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Ultrasonography as a Diagnostic Tool in the Management of Oro-Facial Space Infections in Pregnant Patients: A Clinical Study

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Abstract

Background: Oro-facial space infections represent a significant amount of the dental problems in pregnant patients that present to hospital. Determining whether an odontogenic swelling is a cellulitis or abscess is difficult, but important as both may require different treatments. The use of an ultrasound may aid in differentiating cellulitis and abscess in Pregnant patients. This study was done to compare the accuracy of clinical examination alone versus ultrasonography (USG) in the diagnosis of cellulitis and abscess in symptomatic Pregnant patients with a diagnosis of superficial facial space infection: **Subjects and Methods:** Twenty Pregnant patients diagnosed as superficial facial space infections by clinical and radiographic examinations were included in the study. The provisional clinical diagnosis was made after a thorough history was taken and clinical examination was performed to determine if the swelling was a cellulitis or abscess. Swelling was then evaluated using the ultrasonic transducer which was placed over the swelling to aid the diagnosis which was again recorded. An incision and drainage procedure was performed after the administration of local anesthesia. The success of the ultrasound intervention versus clinical examination was based on whether frank exudation was detected during incision and drainage of such swellings. **Results:** The statistical analysis found that USG is a valuable diagnostic aid for detection of abscess or cellulitis in oro- facial space infections. **Interpretation and Conclusion**: The findings of this prospective analysis indicate that there was statistical difference between clinical examination alone and USG in making the correct diagnosis in pregnant patients. From the results of this study, ultrasound is recommended as an adjunct to clinical examination in differentiating between cellulitis and abscess.

Keywords: Pregnant patients, Abscess, cellulitis, odontogenic infections, superficial oro-facial space infections, ultrasound.

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Introduction

Odontogenic infections represent a significant amount of the dental problems that present to hospital. Most odontogenic infections arise in otherwise healthy patients as a sequel to pulp necroses caused by caries or trauma, periodontal infections, and or pericoronitis confined to local areas but may spread to deeper tissues or distant organs through direct continuity or hematogenous/lymphatic routes, resulting in more severe processes.[1] Inadequate oral hygiene, antibiotic use, trauma, and dry mouth can foster oral infections, causing harm to the oral cavity and possibly allowing the infection to extend into adjacent tissues, leading to systemic infections. Chronic oral infections have been linked to cardiac diseases, and pregnancy has been associated with compromised oral health. Wong et al., in their paper, reported 1.44 % pregnant women with odontogenic infections getting complicated.[2] The incidence of fetal and maternal death associated with oro-fascial infection is high, 13 % and 5.8 %, respectively.[3] The insufficient understanding of the repercussions of severe odontogenic infections during pregnancy has resulted in hesitancy among health practitioners to pursue aggressive treatment for orofacial infections, attributed to concerns regarding potential risks associated with imaging modalities and medications, including antibiotics.[4] Severe odontogenic infections during pregnancy can be life-threatening for both the mother and the fetus, and healthcare providers must be able to manage them appropriately in a multidisciplinary team, considering the potential risks and benefits of dental or surgical treatment. Pregnancy is considered a risk factor for the development, severity, and complications of odontogenic infections. Orofacial infections during pregnancy pose a unique challenge, necessitating a comprehensive understanding of predisposing factors, diagnostic methodologies, and therapeutic interventions. Clinically, there are general differences between a cellulitis and an abscess. A cellulitis is the initial presentation of an infection and is thought to be an acute process. An abscess, while also acute, is often considered the resolution phase of a clinical swelling. The pain described by patients with a cellulitis tends to be more severe and generalized than the localized pain associated with an abscess.[5] A cellulitis often presents with swelling, warmth, erythema, and tenderness over the affected area

and equates to the descriptive terms "tumor," "calor," "rubor", and/or "dolor".[6] The firmness of the cellulitis can range from doughy to indurated. The firmer the cellulitis and the more rapidly it spreads tends to indicate a more severe infection. The borders of cellulitis are typically large, smooth, ill-defined, and do not contain pus. An abscess usually has small and well-circumscribed borders and is soft or fluctuant to palpation indicating a pus-filled cavity. Patients with systemic infections often have elevated temperatures.

It has been suggested in both the medical and dental literature that the use of ultrasonography (USG) can aid in the diagnosis of swellings and also in locating the depth of an abscess to allow a more accurate location for an incision for drainage procedure.[2-3,6-14] While magnetic resonance imaging (MRI) and computed tomography (CT) are valuable diagnostic aids in imaging soft tissue lesions and the spread of infections into fascial spaces; they are not readily available in many dental clinics, are expensive and time-consuming, and expose the patient to large doses of radiation. USG is quick, widely available, inexpensive, relatively painless, and can be repeated as often as necessary without risk to the pregnant patient.[7]

Need for the study

USG is relatively a new diagnostic aid in dentistry. The USG method could be considered to be quick, noninvasive, sensitive, widely available, inexpensive, and relatively painless and safe for pregnant patients . USG has been used to depict swellings, cysts, lymph nodes, salivary glands, vascular structures, and inflammatory masses in the head and neck region. USG could be very useful if repeated follow up examinations required as it has no radiation exposure to pregnant patients.

