ORIGINAL ARTICLE

Comparison of Cytologic Adequacy Obtained with A 21G Needle *versus* 23G Needle in Fine Needle Aspirations of Thyroid Nodules

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ABSTRACT

Background: Samples obtained with FNAC of thyroid nodules may be inadequate for diagnosis. Studies show that needle size affects the rate of cytologic adequacy in FNAC. However, few studies have determined cytologic adequacy rates with needles of 21G and 23G size.

Objective: This study aimed to determine the cytologic adequacy rate for 21G and 23G needles.

Methods: This was a retrospective chart review study of 170 patients in whom FNAC was performed with a 21G or 23G needle. The study was performed in interventional radiology department at Liaquat National Hopsital. Medical records from August 2022 to November 2024 were reviewed. Data collection, analysis, and manuscript preparation were carried out from December 2024 to January 2025. The cytologic adequacy of the specimens was obtained from the cytology reports issued by the histopathology department.

Results: A total of 170 patients were studied. The mean age of patients was 46.8 ± 13.0 years. Almost half of the patients had FNAC with a 21G needle (49.4%) and the remaining half with a 23G needle size (50.6%). The adequacy rate for 21G and 23G needle sizes was 89.3% and 91.9% respectively, with no statistical significance (p=0.565). Two patients who had FNAC with a 21G needle developed small hematomas while there was no complication for patients who had FNAC with a 23G needle.

Conclusion: Both 21G and 23G needles can be used for FNAC as they have similar adequacy rates. We suggest 23G needle to be the first choice for FNAC to avoid harm to patients and ensure patients' safety.

Keywords: *FNAC, sample adequacy, 21G, 23G, thyroid nodules.*

INTRODUCTION

Thyroid nodules are very commonly encountered lesions. With increased use of radiological imaging smaller nodules are now encountered more often than they previously were.

The prevalence of thyroid nodules according to a study, that used high-resolution ultrasound, was reported to be 67 % [1]. Although most nodules are benign, a significant number turn out to be malignant. One study showed the malignancy rate to be 14.8 % [2].

Fine needle aspiration cytology (FNAC) is used to differentiate malignant from benign nodules. For an appropriate cytologic diagnosis, an adequate sample is necessary. An inadequate sample leads to repeated FNACs and a delay in diagnosis. Operator expertise, nodule characteristics, and needle size, all contribute to cytologic adequacy rates. Studies have demonstrated different sample adequacy rates using needles of different sizes [3, 4]. 20G to 27 G needles are used for thyroid FNACs [5].

Several studies have been carried out to determine sample adequacy rates with different-sized needles ranging in size from 21G to 27G. The results from these studies are variable with some researchers showing that finer needles result in better sample adequacy, whereas others showing that using larger needle size will result in an increased quantity of sample thereby reducing the chance of non-diagnostic aspirate [6, 7]. Most of the studies compare adequacy rates between needles ranging in size from 23 to 27 gauge. The existing literature is scarce regarding the comparison of 21G with other needle sizes [8]. To the best of our knowledge, as of yet, only a single study has been conducted comparing sample adequacy of 21G with 23G needles among head and neck masses [9].

Since the early 2000s, we have been using 21G needle for FNAC in our institution with good results without any major complications or patient complaints. However, due to favorable results from studies using smaller needle gauge, we started using 23G needles [7, 8]. Due to the lack of studies on the evaluation of 23G *versus* 21G needle and in light of the recent recommendation for opting for lower gauge needles, we planned the current study to compare cytologic adequacy obtained with a 21G needle *versus* 23G needle in FNAC of thyroid nodules.

METHODOLOGY

This is a retrospective chart review study conducted at the Interventional Radiology Department of Liaquat National Hospital. Medical records from August 2022 to November 2024 were reviewed. Data collection, analysis, and manuscript preparation were carried out from December 2024 to January 2025 after acquiring an exemption letter from the Ethics Committee of Liaquat

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National Hospital, Karachi. Records were retrieved for patients who were referred to the interventional radiology department for FNAC of thyroid nodules. Patients whose cytologic reports were not on record, those who were undergoing a second FNAC following inadequate samples from a first, patients with purely cystic lesions with no identifiable solid component, those with a generalized enlargement of the thyroid gland with no definite thyroid nodule, and pediatric cases were excluded from this study.

Patients meeting the fine-needle aspiration requirements outlined in the American Association of Clinical Endocrinologists (AACE) Guidelines for the Diagnosis and Management of Thyroid Nodules were included in this study [10]. A solid thyroid nodule was defined as one that contained a solid component that made up at least 50% of its volume.

