Complete Blood Count Interpretation: a Survey of Health Professional in Brazil

ORIGINAL

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Abstract

Background: Complete blood count is one of the most ordered tests in clinical and surgical practice. However, it is important to know how to properly interpret it. The aim of this study was to measure the level of knowledge that health professionals have concerning the proper interpretation of the CBC test.

Methods and Findings: The article reports and analyzes the responses of questionnaires on the interpretation of CBC results applied in a sample of one hundred health professionals. A semi-structured tool was developed and composed of topics regarding sociodemographic data, a specific knowledge test on CBC, and a self-evaluation on the interpretation and the importance of the test. All participants scored less than 90% on the questionnaire, a result that was established as unsatisfactory regarding CBC interpretation. Only physicians and biomedical scientists showed suitable knowledge on the interpretation of hematological terms.

Conclusion: Despite the fact CBC is one of the main tests in clinical routine, our results showed deficits in knowledge on the theme by health professionals. Perhaps these results may help to reinforce the importance of multidisciplinarity and also highlight the deficiencies of training in the different professions studied.

Introduction

In clinical pathology, laboratory tests are responsible for most diagnostic and therapeutic decisions [1]. According to the Brazilian Society of Clinical Pathology, the necessary tools that trigger the actions of

health professionals regarding prevention, diagnosis, treatment, prognosis and follow-up of illnesses in general come from, among other things, laboratory test results. These tests can be carried out through the collection of different biological materials, which allow for the identification and evaluation of many analytes by using multiple types of methodologies [2].

The range of information provided by CBC, although very unspecific, has turned it into one of the most subsidiary tests ordered in clinical and surgical practice [3].

However, in order to fully make use of this test, it is important that health professionals know how to properly analyze it. Interpretation is more than just comparing the values obtained by the patient with the reference ranges supplied by the laboratory; it also encompasses the understanding of each alteration found in the test [4].

In order to interpret CBC results, it is necessary to previously know the test itself, the technology employed in its performance, the parameters of the test, the way results are expressed and the correlation of these results with the many pathologies [5].

Automation allowed the inclusion of new parameters in the hemogram. In this way, you can include the RDW (red width distribution). The knowledge and training of the professionals can impact on the understanding and interpretation of these newly included parameters in the hemogram [6].

Therefore, in clinical and laboratory practice, it is observed that laboratory tests, which were previously used only to confirm a medical suspicion, have become an important tool for decision making in the diagnosis and follow-up of the patient. In this context, CBC, a qualitative and quantitative peripheral blood cell test, stands out due to its multiple parameters that not only allow for an evaluation of the blood condition and its forming tissues (the bone marrow in particular), but also indicate the presence of diseases in other organs [7].

The current study aims to measure the level of knowledge that health professionals have concerning the proper interpretation of the CBC test.

Methods

This is a quantitative descriptive exploratory study, which was approved by the Research Ethics Committee of the Centro Universitário Doutor Leão Sampaio under the number 43951415.6.1001.5048.

The studied sample was comprised of male and female biomedical scientists, nurses, pharmacists and physicians. In order to be included, the professionals were required to have at least one year of practice experience in public or private health services in the Cariri region, located in the interior of the state of Ceará, Brazil.

The participants were screened using the snowball sampling technique. At first, it consists of the identification and location of an initial group of participants with certain characteristics. More than just participating, this initial group will provide information for the detection of other individuals with the same characteristics so that they can be included in the research. The process is repeated over and over again in such a way that a greater number of individuals may contribute to the conduction of the study. In the current study, the initial group was composed of professionals with certain characteristics from a clinical school in the Cariri region. A total of two hundred participants were initially recruited; however, forty of them refused to participate, forty-two did not comply with the required demands, and eighteen did not answer all the questions. Four groups with twenty-five professionals of each major mentioned above (medicine, pharmacy, biomedicine and nursing) were included, totaling one hundred participants in the final sample.

The responses were collected between the months of June and September 2015 by means of a semi-structured questionnaire, which included questions on sociodemographic data, specific knowledge re-

garding the CBC test, and a self-evaluation on the interpretation and importance of the test.