Aim and objectives

The purpose of this prospective investigation was to compare the accuracy of clinical examination and USG in the diagnosis of cellulitis and abscess in symptomatic pregnant patients with a diagnosis of oro-facial space infections

Subjects and Methods

Study setting

This study was conducted in the Department of Oral and Maxillofacial Surgery, Government Dental College Srinagar. The study was time based, conducted over a period of 15 months from January 2021 to April 2022

The study group comprised of 20 pregnant patients

All the patients diagnosed to have superficial facial space infections by clinical and radiographic examinations were included in the study.

Inclusion Criteria

All the pregnant patients clinically diagnosed as having odontogenic infections spreading to the facial spaces, and patients who were willing to participate in the study were included in the study.

Exclusion Criteria

Patients were excluded if they had allergies to local anesthetics, or had a history of significant complication in pregnancy. The cases with pathologies other than odontogenic infections were also excluded from the study.

Methods

All potential participants were explained the need and design of the study. Potential benefits of undergoing thorough clinical, radiographic, and ultrasonographic investigations were made known to the potential participants.

Only those individuals who agreed to undergo these procedures were included in the study. Based upon inclusion and exclusion criteria, 20 individuals became part of this study in a period of 15 months. All these patients were assessed using a predesigned and structural methodology.

Clinical and radiographic examination

Recording of demographic data, history regarding facial swelling, general history, and physical examination were carried out in a systematic manner.

A IOPA radiograph needed to diagnose the odontogenic cause was made. The subjects provided written informed consent.

To qualify for this study, patients had a symptomatic necrotic tooth and clinical swelling at the time of treatment.

A clinical examination was performed by palpating the swelling to determine if it was considered a cellulitis or abscess. A diagnosis of cellulitis was made if the swelling was firm, warm, or hot, and no observable fluid movement (purulence) was detected. A fluctuant swelling was diagnosed if there was believed to be fluid movement under the tissue, indicating that pus was present. The tentative clinical diagnosis was recorded.

The swelling was then evaluated using a portable Acuson p50 (Siemens, Munich, Germany) ultrasound unit that produces high resolution images. The best probe to use for the assessment of superficial structures, such as an abscess or cellulitis, is a high frequency linear probe (8 12 MHz or higher). The transducer chosen for this study was the 12L5 linear wideband array transducer. It has a maximum depth of 80 mm (8 cm) and has a frequency range of 4.8 12.0 MHz.

Following a clinical examination, the ultrasonic transducer was placed over the swelling and a diagnosis of cellulitis or abscess was made. A water based Aquasonic gel (Parker Lab Inc., Fairfield, NJ) was used as the medium between the transducer and the patient's skin to eliminate air bubbles. Cellulitis showed a thickened and diffuse hyperechogenicity commonly referred to as "cobble stoning" [Figure 1].[1] The abscess showed a heterogenic, anechoic [Figure 2], or hypoechoic mass containing variable amounts of internal echoes. The tentative diagnosis was recorded. An incision and drainage preoperative variables for all subjects. An incision and drainage procedure was performed after the administration of local anesthesia. The incision was made through the most dependent site of the swelling using a scalpel. A blunt

dissection using a curved hemostat was then performed to the depth of the swelling. The presence of purulence or no purulence was recorded. The success of the ultrasound versus clinical examination was based on whether purulence was detected and confirmed during incision and drainage.

Results

Twenty pregnant patients diagnosed with oro-facial space infections were included in the study

Table 1 and Figure 5 lists preoperative variables for all subjects. Swellings were seen in the maxilla in five patients (25.0%) and the mandible in 15 patients (75.0%), 11 patients (55.0%) had left-sided swelling, and nine patients (45.0%) had right sided swelling. All subjects (100%) reported taking antibiotics. Overall, four teeth (20.0%) associated with the swellings were maxillary anterior, one (5.0%) was maxillary posterior, none (0.0%) were mandibular anterior, and 15 (75.0%) were mandibular posterior.

