

Impact of Introduction of a short course on nasopharyngeal anatomy and swab collection on the knowledge and skills of health professions' students.

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ABSTRACT

Polymerase Chain Reaction (PCR) test is a routine method, used worldwide for diagnosis of Covid-19 disease. Insufficient knowledge of nasopharyngeal anatomy and improper procedure by the healthcare professionals involved in collecting the specimens can result in patient discomfort and a high rate of false negatives. Thus, knowledge and skill necessary to perform the test should be a part of curriculum of health care professionals who will be involved in collecting such specimens. Present study was conducted in Gulf Medical University (GMU). Volunteers were invited from final year students of biomedical sciences. Students took a pre -test on nasopharyngeal anatomy and knowledge relevant to nasopharyngeal swab collection before the course. Students then underwent a short course which included nasopharyngeal anatomy and proper technique of nasopharyngeal swab collection. After the course, students took the post- test and were assessed for the ability to perform the nasopharyngeal swab collection. There was significant increase in the numbers of students identifying the correct method of inserting the nasal swab, locating the nasopharynx, identifying conditions like nasal polyp and deviated nasal septum and ideal nare to insert the swab in abnormal or asymmetrical nasal conditions. Implementation of training programs on knowledge specific to nasal anatomy and clinical aspects of nasal cavity, hands on practice of proper technique of nasopharyngeal swab collection in the curriculum specially for graduating students improves the quality of trained professionals who will perform nasopharyngeal swab collection as a part of their routine lab work.



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1. INTRODUCTION

Testing of Covid-19 patients is essential to plan appropriate preventative and therapeutic measures. Accuracy of laboratory tests is important for diagnosis and management of novel coronavirus outbreak and thus, needs to be assessed carefully. Inaccurate interpretation of results might have serious impact on the society [1], [2]. Substandard method of specimen collection is the reason for false negative results. Error-free sampling technique and precise sample collection are two important steps for accurate RT-PCR test [3].

There are many concerns raised about inaccurate diagnostic tests and applicability of the collected specimen. Polymerase Chain Reaction (PCR) test on a nasopharyngeal swab sample is now a routine method, used worldwide for accurate diagnosis of Covid-19 disease. Nasopharyngeal specimen which carries high viral load is a specimen of choice for RT-PCR test [4], [5]. Nasopharynx is a structure located posteriorly and cannot be visualised easily through external nares by the technologist collecting the specimen [4]. Insufficient knowledge of nasopharyngeal anatomy and improper procedure by the healthcare professionals involved in collecting the specimens can result in patient discomfort and a high rate of false negatives [6]. Knowledge and skill necessary to perform it should be a part of curriculum of health care professionals especially students of biomedical and medical laboratory sciences who, as future technologists, will be involved in collecting such specimens. However, so far there has been no inclusion of such a procedure or skill in their curriculum in Gulf Medical University (GMU). We, therefore, felt a need for a short course on nasopharyngeal swab collection for students currently undergoing clinical laboratory training. We have also studied the impact of its introduction on the knowledge, skills, and the perceptions of these students.

2. Methods

2.1 Study Design

Educational Intervention study (pilot). The study was conducted in GMU. Approval was taken from the IRB College of Medicine, GMU (Ref.no.IRB/COM/FAC/58/March-2021) before start of the study. Students of Bachelor of biomedical sciences, were informed about the course and invited to join. Informed consent was obtained from the students. Enrolling in the course was voluntary. A short course on nasopharyngeal swab collection was conducted in 3 short sessions which included nasal anatomy, clinical aspects of nasal cavity and guidelines on nasopharyngeal swab collection, and hands on practice on manikins and volunteers. All results were kept confidential and stored with the investigators.

2.2 Data collection and analysis

65 students participated in the study. Students took a pre-test on knowledge and skills relevant to nasopharyngeal swab collection before the start of the course. A short quiz with questions based on nasopharyngeal anatomy and clinical aspects of nasal cavity was conducted to evaluate student's knowledge prior to the course. Pre-test also included observation of the skills of nasopharyngeal swab collection on manikins for the students who may have performed it/learnt it before. Students then underwent a short course which included a session on nasopharyngeal anatomy which was aimed at location and extent of nasopharynx, parts of nasopharynx. Location and access to the nasopharynx was more emphasized upon during the course. It also included a session on clinical aspects of nasopharyngeal anatomy by an ENT surgeon and a demonstration video was shown describing the technique, guidelines and challenges that could be faced while collecting the nasopharyngeal swab specimen for testing. The proper technique of nasopharyngeal swab collection was taught by the trained technologist under the guidance of the ENT specialist on manikins and volunteers. Students then had hands-on practice on manikins. Students also practiced the test on each other as volunteers, under supervision.

