Comparison of basic coagulation test specimens from the evacuated blood collection system and the syringe blood collection system

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Objective : To compare basic coagulation test specimens from the evacuated blood collection system and the syringe blood collection system

Design : Retrospective descriptive study

Materials : Laboratory records of coagulation studies in the Division of Laboratory Medicine, King Chulalongkorn Memorial Hospital during the period October to December, 1998

Methods : All data in the laboratory records were reviewed, collected and divided into two groups - specimens from the evacuated blood collection system and specimens from the syringe blood collection system. All specimens were considered using criteria of specimen rejection.

Results : There were 4,128 document subjects in this study (61 % from evacuated blood collection and 39 % from syringe blood collection). 1.8 % of the overall specimens were considered improper. Considering the improper specimens numbers, there was a significant difference between the two groups

Conclusions : The evacuated blood collection system is suitable for blood collection for basic coagulation studies in general cases. While in problematic cases

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especially those with hemolysis risk, the syringe blood collection system should be preferred. Medical personnel should understand and practice both techniques correctly in order to reduce the number of improper specimens.

Key words : *Specimen, Coagulation test, Blood collection.*

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การศึกษาเปรียบเทียบสิ่งส่งตรวจเพื่อการตรวจเกี่ยวกับการแข็งตัวของเลือดเบื้องต้น
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วัตถุประสงค์ : *เพื่อศึกษาเปรียบเทียบสิ่งส่งตรวจเพื่อการตรวจเกี่ยวกับการแข็งตัวของเลือด
เบื้องต้นจากการเก็บตัวอย่างเลือดด้วยระบบสุญญากาศ และระบบกระบอกดูด*

รูปแบบการศึกษา : *การศึกษาเชิงพรรณนาแบบย้อนหลัง*

วัสดุ : *ระเบียนการส่งตรวจทางห้องปฏิบัติเกี่ยวกับการแข็งตัวของเลือดเบื้องต้นที่
หน่วยเวชศาสตร์ชันสูตร โรงพยาบาลจุฬาลงกรณ์ ระหว่างเดือนตุลาคม 2541
ถึงเดือนธันวาคม 2541*

วิธีการ : *ทบทวนข้อมูลทั้งหมดจากระเบียน รวบรวมข้อมูล แบ่งข้อมูลเป็น 2 กลุ่ม คือ
กลุ่มสิ่งส่งตรวจจากการเก็บตัวอย่างเลือดด้วยระบบสุญญากาศ และระบบกระ
บอกดูด พิจารณาความเหมาะสมของสิ่งส่งตรวจตามเกณฑ์ปฏิเสธสิ่งส่งตรวจ*

ผลการศึกษา : *ได้ศึกษาข้อมูลจากการส่งตรวจ 4,128 ครั้ง (61% เป็นสิ่งส่งตรวจจากการ
เก็บตัวอย่างเลือดด้วยระบบสุญญากาศ   39 % เป็นสิ่งส่งตรวจจากการเก็บ
ตัวอย่างเลือดด้วยระบบกระบอกดูด) 1.8 % ของสิ่งส่งตรวจทั้งหมดมีความไม่
เหมาะสม พบความแตกต่างอย่างมีนัยสำคัญระหว่างสัดส่วนของสิ่งส่งตรวจที่
ไม่เหมาะสมของการเก็บตัวอย่างเลือดทั้งสองระบบ*

สรุป : *การเก็บตัวอย่างเลือดด้วยระบบสุญญากาศใช้ได้ดีในการเก็บส่งตรวจเพื่อ
การตรวจเกี่ยวกับการแข็งตัวของเลือดเบื้องต้นในกรณีทั่วไป ในกรณีที่มีปัญหา
เจาะยาก โดยเฉพาะรายที่มีโอกาสเกิดการแตกทำลายของเม็ดเลือดแดงได้ง่าย
การเก็บตัวอย่างด้วยระบบกระบอกดูดเป็นวิธีที่แนะนำ บุคลากรทางการแพทย์
ควรเข้าใจ และทำหัตถการการเก็บตัวอย่างเลือดทั้งสองระบบอย่างถูกต้อง เพื่อ
ลดปริมาณสิ่งส่งตรวจที่ไม่เหมาะสม*

คำสำคัญ : *สิ่งส่งตรวจ, การตรวจเกี่ยวกับการแข็งตัวของเลือด, การเก็บตัวอย่างเลือด*

PT and PTT basic coagulation studies are widely used laboratory tests in medical practice.[1-3] The specimens for these tests are venous blood specimens obtained from venipuncture procedures. Presently; the two most common venipuncture methods are the evacuated blood collection system and the syringe blood collection system.[4] Concerning the evacuated blood collection system, blood automatically flows to mix with anticoagulant in the vacuum tube. The syringe blood collection system is based on a suction principle.[5]

The quality and quantity of the specimens for basic coagulation studies are very important.[1] Aberrant quality and quantities of blood specimens effects not only laboratory results but is also a waste of time and money.[6] In the worst case, patient complications are the results.

The advantages and limitations of the venipuncture techniques have been discussed. But there are many factors affecting specimen presentation.[7] These include equipment factors and user factors. Therefore, this study was to determine the final result of the two techniques and to compare how effective they are.