The specific evaluation aimed to measure the participants' level of knowledge on the interpretation of CBC results. The test consisted of 20 true or false statements, with 9 items about the composition of the CBC test, 4 about the terms used, and 7 about the association between the findings and pathologies.

For each one of the statements, the respondents had to choose one of the following answers: "true," "false" or "I don't remember". One point was assigned for each right answer; no points were attributed for incorrect or "I don't remember" answers; a score of 90% or above was considered suitable.

The collected data were inserted in an Excel spreadsheet. For the sake of statistical analysis, the STATA (Data Analysis and Statistical Software for Professionals), version 11.0, was used. The analysis did not consider the scores of the four groups of professionals individually, but as a whole. Qualitative variables were described by absolute and relative frequencies, whereas quantitative variables were expressed by median (25-75 percentiles, 95% confidence interval). In order to analyze the association between the professionals' educational background and the self-evaluation on the importance and knowledge of CBC results, the chi-square test was applied. Regarding the association between the years of experience since graduation and the knowledge evaluation, the Kruskal-Wallis test was used. Finally, the association between the academic background and the score rate was analyzed by the Mann-Whitney test. The established significance level was $p < 0.05$.

Results

A total of 100 health professionals took part in the current study, and they were divided into 4 groups according to their majors: biomedicine, nursing, pharmacy and medicine. The distribution of the participants according to their sociodemographic characteristics is shown on **Table 1**.

From the professionals who took part in the study, 52% were females and 84% had only one major. A total of 75% of the interviewees already had at least a post-graduate qualification, and most of them showed interest in going further in their studies.

Table 1. Participants sociodemographic characteristics.

Variables	N	%
Gender		
Female	52	52.0
Male	48	48.0
Do you have more than one major?		
Yes	19	19.0
No	81	81.0
What is you major?		
Medicine	25	25.0
Nursing	25	25.0
Biomedicine	25	25.0
Pharmacy	25	25.0
Do you have a graduate degree?		
Yes	77	75.0
No	23	25.0
What is your specialization?		
No specialization	23	23.0
Specialization in hematology and/or clinical analysis	18	18.0
Master degree	4	4.0
Other specializations	55	55.0
The institution which you work for is		
Private	28	28.0
Public	29	29.0
Both	43	43.0
Variables	**Median**	**p.25-p.75**
Age (years)	30	27-33
How long has it been since you graduated from college (years)?	4	3-7
How much experience do you have in your area (years)	4	2-8

The rate of right answers regarding CBC interpretation given by the participants according to their academic background is shown on **Table 2**. All the interviewed groups scored below 90%; thus, their knowledge on the interpretation of CBC results was considered unsatisfactory.

Table 3 reveals the right answers given by the respondents throughout the different stages of the questionnaire. None of the interviewed groups had a score equal to or above 90% regarding the

CBC panel. Even those who are directly responsible for the performance and analysis of the test, biomedical scientists and pharmacists, could not reach the score established as suitable for the sake of the study.

Regarding the interpretation of hematological terms, only physicians and biomedical scientists showed suitable knowledge.

When asked about the correlation between the hematological findings and possible pathologies, none of the groups had satisfactory scores.

Upon making the correlation between the investigated professionals' knowledge on the interpretation of CBC results and the mean years of experience since the graduation, it was possible to observe that there was no significant statistical association ($p>0.05$).

Table 4 shows the opinion given by participants about the importance of the test and self-evaluation on CBC interpretation.

Table 2. Rate of right answers according to academic background.

Variables	Rate of right answers		
	Median	95%CI	p
Physicians	84	84.2; 89.5	
Biomedical Scientists	84	79.0; 89.5	< 0.001*
Pharmacists	79	68.4; 84.2	
Nurses	58	47.9; 68.5	
*: Mann-Whitney test. 95%CI: 95% Confidence Interval.			

Table 3. Rate of right answers throughout the stages of the questionnaire according to academic background.

