International Journal of Research Studies in Medical and Health Sciences
Volume 4, Issue 7, 2019, PP 07-10
ISSN : 2456-6373

Evaluation of Rejection Rates of Samples Arriving from the Pediatric Clinic to the Laboratory: What Should Be Done?

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ABSTRACT

Background: *Pre-analytic phase errors (46-68%) constitute the majority of the total errors in the laboratory. Pre- analytic phase errors should be standardized by clinicians and laboratory professionals. Pediatric blood samples taken in emergency and inpatient services or outpatient clinics are rejected in the laboratory due to clot, hemolysis, fibrin, etc. and generate the need to take a new sample from the patient. As a result of this, there is a delay in diagnosis and treatment due to the difficulties of re-taking blood from the patient and prolonged results. In our study, we aimed to determine the precautions to be taken by examining the reasons of refusal of samples rejected due to nonconformity by the laboratories obtained from the pediatrics department of our hospital.*

Methods: *The rejected pediatric samples in the Biochemistry Laboratory of Health Sciences University Okmeydanı Training and Research Hospital between January 2018 and September 2018 were included. Rejected samples were obtained retrospectively from the hospital information system. Sample rejection rates and conditions were evaluated, and if necessary, laboratory-based and clinician-based measures were evaluated.*

Results: *In the laboratory, 3314 pediatric blood samples were rejected in that time period for various reasons. Of the rejected samples, 1617 (49%) were clotted, 798 (24%) were inadequate sample, 312 (10%) were defective or incomplete test prompt, 150 (4%) were hemolyzed, and 437 (13%) were rejected for other reasons (wrong bar code, wrong tube, having fibrin, cold transport, not an urgent request, etc.). Of the 1617 rejected pediatric clot samples, 684 (42%) came from the emergency department, of which 471 consisted of blood gas.*

Conclusion: *The most common reason for rejection in pediatric samples is the clotted sample. For the solution of clotting, the blood collection tube should be turned upside down and mixed, and no transfer should be made from the tube to another tube. We believe that the rate of rejection of samples can be reduced by in-clinic training for both physicians and nurses in terms of inadequate sample and incorrect or incomplete requests.*

INTRODUCTION

Numerous routine measurements are performed for clinical diagnosis and follow-up of samples such as blood, urine, stool and other biological body fluids sent from clinics to the laboratory. Blood sample sent to the laboratory can be used as whole blood, serum or plasma. If the blood sample taken in an anticoagulant tube is used for measurements without centrifugation, it is 'whole blood'; if whole blood is centrifuged the clear liquid on the upper part after centrifugation is the 'plasma' and if the blood is collected in an anticoagulant-free tube and centrifuged, the upper clear liquid part is the 'serum'. The laboratory determines which sample will be used and therefore which tubes will be drawn for blood (1).

The total test process is a multistage process that involves all stages from the clinician's thought of making the test request to the use of the test result for the benefit of the patient. There are 3 sections in this process. These are the pre-analytic, analytical and post-analytic process. The stage from the deduction of the request of a test by the clinician to the arrival of the blood taken to the laboratory is a pre-analytical process. The process from the acceptance of the test to the laboratory to the production of the

results is the analytical process; and from the production of the laboratory results to the reporting and the use of them for the benefit of the patient is the post-analytical process. Errors that can be made in all these processes affect the test measurement result (2).

The first five steps, which include test selection, requesting, sampling, barcoding, transporting the sample to the laboratory and pre-preparation processes, are called pre-analytic phases (2). In medical laboratories, 46-68% of incorrectly produced results are due to errors in the pre-analytical process. Therefore, control of this process is very important. Pre-analytic phase errors need to be standardized by clinicians and laboratories. Pediatric blood samples taken in emergency services, inpatient services or outpatient clinics are rejected in the laboratory for reasons such as hemolysis, clot, and presence of fibrin and cause a new sampling requirement from the patient. As a result of this, there is a delay in the diagnosis and treatment process due to the difficulties of re-taking blood from the patient and prolonged results (3).

Samples coming to the laboratory should be evaluated prior to analysis to prevent errors caused by the pre-laboratory phase. Faulty samples should be rejected and the clinician or nurse informed. Especially in the pre-analytic phase, it is very important that each hospital conducts its own sample rejection analysis and creates appropriate solutions for the problems. These problems should be solved in the laboratory and clinical cooperation (4).

In our study to analyze the situation in the pediatric clinic of our hospital, we aimed to investigate the reasons for rejection of the specimens requested by the clinician and accepted to the laboratory and rejected due to nonconformity and to discuss the measures that can be taken in this regard.

METHODS

The rejected pediatric samples in the Biochemistry Laboratory of Health Sciences University Okmeydanı Training and Research Hospital between January 2018 and September 2018 were included. Rejected samples were obtained retrospectively from the hospital information system. Sample rejection rates and conditions were evaluated, and if necessary, laboratory-based and clinician-based measures were evaluated.

In this research; blood samples taken from the pediatric wards and pediatric emergency unit within 24 hours daily and from the polyclinics during the daytime working hours (08: 00-17: 00) were included. Samples reach the laboratory sample reception unit through the personnel of the relevant unit. Samples that come to our laboratory are evaluated after being accepted at the sample reception unit, inappropriate samples are written to the laboratory information system and evaluated and rejected as pre-analytical error. Hemolysis detected after centrifugation, etc. the samples are rejected by the technician concerned, then the clinical units are called and a new sample is requested.

