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Ultrasound core biopsies of neck lumps: an experience from a tertiary head and neck cancer unit

M Adeel[1], R Jackson[1], T Peachey[2] and N Beasley[1]

Departments of [1]ENT, Sheffield, UK and [2]Radiology, Royal Hallamshire Hospital, Sheffield Teaching Hospitals, Sheffield, UK

Abstract

Background. Traditionally, fine needle aspiration cytology was the primary diagnostic investigation for head and neck lumps; however, ultrasound-guided core biopsy offers the advantage of preserving tissue architecture with increased tissue yield. This study reviews the diagnostic utility of ultrasound-guided core biopsy for investigating head and neck lumps.
Methods. Overall, 287 ultrasound-guided core biopsies were reviewed between May 2017 and April 2019 at a single tertiary site for head and neck cancer.
Results. On initial ultrasound-guided core biopsy, a diagnostic sample was obtained in 94.4 per cent of patients and in 83.7 per cent of patients with lymphoma. Where the initial ultrasound-guided core biopsy was non-diagnostic, 50 per cent of samples were diagnostic on repeat ultrasound-guided core biopsy. Overall, five complications were seen related to ultrasound-guided core biopsy, and all were managed conservatively. No cases of disease recurrence were identified at the biopsy site.
Conclusion. Ultrasound-guided core biopsy is a safe procedure with a high diagnostic yield when investigating head and neck lumps. Patients whose ultrasound-guided core biopsies were non-diagnostic should be considered for excisional biopsy over repeat ultrasound-guided core biopsy.

Main Article

Mr M Adeel takes responsibility for the integrity of the content of the paper

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Author for correspondence:
Mr Mohammad Adeel, Department of ENT, Bradford Royal Infirmary, Duckworth Lane, Bradford BD9 6RJ, UK
E-mail: Mohammad.adeel@nhs.net

Introduction

The differential diagnosis for any neck lump can be extensive; however, a primary malignancy or metastatic nodal disease must always be considered. Following a detailed history and examination, an ultrasound-guided core biopsy is a well-recognised modality for obtaining a tissue diagnosis that can yield more information compared with ultrasound-guided fine needle aspiration.[1]

Even though ultrasound-guided fine needle aspiration can be carried out accurately using a small needle puncture, the specimen is comprised only of cells. Therefore, even in the hands of an experienced cytopathologist, accurate identification of the correct diagnosis can be challenging. While on-site interpretation of ultrasound-guided fine needle aspiration specimens can improve diagnostic accuracy, access to such services is less widely available and more expensive.[2] Furthermore, ultrasound-guided fine needle aspiration is ineffective in diagnosing cases where lymphoma is suspected; these often require excisional biopsy.[3]

Though fine needle aspiration cytology (FNAC) remains widely used in the diagnosis of salivary gland lumps, several studies have highlighted its limitations, including a high percentage of false-negative results and low accuracy for differentiating between different types of malignant tumours.[4,5] An audit by Howlett *et al.*[6] undertaken throughout the Sussex cancer network reviewed 712 FNAC procedures performed in 647 patients. Fine needle aspiration cytology was found to be non-diagnostic in 52 per cent of patients in the neck node group and in 50 per cent in the salivary gland group, despite around half of these being performed with ultrasound guidance.

More recently, the application of ultrasound-guided core biopsy has dramatically changed the evaluation of head and neck lumps, and its use has become more widespread. In addition to a high diagnostic rate, ultrasound-guided core biopsy has reduced the potential need for general anaesthesia and is associated with better cosmetic outcomes compared with excisional biopsy.[1] Ultrasound-guided core biopsy makes use of a wider gauge needle that samples a tissue core from the lump, with minimal distortion to the tissue architecture. Concerns have been raised regarding the theoretical risk of tumour seeding during ultrasound-guided core biopsy; however, a 2012 review by Novoa *et al.*[7] found no evidence to support this.

Within our department, ultrasound-guided core biopsy has been established as the first-line investigative modality for obtaining a tissue diagnosis for any head and neck lump. For patients at high risk of head and neck malignancy presenting via the two-week-wait cancer referral pathway, ultrasound-guided core biopsy can be performed on the same day as their appointment as part of a one-stop neck lump clinic to facilitate a faster diagnosis.

