

## Ultrasound-guided core needle biopsy of parotid gland swellings

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### Abstract

**Objective:** To determine whether ultrasound-guided core needle biopsy is a safe and reliable investigation in cases of parotid swelling in which fine needle aspiration cytology has failed to give a definitive diagnosis.

**Design:** Analysis of 66 ultrasound-guided core biopsy specimens of the parotid gland (the largest series reported thus far) sample number refers to histological samples throughout the paper.

**Subjects:** All the 184 cases of parotid surgery with a histological diagnosis were included.

**Main outcome measures:** The sensitivity, positive predictive value and diagnostic accuracy of fine needle aspiration cytology and ultrasound-guided core needle biopsy, as compared with the final histological analysis.

**Results:** Of a total of 184 patients, 89.1 per cent (164/184) had benign parotid lesions excised. The sensitivity, positive predictive value and diagnostic accuracy of fine needle aspiration cytology for benign lesions were 76.2, 84.2 and 87.5 per cent, respectively, and those of ultrasound-guided core needle biopsy were 91.7, 98.2 and 96.4 per cent, respectively. Twenty of 184 patients (10.9 per cent) had malignant lesions. The sensitivity, positive predictive value and diagnostic accuracy of fine needle aspiration cytology for detection of malignant lesions were 60, 75 and 75 per cent, respectively, while those of ultrasound-guided core biopsy were 89, 100 and 100 per cent, respectively. Non-diagnostic rates were 25.8 per cent for fine needle aspiration cytology and 4.5 per cent for ultrasound-guided core biopsy. Only one case of complications (a sub-clinical haematoma) occurred in the ultrasound-guided core biopsy group.

**Conclusion:** We propose ultrasound-guided core needle biopsy as a very safe and effective tool in cases of parotid swelling in which fine needle aspiration cytology has failed to give a definitive diagnosis.

**Key words:** Parotid Neoplasms; Needle Biopsy; Diagnosis

### Introduction

Primary neoplasms of the parotid gland represent a rare and heterogeneous group. The behaviour of these tumours varies depending on their type and grade; therefore, tumour classification is of vital importance for subsequent clinical management.

Histopathological examination remains the 'gold standard' for diagnosis of parotid tumours. Samples for such examination can be obtained by open biopsy or needle aspiration. However, most experts do not now recommend open parotid biopsy, because of the high risk of tumour seeding, facial nerve injury, facial scarring and fistula formation.

Fine needle aspiration cytology (FNAC) is an established first line investigation for parotid tumours. It may be performed 'blind' or guided by ultrasound (US) scanning. Fine needle aspiration cytology samples give cytological information only, and blind techniques may have a high non-diagnostic rate.<sup>1</sup> In the parotid gland, there are specific problems with the cytological diagnosis of pleomorphic adenoma,<sup>2</sup> Warthin's tumour<sup>3</sup> and lymphoma.<sup>4</sup> Indeed, the definitive diagnosis of lymphoma invariably requires architectural information which is available only from histopathological tissue specimens, obtained either by excision or core biopsy. Fine needle aspiration cytology also has a low predictive value for benign, non-neoplastic lesions.<sup>5</sup>

An alternative is core ('true-cut') needle biopsy, in which a core of tissue is obtained using a larger bore, spring-loaded needle, and from which histopathological tissue architecture can be studied. Again, this can be performed blind or under US guidance. The advantages of US guidance are accurate needle placement and radiological characterisation and localisation of the lesion. Three recent series examining the use of US-guided core biopsy in the management of parotid masses have shown accuracies of 100 per cent,<sup>2</sup> 97 per cent<sup>6</sup> and 100 per cent<sup>7</sup> when comparing the results from such a biopsy with those of the final histological analysis. There were no reported complications, and a substantial number of patients (26 out of 54<sup>2</sup> and 22 out of 53)<sup>6</sup> avoided surgery as a result of the core biopsy. In addition, the use of an 18-gauge needle was noted to be sufficient for accurate diagnosis.<sup>6</sup>

We describe our experience of US-guided parotid core biopsy in patients from three separate institutions, comprising the largest reported series to date.

### Technique of ultrasound-guided core biopsy

All US scanning and US-guided core biopsies were performed by one radiologist (LHB). A free-hand technique was used for core biopsy, without a transducer biopsy channel. All samples were obtained with a spring-loaded,

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disposable cutting needle (Temno, Bauer Medical, clearwater, Florida, USA), using 1 per cent lignocaine local anaesthesia. An 18-gauge needle was used for small lesions or where the mass was close to major vessels, and a 15- or 16-gauge needle for larger lesions or in cases of suspected lymphoma. If there was any doubt about the adequacy of the specimen, patients underwent more than one needle pass ( $n = 34$  cases).

**Results**

The majority of patients (89.1 per cent; 164/184) had benign parotid lesions (including 43 Warthin's tumours and 96 pleomorphic adenomas), whereas 10.9 per cent (20/184) had malignant lesions (including six adenocarcinomas and five squamous cell carcinomas). Figure 1 shows the histology of the benign and malignant lesions.

