Original Article

Comparison of Microcolumn Agglutination Test for Blood Group Typing and Antibody Screening

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Background: *The microcolumn agglutination tests (MT) with an automated platform has been recently introduced for pretransfusion tests to replace conventional tube test.* ***Objective:*** *The aim of this study was to compare the sensitivity, specificity, operation time (OT) and cost effectiveness of pretransfusion tests performed by 3 commercially available MT: AutoVue® Innova (AVI), Techno TwinStation (TTs), and WaDiana Compact (WDC) with the conventional tube test (CTT) in order to implement automated MT for routine transfusion laboratory service.* ***Materials and Methods:*** *Samples from donors and patients from the Blood Bank, Department of Pathology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University were tested by all of the 4 methods for pretransfusion tests which include ABO, Rh D typing and antibody screening. The OT for each step of each method were recorded. The direct and labour cost were calculated and compared.* ***Results:*** *The sensitivity of CTT and MT for ABO and Rh D typing were not statistically significant ($p > 0.05$). Six out of 1,222 samples showed ABO discrepancies by all of the methods. Detection of two cell populations or mixed field reaction was easily observed in all MT cards, while CTT could not detect it without the use of a microscope. The sensitivity of CTT and MT in detecting clinically significant antibodies (7/2,149 samples) were also not statistically significant ($p > 0.05$). However, 1/7 samples which had anti-E could be detected only by MT. On the contrary, CTT showed higher sensitivity in detecting clinically insignificant antibodies (28/2,149 samples) which reacted only at room temperature. The OT of pretransfusion tests was similar for single samples. However, the OT of MT was faster when a large amount of samples were evaluated in a batch. AVI was the fastest instrument. The direct cost of pretransfusion tests by MT was higher than CTT because of reagent cost, while the labour cost was much cheaper for MT.* ***Conclusion:*** *The sensitivity of CTT, AVI, TTs, and WDC for ABO, Rh D typing, and antibody screening for clinically significant antibodies were not statistically significant difference. CTT had a significantly higher sensitivity than MT in detecting clinically insignificant antibodies. AVI showed higher sensitivity and a false positive rate than those of CTT and TTs. However, AVI had the fastest OT. Therefore, implementation of MT with an automated platform was recommended for transfusion service in order to reduce OT and human errors as well as increase standardization of pretransfusion tests.*

Keywords : ● *ABO grouping* ● *Rh D typing* ● *Antibody screening* ● *Microcolumn agglutination test* ● *Gel test* ● *Glass bead*

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Introduction

Pretransfusion test, which include ABO and Rh D typing, antibody screening and compatibility test, has been performed as the standard for transfusion service in order to select compatible blood for recipients[1]. The serologic tests will prevent immune-mediated hemolytic transfusion reaction and assure the acceptable survival rate of transfused blood. ABO blood group is one of the major histocompatibility complex which plays an important role in transfusion and transplantation. ABO incompatibility can cause acute severe intravascular hemolysis, renal failure and death[2-5]. Antibody screening test is performed to detect non ABO red blood cell (RBC) alloantibodies in recipients' serum. The compatibility test is a method which identical ABO and RhD donor's blood are selected and tested with recipients' blood. Both methods will ensure that no RBC antibodies in recipient serum will react with donor RBC and cause immune reaction during and following blood transfusion. These methods will detect either agglutination or hemolysis of RBC at room temperature (RT), 37 °C and indirect antiglobulin test (IAT) in vitro[4,6,7].

RBC serologic tests were firstly performed on glass slides for ABO and Rh D typings. The limitations of this slide method are false negative results, difficulty in interpretation of weak reaction, cell aggregation due to dry reaction mixture and the most important one, inability to perform serum typing, antibody screening and compatibility tests. The development of saline tube test and antiglobulin test replaced the slide method. However, human errors can be commonly observed with the conventional tube test[4,8]. Enriched media such as albumin[6] and low ionic strength saline (LISS) has been added to the tests to increase the sensitivity and reduce incubation time of the tests[1,4,6,9].

