

## Deep Neck Infection: A Case Series

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### Abstract

### Case Series

**Background:** Deep neck abscess is a collection of pus (pus) in the potential space between the fascia of the deep neck due to spread from various sources of infection, such as teeth, mouth, throat, paranasal sinuses, ears and neck. Various spaces can be a place for deep neck abscesses including the submandibular, peritonsillar, parapharyngeal, retropharyngeal, submental, parotid, anterior visceral, carotid, and masseter spaces. Inflammation or damage to chronic problem teeth can lead to complications of deep neck abscesses. The main complaint that causes sufferers to come to the hospital is dysphagia, which is difficulty swallowing due to the pain felt by the patient. These complaints can also be accompanied by trismus, stridor caused by tracheal compression, to airway obstruction. **Purpose:** To determine the progressivity of deep neck abscess so that it can provide medical management until operative incision and drainage. **Case report:** We report 5 cases of deep neck abscess with management according to the progress of each case. **Conclusion:** The most common cause or etiology that can lead to deep neck abscess is toothache. Management of deep neck abscess, starting with the administration of empirical antibiotics which is the first step to reduce the infection of bacteria that produce beta lactamase. In deep neck abscess, medical therapy can be given in the form of an antibiotic combination of ceftriaxone with metronidazole, or meropenem with metronidazole as well as surgery in the form of incision and drainage. Treatment can be chosen based on the presence or absence of warning signs and signs of complications. Incision and drainage is performed when complaints do not improve after administration of antibiotics, multiple abscesses and airway obstruction that threatens the patient's life.

**Keywords:** Deep neck abscess, submandibular abscess, peritonsillar abscess.

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## INTRODUCTION

Deep neck abscess is a collection of pus (pus) in the potential space between the deep neck fascia due to spread from various sources of infection, such as teeth, mouth, throat, paranasal sinuses, ears and neck (Novialdi & Pulungan, 2011). Abscesses occur due to an inflammatory reaction that forms the abscess wall so that it does not spread to other organs (Hidayati, 2019). The spread of an abscess that originates from a tooth infection can spread extraorally & intraorally. Extraoral examination can be seen from the shape of the face, the shape of the neck whether there are masses, the shape, color and size of the visible masses. In addition to the mass, cellulitis can be seen which determines the severity of the spreading abscess. The visible mass can be in the form of an abscess or enlargement or infection of the lymph nodes (Fan, 2020). Extraoral manifestations do not directly interfere with the patient's respiratory tract,

but can help determine disease progression (Rasul & Kawuluan, 2018).

Intraoral examination is involvement with internal organs to the mediastinum which is an emergency in cases of abscess. Three potential routes for intraoral spread of foci of infection are retropharyngeal, perivascular and pretracheal. The direction of distribution of pus is in accordance with the direction of gravity of the earth, so that oral abscesses can spread towards the neck, thorax and mediastinum (Rochmah, 2018). The intraoral spread of pus involving internal organs has the potential to disrupt the respiratory tract so that more qualified management is needed (Lizar *et al.*, 2017). Suppurative infiltration that occurs due to invasion of odontogenic bacteria will cause edema of the soft palate on the affected side and continues to spread swelling of the surrounding soft tissue causing painful swallowing and trismus (Boies, 1959). Inflammation of the superior pharyngeal constrictor muscle will cause

symptoms of painful swallowing which has the potential to cause dehydration (Rahmah *et al.*, 2023). Trismus will appear if the infection spreads to the pterygoid muscles (Putra & Pradiptha, 2017). One of the actions taken is incision and drainage when complaints do not improve with antibiotics (Lizar *et al.*, 2017).

The most common causes of this infection are poor oral hygiene, low immunity, systemic diseases, etc. Bacteria that cause deep neck abscess generally consist of a mixture of aerobic, anaerobic and facultative anaerobic bacteria. Infection causes cavities filled with infected tissue and cells. White blood cells will enter into the cavity and carry out bacterial phagocytosis. The inflammatory process that occurs is caused by chemotactic factors from bacteria, and bacterial encapsulation will form the infiltration of T lymphocytes, PMNs, and leukocytes. White blood cells that successfully phagocytose bacteria will die and form pus which fills the cavity (Kotsougiani *et al.*, 2010; Rizal Fardani *et al.*, 2022; Statement & Funding, 2016; Subudhi *et al.*, 2020).

Based on its relationship to the hyoid bone, the deep spaces can be classified as follows: spaces that lie above the level of the hyoid (peritonsillar, submandibular, parapharyngeal, buccal, parotid, masticatory/temporal); spaces that involve the entire circumference of the neck (retropharyngeal, prevertebral and carotid); and the anterior or pretracheal visceral space, under the hyoid bone (Kataria *et al.*, 2015). The second and/or third lower molars will spread through the tooth apex with the submandibular and sublingual spaces causing inflammation or damage to chronic dental problems (e.g. dental caries and pulp gangrene) which can lead to complications of submandibular abscess. Submandibular space around the posterior border of the mylohyoid muscle. Infection of the mandibular molars can expand buccally to the submandibular space, so that inflammation of the lower jaw can cause deep neck abscess complications, this is due to the accumulation of pus in the submandibular space which will then expand into the surrounding space. The sublingual space of infection spreads backwards on the substance of the tongue within the gap created by the genioglossus and hyoglossus muscles so that it follows the course of the sublingual artery. Through this route, the infection can spread to the epiglottis and cause swelling at the entrance to the larynx, thus triggering the symptom of stridor. The mechanism of stridor in this abscess is related to obstruction of the upper airways caused by the enlarged abscess. As the abscess grows, it can compress or block the airways in the throat area or at the back of the throat. As a result, airflow becomes restricted or blocked, causing a loud, panting sound known as stridor (Boies, 1959; Rizal Fardani *et al.*, 2022; Singla *et al.*, 2022; Subudhi *et al.*, 2020).

