Effectiveness of Critical Laboratory Value Reporting: An Evaluation by Clinicians

Kritik Laboratuvar Değerlerinin Raporlanmasının Klinisyenler Tarafından Değerlendirilmesi

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Başvuru Tarihi: 05 Şubat 2019 **Kabul Tarihi:** 18 Nisan 2019

ABSTRACT

Aim: High-risk laboratory results, known as "Critical or panic laboratory value", is an indicator of a life-threatening condition. The test results of critical laboratory value levels that are not determined and communicated by clinicians prevent early diagnosis and treatment, and thus bring great risks. The aim of this study was to investigate and improve the efficiency of critical laboratory value communication between clinic and laboratory.

Materials and Methods: This study was applied on 60 specialist doctors and 56 resident doctors in the form of a questionnaire consisting of 10 questions about critical laboratory values.

Results: The ratio of doctors thinking that 'critical laboratory value reporting' contributed to diagnosis was found to be 71.0%. Critical laboratory value reporting was found to be insufficient and sufficient by doctors at 55.0% and 42.0%, respectively. Specialists answered "no" in the ratio of 68.0% when they were asked, "Did the laboratory give feedback for all the results that were considered as critical laboratory value?" Notification of critical laboratory values in hospital information system (HIS) was found insufficient by 72.0% and 83.0% stated that they learned critical laboratory values from HIS. The nurses and auxiliary staff were found to have a role of 9.0% in critical laboratory value notification.

Conclusion: Each hospital should make operation and parameter adjustments about critical laboratory value reporting in the clinical base according to their own conditions.

Key words: critical laboratory value; laboratory information system; hospital information system; quality indicators

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ÖZET

Amaç: "Kritik/panik laboratuvar değerleri", hayatı tehdit eden durumları yansıtan yüksek riskli sonuçlarıdır. Klinisyenlere iletilmeyen veya klinisyenler tarafından tespit edilemeyen "kritik laboratuvar değerleri", erken tanı ve tedaviyi önleyerek büyük riskler oluşturur. Çalışmamızın amacı laboratuvarımız ve klinikler arasındaki kritik laboratuvar değer iletişiminin etkinliğini araştırmak ve geliştirmektir.

Gereç ve Yöntem: Kritik laboratuvar değerleri ile ilgili 10 sorudan oluşan bir anket hazırlanmış olup, hastanemiz kliniklerinde görev yapmakta olan 60 uzman ve 56 asistan doktora bu anket uygulandı.

Bulgular: Katılımcı hekimlerin %71'i kritik laboratuvar değerlerinin raporlanmasının tanıya katkısı olduğunu düşünüyordu. Hekimlerin %55'i kritik laboratuvar değerlerinin raporlanmasının yetersiz olduğunu bildirdi. Katılımcıların %68'i "kritik değer olarak değerlendirdiğiniz tüm sonuçları laboratuvar geri bildirimi yapıyor mu?" sorusuna hayır yanıtı verdiler. Katılımcıların %72'si hastane bilgi sistemindeki (HBS) kritik laboratuvar değer bildirimini yeterli bulmamalarına rağmen %83'ü kritik değerlerde olan sonuçları HBS'den öğrendiklerini belirtti.

Sonuç: Her laboratuvar, kritik laboratuvar değerlerinin raporlaması için uygun parametreleri ve işleyişini kendi koşullarındaki klinik şartlara göre belirlemelidir.

Anahtar kelimeler: kritik laboratuvar değerleri; klinik laboratuvarı bilgi sistemleri; hastane bilgi sistemi; kalite göstergeleri

