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Comparison between Roche Integra 400 plus and Abbott Architect ci8200 in Alanine aminotransferase assay

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ABSTRACT

Background: The aim of this work is to present the results of a comparative study between the ALT assay on Integra 400 plus Roche Diagnostic versus Architect ci8200 of Abbott Diagnostic.
Methods: A total of 200 patients hospitalized in the various departments of the university hospital Mohammed VI of Oujda were prospectively tested on two systems: Abbott Architect ci8200 and Roche Integra 400 plus. Both analyzers use the spectrophotometric technique by coupling the transamination reaction to the oxidation-reduction reaction at NAD. The agreement of the results between the different techniques was evaluated using the Bland-Altman difference diagram and the Passing-Bablok and Deming regression line.
Results: There was a high concordance between the two assays: the equation of the Passing-Bablok line is YArchitect = −0,5625 + 0,9917 XIntegra with a correlation coefficient $r^2 = 0.999$. The Bland-Altman diagram shows that the mean bias between the two methods is of the order of 1.1 IU/L and the difference between the ALT measurements by Architect and Integra is in the range of −1.4 to 3.6.
Conclusion: Our study shows a high correlation of the ALT assay results between the architect ci8200 and Integra 400 plus.

1. Introduction

Alanine amino transferase (ALT), also referred to as glutamate pyruvate transaminase (GPT), is an enzyme involved in amino acid metabolism. It is found in many tissues, but the highest levels are found in liver tissue. Tissue destruction leads to release of the intracellular enzyme into the circulating blood. Elevations in alanine transaminase (ALT) are frequently associated with hepatic injury due to viral hepatitis, autoimmune hepatitis and nonalcoholic fatty liver disease, the latter predictive of future development of metabolic syndrome and type 2 diabetes in some populations [1,2]. Cross sectional data suggests that elevated ALT is also strongly associated with components of the metabolic syndrome, with a positive, linear correlation of ALT with BMI [3], fasting glucose [4] and proatherogenic lipids such as apolipoprotein B, VLDL and LDL [5]. In addition, prospective data indicates that elevated ALT may predict future metabolic syndrome (14% excess risk for every 5 IU/L increase in ALT) [6] and type 2 diabetes [7] (16% excess risk for every 5 IU/L increase in ALT) although studies on the relationship of ALT and cardiovascular or all-cause mortality are conflicting [8–11]. We aimed to compare Roche Integra 400 plus and Abbott Architect ci8200 in Alanine aminotransferase assay.

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2. Materials and methods

It is a comparative descriptive study of non-interventional type which was carried out in the laboratory of biochemistry of the university hospital center Mohammed VI of Oujda.

3. Subjects

The subjects were selected randomly from the usual workflow. No exclusion criteria were applied for age, sex, clinical status or medication. The total number of subjects was 200.

4. Samples

The venous blood samples were transferred to a dry tube without separating gel, and then centrifuged at 4000 rpm for 10 min at room temperature. Strongly hemolyzed, chyleous or icteric samples were excluded from the study.

5. Methods

The ALT assays were performed on the day of the application. The ALT was primarily measured on Architect ci8200 (Abbott Diagnostics) and then repeated on the same date on Integra 400 plus (Roche Diagnostics). Both instruments use the spectrophotometric technique by coupling the transamination reaction to the oxidation-reduction reaction at NAD, and their characteristics are included in Table 1. Calibrations of methods were performed on each analyzer as corrective actions for absurd values of quality control, after change of lots, and after maintenances of analyzers. Internal quality controls were realized every day for both instruments. Levels of control were for Architect ci8200: level 1 target value = 27.6 U/L, level 2target value = 103 U/L, level 3target value = 217 U/L; and for Integra 400 plus: level 1target value = 45.4 U/L, level 2target value = 121 U/L. On each instrument, standard Westgard warning and run rejection rules were applied for which no violations were noticed. All the results of the ALT assay are expressed in U/L.

6. Statistical analyses

The data obtained was analyzed by the statistical software MedCalc Version 17.9.5® and compared using two regression models: Deming [12], which takes into account measurement errors for both methods, and Passing-Bablok [13], which does not require special assumptions about sample allocation and measurement errors. We also used the Bland-Altman diagram [14], where the differences between the two techniques are plotted against the averages of the two techniques.

7. Results

In our sample series, the lowest and highest value of ALT's measurement by both Architect ci8200 and Integra 400plus were respectively: (6 and 334 U/L) and (5.2 and 330 U/L). The statistical analysis of the results shows a very positive correlation between both methods with a correlation coefficient $r^2 = 0.999$ (Table 2). By analyzing the diagram of Bland-Altman (Fig. 1), we note that the mean bias between the two methods is of the order of −1.1 U/L and the difference between the ALT measurements by Architect and Integra is in the range of −3.6 to 1.4 U/L. Details regarding the Passing-Bablok and Deming regression analysis are shown in Table 3. The slope of the Passing Bablok regression line (Fig. 2) was 0,9917 (95% CI:0,9875 to 0,9952) and the y-intercept was −0,5625 (95% CI: -0,6667 to −0,3563). Cusum test revealed no significant deviation from linearity (P = 0.07), and the Deming regression returned an intercept A = −0.7503(95% CI:-0,9450 to −0,5555) and a slope B = 0.9938(95% CI:0,9897 to 0,9979).

