

Is ultrasonography-guided drainage a safe and effective alternative to incision and drainage for deep neck space abscesses?

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Abstract

Background: Deep neck space abscesses are common head and neck surgery emergencies. Traditionally, surgical incision and drainage has been the main treatment for deep neck abscesses. Recently, it has been suggested that ultrasound-guided drainage of neck abscesses can be an effective and less invasive alternative to incision and drainage.

Methods: Patients with deep neck space abscesses referred to the emergency department of Amiralam Hospital were assessed and enrolled to the study if they met the inclusion criteria. Patients were randomly assigned to incision and drainage or ultrasound-guided drainage groups using sealed envelopes.

Results: Sixty patients were evaluated, with 30 patients in each group. There was a significant difference ($p < 0.001$) in mean length of hospital stay between patients who underwent ultrasound-guided drainage (5.47 days) and those who underwent incision and drainage (9.70 days).

Conclusion: Ultrasound-guided drainage is an effective and safe procedure, leading to shorter hospital stay, and thus may be a suitable alternative to incision and drainage of deep neck abscesses.

Key words: Abscess; Body Fluids; Drainage; Neck

Introduction

Deep neck space abscesses are common head and neck surgery emergencies that involve fascial planes and spaces of the head and neck.¹ Nowadays, there are fewer cases of these abscesses reported, as antibiotic treatments are more effective and dental hygiene is generally improved. However, they are still important because of potentially life-threatening morbidities, such as jugular vein thrombosis, pericarditis, pneumonia, mediastinal involvement and arterial erosion.^{2–4} Thus, deep neck abscesses remain a challenge for head and neck surgeons.

Traditionally, surgical incision and drainage with adequate antimicrobial coverage has been the main treatment for deep neck abscesses.⁵ Recent literature suggests that ultrasound-guided drainage of neck abscesses can be an effective and less invasive alternative to incision and drainage.^{6–8} Treatment of neck abscesses with surgical incision and drainage can be performed through either an intraoral or extraoral incision.⁶

These procedures are effective, but have some disadvantages. The patient is required to be anaesthetised

with a secure airway, and fibre-optic guided nasal intubation or a tracheostomy should be provided.⁹ Intraoral approaches can compromise the airway because of the persistent bleeding and purulent discharge. In addition, these can be limited by poor visualisation. Extraoral incision and drainage has a high risk of neurovascular injury, and the scars may be cosmetically undesirable for the patient. In rare cases, the infected neck abscess originates from an unknown underlying malignancy; in such cases, incision and drainage may result in tumoural involvement of adjacent sites.^{7,10} Ultrasound-guided drainage has been proven to be effective and does not have most of the disadvantages of incision and drainage.^{11–13}

Most previous studies on ultrasound-guided drainage of neck abscesses have been case series; a controlled study is needed to determine the exact benefits of this technique. Hence, we designed this study to evaluate the effectiveness (in terms of length of hospital stay and safety) and outcome differences between incision and drainage and ultrasound-guided drainage of well-defined deep neck space abscesses.

Materials and methods

A case-control study was conducted at the Head and Neck Emergency Department of Amiralam Hospital, Tehran University of Medical Sciences, Iran, between August 2012 and September 2013. The Institutional Review Board and Ethics Committee of Tehran University of Medical Sciences approved the study protocol.

Patients with neck abscesses were included in the study if they met the following criteria: aged 16–70 years, with a well-defined deep neck abscess as confirmed on contrast-enhanced computed tomography scans. We excluded patients who were pregnant or who had: evidence of airway compromise, a multiloculated or ill-defined abscess, a recurrent neck abscess, contraindications to surgery, coagulopathy, an immune-suppressing medical condition, or evidence of a neck neoplasm.

The procedure to be undertaken was fully explained to all patients prior to obtaining written consent. Patients who did not provide informed consent were excluded from our study but received standard medical treatment.

Initially, patients were assessed by the otolaryngology – head and neck surgery resident. At this time, the patient's history was taken and a physical examination was conducted. Laboratory investigations, including assessments of complete blood count, serum creatinine, electrolytes and blood sugar levels, were carried out.

Patients were given empirical intravenous antibiotic treatment, which was determined previously in consultation with the infectious diseases service. Each patient was given 1 mg ceftriaxone every 12 hours and 600 mg clindamycin every 8 hours. This was changed to specific antibiotics based on the culture and antibiogram results.

The following data were collected for each patient: age, gender, abscess location, presumed cause of abscess, organism found in fluid culture of neck abscess, length of hospital stay and need for second drainage.

Patients with deep neck space abscesses who met the criteria were assigned to incision and drainage or ultrasound-guided drainage groups randomly using the sealed envelope method.

