

# Ultrasound guided drainage of submasseteric space abscesses

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## ABSTRACT

**Background and Objectives:** The objective of this study was to evaluate the usefulness of ultrasound guided surgical drainage in submasseteric space abscess of odontogenic origin without incision. **Materials and Methods:** Eleven patients (4 males and 7 females) aged 18 to 36 years were included in this study. Each patient had clinically and radiologically diagnosed submasseteric space abscesses of odontogenic origin. All the patients underwent ultrasound guided drainage by using 5.7 MHz B-mode, gray scale, ultrasound scanner. The aspirated pus was sent for microbiological culture and sensitivity tests. All the patients were given a prescription of antibiotics like Amoxicillin with Clavulanate in a dose of 625 mg 8 hourly daily, Metronidazole 400 mg 8 h daily and analgesic Diclofenac potassium in a dose of 50 mg 8 h daily. Infection was considered resolving when the following criteria were met like ceased or minimal drainage. **Results:** There was successful resolution of abscess in 10 cases, 1 case underwent incision and drainage because of spread of infection to other spaces. **Conclusion:** This study on 11 cases supported ultrasonography as an intraoperative aid in the assessment of the abscess cavity and its real-time imaging facility will help in the location and drainage of the abscess cavity effectively. It avoids large, unsightly, postoperative facial scars and often eliminates the need of general anesthesia and hospitalization.

**Key words:** Submasseteric space, transducer, ultrasonography

## INTRODUCTION

Acute fascial space infections are common emergencies presenting to the maxillofacial surgeons. The dilemma often is to differentiate an abscess from cellulitis and determine whether antibiotic coverage is enough or the incision and drainage is needed and whether patency of the incision is to be maintained.

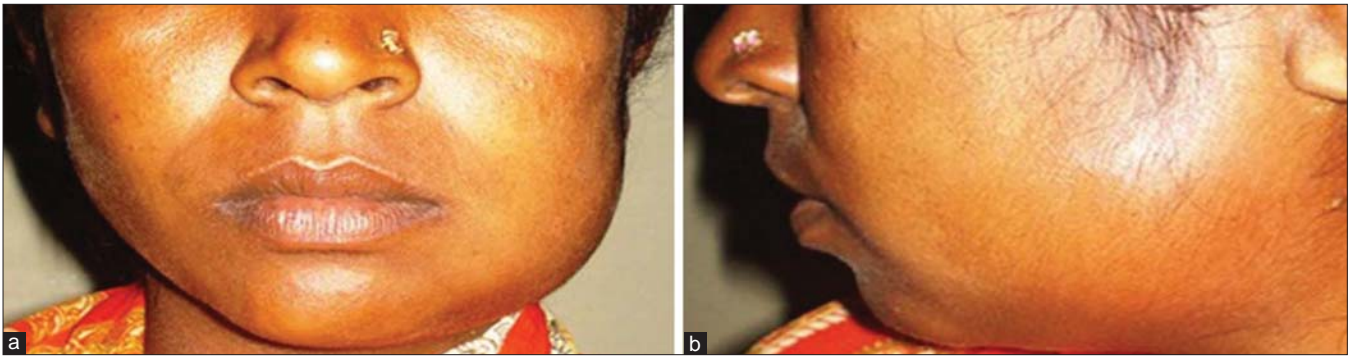
The anatomic location of the abscesses in patients with odontogenic infection is commonly determined by the physical examination, but the abscesses of the deep subcutaneous layer can be difficult to locate. In these cases blind surgical drainage procedure can result in inadequate drainage tissue trauma, unnecessarily extensive incisions, excess time, pain, and failure to locate and evacuate the abscess cavity.<sup>[1]</sup>

Submasseteric space (SMS) abscess usually presents as a

painful, firm swelling over the posterior part of the ramus of the mandible [Figures 1a and b]. Severe trismus reflects involvement of the overlying masseter muscle. This leads to the severe restriction in the mastication and swallowing and patient usually presents with dehydration and fever.<sup>[2]</sup>

Diagnostic ultrasonography (USG) is widely used to identify the presence of fluid collections preoperatively in head and neck region. It is an effective diagnostic tool to confirm abscess formation in the superficial spaces and is highly predictable in determining the stage of infection.<sup>[3]</sup> Presurgical assessment or evaluation of SMS using CT/MRI has yielded good results but not without cost factor. It seems the role of USG in diagnosis of SMS is effective but its role in treatment of SMS is not clear due to very few number of studies.