The microcolumn agglutination test (MT) is the latest method for blood group typing, antibody screening and compatibility test[10]. The advantages of MT are more sensitive, less sample volume and less technical variation. The commercially available kit has been developed using either gel or glass bead in the microcolumn cards. Recently, a fully automated instrument has been available to perform pretransfusion tests by MT to reduce human errors[4,8,9].

The aim of this study was to compare the sensitivity, specificity, operation time (OT) and cost effectiveness of pretransfusion tests performed by 3 commercially available MT: AutoVue® Innova (AVI), Techno TwinStation (TTs), and WaDiana Compact (WDC) with the conventional tube test (CTT) for ABO, Rh D typing and antibody screening test in order to implement automated MT for routine transfusion laboratory service.

Materials and Methods

Sample

The blood samples tested in this study were specimens of donors and patients at Blood Bank, Department of Pathology, Faculty of Medicine, Ramathibodi Hosptial, Mahidol University. Blood grouping (ABO, RhD) and antibody screening were performed on 1,222 and 2,149 samples, respectively. Each sample was tested by conventional tube test (CTT), AVI, TTs and WDC within the same day. All of the blood samples were stored at 2 – 6 °C before testing.

Pretransfusion test

ABO and Rh D typing by fully automated AVI (Ortho Clinical Diagnotics, Rarita, NJ, USA.), fully automated TTs (DiaMed, Cressier, Switzerland) and semi-automated WDC (Diagnostic Grifols,S.A., Barcelona, Spain) were performed in comparison with CTT method. BioVue ABO-Rh/Reverse cassettes were used for AVI and ID-Cards ABO/Rh+ Reverse Grouping were used for TTs. Both of them had 6 columns in one card. The DG Gel® ABO/Rh (2D) cards were used for WDC and had 8 columns in 1 card. The volume of plasma sample used for TTs and WDC were 50 uL while the volume of plasma sample used for AVI was

40 uL. The procedure for AVI did not need the step of room temperature incubation while incubation time for TTs and WDC were 10 and 15 minutes, respectively. The centrifugation time of TTs and WDC were 10 minutes while the centrifugation time of AVI was only 5 minutes. Total time for AVI, TTs and WDC were 5, 20 and 25, respectively.

Antibody screening tests by all of the 4 methods were performed at the same time by using screening cells from the National Blood Centre, Thai Red Cross Society (NBC, TRC). They were pooled group O donor cells suspensions that included the most commonly phenotypes of clinically important RBC antigens. They were D, E, C, e, c, M, N, S, s, P_1, Mi^a, Le^a, Le^b, K, k, Jk^a, Jk^b, Fy^a, Fy^b, Di^a and Di^b. BioVue Anti-Human Polyspecific cassettes and BioVue Reverse Diluent cassettes were used for AVI while ID-Card LISS/Coombs, polyspecific anti-human globulin were used for TTs. DG Gel® Coombs, polyspecific anti-human globulin card were used for WDC. The volume of plasma sample used for TTs and WDC were 25 uL while the volume of plasma sample used for AVI was 40 uL. The incubation time for TTs and WDC were 15 minutes at 37°C while the incubation time for AVI was only 10 minutes at 37°C. The centrifugation time of TTs and WDC were 10 minutes while the centrifugation time of AVI was only 5 minutes. Total time for AVI, TTs and WDC were 15, 25 and 25 minutes, respectively.

Operation time and direct cost

The direct cost of all materials used to perform ABO, Rh D and antibody screening by CTT, MT were calculated. The labour cost per test was also calculated from the salary and the time that the staff spent on performing the tests.

Statistical analysis

The statistical analyses of all data were calculated using SPSS for windows, version 18.0 (IBM SPSS Inc., Chicago, IL). The McNemar test and Cochran Q test were used to gauge the significance of sensitivity and specificity of the ABO, Rh typing and the antibody screening test by CTT and all of MT.