Anatomical pathways of the submandibular space with the submasseter, pterygoid space and

spread of infection may occur in this space. More posteriorly the parapharyngeal and peritonsillar spaces can also be involved by infection causing serious airway obstruction. Infection from the submandibular area, may spread downward along and below the investing layer of the deep cervical fascia, towards the clavicle and further into the mediastinum causing mediastinitis. The deep cervical fascia prevertebral layer, Lincoln's highway or carotid sheath, the space between the alar and prevertebral fascia (danger space) plays an important role in the spread of infection to the mediastinum (Subudhi *et al.*, 2020).

The incidence of deep neck abscess in Indonesia was studied at Hasan Sadikin Hospital in Bandung during 2012. From this study, 28 cases of deep neck abscess were found, with 9 cases of peritonsillar abscess, 1 case of parapharyngeal abscess, 4 cases of retropharyngeal abscess, 5 cases of submandibular abscess, submental abscess 2 cases and combined abscess (submandibular and parapharyngeal) 7 cases. The percentage of male patients was 68% and 32% female, with the most age group being 20-39 years of 50%. The most common location for abscesses to be found is in the peritonsillar space as much as 32% with the most odontogenic source of infection as much as 50% (Sriwijaya *et al.*, 2017).

The most common sign and symptom is dysphagia, which is difficulty swallowing due to pain felt by the patient. These complaints can also be accompanied by trismus, masses of soft or hard consistency, fluctuating masses or not up to stridor. The duration of these symptoms can range from 12 hours to 28 days (Bal *et al.*, 2022). The difference in the symptoms felt includes the anatomical location of the infection. In the peritonsillar abscess, there is a soft palate swelling accompanied by hyperemia, unilateral edema which causes the contralateral uvula. Patients also get a mumbling voice or hot potato voice. In the submental abscess, a soft, fluctuating and unilateral mass was seen on the chin which was preceded by a dental infection. In submandibular abscess, there is a soft, fluctuating and unilateral mass in the lower part of the mandible. Ludwig's angina is visible swelling in the neck that is hard like a board, airway obstruction due to edema which narrows the airways. Complaints felt by patients can be accompanied by manifestations that aggravate the patient's progress such as trismus, snoring, stridor to airway obstruction (Bailey, B. J., Johnson, J. T., & Newlands, S. D. (Eds.). (2006). *Head & neck surgery--otolaryngology* (Vol. 1. Lippincott Williams & Wilkins).

The mechanism of stridor in this abscess is related to obstruction of the upper airways caused by the enlarged abscess. As the abscess grows, it can compress or block the airways in the throat area or at the back of the throat. As a result, airflow becomes restricted or obstructed, causing a loud, gasping breath sound known as stridor (Boies, 1959).

The management of deep neck abscess focuses on 4 things, namely antibiotic therapy, securing the airway, incision and drainage. Empiric antibiotics are the first step to cover bacterial infections that produce beta lactamase. Abscess management should begin with administration of high-dose antibiotics intravenously and then be prepared. For deep neck abscesses, an antibiotic combination of ceftriaxone and metronidazole, meropenem, antibiotic therapy and surgery in the form of incision and drainage can be given. Treatment can be chosen based on the presence or absence of alert signs and signs of complications (Lizar *et al.*, 2017; Mutia Zatadin *et al.*, 2017). Alert signs in the form of elevation of the tongue, trismus, voice changes, odynophagy, and submandibular cellulitis with clinical Ludwig angina and abscess size > 3cm then the patient requires surgery (Mutia Zatadin *et al.*, 2017).

Surgical procedures include puncture to determine whether pus is present, incision when pus is obtained, drainage of pus and if the patient is congested a tracheotomy can be performed, and when the patient has an abscess or is at risk of complications (Lizar *et al.*, 2017; Rizal Fardani *et al.*, 2022). There are also indications for incision & drainage. Indications for surgery are no improvement in symptoms within 24 hours, threat of airway obstruction, presence of life-threatening neurovascular complications, pus that appears more than 3 cm on a CT scan, and multiple abscesses (Santhi Dewantara *et al.*, 2017).