The objective of this study is to evaluate the usefulness of USG guided surgical drainage in SMS abscesses of odontogenic origin



**Figure 1:** Preoperative view: a) Frontal, b) Lateral

without incision and drainage.

## MATERIALS AND METHODS

This study included a total of 11 patients (4 men and 7 women, from 2008 to 2010) age ranging between 18-36 years; average age being 26 years, with confirmed diagnosis of unilateral SMS abscess of odontogenic origin were subjected to thorough detailed clinical examination and radiographic examination (OPG). Preoperative routine blood investigations were performed and specific blood investigation in required cases (few) done to rule out the presence of underlying medical element like uncontrolled diabetes.

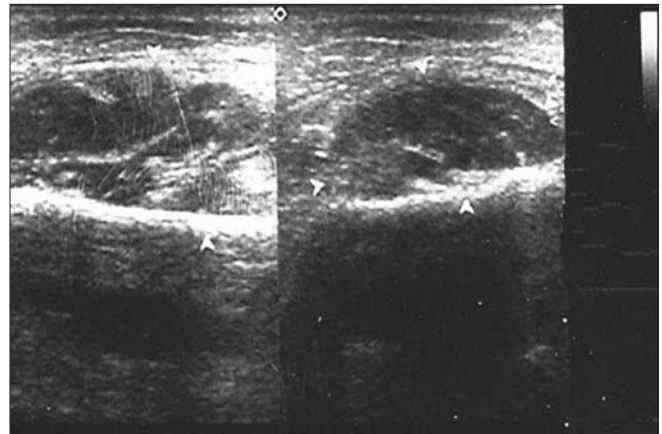
### Surgical procedure

Patient was explained the surgical procedure and informed, written and verbal consent was taken.

Under aseptic measures, a high resolution ultrasound scan was performed using a 5.7 linear array probe in direct contact with skin surface using sterile ultrasound gel as the coupling agent [Figure 2]. Patient was in supine position with the head tilted towards the unaffected side. After visualizing the abscess cavity under the guidance of the ultrasound, the probe position was adjusted so that the intended puncture point of the abscess was aligned with the imaginary midline of the probe and distance from skin surface to the required depth of the needle insertion was measured accurately [Figure 3]. A sixteen gauge intravenous catheter with the trocar needle mounted on sterile 10 ml disposable plastic syringe was inserted freehand at an angle perpendicular to the scanning plane [Figure 4]. During the procedure the patient was instructed to open his/her mouth maximally and not to move, breathe deeply, or swallow during the needle insertion to avoid the shifting of the image. The collected pus was sent for microbiological culture sensitivity tests. The needle was withdrawn leaving catheter in the site. The catheter was carefully taped to the skin and covered with the dressing, till complete cessation of pus. All the patients were prescribed a standard dose of empirical therapy of oral antibiotics covering both aerobic, as well as anaerobic microorganisms (Tab. Augmentin 625 mg 8 hourly and Tab. Metronidazole 400 mg 8 h) along with analgesic Tab. Diclofenac potassium in a dose of 50 mg 8 hourly daily for 5 days. All patients were treated on out patient basis and extraction of offending tooth was done after satisfactory opening of mouth. All patients were advised good home care, maintenance of oral



**Figure 2:** Examination of swelling using Ultrasound transducer



**Figure 3:** Submasseteric space abscess

hygiene and to perform mouth opening exercise. Patients were evaluated for 2 to 3 days postoperatively and if required second follow-up was done on 5<sup>th</sup> postoperative day. This was done till complete resolution of all the sign and symptoms of space infection was attained [Figures 5a and b].

## RESULTS

In all the 11 patients, USG confirmed the clinical diagnosis of

SMS abscess, of which 10 patient were treated successfully using USG guided drainage and one case went for incision and drainage due to involvement of adjacent spaces.

Ninety percent of cases treated by USG guided drainage showed clear edge definition, homogenous pattern with hypoechoic intensity on USG while 10 percent (1 case) showed ill defined edge with homogenous and hypoechoic pattern [Table 1]. Out of 11 cases only 1 case which showed heterogenous pattern with hypoechoic intensity was treated by incision and drainage due to involvement of adjacent spaces. The average predetermined depth of all the cases before insertion of the needle into the abscess

cavity on the ultrasound screen was 9.21 mm and mean actual depth of insertion was 9.5 mm.

