

Invigorating Sound: A Potent Diagnostic Tool for Maxillo-Facial Infections

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ABSTRACT

Aim: To assess the role of ultrasonography as a diagnostic tool to differentiate cellulitis from abscess of the maxillofacial region.

Materials and methods: Twenty patients (11 male and 9 female) reporting to Meghna Institute of Dental Sciences, Nizamabad, Telangana, India during the period of 2015-2016 presenting with signs and symptoms of maxillofacial space infections were included in the study. All the patients were studied clinically, radiographically and ultrasonographically.

Results: In all the cases, the spread of infection was odontogenic in nature. Ultrasound was accurate in assuming the exact location, an extent of spread and presence of pus collection.

Conclusions: Ultrasonography is an inexpensive and non-invasive diagnostic technique that should be used to supplement clinical examination in patients with superficial fascial space infection.

Keywords: Abscess, antibiotics, cellulitis, incision and drainage, odontogenic infections, ultrasonography.

INTRODUCTION

Odontogenic Infections have the potential to spread through the fascial tissue planes of the head and neck region to compromise the vital structures and are frequently encountered in day to day practice of a dentist. These infections often respond to surgical and antimicrobial management if diagnosed and treated appropriately. [1] In the case of acute odontogenic infections it is often difficult to define its exact location and diagnose whether the inflammatory process is in the stage of cellulitis that can be treated by antibiotics alone or abscess formation which requires primary evacuation of pus and administration of antibiotics. [2]. Although spatially confined, purulent material may spread deeply into contiguous fascial spaces

which results in severe complications like Mediastinitis, intracranial abscesses, and parapharyngeal spread with airway obstruction. Thus, early diagnosis and treatment are imperative.[3]

The anatomical location of abscess in patients with odontogenic infection is commonly determined by physical examination, but abscess of deep subcutaneous layer can be difficult to diagnose [4]. A relatively blind surgical incision and drainage of an abscess based on clinical diagnosis usually results in excessive harm, unnecessary extensive incisions, excess time, and failure to locate and evacuate the abscess cavity [5]. Various diagnostic tools are available which have minimized this therapeutic dilemma for dental surgeons to

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precisely diagnose and delineate the extent, and location of the lesion [6]. Plain radiographs do not provide good definition of soft tissues [7]. Computer tomography (CT) scans and magnetic resonance imaging (MRI) are effective in diagnosing inflammatory conditions but are expensive and, have some disadvantages [8].

Fluids return no echoes and thus ultrasonography is very sensitive in detecting fluid collection so diagnostic accuracy has significantly improved with the use of ultrasonography. It saves the patients from unnecessary drainage procedures and ensures fewer errors that will occur if abscesses were mistaken as cellulitis and vice versa. [9] In light of all these factors, the aim of the present study was to evaluate the use of ultrasonography as a diagnostic tool for fascial spaces infection in maxillofacial region.

MATERIALS AND METHODS

Twenty patients reporting to Meghna Institute of Dental Sciences, Nizamabad, Telangana, India during the period of 2015-2016 presenting with signs and symptoms of maxillofacial space infections, were included in the study. A detailed history, clinical and radiographic examination of the swelling was carried out in a systematic manner. Swellings with history of short duration, diffuse margins, lack of fluctuancy and inflamed overlying skin were clinically diagnosed as cellulitis. Well localized swellings with history of longer duration and presence of fluctuancy were diagnosed as abscess.

Ultrasonography

If ultrasound images showing ill-defined edges, heterogeneous pattern, hypoechoic intensity no collection and only increase in thickness of subcutaneous tissue and muscle involved, then the diagnosis was made as **cellulitis**. (Figure.1)

If ultrasound images showing well-defined edges, hypoechoic intensity collection were identified, diagnosis was made as **abscess**. (Figure.2) Dimensions of abscess cavity, amount of pus collected, and depth of the center of the abscess cavity from the skin surface were recorded.

