Ultrasound guided fine needle aspiration cytology of lesions in the head and neck performed without local anaesthesia- an analysis of pain perception

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Abstract

Introduction

Ultrasound guided fine needle aspiration cytology (UGFNAC) is commonly carried out in the head and neck. The aim was to examine the amount pain experienced by patients undergoing this procedure carried out without the use of local anaesthetic.

Methods

A questionnaire was given to 109 consecutive patients undergoing UGFNAC containing a Visual analogue scale (VAS). Patients were asked to mark with a vertical line on the 100mm horizontal scale amount of pain they experienced during the biopsy. The pain was subsequently categorised as 'no pain', 'mild pain', 'moderate pain' or 'severe pain' based on previous pain studies.

Results

100 patients completed the VAS section of the questionnaire satisfactorily. 21 patients experienced no pain, 62 experienced mild pain and 17 experienced moderate pain. No patients experienced severe pain. Further analysis showed females had significantly higher VAS scores (Man-Whitney test: $U = 925.5$, $z = 2.211$, $P = 0.027$). Patients who were aware they were going to have a biopsy had significantly lower VAS scores than those who were not aware (Mann-Whitney test: $U = 859.5$, $z = 2.263$, $P = 0.024$).

Conclusions

UGFNAC is generally a well-tolerated procedure with pain scores being higher in females. It is advised that patients are told by the referring clinician the need for biopsy as this reduces the amount of pain experienced.

Introduction

Ultrasound guided fine needle aspiration cytology (UGFNAC) is a commonly performed procedure in the radiological assessment of patients with a head and neck swelling. Indeed, ultrasound guided assessment and biopsy of neck lumps is now recommended in the most recent NICE guidance on the management of upper aerodigestive tract cancer.[1] It is not unreasonable to assume therefore that there will be a greater demand for ultrasound guided fine needle aspiration neck biopsy. UGFNAC is a quick and relatively easy technique to perform in an outpatient department. The technique has a high accuracy for both lymph node and salivary gland lesions.[2,3,4]

Generally, local anaesthesia is not used when we carry out UGFNAC, as in our clinical experience most patients tolerate the procedure well. The procedure is fully explained to the patient beforehand and the patients' anxieties allayed as much as possible.

The data arose from an audit/service review comprising a patient satisfaction questionnaire given to patients attending the department. Part of the purpose of the audit was to evaluate the pain experienced by adult patients undergoing UGFNAC of lesions in the head and neck.

<u>Methods</u>

This work formed part of a registered audit/service review. 109 consecutive patients were given a questionnaire to complete after undergoing fine needle aspiration of extra-thyroid lesion/s in the head and neck. The questionnaire covered the service provided by the department but also included a question on the amount of pain the patient experienced during the biopsy.

Patients underwent high resolution ultrasound of the head and neck using a Toshiba Aplio 500 ultrasound machine (Toshiba Medical Systems, Otawara-Shi, Japan). using either a 18MHz or a 14MHz ultrasound probe. If biopsy was required, the procedure was explained to the patient and verbal consent obtained.

The biopsy was carried out using an aseptic technique without local anaesthetic. The needle is inserted adjacent to the centre of the short axis of the probe. Once the lesion was penetrated, the needle was gently rotated and moved backwards and forwards to obtain the sample. A capillary method was used with no suction applied to the needle aspiration

In most cases the sample was obtained using a 21G (green) needle although occasionally other needle types were used; 23G (blue needle) or a 22G spinal needle for deeper lesions. The biopsies were performed by a Consultant Dental and Maxillofacial Radiologist and an experienced trainee in Dental and Maxillofacial Radiology.

The age, gender, biopsy site, needle type, operator and number of passes made was recorded on the back of the questionnaire. In some cases, the patient was aware that the biopsy was going to be performed prior to the appointment and this was also recorded. It was also

recorded whether an information sheet on UGFNAC had been given to the patient prior to the appointment.

The patient was then given the questionnaire to complete in the waiting room anonymously and without coercion from the radiologist performing the procedure. Once completed it was handed back to the clinic coordinator. The questionnaire included a visual analogue scale (VAS) (Fig 1). The patient was asked to mark with a vertical line on a 100mm horizontal scale the amount of pain they experienced during the biopsy. The ends of the scale were marked 'no pain' and 'pain cannot be worse'. There were no intermediary markings on the scale.