We carried out a departmental audit to establish: the diagnostic accuracy of ultrasound-guided core biopsy for head and neck lumps, its role in identifying cases of lymphoma, and the utility of repeat ultrasound-guided core biopsy for initially non-diagnostic core samples.

Materials and methods

This project was carried out within the ENT department at a tertiary care referral centre for head and neck cancer, and was registered with the hospital's clinical audit department. The ultrasound department's database was reviewed to identify any patient who had undergone an ultrasound-guided core biopsy of their neck lump between May 2017 and April 2019. Patients who underwent ultrasound-guided fine needle aspiration or who did not complete their ultrasound-guided core biopsy were excluded.

The medical records of those who met the inclusion criteria were reviewed, including clinic letters and radiological and histological reports. Data were extracted regarding patient demographics, site of the head and neck lump, complications related to ultrasound-guided core biopsy, ultrasound-guided core biopsy and post-operative histology reports, and evidence of malignant recurrence at the biopsy site.

Prior to any ultrasound-guided core biopsy, complications of the procedure were discussed, and written consent was obtained. All ultrasound-guided core biopsies were performed under local anaesthetic, mostly using 16- or 18-gauge Temno™ biopsy needles, based on clinical judgment, and performed by a consultant head and neck radiologist. An average of two to three passes were made to obtain sufficient tissue samples.

We biopsied only pathological lymph nodes or masses greater than 1 cm. Any suspected nodes smaller than 1 cm or very superficial were considered for excisional biopsy. All lesions that, on imaging, were suspicious of neurofibroma, arteriovenous malformations, venous varix, arterial aneurysm or haemangioma were not biopsied.

All patients were screened for use of anticoagulation at the time of booking for the procedure. We followed our Trust's guidelines regarding anticoagulation. That is, anticoagulation was stopped at 12 and 24 hours before surgery for patients on prophylactic and therapeutic dalteparin, respectively, at 48 hours for apixaban, and at 5 days for clopidogrel; patients on warfarin received 'bridging' (short-term alternative) therapy as per our local protocol, and we did not stop their aspirin. In patients with known clotting disorders, this was discussed with the haematologist, who provided a specific plan regarding clotting factors.

After the procedure, all patients were observed for 30 minutes within the department for complications related to the procedure. The core biopsy samples and any post-operative histology were all reviewed by a consultant histopathologist with a specialist interest in head and neck malignancy.

Results

Overall, 389 patients were identified as having undergone an ultrasound-guided biopsy of their head and neck lump within the data collection period. A total of 102 patients were excluded because either they underwent FNAC, predominately to investigate a thyroid swelling, or the ultrasound-guided core biopsy was no longer required. In total, 287 patients met our inclusion criteria of having an ultrasound-guided core biopsy.

The mean age of our patients was 58.1 years (standard deviation = 1.39). Cervical nodes and parotid lumps were the commonest subsites to be biopsied, and collectively these accounted for 91.2 per cent of all biopsies. The remainder of the subsites biopsied included submandibular and non-nodal neck lumps, and the cheek or post-auricular region (Table 1).

Analysis of cervical node lumps

When ultrasound-guided core biopsy was performed for cervical neck nodes, the most common type of malignancy identified was metastatic squamous cell carcinoma (SCC), accounting for 54 cases (60 per cent), followed by lymphoma, which was seen in 28 cases (31 per cent). Most benign pathologies identified for lumps in this area were reactive lymph nodes, which were seen in 41 cases (62 per cent); however, 12 cases (18 per cent) had an indeterminate histology (Table 2).

From the cases reported as indeterminate, a repeat ultrasound-guided core biopsy was performed in one patient, which successfully diagnosed lymphoma, whilst the remaining patients underwent excisional biopsy. The final histology for those undergoing excisional biopsies included five cases of lymphoma, three branchial cysts, and one case each of reactive lymph node, dermoid cyst and lipoma (Table 2).

Analysis of parotid lesions

Pleomorphic salivary adenoma and Warthin's tumours were the most common pathologies identified through ultrasound-guided core biopsy of a parotid lump. Malignant tumours seen in this subsite included metastatic SCC, salivary gland carcinoma, adenoid cystic carcinoma, malignant melanoma and one case that raised suspicion of cancer. In three cases, an indeterminate histological result was reported, and following surgical excision, two cases demonstrated chronic sialadenitis (Table 3).