INTRODUCTION

A lot of tests have been conducted on thousands of patients in medical analysis laboratories of hospitals per day. As a typical protocol, these requests are assayed by laboratory technicians, and, after making necessary checks, they are submitted to specialists for approval. The results are evaluated and approved by laboratory specialist, entered to hospital information system (HIS), and are able to be seen by doctors working in inpatient and outpatient clinics. This data transfer is made by laboratory information system (LIS). Laboratory results are interpreted by taking into account the reference range values, which are critical parameters that are helpful in evaluating patients for clinicians. Critical laboratory values represent test results that extremely deviate from the normal in pathophysiological conditions. In some cases, remedial actions are necessary unless immediate required interventions are performed (1). These values have been demonstrated in q-probe studies in which two thirds of clinicians have changed the treatments (2). Therefore, critical laboratory values should be considered separately from other values outside of reference range. Test results in the critical laboratory value range create vital risk for patients. Facing this situation, it is very crucial to inform clinicians for diagnosis and treatment, and each laboratory should establish a notification system (3). This situation has also been emphasized to be immediately notified in CLIA (Clinical Laboratory Improvement Amendments) criteria (4). For this reason, laboratory warning programs have been developed and times for reporting the results to related clinicians has been limited to 4 min and 17 min (5). Despite the short times, times of reflecting these results to treatment by clinicians have been observed longer such as 700-800 min (6). Therefore, short reporting times have been observed to contribute less in treatment durations (7). We also thought that reporting activity is as important as the reporting time. Therefore, we designed this survey in order to determine the efficiency of this reporting to clinics and identify clinicians' tendencies in our hospital.

MATERIALS and METHODS

Study design

This study was planned as a cross-sectional study, and applied to 60 specialist doctors and 56 resident doctors in the form of a questionnaire consisting of 10 questions about critical laboratory values. 74 of the participants were from paediatrics and internal medicine, while 21 from surgery and

21 from emergency department. The study has been performed in our hospital which is the biggest state hospital with 800 beds. The questionnaire was written on a paper and answered on the same document with signature by the researcher, language was in Turkish. The questions are depicted in Graphic 1.

Critical laboratory value reporting

Doctors request analysis and examination for their patients using HIS software in necessary cases. The results can be seen on LIS after entering data and studied by an autoanalyzer. HIS approval by a specialist is important and there must be integration between the device and LIS. When the test results meet the critical laboratory value level, laboratory technicians inform the relevant laboratory expert; laboratory expert makes the test repeated or compares the result with previous values of patient. If it is decided as "critical laboratory value", reporting is processed from "critical laboratory value notification" section of LIS to the clinician's page on HIS.

Statistical analyses

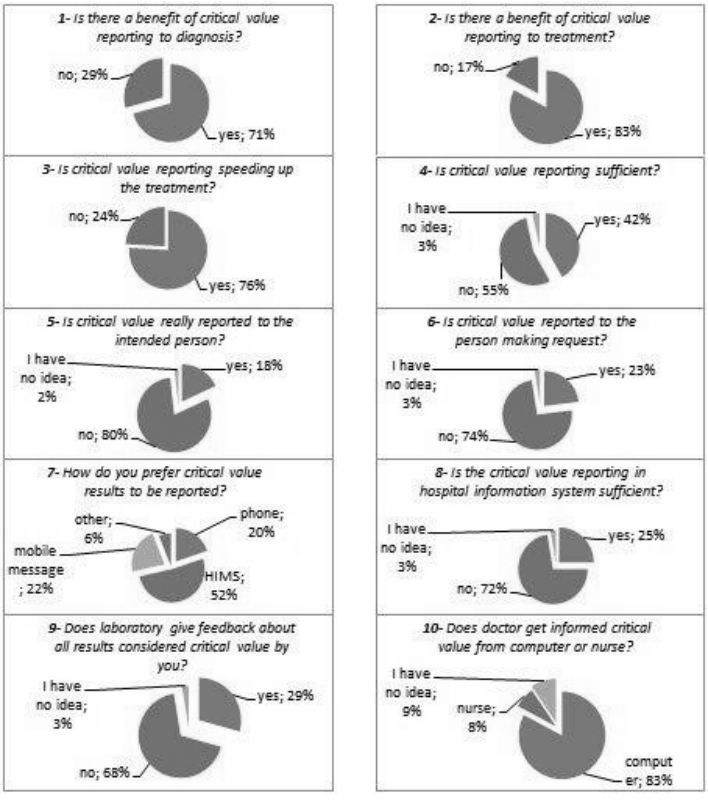
All statistical analysis and graphics were made using MS Excel 2010 (Microsoft Corporation, Redmond, WA) and SPSS 17 (SPSS Inc., Chicago, USA). Comparisons of the questionnaire results between departments and between specialist and residents were made using Chi-square test. Values of $p < 0.05$ were considered significant.

