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Review

Establishing an accurate diagnosis of a parotid lump: evaluation of the current biopsy methods – fine needle aspiration cytology, ultrasound-guided core biopsy, and intraoperative frozen section

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Abstract

The optimum technique for histological confirmation of the nature of a parotid mass remains controversial. Fine needle aspiration cytology (FNAC), which has traditionally been used, is associated with high non-diagnostic and false negative rates, and ultrasound (US)-guided core biopsy and frozen section have been explored as alternatives. US-guided core biopsy is more invasive than FNAC, but is safe, well-tolerated, and associated with improved diagnostic performance. Although frozen section offers better specificity than FNAC, it has a number of important drawbacks and cannot be considered as a primary diagnostic tool. US-guided core biopsy should be considered as the initial diagnostic technique of choice, and in units where the accuracy of FNAC is good it can be used when FNAC is equivocal or non-diagnostic.

Keywords: Fine needle aspiration cytology; Ultrasound-guided core biopsy; Frozen section; Parotid gland lesion

Introduction

To establish an accurate diagnosis of a parotid lump it is now generally accepted that triple assessment, which comprises clinical examination, imaging, and confirmation by biopsy as appropriate, is necessary. Most centres use high-resolution ultrasound as the initial diagnostic imaging of choice[1] as it is quick, safe, and non-ionising, and in experienced hands is capable of a high degree of accuracy; 93% accuracy has been reported for parotid malignancy.[2] For lesions that are large, complex, or likely to be malignant, it guides the need for further investigation, usually with magnetic resonance imaging, but for most focal, and possibly neoplastic lesions, definitive histological confirmation is necessary.

Accurate diagnosis enables the appropriate timing and type of operation (if indicated) and potentially avoids operation in the elderly or unfit, or for certain neoplasms such as Warthin's tumour. It also allows patients to be informed about potential injury to the facial nerve when they give their consent.

Definitive and accurate preoperative diagnosis requires cytological or histological analysis, and the best way to obtain specimens remains controversial. Open surgical parotid biopsy originally fell out of favour because of a number of problems, which included operative complications (injury to the facial nerve and wound infection), delayed complications including formation of a fistula or sialocele, and tumour

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recurrence secondary to tumour spillage.[3] Subsequently, by the early 1980s, open biopsy was largely superseded by fine needle aspiration cytology (FNAC), which was traditionally done blind and usually in the outpatient department.

Fine needle aspiration cytology

Although successful results have been reported, it has become increasingly clear that there is considerable variability in the accuracy of FNAC, and high non-diagnostic rates and poor sensitivity or specificity have been reported.[4–6] The technique is well established, and is commonly used as it is quick, safe, relatively non-invasive, and cheap. However, when done blind and by clinicians with different levels of experience, poor technique or inaccurate or insufficient sampling can result in high rates of non-representative or insufficient aspirates.

The perceived and real problems associated with blind FNAC have led clinicians in different specialties to explore ways to improve the diagnostic yield of parotid biopsy procedures. Broadly, they fall into 3 main categories: use of various techniques to improve the yield of FNAC, use of core biopsy with ultrasound (US) guidance, and finally, publication of data that re-examine the use of intraoperative frozen section. Several systematic reviews with meta-analyses on these techniques, and specifically their performance in the parotid glands, have been published, and we will refer to them in the remainder of this article.

Several techniques that can potentially improve the diagnostic yield of FNAC have been described. US-guidance enables precise sampling of the lesion, selectively avoids cystic areas within tumours, and avoids damage to adjacent (vascular) structures.[7] When a cytologist or cytology technician assesses cellularity at the time of sampling, its performance is further improved.[8] Alternatively, clinical models run purely by a cytologist, which allow repeated sampling of a lesion until a diagnostic aspirate is obtained, have also been described.[9,10] In larger centres, additional ancillary technology may be available such as in situ hybridisation or flow cytometry to further improve diagnostic rates.

A meta-analysis from 2011, which looked at 64 studies published since the late 1980s, included data on FNAC done both blind and under varying levels of optimised conditions.[11] Overall, it was found to be safe and well-tolerated and had high reported specificity (97%) but lower sensitivity (80%). Diagnoses were found to be reliable, but there was a high false negative rate (20%). Not all the studies included information on non-diagnostic samples, but where available, the rate was found to be around 8%.[10] The analysis also showed a significantly wide variation in the performance of FNAC across centres.

What are the reasons for these findings? For the most accurate results, FNAC must be done either by an experienced clinician using ultrasound guidance with a cytologist or cytology technician in attendance, or by a cytologist with ancillary backup cytology diagnostic facilities. In reality, and certainly in the UK, cytologists, cytology technicians, and ancillary equipment are in relatively short supply, and in many units, FNAC done blind by clinicians remains the norm.

There are also intrinsic diagnostic problems even when a cellular aspirate is obtained. The diagnosis of lymphoid hyperplasia, namely the differentiation of reactive nodal hyperplasia from low-grade lymphoma, is usually not possible with FNAC alone.[12] Cytological diagnosis of salivary gland neoplasms can be difficult as they often have low-grade nuclear morphological features that can look similar.[11] Cellular pleomorphic adenomas, monomorphic adenomas, adenoid cystic carcinomas, low-grade mucoepidermoid and adenocarcinomas, can all have overlapping cytological features.[10] In addition, specimens do not provide the architectural information necessary to diagnose some lesions, and in largely cystic tumours (such as Warthin's tumour and mucoepidermoid carcinoma) it is often difficult to aspirate enough material for accurate diagnosis.[10] In a recent paper about the performance of FNAC in a cytologist-led clinic, Fakhry et al. confirmed the problems associated with the technique even when there was an opportunity for repeated sampling.[10] They reported correct diagnoses in 116/138 cases (84%) with 8 false negative (6%) and 14 false positive (10%) results. The sensitivity for malignancy was 73% and specificity 87%.

Ultrasound (US)-guided core biopsy

US-guided core biopsy was initially established in the diagnosis of breast and abdominal masses, and was first described in the parotid gland in 1999 in a series of 16 patients with parotid lumps. In 13 of them initial FNAC had been non-diagnostic,[13] but US-guided core biopsy provided diagnostic specimens in them all. It was found to be better than clinical examination alone in 31% of patients, and in all those operated on results correlated completely with final surgical histological findings. Subsequently, further meta-analyses of published papers on the efficacy of the technique in the parotid glands have been done.[14,15]

The technique is well described.[16] It is more invasive than FNAC as it involves local anaesthesia and a small incision in the skin. A needle (usually 18 or 20G) is deployed by means of a spring-loaded automated biopsy device to obtain a core or cores of intact tissue. Crucially, the tissue contains architectural details that can be sent for detailed immunohistochemical analysis, which enables confirmation of the type and grade of a tumour and improves the diagnosis of lymphoid hyperplasia. Its ability to diagnose parotid lymphoma is well known, and treatment can now be initiated on the results obtained from core biopsy alone without the need for further investigation.[16] The ability to provide a core of tissue also means that the technique can be used to make a confident diagnosis of parotid involvement by systemic disease such as