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Review Article

Contemporary investigative approaches in maxillofacial space infections: A review

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ABSTRACT:
Era of Odontogenic infections is common in the oral surgical practice and their treatment should be a prompt standard procedure for every oral surgeon. For optimal management of septic intraoral problems, the practitioner must understand the underlying causes and etiologies of odontogenic infections. The advent and strategic use of antibiotics have decreased the incidence of deep neck infection. When a deep neck infection does occur, however, it can be the cause of significant morbidity and death, resulting in airway obstruction, mediastinitis, pericarditis, epidural abscesses, and major vessel erosion. Therefore, the early diagnosis of infection and insight investigative clarity is very important in head and neck infections.
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INTRODUCTION

Odontogenic infections have become one of the major sources of fascial space infections in the head and neck region, which have the potential to spread via the fascial spaces.[1] They can compromise the vital structures in this region or involve the distant structures. Although they are spatially confined, the purulent material may spread deeply into the contiguous fascial spaces such as the submandibular, sublingual, pterygomandibular and the buccal spaces.[2] Severe complications can result if the infection is not recognized and treated promptly and properly. The tendency to underestimate the severity and the extent of the abscess may be because of the multiple cervical fascial layers, the numerous portals of entry of the infection and the proximity of the vital structures.[3] The anatomical structures of the face and neck are included in the spaces which are bound by the fasciae and the understanding of this is essential for the diagnosis and the treatment of infections, because the fascia acts as an effective barrier.[4] Odontogenic infections occasionally spread beyond these barriers.[5] The location of abscesses in patients with such infections is commonly determined by physical examinations alone, but the abscesses of the deep subcutaneous layer can be difficult to locate.[6] Odontogenic infections, if they are not properly controlled, can spread to the adjacent head and neck fascial spaces. The spread could be very serious and rapid and it can lead to a critical airway obstruction; therefore, it requires an urgent management in some cases.[1] More serious complications such as life-threatening airway obstructions, mediastinitis, pericarditis, internal jugular vein thrombosis, epidural abscess, and carotid artery erosion have also been reported.[7] Traditionally, the open surgical incision-

and-drainage procedure with an appropriate administration of antibiotics has been the mainstay of the treatment. However, an open surgical drainage may potentially carry the risk of inadvertent injuries to the neighbouring vital structures, such as the internal jugular vein, the carotid artery, and the cranial nerves, and subsequently cause devastating complications.[8]

IMAGING TECHNIQUES:

Various imaging modalities play an important role in the diagnosis of inflammatory diseases of the head and neck.[9] Plain radiographs, computed tomography (CT) scans, magnetic resonance imaging (MRI) and ultrasonography (USG) are the valuable diagnostic aids.[10] These powerful diagnostic tools have minimized the therapeutic dilemma. Though they are readily available, the plain radiographs pose a problem in yielding soft tissue details. The drawbacks of CT include its high costs, technique sensitivity, unavailability in all health care centres, increased doses of ionizing radiation (2-10 rd/slice), its inability to differentiate the soft tissues of similar radiodensities with vastly different chemical compositions and artifacts from any metallic substances and from motion of the patient.[11] The drawbacks of MRI include its high costs, technique sensitivity, a longer scan time, unavailability of the machines to the average physicians, danger to the magnetic information storage, relatively thick sections, and susceptibility to motion artifacts.[12] Thus, the images may suffer from the effects of patient motion. The high static magnetic field also poses a danger to those individuals with cardiac pacemakers, neurostimulator units, and intraocular foreign bodies.[13]

ULTRASONOGRAPH(USG):

It has recently been illustrated that USG is not only of diagnostic value in the management of abscesses in the maxillofacial region, but that it can also can be used therapeutically.[14]A study was done by Misurya et al., on 25 patients who presented with fascial space infections of the head and neck region. They were evaluated clinically and ultrasonographically and it was concluded that the addition of the ultrasonographic findings to the findings of the clinical examination, increased the sensitivity and the specificity for the detection of abscesses, it increased the diagnostic accuracy and it also helped in a proper treatment planning.[15]The USG method could be considered as a quick, widely available, inexpensive, and relatively painless one. It can be repeated as often as necessary without any risk to the patient.[16] Ultrasonography was reported to be a useful tool in detecting abscesses, but it could not differentiate an abscess from the surrounding blood vessels. A combination of colour Doppler USG with a grey scale solved this problem.[17] An intraoral USG (IOU) was reported to differentiate a peritonsillar abscess from cellulitis. IOU is a relatively simple and a safe procedure to perform, the learning curve is short, and the patients tolerate the procedure well.[18] An intraoral approach could be adopted in the future, to assess the deeper fascial space infections, such as those in the peritonsillar, parapharyngeal and the sublingual spaces.[19]

CONTRAST-ENHANCED CT

Contrast-enhanced CT images clearly delineate the position and size of the lesion as well as its relationship with the adjacent anatomic structures. Also, it is useful in evaluating any changes in the upper airway in patients with trismus or with parapharyngeal or retropharyngeal space abscess. The images provide valuable information in deciding the method for maintaining the airway such as endotracheal intubation, cricothryoidotomy, or tracheostomy. On CT images, the attenuation level of space abscess is between that of water and soft tissues. When a contrast medium is used, a rim enhancement around the abscess area is observed. Swelling of the adjacent muscles signifies the spreading of inflammation in the surrounding area. In the present case, the contrast-enhanced CT was used to identify the spreading of pus into deeper spaces after initial treatment, and for guiding extensive incision and drainage under general anesthesia to prevent further expansion. Also, follow-up CTs were used to evaluate the edema of the airway and to determine the timing for endotracheal extubation.[20]

MAGNETIC RESONANCE IMAGING (MRI):