Analysis of non-nodal neck lumps

A total of 11 patients with non-nodal neck lumps underwent ultrasound-guided core biopsy, with lipoma (6 cases) being the commonest pathology. Branchial cysts, an epidermal cyst and a vascular neoplasm made up the remaining pathologies. No malignant lesions were identified within this group. Only one biopsy showed an indeterminate histology, which was later identified as a branchial cyst following surgical excision (Table 4).

Analysis of submandibular biopsies

The ultrasound-guided core biopsy results for lumps in the submandibular region identified three cases of malignancy (25 per cent), of which the same histopathological diagnosis was confirmed following surgical excision. The remaining biopsies identified benign pathologies, which consisted of four cases of pleomorphic adenoma, four cases of chronic inflammatory sialadenitis and one case of lipoma (Table 5).

Analysis of indeterminate biopsy results

Ultrasound-guided core biopsy demonstrated a high incidence of success, with 271 cases (94.4 per cent) accurately diagnosing a head and neck lump on the first attempt. Overall, only

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Table 1. Subsites of ultrasound-guided core biopsies

Biopsy subsites	*n*
Cervical node	162
Parotid lump	100
Submandibular lump	12
Neck lump (non-nodal)	11
Cheek lump	1
Post-auricular lump	1

Table 2. Cervical node biopsy results

Histopathology	*n*
Malignant diagnoses	
– Metastatic SCC	54
– Lymphoma	28
– Metastatic malignant paraganglioma	2
– Other cancers (e.g. papillary thyroid cancer, poorly differentiated carcinoma, fibrosarcoma, neuroendocrine carcinoma, metastatic adenocarcinoma, lymphoma)	6
Benign diagnoses	
– Reactive lymph node	41
– Necrotising inflammation	10
– Other benign lumps (Benign fibromatosis, fungal infection)	3
Indeterminate*	12

*Outcomes of indeterminate excisional biopsies were: five cases of lymphoma, three branchial cysts, one reactive lymph node, one dermoid cyst and one lipoma, with one lymphoma on repeat core biopsy. SCC = squamous cell carcinoma

Table 3. Parotid gland biopsy results

Histopathology	*n*
Benign	
– Pleomorphic salivary adenoma	34
– Warthin's tumour	23
– Lymphoepithelial cyst	8
– Oncocytoma	3
– Reactive lymph node	10
– Lipoma	3
– Others (nerve sheath tumour, neuroendocrine, salivary neoplasm)	4
Malignant	
– Metastatic SCC	4
– Salivary gland carcinoma	2
– Lymphoma	3
– Adenoid cystic carcinoma	1
– Malignant melanoma	1
– Suspicion of cancer	1
Indeterminate	3

SCC = squamous cell carcinoma

16 cases were non-diagnostic following the first ultrasound-guided core biopsy. The practice for investigating indeterminate ultrasound-guided core biopsy results varied between a repeat core biopsy and an excisional biopsy. In 12 patients, a repeat ultrasound-guided core biopsy was organised, which was diagnostic in 6 cases (50 per cent); however, all patients who underwent surgical excision obtained a histopathological diagnosis (Table 6).

Table 4. Neck lump (non-nodal) biopsy results

Histopathology	*n*
Lipoma	6
Branchial cyst	2
Vascular neoplasm	1
Epidermal cyst	1
Indeterminate	1

Table 5. Submandibular gland biopsy results

Histopathology	*n*
Benign	
– Chronic inflammatory sialadenitis	4
– Pleomorphic adenoma	4
– Lipoma	1
Malignant	
– Adenoid cystic carcinoma	2
– Low-grade acinic cell carcinoma	1

Analysis of lymphoma biopsies

Overall, 37 patients (12.9 per cent) who underwent ultrasound-guided core biopsy had a diagnosis of lymphoma, of which 31 (83.7 per cent) were diagnostic at first ultrasound-guided core biopsy (Figure 1). The remaining six (16.3 per cent) required excisional biopsy for diagnosis.

Complications

Overall, there were five separate complications related to performing an ultrasound-guided core biopsy, a rate of 1.7 per cent. Complications included two cases of vasovagal attacks, two cases of bleeding around the biopsy site and one case of transient facial weakness related to the local anaesthetic administered prior to the procedure. All complications were managed conservatively and were not associated with any long-term morbidity. For patients with a malignant diagnosis of histopathology, there were no cases of recurrent disease at the ultrasound core biopsy site over the study period.