Ethics

The present study was approved by the Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

Results

ABO grouping

The total of 1,222 samples were tested for ABO grouping. All of the four methods gave the ABO discrepancies results which were 0.33% for CTT, 0.49% for AVI, 0.41% for TTs and 0.33% for WDC as shown in Table 1. The details of ABO discrepancy results were shown in Table 2. All of the methods can detect two cell populations in 4 samples of ABO-incompatible bone marrow transplantation (BMT) patients. In addition, ABO discrepancies were also observed in 2 samples that had alloantibodies (anti-Le^a+anti-Le^b and anti-P_1+anti-Le^b) by AVI and TTs. All of the antibodies reacted only at room temperature phase. However, the results of all the methods were not statistically significant different ($p > 0.05$).

Rh D typing

All of the four methods showed conclusive result. Rh D positive typings were observed in 99.59%, while Rh D negative typings were observed in 0.41% of the samples as shown in Table 3. The results of all the

Table 1 ABO typing results

Result	CTT (%)	AVI (%)	TTs (%)	WDC (%)
Conclusive result	1,218 (99.67)	1,216 (99.51)	1,217 (99.59)	1,218 (99.67)
ABO discrepancies	4 (0.33)	6 (0.49)	5 (0.41)	4 (0.33)
Total	**1,222**	**1,222**	**1,222**	**1,222**

Table 2 ABO discrepancies results in 6 samples

	Method			
	CTT	**AVI**	**TTs**	**WDC**
ABO – incompatible Allogeneic BMT patients	4	4	4	4
Alloantibodies (RT)	0	2	1	0
Anti-Le^a + Le^b		1	0	
Anti-P_1 + Le^b		1	1	
Total	**4**	**6**	**5**	**4**

Table 3 Rh D typing results

Result	**CTT (%)**	**AVI (%)**	**TTs (%)**	**WDC (%)**
Rh D positive	1,217 (99.59)	1,217 (99.59)	1,217 (99.59)	1,217 (99.59)
Rh D negative	5 (0.41)	5 (0.41)	5 (0.41)	5 (0.41)
Total	**1,222**	**1,222**	**1,222**	**1,222**

Table 4 Antibody screening results

Result	**No.**	**Percent**
Conclusive results	2,115	98.42
Inconclusive results	34	1.58
Total number of samples	2,149	

Table 5 Pattern of conclusive results of antibody screening tests (N = 2,115)

CTT	**AVI**	**TTs**	**WDC**	**No.**	**%**
-	-	-	-	2,102	97.81
+	+	+	+	13	0.60

methods were not statistically significant different ($p > 0.05$).

Antibody screening test

Conclusive results were observed in 2,115 out of 2,149 samples (98.42%) as shown in Table 4. Inconclusive result were obsered in 34 samples (1.58%). All of the four methods showed 97.81% and 0.61% for negative and positive reaction, respectively (Table 5).

The specificity of antibodies that gave conclusive positive results were shown in Table 6. There were anti-D (1 sample), anti-E (1 sample), anti-E + anti-Mi^a (1 sample), anti-D + anti-Le^a + anti-Le^b + warm autoantibody (1 sample), anti-Mi^a (6 samples), warm autoantibody (1 sample) and anti-Le^a (1 sample). However, we found that the specificity of antibody in one sample cannot be identified. Inconclusive results can be categorized into 7 types as shown in Table 7.

Antibodies observed in this study were categorized into clinically significant antibody and clinically insignificant antibody according to the type of immunoglobulin and the ability of antibodies that had the potential to cause hemolytic transfusion reactions (HTRs) and/or hemolytic disease of the fetus and new born (HDFN). Table 8 showed antibody specificity and reactivity of clinically significant antibodies, while Table 9 showed antibody specificity and reactivity of clinically insignificant antibodies.