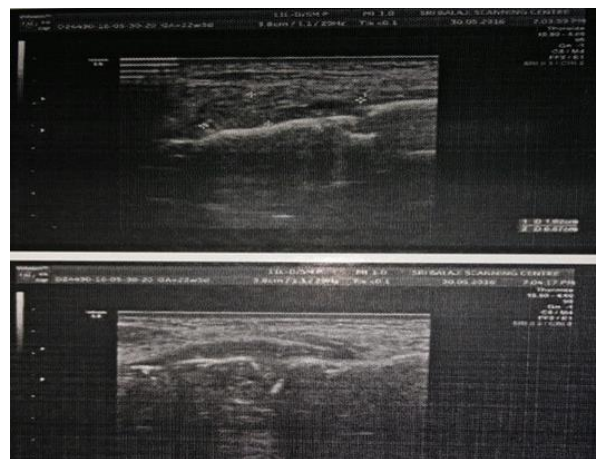


Fig 1: ultrasound images showing ill-defined edges, heterogeneous pattern, hypoechoic intensity no collection and only increase in thickness of subcutaneous tissue and muscle involved, then the diagnosis was made as **cellulitis**



Fig 2: ultrasound images showing well-defined edges, hypoechoic intensity collection were identified, diagnosis was made as abscess.

RESULTS

Of all the 20 patients, 8 patients were diagnosed with cellulitis and the remaining 12 patients with abscess in the maxillofacial region. In all the patients, the spread of infection was odontogenic in nature. [Table 1]

Table 1: Showing staging of the Maxillo-facial space infections

Staging	Number of patients	Percentage (%)
Cellulitis	8	40
Abscess	12	60
Total	20	100

Four different age groups were taken in the study ranging from 15 years to 45 years and above. The highest incidence of space infections were noticed in individuals of age 35-45 years followed by 25-35 years, least was seen in individuals of age 15-25 years. [Table 2]

Table 2: Age wise distribution.

Age	15-25	25-35	35-45	Above 45
Cellulitis	1	3	3	1
Abscess	2	3	4	2
Total	3	6	7	4

The incidence of space infections in the head and neck region of male to female ratio was 1.2:1 (table 3) showing predilection to male patients. [Table 3]

Table 3: Sex distribution.

Group	Male	Percentage (%)	Female	Percentage (%)
Cellulitis	5	45.5	3	33.3
Abscess	6	54.5	6	66.7
Total	11	100	9	100

The present study revealed that out of 20 cases of space infection 16 were diagnosed as abscess and 4 were diagnosed as cellulitis clinically, but ultrasonography had revealed 12 cases as abscess and 8 cases as cellulitis and radiographically all 20 were diagnosed as abscess. [Table 4]

Table 4: Comparison Between The Clinical Vs USG vs radiological Diagnosis.

	Clinically	Ultrasonographically	Radiologically
Abscess	16	12	20
Cellulitis	4	8	0
Total	20	20	20

The present study also revealed 100% sensitivity and specificity of ultrasound in diagnosing and differentiating cellulitis from abscess. [Table .5]

Table 5: Comparison of sensitivity and specificity Between Clinical Vs USG vs radiological Diagnosis.

	Clinically	Ultrasonographically	Radiologically
Sensitivity	100%	100%	100%
Specificity	50%	100%	0%
Positive Predictive value	100%	100%	100%
Negative Predictive value	75%	0%	0%
Diagnostic accuracy	80%	100%	60%

DISCUSSION

Odontogenic infections are one of the major sources of space infections in the head and neck region. These infections spread through different tissue planes involving one or more spaces and cause swellings in the maxillofacial region. Prompt diagnosis and management are necessary to prevent life threatening complications such as mediastinitis, meningitis, cavernous sinus thrombosis.[10] Topazian et al.[11] conducted a study on the etiology of the facial space infections of most of inflammatory swellings which occurs either in or around the jaws and came to a conclusion that dental caries is the underlying cause.

