Original Research Article

Pre-Sensitization Assessment of Knowledge Regarding Clinical Sample Collection, Storage and Transportation among Health Care Workers at a Tertiary Care Hospital in Madhya Pradesh

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Abstract

Background: A test report is of use to clinician in diagnosing and assessing condition of patient. And a test report is only good if the sample is collected properly. In diagnostic field it is very important to know when and how to collect sample, how to transport it and precautions taken during this entire process, otherwise that sample will be of no use for diagnostician. Furthermore, if precautions are not taken during the procedure, it will increase the chances of hospital acquired infections. **Aim:** This study was done to evaluate the knowledge of health care workers regarding the process of sample collection, storage and transportation and various infection control procedures. The main aim was to conduct frequent teaching sessions for their improvement, after assessing their baseline knowledge. **Methods**: This study was conducted in a tertiary care hospital of Madhya Pradesh. A questionnaire with multiple choice questions was made and given to health care workers to assess their knowledge regarding various aspects of sample collection and transportation. **Results**: Total 75 health care workers participated in this study, and their cumulative (average) score in questionnaire was 28.17%, which was not very good, signifying the requirement of timely and frequent conduction of scientific sessions among health care workers to assess their knowledge and to improve it. **Conclusions**: A laboratory diagnostician is only as good as the sample he gets for diagnosis. And good sample depends on the knowledge of person collecting and transporting them to laboratory. So, it is very important to assess their knowledge and take measures to improve it.

Keywords: Health Care Worker, Health Care Associated Infection, Sample Collection, Sample Transportation.

Background

Laboratory services are the backbone of the modern health care sector. Laboratory tests are equally useful to the clinicians in making right diagnosis regarding patient's illness as are history, clinical examination and other supportive tests, especially in case of infectious diseases[1]. In that context, specimen collection plays an important role in getting timely and accurate results of investigation required for diagnosis. In spite of rapid advances in laboratory science, it is still susceptible to various manual and systemic errors. Various types of errors that we encounter in the laboratory are classified as pre-analytical, analytical, and post-analytical, depending upon the time of presentation.

The pre-analytical phase occurs first in laboratory process. This phase includes specimen handling issues that occur even prior to the time the specimen is received in the laboratory. Important errors can occur during the pre-analytical phase with specimen handling and identification. The second phase is the analytic phase. This phase includes what is usually considered as the actual laboratory testing or the diagnostic procedures, processes, and products that ultimately provide results. The post-analytic phase is the final phase of the laboratory process. This phase culminates in the production of a final value, result, or in the case of microbiology, a diagnostic report.

The pre-analytical phase is an important component of laboratory medicine and most errors occur in the pre-analytical phase affecting the results.

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Proper collection, processing and storage of common sample types associated with requests for diagnostic testing are critical in providing quality test results and many errors can occur during these steps. Such errors are considered pre-analytical errors and are known to contribute to delayed and suboptimal patient care. If there is any error in delivery of sample from patient to laboratory, which might be due to improper collection, untimely collection, poor transportation, it will lead to error in diagnosis[2]. It may lead to failure in isolation of causative micro-organism or recovery of contaminant or normal microbiota. This type of report may also be responsible for surge in cases of anti-microbial resistance. Direct specimen smear may also helps in assessing the quality of specimen which will provide rapid information for diagnosis and treatment and allow the clinician to determine, if additional better quality specimen should be collected.

Steps must be taken to avoid the errors occurring while collection of samples. They are as follows:

- Material must be from the actual site of infection with minimum contamination.
- Sample collection must be done in optimum time, according to –
- Disease/clinical symptoms presented.
- Antibiotic intake (sample must be taken prior to antibiotic intake)
- Adequate quantity of specimen must be collected.
- Appropriate collection devices must be used for sample collection.
- Specimen must be properly labelled, otherwise it may lead to sample rejection.

Sample rejection criteria must be known to all and they are as follows-

- If there is any discrepancy between patient identification on requisition and sample container.
- If no identification is mentioned on sample container.
- Specimen source or type is not mentioned on requisition slip.
- Test required is not indicated on requisition slip.
- Specimen for microbiological study is received in formalin.
- In case of improper, non-sterile or leaking container.
- If the swab is dry.
- If only one swab is submitted for multiple requests.

If these criteria's are not followed then lab will not be able to process the sample, and it will lead to patient discomfort as it will required repeat sample collection and it must be known to health care workers that which sample are collected for the suggested set of symptoms/disease and how to transport that sample and its preservation. The sample collected for various diseases is mentioned in Table 1.