## CASE REPORT

### First Case

We report a case of peritonsillar abscess, Mr. TB, 22 years old, came to the Karanganyar Hospital Emergency Room with the main complaint of difficulty breathing since 1 day ago, continuously and getting worse over time. Symptoms accompanied by shortness of breath, difficulty swallowing, painful swallowing, dry throat, bad breath, snoring, and hypersalivation since 1 day ago before coming to the ER. In addition, information was obtained that 1 week ago the patient had a fever. The patient had no history of hypertension, diabetes mellitus, allergies or asthma. The patient's condition is compos mentis with a temperature of 38.9°C with a pulse of 112/minute, blood pressure of 136/75 mmHg, respiratory rate of 23/minute, and 96% SpO<sub>2</sub>. ENT examination of the throat by inspection shows peritonsillar edema, peritonsillar hyperemia, contralateral uvula, peritonsillar swelling appears asymmetrical, and the patient's voice when speaking sounds like muttering or hot potato voice. Examination of the neck revealed swelling, bilateral. Examination of nose and ears within normal limits. On palpation examination found tenderness, with the consistency of supple swelling. Laboratory investigations showed an increase in hemoglobin 17.5, leukocytes 17.18, and monocytes 10.1%. CT-Scan examination was not carried out. Culture examination and chest X-ray photos were

also not carried out. Patients were given Ringer's lactate infusion 20 drops per minute, OMZ 1 vial/12 hours, analgesic 1a/8 hours, metronidazole 3x1, and meropenem 2x1.

### Second Case

We report a case of submandibular abscess Mrs. S, 78 years old, came to the Karanganyar Hospital Emergency Room with the main complaint of pain when swallowing since 1 day ago and it was getting worse over time. Symptoms are accompanied by swallowing pain, difficulty opening the mouth since 1 day ago before coming to the emergency room. Then, information was also obtained that in the patient's neck there was swelling in the submandibular section radiating to the right side of the neck, bilateral, and progressively worsening since 3 days ago. The patient also complained of neck stiffness since 1 day ago, progressively worsened. Apart from that, in the facial area the patient also complained of feeling thick since 1 day ago together with complaints of neck stiffness and painful swallowing with progressively worsening. During an anamnesis at previous medical history the patient said that 5 days ago he had complaints of toothache for 3 days before the appearance of swelling in the submandibular part which radiated to the neck. Then the patient also has a history of fever when having a toothache and the appearance of swelling, intermittent, the progress of the fever improves. For a history of DM, hypertension, asthma, and allergies the patient does not have it. At the time of examination the blood pressure was 125/67, pulse 61, respiratory rate 20, temperature 36.1, SpO<sub>2</sub> 91%. On physical examination of the neck, a hard mass was found in the mandibular area radiating to the neck, bilateral, and progressively improving. On physical examination of the nose, ears, throat all are within normal limits. Lab examinations showed several results that had increased, namely leukocytes (11.41), neutrophils (88.3%), monocytes (13.6), NLR (19.62), RDW-SD (38.9). Then for the lab results that have decreased are lymphocytes (4.5%), monocytes (0.0%). CT-Scan examination was not carried out. Culture examination and chest X-ray photos were also not carried out. During the treatment period the patient was given ceftriaxone 2x1, OMZ 2x1, santagesic 3x1, Metronidazole 3x1, inf. RL 20 drops per minute, Betadin gargling. Then continue evaluating the abscess. Evaluation on the third day ceftriaxone was replaced with meropenem 2x1 due to the patient's condition deteriorating to shortness of breath, and planning for incision and drainage was carried out.

### Third Case

We report a case of submandibular abscess. A woman, Mrs. PW, 23 years old, came to the ENT clinic at Karanganyar Hospital. on May 26 2023 with complaints of swelling in the submandibular area. Complaints have been felt since 1 day ago. Other complaints felt by patients are swallowing pain, lumps, and difficulty opening their mouths. The patient's past medical history, namely toothache in the upper and lower

1st molars since 1 week ago. The patient denied having a history of hypertension, diabetes mellitus, asthma, or drug allergies. Vital sign examination and physical examination were carried out on the ward. The results of the patient's vital sign examination showed blood pressure 120/72 mmHg, pulse 81x/minute, respiratory rate 20x/minute, temperature 36.0°C, and the patient's SpO<sub>2</sub> was 96%. Physical examination of the neck revealed a unilateral hard mass in the submandibular area. tenderness is felt by the patient, and the patient can only open his mouth with a size of 2 fingers. The patient's laboratory investigations showed leukocytes 13.62 (high), MCV 79.7 (low), MCH 27.7 (low), and RDW-SD 35.7 (high). The patient was given Ringer lactate infusion 20 tpm. In addition, the patient was also given drug therapy in the form of 2x1 meropenem, 3x1 metronidazole, 3x1 santagesic, and 3x1 dexamethasone.

#### Fourth Case

There was a case of deep neck abscess suspected Ludwig's angina who came to the Karanganyar Hospital Emergency Room on behalf of Mr. H, 38 years old with the main complaint of pain when swallowing since 1 week ago and is getting progressively worse. Symptoms are accompanied by swallowing pain, difficulty opening the mouth since 1 week ago before coming to the emergency room with progressively getting worse. Then, information was also obtained that in the patient's neck there was swelling in the submandibular region radiating to the neck and shoulders, bilateral, and the progressiveness had worsened since 1 week ago. The patient also complained of neck stiffness since 1 week ago along with the main complaint progressively worsening before being taken to the ER. On the face the patient complained of a thick facial area along with the appearance of swelling about 1 week ago and its progressiveness was getting worse. The patient has breathing problems so it is more comfortable when sitting than sleeping on his back. When anamnesis was carried out regarding RPD (History of Past Illnesses) the patient had a history of fever together with the appearance of swelling, intermittent, progressively improved. Then the patient also has a history of toothache since 1 week ago for 3 days, progress has improved. The patient denied having a history of hypertension, DM, asthma, drug allergies as well as a family history of disease. The patient's condition at the time TTV was performed on the ward showed blood pressure 132/92, pulse 87 x/min, respiratory rate 20 x/min, temperature 36.5 Celsius, and SpO<sub>2</sub> 93%. Then when a physical examination was carried out on the neck, it was found that there was a hard mass like a board in the submandibular section, spreading to the neck and even to the shoulders. The patient also complained of pain when the swelling that radiated to the shoulder was pressed, whereas in the neck and submandibular when pressed they did not complain of pain. Then for a physical examination of the head, ears, nose and mouth, all are within normal limits. Lab examinations showed several results that had increased, namely leukocytes