Tables I and II show the sensitivity, positive predictive value and diagnostic accuracy of FNAC and US-guided core biopsy in our department. Fine needle aspiration

cytology samples were taken with a blind technique and the sample subsequently analysed by a cytopathologist.

The overall non-diagnostic rates for both benign and malignant lesions, for FNAC and US-guided core biopsy, are shown in Figure 2.

**Discussion**

*Key findings*

Pre-operative diagnosis is of great value in parotid disease. For most benign lesions in the superficial lobe, a partial (superficial) parotidectomy is the agreed management. Most malignant tumours require total parotidectomy. In patients considered an anaesthetic or surgical risk (e.g. the elderly or infirm), a confident diagnosis of benign disease can save inappropriate or unnecessary surgery.

The clinical decision to undertake further intervention (either conservative or surgical) can be made on the basis of clinical examination alone, FNAC or US-guided core biopsy. In our series, these methods had diagnostic accuracies for benign disease of 71.8, 90 and 96.4 per cent, respectively. The overall non-diagnostic sampling rate for all lesions was 25.8 per cent (16/62) for FNAC and 4.5 per cent (three of 66) for US-guided core biopsy. Half of the patients with non-diagnostic FNAC samples ( $n = 8$ ) went on to undergo further US-guided core biopsy, and all of these subsequent biopsies were diagnostic. The sensitivity, positive predictive value and accuracy of US-guided core biopsy were significantly better, for both benign and malignant tumours, compared with FNAC, with values approaching 100 per cent with the former method. These results are comparable to those of previous series.<sup>8</sup>

In our series, at least 14 patients (in whom FNAC had been non-diagnostic) were saved an inappropriate or unnecessary operation as a result of US-guided core biopsy: inappropriate surgery, in cases in which subsequent US-guided core biopsy had enabled a correct diagnosis of malignancy;<sup>5</sup> or unnecessary surgery, in elderly patients with a benign diagnosis following US-guided core biopsy.<sup>9</sup>

*Fine needle aspiration cytology*

Cytopathologists have reported varying experiences in the diagnosis of (relatively rare) salivary tumours.<sup>9</sup> Whether the surgeon or cytopathologist is performing the aspiration has an influence on accuracy, as does the concurrent use of US to guide the biopsy. Inadequate aspirations can be repeated by the cytopathologists. The ultrasonographer can guide the tip of the biopsy needle accurately to cellular areas, thereby reducing non-diagnostic rates.<sup>10</sup>

Salivary tumours are a heterogeneous group with a variety of morphological features. Information on such features is seldom available from cytological specimens. Fine needle aspiration cytology has obvious disadvantages in smaller and hypocellular tumours and those with uncommon histology. In addition, it does not give enough information to enable tumour grading or typing, or to

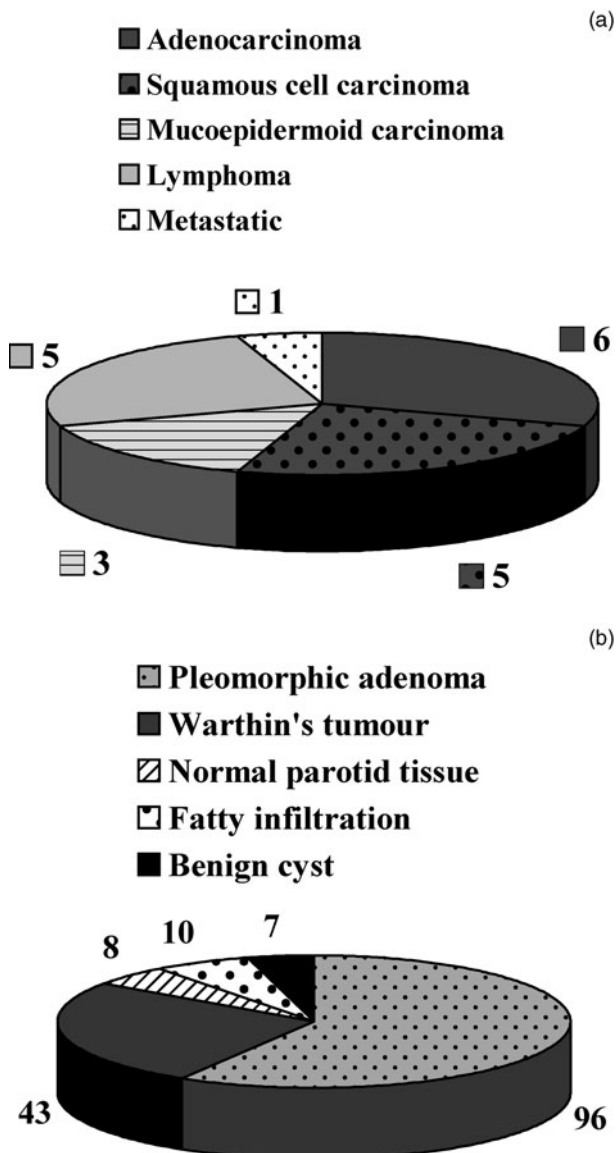


FIG. 1

The final histological diagnosis for (a) malignant and (b) benign lesions. Data indicate total number of diagnoses.