Discussion

While blind (non-radiologically guided) FNAC remained the standard of care for a long time, there were issues regarding diagnostic accuracy and a high false-negative rate.[8] However, ultrasound-guided FNAC alongside an onsite cytologist can increase the diagnostic accuracy by as much as 23 per cent when compared with blind FNAC.[9] Other established techniques for the tissue diagnosis of head and neck lumps include ultrasound-guided core biopsy and excisional biopsy. Though excisional biopsy provides the best tissue yield, it is invasive

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Table 6. Histological results of patients undergoing repeat ultrasound-guided core biopsy

Site	Diagnostic result (*n*)	Non-diagnostic result (*n*)
Neck mass	Branchial cyst (3)	Non-diagnostic (1)
Cervical node	Lymphoma (1)	Inconclusive (3)
Parotid lump	Sialadenitis (2)	Inconclusive (2)

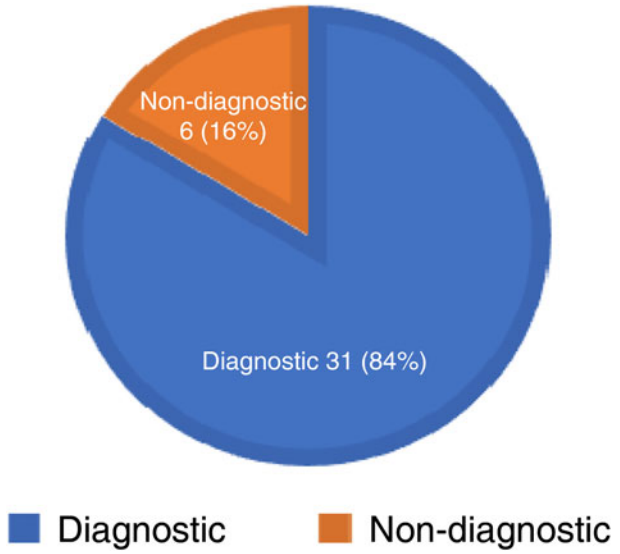

Fig. 1. Core biopsy results in patients with suspected lymphoma.

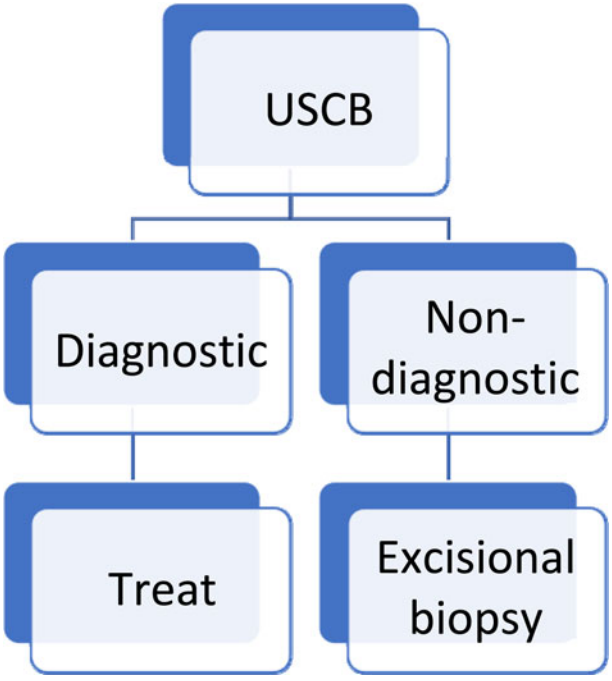

Fig. 2. Algorithm for neck lump management. USCB = ultrasound core biopsy

and more expensive, and may require a general anaesthetic which in turn carries additional risks.[10] Furthermore, from an oncological perspective, excisional biopsy is an unacceptable primary tool for tissue diagnosis in cases of SCC because of its association with poor prognosis secondary to tumour seeding affecting long-term survival.[10] In comparison, ultrasound-guided core biopsy has demonstrated increased diagnostic accuracy and a low risk of injury to surrounding structures, and has comparable complication rates to FNAC.[11,12] One significant advantage of ultrasound-guided core biopsy is the yield of tissue cores that preserve tissue architecture, and hence can be used for immunohistochemistry, characterisation and diagnosis of many pathologies, especially SCC and lymphoma.[11]

