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Review

Surgical and Non-Surgical Maxillofacial Infections

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Abstract

One of the most common infectious processes known to ancient and modern medicine alike, the majority of these illnesses are odontogenic in identity. The majority of these infections can be treated surgically, including drainage, endodontic treatment, and exodontia in order to be controlled without resorting to antimicrobials. Due to the intricate anatomy involved and the potential for catastrophic medical problems even with expert therapy, severe space infections pose a difficult dilemma for maxillofacial surgeons. Because of the proximity of the submandibular and submental areas, infections can also affect several spaces. Streptococcus pyogenes, a Gram-positive aerobic pathogen, was found to be the most frequent organism linked to orofacial infection. Possibly deadly consequences that may appear after MSI include septicemia, airway compromise, cavernous sinus thrombosis, necrotizing fasciitis, and mediastinitis. Deep space maxillofacial and cervicofacial infections should be managed according to certain principles, including immediate and prompt evaluation of the infection's extent based on anatomical location, rate of development, and possibility for airway impairment. Penicillin is still the preferred empiric medication, at least for outpatients, according to recent data on the antibiotic sensitivity of the most frequently identified bacteria of odontogenic infections. With respect to surgical intervention, many surgeons have been shown to favor tracheotomy to endotracheal intubation for maintaining the airway in patients with airway blockage. In contrast to those who receive endotracheal intubation, patients with severe cervicofacial infections who receive tracheotomy for airway support have been shown to have a shorter stay in critical care, experience fewer problems, and pay less overall. After assessing the host immunity, early definite operative therapy is essential for halting the infection's spread.

Keywords: *maxillofacial infection, cervicofacial infection, fascial space, management*

Introduction

Since humans have existed, there have been cases of maxillofacial infections. One of the most common infectious processes known to ancient and modern medicine alike, the majority of these illnesses are odontogenic in identity (1, 2). The majority of these infections can be treated surgically, including drainage, endodontic treatment, and exodontia in order to be controlled without resorting to antimicrobials (3, 4). As the blood flow is recovered, surgical incision and drainage may also eliminate the need for an antibiotic or boost its effectiveness. However, antibiotic therapy is recommended when an acute bacterial infection has worsened or when patients might stand to gain from antimicrobial therapy (3, 4). Ninety to ninety-five percent of all orofacial infections are thought to start in the teeth or the tissues that support them (5). Additionally, periapical inflammation, such as acute periapical periodontitis or a periapical abscess, characterizes roughly 70% of odontogenic infections. The periodontal abscess is the second most typical odontogenic infection type (6). The majority of these infections are purulent, according to a microscopic analysis to detect the presence of microorganisms in cases with suspected wound infections. When antimicrobial treatment has to be initiated before laboratory results findings are obtained, Gram stain of the specimen spread on a slide can be revealed in under ten minutes and can provide hints to the possible identification of the microorganism, directing adequate antibiotic treatment. The majority of pathogens need about 24 hours to proliferate in vitro. Additionally, Giemsa's stain can be added to it to enhance the detection of organisms (5). To identify which antimicrobial agents bacteria or fungi are susceptible to, antibiotic sensitivity tests are utilized. Antimicrobial susceptibility tests can help the doctor decide which antibiotics and what dosing to use for infections that are challenging to treat (7). The development of a localized odontogenic infection into a maxillofacial space infection (MSI) can be attributed to anatomic, microbiological, and host tolerance variables as well as a host's diminished ability to fight off infection (8). Due to the intricate anatomy involved and the potential for catastrophic medical problems even with expert therapy, severe space infections pose a difficult dilemma for maxillofacial surgeons. Possibly deadly consequences that may appear after MSI include septicemia (9), airway compromise (10), cavernous sinus thrombosis (11, 12), necrotizing fasciitis (13), and mediastinitis (14). Deep space maxillofacial and cervicofacial infections should be managed according to certain principles, including immediate and prompt evaluation of the infection's extent based on anatomical location, rate of development, and possibility for airway impairment. After assessing the host immunity, early definite operative therapy is essential for halting the infection's spread. The application of drains, professional supportive therapy, and ongoing infection treatment are discussed. Based on the site of origination and the aetiologic organism, orofacial infections frequently move predictably from one anatomical region to another. The oral and maxillofacial surgeon is an expert in the treatment of these situations because of their capacity to anticipate the clinical course of deep space infections of the head and neck.

Methodology

This study is based on a comprehensive literature search conducted on October 27, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about surgical and non-surgical maxillofacial infections. There were no restrictions on date, language, participant age, or type of publication.