Ethical considerations

The study and questionnaire had been carried out in accordance with the Declaration of Helsinki (2008) of the World Medical Association and approved by the Ethics Committee of our hospital with the reference number of 259 at 23/12/2014.

RESULTS

The response rate to the questionnaire was 85% (116 of 137). The results of the questionnaire were summarized in Graphic 1.



Graphic 1: The results of questionnaire.

The ratio of doctors that believed the contribution of critical laboratory value reporting on diagnosis was 71.0%, while 83.0% of doctors also found it helpful for the treatment. In addition, 76.0% of them said that critical laboratory value reporting had an accelerating effect on treatment. There was no consensus on the question whether critical laboratory value reporting was sufficient or not.

There was a significant difference between the answers of specialists and residents just in one question. As shown in Table 1, when asked "Is critical laboratory value reported to the person making request?", residents (82.1%) gave more "no" answer than specialists (66.6%) (p=0.03).

There were significant differences between the answers of paediatrics/internal medicine, surgery and emergency departments in two questions. The first different answers to "Is critical laboratory value reporting speeding up the treatment?" question were given in Table 2. While 90.5% of surgery department thought that critical laboratory value reporting accelerates the treatment, 77% of paediatrics/internal medicine and 57.1% of emergency departments thought that (p=0.038).

The second different answers to "Is the critical laboratory value reporting in hospital information system sufficient?" question were given in Table 3. While 90.5% of emergency department found critical laboratory value reporting in HIS insufficient, 73% of paediatrics/internal medicine and 52.4% of surgery departments found insufficient (p=0.033).

Table 1. Comparison of the answers of residents and specialists to question 6

	Is critical laboratory value reported to the person making request?		
	Yes	**No**	**I have no idea**
Residents	8 (14.3%)	46 (82.1%)	2 (3.6%)
Specialists	19 (31.7%)	40 (66.6%)	1 (1.7%)

Table 2. Answers to question 3 according to the departments

Department	**Is critical laboratory value reporting speeding up the treatment?**	
	Yes	**No**
Paediatrics/internal medicine	57 (77%)	17 (23%)
Surgery	19 (90.5%)	2 (9.5%)
Emergency	12 (57.1%)	9 (42.9%)

Table 3. Answers to question 8 according to the departments

Department	**Is the critical laboratory value reporting in hospital information system sufficient?**		
	Yes	**No**	**I have no idea**
Paediatrics/internal medicine	18 (24.3%)	54 (73%)	2 (2.7%)
Surgery	9 (42.8%)	11 (52.4%)	1 (4.8%)
Emergency	2 (9.5%)	19 (90.5%)	0 (0%)

DISCUSSION

We aimed to investigate the effectiveness of critical laboratory value reporting between our laboratory and clinics. The results of our study indicated that critical laboratory value reporting was found beneficial by clinicians in terms of diagnosis and treatment with some deficiencies in terms of reporting and effectiveness, thus critical laboratory value reporting was found to be not sufficient enough.

The obligation of critical laboratory value reporting was entered into force with "Regulations on Improvement and Assessment of Health Care Quality" published in the official gazette in 27-06-2015 with issue number of 29399. The results outside of the range between lower and upper limits are represented with different colors in LIS. The levels below lower limit are blue, and the levels above upper limit are red. This reduces the cases escaping the attention. In this system, the test is repeated in case the result is not correlated with patient's prediagnosis/ diagnosis, age, previous results if there is a test value meeting critical laboratory value list. If the repeated test result meets Critical laboratory value List, then it is reported to specialist making the request using critical laboratory value reporting button. Having different colors for critical laboratory values in LIS is important to detect the patients at risk. This demonstration leads to early diagnosis of patients and accelerating the treatment process. However, some deficiencies have been found in LIS as a result of our questionnaire. The specialist, that we reported, often was not the responsible doctor for the reported patient. The patient, hospitalized at night under the responsibility of a doctor, was transferred to another doctor in the service in the next day, but LIS continued to run on the previous doctor. We, the laboratory specialists, report to the doctor seen on the system. Therefore, both reporting on system and reporting by phone have been used in order to overcome this deficiency. Most of the clinicians preferred regulations specific to the clinic that could accelerate the diagnosis and treatment rather than common critical laboratory value feedback of the hospital. In our questionnaire, doctors who thought that critical laboratory value reporting accelerates the treatment were most frequently in surgery, paediatrics/internal medicine and emergency departments, respectively.