Table 1: Preoperative variables for all subjects

Jaw		
Maxilla	5	25
Mandible	15	75
Side		
Left	11	55
Right	9	45
Tooth type		
Maxillary anterior	4	20
Maxillary posterior	1	5
Mandibular anterior	0	0
Mandibular posterior	15	75

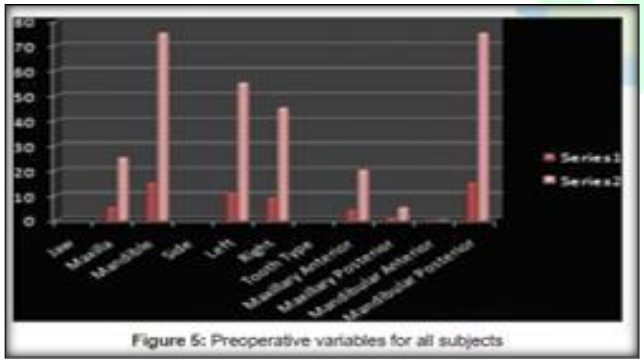


Figure 5: Preoperative variables for all subjects

Table 5 and Figure 7 demonstrates the number of cellulitis versus abscess type swellings recorded with clinical exam alone, ultrasound, and findings after incision for drainage. Diagnosis of abscess was made seven out of 20 times (35%) and cellulitis was diagnosed 13 out of 20 times (65%) with clinical examination. In ultrasound abscess was diagnosed 12 out of 20 times (60%) and cellulitis was diagnosed in eight out of 20 times (40%). The number of swellings determined to be abscess or cellulitis, found after incision for drainage, were 11 (55.0%) and nine (45.0%), respectively. These findings after incision for drainage were used as the standard.

Table 6 and Figure 8 clinical exam alone versus USG for diagnosis is demonstrated. With clinical examination alone a correct diagnosis was made 17 of 20 times (85%) and incorrect diagnosis was made in three of 20 times (15%). With USG a correct diagnosis was made 19 of 20 times (90%) and incorrect diagnosis was made in one of 20 times (5%) cases.

Table 7 and Figure 9 shows the statistical analysis of diagnosis using Fisher's exact test and infers that sensitivity of USG examination was found to be 87% as that compared to sensitivity of clinical examination which was 62%.

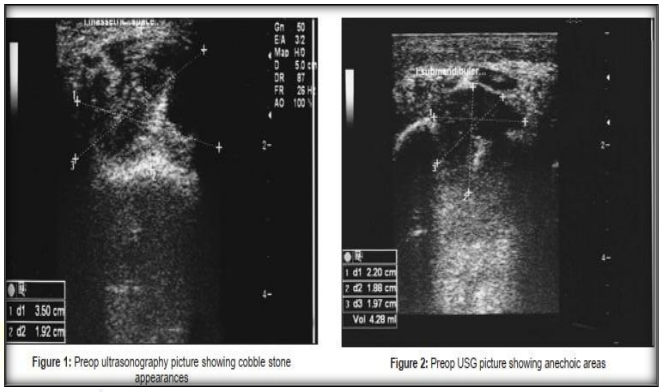
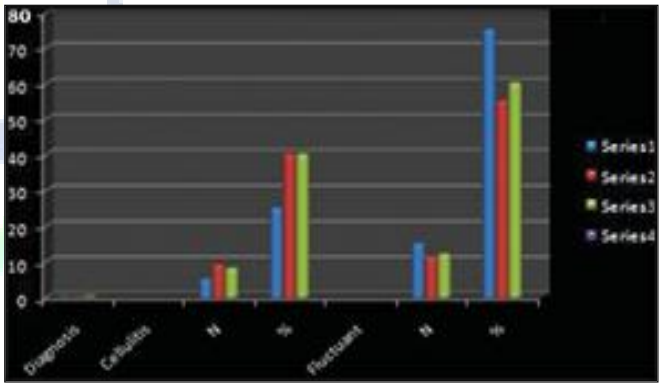
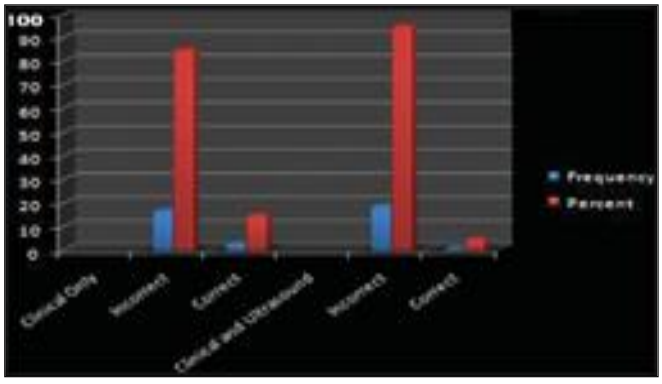


