The Impact and Outcome of Training Programme of Health Care Workers with Reference to Sample Collection in Microbiology Laboratory

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ABSTRACT

BACKGROUND

Sample collection of blood, urine, stool, sputum and swab collection for various tests in a microbiology laboratory is a very important and crucial part of laboratory investigations. All samples should be properly labelled, and the requisition form should be filled properly. The purpose of this study was to determine the effect of the training programme to improve the quality of sample collection in the microbiology laboratory.

METHODS

It is an observation based cross-sectional study which was conducted among the health care workers of a tertiary care hospital in Rajasthan to assess their knowledge regarding safe and proper sample collection and transportation.

RESULTS

In pre-session a lot of loopholes were found among the healthcare workers regarding proper sample collection techniques, handling of sample, transportation and storage of the sample, dealing with blood spillage and in general disinfection. After the orientation session, there was a significant increase in knowledge of how & when to take a sample that is 63 % & 54 % respectively which is almost more than double pre-session.

CONCLUSIONS

Proper sample collection and transportation are key steps to patient care and very useful for correct diagnosis. Most of the errors happen in the pre-analytical phase. In our study, we observed that the knowledge of participants improved significantly after continuous training sessions. This indicates that such a type of knowledge session is essential for improving sample collection practices. It is therefore important to train health care workers (HCW), who form the root of the health care system at regular intervals, to enhance knowledge significantly.

KEY WORDS

Sample Collection, Training, Laboratory, Sample Collection

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DOI: 10.14260/jemds/2021/657

How to Cite This Article:
Naz R, Saxena N, Khan . The effect and outcome of training programme of health care workers with reference to sample collection in microbiology laboratory. J Evolution Med Dent Sci 2021;10(37):3237-3241, DOI: 10.14260/jemds/2021/657

Submission 18-02-2021,
Peer Review 29-07-2021,
Acceptance 06-08-2021,
Published 13-09-2021.

BACKGROUND

Microbiological laboratory test results are very important for clinicians to make a correct diagnosis of the patient's illness. Sample collection is a crucial part of these investigations.[1] It is also important that all specimens should be properly labelled and requisition forms should be properly filled.[2]

Improperly collected samples with poor transportation systems may lead to a major error in diagnostic investigations. Most commonly these mistakes are at the pre-analytical level which can be easily preventable by proper training and monitoring.[3,4]

Health care workers should be well aware and updated about collecting samples properly. In the microbiology laboratory, these improperly collected specimens fail to isolate causative organisms and recovery of contaminants or normal microbiota.[5,6] The purpose of this study was to determine the effect of the training programme to improve the quality of sample collection in the microbiology laboratory.

METHODS

It is a descriptive study that was conducted among the health care workers of a tertiary care hospital in Rajasthan to assess their knowledge regarding safe and proper sample collection and transportation.

The study population comprised resident doctors, staff nurses and laboratory technicians from various departments including microbiology, medicine, paediatrics, surgery, orthopaedic and obstetrics and gynaecology. A total of 200 health care workers gave consent and participated in this study from February 2019 to January 2020. We designed a pre-session questionnaire before training and a post-session questionnaire after the full training program was completed to enquire their knowledge regarding the collection of samples, its timing, storage, transportation and report turnover time. Most of the health care workers are already skilful but sometimes without an update of knowledge they start to make mistakes. This method is based on a study conducted by Tenney J H et al. previously.[7]

Firstly, we want to know about their knowledge about proper sample collection for which we give them a questionnaire about sample collection. This questionnaire included questions regarding time and amount of samples like urine, blood, CSF and stool collection and transportation. Consent was taken from participants to take part in this study. The mean time for completing the questionnaire was 10 minutes. The question paper was confidential to participants and privacy was strictly maintained during this study. A knowledge session of one hour to enhance their knowledge in above mentioned all aspects was taken. This session included knowledge about proper time of blood, CSF and urine collection, appropriate amount according to age and proper guidelines related to the transport of sample collection.

A post-session questionnaire with the same questions was distributed and their knowledge after the session was checked. We held a total of 31 sessions in one year and did a descriptive analysis of one-year data.[8,9]

RESULTS

In pre-session, a lot of loopholes were found among the healthcare workers regarding proper sample collection techniques, handling of sample, transportation and storage of the sample, dealing with blood spillage and in general disinfection.

About 33 % of health care workers had knowledge regarding proper ways to collect samples. Only 23 % of HCWs knew when to collect the sample. 34 % of HCWs had the idea of how to store samples and about 21 % regarding their transportation. Only 28 % of HCWs knew when to expect a report of a test or the time taken to process the samples. About 38 % of HCWs had knowledge about how to take a sample when a patient was suspected of having tuberculosis. And about 42 % of HCWs had a general idea of what to do in case of blood spillage and disinfection.

