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Mini Review

Pre-Analytical Errors: A Major Issue in Medical Laboratory

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Abstract

The majority of errors come from the pre-analytical phase, which is considered the basis for all laboratory works. Pre-pre-analytic and true pre-analytic are two areas of the pre-analytical phase. Test selection, patient identification, sample collection, preparation and handling are part of the pre-pre-analytical process, while storing, pipetting and centrifugation sample are actual pre-analytical processes. Missing any steps in the previous processes will cause errors related to the pre-analytical phase. In addition, pre-analytical errors can result in lack of trust from the patient and medical staff, economic consequences to the patient as well as the medical laboratory department, and unfavorable implication on the medical laboratory department.

Keywords: Pre-Pre-Analytic; Pre-Analytic Phase; Analytic Phase; Post Analytic Phase

Introduction

The majority of errors come from the pre-analytical phase, which is considered the basis for all laboratory works. Pre-pre-analytic and true pre-analytic are two areas of the pre-analytical phase [1]. Test selection, patient identification, sample collection, preparation and handling are part of the pre-pre-analytical process, while storing, pipetting and centrifugation sample are actual pre-analytical processes [1,2]. Missing any steps in the previous processes will cause errors related to the pre-analytical phase. In addition, pre-analytical errors can result in lack of trust from the patient and medical staff, economic consequences to the patient as well as the medical laboratory department, and unfavorable implication on the medical laboratory department.

Pre-Analytical Errors

As noted in a review of the retrieved articles, the pre-analytical phase is the main source of errors in the laboratory department [1]. Missing patient's identification, missing samples, and using inappropriate tubes or containers are the most common pre-analytical errors occurring outside the laboratory domain [1]. Missing patient identification includes unlabeled samples and incorrect name and file number [3]. Missing samples indicate that the specimen was drawn from the patient, but the laboratory did not receive the sample.

Further, transporting the sample under improper environmental conditions or delays in the sample transportation is considered an error in the pre-pre-analytical phase [4]. For example, arterial blood gases samples must be sent in the syringe with an ice pack directly to the laboratory without any delay. If the nurse sends the sample an hour later, the result will be incorrect. Consequently, missing sorting, pipetting or centrifugation of the sample will cause a delay in the specimen processing. In other words, the quality of the sample will be compromised due to the delay and the inappropriate transporting environment [4].

A delay in blood samples was tested in one of the literature reviews and the result indicated a significant change in the procoagulant functions [5]. In addition, the error related to long agitation for the blood sample was examined and the result was inaccurate because of this factor [5]. Even though this study focused on the lag in time, it did not specify what type of test was affected due to the delay of the sample.

Some microbiological samples must be sent in a transporter medium to keep the sample wet, such as a throat swab. Other samples require a specific tube or sterile container to avoid contamination. For instance, sodium citrate tube is required for measuring the coagulation factors [6]. Physicians, nurses, and medical technicians are responsible for these types of errors.

Who's responsible?

Physicians also are encountering pre-analytical errors such as ordering test requests that are not relevant to the patient condition [7]. For instance, a physician ordering a vitamin D test for a patient that presented with a headache. In other words, vitamin D deficiency has nothing to do with the headache. In addition, a physician requests blood glucose test to evaluate a patient who presents with leukemia symptoms. As a result, the patient diagnosis will be delayed, which will make the treatment difficult within the time.

Since the error in this phase will result in a wrong diagnosis, the patient will have the wrong medication. Moreover, nurses, physicians, and medical technicians can cause pre-analytical errors. In other words, pre-analytical errors occur before the specimen comes to the laboratory department that is considered challenges to the MLS.

Limitations

Most of the retrieved articles did not provide enough examples that might help in the illustration for pre-analytical errors. Furthermore, the researchers did not correlate the errors with the whole computer system in the hospital. For instance, the internal system in the hospital might shut down due to technical issues which then will provide incompatible patient information.

Implications

After the pre-analytical phase, the patient specimen is handed to the laboratory scientist who will process the samples and issue the results to the doctor. Thus, the laboratory scientist has to pay close attention to the patient information on the label and the test that has been ordered by the doctor. By ignoring this confirmation step, the laboratory scientist will put the patient's life in danger, because the result does not correlate with the patient's condition [3].

Moreover, pre-analytical errors might imply a weakness in the laboratory protocol [8]. Consequently, the errors in this phase will have undesired consequences that will put the laboratory at risk [6]. Therefore, the patient will feel uncomfortable with his laboratory results because of the preliminary errors that occurred before processing the specimen [8]. That particularly means that the patients do not know the actual source of error, but they assume that the laboratory is at fault.

A lack of trust from the medical staff in the hospital may be another implication that MLS will face due to those errors in the pre-analytical phase [6]. That means, when a physician receives a patient's results, he/she may send them to another laboratory for confirmation. Thus, MLS practice will be under pressure because of this challenge that was induced by a non-laboratory professional.

Additionally, the pre-analytical errors will cause economic consequences to the laboratory as well as the patients [6]. That means the patient has to pay for the test that was not necessary for his medical condition. Furthermore, the patient will pay for the medication that was not related to his condition, due to the pre-analytical error that led to the wrong diagnosis [6].

The more pre-analytical errors that occur, the more impact they will have on the MLS practice. In addition, hospitals will suffer from these implications because the laboratory medicine department is considered as the main basis for the health system [2].

Resolutions

To improve the MLS practice, the following aspects need to be taken into consideration to minimize the errors from the pre-analytical phase. Primarily, selecting an appropriate laboratory test is one step that can reduce pre-analytical mistakes [1]. Another step includes appropriate patient identification, proper sample collection, handling, transporting, and centrifugation for the sample.

When the sample is received by the laboratory, the MLS technician should confirm the patient identification by looking at the label [9]. In addition, the technician should examine the specimen to make sure that the sample is not haemolysed. Moreover, the medical laboratory scientist should confirm that the specimen was sent in the appropriate tube or container. By applying the previous steps, the MLS technician/scientists seem to be adhering to the laboratory protocols.

Secondarily, MLS scientists/technicians should investigate the main source of the pre-analytical errors in the laboratory [9]. This starts by identifying the source of the sample and the medical crew who is responsible for the patient. After that, the lab scientist determines the type of error and the outcome from this error. For instance, a blood sample was sent from the intensive care unit (ICU) in a plain tube for the hematology department. This sample must be sent in an EDTA tube, which means that the tube contains an anticoagulant substance. Therefore, the lab technician will reject the sample and ask for a redrawing of the blood from the patient and to put it in the right tube.

Then, the medical laboratory scientists are encouraged to educate the nurses, medical technicians, and doctors about the outcomes of pre-analytical errors [7]. In addition, the lab scientists should provide documentation for the medical staff who is involved in this issue. Furthermore, the laboratory scientists should explain the issue in a proper way so the audience can value the main concept behind the lecture that explains the outcome of the pre-analytical errors.

Additionally, the laboratory department can make a workshop that highlights the importance of minimizing the pre-analytical errors. This workshop can be run at least twice a year for all medical staff. Therefore, MLS department is not specifying the medical staff who is responsible of the errors in the pre-analytical phase.

Conclusions

Many research studies were conducted in order to find a way to limit the pre-analytical errors. One study by Rin [10] suggested the use of an automated system, which will reduce the pre-analytical errors. This idea started from labeling the sample automatically after receiving the test request to help in selecting the proper tube for the medical staff who is responsible for drawing the blood from the patient.

Although these research studies gave suggestions on how to reduce pre-analytical errors, a few questions do not have any answers yet such as: How to prevent pre-analytical errors from increasing in the healthcare system?

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