Ultrasound-guided drainage was performed under sonographic guidance once local anaesthesia had been achieved using 5 mg lidocaine 1 per cent. Abscess fluid was aspirated, sent for bacterial culture (aerobic or anaerobic) testing and an antibiogram test. A drain (central venous line catheter, arrow type) was then inserted into the abscess cavity and fixed with a silk suture. Ultrasonography imaging was repeated every 24 hours, and the drain was extruded as soon as there was no collection.

In the incision and drainage group, a secure airway was established before the surgical procedure commenced. A transcervical approach was utilised to gain

adequate exposure of the abscess and protect the surrounding neurovascular structures. Abscess cavities were profusely irrigated, debrided and left open with a drain to prevent re-accumulation. Cultures were also obtained to facilitate direct antimicrobial therapy.

Patients were discharged when pain was under control, the neck drain had been removed and oral intake could be endured, and if there were no signs or symptoms of abscess recurrence, no fever for 24 hours and white blood cell count was within normal limits compared to laboratory test results at the initial presentation. In cases of an odontogenic cause, patients were advised to visit a dentist in one week for further management.

Statistics

Statistical analyses were performed using SPSS software (version 20; SPSS, Chicago, Illinois, USA). Comparison of length of hospital stay in each group was performed with the independent sample *t*-test. Comparisons between length of hospital stay according to different abscess aetiology, space involved and the organism identified were performed using a one-way analysis of variance. Differences between groups were assumed to be statistically significant when the *p*-value was less than 0.05.

Results

Sixty patients who met the inclusion criteria were enrolled in our study. Thirty patients underwent incision and drainage, and 30 patients underwent ultrasound-guided drainage. Thirty-seven patients (61.7 per cent) were male. Patients' mean age (\pm standard deviation) was 35.35 ± 13.87 years (Table I). There were no statistically significant differences between the two groups in terms of patients' demographics or abscess characteristics.

Regarding aetiology, most of the deep neck abscesses in both groups were odontogenic; the next most common cause was sialadenitis. Sialolithiasis, trauma and adenitis were assumed to be the cause of abscess formation in three patients in the incision and drainage group, but there was no history indicating these diagnoses in the ultrasound-guided drainage group (Table I).

The submandibular space was the most common location for abscess formation in both groups, followed by the parotid space and the buccal space in the ultrasound-guided drainage group and the incision and drainage group, respectively (Table I). Abscess location was not significantly related to length of hospital stay ($p = 0.623$).

We also evaluated the organisms grown from bacterial cultures. The most common organism was *Streptococcus pyogenes*. There was no bacterial growth from cultures in 14 abscesses (7 patients in each group) (Table II). *Staphylococcus aureus* was grown in four patients in the ultrasound-guided drainage group and in five patients in the incision and

TABLE I
PATIENTS' CHARACTERISTICS*

Characteristic	Ultrasound-guided drainage [†]	Incision & drainage [‡]	Total	<i>p</i>
Mean age (years)	34.97	35.73	35.35	0.832
Gender ratio (male:female)	18:12	19:11	37:23	0.791
Mean temperature (°C)	38.25	37.94	38.10	0.700
Mean white blood cell count	16 016	20 683	18 350	0.382
Abscess location (<i>n</i>)				
- Submandibular	13	13	26	-
- Buccal	3	5	8	-
- Pterygomandibular	3	3	6	-
- Parotid	5	3	8	-
- Masseteric	3	2	5	-
- Parapharyngeal	0	2	2	-
- Submental	3	1	4	-
- Neck level 2	0	1	1	-
Presumed cause (<i>n</i>)				
- Odontogenic	17	18	35	-
- Sialadenitis	4	3	7	-
- Adenitis	0	1	1	-
- Sialolithiasis	0	1	1	-
- Trauma	0	1	1	-
- Unknown	9	6	15	-

*For 60 patients who underwent ultrasound-guided drainage or surgical incision and drainage of their neck abscess. [†]*n* = 30; [‡]*n* = 30

drainage group. There were also two cases of methicillin-resistant *S aureus* in ultrasound-guided drainage cultures and two in the incision and drainage cultures. There was one case of *Haemophilus influenzae* in the incision and drainage group.

Five patients in the incision and drainage group had diabetes mellitus; there was no history of diabetes mellitus in the ultrasound-guided drainage patients. We analysed length of hospital stay in these patients and the non-diabetic patients who underwent incision and drainage. There was no significant difference in the length of hospital stay between these two groups (*p* = 0.179). Therefore, we did not exclude these diabetes mellitus patients from our final analysis in which length of hospital stay was compared between the two different drainage types.