(22.37), neutrophils (75.8%), monocytes (13.6), NLR (7.43), RDW-SD (45.9). Then the lab results that experienced a decrease were lymphocytes (10.2%), eosinophils (0.2%). CT-Scan examination was not carried out. Culture examination and chest X-ray photos were also not carried out. During the treatment period the patient was given 2x1 meropenem, 2x1 OMZ, 3x1 santagesic, 3x1 Metronidazole, inf. RL 20 drops per minute. Then continue evaluating the abscess. The second day the patient was referred to Moewardi Hospital due to the spread of the abscess to the shoulder.

#### Fifth Case

We report a case of submental abscess. A man named Mr. R aged 58 came to the otolaryngologist clinic at Karanganyar Hospital on May 26 2023 with the main complaint of pain when swallowing. Complaints have been felt since 2 weeks ago. Complaints of pain when swallowing together with fever. In addition, the patient complained of a lump on the chin, complaints of pain when swallowing, which made it difficult for the patient to eat and drink. The patient denied complaints of ears, nose and head. The patient has never experienced a similar disease. The patient was confirmed to have diabetes mellitus with a fasting blood glucose result of 184 at a lab examination on 22 May 2023. History of hypertension, history of asthma, history of allergies and history of toothache was denied by the patient. The patient's family did not have similar complaints or comorbid diseases. On physical examination, the patient was found to be compos mentis, general condition adequate, blood pressure 120/70 mmHg, pulse 81 x/minute, respiratory rate 20 x/minute, temperature 35.0oC, and SpO<sub>2</sub> 97%. ENT examination of the neck revealed a lump under the chin, unilateral. Ear, nose, throat and head examination were within normal limits. On palpation examination, there was tenderness in the lump, with the consistency of the lump being supple and fluctuating. CT-Scan examination was not carried out. Culture examination and chest X-ray photos were also not carried out. Patients were given 20 drops per minute of ringer lactate infusion, 2x1 ceftriaxone, 3x1 dexamethasone, 3x1 santagesic, and 3x1 metronidazole. Patients were given management for DM comorbidities, namely novorapid 10:10:10 and metformin 3x1. On the fifth day the patient stopped giving dexamethasone.

## RESULT AND DISCUSSION

Deep neck space infection (DNSI) refers to infection with either abscess formation or cellulitis. Infection occurs due to Group-A Beta-hemolytic Streptococcus bacteria. and *F. necrophorum* (Putri, 2021). Apart from GABHS, peritonsillar abscesses can also be caused by other aerobic and anaerobic microorganisms. Some aerobic bacteria which are the etiology of this disease are Streptococcus groups B, C, and G, Haemophilus influenzae type B and nontypeable, Neisseria sp, Staphylococcus aureus, and Mycobacterium sp. Other causes of peritonsillar abscess

are viruses, for example parainfluenza and herpes simplex virus (Rahmah *et al.*, 2023).

In this case, 5 cases of abscess were reported where in the first case the patient was diagnosed with peritonsillar abscess due to the main complaint of difficulty breathing which was the reason the patient came to the emergency room at Karanganyar Hospital. It is caused by damage to the salivary glands of the upper soft palate known as Weber's glands. These glands are located proximal to the palatine tonsils and help keep the peritonsillar niche and tonsillar crypts clean. When an infection occurs it will cause blockage of the gland or drains. This coincides with a decrease in saliva production which triggers the formation of pus in the tonsillar crypts and oral scarring (Powell *et al.*, 2013). In peritonsillar abscess, a collection of pus is found located between the fibrous capsule of the palatine tonsil (usually in the upper pulp) and the superior pharyngeal constrictor muscle. This area consists of loose connective tissue, the infection can spread quickly to form a purulent discharge. Progressive inflammation may extend directly to the soft palate, lateral wall of the pharynx, and rarely to the base of the tongue. The peritonsillar space can become infected with *Streptococcus* sp. (Marbun, 2016).

Upper airway obstruction may occur due to infectious mononucleosis causing large-volume abscesses, tonsillar hypertrophy, and/or collateral mucosal edema or phlegmon of the pharynx and larynx (Klug *et al.*, 2020; Ravindran *et al.*, 2021). Patients with peritonsillar abscess usually present with a history of sore throat for 3-4 days. In general, patients complain of sore throat, inability to open mouth fully (trismus), hypersalivation, and fever over 38 °C, accompanied by difficulty and pain in swallowing both liquids and food (dysphagia). The classic symptoms of this disease are a mumbling sound (hot potato voice), the uvula being pushed in a direction that doesn't hurt (contralateral), and trismus (AlAwadh *et al.*, 2017; Rahmah *et al.*, 2023). However, in this case the patient did not experience trismus because he could open his mouth up to 3 fingers.

