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Technical Report

Comparison of Diagon Coag XL and Cobas t 511 analyzers

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Abstract

Objectives: We compared prothrombin time (PT), activated partial thromboplastin time (aPTT), fibrinogen, and D-dimer test results measured using the Diagon Coag XL coagulation analyzer with Cobas t 511 analyzer.

Methods: Imprecision studies were performed for the PT, aPTT, fibrinogen, and D-dimer tests used by the Diagon Coag XL analyzer. For the comparison study, we used the leftover citrated plasma from patient samples after routine analysis with Cobas t 511. All of the results were analyzed using the correlation coefficient and Passing–Bablok regression analysis.

Results: Total coefficient of variation obtained for all tests were within the criteria for acceptance. The method comparison study showed a good correlation between the results obtained on Diagon Coag XL and Cobas t 511 analyzers, except for aPTT test. The correlation coefficients obtained were 0.98 for PT, INR, and D-dimer, 0.95 for fibrinogen, and 0.80 for aPTT.

Conclusion: For PT, aPTT, fibrinogen, and D-dimer tests, Diagon Coag XL analyzer is suitable for monitoring the coagulation system, and it can be used in clinical laboratories. However, the precision values of tests stated by the manufacturer must be verified.

Keywords: Analytical performance, Cobas t 511, Diagon Coag XL

The coagulation analyzer and its tests play an important role in clinical laboratories. Coagulation tests are used quite commonly for the diagnosis of coagulopathies, the management of surgical processes, and the monitoring of anticoagulant medication [1-3]. The most recommended tests to evaluate coagulation are prothrombin time (PT), activated partial thromboplastin time (aPTT), fibrinogen, and D-dimer. It is important that the new analyzers installed in the laboratory are evaluated for precision and compared with the existing analyzers. Therefore, the aim of this study was to evaluate the performance characteristics of PT, aPTT, fibrinogen, and D-dimer tests measured using the Diagon Coag XL (Diagon Ltd., Budapest, Hungary) coagulation analyzer.

Materials and Methods

This study was conducted for 2 weeks in 2021, in the Clinical Biochemistry Laboratory of Zonguldak Bülent Ecevit University Hospital. The study was approved by Zonguldak Bülent Ecevit University institutional ethical committee.

Blood samples were collected in sodium citrate [3.2% (0.109 M)] tubes (Vacuette, Greiner Bio-One GmbH, Kremsmünster, Austria) and centrifuged for 10 min at 3000×g to obtain plasma samples. After routine coagulation testing on Cobas t 511 (Roche Diagnostics GmbH, Mannheim, Germany) had been completed and reported, anonymized residual plasma was analyzed immediately using Diagon Coag XL, according to tests recommended by the clinicians. Reagents and quality control materials were of the same origin as the instrument. Optical method based on clot formation was used for PT, aPTT, and fibrinogen tests, whereas an immunological method was used for the D-dimer test. The intra- and inter-assay precisions supplied by manufacturer are 0.8% and 2.5% for PT, 0.4% and 1.3% for aPTT, 2.1% and 3.8% for fibrinogen, and 2.7% and 7.5% for D-dimer tests, respectively. All assays were applied according to the manufacturers' instructions. Quality control measurements were performed at the beginning of each kit in the morning and in the evening and after calibration.

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Precision

The intra-assay precision and inter-assay precision were evaluated for all tested parameters according to Clinical Laboratory Standards Institute (CLSI) EP05-A3 guidelines [4]. Intra-assay precision was evaluated using normal and abnormal controls consecutively 10 times, in the same run. Inter-assay precision was evaluated over 10 days using two controls (each measured two times daily). Acceptance criteria for inter-assay precision and total reproducibility were <5% and ≤25%, respectively [5].

Method comparison

To evaluate the accuracy of all parameters, method comparison was performed, according to CLSI EP09-A3 guidelines [6]. For comparison, we used the Passing-Bablok regression analysis and Spearman's correlation coefficient. For Passing-Bablok regression, we deemed an acceptable comparison to be a slope of 1.0±0.1 and a correlation coefficient of r>0.95.

Statistical analysis

Mean, standard deviation (SD), and coefficient of variation (CV) were calculated using routine descriptive statistical procedures. Total CV (%) was calculated by taking the square root of the sum of the squares of intra- and inter-assay variances. Correlation between the analyzers was calculated using nonparametric Passing-Bablok regression analysis and Spearman's rank correlation coefficient. The significance level was determined by the associated p-value set at <0.05. The Passing-Bablok plots were analyzed using MedCalc Software version 20.