Table 6 The specificity of antibodies from positive conclusive results (N = 13)

Antibody specificity	No. of sample
Anti – D	1
Anti – E	1
Anti – E + anti-Mi^{a}	1
Anti – D + anti-Le^{a} + anti-Le^{b} + warm autoantibody	1
Anti – Mi^{a}	6
Autoantibody	1
Anti-Le^{a}	1
Unidentified	1
Total	**13**

Table 7 Type of inconclusive results of antibody screening tests (N = 34)

Type	Method				No. (%)	Antibody Specificity
	CTT	AVI	TTs	WDC		
1	-	+	-	-	1 (0.05)	Unidentified
2	-	+	+	+	1 (0.05)	Anti-E
3	+	-	-	-	18 (0.84)	
					3	Anti-Le^{a}
					3	Anti-Le^{a} + anti-Le^{b}
					6	Anti-P$_{1}$
					1	Anti-N
					1	False positive*
					4	Unidentified
4	+	+	-	-	9 (0.42)	
					1	Anti-E
					2	Anti-Le^{b}
					1	Anti-Le^{a} + anti-Le^{b}
					1	Cold autoantibody
					3	False positive*
					1	Unidentified
5	+	+	+	-	1 (0.05)	Anti-Le^{a} + anti-Le^{b}
6	+	+	-	-	3 (0.14)	
					1	Anti-Mi^{a}
					1	Anti-Le^{a}
					1	Anti-M
7	+	-	+	+	1 (0.05)	False positive*

**False positive : positive antibody screening but negative for antibody identification;*

Unidentified : positive antibody screening and positive for antibody identification but specificity cannot be interpreted.

Table 8 Reactivity and specificity of clinically significant antibodies

	No.	CTT	AVI	TTs	WDC
Anti – D	1	1	1	1	1
Anti – E	3	2	3	2	2
Anti – E + Mi^a	1	1	1	1	1
Anti – D + Le^a + Le^b + warm autoantibody	1	1	1	1	1
warm autoantibody	1	1	1	1	1
Total	**7**	**6**	**7**	**6**	**6**
Sensitivity (%)		85.71	100	85.71	85.71

Table 9 Reactivity and specificity of clinically insignificant antibodies

	No	CTT			AVI			TTs	WDC
		RT	IAT	RT&IAT	RT	IAT	RT&IAT	IAT	IAT
Anti – Mi^a	7	0	1	6	0	0	7	6	7
Anti – P_1	6	0	6	0	0	0	0	0	0
Anti – Le^a	5	1	4	0	0	0	2	1	2
Anti – Le^b	2	0	2	0	2	0	0	0	0
Anti – Le^a+Le^b	5	0	4	1	1	1	0	1	0
Anti – M	1	0	0	1	0	0	1	0	1
Anti – N	1	1	0	0	0	0	0	0	0
Cold autoantibody	1	1	0	0	1	0	0	0	0
Total	**28**	**3**	**17**	**8**	**4**	**1**	**10**	**8**	**10**
Sensitivity (%)			100			53.57		28.5	35.71

Table 10 Operation time of ABO, Rh D typing and antibody screening

No. sample(s) per batch.	Method	Time (min)	
		ABO/Rh D	Ab Screening
1	CTT	7.25	28.39
	AVI	7.55	23.00
	TTs	24.27	28.21
	WDC	30.02	29.14
5	CTT	13.40	35.26
	AVI	14.38	25.43
	TTs	32.11	32.04
	WDC	N/A*	32.19
10	CTT	23.51	52.05
	AVI	20.46	28.59
	TTs	52.44	36.51
	WDC	N/A*	35.23

** The instrument was not available*

Table 11 Comparison of ABO / Rh D typing direct cost (Baht)

Cost	CTT	AVI	TTs	WDC
Labor cost	6.48	5.76	5.76	5.76
Material cost	56.21	135.75	112.42	183.90
Direct cost	62.69	141.51	118.18	189.66

Table 12 Comparison of antibody screening test direct cost (Baht)

Cost	CTT	AVI	TTs	WDC
Labor cost	7.55	2.00	2.00	2.00
Material cost	21.01	70.96	50.04	63.82
Direct cost	28.56	72.96	52.04	65.82

The reactivity of 7 samples containing clinically significant antibodies (cs-ab) was shown in Table 8. The sensitivity of CTT, AVI, TTs and WDC were not significantly different ($p > 0.05$) in detecting clinically significant antibody. The reactivity of 28 samples of clinically insignificant antibodies (is-ab) were shown in Table 9. The sensitivity of CTT, AVI, TTs and WDC were significantly different ($p < 0.05$) in detecting clinically insignificant antibody. The sensitivity was significantly higher in CTT ($p < 0.00$) but the sensitivity of AVI was also significantly higher than those of TTs and WDC ($p < 0.05$).