On ENT examination, starting from inspection of the throat area, signs of peritonsillar edema, peritonsillar hyperemia, contralateral uvula, peritonsillar swelling appear asymmetric. When the patient speaks, a mumbling voice or hot potato voice is heard. Examination of the neck revealed swelling, bilateral. On palpation examination found tenderness, with a rubbery swollen consistency. The voice is described as thick or muffled, and is called the "Hot Potato Voice" (HPV), as if the patient were consuming hot food. Peritonsillar infection will paralyze the palatopharyngeal, superior constrictor, and levator veli palatini muscles from the affected side, and cause a grunting sound (Fujimura *et al.*, 2019). Complications that can occur based on the symptoms felt by the patient are when there is swelling that arises in the supraglottic area which can cause airway obstruction which requires a tracheostomy.

Involvement of the pharyngomaxillary spaces in peritonsillar abscess complications may require drainage from the outside through the submandibular triangle (Marbun, 2016).

Patients were given treatment in the form of Ringer's lactate infusion 20 tpm, OMZ 1 vial/12 hours, santagesic 1a/8 hours, metronidazole 3x1, and meropenem 2x1. Giving Ringer's lactate serves to prevent dehydration in patients due to symptoms of difficulty swallowing in patients who interfere with nutritional intake. In addition, administration of Ringer lactate functions as volume resuscitation in the intravascular volume which increases preload. Providing the body with sodium lactate which functions as a bioenergy fuel that the human body is designed to metabolize under ischemic conditions thus reducing cell death due to ischemia (Kerndt *et al.*, 2020). Nonsteroidal anti-inflammatory drugs are used for mild to moderate pain. Opioid analgesics, such as dihydrocodeine and pethidine, are used for severe pain (Litha *et al.*, 2019). The patient was also given omeprazole, omeprazole is a type of proton pump inhibitor (PPI) drug which functions to activate and release sulfonamides or sulfenic acid, thereby inhibiting gastric acid secretion by covalent (irreversible) bonds with cysteine sulfhydryl groups in the H<sup>+</sup>/K<sup>+</sup> extracellular domain -ATPase. Decreased gastric acid secretion results in faster healing of lesions, depending on the dose administered. Omeprazole is given to prevent stomach ulcers due to NSAID administration (Paz *et al.*, 2020). The patient was given a combination of 2 antibiotics namely metronidazole and meropenem. The sensitivity test results for antibiotics from pus culture showed that the highest sensitive number was Meropenem followed by Ceftriaxone, Cefoperazone-sulbactam and Cefotaxime. Meropenem is a broad spectrum antibiotic that can eradicate aerobic and anaerobic bacteria. Metronidazole has good sensitivity against anaerobic bacteria. (Adamson *et al.*, 2019; Arianto & Romdhoni, 2019; Hartedja *et al.*, 2021).

In the second case, a patient was diagnosed with a submandibular abscess. The patient came to the hospital with complaints of pain when swallowing since 1 day ago and was getting progressively worse. Symptoms are accompanied by swallowing pain, difficulty opening the mouth since 1 day ago before coming to the emergency room. Patients also complain of neck stiffness, facial area feels thick. The patient has a history of toothache accompanied by fever. In general, the source of infection in the submandibular space comes from infectious processes from the teeth, floor of the mouth, pharynx, submandibular lymph nodes. Apart from being caused by a dental infection, an infection in the submandibular space can be caused by lymphadenitis, trauma, or surgery and can also be a continuation of another deep neck space infection. The usual signs and symptoms are fever and neck pain accompanied by swelling under the mandible and/or under the tongue, which may fluctuate and trismus is

often found (Litha *et al.*, 2019). Bacterial infections can occur due to endogenous oropharyngeal flora, nose or teeth or skin infections on the scalp, face or spread through the air. The upper anterior neck is the most frequently involved anatomy followed by the submandibular and middle anterior neck. Similarly, cervical and submandibular locations in the upper anterior are the most frequently involved areas. Because the submandibular and deep anterior and posterior cervical nodes have the function of receiving most of the lymphatic drainage from the head and neck, they are involved in a greater number of cases. The most common causes of this infection are poor oral hygiene, low immunity, systemic diseases, etc. Odontogenic infection begins in the dental and periodontal tissues which can spread to the deep anatomical structures of the neck. When bacteria or microorganisms reach the dental pulp, it causes necrosis and induces abscess or pus formation. Once infection is established in the periapical tissues, it traverses the periosteum and passes through a route susceptible to infection. Odontogenic infections, such as abscesses of third molars, are classified according to their morphological location as peritonsillar, pharyngeal, or submandibular infections. In addition, deep neck space infections most commonly arise from foci of infection of the mandibular teeth, tonsils, parotid glands, middle ear or sinuses, and are accompanied by a rapid onset with the development of life-threatening complications, especially airway obstruction (Singla *et al.*, 2022); Yusra & Yani, 2019).

