Do Immediate Cytology and Specialist Radiologists Improve the Adequacy of Ultrasound-Guided Fine-Needle Aspiration Cytology?

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Abstract

Objective. To assess whether a dedicated “1-stop” neck lump clinic has improved the percentage of adequate fine-needle aspiration cytology (FNAC) samples and reduced the need for repeat FNAC.

Study Design. Retrospective review.

Setting. District General Hospital in the United Kingdom.

Subjects and Methods. Patients attending for ultrasound-guided FNAC over a 6-month period from August 2012 to February 2013. Patients were placed in 4 groups: group 1, FNAC performed by any of the subspecialist radiologists with cytology support (n = 100); group 2, FNAC performed by general radiologists without cytology support (n = 112); group 3, FNAC performed by a particular subspecialist radiologist with cytology support (n = 61); and group 4, FNAC performed by the same subspecialist radiologist without cytology support (n = 125).

Results. There was a significantly higher rate of adequacy of FNAC in the presence of a subspecialist radiologist with immediate cytology (group 1) versus a general radiologist without cytology support (group 2; 87/100 vs 63/112, \( P = .0001 \)), a significantly higher rate of adequacy of FNAC in the presence of cytology support with the same radiologist (group 3 vs group 4, 55/61 vs 97/125, \( P = .04 \)), and a significantly higher rate of adequacy of FNAC in the presence of a subspecialist radiologist versus a general radiologist without cytology support (group 4 vs group 2, 97/125 vs 63/112, \( P = .0005 \)).

Conclusion. Immediate cytology and the presence of a subspecialist radiologist increase the adequacy of FNAC. The adequacy rate of non–cytology-supported FNAC or nonspecialist FNAC is below the adequate rate expected from the literature or as recommended in national guidelines.

Keywords

head and neck neoplasms, biopsy–fine needle, audit

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The National Institute for Health and Clinical Excellence (NICE) guidance on cancer services published in 2004 recommended that specialist clinics should be set up for the assessment of patients with neck lumps.¹

Fine-needle aspiration cytology (FNAC) is considered the initial investigation for lesions in the head and neck. It is cost-effective, quick to perform, carries a low morbidity, is acceptable to patients, and can have a high diagnostic accuracy when performed optimally.²³

In the literature, the accuracy of ultrasound FNAC analysis has been reported to approach 95%. However, it is recognized that in reality, FNAC analysis fails to provide an adequate sample or that cytological findings are indeterminate in 10% to 20% of cases, with a false-negative rate ranging from 1% to 11%. However, the adequacy rates can drop even further in the presence of an inexperienced operator or with the use of incorrect techniques in sampling or in the preparation of samples.⁴⁵

As part of the 1-stop clinics, the provision of on-site cytology has been proposed to increase the cost-effectiveness and diagnostic accuracy of ultrasound-guided FNAC by allowing

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the immediate assessment of sample adequacy and allowing a repeat aspirate to be taken if required.6-11

However, this assertion has been disputed by some authors. For example, O’Malley et al12 did not find a statistically significant difference in specimen adequacy between the FNAC of lesions (thyroid) undergoing immediate cytological analysis and those with delayed analysis, and they stated that immediate cytological analysis significantly prolonged the time of the FNAC procedure and actually reduced efficiency (12.5 minutes without cytology support vs 44.4 minutes with cytology support, P < .01).

In August 2012, the provision of on-site cytology support by biomedical scientists was introduced at Queen’s Hospital as part of the development of a “1-stop” head and neck service. The cytology technicians are responsible for the preparation of slides and stains and assessing samples for adequacy, but no preliminary diagnosis is given. The aim of this study was to assess whether this service has improved adequacy, but no preliminary diagnosis is given. The aim of this study was to assess whether this service has improved the percentage of adequate samples and helped reduce the need for repeat FNAC biopsy in our department.

Methods

This study was approved by the Barking, Havering and Redbridge University Hospitals National Health Service (NHS) Trust Audit and Clinical Governance Department. A retrospective review of case notes was undertaken of all patients attending for ultrasound-guided FNAC for a single neck lesion over a 6-month period between August 2012 and February 2013. Patients with benign and malignant pathology were included. Abscesses were excluded from the study. Patient demographics, reason for ultrasound, FNAC adequacy, type of radiologist, and whether cytology support was available were all recorded.