Once returned, the VAS scores were measured to the nearest 1mm with a ruler. The score was then categorised into 4 groups: No pain (VAS score 0-4mm), mild pain (VAS score 5-44mm), moderate pain (VAS score 45-74mm) and severe pain (VAS score 75-100mm), as suggested by Jensen, Chen and Brugger.[5]

Statistical tests

Descriptive statistics and graphical methods were used to explore the data initially. VAS scores were found to be heavily right-skewed and so medians as well as means are quoted here. 95% confidence intervals (95% CI) of the mean, standard deviations, and interquartile ranges are quoted also. The right-skew of the data could not be corrected via application of logarithms and so non-parametric tests were used here to test for differences between groups, namely, the Mann-Whitney test for all two-group comparisons and Kruskal-Wallis test (non-parametric one-way ANOVA) for comparisons of three or more groups. Due to the heavy

right-skew of the VAS data, the relationship between VAS score for males and females independently was explored using Spearman's rank-correlation coefficient (rho) and also by gamma regression. Gamma regression is the preferred method when data is right-skewed and inspection of residuals showed that they followed a gamma distribution, as required. Median regression was also carried out (results not quoted here) and the results were found to be broadly similar to results of gamma regression. All inferential statistical tests were carried out using SPSS V23 and gamma regression was carried out using STATA V13.

Results

Of the 109 questionnaires given to the patients 100 had the VAS scale marked giving a response rate of 92%. The subject and biopsy characteristics are given in Table 1. The mean age of the subjects was 58.17 years and the youngest subject was 18 years old and oldest subject was 96 years old. There were roughly equal numbers of males and females. In the vast majority of cases (97%), the information sheet was not given to the patient. 38% of subjects were aware about the biopsy taking place and the procedure was carried out by two operators. In the vast majority of cases (97%), a green needle gauge was used and the median and modal average number of passes was equal to 2. The site for the procedure were mainly in the lymph node region (64%), salivary gland region (23%), both lymph node and salivary gland regions (4%), with "other areas"(i.e., cheek, lesion in supraclavicular fossa, lesion in occipital region) accounting for the remaining 9% of cases.

The VAS scores grouped together into the pain categories is shown in table 2. VAS scores as a function of various groupings are shown in Table 3. This shows that the females had significantly higher VAS scores (Mann-Whitney test: $U = 925.5$, $z = 2.211$, $P = 0.027$) than men, where the difference in mean VAS scores between males and females was 9.414 (95% CI: 1.707 to 17.121). Furthermore, those subjects that were aware about the biopsy had significantly lower VAS scores than those subjects who were not aware (Mann-Whitney test: $U = 859.5$, $z = 2.263$, $P = 0.024$), where the difference in mean VAS scores between "aware" and "not aware" was 7.6 40 (95% CI: –0.373 to 15.654). Although there was some evidence that VAS scores increased with increasing number of passes up to the 3 passes, no significant differences occurred (Kruskal-Wallis test: Chi-square $= 3.812$, DOF $= 3$, $P = 0.283$). Furthermore, 4 or more passes demonstrated anomalous results (e.g., mean VAS score = 16). Finally, there was no significant differences in VAS scores by site (either lymph node or salivary gland: Mann-Whitney test: $U = 612$, $z = 1.194$, $P = 0.232$) or by operator : Mann-Whitney test: $U = 842$, $z = 0.57$, $P = 0.569$). Sample sizes were too low in some groups for the other variables (e.g., needle gauge) to allow reliable quantitative comparison of VAS scores for these variables.

The relationship between VAS and age (in years) was investigated using scatter plots, as shown in Fig. 1. "Lines of best fit" shown in these figures were formed using gamma regression, which is appropriate for right-skewed data. We see that VAS scores for males reduce strongly with age. It was found that the line of best fit of VAS scores scaled with age (in years) followed the expression: VAS $= 60.9244 \times \exp\{-0.0229 \times age\}$. This result indicates a statistically significant 2.26% "compound" reduction ($z = -2.92$ and $P = 0.003$) in VAS each