In this second case, the patient looks hard masses and spread bilaterally. In submandibular abscess disease, a unilateral mass is often found with a springy consistency accompanied by fluctuating. This can occur because the cervicofacial area is often affected by the suppurative process. The stages go through an acute phase, chronic cellulite (or chronic inflammatory cellulite), abscess, and phlegmon. Cellulite is the result of an inflammatory process, characterized by vasodilation. Abscess is a manifestation in the form of pus where on clinical examination fluctuations are often found. Abscess manifestations will show normal skin shape that is not tense, erythematous, with fever, tachycardia. Phlegmon has the clinical characteristics of an abscess, but is a large, indeterminate pus. Clinically, massive swelling, hard mass was detected, but still fluctuating (Venter *et al.*, 2021). Complications that can occur in these patients are neck stiffness felt by the patient. Complications that can occur in patients with submandibular abscess are airway obstruction, mandibular osteomyelitis, spread of infection to the nearby deep neck space, mediastinitis and sepsis. The infection appears as a moderate swelling in the submandibular area that spreads to cause larger hardened edema and skin redness. The mandibular angle also seems to disappear, accompanied by pain on palpation and moderate trismus due to involvement of the medial pterygoid muscle (Anggreni Setiawan & Putra, 2020; Rizal Fardani *et al.*, 2022). The progress of the symptoms

& signs experienced by the third patient is probably due to old age so that there is a decrease in the immune system & is susceptible to disease progression. When human age reaches old age, the body's immunity will experience changes, namely a decrease in the immune system such as a reduced number of T cells which is indicated by their susceptibility to disease, produces antibodies that fight their own antigens and leads to autoimmune diseases (Karomah, 2021).

During the treatment period, the patient was given ceftriaxone 2x1, OMZ 2x1, santagesic 3x1, Metronidazole 3x1, inf. RL 20 tpm, Betadin gargling. The drug ceftriaxone was given because ceftriaxone was stronger on organisms isolated from cellulitis, necrotizing fasciitis and Ludwig's angina. Bacterial isolates in severe odontogenic orofacial infections were significantly more sensitive to ceftriaxone than to meropenone which may indicate that ceftriaxone is a better choice as an empiric antibiotic for severe odontogenic infections. The combination of ceftriaxone and metronidazole has been shown to be effective in eradicating the bacteria that cause submandibular abscesses (Adamson *et al.*, 2019; Arianto & Romdhoni, 2019; Hartedja *et al.*, 2021). Considering that the dominant bacterial cause of submandibular abscess comes from dental infection. Odontogenic infections are caused by bacteria that reside in plaque, in the gingival sulcus, and on the oral mucosa. These types of bacteria under normal conditions constitute the normal flora in the oral cavity. The bacteria commonly found are aerobic gram-positive cocci, anaerobic gram-positive cocci and gram-negative anaerobic rods. Giving metronidazole is effective for a narrow spectrum, especially anaerobic bacteria which must be combined with aerobic gram-negative bacteria to achieve maximum results (Hartedja *et al.*, 2021). Giving betadine mouthwash functions as the most widely available broad-spectrum antimicrobial to reduce pathogens. PVP-I is a complex of povidone and iodine which dissolves in water and is known to have strong activity in killing microorganisms (Ferdina *et al.*, 2022). On the third day the patient's condition worsened so that ceftriaxone was replaced with meropenom. Meropenom belongs to the carbapenem group which is a beta-lactam antibiotic like other penicillin antibiotics (cephalosporins and monobactams). They are the most widely used antibiotics worldwide. All  $\beta$ -lactam antibiotics have a similar molecular structure: a beta-lactam ring. Carbapenems have a five-membered ring like penicillin, but the sulfur at C-1 in the five-membered ring is replaced by a carbon atom and a double bond between C-2 and C-3. This antibiotic is capable of inhibiting the formation of peptidoglycan (Aurilio *et al.*, 2022).

Based on the third case report, a patient was diagnosed with a submandibular abscess. The patient came with complaints of swelling in the submandibular area. Other symptoms that are complained of are swallowing pain, lumps, and difficulty opening the

mouth. Past medical history includes toothache in the upper and lower 1st molars since 1 week ago. Physical examination of the neck found a unilateral hard mass in the submandibular area, tenderness was felt by the patient, and the patient could only open his mouth with a size of 2 fingers. Patients with submandibular abscess often present with complaints of swelling under the jaw on one or both sides which is painful. The patient also complained of fever accompanied by other complaints such as painful swallowing and difficulty opening the mouth. Clinical symptoms of submandibular abscess include high fever, neck pain accompanied by swelling under the mandible and/or under the tongue, possibly fluctuating. There may also be pain in the floor of the mouth, trismus, submandibular induration and skin under the chin erythema and edema (Anggreni Setiawan & Putra, 2020). The difference in signs and symptoms felt by the third patient was that in the third patient there was no neck stiffness & the mass was located unilaterally which was different from the previous patient. The patient was given Ringer lactate infusion 20 tpm. In addition, the patient was also given drug therapy in the form of 2x1 meropenem, 3x1 metronidazole, 3x1 santagesic, and 3x1 dexamethasone. The difference from the second patient was that from the beginning the patient was admitted to the ward, the patient was given meropenom therapy from the time he was admitted to going home and was given dexamethasone. The administration of dexamethasone is given as a result in several studies showing that steroids can reduce the length of stay when combined with antibiotic therapy. Used initially for pain control in the setting of edema produced by a bacterial abscess. Steroids were found to produce a synergistic effect in treating abscesses leading to better outcomes (Tansey *et al.*, 2020).

