The Application Effect of Specialized Sampling Nurses in the Nasopharyngeal Swab Collection for Nucleic Acid Amplification Test of COVID-19

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Abstract: Objective: To explore the application effect of specialized sampling nurses in the nasopharyngeal swab collection for nucleic acid amplification test of COVID-19. Methods: The research period was from January 26, 2020 to February 8, 2020. It was from February 1, 2020 that specialized sampling nurses began to collect specimens. The pre-implementation period was from January 26 to 31, 2020, while the post-implementation period was from February 1 to 8, 2020. The pass rates of nasopharyngeal swab specimens collected before and after implementation were compared. At the same time, the working hours before and after implementation were also compared. Results: The pass rate of nasopharyngeal swab specimens after implementation was significantly higher than that before implementation (P<0.05), and the working time of specimen collection was significantly shortened. Conclusion: By establishing specialized sampling nurses to collect nasopharyngeal swabs, we can effectively improve the pass rate of specimens, shorten the working time and guarantee timely and accurate assistance to clinical diagnosis.

Keywords: 2019-nCoV; nurse; sampling; specimen collection

1. Introduction

2019 novel coronavirus (2019-nCoV) was named by the World Health Organization on January 12, 2020 [1]. On February 8, 2020, the members of the Joint Prevention and Control Mechanism of the State Council against COVID-19 Outbreak decided to name the novel coronavirus-infected pneumonia as novel coronavirus pneumonia ("NCP" for short) temporarily. The spread of 2019-nCoV in Hubei Province, China and even other countries resulted in the occurrence of thousands of cases. Both the number of outpatients and inpatients kept increasing. In the newly released "Diagnosis and Treatment Plan for Novel Coronavirus-infected Pneumonia (Trial, 5th Edition)", it was recommended to select nasopharyngeal swabs to conduct nucleic acid amplification test and confirm COVID-19 infection. For this reason, whether nasopharyngeal swab sampling was accurate and whether key sites were sampled and other factors may affect the test results. Our hospital implemented a system for specialized sampling nurses to collect nasopharyngeal swab specimens and achieved good results. Below, the research process will be shared, in the hope of contributing to nasopharyngeal swab collection by anti-epidemic hospitals this time.

2. Data and Methods

2.1. General Data

Our hospital was prefecture-level medical center in Hubei Province. On January 21, 2020, it was named as a fever clinic medical institution, a designated treatment agency for COVID-19 and a designated treatment hospital for critically ill patients in Jingzhou City. Since January 26, it has begun to collect 2019-nCoV nasopharyngeal swabs for nucleic acid amplification test. From January 26 to 31, 2020, the swabs were collected by medical personnel on duty in the fever clinic and infection wards. Since February 1, 2020, the swabs began to be collected by specialized sampling nurses. There were no significant differences between two groups in terms of general data before and after implementation (P>0.05).

2.2. Materials and Methods

2.2.1. The collection and delivery of specimens

Before implementation, the specimens were collected by medical personnel in the fever clinic and infection wards and then immediately submitted for test by dedicated staff in the Public Health Division. After implementation, the specimens were collected by specialized sampling nurses at the bedside of the fever clinic and infection wards and then immediately submitted for test by dedicated staff in the Public Health

Division.

2.2.2. Nasopharyngeal swabs

In our study, FLOQSwab® disposable sampling swabs and virus sampling tubes produced by Shanghai Yingchuang Biotech Co., Ltd. were used uniformly. Attention was paid to the fact that only sterile polyester or rayon swabs with plastic rods can be used for nasopharyngeal swab collection [2]. When the swabs were contaminated, other cotton swabs with wooden rods cannot be used instead.

2.2.3. Inclusion criteria

Only nasopharyngeal swabs that complied with the nucleic acid amplification test standard, upon consultation of the expert panel of the hospital and passed the review of the Public Health Division of the hospital were included.

2.2.4. Definition of unqualified specimens

(1) No epithelial cells were detected during test; (2) the cap of sampling tube was not tightened and liquid oozed; (3) the label on the sampling tube was blurred.

