (15, 25). Odontogenic infections of the head and neck continue to be the leading cause of hospitalization in departments of maxillofacial surgery despite favorable socioeconomic situations, accessibility to dental care, and availability of antibacterial medications (14, 24, 26-28).

When deep fascial space infections are discovered, it might be difficult to make an early diagnosis and put off starting treatment, which raises the risk of consequences (27, 29, 30). Due to the particular structure of the head and neck, inflammatory illnesses there have distinctive characteristics (31-33). The key contributing elements to these distinguishing features are the intricate structure of the face and neck, the existence of teeth in the oral cavity, the close proximity of the paranasal sinuses, the robust blood supply, and the presence of critical organs for sight, hearing, smell, and taste (34, 35). Today, improvements in diagnosis and treatment have considerably decreased the prevalence of serious outcomes following odontogenic infections, largely because predisposing factors are present (36). The use of radiodiagnostic tools is essential for discovering infections, identifying abscesses, tracking their development, and, occasionally, administering drainage procedures (37, 38). The most crucial imaging test for accurately evaluating neck spaces impacted by deep neck infections is a computed tomography scan (39). According to recent suggestions, computed tomography scans may be useful in determining the extent of the infection's spread so that the best surgical strategy can be planned (40). With adequate surgical care, appropriate antibiotics, and removal of the odontogenic focus, the majority of patients experience full recovery (41).

To prevent tragic outcomes, prompt medical attention, often involving surgery, is imperative (18, 42). Early diagnosis and timely surgical therapy within the first twelve hours significantly decrease the mortality rate (43, 44). Unquestionably, the patient's treatment's initial strength was the rapid laterocervical surgical drainage, tracheostomy, and administration of an appropriate and sufficient antibiotic medication. In fact, the treatment for these infections includes the use of broad-spectrum antibiotics, airway management techniques (including tracheostomy), and surgical intervention. Additionally, the abscess may need to be surgically drained at first (16). All patients who were admitted to the hospital because of an odontogenic infection received surgical incision and drainage treatment (3). Either a general anesthetic with endotracheal intubation or a local anesthetic with premedication was used. Due to respiratory obstruction and problems with endotracheal intubation, head and neck odontogenic infections pose serious consequences. Trismus and anatomical anomalies pose particular difficulties.

According to a study described by Keswani et al. all patients received incision and abscess draining under local anesthetic and analgesia without respiratory assistance (45). Deep neck infections can lead to life-threatening consequences, including airway compromise, mediastinitis, pericarditis, cerebral involvement, and artery erosion (46-49). Another serious consequence that might occur is descending necrotizing mediastinitis (DNM), a serious infection that affects the chest and neck and progresses over time. This syndrome occurs when an infection that starts in the mouth, throat, or neck quickly spreads through the subcutaneous tissue and cervical fascia to the thoracic cavity, causing tissue necrosis (50). If this condition is not treated promptly and effectively, the death rate (10–40%) by sepsis and organic failure is high. The existence of comorbidities or other health disorders is another crucial factor to consider (51).

The person profiled in this article has diabetes, is overweight, and has high blood pressure. This patient has a number of risk factors for necrotizing fasciitis (NF), including diabetes mellitus (DM), alcoholism, liver cirrhosis, chronic renal failure, hypertension, and malignancy (52). The most prevalent comorbidity, DM, significantly raises the risk of Deep Neck Space Infection (DNSI) complications and mortality (53). In a study of 263 cases, a significant proportion of patients with DNSI also had DM, HIV infection, primary arterial hypertension, or coronary heart disease (14, 54). DNSI (Deep Neck Space Infections) are highly influenced by body mass index (BMI). Acute phlegmonous laryngitis as the underlying cause, neck phlegmon as the affected area, and a higher risk of sequelae are all clearly correlated with rising BMI (54). An important aspect of this instance was the presence of gas bubbles at the level of the cavernous sinus, as revealed by CT. Gas bubbles created by bacterial fermentation are typically present in a wide range of severe disorders.

The microbiome is a vital element that could influence how a patient develops. There are two types of CNF: suppurative and gaseous. The first exhibits an accumulation of purulent fluid, while the second exhibits gas production (55). Six patients with DNM (descending necrotizing mediastinitis) caused by pharyngolaryngeal and odontogenic infection were studied by Sakai et al. and required thoracic surgery, broad-spectrum antibiotic therapy, and forceful drainage (56). All patients exhibited gas bubbles on their chest CT scans and had polymicrobial infections involving both aerobic and anaerobic bacteria, including the Streptococcus anginous group SAG (56). The bacteria that cause phlegmon, a purulent infection of the subcutaneous connective tissue, can come from the tonsils, pharynx, oral cavity, and other places. Phlegmon and abscesses can develop as a result of these bacteria spreading through the fascia's gaps and connective tissues.

Targeted antibiotic therapy may be useful when specific bacterial or fungal strains can be identified. Another noteworthy element of the patient's care that has been often noted in the literature was the empirical antibiotic therapy in this clinical case, which included a combination of drugs effective against gram-negative and gram-positive bacteria (57-65).

It is essential to develop and use a few reliable technologies in order to quickly detect and identify DNSI repercussions such as DNM, CNF, and systemic sepsis. The neutrophil-to-lymphocyte ratio (NLR), the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, and the LRINECxNLR scores are suggested by Fiorella et al. to predict septic complications and the risk of CNF during DNSI (66).

CONCLUSIONS

Despite major improvements in their detection and treatment, deep-neck infections still rank among the most seriously life-threatening illnesses. In order to effectively treat widespread cervico-mediastinal abscesses with an odontogenic etiology, early detection, intensive antibiotic treatment, and surgical treatments are essential. Any odontogenic infection must be treated right away since a missed or delayed diagnosis of a deep-space neck infection can result in dangerous consequences. Broad-spectrum antibiotic therapy, prompt odontogenic source extraction, appropriate airway management, and early surgical drainage have all been shown to speed up recovery and decrease hospital stays without raising hazards. For precise diagnosis, clinical presentation and instrumental techniques like CT scans are essential, but laboratory markers should also be taken into account for prompt and trustworthy support.

Author Contributions:

Conceptualization, G.D., A.M.I., and F.V.; methodology, V.E.S., S.G., and F.M.; software, A.P., and A.D.I.; validation, F.I., G.F. and L.S.; formal analysis, F.V., and A.M.I.; investigation, N.A.A.Q., A.I., and S.G.; resources, F.M.; data curation, N.A.A.Q., A.P., and G.D.; writing—original draft preparation, V.E.S., and F.I.; writing, review and editing, A.I., A.M.I, A.S. and G.D.; visualization, F.I., and G.F.; supervision, L.S., and F.I..; project administration, A.D.I.

Conflicts of Interest:

The authors declare no conflict of interest.

Informed Consent Statement:

Informed consent was obtained from the patient involved.

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