

Whole Blood Clotting Time: Variation of Practice in Coagulation Laboratory, Members of Thailand National External Quality Assessment Scheme

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ABSTRACT

Objective: To collect the necessary data for a perspective of Whole Blood Clotting Time (WBCT) practice in Thailand.

Methods: In March 2007, 124 questionnaires were sent to laboratory members of the Thailand National External Quality Assessment Scheme (Thailand NEQAS) to obtain essential information about the WBCT practice.

Results: From a dispatch of 124 questionnaires, 120 (96.77%) were returned. There were 101 (84.1%) hospitals performing WBCT in the laboratories and the mean number of WBCTs performed was 16.17 times/month. Eighty nine laboratories (88.11%) used the modified Lee-White methods. Seventy four laboratories (73.26%) used snake bite and other animal bites as the indication for WBCT. Thirty three laboratories (34.37%) had problems performing the WBCT.

Conclusion: The WBCT methods among the practice of the Thailand NEQAS laboratory members were as various as problems concerning WBCT throughout Thailand. Their practice needs to be improved and standardized by proper education. It also emphasizes the need for an appropriate guidelines for WBCT in Thailand.

Keywords: Whole blood clotting time, venous clotting time, WBCT, snake bite

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Accurate clotting time assessment in venomous snake bite patients is essential in Thailand where snake bites are still an important health problem. From the annual report in 2008 of the Bureau of Epidemiology, Department of Disease control, Ministry of Public Health, Thailand, there were 7,835 snake bite patients, but only 1,843 cases recognized the snakes.¹ Although there are two major families of venomous snakes found in Thailand (Elapidae and Viperidae)², about 70% of those patients who could correctly identify the snakes suffered from the Viperidae family or hematotoxin possessed snakes.¹ Therefore, plenty of coagulation tests are performed each year for both evaluation of the coagulation status of those patients who definitely were envenomed with toxin disturbing the coagulation cascade and determination of the type of snake or the toxic nature of venom.

Although there are a lot of sophisticated coagulation tests performed in this era, the whole blood clotting time (WBCT) is the most frequently carried out coagulation test as an indicator for venom-induced coagulopathy. This is because it is the cheapest and simplest coagulation test which can be performed at the bed-side even in the rural area where most snake bites occur. It does not need any automated machine to run the test, and it provides a sufficient coagulation evaluation for proper further management. This test was originally described by Lee and White in 1913.³ The principle of the WBCT is based on the measurement of the duration from the initiation of clot formation until the clot is visible. It was previously used for monitoring heparin therapy.⁴ Later the more advanced and more sensitive tests have replaced the WBCT for diagnosis and monitoring therapy involved in hemostasis.⁵⁻¹⁰ Therefore, WBCT is no longer used for those purposes.¹¹ Afterwards the primary WBCT has been modified to several versions for numerous purposes which are known as the modified Lee-White WBCT methods.¹²⁻¹⁵ Despite its uncomplicated technique, results of both the original Lee-White WBCT and modified Lee-White WBCT methods

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are variable due to the various modified techniques and the subjective differences in performance of the tests. This problem has led to the difficulties in result interpretation.^{11-12,15-16}

In 1999, the World Health Organization (WHO) recommended another version of the WBCT, known as the 20 minutes WBCT (20WBCT), to be used as a diagnostic test of a viper bite and rules out an elapid bite in South East Asia. In addition, it was introduced to overcome the variable results and interpretation difficulties of those modified Lee-White WBCT methods.¹⁷ The 20WBCT requires very little skill and only one new dry clean glass vessel is needed. Although this recommendation was officially announced, the real practice situation throughout Thailand has never been evaluated either in the medical and paramedical personnel understanding of this recommendation or in the problems associated with WBCT. The objective of this study was to explore the WBCT methods being performed in the laboratories, appropriate use of the test, and the difficulties of those methods.

