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# Evaluation of biopsy methods in the diagnosis of submandibular space pathology

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*Abstract.* The aim of this study was to evaluate the performance of fine needle aspiration cytology (FNAC), ultrasound-guided core needle biopsy (USCNB), punch biopsy, and surgical excision biopsy in neoplasms presenting within the submandibular space. A retrospective analysis of all patients with a pathological diagnosis of a submandibular space neoplasm within a 12-year period (February 1999 to June 2011) was performed. Biopsy results were compared to histopathological diagnosis obtained from surgical excision biopsy. Eighty-one specimens from 44 patients met the search criteria (15 FNAC, 24 USCNB, 7 punch biopsy, and 35 surgical excision biopsy). The final diagnosis was established by USCNB, punch biopsy, or surgical excision biopsy and not by FNAC alone. Surgical excision biopsy was performed as a primary diagnostic ($n = 8$), secondary diagnostic ($n = 15$), or as a post-diagnostic therapeutic procedure ($n = 12$). Non-diagnostic results were: FNAC 11/15, USCNB 2/24, and punch biopsy 1/7. Diagnostic results were: FNAC 2/15, USCNB 20/24, and punch biopsy 5/7. No complications were reported. Although punch biopsy demonstrated good yield and accuracy, its use is restricted to a small cohort of patients. USCNB is a safe and accurate technique in the submandibular space, with a low non-diagnostic rate.

Keywords: salivary gland; submandibular gland; fine needle aspiration cytology; punch biopsy; ultrasound-guided core needle biopsy; surgical excision biopsy.

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The salivary glands comprise three paired major glands (parotid, submandibular, and sublingual glands) and 600–1000 minor glands distributed widely beneath the mucosa of the oral cavity, palate, paranasal sinuses, and upper respiratory tract. Approximately 6% of all head and neck tumours occur within the salivary glands;[1] 80% of these occur within the parotid gland, 10–15% within the submandibular gland, and the remaining 5–10% within the sublingual and minor salivary glands. Approximately 50% of submandibular gland neoplasms are benign, with pleomorphic adenoma accounting for over a third; 50% are malignant, with adenoid cystic carcinoma being the most common, accounting for 25% of cases.

Controversy remains regarding the best biopsy method for salivary gland neoplasms, with very little published data pertaining to the submandibular gland and submandibular space. However, accurate diagnosis is needed to guide appropriate management and avoid unnecessary surgical intervention. Historically, fine needle aspiration cytology (FNAC) has been the main biopsy method in the salivary glands; it is safe, quick to perform, and well suited to an outpatient setting.[2] It has a high specificity in the head and neck (98%), but a relatively high false-negative rate and variable diagnostic accuracy (86–98%). It requires optimized circumstances to perform well, including ultrasound guidance and a cytologist

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present at the time of sampling. These facilities are not widely available leading to reported heterogeneity in performance across various centres.[3–7] The lack of consistency in terms of FNAC sensitivity and diagnostic accuracy has led to the increasing use of alternative methods such as ultrasound-guided core needle biopsy (USCNB) and punch biopsy.

Ultrasound provides good anatomical and pathological characterization, therefore biopsies can be performed safely under direct visualization without damaging neighbouring structures.[8] The increase in ultrasound expertise and image quality among radiologists and clinicians who utilize it regularly has had a direct effect on the use of ultrasound-guided biopsy methods, such as ultrasound-guided FNAC and USCNB, with improved diagnostic accuracy and less variability in performance compared to blind FNAC.[9–11] Punch biopsy is a more invasive biopsy method suitable for superficially sited lumps. There is a paucity of data looking at the performance of these biopsy methods for submandibular space neoplasms. The aim of this study was to evaluate the diagnostic performance of FNAC, punch biopsy, and USCNB in the diagnosis of lesions of the submandibular space.

## Materials and methods

The pathology database (APEX) was reviewed to identify all patients who underwent a submandibular gland/space biopsy within a 12-year period (February 1999 and June 2011). All patients with a pathological diagnosis of submandibular gland/space neoplasm were included in the study. If a surgical excision biopsy was undertaken (diagnostic or therapeutic), the histology result was used as the reference standard. Clinical records, radiology and pathology reports, and PACS (Picture Archiving and Communication Systems) imaging were reviewed in each case.