2.3. Management of Specialized Sampling Nurses

2.3.1. A specialized sampling nurse team was set up

The team was organized, established and managed by the Nursing Department in a uniform way. The first echelon shall be composed of 4 people, the team leader and team members. While the second echelon shall be composed of 4 people, who awaited orders receiving training and assessment and can be invoked at any time. The team leader was the head nurse of the Department of Pediatrics who had rich experience in the collection of nasopharyngeal swab specimens, while the team members were backbone nurses who were skilled in operation and stable in psychological quality, selected from nurses in the Department of Respiratory and Critical Care Medicine and the Department of Pediatrics.

2.3.2. Special trainings on knowledge related to sampling

(1) Training contents: ① knowledge related to the protection from COVID-19: on the basis of strictly implementing standard prevention, specialized sampling nurses stepped up controls over f infection through contact transmission, droplet transmission and airborne transmission [3], launched three-level protection and added face shields; ② the usage of protection articles, including wearing, taking off and classified disposal; ③ key points in the collection of nasopharyngeal swab specimens: “To be deep, turn and get cells”. “To be deep” meant to reach deep inside, till 1/2 of the length from the earlobe to nasal tip. “To turn” meant that the head end of swab should make about 4-5 turns after reaching the site. “To get cells” meant that epithelial cells should be extracted from the nasopharyngeal cavity and oropharyngeal cavity.

(2) Training methods: WeChat video teaching, demonstration teaching and role play were adopted. Role play was added for the collection of nasopharyngeal swab specimens, that is, the team members worked in pairs, served as the collector and patient to each other and experienced the angle, depth and force of collection, as well as the feelings of patients.

(3) Operation method: ① two specialized sampling nurses worked in fixed pairs and worked together to finish the operation. One nurse served as the sampling operator and the other nurse served as an assistant who always kept relatively clean, passed on the operation items and specimen seals to the operator. ② Specimens were collected with pharyngeal swab rods, which allowed sampling easily with little pain. Using two swab rods, the operator sampled the nasopharyngeal cavity and oropharyngeal cavity by scraping the lower nasal cavity and posterior pharyngeal wall by appropriate force, without touching the tongue and oral mucosa. After sampling, the head ends of the two swab rods were put into the same sampling tube and the cap was tightened. The sampling tube was dropped into the sealing film in the hand of assistant.

(4) Assessment method: standardized patient simulation assessment was employed.

2.3.3. Empowerment of specialized sampling nurses

Nasopharyngeal swab collection implied a high occupational exposure risk. Specialized sampling nurses needed to go deep into multiple infection wards every day, and the working environment was very complex, which cannot be handled by a single person. To cope with the stressful situation, it was a necessary course to empower members of the specialized sampling nurse team and build the team [4]. In this case, specialized sampling nurses signed up voluntarily and the Nursing Department selected from them. The Nursing Department took the lead to organize training, enhance the protection knowledge and sampling capacity, offer sufficient protection articles to the nasopharyngeal swab collection team, step up efforts in publicity, carry forward positive ethos and inspire the teamwork spirit of specialized sampling nurses. The team leader was responsible for communicating, contacting and arranging shifts according to the workload, supervising quality and the ideological trend of members and summarizing the work on a daily basis.

2.4. Modification of Workflow

(1) The persons in charge of the fever clinic and infection wards tallied the information of patients who needed nasopharyngeal swab specimen to be collected the next day in each ward and submitted it to the dedicated staff of the Public Health Division for approval.

(2) Before 21:00 every day, the dedicated staff of the Public Health Division sent the patient information sheets that had been approved (department, bed no., name, admission/medical record no., tel) to the WeChat group of specialized sampling nurse group.

(3) The team leader arranged specialized sampling nurses on duty the next day to work in pairs in an orderly

manner, according to the sampling workload of each ward the next day, informed the place and specific time to start working in the morning to each pair.

(4) The specialized sampling nurses working in pairs arrived at designated wards on time each day, wearing protection suits and articles, checked the list of sampled patients, and cooperated with each other to complete the collection of specimens.

(5) After sampling was done in each ward, the specialized sampling nurses immediately handed over the specimens to the dedicated staff of the Public Health Division, so that the specimens can be delivered in time.

2.5. Quality Control

The team leader contacted dedicated staff of the Public Health Division every afternoon, checked whether the specimens collected on that day were up to standard. For unqualified specimens, the leader discussed with the examiners and samplers in the WeChat group, to identify problems, analyze the reasons and figure out improvements.