MATERIALS AND METHODS

In March 2007, 124 questionnaires were sent to hospital laboratories which were members of the Thailand National External Quality Assessment Scheme (NEQAS) for coagulation testing. Participants of this scheme include laboratories in university hospitals, in other government hospitals and in private hospitals from every region of Thailand. There were six questions to be answered as followed:

1. Is the WBCT performed in the laboratory?
2. How many WBCTs are performed in the laboratory each month?
3. Which is the method used to perform WBCT in the laboratory?
 - a. 20 minutes WBCT
 - b. 30 minutes WBCT
 - c. Modified Lee and White methods (tilting the first of the three tubes until clot before start tilting the next tube)
 - d. Tilting each tube serially with the 30 second interval
4. What is the indication for the WBCT?
 - a. Snake bite
 - b. Snake bite and/or other conditions
 - c. Unknown
5. What is the normal reference value for WBCT?
 - a. Less than 20 minutes
 - b. Less than 30 minutes
 - c. Other
6. Are there any problems concerning WBCT in the laboratory?

Data were analyzed by descriptive statistics using histogram display, percentage, mean and mode.

RESULTS

Number of hospital laboratories performing WBCT

From a dispatch of 124 questionnaires, 120 (96.77%) were returned. There were 101 (84.1%) hospitals performing WBCT in the laboratories as shown in Table 1.

Number of the WBCTs performed in the laboratories each month

There were seventy-nine laboratories, from all hospital laboratories performing WBCT, answering this question. The minimum number of the WBCT performed per month was 0.4 times/month, while the maximum number was 130

TABLE 1. Number of hospitals performing WBCT in the laboratories.

	Number of hospitals	%
Performed	101	84.1
Not performed	14	11.7
Not answer	5	4.2
Total	120	100.0

times/month with the mean at 16.17 times/month. Most hospitals performed WBCT at the average of 1-5 times/month, as shown in Fig 1.

The method of the WBCT

Of all the 101 hospital laboratories performing WBCT, 89 hospitals (88.11%) used the modified Lee and White methods. Eight laboratories (7.93%) used the method in which each tube was serially tilted once every 30 seconds. Two laboratories (1.98%) used 20 WBCT, but they also used it along with the modified Lee and White method. Two laboratories (1.98%) used other methods. The first laboratory collected two tubes of venous blood, and then tilting both tubes together every 30 seconds after 6 minutes had elapsed. Another laboratory collected blood in a microhematocrit tube, and tilted it once every 30 seconds. All methods are summarized in Table 2.

Indications for the WBCT

From the survey, 74 laboratories (73.26%) used snake bite and other conditions as the indication for WBCT, whereas 14 laboratories (13.86%) used snake bite alone as their indication for WBCT. Thirteen laboratories (12.88%) didn't have precise indications for WBCT. The indications of WBCTs being performed in those laboratories are shown in Table 3.

The reference value of WBCT

Ninety-seven laboratories (96%) from all laboratories performing WBCT answered the question. Forty-seven laboratories (48.45%) used the value of less than 20 minutes as their normal reference of WBCT. Forty-eight laboratories (49.49%) used other references and the most popular reference range being used was 5-15 minutes which equaled 37.5% of other references group. The data are summarized in Table 4.

Difficulties concerning WBCT

Ninety-six laboratories (95%) from all laboratories

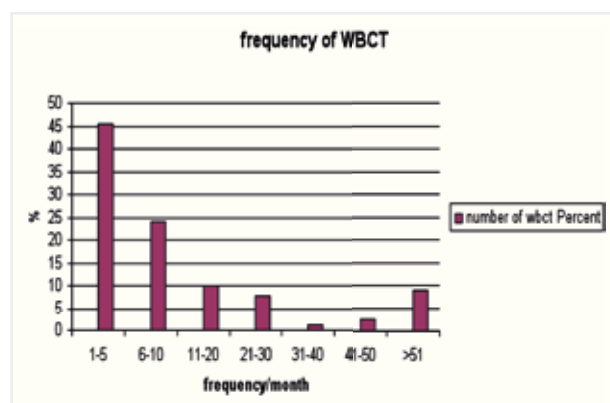


Fig 1. Number of the WBCT that performed in the laboratory each month.