Table 2 shows the amount of pus individually collected for each case and cessation of drainage in all 11 cases. The average individual case pus collected after ultrasound guided needle aspiration was 2.1 ml and table also shows the period of minimal drainage and cessation of pus. The average minimal drainage period was 1-2 days and average cessation period was 2 days (mode value). All the patients followed the routine postoperative visits and all the patients followed the instructions as given to them.

### DISCUSSION

Ultrasound is a recognized diagnostic tool in various medical fields and has recently been used in the oral and maxillofacial region. It offers potential advantage because it can be performed non-invasively, repeatedly, easily and even at the bedside.<sup>[4]</sup> Since USG is a non-ionizing device it offers advantages of multiple exposure.<sup>[5]</sup> There is no need for administration of any radiological contrast which is used in certain radiological techniques like CT scans, and angiography that may be possibly harmful to the patients with impaired organ function (e.g. renal failure or liver failure). The major feature that is unique to USG is the ability to recognize and verify deep body organs and lesions having similar density on conventional radiographic studies. The information gained through ultrasound, like other imaging modalities is optimal when coupled with the patients clinical findings.<sup>[6]</sup>

The relatively blind surgical incision and drainage of abscess based on the diagnosis by physical examination may result in excessive



Figure 4: Drainage of abscess

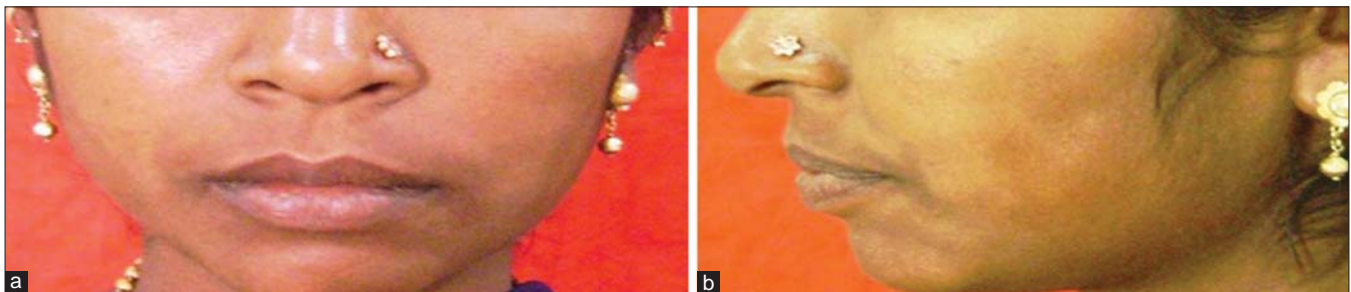


Figure 5: Postoperative view: a) Frontal, b) Lateral

Table 1: Details of submasseteric space abscess in 11 patients								
Sex	Age (years)	Etiology of infection	Ultrasonographic findings			Predetermined depth (mm)	Actual inserted depth (mm)	Method of drainage
			Edge definition	Internal echo				
				Pattern	Intensity			
F	28	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.2 mm	9.4 mm	USG guided
M	36	Pulpoperiapical	Clear edge definition	Hetero	Hypo	9.6 mm	9.8 mm	Incision and drainage
F	25	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.0 mm	9.3 mm	USG guided
F	30	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.4 mm	9.6 mm	USG guided
F	25	Pericoronitis	Clear edge definition	Homo	Hypo	9.0 mm	9.4 mm	USG guided
F	18	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.6 mm	9.8 mm	USG guided
F	28	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.6 mm	9.8 mm	USG guided
F	21	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.0 mm	9.2 mm	USG guided
M	34	Post extraction	Clear edge definition	Homo	Hypo	9.2 mm	9.4 mm	USG guided
F	25	Pulpoperiapical	Clear edge definition	Homo	Hypo	9.0 mm	9.2 mm	USG guided
M	24	Pulpoperiapical	Ill-defined	Homo	Hypo	8.9 mm	9.2 mm	USG guided