Overall, our results demonstrate that the vast majority of patients who undergo ultrasound-guided core biopsy will obtain an immediate histopathological diagnosis, with 271 of 287 patients (94.4 per cent) having a diagnostic result after the first core biopsy. The rate of non-diagnostic ultrasound-guided core biopsy in our series was 5.6 per cent, in keeping with the Screaton *et al.*[13] study, which reported 22 of 260 biopsies (8.5 per cent) to be inadequate using ultrasound-guided core biopsy. With regard to ultrasound-guided core biopsy for salivary gland swellings (parotid or submandibular), our study found the incidence of a non-diagnostic result to be 2.6 per cent. These findings are similar to those of a recent meta-analysis by Kim *et al.*,[14] who reviewed the core biopsy results of salivary gland lumps and found the rate of inadequate diagnosis to be 3.26 per cent. By comparison, a meta-analysis by Schmidt *et al.*[15] reported an 8 per cent rate of inadequate diagnosis through FNAC for parotid lesions.

Our results found ultrasound-guided core biopsy to be particularly useful in diagnosing lymphoma, with 31 of 37 cases (83.7 per cent) being identified on first biopsy, a feat that would not be possible using FNAC. Two important aspects in the diagnosis of lymphoma are tissue architecture and immunohistochemistry; both of these can be adequately addressed using ultrasound-guided core biopsy.[8,16] Studies by Burke *et al.*[17] and Pfeiffer *et al.*[18] reported that ultrasound-guided core biopsy was diagnostic for lymphoma in 92.3 per cent and 81 per cent of patients, respectively, without the need for further tissue biopsy. In our series, ultrasound-guided core biopsy successfully identified 84 per cent of all lymphoma cases on first biopsy, and therefore these patients were not exposed to the risks associated with excisional biopsy. Furthermore, lymphoma patients with a positive ultrasound-guided core biopsy obtained their diagnosis earlier and medical treatments were initiated more promptly.

One of the concerns regarding the use of core needle biopsy for investigating malignant lesions is the theoretical risk of tumour seeding, with local spread secondary to the procedure. In our series, there were no cases of recurrent disease at the site of ultrasound-guided core biopsy during short- to mid-term follow up. Other studies have demonstrated similar findings.[16,19]

Furthermore, complications associated with ultrasound-guided core biopsy were low, with five separate complications seen, representing a rate of 1.7 per cent. Two patients had a post-procedural haematoma (0.7 per cent) and one (0.3 per cent) had a temporary facial weakness. Similarly, Kim *et al.*[14] reported a haematoma rate of 0.5 per cent, one case of temporary facial weakness, and an overall complication rate of 0.6 per cent.

At our institution, ultrasound-guided core biopsy has become the procedure of choice for neck lump biopsy, with the aim of offering same-day biopsies for any fast-track patient attending a one-stop neck lump clinic. This has resulted in expedited care for suspected cancer patients. However, interestingly, our study identified that 50 per cent of all repeat ultrasound-guided core biopsies were non-diagnostic. Consequently, we have established a protocol within our unit whereby any patient undergoing non-diagnostic ultrasound-guided core biopsy where the clinical and imaging findings

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are suggestive of malignancy should undergo excisional biopsy instead of a repeat ultrasound-guided core biopsy (Figure 2). Through using this pathway, we aim to reduce the time taken to establish a diagnosis and avoid further delays in initiating definitive treatment.

- Ultrasound core biopsy has a lower complication rate and high diagnostic rate
- Repeat ultrasound core biopsy has a low yield
- Patients whose ultrasound core biopsy was non-diagnostic should be considered for excisional biopsy
- Ultrasound core biopsy can avoid unnecessary excisional biopsy, especially in patients with suspected lymphoma

Conclusion

Our study found ultrasound-guided core biopsy to be a safe and highly effective technique for diagnosing a head and neck lump. Because of the low diagnostic yield of repeat ultrasound-guided core biopsy, we recommend that patients undergo excisional biopsy to avoid delays in establishing a diagnosis. Furthermore, ultrasound-guided core biopsy demonstrates a high diagnostic yield in patients with lymphoma, which avoids the additional costs and risks associated with excisional biopsy, whilst enabling a diagnosis to be established more quickly.

Competing interests. None declared

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