Many health workers didn't know how much volume of blood was sufficient to be inoculated in a blood culture bottle as we often received inadequate quantities of blood samples. Only 22 % agreed that 1–2 ml blood should be inoculated in a 10 ml culture in case of a child and most were in favour of 5–6 ml blood. The volume of blood to be inoculated per culture is the most important variable which can affect the recovery of microorganisms from a patient's sample with sepsis. There are so many studies that confirmed the more the volume cultured, the higher the rate of detection of bloodstream infection, reporting an increase in yield from 0.7 % to 4.7 % per extra millilitre of blood cultured. However, to prevent the inhibitors present in the blood, for example, host serum factors, complements, defensins, lysozymes, and other antimicrobial agents which inhibit the growth of bacteria in culture, 1–2 ml blood should be inoculated in a bottle with 10 ml media.[10,11]

Therefore, inoculated blood must be diluted to minimise the effect of inhibitory substances. The recommended dilution factor is up to 10 times.[6] Time-to-time educational interventions like training and seminars are necessary for the study area to bridge the knowledge gap so that the quality of blood culture should improve.[10]

When the questionnaire was about the time to take blood for culture, 57 % gave answers as only when the patient was febrile > 38^{o}C, with or without sepsis, 34 % when the patient felt rigours and 10 % at the time of admission.[11]

The literature indicates that blood culture has to be taken only when there is a critical indication to do so. After identification of signs and symptoms of bacteraemia or sepsis and before administration of antibiotics.[10]

If antibiotics are continued then blood should be taken just before administration of the next dose, with the exception of paediatric patients. Blood should be taken by trained people. Literature also indicates that blood should not be repeated by 2-5 days. The use of this blood culture surveillance had been used only in those patients who were waiting for organ transplantation.[8]

Literature also indicates about the site of collection, wherein peripheral venipuncture is the preferred site. To collect the blood drawn from the intravascular site is not optimal for they can be contaminated by organisms colonizing the hub or the wall of the catheter.[11,12]

In our questionnaire, 68 % answered that we can collect blood from both site venipuncture and intravascular catheter. In the post-session questionnaire, 73 % of people understood

about the right volume of blood, 55 % about the indication of blood culture and, and 88 % gave answers that venipuncture should be preferred for sample collection for blood culture.

In response to a questionnaire about wearing sterile gloves during venipuncture, 60 % responded of wearing sterile gloves, 12 % didn't wear them at all and the rest wore only when re-palpating the vein after skin decontamination. After the session, 78 % agreed to use gloves for the whole-time during blood collection. The literature said that a person drawing the blood should not palpate the vein after skin disinfection unless sterile gloves are worn. To avoid cross-contamination, it is fundamental not to re-palpate the vein.[13, 14] There are so many discrepancies about the use of skin decontaminants before venipuncture. 43 % use spirit, 23 % use povidone-iodine and the rest use chlorhexidine.

Literature said that before venipuncture skin preparation should be done carefully with the use of alcohol or alcoholic chlorhexidine or tincture of iodine rather than povidone-iodine. Should allow adequate time for skin contact and let it dry.[15,11] Alcoholic product is better in reduction of blood culture contamination, povidone iodine may cause skin irritation, alcoholic chlorhexidine needs 15 to 30 seconds to dry and tincture iodine 30 seconds and povidone-iodine needs 2 minutes to dry. Alcoholic chlorhexidine is best for skin decontamination and degreasing.[16] In the present study, 83 % gave answers about using alcohol for decontamination of skin.

CSF culture is essential in every meningitis patient but awareness was much below expectation. In this study, knowledge regarding a delay in transportation of cerebrospinal fluid, only 32 % of participants answered that it should be stored in the refrigerator, 42 % agreed with storing the specimen at room temperature while rest were in favour that it should not be stored in incubator.[16] Literature said CSF should not be stored at low temperatures in the refrigerator or at high temperatures in sunlight. It should be transported immediately as soon as possible. If delayed, must be kept at room temperature for a short time.[17] In the post-session questionnaire only 68 % agreed that samples should be sent immediately to the laboratory.

The final question was about the timing of collection of stool samples and urine samples with microbiological swabs. 55 % took swabs only as indicated, 45 % performed microbiological swabs as a routine procedure for hospital admission, 22 % performed routine swabs weekly from all the admission in hospital, and rest of them took swabs after the first spike of fever. In the case of a urine sample for culture and sensitivity, 37 % performed urine culture only in those cases where patients reported some clinical symptoms or signs of cystitis, 44 % performed urine culture at the time of hospital admission, 14 % of culture samples were performed only in catheterised patients.[17,18] In the case of stool samples, 66 % took stool culture samples only in cases of diarrhoea, 19 % took samples during hospital admission, 12 % performed weekly samples from the time of admission in hospital.