After the course, students took the post-test on nasopharyngeal anatomy and were assessed for the ability to perform the nasopharyngeal swab collection. Students' feedback regarding the utility of the course with respect to improvement in knowledge and skill of nasopharyngeal swab collection was also obtained. Appropriate Descriptive and inferential statistics was used to analyse the results. Results were considered to be statistically significant with P value ≤ 0.05 (by Wilcoxon signed rank test).

3. Results

There was a significant improvement in students' knowledge of nasal anatomy or clinical aspects related to nasal cavity after the course (Table 1).

There was a significant increase in the numbers of students identifying the location of the nasopharynx 10(15%) vs 2(3%) p value ≤ 0.05 , identifying conditions like nasal polyp 22(33%) vs 7(10%) p value ≤ 0.05 and deviated nasal septum 21(32%) vs 6(9%) p value ≤ 0.05 and ideal nare to insert the swab in abnormal or asymmetrical nasal conditions 18(27%) vs 7(10%) p value ≤ 0.05 . The was correct pathway of inserting the nasal swab 40(61%) vs 1(1.5%) p value ≤ 0.05 .

Table 1: Comparison of responses in the pre-test and post-test

Incorrect responses	Pre-test Number (%)	Post-test Number (%)
Location of nasopharynx	10 (15%)	2 (3%)
Identification of nasal polyps	22(33%)	7 (10%)
Identification of deviated nasal septum	21 (32%)	6 (9%)
Identification of suitable nare to insert the swab	18(27%)	7(10%)
Pathway of inserting swab	40 (61%)	1 (1.5%)

All the students followed a checklist to collect the specimen. (Table 2). 2 (3%)students out of 65 followed the checklist in the first attempt. 58(89%) students followed the checklist in the second attempt. While 5 (7%) students followed the checklist in third attempt. (Table 3)

Table 2: Performance Checklist

No.	Task to be performed
1	Prepares the workspace and dons Personal Protective Equipment (medical mask, face shield, gown, alcohol rub, gloves)
2	Documentation of patients' demographic information and cross checks patients name with the label provided for the specimen
3	Obtains patients clinical history, explains the procedure to the patients and positions the patient appropriately
4	Inserts the swab correctly and obtains the specimen from nasopharynx, collects it in the collection tube
5	Removes PPE and discards appropriately

Table 3: Performance of the nasopharyngeal swab collection skill

Attempts	Correct performance Number (%)
First attempt	2(3%)
Second attempt	58 (89%)
Third attempt	5 (7%)

Feedback was taken from the students regarding their knowledge, technique and comfort in performing the

swab collection (Table 4). Feedback was also taken regarding inclusion of this course into the regular curriculum considering the current situation of pandemic. 61(93%) students felt that training program should be included in the curriculum.

Table 4: Students' feedback regarding the course

No.	Item	Positive Responses
1	The session improved my knowledge of nasal anatomy	65 (100%)
2	The session gave me relevant information about guidelines and procedure of nasopharyngeal swab collection	65 (100%)
3	The session improved my skill of collecting nasopharyngeal swab.	65(100%)
4	The session will help me in my professional carrier	65(100%)
5	Do you think this course should become a part of the curriculum?	61(93%)

There was an increase in the average number of correct responses to the knowledge-based test following the session. In the pre and post-test (n=65), Average score was observed was 8 (range-8) & 10 (range-5) respectively. Introducing the short course improved the average score improved from 8 to 10. The observed '2 score difference' in the average (effect size-2 score) was found to be statistically significant with p value ≤ 0.001 (by Wilcoxon signed rank test).

4. Discussion

RT-PCR of nasopharyngeal swabs have been used typically as a confirmatory diagnostic method for covid 19 as it is most convenient and accurate. Nasopharyngeal site has the highest viral load and thus SARS COV 2 can be readily detected in the specimen collected [3], [7]. Nasopharyngeal swab collection must be performed by a trained healthcare professional who is familiar with knowledge specific to nasal anatomy the proper technique [8]. All the students who participated in the study had taken anatomy courses. However, they did not have any prior educational session specifically only on nasal anatomy or any prior experience of performing nasopharyngeal swab collection or any other type of nasal tests. In present study there was a significant improvement in knowledge of the students after the course. Prior to the course the students were aware of nasopharynx as the target for swab collection but could not identify the exact location on the sagittal section. Students also failed to identify the boundaries of the nasal cavity. 10(15%) students could not locate the nasopharynx prior to the training program. There was significant increase in average number of correct responses and improvement after the course where in students could locate the nasopharynx on a sagittal section (Table 1). A trained professional collecting the nasopharyngeal swab should have adequate knowledge of nasal anatomy and should be aware and cautious of clinical aspects of nasal cavity such as deviated nasal septum, nasal polyps and blocked nasal passage [9]. In present study students had not taken any training program and had a limited knowledge on clinical aspects of nasal cavity. As shown in Table 1, students failed to identify the boundaries of the nasal cavity, conditions like deviated nasal septum, nasal polyps prior to the course. 22(33%) students could not identify nasal polyp and 21(32%) students could not identify the deviated nasal septum in pre-test. They also failed to identify the suitable nare which could be comfortably used for swab collection. 18(27%) students could not correctly identify the suitable nare for swab collection in abnormal or asymmetrical conditions prior to the course. Identification of conditions such as nasal polyp, septal deviation, inferior turbinate hypertrophy or presence of post-surgical scar tissue will help the students to select a suitable nare for swab collection and prevent patient discomfort, nasal trauma or nasal bleeding [4]. There was significant improvement after the course