Reason for Rejection = (Number of Rejected Samples / Total Number of Rejected Samples) x100.

Ethics Committee Approval

Author declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects".

RESULTS

In the laboratory, 3314 pediatric blood samples were rejected in that time period for various reasons. Of the rejected samples, 1617 (49%) were clotted, 798 (24%) were inadequate sample, 312 (10%) were defective or incomplete test prompt, 150 (4%) were hemolyzed, and 437 (13%) were rejected for other reasons (wrong bar code, wrong tube, fibrinated, cold transport, not an urgent request, etc.). Of the 1617 rejected pediatric clot samples, 684 (42%) came from the emergency department, of which 471 consisted of blood gas.

DISCUSSION

In the pre-analytic process, inaccurate patient identification, fasting or postprandial status of the patient, wrong test request, patient position, incorrect tourniquet application, failed phlebotomy, inaccurate - hemolyzed - clotted - insufficient sample, blood collection in the wrong tube, mixing tubes, wrong barcoding, loss of sample, improper sample transport and improper sample storage conditions are the main sources of error. The main reason for sample rejection in adults is due to the hemolyzed sample (5, 6). However, as a result of our study, the situation in pediatric samples is different. In our study, we observed the most common reason for rejection in pediatric samples as clotted samples. And we observed that clotted

samples were mostly found in blood taken for blood gas analysis. Firat Oguz et al. reported that the most common reason for rejection was clotted samples in their analysis of pediatric samples and in this case it was observed especially in samples taken for blood gas analysis (7). We also obtained similar results in the study. Guimares et al. reported that they made sample rejection due to 43.8% clotted, 24% insufficient samples (8). In another study, the most common cause of sample rejection was reported to be clotted samples (51.2%), followed by mislabeled sample cup (14.4%) and hemolyzed samples (11.4%) (9). In another center, it was reported that the most commonly clotted samples were rejected (55.8%), followed by sample rejection due to insufficient sample volume (29.3%) (10). In a study of Kume et al. examining sample rejections from the emergency department; it was reported that clot formation was the most common cause of sample rejection in blood gas and complete blood count tests (11).

For the solution of clotting, the blood collection tube should be turned upside down and mixed, and no transfer should be made from the tube to another tube. Taking blood for blood gas analysis is a process that requires experience. Because this test is run on syringes containing anticoagulants, good mixing of blood with anticoagulants is of great importance in preventing clot formation. In the emergency department, which has an intense work rhythm and heavy workload, and due to lack of personnel, there may be problems in blood gas sampling during shifts and emergency interventions. It is also ordinary that erroneous results, especially clot, are present in samples that are kept waiting for a long time and delivered to the laboratory as delayed (5).

In our study, the second most common reason for rejection was found to be inadequate samples. We believe that the rate of rejection of samples can be reduced by in-clinic training for both physicians and nurses in terms of inadequate sample and incorrect or incomplete requests. Difficulties in pediatric vessels, children who are restless during blood collection are the main reasons for inadequate sampling. In this case, the altered ratio of blood and anticoagulants will lead to inaccurate measurements and clotting problems (12).

The main causes of hemolysis are blood sampling without waiting for the drying of disinfectants such as alcohol, use of unsuitable puncture sites, prolonged tourniquet, wrong blood collection procedures, tube size, rinsing the tube too much, and injecting blood with a syringe. In order to prevent hemolysis, blood should be taken after disinfectants such as alcohol are allowed to dry, tourniquet time should not be extended, punch opening and closing movements should not be performed and blood should be taken with vacuum system (13). By minimizing errors in this way, blood will not be taken from the patient again and delays in diagnosis and treatment process will be reduced. Chawla et al. reported the most common cause of sample rejection as hemolysis (0.7%) in their study (5). In a study where the reasons for rejection were examined according to the department from which the sample came, it was found that the most frequent and very high error rates were caused by hemolyzed samples (6). However, in the pediatric group, we found that hemolysis was the fourth most common cause of sample rejection.

In our study, we also observed that the pediatric emergency department had the highest sample rejection rate. Unlike other units, emergency units have very high patient numbers and heavy workload. Therefore, it is among the most common units where pre-analytic errors are seen (6). Emergency departments are also the units where panic and chaos are common due to critical patient care. These working conditions increase the frequency of errors in emergency services (14). For similar reasons, we think that there is an excessive sample rejection since our hospital is a center with a high workload.

There are studies showing that continuous in-service training is useful in preventing pre-analytical errors. Trainings regarding the sampling, error sources, and transfer to laboratory will help to reduce pre-analytical errors (15). In this process, both laboratory specialists and pediatricians have great responsibilities.

In conclusion, necessary measures should be taken to prevent all sample rejections, especially pediatric sample rejections, particularly clotted samples in emergency services. Controlling pre-analysis factors requires clinical and laboratory collaboration. Therefore, to prevent and minimize sample rejections in the pre-analytical process, the clinician and the laboratory worker should be careful in sample collection, delivery to the laboratory and testing process.

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Citation: *Hüseyin Dağ et.al., "Evaluation of Rejection Rates of Samples Arriving from the Pediatric Clinic to the Laboratory: What Should Be Done?", International Journal of Research Studies in Medical and Health Sciences. 2019; 4(7): 07-10.*