year for males only, e.g., an initial value of VAS = 30.0 reduces to VAS = 30.0 × exp{−0.0229 × 50} = 9.5 over 50 years. We see from Fig. 1 that VAS scores for females reduce slightly with age. It was found that the line of best fit of VAS scores scaled with age (in years) followed the expression: 32.7828 × exp{−0.0030 × age}. This result indicates a 0.3% "compound" reduction (z = −0.60 and P = 0.545) in VAS each year for females only, e.g., an initial value of VAS = 30.0 reduces to VAS = 30.0 × exp{−0.0030 × 50} = 25.8 over 50 years. Finally, results for Spearman's correlation coefficient (rho) of VAS with age agree with all of these results presented above, i.e., rho for males = −0.364 (P = 0.012) and rho for females = −0.021 (P = 0.825). Thus, males again demonstrate a negative correlation of VAS scores with age that is significant, whereas females demonstrate (at best) a very weak negative correlation of VAS scores with age.

Discussion

VAS is a well-established technique for the assessment of pain following UGFNAC.[6-9] Our results demonstrated that most patients experienced either mild pain (n=62) or no pain (n=21). 17 patients experienced moderate pain, and none experienced severe pain. The cut off points of the categories were those suggested by Jensen.[5] The pain categories are based on the distribution of pain following surgery,[10] but they have subsequently been used to evaluate pain following biopsy in the head and neck.[9]

VAS has been shown to be a reliable and valid method of assessing acute pain.[11] VAS is quick and simple to carry out and has been used in several studies assessing pain following fine needle aspiration biopsy of lesions in the head and neck.[6,8,12] Other established methods of pain assessment include the Numeric Rating Scale (NRS) and the Verbal Rating Scale (VRS),

both of which can also be carried out graphically. The NRS is quick and easy to score but has been shown to have poor reproducibility.[13] VAS is more sensitive than VRS because a larger change is required before it becomes evident on the scale.[14] Overall VAS seems to be the most statistically robust method of assessing pain .[14]

We found that women had a significantly higher VAS score than males, a finding also reported following biopsy of thyroid nodules.[9] There is strong evidence of an increased sensitivity to pain and pain threshold in women.[15,16] Although the reasons for the differences in pain perception between the sexes is unknown it is thought to be multifactorial with genotype and endogenous opioid functioning playing a major role.[17] Sex hormones are also thought to play an important role in pain perception.[17] However it should be noted that other studies have found no differences in pain perception between the genders during biopsy. [7,18]

Age differences in pain perception are not well understood,[19] with some studies reporting an increase in experimental pain in older adults and others reporting the opposite findings. [20,21] However, several studies have reported no differences in pain scores and age.[6,9,18,22] We found that VAS scores for males reduced markedly with age and the VAS scores for females reducing slightly with age. Overall our findings support the findings of a recent study that reported higher VAS scores in younger patients.[23]

Anxiety may also play a role in pain perception.[24] This may partially explain why those patients who knew they were going to have a biopsy generally reported lower pain scores. Presumably these patients had time to assimilate the information and were therefore less anxious about the procedure. As far as we are aware, this finding has not been reported before in relation to UGFNAC in the head and neck. The sample size was too small to examine whether the

information sheet would be helpful, but it seems sensible to provide one whenever possible to allay patients' concerns. One of the action points following the audit was to produce a patient information video on what to expect when having a biopsy carried out.

In our audit/service review we found no differences in VAS scores between the two operators. Although one of the operators was a trainee they were experienced in performing the procedure. A previous study also showed no differences in pain scores between radiologists with different levels of experience.[22]

A study on thyroid FNAC found that pain scores were related to the number of passes.[23] Our results showed there was some evidence of increase in pain scores with the number of passes, but this was not significant. Furthermore, the pain scores for 3 passes were generally higher than for 4 passes indicating larger sample sizes are required to look at this effect.

When we compared the pain scores from biopsies of the salivary glands with those from lymph nodes we found no significant differences. In a recent study by Lo et al. they found that pain scores from lymph nodes were significantly higher than thyroid nodules. The authors were not clear why there was a difference but proposed this may partly be due to the distribution of sensory nerve endings in the neck.[25]

We did not record the depth of the lesion in our audit data set, but it is known that there is an association between lesion depth in the thyroid and increased VAS score.[18] Thyroid biopsy was not included in this audit/service review as these procedures are performed by a different team.