Table 1: Types of specimen preferred to be collected for various diseases

Type of specimen	Container	Transportation	Storage
Eye			
Conjunctival	Sterile, moist, swab	Within 2 hours	Refrigerate
Corneal scrapping	Alcohol cleaned glass slide or self-inoculated culture media plate (blood and chocolate agar)	Immediately	Refrigerate
Ear	Sterile swab	Immediately	Refrigerate
Upper respiratory tract –			
Nasal, oral, pharyngeal, laryngeal, throat swab	Sterile, moist swab	Within 2 hours	Refrigerate
Lower Respiratory tract –			
Sputum	Wide mouth, screw capped, sterile, plastic, disposable container	Within 2 hours	Refrigerate
Broncho-alveolar lavage, transtracheal aspirate, bronchial brush			Refrigerate
Gastric lavage			Refrigerate
Body fluids			
CSF	Sterile, screw capped container or Syringe	Transport immediately	Do not refrigerate CSF
Pleural fluid			
Peritoneal fluid			
Synovial fluid			
Pericardial fluid			
Ascitic fluid			
Gastro-intestinal tract			
Stool	Wide mouth, screw capped, disposable, sterile container	For diarrhoea – within 2 hours For dysentery – within 30 minutes	Add neutral glycerol saline
Rectal swab	Sterile swab		
Duodenal aspirate	In sterile container		
Urinary tract infection			
Urine (clean catch mid stream)	Universal container	Within 2 hours If not possible refrigerate for 8 hours > 8 hours add 0.2 gm boric acid	Boric acid 0.2 gm
Catheterised sample	Syringe		
Supra-pubic aspirate	Syringe		
Deep Abscess	Syringe	Immediately for anaerobes in thyoglycollate or RCM	
Superficial abscess	Syringe or swab	Within 2 hours	
Genital tract (females)			
Cervical fluid/ pus	Moistened sterile swabs	Immediately	Refrigerate
Vaginal fluid			
Urethra			
Genital tract (males)			
Urethra	Moistened sterile swabs	Immediately	Refrigerate
Prostate			
Blood for culture	Blood culture bottles	Immediately	
Blood for serology (serum)	Vacutainer tubes	Within 2 hours	Refrigerate
Skin scraping, Nail, hair clippings	In Black paper	Within 24 hours	At dry place
Viral infections	In Viral transport medium	As soon as possible	Refrigerate

Also, many times due to errors while collecting the sample from patient, injuries can occur. Many studies suggest that while hospitalized, many patients suffer from injuries gain during health care i.e. due to faulty techniques of health care workers. As most of these injuries are human errors, it is therefore necessary to take measures and develop such systems which will help in increasing patient safety. A wide number of studies suggest that most of the errors in laboratory medicine are linked to the pre-analytical phase i.e.

before the sample is analyzed in a laboratory. Analytical errors (within the laboratory) and post-analytical errors (reporting and interpretation of results) are less frequent[3,4].

In a report published by CDC, it was said that health care associated infection prevalent in hospitalized patients is 1 in every 25 patients[5]. Healthcare associated infections are infections that occur while receiving health care, developed in a hospital or other health care facility that first appear 48 hours or more after hospital admission, or within 30 days of receiving health care. Most common infections are surgical site infections, ventilator associated pneumonia, and gastro-intestinal infections. Central line–associated bloodstream infections, catheter associated urinary tract infections, and *Clostridium difficile*–associated disease, are other examples. The risk of developing a Hospital associated infection varies, depending on the patients' immune status, overall health, and their medical condition and procedures that they are undergoing. Healthcare associated infection constitutes an important public health problem, contributing to morbidity, mortality and additional cost. Approximately 80% of Hospital associated infections are caused by *Staphylococcus aureus* (16%), *Enterococcus* spp. (14%), *Escherichia coli* (12%), coagulase-negative staphylococci (11%), *Candida* spp. (9%), *Klebsiella pneumoniae* and *Klebsiella oxytoca* (8%), *Pseudomonas aeruginosa* (8%), *and Enterobacter spp.* (5%). Many of these pathogens in healthcare associated infections are multi-drug resistant and are able to survive in the environment for a long period of time. The most important mechanism of spread of these healthcare associated infections is via the contaminated hands of the healthcare givers that is doctors, nurses, other staff or relatives/friends of the patients. Contaminated environmental surfaces are another important reservoir for spread of these infections[6,7].