The same experienced cytology technician (M.H.) performed the analysis of FNAC samples for adequacy in all groups where cytology support was used.

The same technique for fine-needle aspiration (FNA) was adopted by all radiologists. A 21-gauge needle attached to a 10-mL disposable syringe is used to enter the lesion with negative suction applied to the syringe, maintained by pulling the syringe plunger back. Five passes are made through the lesion without exiting the skin. The vacuum on the syringe is then released, and the skin is exited. Up to 3 repeat aspirations were performed (as tolerated by the patient) if the initial cytology specimen was reported as inadequate. Where the procedure was aborted with the availability of cytology support, this was because multiple attempts to obtain an adequate sample had been unsuccessful and was not due to technician error.

Patients were placed within 2 groups: group 1, FNAC performed by any of the subspecialist radiologists (defined as a radiologist with a fellowship in head and neck radiology) with cytology support (n = 100), and group 2, FNAC performed by general radiologists without cytology support (n = 112). To test for intraobserver agreement, 2 further groups were added: group 3, FNAC performed by particular subspecialist radiologist (not included within groups 1 or 2) with cytology support (n = 61), and group 4, FNAC performed by same subspecialist radiologist without cytology support (n = 125).

Statistical analysis and comparisons were carried out using Fisher exact test, and significance was set at P < .05 (GraphPad Software, San Diego, California).13

Results

A total of 398 ultrasound scans were performed during the study period. The number of female patients was 252, compared with 146 male patients. The median age of patients was 46.3 years (range, 18-84 years).

Group 1 contained 100 patients, group 2 contained 112 patients, group 3 contained 61 patients, and group 4 contained 125 patients. Across the groups, age and gender were comparable. Each patient in group 2 had 1 FNAC performed (when there was no cytology support available), whereas in group 1 (with cytology support available), patients had up to 3 aspirations performed, depending on adequacy of the initial sample. The subspecialist head and neck radiologists broadly had similar experience levels (with a fellowship in head and neck radiology), and the general radiologists had no subspecialist training in head and neck radiology.

We also looked at time spent for each test within groups 1 and 2. The mean time spent in group 1 (with cytology support) for FNAC was 28.3 minutes versus 16.2 minutes in group 2 (without cytology support). Within group 1, the mean time spent for patients who required multiple attempts due to inadequate samples was 33.7 minutes as compared with 21.4 minutes for those patients who required just 1 attempt.

Of all the neck ultrasounds performed during the study period, 74% were performed on the thyroid gland, 13% on salivary glands, 9% on soft-tissue lesions, and 4% on lymph nodes.

The adequacy rate (defined as the adequacy of the FNAC sample for diagnosis) in group 1 was 87%. In group 2, the adequacy rate was 56%, while the adequacy rates in groups 3 and 4 were 90% and 78%, respectively. These results were consistent across all sites in the neck (Table 1; Figure 1).

There was a significantly higher rate of adequacy of FNAC in the presence of a subspecialist radiologist with immediate cytology (group 1) as opposed to a general radiologist without cytology support (group 2; 87/100 vs 63/112, P = .0001). Thus, immediate cytology and the presence of a subspecialist radiologist increased FNAC adequacy by 31% when compared with a general radiologist without immediate cytology support.

There was a significantly higher rate of adequacy of FNAC in the presence of cytology support (group 3) as opposed to the rate of adequacy without cytology support with the same radiologist (group 4; 55/61 vs 97/125, P = .04). Thus, the presence of immediate cytology support with a specific subspecialist radiologist (defined as a radiologist with a fellowship in head and neck radiology not included in group 1) increased the FNAC adequacy rate by 12% when compared with the same radiologist without immediate cytology support. To
demonstrate that this specific subspecialist radiologist was not significantly more experienced than the other subspecialist radiologists, we compared groups 1 and 3 (87/100 vs 55/61, \( P = .62 \)), which showed no significant difference in adequacy rates. There was a significantly higher rate of adequacy of FNAC in the presence of a subspecialist radiologist without cytology support (group 4) as opposed to a general radiologist without cytology support (group 2; 97/125 vs

**Table 1.** Adequacy Rates (Defined as the Adequacy of the Fine-Needle Aspiration Cytology Sample for Diagnosis) among All Groups in Neck Ultrasound Scans.