TABLE I

RESULTS FOR FNAC AND US-GUIDED CORE NEEDLE BIOPSY OF MALIGNANT PAROTID LESIONS

Parameter	Test	
	FNAC	US-guided core biopsy
Sensitivity (%)	60	89
Positive predictive value (%)	75	100
Diagnostic accuracy (%)	75	100

FNAC = fine needle aspiration cytology; US = ultrasound

TABLE II

RESULTS FOR FNAC AND US-GUIDED CORE NEEDLE BIOPSY OF BENIGN PAROTID LESIONS

Parameter	Test	
	FNAC	US-guided core biopsy
Sensitivity (%)	76.2	91.7
Positive predictive value (%)	84.2	98.2
Diagnostic accuracy (%)	87.5	96.4

FNAC = fine needle aspiration cytology; US = ultrasound

distinguish in situ from invasive malignancy. The sensitivity of fine needle aspiration cytology in differentiating benign from malignant disease ranges from 60 to 100 per cent, and a specific diagnosis can be made with only 57–92 per cent accuracy.<sup>10</sup> Cases of non-diagnostic FNAC are often excluded from analysis, which skews results in favour of the technique.

*Ultrasound-guided core needle biopsy*

Ultrasound-guided core needle biopsy has been shown to be superior to FNAC in other parts of the body (e.g. breast),<sup>11</sup> although both methods are clearly operator-dependent. Histological examination of a core biopsy specimen can provide more accurate information about cell type and tissue characteristics, as well as enable the possibility of immunohistochemical analysis. This is particularly important in cases of lymphoma, but also in cases of heterogeneous salivary and other well differentiated tumours.

Ultrasound-guided biopsy provides accurate specimens in nearly 100 per cent of cases of neck disease.<sup>12</sup> This technique has several additional advantages. Lesions adjacent to major vessels can be approached from a safe angle. Smaller and impalpable lesions can be biopsied.<sup>13</sup> The tip of the needle can be directed to the precise site of biopsy (e.g. the centre of a solid lesion or the periphery of a cystic lesion). Furthermore, US can sometimes detect immediate complications of the procedure, such as sub-clinical haematoma.

*Complications*

Our series had no incidents of facial nerve injury. The exact position of the facial nerve, although not reliably seen on US, can be inferred, as it lies immediately superficial to the main intraparotid vessels, which are well seen. As

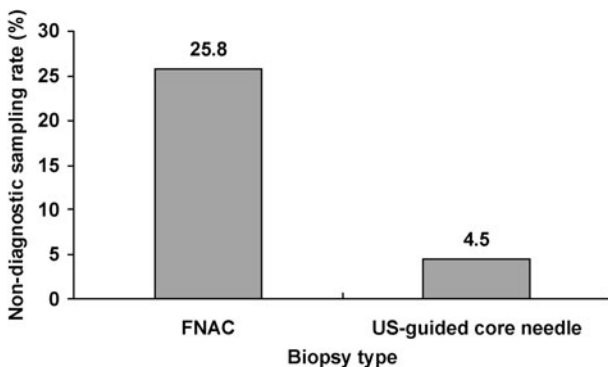


FIG. 2

Non-diagnostic sampling rates for fine needle aspiration cytology (FNAC) and ultrasound (US) guided core needle biopsy. Data indicate percentage.

80–90 per cent of parotid masses are confined to the superficial lobe, we feel this technique is safe and effective.

Our series showed one sub-clinical haematoma as a result of core biopsy, which resolved without further complication on antibiotics.<sup>14</sup>

Studies have shown a high incidence of seeding of tumours, particularly pleomorphic adenomas and carcinomas, as a result of incisional biopsy.<sup>15</sup> There have also been some reports of seeding along the needle tract after aspiration or core biopsy, the incidence of which increases with needle bore diameter,<sup>16</sup> probably because larger stromal components are aspirated with the cellular components. Only two case reports have described seeding following parotid biopsy with larger bore (<20-gauge) needles.<sup>17,18</sup> Even after definitive surgery for pleomorphic adenoma (superficial parotidectomy in most cases) there is a 2–5 per cent local recurrence rate.<sup>18</sup> This is thought to be due to microscopic pseudopodia of disease extending outside the capsule, rather than to true breach of the capsule during surgery. None of the patients in our series were found to have recurrent tumour along the biopsy track. We feel therefore that this complication has probably been overstated in the past. However, we do acknowledge that patients need to be followed up for many years to ensure that this complication has not occurred, which was not the case in this study. Despite this, there was no evidence of tumour seeding within the needle tract in this study group.

*Clinical applicability of findings*

Prior to further surgical intervention or management decisions, we propose the use of US-guided core needle biopsy in those patients with parotid swellings who have had previous unsuccessful FNAC, as the former method is a very safe, reliable diagnostic technique.

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