The patient was kept with their neck extended and in the supine posture. After all aseptic measures, 2% lidocaine was given as a local anesthetic. 21G or 23G gauge needles attached to the syringe were used. The needle gauge was decided randomly. Under ultrasound guidance, the needle was moved back and forth within the nodule 10 to 15 times. Slides were made from the aspirated content, fixed with fixative, and sent for cytology. All the procedures were performed by trained radiologists having at least 5 years of relevant experience. The cytopathologic diagnosis was made using hematoxylin-eosin staining. A pathologist blinded to the needle size assessed all specimens. Adequate FNAC specimens were defined as containing six groups of follicular cells of 10 to 20 cells each on two different slides [11].

The details of the procedure and equipment used were collected from the patient's records file. The cytology reports were collected from the histopathology department. Data was retrieved for variables including patients' age, gender, needle size, and sample adequacy.

The collected data was entered in SPSS version 27 to perform data analysis. Frequencies and percentages were computed for categorical variables including age groups, gender, needle size, and adequacy status. Numerical variable such as age was summarized as mean ± standard deviation. Stratification was done for age groups and gender. Post-stratification chi-square or Fisher-exact test was applied to compare adequacy among two needle sizes. Statistical significance was defined based on a 5% level of significance.

RESULTS

A total of 170 patients were studied. The mean age of patients was 46.8 ± 13.0 years. The age range of patients was 25-78 years. A few of the patients had an age range of 25-29 years (10%). Nearly a quarter of patients were in the age bracket of 30-39 years (25.9%) and 40-49 years (27.1%) whereas one-fifth had an age group of 50-59 years (16.5%) and 60 years and above (20.6%). Fig. **(1)** displays the age distribution of study subjects. More than half of the patients were females (57.6%).

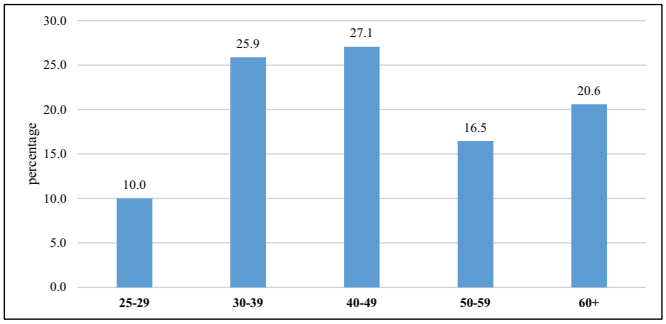

Fig. (1): Frequency distribution for age of study subjects.

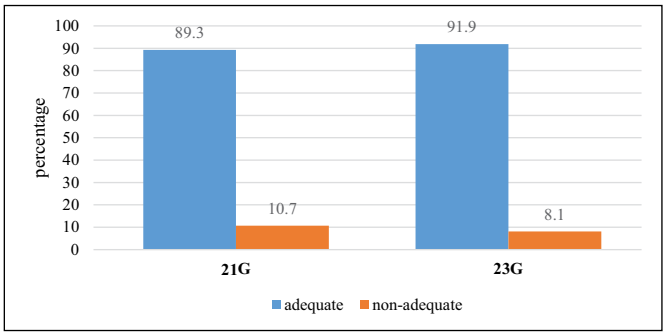

Fig. (2): Frequency of adequacy for needle size of 21G and 23G.

Table 1: Comparison of adequacy among two needle sizes with stratification of patients' age and gender.

Variables	Groups	Needle Size		p-value
		21G n(%)	23G n(%)	
Age groups				
25-29 years	adequate	12(100)	5(100)	-
	non-adequate	0(0)	0(0)	
30-39 years	adequate	19(90.5)	21(91.3)	1.000
	non-adequate	2(9.5)	2(8.7)	
40-49 years	adequate	19(79.2)	21(95.5)	0.190
	non-adequate	5(20.8)	1(4.5)	
50-59 years	adequate	12(92.3)	13(86.7)	1.000
	non-adequate	1(7.7)	2(13.3)	
60 years and above	adequate	13(92.9)	19(90.5)	1.000
	non-adequate	1(7.1)	2(9.5)	
Gender				
Male	adequate	30(88.2)	35(92.1)	0.700
	non-adequate	4(11.8)	3(7.9)	
Female	adequate	45(90)	44(91.7)	1.000
	non-adequate	5(10)	4(8.3)	

Almost half of the patients received a 21G needle size (49.4%) and the remaining half received a 23G needle size (50.6%). The adequacy rate for 21G and 23G needle sizes was 89.3% and 91.9% respectively **(Fig. 2)**.

Adequacy rate for the two needle sizes was not significantly different (p=0.565). Two patients who had FNAC with 21G needle developed small hematomas while there was no complication for patients who had FNAC with a 23G needle.