TABLE II
BACTERIAL CULTURE RESULTS*

Organism	Ultrasound-guided drainage (<i>n</i>)	Incision & drainage (<i>n</i>)	Total (<i>n</i>)
<i>Streptococcus pyogenes</i>	8	8	16
Unknown	7	7	14
<i>S pyogenes</i> + anaerobic	6	5	11
<i>Staphylococcus aureus</i>	4	5	9
Methicillin-resistant <i>S aureus</i>	2	2	4
Mixed anaerobes	1	2	3
<i>Haemophilus influenzae</i>	0	1	1
<i>Enterobacter</i>	1	0	1
<i>Pseudomonas</i>	1	0	1

*For patients who underwent ultrasound-guided drainage or surgical incision and drainage of their neck abscess

We found a significant difference (*p* < 0.001) in the mean length of hospital stay between patients who underwent ultrasound-guided drainage (5.47 days) and those who underwent incision and drainage (9.70 days) (Table III). Five patients in the ultrasound-guided drainage group required a second drainage; a second drainage was only necessary for three patients in the incision and drainage group; this difference was not statistically significant (*p* = 0.706).

We also measured the pus-drained volume via the ultrasound-guided drainage method in each individual case. The mean pus-drained volume was 13.03 ml (range, 3–26 ml). There was no significant association between the isolated organism obtained from the abscess and the amount of pus drained. We drained significantly more pus from submandibular abscesses compared to abscesses in other spaces (*p* = 0.020).

Discussion

Recent evidence suggests that ultrasound-guided drainage is an effective alternative to incision and drainage in some cases of neck abscesses. Baatenburg de Jong *et al.* reported one of the first series of deep neck space abscesses that were drained successfully using

TABLE III
LENGTH OF HOSPITAL STAY AND RECURRENCE DIFFERENCES*

Parameter	Ultrasound-guided drainage	Incision & drainage	<i>p</i>
Mean hospital stay (days)	5.47	9.70	<0.001
Need for second drainage (<i>n</i>)	5	3	0.706

*Between ultrasound-guided drainage or surgical incision and drainage groups

ultrasound-guided drainage with no recurrences.¹⁴ Yeow and colleagues also reported successful drainage of deep neck space abscesses involving retropharyngeal and parotid spaces.^{15,16} The same research group subsequently, in 2001, demonstrated their experience of 15 unilocular deep neck space abscesses, with a success rate of 87 per cent and no complications when using ultrasound-guided drainage.¹⁷ In a more recent series, Al-Belasy reported 11 masseteric space abscesses drained using ultrasound-guided drainage, with a 73 per cent success rate.⁶ Together, the findings suggest that ultrasound-guided drainage of deep neck space abscesses is an effective alternative for a select group of patients.

The present study revealed that the length of hospital stay was shorter in patients who underwent ultrasound-guided drainage in comparison with those who underwent incision and drainage. In addition, the need for a second drainage in our patients who underwent ultrasound-guided drainage was not high (5 patients out of 30). These findings are consistent with a clinical study conducted by Biron *et al.* in Alberta, Canada.¹⁸ These authors likewise reported that length of hospital stay was significantly shorter in patients who underwent ultrasound-guided drainage. The results of this study and other studies with similar findings can be applied largely to selected groups of patients, in whom the length of hospital stay can be decreased, which may lead to fewer complications and reduced costs. We did not see any significant difference in length of hospital stay between diabetes mellitus patients and non-diabetic patients, but other studies have reported significant differences between these two groups.¹⁹

- Deep neck abscesses are common head and neck surgery emergencies
- Traditionally, surgical incision and drainage has been the main treatment for neck abscesses
- This study evaluated the effectiveness and outcome differences between incision and drainage and ultrasound-guided drainage of neck abscesses
- Ultrasound-guided drainage is a safe and effective alternative to incision and drainage
- In addition, it is associated with shorter hospital stay and may reduce healthcare costs

In our study, bacterial cultures obtained from deep neck space abscesses were sensitive to a prescribed antibiotic regimen that resulted in the effective resolution of symptoms. We obtained positive cultures in 46 deep neck space abscesses (76 per cent); this is in agreement with other studies, in which the rate of positive cultures ranged from 56.3 to 85.7 per cent. The majority of our cultures grew streptococcus species,

which is also in line with previously reported culture findings.¹⁸ The second most common culture finding reported was no growth; this finding is again in agreement with other studies.¹⁸

We did not attempt ultrasound-guided drainage in cases of multiloculated abscesses because it was almost impossible in many of these cases to open all the septations effectively. We excluded patients older than 70 years from the study because of possible prolonged hospital stay with poor wound healing. Some studies that have included patients of an older age in their study population may have found misleading results.⁷

In this study, there might have been patient and physician bias in terms of discharge from hospital. Discharge was carried out by several different residents who were not involved in this study, using specified criteria, in order to reduce the bias.

Conclusion

Ultrasound-guided drainage is an effective and safe alternative to the incision and drainage of deep neck abscesses in a certain group of patients, resulting in shorter hospital stays. Ultrasound-guided drainage may lead to decreased complications and result in significant healthcare cost savings associated with shorter hospital stays.

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