The following details were collated from the pathology database: (1) date and anatomical site of biopsy; (2) biopsy technique (FNAC, USCNB, punch biopsy, or surgical excision biopsy); (3) needle gauge and number of biopsy passes; (4) adequacy of biopsy specimen; (5) relevant previous pathology and final biopsy results.

Non-neoplastic submandibular gland lesions and parotid, minor salivary gland, and other head and neck lesions were excluded from the final dataset.

### FNAC

All FNAC were performed blind in the outpatient setting (ENT or maxillofacial surgery clinics) by a range of clinicians. A 21-gauge needle was routinely employed without the administration of a local anaesthetic. A cytologist was not present in the outpatient clinic for immediate sample analysis.

### USCNB

USCNB were performed by consultant radiologists within the radiology department. A diagnostic ultrasound was routinely performed prior to biopsy, with written consent. Two to five millilitres of 1% lignocaine was infiltrated into the subcutaneous tissue prior to making a small skin incision. The biopsy was performed using a technique similar to that described previously in parotid neoplasia, with a spring-loaded semi-automatic biopsy gun and variable throw 18/20-gauge needle (Bard Magnum; C. R. Bard Inc., Covington, GA, USA).

### Punch biopsy

Punch biopsies were performed by maxillofacial or ENT surgeons in a day surgery unit, with local anaesthetic, using 1–8-mm circular blades to produce cylindrical cores of tissue.

### Definitions

For the purpose of this study the following terms are defined: 'Diagnostic specimen': a specimen that yielded a single definitive cytological or histological diagnosis. 'Non-diagnostic specimen': a specimen that did not yield a single definitive cytological or histological diagnosis; these were sub-divided into insufficient or equivocal samples. The non-diagnostic rate was calculated from the insufficient samples, as equivocal results did provide some useful information to guide management, although they were not truly diagnostic. 'Primary diagnostic surgical excision': a surgical excision performed without prior FNAC/USCNB/punch biopsy. 'Secondary diagnostic surgical excision': a surgical excision performed after initial non-diagnostic FNAC/USCNB/punch biopsy. 'Therapeutic surgical excision': a surgical excision performed for therapeutic purposes after cytological/histological diagnosis was established from prior FNAC/USCNB/punch biopsy.

## Results

A total of 81 specimens from the submandibular gland/space met the search criteria and were analysed. Each FNAC/USCNB/punch biopsy was treated as a separate episode for the purpose of the study. There were 44 patients: 22 males and 22 females. The age range was 23–98 years, with a mean of 66 years.

### FNAC

Fifteen FNAC were performed in 13 patients; two patients underwent repeat FNAC due to the initial samples being inadequate for analysis (Table 1). Of the

*Table 1*. Fine needle aspiration cytology: 13 patients, 15 episodes.

| Patient | FNAC | USCNB | Surgical excision (primary, secondary or therapeutic) | FNAC episodes |
|---|---|---|---|---|
| 1–5 | Non-diagnostic (insufficient tissue) | – | Pleomorphic adenoma (secondary) | 5 |
| 6 | Non-diagnostic (insufficient tissue) | – | Warthin's tumour (secondary) | 1 |
| 7 | Pleomorphic adenoma | Pleomorphic adenoma | – | 1 |
| 8 | Non-diagnostic (insufficient tissue) | – | – | 2 |
| | Non-diagnostic (insufficient tissue) | – | Pleomorphic adenoma (secondary) | |
| 9 | Non-diagnostic (insufficient tissue) | – | – | 2 |
| | Equivocal -? lymphoma or reactive node | MALT B-cell lymphoma | – | |
| 10 | Equivocal -? lymphoma or reactive node | – | Low grade B-cell lymphoma (secondary) | 1 |
| 11 | Non-diagnostic (insufficient tissue) | – | Squamous cell carcinoma (secondary) | 1 |
| 12 | Pleomorphic adenoma | – | Pleomorphic adenoma (therapeutic) | 1 |
| 13 | Non-diagnostic (insufficient tissue) | High grade B-cell lymphoma | High grade B-cell lymphoma (therapeutic) | 1 |

FNAC, fine needle aspiration cytology; USCNB, ultrasound-guided core needle biopsy; MALT, mucosa-associated lymphoid tissue.