Hence, healthcare workers must know the various measures for patients as well as their own protection. They should improve organization of work, implement standard precautions and dispose biomedical waste properly to prevent occupational exposure. Cross infection makes infection control practices important for health care personal's to protect both patient as well as themselves. Effective implementation of infection control procedures and adherence to standard precautions are challenging especially in resource-limited settings. These infections can be minimised by making standard precautions guidelines and instructing the health care workers to adhere to them. However, compliance rate with use of such measures by health care workers has been seen to be unsatisfactory.

It is therefore important to develop systems and routine to enhance knowledge, attitude and practice among health care workers regarding proper sample collection, storage and transportation so as to promote cost-effectiveness[8]. To improve the behaviour of health care workers regarding this, training sessions and increasing educational facilities for recognition and control of infections has been recommended. Different studies have been conducted in different parts of the world showing poor knowledge in infection control practices or lack of implementation of such knowledge into day-to-day practices, which can be improved by continuous education and regular training.

For this purpose (i.e. to assess the baseline knowledge of healthcare workers regarding various procedures and precautions taken while sample collection and transportation) a questionnaire survey was done. Questionnaire surveys have several benefits as they are practical to handle, self-administered, economical and give the respondents anonymity.

Methods

A cross sectional study was conducted among the health care workers of a tertiary care hospital in Madhya Pradesh to assess their knowledge regarding safe and proper sample collection and transportation and infection control practices. The study was done in the month of January 2019 and total 75 health care workers (consisting of nursing staff, laboratory technicians and laboratory attendant) participated in this study.

An anonymous, self-structured, self-administered questionnaire printed in Hindi and English language was used. This questionnaire consisted of two parts: The first part was a demographic checklist. The second part investigated the knowledge of health care workers about various aspects. Questionnaire was consisting of 10 multiple choice questions with four options each. Each question has one correct answer and carried one mark and the total score was calculated by adding the score of all correct answers and ranged from 0 to 10. The questionnaire was designed to enquire their knowledge regarding collection of sample, its timing, storage, transportation and report turn-over time. A special mention was given to sample collection in case of Tuberculosis and also about disinfection.

The mean time for completing that questionnaire was 10 minutes. Apart from their knowledge regarding various practices, their demographic profile like gender, education, working area and years of experience was also recorded.

Prior consent was taken from participants to taking part in this questionnaire study. Confidentiality was assured to participants and strictly maintained during this study.

All the data were collected and entered into MS-Excel and the socio-demographic details and the responses were presented in the form proportions (%) and SPSS software was used for analysis.

Results

The hospital and laboratory staff participating in study was asked to state their age, sex, education, and years of experience in the given proforma. Their demographic variables were mentioned in Table 1.

Table 2 showed that out of all participants, males were 53.5% and females 46.5 %, most of the laboratory staff being male. All staff nurses have completed their BSc Nursing or Diploma, Lab technicians were Diploma in Medical Laboratory Training, and attendants were higher secondary qualified. Majority of personnel were of age group 21-30 years. About 70% staffs was less than 5 years experienced, 15 % were with experience of 5-10 years and 15% have more than 10 years' experience.

The questionnaire was checked for their responses and inferences were drawn on its basis. Gross deficiency was found among the healthcare workers regarding knowledge in the areas of proper sample collection techniques, handling of samples, transportation and storage of samples, dealing with blood spillage and in general disinfection.

Table 3 showed that about 26.6 % health care workers have the knowledge regarding proper ways to collect samples. Only 6.7% health care workers know when to collect sample. 26.7% health care workers have the idea of how to store samples and about 13.3% regarding their transportation. Only 26.7% health care workers know when to expect the report of tests or the time taken to process the samples.

About 46.7% health care workers have the knowledge about how to take sample, when patient has suspicion of having tuberculosis. And about 50.5 % health care workers have the general idea of what to do in case of blood spillage and disinfection.

