Category of preanalytical errors in pathology laboratory in Birat Medical College Teaching Hospital

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ABSTRACT

INTRODUCTION

The accurate laboratory reports are an essential part of the health care delivery system. The quality of a diagnostic laboratory is reflected by its accurate diagnostic results. A preanalytical error means any error in the laboratory that occurs during sample collection and transportation. This can lead to inaccurate laboratory results which can further lead to inappropriate clinical decision and can cause serious health risk to the patients.

MATERIAL AND METHODS

The study was conducted in Department of Pathology, Birat Medical College Teaching Hospital for 6 months (from 1 August 2022 to 31 January 2023). All the samples received in the pathology department were verified by the laboratory staff on duty for patient's identification like name, surname, age, sex, date of sample collection, hospital registration number, bill number and relevant clinical history.

RESULTS

Out of twenty four thousand five hundred and sixty three (24563) total samples received in pathology department, preanalytical errors were seen in one hundred and ninety four (194) samples which comprises of 0.7 percentages of total sample. Most common preanalytical errors were clotted samples which comprises of (47.42%) of all the errors.

CONCLUSION

Preanalytical errors can cause unnecessary panic in patients and wastage of both time and money. We can minimize preanalytical errors by regular training of laboratory staff and by virtual coordination and conversation between the sample collecting laboratory staffs.

KEYWORDS

Accurate laboratory reports, Clotted samples, Sample collection

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INTRODUCTION

The laboratory test results are an essential part of clinical medicine. Diagnoses of patient's diseases are most of the time dependent of laboratory test results. Reviewing the literature it is seen that 60% to 70 % of medical diagnosis are dependent on a reliable laboratory results.[1] A standard laboratory service guarantees an accurate test resultson time which should be error free. The patient and the treating physician must have trust in the lab report. This can only be done if the lab maintains its high standard and ensure its users of reliable test results. In order to maintain a standard and reliable lab reports, the laboratory should know where the errors are occurring and how to avoid it. Laboratory errors are defects occurring at any level from requesting test samples till reporting results. The inaccuracies in the laboratory results because of preanalytical errors need to be identified because this could be one of the major cause for sample rejection. The preanalytical phase includes all the procedures done before the sample is being processed and analyzed in the laboratory.[2] This includes filling of laboratory requisition form with patients information and all the relevant clinical parameters information which are associated with the sample. It also includes specimen collection, handling and transportation to the laboratory. Pre examination error can occur if the sample is unlabeled or mislabeled, sample is inadequate in amounts, there is contamination of the sample, the sample is clotted, hemolyzed or insufficient in amount . Sample is transported to laboratory inappropriately, or the reagents, syringes, vial or test kits used in the sampling technique is damaged because of improper storage.

Quality assurance is a must for any laboratory. Most of the clinical diagnosis is dependent on laboratory results. Laboratory errors can cause delay in diagnosis or wrong diagnosis. This can decline a patient's satisfaction, misguide the treating physician and can cause serious health risk to the patient.[3] Researchers have found that 6.4% to 12% risk of undesirable medical care and related death occurs due to laboratory errors.[4]

Many a times these errors can be life threatening. Like if there is error in patients identification in the laboratory request form because of not properly written the name of patient or if there are two patients of the same name, the surname of the patient, the age and the referring unit should be clearly mentioned. Otherwise the report can land in wrong hands. If the patient receives wrong blood transfusion or medication because of the preanalytical error it could be fatal. So every lab should have a check in these types of error.

This phase includes the first step of laboratory process which is conducted by healthcare personnel. Around 70% of all total laboratory faults are because of preanalytical errors.[5]

Most of which arise from wrong method of sample collection, incorrect practice of transportation and incorrect methods of storage.[6]

MATERIAL AND METHODS

The study was conducted in department of Pathology Birat Medical College Teaching Hospital for 6 months (from 1 August 2022 to 31 January 2023). The pathology laboratory of the hospital is automated and all the laboratories informations were entered in the computer including the patient's identifications and the entire pathology reports. There is a centralized collection center where phlebotomies are done by trained laboratories staff. For patients admitted in ward, ICU and emergency, samples were collected in the respective place by the trained health care workers.