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of cases</strong></td>
<td>100</td>
<td>112</td>
<td>61</td>
<td>125</td>
</tr>
<tr>
<td><strong>Number (%) of adequate cases</strong></td>
<td>87 (87)</td>
<td>63 (56)</td>
<td>55 (90)</td>
<td>97 (78)</td>
</tr>
<tr>
<td><strong>Thyroid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number</strong></td>
<td>57</td>
<td>105</td>
<td>35</td>
<td>95</td>
</tr>
<tr>
<td><strong>Number (%) of adequate cases</strong></td>
<td>50 (87)</td>
<td>61 (58)</td>
<td>32 (92)</td>
<td>75 (77)</td>
</tr>
<tr>
<td><strong>Parotid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number</strong></td>
<td>20</td>
<td>1</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td><strong>Number (%) of adequate cases</strong></td>
<td>17 (85)</td>
<td>0 (0)</td>
<td>14 (82)</td>
<td>9 (69)</td>
</tr>
<tr>
<td><strong>Lymph node</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number</strong></td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td><strong>Number (%) of adequate cases</strong></td>
<td>0 (0)</td>
<td>1 (33)</td>
<td>0 (0)</td>
<td>11 (84)</td>
</tr>
<tr>
<td><strong>Soft tissue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number</strong></td>
<td>23</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Number (%) of adequate cases</strong></td>
<td>20 (87)</td>
<td>1 (33)</td>
<td>2 (50)</td>
<td>2 (50)</td>
</tr>
</tbody>
</table>

![Figure 1](https://example.com/figure1.png)

**Figure 1.** Adequacy rates (defined as the adequacy of the fine-needle aspiration cytology sample for diagnosis) among all groups.
With cytology support and subspecialist radiologists, the standard adequacy rate for FNAC of 80% (minimum adequacy rate as quoted in the literature) is being surpassed.\textsuperscript{14} Without immediate cytology support, this standard is not being met.

**Discussion**

NICE published recommendations for improving head and neck cancer services in November 2004, and 1 of the 7 “key recommendations” is the stipulation that “diagnostic clinics should be established for patients with neck lumps” with FNA of any suspicious neck lumps.\textsuperscript{1}

There is evidence to support the assertion that a delay in diagnosis can lead to lower survival rates (defined as mean age-adjusted 5-year relative survival); thus, a dedicated neck lump clinic with cytological support and specialist radiologists can improve head and neck cancer survival as treatment is instituted more rapidly.\textsuperscript{15} The incidence of head and neck cancers in England and Wales is reported to be between 8 and 15\(\times\)100,000 of the population, but the survival rates are lower when compared with our European partners.\textsuperscript{15} This may be due to a delay in diagnosis and initial treatment.

Initial investigation of a neck lump by ultrasound is a well-established practice.\textsuperscript{2} Fine-needle aspiration for head and neck cancers started in the 1930s but more recently has been surpassed by the development of ultrasound-guided FNA.\textsuperscript{16–18} There are definite advantages to ultrasound-guided FNAC, which include information on characteristics of the lump, real-time images of the area of interest in the lump avoiding necrotic areas, as well as sampling impalpable lesions.\textsuperscript{6} At our institution, all FNAC of neck masses is performed under ultrasound guidance, regardless of size.