Results

Precision study

The intra-assay and inter-assay CVs of all parameters were higher than those supplied by the manufacturer. The within- and between-run precision values for aPTT and PT assay were within the criteria, except for PT in low control levels. Also, fibrinogen for both control levels and D-dimer for only the low control level were not within 5% CV. However, CVs for total reproducibility across all four parameters ranging from 3.3% to 21.4% were within the criteria for acceptance (Table 1).

Method comparison study

We compared randomly patient samples, which included 371 for PT and INR, 351 for aPTT, 246 for fibrinogen, and 223 for D-dimer tests. The Passing-Bablok regression analysis between the Diagon Coag XL and Cobas t 511 for each tests is shown in Figure 1. The regression analysis demonstrated good agreement for each parameter, except for aPTT. The calculation of Spearman's correlation coefficient between the two analyzers showed a positive correlation for PT, INR, aPTT, fibrinogen, and D-dimer (r=0.98, p<0.001; r=0.98, p<0.001; r=0.81, p<0.001; r=0.95, p<0.001; and r=0.98, p<0.001, respectively).

Discussion

Inter-assay precision for PT assay was not within 5% CV although the total precision was within the criteria for acceptance. This result was similar to a previous study that was performed using Diagon Coag XL for PT assay [7]. However, the correlation coefficient was strongly positive for the PT test.

Table 1. Precision results by Diagon Coag XL analyzer

Test	Sample	Intra-assay			Inter-assay			Total
		Mean	SD	CV (%)	Mean	SD	CV (%)	CV (%)
PT (s)	Dia-CONT I (n=10)	9.35	0.17	1.8	10.53	0.66	6.2	6.5
	Dia-CONT II (n=10)	13.15	0.16	1.2	14.67	0.73	4.9	5.0
aPTT (s)	Dia-CONT I (n=10)	36.25	0.93	2.5	35.73	0.75	2.1	3.3
	Dia-CONT II (n=10)	53.3	1.75	3.2	50.7	1.11	2.2	3.9
Fibrinogen (mg/dL)	Dia-CONT I (n=10)	251.4	8.6	3.4	249.8	17.9	7.2	8.0
	Dia-CONT II (n=10)	132.4	8.1	6.0	121.3	9.4	7.9	9.9
D-dimer (µg FEU/mL)	Dia-CONT I (n=10)	0.32	0.06	18.7	0.48	0.05	10.4	21.4
	Dia-CONT II (n=10)	1.51	0.05	3.2	2.02	0.07	3.4	4.7

SD: Standard deviation; CV: Coefficient of variation; PT: Prothrombin time; aPTT: activated partial thromboplastin time.