The examination of inflammatory facial swellings was largely restricted to clinical techniques of evaluation, such as inspection and palpation.[12] However, clinical examinations alone is often difficult to be determined because of the complicated anatomic structure of the head and neck. Especially in spaces such as the submasseteric, where purulent material is deep within the soft tissues and muscles finding of fluctuancy is often difficult on clinical examination.[13] As presence of fluctuancy

indicates accumulation of pus and differentiates an abscess from cellulitis which is the outcome of an odontogenic infection. In turn, this differentiation helps in preventing unnecessary surgical procedures as incision and drainage of pus is necessary for management of abscess and only medical management is essential for cellulitis. Here it necessitates for an sophisticated and a easy to perform investigation which can be used as a routine and a gold standard diagnostic method.[14]

Various diagnostic modalities are available to clinical examination. Radiographs and other imaging studies can be used to diagnose the spreading infections in the head and neck area. Plane radiographic techniques play a role in locating the accumulation of pus as bone loss which cannot locate the soft tissues and the tissue planes. [15]

Advanced techniques such as Ultrasound(US), Computed Tomography(CT), and Magnetic resonance imaging (MRI) have revolutionized the field of diagnostic radiology. These imaging modalities have minimized the therapeutic dilemma for Dental surgeons.[16] CT and MRI are effective in diagnosing inflammatory conditions and choice between these two techniques usually depends on the area involved. However, both techniques are expensive and cannot be used as a routine diagnostic technique with many disadvantages and limitations for using in the head and neck region.[17] USG has several advantages over other modalities as it is harmless, uses no ionizing radiation, is widely available, easy-to-use, inexpensive and unaffected by metal objects such as dental restorations.[18] In the present study, 20 cases with odontogenic infections leading to space infection were examined clinically, radiographically and ultrasonographically to differentiate abscess from cellulitis and to assess the role of ultrasound in diagnosing the space infections and their management.

Rahman and Hamimah et al.[19] conducted a study on clinical patterns of oro-facial infections. A total of 409 patients [258 (63.1%) males and 151 (36.9%) females] were included in this study. The incidence of oro-facial infections was highest in males rather than females, which is in accordance with present study results which shows 11 male

patients when compared to 9 female patients. The present study also revealed that patients with acute odontogenic infections of superficial fascial space showed signs of collection of pus on ultrasonographic examination which is in accordance with study conducted by Peleg et al[20].

Ultrasonographic picture in the cases of cellulitis showed ill-defined edges with heterogenous pattern and hypoechoic intensity also with an increase in the thickness of involved muscle and subcutaneous tissue [Figure 1]. While in case of abscess, the edges were well defined with the homogenous pattern and hypoechoic intensity, with posterior acoustic enhancement suggestive of some collection [Figure 2]. Even the same findings were confirmed in the study conducted by Loyer et al.[21]

Study showed 100% sensitivity for diagnosing an abscess which was same for clinical, Radiographical and Ultrasonographic examinations which is in accordance with study conducted by Scott. et al [22]. Specificity of ultrasound (100%) was found to much superior to clinical specificity (50%) which is in accordance with study conducted by Siegert Ralf [23]. According to Sakaguchi M et al.[24] infection still in the cellulitis stage can be successfully treated with antimicrobials alone whereas surgical intervention is indicated when an abscess is established. In this study, patients with cellulitis also showed good response to antimicrobial therapy.

Thus, not only ultrasound examination was helpful in differentiating cellulitis from abscess, it also helped us in management of patients with superficial fascial space infection.

CONCLUSION

Diagnostic Ultrasonography stands as a non-invasive, cost effective, readily available, easy to use imaging modality, which does not involve ionizing radiation. As a portable imaging unit that can be used in real time during surgical procedure. Ultrasonography has been useful in detecting abscess formation in maxillofacial spaces and highly predictable in determining the stage of infection. Thus a paradigm shift from conventional radiography to ultrasonography in maxillofacial

imaging aids dental surgeons towards a successful management of space infection patients.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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