Table **1** displays a comparison of cytologic adequacy between the two needle sizes with stratification of patients' age and gender. The adequacy rate was 100% for both of the needle sizes in the age group 25-29 years. Adequacy rate was not hugely different among patients of age 30-39 years (90.5% *versus* 91.3%) and those who were 60 years and above (92.9% *versus* 90.5%). For the age range of 40-49 years (79.2 *versus* 95.5%) and 50-59 years (92.3% *versus* 86.7%), a noticeable difference was seen in adequacy between the two needle sizes but it was not statistically significant. Adequacy was not found to be statistically different among the two needle sizes when stratification was not for males and females.

DISCUSSION

The diagnosis and treatment of thyroid nodules are influenced by many factors, especially the ultrasound-guided FNAC results. However, the application of FNAC is limited by the high non-diagnostic rate. The non-diagnostic result on FNAC may lead to a delay in treatment, unnecessary diagnostic thyroidectomy, or repeat fine-needle aspiration. A repetition of fine-needle aspiration may prolong patient anxiety and cause an economic burden on patients [12, 13].

One of the several factors that contribute to unsuccessful FNAC procedures, in which an inadequate amount of aspirated material is collected, is the size of the needle used [14]. Despite the many advances in all aspects of cancer diagnosis, there are still no uniform standards for the size and type of needle that will allow for optimal diagnosis. Thus in this study, we compared the diagnostic yield of 21G with 23G needles which are used in our institute.

This study found an adequacy rate of 89.3% for 21G needles. This finding is consistent with a similar research conducted in Turkey reporting sample adequacy of 84% for 21G needle [8]. Our finding is also closer to a study performed in North America demonstrating that 21G yielded sample adequacy of 82% [15]. Nagarajah and coworkers assessed the success rate of repeated FNAB for clinically suspicious thyroid nodules. They reported that a 21G needle provided a mean of 41-cell cluster with a mean of 1010 cells and a success rate of 78% [16]. A very low sample adequacy of 57% was reported in a study by Degirmenci *et al.* for 20G needle which shows that increasing the size of needle beyond 21G may result in poor sample adequacy [17].

The present study indicated a sample adequacy of 91.9% for the 23G needle. Our results are comparable to those obtained in a study by Chen *et al.* who assessed the difference in sample adequacy between successive needle passes [18]. Chen *et al.* utilized a 23G needle in their study and reported an overall adequacy of 92.1% [18]. The adequacy rate for first, second, and third passes was 91.3%, 92.5%, and 92.5% respectively [18]. In contrast to our findings, Puga *et al.* reported a lower rate of cytologic adequacy, 69.4%, using 23G needle [19]. An adequacy rate of 88.5% was seen for 23G needle in the study of Zhang L and coworkers [6]. Dong *et al.* studying ultrasound-guided fine needle aspiration cytology quality in thyroid nodules with different needles, reported adequacy of 79.6% for 23G needle [7]. Rechter *et al.* however showed an inadequacy rate of 32.6% for the 23G needle, which is quite high [20]. Another research showed a non-diagnostic rate of 17% for 23G needles [21]. The variability in cytologic adequacy rates between studies using the same needle sizes may be due to differences in techniques, operator expertise, or needle characteristics other than the gauge. Also, none of our patients developed any significant or lasting complication from either needle size, again proving the safety of both needle sizes for fine needle aspirations.

No significant difference in cytologic adequacy rate was seen between the two needle sizes, 21G and 23G, in our research. Moreover, the difference in complication rates between the two needle sizes was also non-significant in this research. A clinical trial was performed on 100 patients comparing the sample adequacy and pain status between 21G and 23G needles used for fine needle aspirations. The trial reported that pain was lower for the 23G needle but there was no difference in sample adequacy rate [9]. Apart from our study literature does not exist comparing 21G with 23G in terms of sample adequacy of FNAC in thyroid nodules. The most likely reason for the non-existence of this comparison could be that operators have shifted away from larger needle sizes to avoid higher complication rates compared to smaller bore needles.

CONCLUSION

Both 21G and 23G needles can be used for FNAC as they have similar adequacy rates and similar safety profiles. However, 23G needles may be the first choice

for FNAC to avoid the minimal increased risk of minor complications to patients by 21G needle usage.

ETHICS APPROVAL

Due to the retrospective nature of this study, an exemption letter was received from the Ethics Committee of Liaquat National Hospital, Karachi. All procedures performed in studies involving human participants followed the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

KM: Design, literature review, supervision, and writing.

MT: Concept, protocol review, data collection, data interpretation, and manuscript review.

DKS: Drafting, data collection, and critical review.

SH: Protocol review, data collection, and manuscript review.

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