F = Female, M = Male, USG = Ultrasonography

**Table 2: Amount of pus collected and cessation of pus drainage**

Amount of pus collected	Minimal drainage of pus	Cessation of pus drainage
2 ml	After one day	After two days
4 ml	No cessation of pus drainage	No cessation of pus drainage
3 ml	After one day	After three days
1 ml	After one day	After two days
1 ml	After one day	After two days
1.5 ml	After one day	After two days
3 ml	After one day	After two days
2 ml	After four days	After eight days
3 ml	After one day	After two days
2 ml	After two days	After four days
0.5 ml	After four days	After eight days

tissue trauma, unnecessarily extensive incisions, excessive time, pain, and failure to locate and evacuate the abscess cavity completely.<sup>[7]</sup> Ultrasound pinpoints the relation of the abscess to the overlying skin, the accurate dimensions of the abscess cavity, and its precise depth below the skin surface.<sup>[3,7]</sup> With the aid of high resolution transducer, USG shows the internal muscle structures more clearly than CT.<sup>[7]</sup> Sonographic reduction of echo intensity is interpreted as an echo free or hypoechoic region which is indicative of an abscess.<sup>[4]</sup> Although it is sometimes difficult to confirm the existence of an abscess without open surgery. It would be more appropriate to use USG aspiration, for verification of an area felt to correspond to an abscess. Change of pattern of hypoechoic area is known to result from pre-examination surgical treatment. The heterogeneous appearance may be a sign of healing process and can be important in follow-up examinations.<sup>[7]</sup> The needle tip was guided accurately into all the abscesses, through skin, masseter muscle, without misdirected and repetitive punctures, or injury to the vessels. The technique presented here reduces the needle insertion distance by inserting it perpendicular to the scanning plane at the midline of the probe. Although it is difficult to visualize the whole needle by this method, the location of the tip of the needle relative to the abscess is always visible on the display. In addition, this decreases risk of vessel injury and facilitates the introduction of a drain.

Fouad A. Al-Belasy (2005) *et al.*, opined that USG guided drainage can be effectively employed in treatment of SMS abscess.<sup>[4]</sup> Similar views are also held by Pandey, *et al.*, although they used USG mainly for diagnosis of only five SMS abscesses.<sup>[8]</sup> The very high success rate (91%) of present study also support the findings of previous authors.

Once the SMS abscess develops, therapeutic management requires early incision and drainage. However, in a patient presenting with marked trismus, incision and drainage would require a general anesthesia necessitating an intubation while awake, which adds to morbidity. To address this situation, needle or catheter aspiration with ultrasound guidance has been used as the initial method of treatment. As suggested by Fouad A. Al-Belasy a 16-gauge intravenous catheter can be used and left inside the abscess cavity to serve as drain and to allow the constant painless access to the infection.<sup>[4]</sup> Easy maneuvering probe into the correct position to obtain dependent part of the abscess, and absence or bearable pain during procedure makes it feasible.<sup>[9]</sup> The presence of even meager amount of pus (less than 1 ml), has been detected by USG probe, as evident in 40% cases of our study. This highlights the advantage

of USG in detection of even minimum amount of fluid or pus.

Another advantage of USG is the portable feature which can be used in real time during surgery.<sup>[5]</sup> When used intraoperatively in real time, the continuous imaging capability is far more useful to the surgeon than static images as represented by other modalities.<sup>[10,11]</sup> Interestingly the visualization of *in situ* positioning and movement of the needle or other instrument on the ultrasound screen facilitates guidance to the surgeon. This study further illustrates the reliability of USG in imaging and adequacy in drainage of SMS abscess at the time of operation.

Although USG is considered to be safe to use repeatedly, there are few reported cases of heating effect of diagnostic ultrasound, which can be overcome by simple B-mode scanner which is used in oral and maxillofacial surgery that has no risk of adverse heating. So B-mode ultrasound scanning procedures that use scanned beams was also employed in our study.<sup>[12]</sup> Additionally it is not possible with USG to evaluate soft tissue swelling medial to the vertical ramus of the mandible because of total reflection of USG, as the bony surface shields the deep tissues.<sup>[9]</sup>

## CONCLUSION

This study recommends the use of USG not only for diagnosis of SMS abscess but also for real time intraoperative USG guided drainage of SMS abscess. Further the study may be of great value in diagnosis of maxillofacial space infections containing meager amount of pus or fluid.

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