Operation time and direct cost

The operation time of ABO, Rh D typing and antibody screening test for 1, 5 and 10 samples as the batch loading were shown in Table 10. The comparison of direct cost for ABO and Rh D typing, antibody screening test which included the cost of labour and material were shown in Table 11-12.

Discussion

It was observed in this study that the sensitivity of ABO and Rh D typing by CTT, AVI, TTs and WDC was not statistically different ($p > 0.05$), which were similar to the study of Langston et al[11]. All of the 4 methods had the same ability in detecting 4 samples of ABO discrepancy from ABO-mismatched bone marrow transplant (BMT) patients as previously described in the other study[12]. Even though WDC can detect two cell populations in only 2 of 4 samples while AVI, TTs and CTT can detect in all 4 samples, but WDC gave the discrepancy between cell and serum grouping in the other 2 samples which then lead to manual verification.

The advantages of microcolumn agglutination test (MT) over CTT in detecting two cells populations are clear reaction without using a microscope and stable end point. Moreover, the red cell can be easily distinguished between agglutinated red cell on the top and non-agglutinated red cell at the bottom of the column. The red cell agglutination by conventional tube test cannot be seen without the aid of a microscope. The microcolumn agglutination assay is a better method in detecting mixed red blood cell population, particularly in the ABO mismatched BMT and ABO subgroups.

ABO discrepancy was observed in 2 samples with alloantibodies by AVI and TTs. Anti-Le^a and anti-Le^b were identified in one sample while anti-P_1 and anti-Le^b were identified in the other sample. The discrepancy observed in ABO reverse grouping was due to the better sensitivity of MT over CTT.

The sensitivity of antibody screening test by CTT, AVI, TTS and WDC for clinically significant antibodies was not statistically different ($p > 0.05$) as shown in Table 8. However, AVI can detect one more sample of anti-E while the others cannot detect it. Our results showed the same finding as the previous study[12] that

anti-E can be detected in more samples by MT than CTT. This finding was in contrast with the study from Hong Kong[13] which showed that the gel test can detect less anti-E than CTT. Unfortunately, anti-C, anti-c, anti-Jk^a and anti-K were not included in our study because they are not common antibodies in Thai.

The sensitivity of antibody screening test by CTT, AVI, TTS and WDC for clinically insignificant alloantibody was statistically different (p <0.05) as shown in Table 9. All of anti-P_1 (N = 6) which can be identified by CTT, were not detected by MT. Moreover, among 12 samples, which were positive for anti-Le^a and/or anti-Le^b by CTT, only 3 samples were detected by MT. AVI had a better sensitivity than TTs and WDC. Anti-N was observed in only 1 sample by CTT but cannot be found in any of MT. These findings for clinically insignificant alloantibodies from our study were similar to those of the previous studies which showed that the gel test was less sensitive in detection of cold alloantibodies such as anti-P_1 and antibodies in the Lewis system[14,15]. However, all of the 4 methods showed the same sensitivity for anti-Mi^a, which is common in Thai.

Three out of 29 positive antibody screening samples by MT (10.34%) showed negative reaction for antibody identification, while 5/45 (11.11%) positive antibody screening samples by CTT showed negative reaction for antibody identification, as well. Therefore, MT did not give more false positivity than CTT (Table 7).

The OT for ABO grouping and Rh D typing by CTT was almost the same as AVI for single sample, but for the large amount of sample in a batch, the OT of MT were shorter as shown in Table 10. The OT of ABO and Rh D typing by AVI was faster than those of the other two instruments (TTs and WDC). The results of ABO grouping and Rh D typing from all instruments were not statistically different (p > 0.05). TTs and WDC needed a minimum of 20 and 25 minutes for incubation and centrifugation while AVI required only 5 minutes for incubation and centrifugation.