MRI was superior to CT in regard to lesion conspicuity, number of anatomic spaces involved, extension, and source. CT was superior to MRI in the detection of intralesional gas and calcium and showed fewer motion artifacts. MRI has a better view of soft tissue than CT without exposure to radiation. In addition, MRI is more accurate than CT in detecting complications from deep neck infections such as internal jugular vein thrombosis or erosion of the abscess into the carotid sheath. Backdraws of MRI include longer scanning time, lack of availability, higher cost, and the potential for claustrophobia**.**[21]

APPROACH TO IDENTIFICATION OF PUS SAMPLES:

Smear studies of gram staining: Aerobic culture, Anaerobic culture[22]

AEROBIC CULTURE:

For aerobic culture the samples are inoculated on Mac-Conkeys agar, blood agar, and nutrient broth. After overnight inoculation the plates were observed for colony formation. The colonies are identified by gram staining and biochemical tests. For gram positive cocci catalase, bacitracin sensitivity, optochin sensitivity, coagulase test and growth in 6.5 % sodium

chloride are used. For gram negative bacilli oxidase test, catalase test, indole test, urease test, citrate test and triple sugar iron are used.If no growth was observed after the first culture, subcultures from nutrient broth was made on Mac-Conkey's agar, blood agar and looked for growth after overnight incubation. Growth was identified using appropriate biochemical tests.

ANAEROBIC CULTURE:

For anaerobic culture, sample are inoculated into plain blood agar, kanamycin and vancomycin blood agar, bile esculin agar and incubated anaerobically using gas pack, in anaerobic jar for 47–72 h. The plates are observed for colony formation.The colonies are identified by gram's stain morphology, hemolysis, and sensitivity to antibiotics like Penicillin, vancomycin, kanamycin, colistin, growth in bile, indole test, pigmentation, lipase, catalase and sodium polyethanol sulphonate and colonies are tested for aero-tolerance.If no growth was observed after first culture, subculture was done from Brain heart infusion broth on plain blood agar, bile esculin agar and identified as mentioned above.

Unique paradigm of clinical features that anticipates most obvious space infection

- Buccal space infections – These arise primarily from mandibular or maxillary bicuspid or molar teeth, the apices of which lie outside of the buccinator muscle attachments. They are readily diagnosed because of marked cheek swelling but with minimal trismus or systemic symptoms
- Canine space infections – These originate from the maxillary incisors and canines and manifest as dramatic swelling of the upper lip, canine fossa, and frequently the periorbital tissues Pain is usually moderate, and systemic signs are minimal. Occasionally, direct extension of infection into the adjoining antrum leads to purulent maxillary sinusitis.
- Submental space infections – These originate from a mandibular incisor that perforates below the mentalis muscle. The chin appears grossly swollen and is firm and erythematous.
- Masticator space infections – These infections typically originate from the third molar tooth to involve the masticator spaces consisting of the masseteric, pterygoid, and temporal space components.. These spaces intercommunicate with each other, as well as the buccal and deeper peripharyngeal fascial spaces The clinical hallmark of infection is trismus with pain in the area of the body or ramus of the mandible Swelling may not be prominent since the infection is beneath large muscle masses. When present, swelling tends to be brawny and indurated, suggesting the possibility of cervicofacial actinomycosis or mandibular osteomyelitis.
- Temporal space infections – These infections typically originate from the posterior maxillary molar teeth. Swelling may be limited to the preauricular region and an area over the zygomatic arch.As infection progresses, the cheek, eyelids, and whole side of the face may be involved. Infection may extend directly into the orbit via the inferior orbital fissure and produce proptosis, optic neuritis, and abducens nerve palsy
- Infratemporal space infections – An infratemporal space infection usually originates from the third maxillary molar tooth. Clinically, marked trismus and pain are present, but very little swelling is observed early in the course. Late manifestations are similar to those of temporal space infections, including extension into the orbit through the inferior orbital fissure. Infection may also extend internally to involve an area close to the lateral pharyngeal wall, resulting in dysphagia.
- **Oropharyngeal, peritonsillar, parotid, and submandibular abscesses include** sore throat and trismus, unilateral erythema and swelling of face and neck purulent oral or pharyngeal exudate pooling of saliva asymmetry of the oropharynx submandibular or cervical lymphadenopathy. Trismus is due to pressure or infection of the muscles of mastication (masseter and pterygoids). Dysphagia and odynophagia are secondary to inflammation of the cricoarytenoid joints. Dysphonia and hoarseness indicate involvement of the tenth cranial nerve. Unilateral tongue paresis indicates involvement of the twelfth cranial nerve. Stridor and dyspnea signify airway obstruction and may indicate spread of infection to the mediastinum. Unexplained bruising or bleeding in the neck, oral cavity, nose, or ear may suggest carotid sheath involvement with mycotic aneurysm of the internal carotid artery.

ANTIBIOTIC SENSITIVITY TESTS:

Antibiotic sensitivity was done by Kirby-Bauer disk diffusion method for the following drugs: Penicillin G, Ampicillin, Amoxycillin, Amoxycillin-Clavulanic acid, Cotrimaxazole, Cefotaxime, Cephalexin, Gatifloxacillin, Gentamycin, Amikacin, Doxycycline, Metronidazole, Erythromycin, Roxythromycin, Clindamycin

CONCLUSION

In conclusion, early diagnosis and treatment is important for a good prognosis of head and neck space infections. When the infection spreads to the deep neck area, especially contrast-enhanced CT and USG; would be useful to observe every facial space and to locate abscesses effectively in the head and neck area. Alleiviate use of cutting edge technology will make promising percepective of investigation.in

wide arena of recent technology making feasible for every possible good prognosis.More than an insight and its application of investigation helps to decide the treatment regimen.

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