Methods and Materials

This study was designed as a retrospective descriptive study. The laboratory records of coagulation studies in the Division of Laboratory Medicine, King Chulalongkorn Memorial Hospital during the period October to December 1998 were reviewed. As the services of the laboratory are the same in every month, only records for three months were selected as document subjects. In cases that the records were not complete, they were excluded.

All review data was collected and divided into two group, specimens from the evacuated blood collection system and specimens from the syringe blood collection system. All specimens were considered using criteria of specimen rejection [8-13] (Table 1) to determine how proper the specimen presentations were. Specimens within the criteria for specimen rejection were considered improper specimens. The others were considered to be proper specimens. Comparison between the two groups was done using descriptive statistical analysis.

Results

There were 4,218 document subjects in this study. Specimens from the syringe blood collection system totaled 2,562 (61 %) and specimens from the evacuated blood collection system totaled 1,656 (39 %). Concerning specimen rejection criteria, there were 76 (1.8 %) improper specimens and 4,142 (98.2 %) proper specimens (Table 2). The ratios of improper specimens in the evacuated blood collection system group and the syringe blood collection system group were 25/2562 and 51/1656 respectively. There was a significant difference of ratio between the two groups. Detail of significance tests for each subtype of the improper specimen ratios are shown in Table 3.

Table 1. Criteria of specimen rejection.

Causes	Example
1. Improper in quantity	● Too much
	● Too little
2. Improper in quality	● Clot
	● Hemolysis

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Table 2. Specimens in this study.

	Evacuated technique	Syringe technique
Proper	2537	1605
Improper	25	51
A. in quantity		
● too much	0	14
● too little	4	19
B. in quality		
● clot	8	16
● hemolysis	13	2

Table 3. Details of tests of significance for each subtype of improper specimens ratio.

	Evacuated technique	Syringe technique
A. in quantity *	4/2562	33/1656
● too much *	0/2562	14/1656
● too little *	4/2562	19/1656
B. in quality *	21/2562	18/1656
● clot *	8/2562	16/1656
● hemolysis *	13/2562	2/1656

*Significant difference (two - tailed Z test , p = 0.05)

Discussion

Basic coagulation studies are tests where many factors can cause spurious test results.[13] These factors include improper blood specimen. These days, the evacuated blood collection and the syringe blood collection system are the two most common techniques used.[4] Studies of their use in real situations are useful to determine differences in the quality of the useful specimens obtained from the two systems.

From this study, there was a significant difference between the two systems. The ratio of improper specimens from the evacuated blood collection system group was lower than the ratio in the syringe blood collection system. This can imply that higher numbers of proper specimens can be obtained from the evacuated blood collection system than from the syringe blood collection system. When considering the improper specimens from each subtype, there was a significant difference between the two systems. Considering the quantity of the specimen the evacuated blood collection system resulted in fewer improper specimens than the syringe blood collection system. In this study, there was never an excess of quantity from the evacuated blood collection system. This is a result of the principle of the equipment that the blood flow into the vacuum tube is controlled mainly

by the pressure difference between the intravenous pressure and the tubular pressure. Blood automatically ceases when an equilibrium of pressure is reached.[4] Therefore, blood specimens cannot be in excess of the proper quantity. In cases where the specimen was too little, an explanation is vein collapse caused by the suction effect. This is a limitation of the evacuated blood collection system. While in the syringe collection system, the quantity of the blood specimen is mainly controlled by manual pulling. If the medical personnel do not pay appropriate attention to the pulling, the specimen will be improper in quantity. All medical personnel should be aware that an improper quantity of specimen can result in false results, especially in the basic coagulation tests which require a precise ratio of blood to anticoagulant.[1-3] Furthermore, it is a waste of time to request the physician to collect a new specimen and it is also a waste of money in using new set of equipment.[6]

Considering the quality of the specimens, the evacuated blood collection system also gave better results than the syringe system. But considering the subtypes of improper specimens, the ratio of improper hemolysis in the evacuated blood collection method was higher than for the syringe method. Perhaps manual suction in the two-syringe technique can better control force while the evacuated system user cannot control the force of blood flow through the needle hole. There are many new evacuated system components to reduce this problem such as the Leur adapter, [4] and ultra-thin needles but they rather difficult to acquire and difficult to use.

This study was a retrospective study and data for analysis were yielded from reviewing laboratory records. Therefore, some improper specimens rejected

at the specimen presentation to the laboratory step could not be studied. Suggestion to further study designing as a prospective study was set.

Some conclusions about venipuncture for basic coagulation tests were suggested based on this study. Most results were according to the basic principles of the instrumentation of both systems. In general, using the evacuated blood collection system results in better specimens than the syringe blood collection system. But in problem cases where the venipuncture cannot be easily performed, especially in cases where hemolysis is likely to occur, the syringe blood collection system should be preferred. Therefore, both venipuncture techniques should be taught to all medical personnel.

Conclusions

The evacuated blood collection system is appropriate for collection of blood specimens for basic coagulation tests. But both the evacuated and syringe techniques still produce improper specimens. Therefore, the best method should not depend on what equipment is at hand but which method provides less error.

Acknowledgement

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