Discussion

Odontogenic infections are the most common type of head and neck infections among adults (8). Odontogenic infections contribute to MSI in the range of 50–89% in reports from different parts of the world. Studies have shown that orofacial infections mostly affect patients in their third and fourth decade of life. Fating *et al.* reported that orofacial infections are seen more often in these patients, and Kityamuwesi et al. reported the mean age of the patients as 29.5 years and most patients (73.1%) were younger than 35 years, which is lower than values recorded in other studies (15, 16). In 185 cases of deep neck infections in a Taiwanese sample population, Huang *et al.* found 50% odontogenic infection; in 212 cases of MSI in a Chinese sample, Zhang *et al.* showed 56.1%; and in 121 incidents of Ludwig's angina in a Mexican sample of patients, BrossSoriano *et al.* reported 89% (17-19). According to Parhiscar and Har-El from the US, the prevalence of odontogenic causes among cervicofacial abscesses has been rising over time

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(2). These findings suggest that odontogenic infections have not been as well prevented and treated as other MSI-causing conditions such tonsillopharyngitis and lymphadenitis. Antibiotic therapy is an addition to definitive treatment for odontogenic infections, which cannot be managed with antibiotics solely. In many cases, the patient is seriously at risk for infection advancement if they self-medicate and their primary dentist or doctor fails to offer final care. Our analysis of 137 severe odontogenic infections over a period of five years highlights the necessity of raising primary care physicians' knowledge of odontogenic infections. It is necessary to advocate for public health initiatives to prevent odontogenic infections.

MSI are a result of a protracted disease course. Most individuals experience reoccurring symptoms long before a space infection appears. According to numerous research, swelling and discomfort are the most frequent presenting symptoms in MSI patients. As the cases covered in these research are space infections which have spread beyond the boundaries of the jaw, swelling is a frequent problem. Despite having had periodic pain previously, 98% of the patients, according to Bridgeman *et al.* only sought medical attention when a sudden onset of edema occurred. For the sensation of odontogenic pain, they had either not sought therapy or had gotten insufficient care (20). One study from Iraq found that 50.4% of the cases had progressed to the trismus stage, indicating that the infection had spread to the masticatory areas and might suddenly obstruct the upper airway. In 26% of these individuals, dyspnea was present, indicating the onset of airflow limitation. Patients and dentists frequently downplay the importance of trismus and blame it on other factors. Trismus in those who have an odontogenic infection is a warning sign that calls for a thorough check for symptoms and indications of upper airway compromise, such as tongue protrusion, stridor, trouble swallowing saliva, and shortness of breath.

A pulpal focus is one of the most typical sources of the MSI. After the entire pulp chamber is damaged, a variety of anaerobic bacteria inhabit the root canals. When these pathogens and their poisonous byproducts penetrate the peri-apical tissue through the apical foramen, they cause acute inflammatory response and pus development, which leads to abscess development (21). In close contact to the tooth roots, this pus travels to the maxillofacial regions. The most frequently affected spaces are the submandibular area and the lower third molars are the most frequently affected teeth. Children typically have maxillary infections, whereas adults typically have more mandibular infections (8, 17, 22). According to reports, the submandibular area is the mandibular space that is most frequently affected by MSI (18, 23, 24). According to certain studies, the mandibular buccal, lateral pharyngeal, and pterygomandibular spaces are the most common. Our study found a low prevalence of pericoronitis leading to serious infection (5%), likely because pericoronitis typically affects younger people and is frequently treated right away due to its severe symptoms. In many studies, the greater proportion of multiple space infections relative to single space infections is likely due to the delay in presentation to the treatment institution. Studies have generally shown that patients with head and neck infections of odontogenic origin have more multiple space infections than single space infections (25).

The sub-mandibular space was observed to be the most frequently infected fascial space, likely as a result of the apices of the mandibular molars, especially the second and third molars, being below the attachment of the mylohyoid muscle and the lingual cortical plate being thinner than its buccal cortical counterpart. Most frequently, these teeth's odontogenic infections will penetrate the lingual plate, infecting the space below the mandible. According to Bahl *et al.* both single and multiple fascial space infections most frequently impacted the submandibular area (26). According to Ismi *et al.* the submandibular space is the most frequently affected area in this sort of infections since the apices of the second and third lower molars advance to the interface of the mylohyoid muscle with the mandibular corpus, which is close to the submandibular and parapharyngeal spaces (27).

Because of the proximity of the submandibular and submental areas, infections can also affect several spaces. *Streptococcus pyogenes*, a Gram-positive aerobic pathogen, was found to be the most frequent organism linked to orofacial infection. Since *Streptococcus* is the most abundant commensal genus of the oral cavity, Celakovsky *et al.* and Kim *et al.* found that this strain of bacteria was the most frequently isolated microorganism, and that *Streptococcus* spp. was the most frequent (54%) (28, 29). However, Sobotka *et al.* showed that anaerobic bacteria were the most often detected bacterium in odontogenic infections. This is in contradiction to the other findings (30).