The literature suggests that routine fungal or bacterial culture should not be done in asymptomatic patients. The site of culture should be decided according to signs and symptoms. After the session, only 23 % of resident doctors gave answers that microbiological culture should be taken from symptomatic patients.[19,10] This part we have to work more in our future training session. Still, physicians send samples without signs and symptoms.

After the orientation session, there was a significant increase in knowledge of how & when to take samples that is 63 % & 54 % respectively which is almost more than double the pre-session. Regarding the storage of samples, almost 76 % gave the correct answer. There was 3 times increase in knowledge of how to transport samples and 71 % and 76 % of people knew the processing of tuberculosis samples. The knowledge of blood spillage handling also increased up to double from pre-session. Overall training doubled the knowledge of HCW.

	Test Results in % before Session	Test Result after Session
When to collect blood sample	23	63
How to store CSF	34	68
What to do in case of blood spillage	38	81
Site of blood collection	55	73
How to disinfect during blood collection	43	83
How to transport urine sample	23	71

Table 1. Comparison of Both Results before and after Session.

DISCUSSION

Specimen collection and transportation play a major role in timely reporting and appropriate results of the investigation which was required for diagnosis. Health care workers play a crucial role in providing first-hand bedside care and their action has a direct role in the positive patient outcomes as it affects sample quality which is processed in the laboratory. It is therefore important to arrange regular training sessions to enhance knowledge, improve their attitude regarding proper sample collection, storage and transportation.[20,11]

In the present study, 57 % were males and 43 % were females and 29 % were resident doctors, 54 % were staff nurses and 17 % were laboratory technicians. Of all participants 43 % had less than 5 years of experience, 25 % were between 5-10 years, and the rest had more than 15 years of experience. While the study was done by Chandak, Poonam et al. 35 % had up to 5 years experience, 49 % had 6-10 years' experience and 10 % had 11 - 15 years experience.[9] In our study, the knowledge regarding how & when to collect the sample, storage of the sample, when to expect a report, how to transport sample and processing of sample was increased by double while a study done by B. Sandeep et al.[21] showed the increase of knowledge by only 32 %. In our study, the knowledge regarding blood spillage handling increased by 81 % while another study showed the increase of knowledge by 30 %.[21]

The reason for the lower performance on these questions about sample collection in the pre-session questionnaire may be that most doctors, apart from the laboratory physicians, do not have sufficient knowledge of the processes in the laboratory.[22]

Once the specimens are submitted to the laboratories, they are ignorant of the further procedures done on those samples. It is an important step to increase knowledge about sample collection that all doctors, especially residents, are made to rotate through the laboratories to acquaint themselves with proper sample collection. Some researchers suggest the importance of rotatory postings of clinical residents in laboratories to acquaint them with the importance of proper collection and transport of specimens.[11]

The literature tells us that fungal cultures should not be performed in those patients who are asymptomatic. All the bacterial and viral cultures from sites of suspected infection should be performed only if it is indicated.[16,17]

Some clinicians propose these viral fungal investigations as routine due to the lack of proper reference documents. Another factor is possibly the limited number of CME or training schedules. The literature always emphasizes the diagnostic importance of microbiological cultures, and hence the importance of how the sample is collected. Samples can be contaminated by many sources such as the material used to collect samples, the patient's skin and the hands of the person taking the sample or vial or container contamination. Sometimes delay in sample transport is also an important reason for false reporting.[22]

Another decisive factor is the number of samples collected. The inappropriate collection plays a major role in false positive reporting. These inaccurate reports become a problem for patients about irrational use of antibiotics which may lead to an increase in hospital stay and cost of treatment unnecessary treatment and increased antibiotic resistance.[5]

There should be a consistency between health knowledge and health practices, it is the cornerstone for the success of any disease prevention program. Dedicated and multidirectional efforts must be adopted to rectify this attitude and behaviour.

Our study has some limitations wherein the results are based on the answers given by health workers. For accurate results they should be observed and monitored.

CONCLUSIONS

Proper sample collection and transportation is a key step to patient care and is very useful for correct diagnosis. Most of the errors happen in the pre-analytical phase. Analytical and post-analytical errors are less frequent. In our study, we observed that the knowledge of participants improved significantly after continuous training sessions. This indicates that such a type of knowledge session is essential for improving sample collection practices. It is therefore important to train HCWs, who form the root of the health care system at regular intervals, to enhance knowledge significantly.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

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