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Comparison of the results for three automated immunoassay systems in determining serum HBV markers

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Abstract

Background: Automated immunoassay analyzers are used to identify hepatitis B virus (HBV) serum markers. In regions with high prevalence of HBV, it is imperative to compare test results from different immunoassay analyzers.
Methods: Samples from 496 subjects were collected and HBV markers were determined (double-blind, parallel manner) using Abbott AxSYM, Roche Modular Analytics E170, and Abbott Architect i2000).
Results: Concurrence between AxSYM and E170 was 97.78% for HBsAg, 91.13% for anti-HBs, 98.79% for anti-HBc, 98.39% for HBeAg, and 88.91% for anti-HBe. Positive rates of anti-HBs and anti-HBe from AxSYM were lower than E170 ($P<0.01$). Concurrence between AxSYM and Architect i2000 was 98.79% for HBsAg, 91.33% for anti-HBs, 95.97% for anti-HBc, 98.39% for HBeAg, and 95.77% for anti-HBe. Positive anti-HBs rates from AxSYM were lower than Architect i2000 ($P<0.01$). Concurrence between E170 and Architect i2000 was 97.38% for HBsAg, 94.15% for anti-HBs, 95.56% for anti-HBc, 99.60% for HBeAg, and 88.10% for anti-HBe. Positive anti-HBe rates using Architect i2000 were lower than E170 ($P<0.01$). Overall, the greatest differences were observed in samples with low-level serum HBV markers.
Conclusion: Significant discrepancies were observed among results for the 3 automated immunoassay analyzers, especially for low-level anti-HBs and anti-HBe results.

Keywords: Immunoassay; Hepatitis B; Correlation

1. Introduction

Serum hepatitis B virus (HBV) markers are the most important clinical data used for epidemic screening and diagnosis of HBV infection. In recent years, several automated immunoassay analyzers have been used to determine serum HBV markers in regions such as China that have a high prevalence of HBV. Though these analyzers have such qualities as high sensitivity, repetitive throughput, and rapid and safe operation, results validation comparing the concurrence of outputs from different analyzers has become a clinical imperative. Therefore, we compared concurrence among HBV serum marker results from the 3 most common automated immunoassay analyzers currently used in China — Abbott AxSYM, Roche Modular Analytics E170 (E170), and Abbott Architect i2000 (i2000).

2. Materials and methods

A total of 496 serum samples were collected from August to November 2004 from 298 community volunteers and 198 hospitalized patients. Among community volunteers, there were 156 males and 142 females with a mean age of 30.2 y (range 18–61 y). Of the hospitalized patients, there were 123 males and 75 females, with a mean age of 46.6 y (24–68 y). Five HBV serum markers were selected for comparison: HBV surface antigen (HBsAg), anti-HBsAg (anti-HBs), HBV core antigen antibodies (anti-HBc), HBV e antigen (HBeAg), and anti-HBeAg (anti-HBe). Samples were processed using the 3 predetermined automated immunoassay analyzers (AxSYM, E170, Architect) using a double-blind, parallel method. Testing was performed on fresh serum samples.

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AxSYM is a third generation microparticle enzyme immunoassay (MEIA) analyzers used for the qualitative detection of serum HBV markers. HBsAg was interpreted with the ratio of the sample rate to the Index Calibrator mean rate (S/N), where S/N ≥ 2.00 was positive. Results of anti-HBs were performed using quantitative analysis, with low range neat 0.0 mIU/ml to high range neat 1000.0 mIU/ml. Specimens with concentration values ≥ 10 mIU/ml were considered anti-HBs positive. Serum samples with anti-HBs concentrations reported as >1000.0 mIU/ml were diluted using an automated dilution protocol (1:25). HBeAg, anti-HBc, and anti-HBe were interpreted with the ratio of the sample rate to the cutoff rate (S/CO), S/CO where ≥ 1.0 was HBeAg positive and S/CO ≤ 1.0 was anti-HBc or anti-HBe positive. AxSYM automated immunoassay analyzers and associated reagents for serum HBsAg, anti-HBs, anti-HBc, HBeAg, and anti-HBe determination are manufactured by Abbott Diagnostics, Abbott Park, IL.

Modular Analytics E170 analyzer uses electrochemiluminescence immunoassay (ECLIA) to analyze serum HBV markers. HBsAg, anti-HBc, HBeAg, and anti-HBe were interpreted using the ratio of the sample signal to the cutoff signal (S/CO), S/CO where ≥ 1.00 was HBsAg or HBeAg positive and S/CO ≤ 1.00 was anti-HBc or anti-HBe positive. Results of anti-HBs were quantitatively analyzed and concentrations ≥ 10 mIU/ml were anti-HBs positive. Specimens with anti-HBs values exceeding 1000 mIU/ml were diluted using an automated dilution protocol (1:100). E170 automatic immunoassay analyzers and associated reagents for serum HBsAg, anti-HBs, anti-HBc, HBeAg, and anti-HBe determination are manufactured by Roche Diagnostics, Mannheim, Germany.