According to Veronez *et al.* 37% of cases required general anesthesia for the surgical procedure, whereas

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63% of cases were treated via local anesthetic because of the potential dangers of general anesthesia as well as the added expense and time (31). The majority of patients presented at a late stage due to either neglect or poor planning by dentists, who typically limit their management to the medical part while ignoring surgical aspects, or because they underwent submandibular fascial space infections, which are drained extra orally. This finding was confirmed by numerous studies.

It was possible to determine the synergistic roles that anaerobes and streptococci play in these illnesses because to improved culturing methods. Over 60% of the species detected in these illnesses, as determined by molecular approaches for identifying unculturable pathogens, cannot be cultivated in a lab. In the head and neck area, antibiotic resistance is becoming more and more of an issue. Penicillin is still the preferred empiric medication, at least for outpatients, according to recent data on the antibiotic sensitivity of the most frequently identified bacteria of odontogenic infections. Erythromycin and the new macrolides are ineffective against oral streptococci and anaerobes, although azithromycin's accumulation in phagocytes potentially renders this macrolide beneficial. There hasn't been agreement on a conventional antibiotic treatment, primarily because there isn't enough clinical trial evidence to favor one regimen over another. Clindamycin continues to be beneficial in severe (hospitalized) and persistent instances. The utility of some newer antibiotics, such as new fluoroquinolones and cephalosporins, in treating odontogenic infections and the fact that some older antibiotics are no longer effective can also be inferred from these findings. Contrary to Chunduri *et al.*, who found that amoxicillin was effective against 90% of Gram-positive cocci and 79% of Gram-negative rods, Sulaiman et al study in Iraq found that netilmicin, cefoperazone, and rifampicin had the highest susceptibilities (32, 33). In contrast to a previous study's findings, amoxicillin/clavulanic acid resistance was shown to be rather high when compared to resistance to other antibacterial drugs. This could be as a result of widespread antibiotic misuse, which has given rise to resistant microbial strains. Trismus is characterized as a motor disturbance of the trigeminal nerve, particularly spasm of the masticatory muscle with difficulties opening the jaws. Trismus is a product of the inflammatory response to orofacial infection assessed qualitatively dependent on the patient's own finger (34). The majority of cases with odontogenic infections experience this restriction in mouth opening, which typically gradually improves over the course of the follow-up period as a result of the medical care and physical therapy provided to these individuals. According to Ishfaq *et al.* and Santosh *et al.*, the majority of the patients had mild (63%), moderate (23%) or severe (13%) trismus (35, 36).

Many surgeons have been shown to favor tracheotomy to endotracheal intubation for maintaining the airway in patients with airway blockage. In contrast to those who receive endotracheal intubation, Potter et al's study found that patients with severe cervicofacial infections who receive tracheotomy for airway support have a shorter stay in critical care, experience fewer problems, and pay less overall (37). One North Indian study found that patients who underwent tracheotomies for respiratory support experienced a smooth recovery (38). Regardless of the identification of pus, surgical drainage was done on all research participants. The question of whether drainage is necessary when a patient simply cellulitis has is frequently discussed. The problem of treating cellulitis differently stems from a time before the development of antibiotics, when there was a possibility that surgical intervention would make the infection worse (8, 39).

When tissue spaces show oedema but do not appear to harbor pus on clinical or radiographic inspection, the care of cervicofacial infection is debatable. It is noteworthy that, in this situation, 60% of respondents in one study said they would treat patients clinically with antibiotic therapy, including or without the addition of steroids, and that the other 40% would choose investigation and drainage (potentially with the objective of avoiding the development of abscess) (40). While it is preferable to avoid intervention wherever feasible, this has to be weighed against the hazards of a pus accumulation that may have been prevented from developing. Picking such a choice may be influenced by the anatomic location of the relevant fascial area. In contrast to exploring oedema in the parapharynx, clinicians may feel better at ease treating oedema in the buccal region non-surgically.

Conclusion

It happens frequently for maxillofacial infections to start in the oral cavity. However, the same illness in the head and neck region can occasionally become life-threatening for the affected patient if untreated or poorly managed. When such a circumstance arises, it is the clinician's duty to provide quick treatment. Certain well-

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documented consequences of a carious tooth are dentoalveolar abscess, facial cellulitis, and Ludwig's angina, but less frequently, diseases like a temporal abscess may result from an odontogenic infection. The vast majority of infections can be effectively handled with surgical treatment, such as providing pulpal access, incision and drainage, along with antimicrobial medication.

Disclosure

Conflict of interest

There is no conflict of interest

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Ethical consideration

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Data availability

Data that support the findings of this study are embedded within the manuscript.

Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

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