TABLE 2. The method of WBCT performed in the laboratories.

The method of WBCT	Number of laboratories	%
20 WBCT	2	1.98
30 WBCT	0	0
Modified Lee and White methods	89	88.11
Tilt each tube with 30 sec interval	8	7.93
Others	2	1.98
Total	101	100.0

performing WBCT answered this question. Thirty-three laboratories (34.37%) had problems. The problems were classified into four categories as shown below and summarized in Table 5.

1. Pre-analytical phase: four laboratories (12.12%) had problems concerning specimen collections, such as difficult venipuncture.

2. Analytical phase: four laboratories (12.12%) were unable to incubate when WBCT was performed.

3. Post-analytical phase: six laboratories (18.19%) had problems concerning interpretation of WBCT when specimens were partially clotted.

4. Others:

4.1 Fifteen laboratories (45.45%) wanted to know the standard method of the WBCT.

4.2 Four laboratories (12.12%) had management problems.

DISCUSSION

This survey showed that a large numbers of WBCTs are performed each year by the laboratory members of Thailand's NEQAS with an average of 17 times/month/laboratory. In some laboratories, the test frequency was obviously high (more than 100 times/month). However, if considering the specified indications for test performing in the laboratories, the high WBCT performing rate did not absolutely reflect the snake bite cases in those areas as the WBCTs were done for many other reasons than for the venomous snake bite only. This is a surprise because nowadays snake bite is the only indication for WBCT, but other conditions suspected to be disturbing the coagulation should be indicated for other more sensitive tests such as prothrombin time and activated partial thromboplastin time.^{5-10,17}

In some laboratories (11.7%), which did not perform the WBCT, although they did not specify the reason for not doing the WBCT, it can be assumed that they may perform other tests for determination the coagulation status instead. Using other tests for coagulation evaluation in venomous snake bite is not against the rule as the WBCT is the least requirement.¹⁷ Or the test may be performed by other medical personnel, not by the laboratories. Another less likely cause, but possible, is that they may never have the venomous snake bite patient.

TABLE 3. Indications for the WBCT.

Indications	Number of hospitals	%
Snake bite	14	13.86
Snake bite and other animal bites	74	73.26
Unknown	13	12.88
Total	101	100.0

TABLE 4. The reference values of WBCT.

Reference values	Number of hospitals	%
Less than 20 minutes	47	48.45
Less than 30 minutes	2	2.06
Other	48	49.49
Total	97	100.0

For the laboratories that performed WBCT, almost all of them (88.11%) used various versions of the modified Lee and White methods. Only two hospital laboratories used 20 WBCT, but it was carried out along with the modified Lee and White method. From these data can be implied that the WHO recommendation for the use of 20WBCT is not properly understood and not widely used by the medical personnel in Thailand. They still perform the techniques they are familiar with, although that method is subjected to the test performance.^{11-12, 15-16} Moreover this evidence showed that the laboratories which used 20WBCT along with the modified Lee and White method might not feel positive or comfortable enough to use the recommended method alone. Thus, they did both in order to be confident. However, they overlook the possible problems that might occur from unnecessarily repeating the test. First of all, definitely the needless test costs more and more workload is needed. Second, there are more risks for both patient and medical personnel to be managed from extra-tests as more blood is needed from the patient and more blood will be exposed by the technicians. The last possible problem is what to do and how to interpret the results if they are not equal or comparable.