Figure 1: Preop ultrasonography picture showing cobble stone appearances

Figure 2: Preop USG picture showing anechoic areas





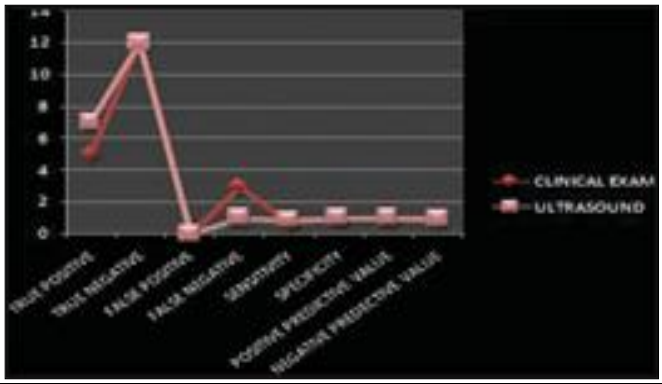


Table 5: Diagnoses after: Clinical exam, ultrasound exam, and incision for drainage

Diagnosis	Clinical exam diagnosis	Ultrasound exam diagnosis	Findings after incision for drainage
Cellulitis			
N	5	9	8
%	25	40	40
Abscess			
N	15	11	12
%	75	55	60
Total	20	20	20

Table 6: Clinical exam versus ultrasound correct and incorrect diagnoses

Exam type	Frequency	Percent
Clinical only Correct	17	85
Incorrect	3	15
Clinical and ultrasound Correct 19		95
Incorrect	1	5

Discussion

The purpose of this study was to compare the accuracy of USG versus clinical examination alone in the diagnosis of cellulitis and abscess in symptomatic patients with facial space infection. It is believed that identifying the correct diagnosis of facial space swelling is important to render the appropriate treatment. However, it has been suggested that the two conditions (abscess and cellulitis) may coexist making diagnosis difficult which in turn may lead to missed abscesses and/or unnecessary invasive procedures.[1] Failure to diagnose correctly may lead to inappropriate or delayed therapy which in turn can lead to medical complications, extra emergency department, and increased costs.[1]

In the present study, the swellings were not "staged" because a clear cut diagnosis by clinical exam or ultrasound to determine cellulitis or abscess was being evaluated. It is not clear in the literature what is expected to be found in the other stages upon surgical intervention. For example, is pus expected to be found in the preabscess stage since it is considered to be between the cellulitis and abscess stages? It is possible that most swellings are a combination of the two making diagnosis very difficult. Making a clear cut diagnosis or knowing the stage of the swelling is important if the treatment of the swellings is different.

Twenty adult pregnant patients participated in this study. Who presented to the Department of Oral and Maxillofacial Surgery, Government Dental College, Srinagar with odontogenic swelling. Liddel and Locker found that women are significantly more affected by pain, have a lower acceptance of pain, a greater fear of pain, and avoid pain more than males.[15] Fillingim et al. also found that women had significantly lower thresholds for the detection and tolerance of pain.[16]

The present study used incision for drainage as the standard in determining cellulitis or abscess because it is the most common method used. If pus was expressed after the incision for drainage, the swelling was classified to be an abscess. If pus was not expressed then the swelling was classified a cellulitis.

A higher incidence for abscess was found in the present study compared to Peleg and coauthor's findings and almost similar incidence than Squire and coauthor's findings. The incidence for cellulitis in this study was higher than that found by Squire, et al.[1]

The results of this study found the sensitivity (the ability to detect cellulitis when it was cellulitis) of the clinical exam alone was 62.5% and for USG was 75%.

Overall, the findings of this study suggest that USG may be useful as an adjunct to clinical exam in differentiating between cellulitis and abscess. This agrees with many of the other studies done using ultrasound as an aid. A review article by Ramirez-Schrempp, et al.[3] stated "Ultrasound is an efficient, noninvasive diagnostic tool which can augment the physician's clinical examination. Ultrasound has been shown to be superior to clinical judgment alone in

determining the presence or the absence of occult abscess formation, ensuring appropriate management, and limiting unnecessary invasive procedures".

Conclusion

This study investigated the use of USG as a valuable aid to clinical examination in differentiating between abscess and cellulitis. The purpose was to compare the accuracy of USG versus clinical examination in the diagnosis of cellulitis and abscess in symptomatic pregnant patients with a diagnosis of superficial facial space infection. Studies in both the medical and dental literature suggest that ultrasound is a promising adjunct.[1-3,7-14,17] However, as thoroughly discussed, many of these studies were underpowered or were not well-controlled research designs.

In this study, incision for drainage was used as the standard in making the final diagnosis. The results of this study show that there was statistical difference between clinical examination alone and USG in making the correct diagnosis. The sensitivity, specificity, positive predictive, negative predictive, and accuracy were not similar for all methods tested.

From the results of this study, ultrasound is recommended as an adjunct to clinical examination in differentiating between cellulitis and abscess in pregnant patients diagnosed with oro-facial space infections.

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