All the samples received in the pathology department were verified by the laboratory staff on duty for patient's identification like name, surname, age, sex, telephone number, date of sample collection, hospital registration number, bill number and relevant clinical history. Apart from this for histopathology examination laboratory request forms were verified for proper surgical diagnosis, name of operating surgeon, anatomic site, location and tissue laterality whether they are properly mentioned or not. Cytology and histopathology samples were checked whether it is sent in proper fixatives. Blood samples were also checked for adequacy inamount, properly labeled or not, or either clotted, diluted orhemolyzed. If there was a preanalytical error, it was noted and categorized.

RESULTS

Out of twenty four thousand five hundred and sixty three (24563) total samples received in pathology department, 21579 samples were received in hematology laboratory, 1976 samples were received for histopathology analysis and 1008 samples were received for cytology studies. Preanalytical errors were seen in One hundred and ninety four (194) samples which comprises of 0.7 percentages of total samples.

Most common preanalytical errors were clotted samples which comprises of (47.42%) of all the errors. The second common error was pathology request form not properly filled comprising (13.92%). The remaining errors were as mislabeled samples (11.34%), inadequate in amount (10.30%), samples sent in incorrect vials (8.77%) and diluted samples (8.25%) respectively. The distribution of different types of errors are tabulated in the table 1.

Table 1. Frequency of the types of preanalytical errors

Types of preanalytical errors	Number of cases	Percentage of total errors
Clotted samples	92	47.42%
Request form not filled	27	13.92%
Mislabeled	22	11.34%
Inadequate in amount	20	10.30%
Incorrect vial	17	8.77%
Diluted samples	16	8.25%

The potential contributing factors of clotted samples include delay in transportation and improper phlebotomy technique. Among the twenty seven(27) cases in which the request form was not filled, seven (7) were FNAC samples, four (4) were Pap smears, five (5) were ascitic fluid samples, two (2) pleural fluid samples and two (2) were urine samples where the patient's clinical history was not mentioned. Two(2) cases were CT-guided lung biopsy tissues in which the site, whether right or left lung, was not mentioned and one(1) was ovarian tissue were site, whether right or left ovary was not mentioned.

Two (2) FNAC samples were from patients with multiple swellings but the exact swelling site was not mentioned. Two (2) core biopsy histopathology specimens did not mention the parent organ. Among the twenty-two (22) mislabeled or unlabelled samples, ten (10) were blood samples in which the laboratory request form was not properly filled, and the specific test to be performed was not mentioned. Six (6) cases had similar barcodes on two different samples. Six (6) cases showed errors in container labeling. For example, in one case the bill indicated a stool sample, but the specimen was labeled as urine. Twenty (20) blood samples were submitted for CBC testing, but the amount of sample provided was insufficient for analysis.

Out of the seventeen (17) samples that were sent in the wrong type of container, seven (7) were submitted in plain vials even though a peripheral blood examination had been requested. Four (4) samples were meant for Pap smear evaluation, but the slides were received without any fixative. Three (3) cases required PT-INR testing, yet the samples again arrived in plain vials. Additionally, three (3) biopsy specimens—two appendicular tissues and one ovarian tissue—were submitted without being placed in formalin.

Maximum numbers of samples showing preanalytical errors were from Obstetrics and Gynecology department. It comprised of total 35 samples (18.04%). Second common preanalytical error was from ICU department which comprised of 34(17.53%) cases. Of the 194 total errors, **132 (68.04%)** occurred in **IPD** samples, while **62 (31.96%)** occurred in **OPD** samples.

The distribution of samples showing preanalytical errors from different departments are tabulated in table 2.

Table 2. Department-wise pre-analytical error frequency in OPD and IPD

Department	OPD errors	IPD errors	Total errors	Percentage
Gynae	18	17	35	18.04%
ICU	NA	34	34	17.53%
Emergency	NA	33	33	17.01%
Medicine	23	10	33	17.01%
Surgery	11	17	28	14.43%
Paedia	8	6	14	7.22%
ONCO	NA	6	6	3.09%
Ortho	1	4	5	2.58%
CCU	NA	4	4	2.06%
Derma	1		1	0.52%
Urology	NA	1	1	0.52%
Total	62 (31.96%)	132 (68.04%)	194	

*NA=Not applicable

DISCUSSION

Reliable laboratories repots are an integral part of our health care system. Butsometimes laboratory generated reports are not correct because of the errors. Some of the studies have shown that preanalytical errors comprises of upto seventy-five percentage of total laboratory errors.[5]

In our study we found Preanalytical error comprising of 0.7 % of the total samples received in Pathology department. Our study is in accordance with many other studies were preanalytical error ranged from 0.38 % to 1%.[7-9]

The maximum numbers of samples received with errors were clotted samples. Delay in transferring the collected blood sample in EDTA vial could be one of the main reasons in our laboratory for receiving clotted samples. For a single patient, if many different types of blood investigations are recommended by the clinician, the collecting staff if not properly trained can take long time in blood collection. So the blood gets collected before it is transferred in EDTA vial. Another reason for the clotted samples in our laboratory couldbe improper mixing of the samples tubes after blood collection.