The OT of antibody screening test by AVI was the fastest. AVI required 5-7 minutes for set up time and centrifugation, while TTs and WDC needed 10-15 minutes for either one sample or batch test as shown in Table 10. The CTT was time-consuming when compared to MT because of 2 reasons. The first one was the longer incubation in CTT. The second one was the extra time for washing RBC before adding antiglobulin serum.

The direct costs of ABO, Rh D typing and antibody screening test by MT were higher than CTT as shown in Table 11-12. The reagent cost was much more expensive in MT, while the labour cost was cheaper. However, automated microcolumn agglutination systems have the advantage of connecting the result with laboratory information system and hospital information system, resulting in less identification error.

Conclusion

The microcolumn agglutination test on the automation platform has been recently introduced to replace the conventional tube test for pretransfusion tests. The aim of this study was to compare the sensitivity, specificity, turnaround time and cost effectiveness of these technologies in order to implement the MT for routine use in transfusion service. The results_of ABO, Rh D typing by all of the methods were not statistically significant. The sensitivity of CTT, AVI, TTs and WDC were also not statistically significant in detecting clinically significant antibodies. However, 1 sample of anti-E which is one of the common antibody in Thai was only detected by MT. On the contrary, CTT showed higher sensitivity in detecting clinically insignificant antibodies which reacted mostly at RT phase such as anti-Le^a, anti-Le^b, anti-P_1 and anti-N. Because of the advantages of MT over CTT in standardization of the method, shorter OT and reduced human error,

in combination with higher sensitivity results shown by our study, therefore, the microcolumn agglutination test on automation platform should be recommended for transfusion service laboratory.

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การเปรียบเทียบการตรวจหมู่โลหิต และการทดสอบหาแอนติบอดีต่อหมู่โลหิต โดยวิธี Microcolumn Agglutination Test

พิมพรรณ กิจพ่อค้า[1] ปณิธิตา สุขสมบูรณ์วงศ์[1] วิโรจน์ จงกลวัฒนา[2] และ พิมลพรรณ รัตนศิริวานิช[3]

[1]สาขาวิชาพยาธิวิทยาคลินิก ภาควิชาพยาธิวิทยา คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี [2]ภาควิชาเวชศาสตร์การธนาคารเลือด คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล กรุงเทพฯ [3]ธนาคารเลือด โรงพยาบาลมหาวิทยาลัยนเรศวร คณะแพทยศาสตร์ มหาวิทยาลัยนเรศวร จังหวัดพิษณุโลก