Ultrasound-guided FNAC is the gold standard according to the literature, with sensitivity rates of up to 95% reported. In reality, in 10% to 20% of cases, there is an inadequate sample, and the false-negative rates vary from 1% to 11%.\textsuperscript{19} The rate of adequacy is known to decrease with an inexperienced operator, incorrect techniques in sampling, and incorrect preparation of the samples.\textsuperscript{9}

The benefits of immediate cytology are reported to increase the accuracy of ultrasound-guided FNAC with immediate assessment of samples for adequacy and immediate repeat sample taken if necessary. This in turn benefits the patient and improves trust between the clinician and patient, reduces time from referral to diagnosis, reduces repeat visits, and increases compliance with national cancer targets.\textsuperscript{7}

Currently, the NHS targets for cancer management are 62 days from urgent general practitioner (GP) referral to first treatment and 31 days from diagnosis to first treatment.\textsuperscript{1} Therefore, in our article, assuming a maximum time of 2 weeks from GP referral to initial consultation, there would be only 17 days in which to reach a diagnosis. In the 22% of patients who had inadequate initial FNA samples in group 4 (without on-site cytology support), this would have meant that these patients would fail to meet government targets. Without on-site cytology support at our institution, it can take up to 10 days for resampling of inadequate samples.

However, not all of the literature supports the assertion that on-site cytology improves FNAC adequacy. O’Malley et al\textsuperscript{15} have reported that there was no statistically significant difference in specimen adequacy between FNAC of lesions with immediate versus delayed analysis. A systematic review evaluating 1-stop neck lump clinics found that there is not enough objective evidence to support the view of NICE that diagnostic clinics for neck lumps offer an enhanced service.\textsuperscript{8} On-site cytology can also be quite expensive, with a cytopathologist costing approximately £81 per hour in the United Kingdom and a cytology technician costing roughly £20 per hour.\textsuperscript{5} Having a cytology technician as opposed to a cytopathologist has been shown to have comparable adequacy rates and so could be used as a less expensive alternative.\textsuperscript{11} However, having an on-site cytologist can be important to give a preliminary diagnosis to the patient and allow more adequate patient counseling, thus improving patient satisfaction.

By using the same cytology technician for reporting adequacy for all patients where cytology support was available, this improved the ability to make conclusions regarding the effect of cytology support. However, although the cytology technician was very experienced, there may have been an improvement in her ability to report adequacy as the study progressed, which may have affected the results to some extent.

The adequacy rate with cytology support was 90%, which is comparable with the literature running similar 1-stop clinics in other regions. Adequacy rates with cytology support vary from 74% to 96%.\textsuperscript{7–12}

In this article, we have also looked at the benefits of having a head and neck subspecialist radiologist performing the ultrasound. We demonstrated an increase of 22% in the adequacy of FNAC with the presence of a subspecialist radiologist. To our knowledge, the benefits of having a subspecialist radiologist performing the scans has not been reported previously; therefore, this study presents the first data to support the assertion of the benefits of a head and neck radiologist performing the ultrasound-guided FNAC.

To improve the study design and control groups, we could have included subgroups with and without cytology support within group 1 (subspecialist radiologist) and group 2 (general radiologist). However, when the study was first designed, we wanted to look at the influence of head and neck radiologists with cytology support combined on adequacy rates; hence, the development of groups 1 and 2.

The groups in this study were not matched, and therefore one of the limitations is that comparisons between the groups is limited; however, broad conclusions are clear from the data. Future work is under way to look at other methods to improve the adequacy of ultrasound-guided FNAC, including improving techniques in sample collection.
and preparation, colleague education, and improving selection of target lesions (particularly for thyroid FNAC).

The results support our conclusion that a 1-stop head and neck cancer clinic with on-site cytology support and subspecialist radiologist support can improve patient care and benefit institutions in achieving cancer care targets.

**Conclusion**

Immediate cytology support increases the adequacy of FNAC. The adequacy rate of non-cytology-supported FNAC is below the adequate rate expected from the literature. Nonspecialist radiologist FNAC accuracy rates are significantly less than subspecialist radiologists.

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**Author Contributions**

Sunil Dutt Sharma, concept and design, obtained and analyzed the data, prepared the manuscript, and drafted and approved the final version; Gaurav Kumar, obtained and analyzed the data, drafted the article, and approved the final version; Avril Horsburgh, concept and design, obtained and analyzed the data, drafted the article, and approved the final version; Mahmuda Huq, concept and design, obtained and analyzed the data, drafted the article, and approved the final version; Raed Alkilani, obtained and analyzed the data, drafted the article, and approved the final version; Sanjiv Chawda, concept and design, drafted the article, and approved the final version; Hesham Kaddour, concept and design, drafted the article, and approved the final version.

**Disclosures**

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