We do not routinely use any topical or injected local anaesthetic during UGFNAC. There are conflicting results on whether topical local anaesthetic is useful.[6,9] In addition, the use of

topical anaesthetic potentially increases the appointment time and adds to the overall cost of the procedure. Alternatively, local anaesthetic can be injected prior to UGFNAC. Despite some papers advocating local anaesthetic injection before ultrasound guided biopsy in other sites such as prostate,[26] pain scores can be higher using this technique in the head and neck.[12] For this reason, it is not recommended to use this technique if there is going to be only a single pass of the biopsy needle.

In the United Kingdom, recently published National Institute for Clinical Excellence guidance in the management of patients with upper aerodigestive tract cancer recommends the use of ultrasound guided biopsy as part of the assessment of a neck swelling.[1] While the presentation of a 'neck lump' encompasses a range of benign and malignant diseases, differentiating between the two may only be possible with UGFNAC. Certainly, the role of ultrasound in the diagnostic work up of these patients will increase. While different models of access to this type of service exist throughout the UK, our work highlights some useful findings which may be taken into consideration when designing a patient centred neck lump service.

Conclusions

- FNAC is generally well tolerated procedure with most patients experiencing either mild pain or no pain during the procedure. No patients experienced severe pain.
- There was no difference in VAS scores between lymph node biopsy and salivary gland biopsy.
- VAS scores were significantly higher in females than males.

- VAS scores for males reduced markedly with age.

- VAS scores were higher in those patients who were not aware they were going to have a biopsy before the appointment. It is advised therefore that patients are told by the referring clinician the need for biopsy and if possible provide the patient with information on the procedure prior to the appointment.

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Table 1. Subject and biopsy characteristics.

|	**Mean**	**Median**	**Minimum**	**Maximum**
Age (years)	58.17	60	18	96
Gender	Males (*n* = 47)	Females (*n* = 53)		
Information sheet given to patient	Yes (*n* = 3)	No (*n* = 97)		
Aware about biopsy taking place	Yes (*n* = 38)	No (*n* = 62)		
Operator	consultant (*n* = 65)	trainee (*n* = 28)	Both (*n* = 7)	
Needle gauge used for biopsy	21G, Green (*n* = 97)	23G, Blue (*n* = 1)	Both 21G and 23G (*n* = 1)	Spinal needle (22G) (n=1)
Number of passes made with the needle into lesion	1 Pass (*n* = 28)	2 Passes (*n* = 50)	2 Passes (*n* = 13)	4 or more passes (*n* = 9)
Site	Lymph Nodes (LN) (*n* = 64)	Salivary Gland (SG) (*n* = 23)	Both LN & SG (*n* = 4)	Other (*n* = 9)

Table 2 VAS scores grouped into pain categories

VAS score	Pain Category	Frequency
0-4mm	No pain	21
5-44mm	Mild pain	62
45-74mm	Moderate pain	17
75-100mm	Severe pain	0
Total		100

Table 3: VAS scores for various groupings.

	Mean (95% CI)	Sample standard deviation	Median	IQR
Males	17.51 (12.48 to 22.54)	17.141	12	25
Females	26.92 (21.09 to 32.76)	21.169	22	32
Aware = Yes	17.76 (11.22 to 24.31)	19.917	10.5	28
Aware = No	25.40 (20.47 to 30.33)	19.406	22	30
1 Pass	18.29 (11.84 to 24.74)	16.635	13	28
2 Passes	23.53 (17.74 to 29.30)	20.322	19.5	35
3 Passes	32.15 (19.53 to 44.78)	20.888	31	37
4 or More Passes	16.00 (< 0 to 33.06)	22.192	5	14
Lymph Nodes	24.67 (19.61 to 29.74)	20.276	19	33
Salivary Glands	19.30 (11.18 to 27.43)	18.792	13	24
Operator (consultant)	22.05 (17.26 to 26.84)	19.335	18	32
Operator (Trainee)	20.11 (12.85 to 27.37)	18.719	16	26
All subjects	22.50 (18.56 to 26.44)	19.854	18	34

Figure 1: The VAS question that the patients were asked to answer.

3. On the following scale mark with a vertical line the amount of pain you experienced during the biopsy

No pain ├─────────────────────────────────┤ Pain could not be worse
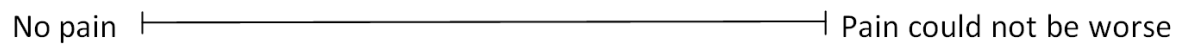
Figure 2: Results of gamma regression of VAS as a function of age for males and females separately.