Architect i2000 analyzer uses chemiluminescent microparticle immunoassay (CMIA) for the quantitative determination of serum HBV markers. Specimens with concentration values ≥ 0.05 IU/ml are considered reactive by HBsAg criteria. Specimens with concentration values ≥ 10 mIU/ml are considered reactive by anti-HBs criteria. Specimens with a HBsAg value exceeding 250 IU/ml were diluted using a manual dilution procedure (1:500). Specimens with an anti-HBs value exceeding 1000 mIU/ml were diluted using either an automated dilution protocol (1:15 for concentrations up to 15,000 mIU/ml) or a manual dilution procedure (1:100 for concentrations up to 100,000 mIU/ml). HBeAg and anti-HBe were interpreted using a ratio of the sample relative light unit (RLU) rate to the cutoff RLU (S/CO), where S/CO ≥ 1.00 was HBeAg positive and S/CO ≤ 1.00 was anti-HBe positive. Anti-HBc was determined using sandwich enzyme immunoassay

Table 1
Device profiles of automated immunoassay systems used to compare HBV serum markers

Test	Assay system	Test principle	Interpretation	
			Positive	Negative
HBsAg	AxSYM	Sandwich MEIA, qualitative detection	S/N ≥ 2	S/N < 2
	E170	Sandwich ECLIA, qualitative detection	S/CO ≥ 1	S/CO < 1
	i2000	Sandwich CMIA, quantitative determination	≥ 0.05 IU/ml	< 0.05 IU/ml
Anti-HBs	AxSYM	Sandwich MEIA, quantitative determination	≥ 10 mIU/ml	< 10 mIU/ml
	E170	Sandwich ECLIA, quantitative determination	≥ 10 mIU/ml	< 10 mIU/ml
	i2000	Sandwich CMIA, quantitative determination	≥ 10 mIU/ml	< 10 mIU/ml
HBeAg	AxSYM	Sandwich MEIA, qualitative detection	S/CO ≥ 1	S/CO < 1
	E170	Sandwich ECLIA, qualitative detection	S/CO ≥ 1	S/CO < 1
	i2000	Sandwich CMIA, qualitative detection	S/CO ≥ 1	S/CO < 1
Anti-HBe	AxSYM	Competitive MEIA, qualitative detection	S/CO ≤ 1	S/CO > 1
	E170	Competitive ECLIA, qualitative detection	S/CO ≤ 1	S/CO > 1
	i2000	Competitive CMIA, qualitative detection	S/CO ≤ 1	S/CO > 1
Anti-HBc	AxSYM	Competitive MEIA, qualitative detection	S/CO ≤ 1	S/CO > 1
	E170	Competitive ECLIA, qualitative detection	S/CO ≤ 1	S/CO > 1
	i2000	Sandwich CMIA, qualitative detection	S/CO ≥ 1	S/CO < 1

Note: MEIA = microparticle enzyme immunoassay; CMIA = chemiluminescent microparticle immunoassay; ECLIA = electrochemiluminescence immunoassay.

Table 2
Comparison of AxSYM with i2000 and E170: HBV serum marker results from community volunteers (n = 298)

Assay	System	Positive results (n)/positive rates (%)	Discrepant positive results[c] (n) (comparator/AxSYM range)	Discrepant negative results[d] (n) (comparator/AxSYM range)	Concurrence (%)
HBsAg	AxSYM	26/8.72			
	i2000	31/10.40	5(0.6–0.14/0.91–1.82)	0	98.32
	E170	31/10.40	5(1.03–1.49/0.89–1.51)	0	98.32
Anti-HBs	AxSYM	141/47.32[a]			
	i2000	165/55.37	28(10.17–114.10/0.20–9.80)	4(3.92–9.25/10.00–12.90)	89.26
	E170	163/54.70	25(10.29–128.50/0.00–9.80)	3(3.30–8.51/10.00–12.90)	90.60
Anti-HBc	AxSYM	208/69.80			
	i2000	203/68.12	3(1.02–1.05/1.20–1.83)	8(0.55–0.99/0.27–0.95)	96.31
	E170	207/69.46	2(0.72–0.95/1.16–1.68)	3(1.01–1.38/0.44–0.99)	98.32
HBeAg	AxSYM	4/1.34			
	i2000	6/2.01	2(2.17–3.62/0.78–0.84)	0	99.33
	E170	6/2.01	2(1.39–2.98/0.78–0.84)	0	99.33
Anti-HBe	AxSYM	99/33.22			
	i2000	94/31.54	3(0.82–0.95/1.02–2.19)	8(1.03–1.73/0.11–0.97)	96.31
	E170	119/39.93[b]	22(0.08–0.99/1.02–2.50)	3(1.00–1.46/0.31–0.97)	91.61

[a] χ^2 test: AxSYM vs. i2000: $P < 0.01$; AxSYM vs. E170: $P < 0.01$.
[b] χ^2 test: E170 vs. AxSYM: $P < 0.01$; E170 vs. i2000: $P < 0.01$.
[c] Positive for i2000 or E170 but negative for AxSYM.
[d] Negative for i2000 or E170 but positive for AxSYM.
Note: Results interpretation according to cutoff values indicated in Table 1.