where in number of students accurately identifying conditions related to nasal cavity significantly improved.

Obtaining nasopharyngeal specimen is not as easy as other types of specimens. Specimens obtained by inexperienced personnel could result in substandard specimen and consequently a false negative result. Challenges with nasopharyngeal swab collection include patient discomfort, coughing, nasal bleeding. Poor technique of specimen collection, inadequate sample, specimen transport and storage issues are the potential causes of false negative results. The most common cause of false negative test results is inadequate sample collection. Thus, clear knowledge and understanding the proper technique of adequate sample collection is important [9- 11] Prior knowledge of nasal anatomy and clinical aspects related to nasal cavity and adequate training about the technique of nasopharyngeal swab collection is important to avoid improper test results. In present study training the students with proper technique of nasopharyngeal swab collection was emphasized. Students were not comfortable performing the test prior to the course. They experienced issues like inability to position the patient accurately, inability to identify the suitable nare to pass the swab, patient discomfort, inability to locate the nasopharynx, pass the swab at a correct angle to reach the target area. The correct pathway to reach the nasopharynx is along the hard palate of the nose which is often presumed to be along the dorsum of the nose. 40(61%) students did not know the correct pathway to reach nasopharynx. After the course there was improvement in the swab collection technique of the students. (Table 1). With improved knowledge of specific nasal anatomy, clinical aspects related to nasal cavity and training on proper technique of swab collection helped them reach the nasopharynx for smooth and correct method of specimen collection [6]. There was significant improvement in the technique of nasopharyngeal swab collection. Students felt comfortable performing the nasopharyngeal swab collection after the session. Performance was checked using a checklist (Table 2). As shown in Table 3, only 2 (3%) students out of 65 performed it correctly in the first attempt. 58 (89%) students performed it correctly in the second attempt. While 5 (7%) students needed a third attempt. All 65 (100%) of them performed it correctly independently on the manikin by the end of the session. In addition, 32 (49%) felt comfortable enough to perform the nasopharyngeal swab collection on a volunteer under supervision. Thus, there was a significant improvement in technique of nasopharyngeal swab collection after the course. Similar study was conducted. They found improvement in knowledge and confidence level of performing the nasopharyngeal swab [12]. Study conducted by Mark et al on simulation education on comfort of healthcare worker with nasopharyngeal swabbing showed improvement in knowledge and confidence in performing the nasopharyngeal swab [13].

Feedback was taken from the students regarding their knowledge, technique and comfort in performing the swab collection (Table 4). All students found the course to be useful and that their knowledge and skills had improved. Feedback was also taken regarding inclusion of this course into the regular curriculum considering the current situation of pandemic. 61(93%) students felt that training program should be included in the curriculum.

5. Conclusion

Considering the current situation of Covid-19 pandemic there is additional pressure on healthcare professionals in various fields to collect nasopharyngeal swabs which is the most reliable procedure in accurate diagnosis of covid 19. Adequate training of technicians involved in covid testing is essential to avoid inaccurate test results. Training program includes clear knowledge of nasal anatomy, clinical aspects of nasal cavity and training of proper technique of nasopharyngeal swab collection. Many online courses on how to obtain a nasopharyngeal swab have been introduced for training healthcare providers and technicians. However, clear knowledge specific to nasal anatomy and clinical aspects of nasal anatomy,

hand on practice of proper technique of nasopharyngeal swab collection will improve the quality of trained professionals who would in future be posted in various labs and perform the procedure. Our study recommends implementation of training programs in the curriculum specially for final term and graduating students who will be expected to perform nasopharyngeal swab collection as a part of their routine lab work.

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7. Competing Interests

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9. Authors contribution

Conceptualization was by GK. SS, RG were involved in data collection and methodology. SS data analysis, writing of paper. All authors read, edited, and approved the final manuscript and are all in agreement with the manuscript.

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