Despite the above mentioned, more serious information was also shown in this survey. The method of WBCT performed in one laboratory was distorted by using the microhematocrit tube. Since the objective of the original WBCT was to measure the intrinsic and common pathways of coagulation cascade, the contamination of tissue fluid should be avoided as much as possible.^{3,18,19} However, using a microhematocrit tube is unlikely to prevent the contamination, unless the blood is drawn from a vein and subsequently filled in the microhematocrit tube.²⁰

A large variety of reference values used in laboratories performing WBCT was also observed from this survey. If the reference value from each laboratory was matched with the WBCT method used in that laboratory, an even more amazing feature appeared, because the different methods possess the same reference values and vice versa. Among those various different reference values, there were some popular sets of numerical values (such as 6-21 min, 5-15 min) mentioned in the survey. It implied that the sources of those values were from some reference books rather than laboratories establishing their own range. Even though using the reference value from the book may be acceptable as clotting time spans for a wide range, unfortunately about 50% of the laboratories mixed up the reference values from one book with the techniques from another book.^{18-19,21}

TABLE 5. The problems concerning WBCT, in details.

Problem categories	Number of hospitals	%
Pre-analytical phase	4	12.12
Analytical phase	4	12.12
Post-analytical phase	6	18.19
Others	19	57.57
Total	33	100.0

Thirty three laboratories had problems about WBCT. The problems did not exist only in all phases of test performance, but also in other areas apart from the test process such as finance or management. However, all problems about the test retrieved from this survey demonstrated that laboratories performed the WBCT without a clear understanding in principle of both test performance and test interpretation. Although the problems are different from each other, the most important one is what should be the standard method of WBCT. This question emphasizes again the misunderstanding of both the use of WBCT and the WHO recommendation. Lack of standard methods or lack of method standardization for WBCT among the laboratories in Thailand is a big issue and underlines another critical danger for patient care. As each hospital in Thailand provides different levels of medical care, some patients must be referred to a superior level medical center for appropriate treatment which is not available in that hospital. Referral by the important laboratory results along with the patients is essential for urgent patient management, including anti-venom therapy in venomous snake bite. Following up the laboratory result for monitoring treatment like WBCT in different hospitals using different techniques may be difficult and not comparable. If those results misguide the treatment for some patients, the outcome could be disaster.

The limitation of this study was that questionnaires were only sent to the hospital laboratories, while practically in some hospitals, WBCT could be performed by nurses or medical students on the wards. Therefore, this survey did not include the information from those practices. At least, this survey demonstrated a confusing status of the use of WBCT in Thailand. Furthermore, it reflects that the volume of problems in WBCT practice is in the national level as well as it indicates an urgent need for national reorganization of this practice.

In conclusion, this study emphasized that there were many problems concerning WBCT in Thailand, which needed to be improved by proper education of all medical personnel both users and performers such as physicians, nurses, laboratory technicians as well as medical students. It also highlights the need for an appropriate guideline for suitable use of WBCT in Thailand, including interpretation and limitations of the test. Since available guidelines in Thailand, including the Practice Guideline for Management of Patients with Snake Bite of the Ministry of Public Health, mention about 20WBCT and venous clotting time (VCT), but no description of the procedure, interpretation and limitations of the test.^{2,23} The perfect guideline should be derived by brainstorming and approved by both authority hematologists and laboratory personnel. Furthermore, the 20WBCT should be promoted to be the only standard WBCT method in Thailand as it costs less, shows the good relation to fibrinogen level²² and is much more easily performed compared to other methods. Therefore, the results can be comparable throughout the country, if the patients need to be referred. Along with this message, it should be strongly underlined that the only indication for 20WBCT is the venomous snake bite in the area or hospitals that cannot perform other better coagulation tests. For utmost patient safety, hemostasis evaluation in other conditions should not be screened by this method. National help desk and national schemes of external quality assessment should really be considered by the responsible units such

as The Ministry of Public Health, the professional organizations and the medical schools, if this test is the only standard method used for venomous snake bites throughout Thailand. Additional researches may be carried out to study the correlation of 20WBCT and other coagulation tests with the clinical manifestations of patients before a guideline is set up. Therefore, the existing problems when performing 20WBCT need to be clarified more clearly and which results should be seriously considered as clinically significant. After the guideline is settled, another survey should be distributed for perspective re-evaluation of this practice.

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