Table 2: Demographic details

	Characteristics	n (%)
Gender distribution	**Males**	40 (53.5%)
	Females	35 (46.5%)
Distribution of participants	**Nurses**	30 (40%)
	Lab technicians	15 (20%)
	Lab attendants	30 (40%)
Age group	**21-30**	45 (60%)
	31-40	23 (30.6%)
	41-50	7 (9.3%)

Educational qualification	**BSc/Diploma/GNB**	30 (40%)
	MLT	15 (20%)
	Higher secondary	30 (40%)
Level of experience	**< than 5 years**	53 (70.7%)
	5-10 years	11 (15.5%)
	> than 10 years	11 (15.5%)

Table 3: Knowledge in various aspects

Sl. No.	Topics Covered	Response in percentage
1	**How to collect sample**	26.6 %
2	**When to collect sample**	6.7 %
3	**Storage of sample**	26.7 %
4	**Transportation of sample**	13.3 %
5	**Processing time of sample**	26.7 %
6	**Collection of sample in TB patients**	46.7 %
7	**Handling of blood spillage**	50.5 %
8	**Total average responses**	28.17 %

Discussion

Consistency between health information and knowledge and between knowledge and practice is the cornerstone for the success of any health promotion or disease prevention program[9]. In tertiary institutions, paramedical and nursing staff is mainly responsible for proper sample collection and transportation to laboratories. Therefore, they are expected to have good knowledge about the same, as rightly collected sample helps in generating the right test result.

Knowledge of hospital acquired infections and compliance to methods in preventing them such as proper practice of aseptic precautions could lead to reductions in healthcare associated infections in the hospital.

This study helps in assessing the basic knowledge of health care workers on various aspects regarding sample collection, transportation, storage and processing. This also determines the base level knowledge of how to manage accidental spills, which could be a potential source for nosocomial infections.

In our study out of all health care workers participants, males were 53.5 % and females were 46.5 %. This ratio was different than other studies where female participants were more in number. For example in study by R Chandaket al[10]. 87% participants were female and in study by Mythri H et al[11]. 62.5 % were females. Although no statistical difference was found in knowledge between males and females in our study, an earlier study showed male participants to be less aware than females[8].

In our study, participation of nursing staff and laboratory attendants was equal i.e. 40 % each whereas in study by Mythri H,[11] nurses participation was more. Laboratory technicians showed more knowledge than the nursing staff and laboratory attendants in regard to sample collection and transport. This suggest that educational status of health care workers play an important role in minimising health care associated infections as they practiced proper precautions while collecting samples.

Out of total participants, 40 % graduates of nursing, 20 % were diploma holders in laboratory techniques and 40 % were only higher secondary graduates. In the study of R Chandak,[10] 89.9 % participants were diploma holders while rest were graduates. No statistical difference was found amongst diploma holders and graduates in our study. This was similar to some study[12] whereas few study showed improved level of knowledge with higher level of education[13,14]. Nearly 60 % participants were between 20-30 year age group in our study. This finding was similar with a study conducted in 2015[11].

In our study although the maximum participants were with experience of less than 5 years, i.e. 70 %, maximum scoring in questionnaire was shown by participants with more than 10 years of experience. Similar finding was reported by R Chandak[6] and Asadollahi M et al[15].

The data from our study suggest that current state of healthcare workers knowledge related to sample collection, transport and processing is poor, particularly in regard to when to collect sample. Most of them have no idea regarding the ideal time of sample collection in respect to various infections. In our study average score for information regarding sample collection and transport was found to be 28 %. It was somewhat similar to study of R Chandak[10] with score of 30 %. But in study by Khan F et al.[6] 53 % participants demonstrated good knowledge of sample collection. A lack of awareness of the appropriate microbiological samples and correct method of their collection was seen. Health care workers showed poor knowledge of collecting and transport crucial samples like blood, CSF, etc. This finding in our study is important because knowledge of type of sample collection for a given microbiological test with appropriate transport to the laboratory is very vital for correct and timely investigation of critically ill patients.

During study it was seen that although majority of health care workers have knowledge and understanding of hospital acquired infection's preventive methods still implementation of this knowledge through compliance of preventive methods were poor.

Conclusions

The key to cure patient effectively is to make correct diagnosis regarding underlying cause. And for that to be accurate, it is necessary to collect samples properly and get them to the laboratory as soon as possible without any error. In this whole process, health care workers play an important role. With the help of a questionnaire, basic level of knowledge among health care workers can be established. This will help in foundation of an educational intervention programme to educate them, which will further help them in identifying problem areas in specimen processing and to prevent health care associated infections.

It is important to conduct training sessions and workshops at regular interval of time for health care workers to educate them and to update their knowledge with newer concepts in patient care, sample handling, along with induction courses of newly joined staff. This will help in controlling the spread of nosocomial infections and providing a better patient care.

Improved compliance with recommended infection control measures is required for all health care personnels.

Scope of the study

1. The number of participants in this study can be increased to improve accuracy of result which was lacking in our study.
2. If Medical students and Faculty of the hospital were also included in the comparison groups other than nursing staffs and lab technicians, the accuracy of the study could have increased manifold

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