Based on the fourth case report, there were reports of sufferers of deep neck abscess suspected Ludwig's angina with the main complaint of pain when swallowing since 1 week ago, symptoms accompanied by difficulty opening the mouth, neck stiffness, and a thick feeling on the face that had occurred 1 week ago. In the previous medical history, there was toothache for 3 days in the last week. On physical examination, a hard mass like a board was found in the submandibular section, radiating to the neck and even to the shoulders. The patient also complained of pain when the swelling that radiated to the shoulder was pressed, whereas in the neck and submandible when pressed they did not complain of pain. Ludwig's angina or phlegmon is a manifestation of acute cellulitis that occurs in the primary mandibular space, namely the left and right submandibular spaces, submental spaces and sublingual spaces (Rasul & Kawulusan, 2018). Whereas in this patient, there was no cellulitis in the sublingual area so the diagnosis of Ludwig's angina could not be established, but had manifestations of Ludwig's angina.

Ludwig's angina is the most common complication of odontogenic infection. It occupies the

submental, submandibular and sublingual spaces bilaterally and is considered an emergency because of its rapid onset. Ludwig's angina usually originates in the second and/or third lower molars because of the proximity of the apex of the tooth to the submandibular and sublingual spaces which communicate with the submental space and can spread into the pharyngeal space to reach the mediastinum. Ludwig's angina begins as a mild infection and progresses to upper neck induration with pain, trismus, and elevation of the tongue. Symptoms of Ludwig's angina include painful neck swelling, toothache, dysphagia, odynophagia, dyspnea, fever, and malaise. Other signs include swelling of the submental and anterior neck without fluctuation, tachypnea, stridor, trismus, and drooling. High leukocyte count (Chacko *et al.*, 2019). The tripod position suggests airway involvement, which may occur later in the clinical course as respiratory obstruction worsens and there is a risk of losing the airway. As symptoms worsen, patients can lean forward in a tripod position to widen the diameter of their airways. Respiratory distress and failure is characterized by difficulty breathing, stridor, cyanosis, and changes in mental status (Bridwell *et al.*, 2021). During the treatment period the patient was given 2x1 meropenom, 2x1 OMZ, 3x1 santagesic, 3x1 Metronidazole, inf. RL 20 tpm. Then continue evaluating the abscess. The drug administration in this patient that differentiated it from previous patients was that there was no involvement of the drugs ceftriaxone or dexamethasone. This was because in this case it was seen that the abscess had spread to the neck and was spread bilaterally indicating poor progress compared to the previous patient. Extraoral spread of the abscess which aggravated the patient's breathing problems, causing the patient to be referred to the Moewardi General Hospital. The spread of oral infection can spread to surrounding areas such as the neck area (colli) and can even reach distant parts such as the thorax and mediastinum. The spread of infection can be through bacteremia or percontinuum through the surrounding anatomical structures accompanied by toxemia due to pathogenic bacteria. The spread of infection will be compounded by an autoimmune response and dissemination or abscess through the anatomical route. The patient's condition worsened after medical treatment led to incision and drainage of the patient (Rochmah, 2018).

Based on the third case report, a patient was diagnosed with a submandibular abscess. The patient came with complaints of swelling in the submandibular area. Other symptoms that are complained of are swallowing pain, lumps, and difficulty opening the mouth. Past medical history includes toothache in the upper and lower 1st molars since 1 week ago. Physical examination of the neck found a unilateral hard mass in the submandibular area, tenderness was felt by the patient, and the patient could only open his mouth with a size of 2 fingers. Patients with submandibular abscess often present with complaints of swelling under the jaw on one or both sides which is painful. The patient also

complained of fever accompanied by other complaints such as painful swallowing and difficulty opening the mouth. Clinical symptoms of submandibular abscess include high fever, neck pain accompanied by swelling under the mandible and/or under the tongue, possibly fluctuating. There may also be pain in the floor of the mouth, trismus, submandibular induration and skin under the chin erythema and edema (Anggreni Setiawan & Putra, 2020).

Based on the fifth case report reported a patient with a diagnosis of submental abscess. The patient came with complaints of painful swallowing since 2 weeks ago. Other symptoms felt by patients are fever, lump on the chin, difficulty eating. Past medical history of the patient had diabetes mellitus with a GDS of 184. On physical examination, a lump was found under the chin, unilateral, tender and fluctuating. In pyogenic infections, the host's immune response is impaired and infection progresses. This mechanism is the main cause of inflammation in the head and neck region. Pathogens usually arise from necrotic tooth pulp or root, apex and periodontium pathology, infected odontogenic cysts, and pathology associated with fully or partially retained teeth. Necrotic pulp in molars and rarely in premolars is usually the site where infection begins or single root teeth in the maxillary and mandibular anterior segments. The etiological factor in 20-30% of odontogenic infections is periodontitis (Munjali *et al.*, 2022). Odontogenic infection occurs when the oral flora spreads from the alveolar process to the deeper tissues of the head and neck region. Different streptococci (especially alpha-hemolytic streptococci) are the main pathogens of the infection. Space infection pathogens will produce hyaluronidase, streptokinase, and other enzymes that cause the spread of infection and cellulitis. Decreased host defense, increased bacterial resistance, nutritional status of the patient, bacterial virulence as well as socioeconomic status and local factors such as patient hygiene also play an important role in the spread of infection. The sublingual space is also connected to the submandibular space around the posterior border of the mylohyoid muscle. Unilateral submandibular gland infection can spread easily to the sublingual and to the contralateral submandibular and submental spaces (Subudhi *et al.*, 2020).