บทคัดย่อ *การใช้เทคนิค microcolumn agglutination test (MT) โดยเครื่องตรวจอัตโนมัติได้ถูกนำมาใช้ทดสอบ pretransfusion test เพื่อแทนเทคนิค conventional tube test* ***วัตถุประสงค์*** *เพื่อเปรียบเทียบการใช้ชุดทดสอบสำเร็จรูป MT ด้วยเครื่องมืออัตโนมัติ 3 เครื่องได้แก่ AutoVue® Innova (AVI), Techno TwinStation (TTs) และ WaDiana Compact (WDC) กับวิธี conventional tube test (CTT) โดยศึกษาเปรียบเทียบความไว ความจำเพาะ เวลาที่ใช้ในการทดสอบ ต้นทุน และประสิทธิผลของการทดสอบ เพื่อนำเทคนิคการตรวจ MT โดยเครื่องอัตโนมัติมาใช้งานในห้องปฏิบัติการคลังเลือด* ***วัสดุและวิธีการ*** *ตัวอย่างทดสอบได้จากตัวอย่างโลหิตที่สุ่มจากผู้บริจาคโลหิตและผู้ป่วยของคลังเลือด ภาควิชาพยาธิวิทยา คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล โดยทดสอบ pretransfusion test ซึ่งประกอบด้วยการตรวจหมู่โลหิต ABO Rh D และการทดสอบหาแอนติบอดีต่อหมู่โลหิต มีการบันทึกเวลาทุกขั้นตอนที่ใช้ในการทดสอบทั้ง 4 วิธี และมีการคำนวณเปรียบเทียบหาต้นทุนทางตรง และต้นทุนค่าแรงของการทดสอบ* ***ผลการศึกษา*** *ผลการเปรียบเทียบความไวในการทดสอบหาหมู่โลหิต ABO และ Rh D ด้วยวิธี MT และ CTT พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p > 0.05$) และพบผลการตรวจที่ไม่สอดคล้องกันของหมู่โลหิต ABO โดยมีจำนวนเท่ากันคือ 6 ใน 1,222 ตัวอย่างในทุกวิธีทดสอบ การตรวจพบปฏิกิริยาของเซลล์สองกลุ่มอยู่ปนกันหรือ mixed field reaction สามารถสังเกตเห็นได้อย่างชัดเจนจาก card โดยวิธี MT ในขณะที่วิธี CTT ไม่สามารถเห็นได้ด้วยตาเปล่า จำเป็นต้องดูจากกล้องจุลทรรศน์ ผลการเปรียบเทียบความไวในการตรวจหาแอนติบอดีที่มีความสำคัญทางคลินิคโดยวิธี MT และ CTT พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p > 0.05$) โดยตรวจพบ 7 ใน 2,149 ตัวอย่าง อย่างไรก็ตามพบว่า 1 ใน 7 ตัวอย่างซึ่งมี anti-E สามารถตรวจพบได้โดยวิธี MT เท่านั้น ในทางตรงกันข้ามพบว่าวิธี CTT มีความไวสูงกว่าวิธี MT ในการตรวจหาแอนติบอดีที่ไม่มีความสำคัญทางคลินิก ซึ่งเกิดปฏิกิริยาที่อุณหภูมิห้อง โดยพบ 28 ใน 2,149 ตัวอย่าง เมื่อเปรียบเทียบเวลาที่ใช้ในการทดสอบพบว่าหากเป็นการทดสอบเพียง 1 ตัวอย่างทั้ง MT และ CTT ใช้เวลาใกล้เคียงกัน แต่ถ้าเป็นการทดสอบตัวอย่างที่มีจำนวนมากหรือทดสอบเป็นกลุ่มตัวอย่างพบว่า MT ใช้เวลาน้อยกว่า และพบว่า AVI เป็นเครื่องตรวจอัตโนมัติที่ตรวจได้เร็วที่สุด สำหรับต้นทุนทางตรงของการทดสอบพบว่าวิธี MT มีต้นทุนสูงกว่า CTT จากราคาที่สูงกว่าของชุดน้ำยาสำเร็จรูป ในขณะที่ต้นทุนค่าแรงของวิธี MT นั้นต่ำกว่า CTT* ***สรุป*** *ความไวในการทดสอบหมู่โลหิต ABO Rh D และการทดสอบหาแอนติบอดีที่มีความสำคัญทางคลินิคโดยวิธี CTT, AVI, TTs และ WDC ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ แต่พบว่าวิธี CTT มีความไวมากกว่าวิธี MT ในการทดสอบหาแอนติบอดีกลุ่มที่ไม่มีความสำคัญทางคลินิค AVI เป็นเครื่องอัตโนมัติที่ให้ผลการทดสอบที่มีความไวสูงกว่าและให้ผลบวกปลอมมากกว่าวิธี CTT และ TTs แต่ใช้เวลาในการทดสอบเร็วที่สุด ดังนั้นจึงควรนำเครื่องมืออัตโนมัติที่ตรวจโดยเทคนิค MT มาใช้ในงานห้องปฏิบัติการเวชศาสตร์การบริการโลหิต เพื่อให้ได้ความไวของการทดสอบที่สูงขึ้น ลดเวลาการทดสอบ และลดความผิดพลาดที่เกิดจากขั้นตอนการทำงาน รวมทั้งเป็นการเพิ่มมาตรฐานของการทดสอบ pretransfusion tests*

Keywords : ● *ABO grouping* ● *Rh D typing* ● *Antibody screening* ● *Microcolumn agglutination test* ● *Gel test* ● *Glass bead*

วารสารโลหิตวิทยาและเวชศาสตร์บริการโลหิต 2557;24:7-16.