There are reporting person, reported person, patient name, critical laboratory value result, reporting date and time in critical laboratory value documentation. Elisa Piva et al. investigated effectiveness of critical laboratory value reporting on patient's condition during 6 months, and concluded that critical laboratory value reporting by laboratory plays an important role in providing improvement of patients (8). Similarly in our study we can say that doctors have the necessary information on the importance of critical laboratory value reporting but not sufficient information.

When asked whether critical laboratory value reporting was sufficient or not, there were 55.0% of "no" and 42.0% of "yes". Since the values were close to each other, we observed that they had different expectations as department. For example, it was more sufficient for surgery department than the paediatrics/internal medicine and emergency departments. Mosallam et al. conducted cross-sectional descriptive study consisting of four parts in order to examine policies and practices of critical laboratory value reporting. As a result, the policies and practices of critical laboratory value, and some deficiencies in reporting practices varied between institutions. They found test selections, that were used to set reporting and boundaries of reporting, also varied in a wide range (9). We also thought that the difference among departments could be caused by this variation. Since clinicians focused on different points, they found critical laboratory value warning more meaningful at those specific points. Therefore, it was necessary to update the critical laboratory value list according to branches. Specialists answered "no" in the ratio of 68.0% when they were asked, "Did

the laboratory give feedback for all the results that were considered as critical laboratory value?" This ratio demonstrated that it is necessary to examine critical laboratory value perception among branches better. In conclusion, each clinic should determine their own critical laboratory value since each branch shows alarmed reflex at different result levels as Lundberg and Dighenin previously stated (1,10).

In addition, we got an answer of "no" in the ratio of 74.0% for the question of "Is critical laboratory value reported to the person making request?". Since the doctor hospitalizing the patient and the doctor following up the same patient could be different and the previous doctor was seen in LIS, we detected that we could not report the result to the doctor making the request. In this case, we found that specialist gave more "yes" answer than the residents. This difference may be due to the doctors who follow up the inpatients are residents most of the time. In addition, 52.0% of doctors preferred HIS when they were asked, "How do you prefer critical laboratory value results to be reported?" The majority of the remaining 48.0% preferred mobile messaging and phone, thus they represented different expectations. We believe that this difference stemmed from the percentage of success in critical laboratory value reporting. It was also shown that 72.0% of the doctors answered "no" for the question of "Is the critical laboratory value reporting in HIS sufficient?", which is consistent with 77.0% ratio of Goldenstein (11). In our study, departments which found the critical laboratory value reporting in HIS most insufficient were emergency, paediatrics/ internal medicine and surgery, respectively. This result may be due to patient density of these departments. As it is stated in literature, this showed that it is necessary to add different methods such as phone, messaging, or face-to-face reporting in critical laboratory value reporting (12). Furthermore, we found that 83.0% of clinicians learn critical laboratory value from HIS and the nurses and auxiliary staff have a role of 9.0% in critical laboratory value reporting. We think that increase in this ratio would play a role in more effective communication. Therefore, we suggest that it will increase the awareness to give the education on critical laboratory value concept and reporting to not only laboratory personnel, but also inpatient and outpatient nurses.

One limitation of our study is that we couldn't make an evaluation about the actual reporting times of the critical laboratory values to related clinicians and their opinions on this subject.

In conclusion, communication methods in critical laboratory value reporting must be increased for faster and more efficient diagnosis and treatment. Each hospital should make operation and parameter adjustments about critical laboratory value reporting in clinical base according to their own conditions.

Acknowledgements

We would like to thank all participant doctors who filled the entire questionnaire form.

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