Mukhopadhyay T et al[10] and Narang V et al[11] also found clotted sample as the most common cause of preanalytical error. In the study done by Rajalakshmi et al[12] and Arul P et al[7] the second most common cause of preanalytical error was clotted samples. In their study the commonest cause of clotted sample was insufficient and inadequate sample. In many laboratories, hemogram reports generated by the autoanalyzer are dispatched to the patients. In such settings, microclots which could not be identified by the naked eye examination. It can generate an incorrect report which can cause dagenerous health issues to the patients. Such errors were minimized in our laboratories because before dispatching the reports generated by analyzer we many of the times cross check our reports by peripheral smear examination.

The second common error in our study was improperly filled request form. Gyawali P et al[13] have studied that facts mentioned in the investigation requisition form plays a crucial role between the clinicians and the laboratory. We found that Patients Name, billing information and hospital registration number were properly filled in most of the investigation forms.The part lacking in the investigation form was the relevant clinical history of the patient. Investigation forms were not properly filled particularly in the cytology and histopathology cases .Like in two cases the fluid samples sent for cytology examinations were synovial fluids. But it was not properly mentioned in the investigation form. In the investigation form, only body fluid examination was mentioned . Such types of errors can lead to wrong interpretation of the reports because the total

count and differential for different body fluids mayvary. Similarly in two of the FNAC cases the site for FNAC to be done was not mentioned. If the patients have multiple swellings, it becomes difficult for the pathologists to asses from which swelling to do FNAC. Such errors were corrected by sending back the patients and request form to the clinician and get it properly filled.

Inadequate samples which are not sufficient in amount for laboratory investigations are most of the time collected from pediatrics age groups and debilitating diseases patients, were veins are thinned out and not identified properly. Such samples can lead to generation of wrong report by the analyzer because of inadequate sample and anticoagulant ratio. To minimize this, sample collection staff should be trained on time to time to understand the importance of adequate sampling technique. Our study is similar to Study done by Chandra H et al[8] which showed inadequate sample comprising of 9.4% of the total error. Sometimes like in histopathology tissue if the formalin fixatives are not used in proper amount the tissue gets autolyzed which can hamper the diagnosis. Similarly if proper fixatives are not used in cytology slides to be examined, the slides may show drying artifact obscuring its cellular morphology. This can also hamper the correct diagnosis of the disease and the patients may suffer. Few histopathology cases in our study tissue were sent in inadequate amount of formalin and few cytology cases were sent in improper fixatives. These types of errors in our cases were categorized in incorrect vials. The cause of these types of errors could be due lack of awareness in the staffs.

Among all the errors diluted samples were the least common cause in our study. In the study done by Gaur K et al5 and Iqbal MS et al[14] diluted blood samples were received more from patients admitted in hospital. In their study none of the OPD patient's blood samples were diluted. Diluted samples are generally seen when the blood samples are collected from the veins from the same side of the arm where intravenous lines are opened. In order to minimize this error the hospital should train the nursing staffs. Blood samples should be collected from the opposite arm where intravenous infusion is running. In our study the hemolyzed samples were not observed because it is challenging to observe hemolysis without centrifugation. Most of the tests which are conducted after centrifugation are biochemical tests which were not a part of our study. The maximum number of samples which should preanalytical errors was from the department of Obstetrics and Gynecology.

CONCLUSION

Preanalytical errors are difficulties occurring in laboratory. Our study showed that majority of preanalytical errors is caused by clotted samples, mostly because of incorrect practice of sample collection. All such samples demand a repeat blood sample examination. This cause unnecessary panic in patients, and wastage of both time and money. We can minimize preanalytical errors byregular training of laboratory staffs. Also their abilities can be checked by conducting theory as well as practical assessments time to time. Virtual coordination and conversation between the sample collecting laboratory staffs, nurses and ward staffs can also help preventing this problem. All the laboratory workers should be trained time to time with continuing Quality control programmes. The errors encountered in the laboratory should be kept in records and further necessary actions should be taken to avoid it.

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CONFLICT OF INTEREST

None

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