Patients were given 20 tpm ringer lactate infusion, 2x1 ceftriaxone, 3x1 dexamethasone, 3x1 santagesic, and 3x1 metronidazole. Patients were given management for DM comorbidities, namely novorapid 10:10:10 and metformin 3x1. On the fifth day the patient stopped giving dexamethasone. This patient was not given meropenem, and OMZ. Dexamethasone is a potent corticosteroid with anti-inflammatory, immunomodulating, analgesic and antiemetic effects. In the perioperative setting, low-dose dexamethasone (<10 mg) is given primarily for prophylaxis of nausea and vomiting. A quantitative systematic review concluded that a single prophylactic dose of dexamethasone has a

significant antiemetic effect without clinically relevant toxicity. Dexamethasone is a potent corticosteroid with anti-inflammatory, immunomodulating, analgesic and antiemetic effects. In the perioperative setting, low-dose dexamethasone (<10 mg) is given primarily for prophylaxis of nausea and vomiting. A quantitative systematic review concluded that a single prophylactic dose of dexamethasone has a significant antiemetic effect without clinically relevant toxicity. Although the benefits of dexamethasone treatment are well documented, the adverse effects associated with glucocorticoid administration are less well defined. Administration of a single low-dose dexamethasone at induction of anesthesia can induce intraoperative and postoperative hyperglycemia. A small number of previous studies showed that blood glucose concentrations increased after administration of dexamethasone (8-14 mg) (Rochmah, 2018). Therefore dexamethasone administration was discontinued due to an increase in the patient's GDS.

Complications that occur if this disease is not handled properly then the infection can spread upwards through various foramen such as foramen ovale, foramen jugularis and foramen lacerum, present at the base of the skull, will cause brain abscess, meningitis or sinus thrombosis. It can also radiate down the carotid sheath to the mediastinum; a route Mosher refers to as the "Lincoln Highway" in the neck (Singla *et al.*, 2022). Other complications that may occur include airway obstruction, descending mediastinitis, pericarditis, pleural empyema, cavernous sinus thrombosis, sepsis, respiratory disorders, disseminated intravascular coagulation, pleuropulmonary suppuration, and hematogenous spread to distant organs (Kataria *et al.*, 2015). Infection can spread from the deep cervical space to the mediastinum via the retropharyngeal, vascular, and pre-tracheal spaces, and downward spread of DNI can be accelerated by gravity, breathing, and negative intrathoracic pressure (Ma *et al.*, 2019).

In cases of deep neck abscesses, if they do not respond to medical treatment, surgical management can be given. Clinical prediction scores use simple criteria to quickly determine whether a patient with deep neck abscess requires incision and drainage. The doctor will evaluate the results with reference to the preoperative clinical examination and CT findings, and find that fever, leukocytosis, induration or elevation of the floor of the mouth, and elevation of the tongue, but not trismus and dysphagia, a hypodense area > 2mL, and no improvement in either signs & symptoms are clinical predictors of incision and drainage (Ban *et al.*, 2018). Critical aspects of the development of a deeper abscess are the possibility of airway obstruction and the rapid spread of persistent infection from the neck to the mediastinum. Ultrasonography (US) and computed tomography (CT) of the neck are the standard imaging methods for confirming the diagnosis and evaluating the extent of infection prior to surgical management. The

treatment plan for a deep abscess includes surgical drainage of the involved area. room to ensure adequate ventilation and systemic administration of broad-spectrum antibiotics. US and/or CT procedures are helpful in differentiating between an abscess and cellulitis and for making decisions about possible treatment options. Computed tomography has advantages over ultrasound in visualizing the precise extent of inflammation, diagnosing parapharyngeal abscesses, and identifying complications (Rzepakowska *et al.*, 2021).

## CONCLUSION

Patients with deep neck abscess who were treated at the Cempaka and Teratai inpatient rooms at Karanganyar Hospital for the period April - May 2023 with the most characteristics of male sex. The age range obtained was 22-78 years. The most common abscess is submandibular followed by peritonsillar, submental, and Ludwig's angina. The most common cause or etiology that can cause deep neck abscess is toothache. Abscesses are formed from normal flora that develop in the body. There were 2 patients who had submandibular abscess, 1 patient who had deep neck abscess suspected Ludwig's angina, 1 patient had submental abscess. Danger signs were found, namely pain swallowing (odinophagi) in 5 patients, pain on turning in 3 patients, trismus in 3 patients, voice changes in 1 patient, and hypersalivation in 1 patient.

The average length of treatment is 5 days or even less. Risk factors that can increase the occurrence of complications include DM in 2 patients, hypertension in 1 patient. Patients in this case were given antibiotics for their management and all showed improvement. Drainage and incision was performed on one of our patients who had a submandibular abscess with the aim of preventing complications that could harm the patient, especially for the patient's respiratory system. There were no complications found in the five patients we treated.

Treatment of neck abscesses can be given antibiotics such as ceftriaxone and metronidazole or meropenem. For pain, an anti-inflammatory is given, for inflammation and anti-inflammatory, dexamethasone is given. If the patient has complaints in the abdomen such as gastroesophageal reflux (stomach acid), OMZ (Omeprazole) can be given. Then incision and drainage can be done if necessary. Treatment can be chosen based on the presence or absence of warning signs and signs of complications.

Based on this research, it is suggested to the public to maintain dental health and regulate their diet so that the risk of suffering from DM and hypertension is reduced, as well as the risk factors for complications from deep neck abscesses can also be suppressed.

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