3. Results

3.1. Analysis of Pass Rate of Specimens

In this study, a total of 584 nasopharyngeal swab specimens were collected. Among them, the medical personnel in the fever clinic and infection wards collected 283 specimens, including 10 unqualified specimens, 8 cases without any epithelial cells being detected, 8 cases with untightened cap of sampling tube, 1 case with blurred label on sampling tube. The specialized sampling nurses collected 301 specimens, including 1 unqualified specimen, without any epithelial cells being detected. The pass rates of nasopharyngeal swabs before and after the implementation of specialized sampling nurses were compared and the difference was statistically significant (P<0.05). For details, see the following Table 1.

Table 1. The Pass Rates of Specimens before and after the Implementation of Specialized Sampling Nurses

Group	Total Number of Cases	Passed	Failed	Z	P
Pre-implementation	283	273 (96.47 %)	10 (3.53 %)	-2.838	0.004
Post-implementation	301	300 (99.67 %)	1 (0.33 %)		

3.1. Analysis of Operation Time of Sampling

Before the implementation of specialized sampling nurses, the sampling in the fever clinic and various wards was done by medical personnel on duty on the same day in each ward. Ten patients in the wards were sampled in batches. It took 85 minutes to wear and take off the protection suit, and hand over the specimen to the staff of the Public Health Division. 10 patients in the same ward were sampled by specialized sampling nurses, and it took 45 minutes to wear and take off the protection suit, and hand over the specimen. After the implementation of specialized sampling nurses, the working time was remarkably shortened.

4. Discussion

4.1. Special Trainings were the Basis

Now it has been confirmed that 2019-nCoV can be transmitted from person to person on a continuous basis, mainly through respiratory droplets and contacts [5]. If the sampling was carried out by different medical workers every day, some feared that aerosols may be produced and they may be infected for getting too close to the patients. Moreover, the technical training was not all-pervading, which can lead to insufficient sampling depth and brushing frequency of sampling operators. After systematic training and assessment was given to specialized sampling nurses, a correct sense of protection and standardized protection measures can reduce the working stress of nurses and avoid occupational exposure, and increase the pass rate of specimen collection and the accuracy of test results, so as to offer an accurate diagnostic basis for doctors [6].

4.2. The Optimization of Workflow was the Premise

Before the implementation of specialized sampling nurses, there existed such phenomena as the preparation the Public Health Division, samplers and patients were at different stages, the medical staff got tired for wearing heavy protection suit and waiting for too long. While after the implementation of specialized sampling nurses, the workflow was straightened out, communication and cooperation among various parties were strengthened, and the three parties were notified to make preparations in advance, which shortened the time and avoided the above circumstances [7].

4.3. Quality Control was the Guarantee

After the implementation of specialized sampling nurses, only 1 unqualified specimen occurred. By communicating with the clinical lab, we learned the reason for the failure of nasopharyngeal swab collection, that is, no epithelial cells were extracted. Through analysis, it was found that the nasopharyngeal mucosa of the patient was dry and the brushing force was insufficient. As a result, the cells cannot adhere to the swab rod. Members of the specialized sampling nurse team jointly developed the following countermeasures: Countermeasure 1: before each patient was sampled, the swab rod should be soaked in a 10ml normal saline plastic bottle that was packaged independently, so that the secreta and epithelial cells can adhere to the swab rod [8]; Countermeasure 2: during sampling, the swab rod should go deep to the right place (oropharyngeal cavity and nasopharyngeal cavity). The sampling site should be fully exposed with a disposable tongue depressor where necessary, and appropriate force should be exerted while brushing specimens [9]; Countermeasure 3: before operation, patients should be instructed to cooperate and informed of the way to open mouth, the sampling site and brushing time [10].

5. Conclusion

At present, the sampling workload of nasopharyngeal swab specimens in our hospital is not huge. We only put the first echelon into service. In case of special circumstances, such as treatment peak and increased specimens, and the second echelon can be invoked at any time to ensure that the sampling work can go along in an orderly way. In this study, after specialized sampling nurses were tasked with nasopharyngeal swab collection, the workflow has been optimized, special trainings have been offered, the quality has been improved, the pass rate of specimen collection has been enhanced, the working hours have been shortened, and the mental stress brought to patients by resampling as a result of unqualified specimens has been avoided. Therefore, during the outbreak of 2019-nCoV, the working mode of establishing specialized sampling nurses is worthy of popularization.

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