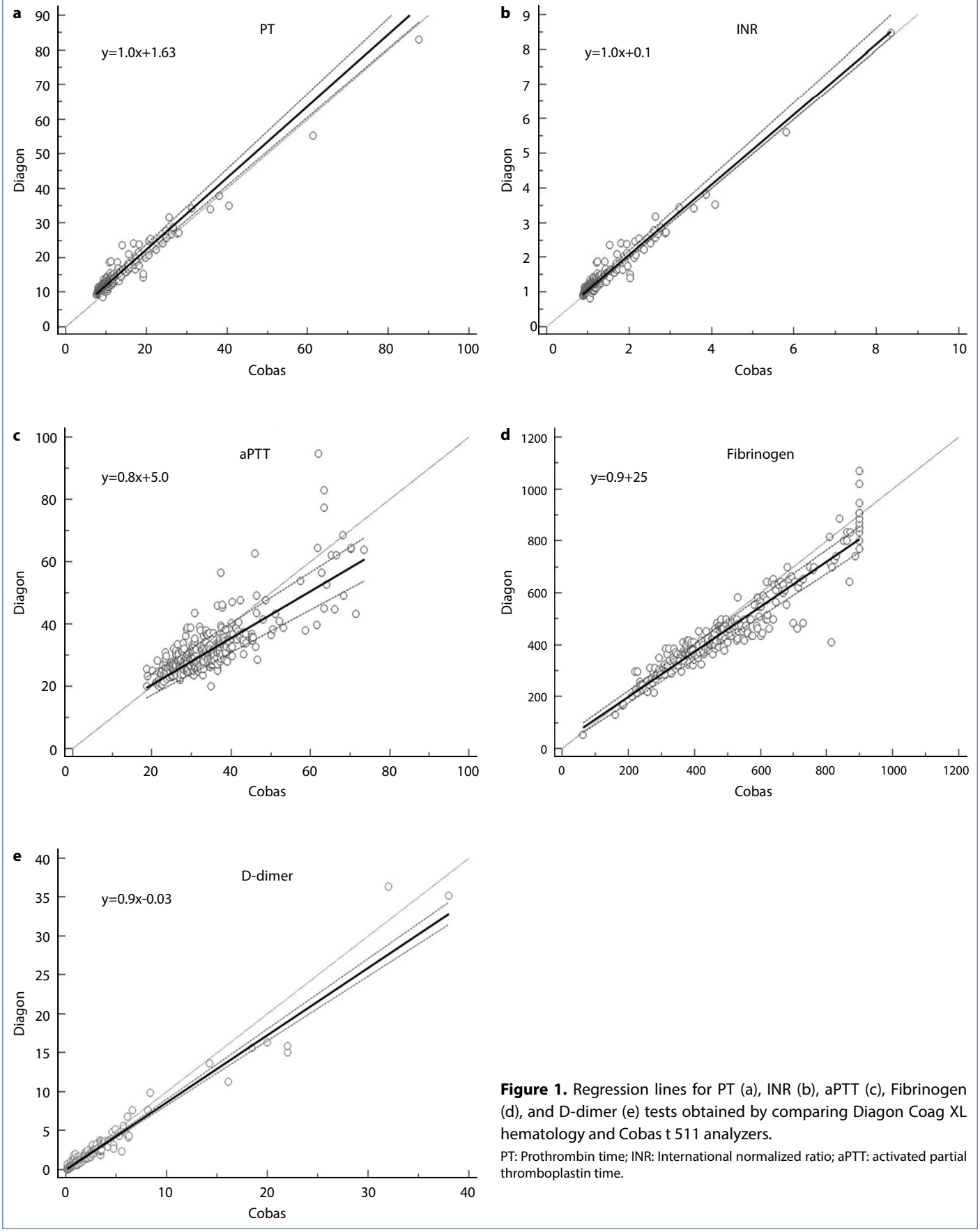

Figure 1. Regression lines for PT (a), INR (b), aPTT (c), Fibrinogen (d), and D-dimer (e) tests obtained by comparing Diagon Coag XL hematology and Cobas t 511 analyzers.

PT: Prothrombin time; INR: International normalized ratio; aPTT: activated partial thromboplastin time.

Also, the INR results were similar to Cobas t 511 despite using a different reagent (thromboplastin) and calibrators.

The imprecision studies of aPTT were found to be low, while the correlation coefficient (i.e., 0.8) of aPTT values with those obtained on the Cobas t 511 was less satisfactory. The slope of the regression line for aPTT demonstrated approximately 20% negative bias of Diagon Coag XL compared with Cobas t 511, being more prominent at high aPTT levels. This result was inconsistent with a previous study comparing aPTT results on Diagon Coag XL with another coagulation analyzer [7]. We think that the inconsistency between the Diagon Coag XL and Cobas t 511 for aPTT may be due to the Cobas measurement. Our previous report demonstrated that aPTT levels of Cobas t 511 had a positive bias compared with Sysmex CS-2000i, especially at prolonged aPTT levels [8]. Also, another study comparing aPTT test of Cobas and ACL TOP analyzers showed a similar slope and correlation coefficient [9]. These variations between analyzers may be due to Cobas aPTT reagent based on different contact activators.

Both fibrinogen and D-dimer showed high CV profiles that could not be compared with the precision results declared by the manufacturer, especially in low-level control testing. However, these results are consistent with those of previous reports, which demonstrated more variable CVs at low concentration levels [10, 11]. Total precisions in both assays were within the criteria for acceptance. In addition, fibrinogen and D-dimer measurements showed good agreement when correlation analysis was performed.

Conclusion

We found that the Diagon Coag XL analyzer with PT, aPTT, fibrinogen, and D-dimer tests is suitable for monitoring the coagulation system and can be used in clinical laboratories. As a note, particularly for PT, D-dimer, and fibrinogen tests, the precision values stated by the manufacturer must be verified.

Conflict of Interest: No conflict of interest was declared by the authors.

Ethics Committee Approval: The study was approved by The Zonguldak Bülent Ecevit University Non-Invasive Clinical Research Ethics Committee (No: 2021/12, Date: 23/06/2021).

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