Variables	CBC Panel			Hematological Terms			Correlation to Pathologies		
	Median	95%CI	p	Median	95%CI	p	Median	95%CI	p
Medicine	88.9	88.9; 98.9		100.0	80.0; 100.0		80.0	80.0; 100.0)	
Nursing	66.7	56.8; 77.8	< 0.001*	60.0	60.0; 80	< 0.001*	40.0	22.1; 60.0)	< 0.001*
Biomedicine	88.9	79.0; 98.9		100.0	80.0; 100.0		80.0	60.0; 80)	
Pharmacy	77.8	77.8; 87.8		80.0	80.0; 100.0		60.0	42.1; 80)	
*: Mann-Whitney test. 95% CI: 95% Confidence Interval.									

Table 4. Participants' opinion about the importance of the test and self-evaluation on the interpretation of CBC results.

Variables	Total	Physicians	Nurses	Biomedical Scientists	Pharmacists
Importance of the test					
Irrelevant	-	-	-	-	-
Important	15	12	24	8	16
Essential	85	88	76	92	84
Professionals' self-evaluation on the interpretation of CBC results					
I need to improve	31	12	56	20	36
I fairly know how to interpret results	55	72	40	68	40
I master interpretation	14	16	4	12	24
*: Chi-square test.					

Most of the interviewees (85%) believe that the performance of CBC is essential in clinical practice. Within the four participating groups, biomedical scientists were the professionals who mostly mentioned the relevance of the test. In fact, 92% of them classified the performance of the test as essential.

More than half of all participants (55%) answered they fairly know how to interpret CBC results. Only 31% admit the need to improve their knowledge regarding the analysis of the results. However, the number of nursing professionals (56%) that acknowledge the need for improvement draws the attention. A small part of the participants (14%), especially pharmacists (24%), reported mastering the interpretation of the test.

Discussion

The insufficient knowledge of many professionals regarding the interpretation of CBC results, especially when it comes to the correlation with pathologies, may be related to the fact that CBC is a nonspecific test with a complex content.

Nevertheless, despite its nonspecificity, this test can be a relevant tool when in the hands of a professional who knows the cellular functions and the pathophysiological basis of diseases. Due to its sensitivity, it may be useful in the analysis of many different situations, like detection, evolution and diagnosis of many hematological and non-hematological pathologies [3].

A failure in knowledge regarding the interpretation of CBC results was detected among the different groups of participants, even among physicians, who are responsible for the clinical decision making. However, although the diagnosis is private information to physicians, other professionals involved are not exempt from the responsibility of interpreting the test. On the contrary, each professional has a specific function that supports the clinical diagnosis.

An alteration in a CBC test may represent a relatively benign condition, like an inflammation or infection, or a more severe case, like bone marrow disturbances. A precise diagnosis, as well as the specific classification of pathologies, requires a multiparameter approach to the test [8, 9].

According to Birhaneselassie et al., most of health professionals do not use a great part of the data supplied by the CBC test [10]. Sandhaus and Meyer [11] state that the test result format does not make its understanding easy since the information contained in it cannot be easily read. The current study reveals that just a change in the format of the test result would probably not be enough for its understanding. As shown by results here described, the poor knowledge of the professionals regarding the interpretation of the parameters and their correlation with existing pathologies hinders the proper use of the test in clinical practice.

Despite the fact 77% of the participants had a post-graduate degree, only 18% of the specializations were in hematology or clinical analysis, which may explain the ineffective understanding of CBC results. Educationally speaking, it is almost impossible to cover the broad spectrum of information required in all areas of expertise at an undergraduate level [12].

When self-evaluated, a large share of the participants (55%) replied that they fairly know how to interpret CBC results, indicating the urge to qualify these professionals and keep them updated.

The current study had some limitations due to the lack of participation of some professionals and the incorrect completion of the evaluation tool. A bigger data set may generate more significant results. Another limitation was the lack of studies with the same objective involving the same target population. This research was limited to literature reviews and the comparison of results with other published studies.

Conclusion

Despite the fact CBC is one of the main tests in clinical routine, the low rate of right answers regarding its interpretation provided by the interviewed health professionals showed deficits in knowledge on the theme.

The obtained results in this study can help identify which are the deficiencies in knowledge among the different groups involved and lead to future planning of strategies for the formation and improvement of health professionals.

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