Table 1
Comparison of the characteristics of the two methods for the determination of Alanine aminotransferase. (ND: not disclosed).

	Architect ci8200	Integra 400 plus
Principle	Spectrophotometric	Spectrophotometric
Analytical target	ALT	ALT
Reagent stability if it's uncapped and onboard	27 days	12 weeks
Samples	Serum, plasma	Serum, plasma
Measuring range (U/L)	2–942	5–700
Reference value (U/L)	0–55	Man: 0-41 Woman: 0-33
Intra-serial precision (CV [%])	1.5	ND
Total precision (CV [%])	3.6	3.2
Dosing time (min)	9	10
Certificate of analysis	YES	YES
Ec declaration of conformity	YES	YES
Safety data sheet	YES	YES

Table 2
Results of Pearson's correlation analysis.

Sample size, n	200
Correlation coefficient r	0,9998
95% confidence interval for r	0,9998 to 0,9999
P- value	<0,0001

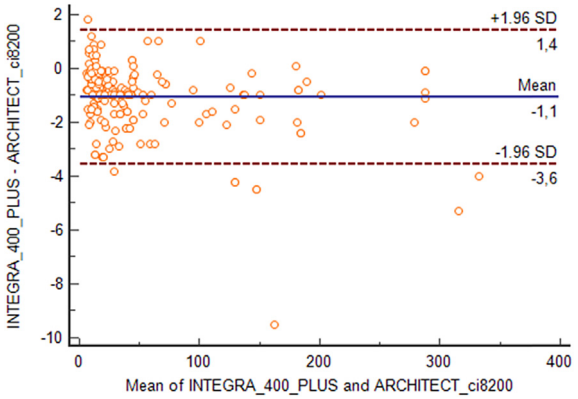

Fig. 1. Bland-Altman diagram of the difference between Architect ci8200 and Integra 400 plus in ALT assay.

Table 3
Results of the regression analysis. (NA: not applied).

	Passing-Bablok	Deming
Systematic differences:		
Intercept A	−0,5625	−0,7503
95% CI	−0,6667 to −0,3563	−0,9450 to −0,5555
Proportional differences:		
SlopeB	0,9917	0,9938
95% CI	0,9875 to 0,9952	0,9897 to 0,9979
Linear model validity:		
Cusum de linéarité	0,07	NA

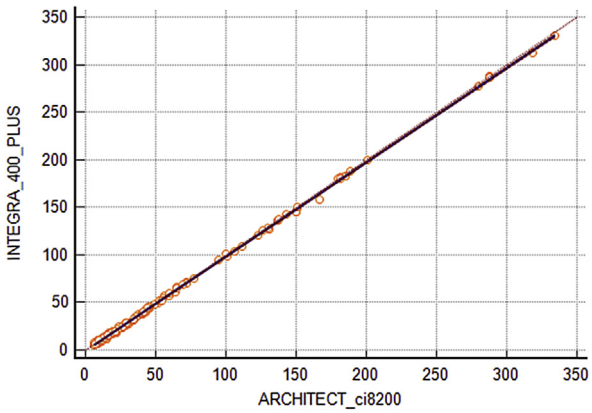

Fig. 2. Correlation diagram according to Passing and Bablok. N = 200 (Intersection: -0,5625 Slope: 0,9917).

8. Discussion

The act of medical biology is part of a preventive, diagnostic, prognostic and therapeutic approach. The biologist assumes responsibility for this act that includes the entire analytical macro-process with all the pre-analytical, analytical and post-analytical stages, from the prescription to the validation and the transmission of the results. The standards NF EN ISO 15189 and NF EN ISO/CEI 17025

define the general requirements concerning the quality and the competence of the laboratories of medical biology and the testing laboratories. This is why the quest for quality must be an essential and constant concern of the biologist and all the laboratory personnel [15]. According to ISO 15189 and the Cofrac SH-GTA-04 Human Health Accreditation Technical Guide, the comparison of two methods is an integral part of the verification and on-site validation of a method's performance. It makes it possible to estimate the comparability of the results obtained by these methods and to determine if there is a bias between them. In the event of a discrepancy between the two methods, the causes should be evaluated and the prescribers and patients informed. This evaluation makes it possible to control any discrepancies between two analytical systems that are simultaneously available in a laboratory [16].

In this work, we conducted a comparative study on the ALT assay on the two platforms used in our biochemistry laboratory at Mohammed VI Oujda University Hospital, Morocco.

According to our correlation coefficient r^2, which was too close to one, there is a perfect positive relationship between the two methods. This means that as ALT's values on Architect ci8200 increase there is a perfectly predictable increase in ALT's values on Integra 400plus. As for Bland and Altman plots, they are extensively used to evaluate the agreement among two different instruments or two measurements techniques. It allows identification of any systematic difference between the measurements. According to our Bland–Altman plot interpretation, the majority of values (96.5%) fell within the limits of agreement, which are defined as the mean difference plus and minus 1.96 times the standard deviation of the differences.

Passing–Bablok regression, which requires no special assumptions regarding the distribution of the samples and the measurement errors, calculated an intercept $A = -0.5625$ and a slope $B = 0.9917$, signifying a systematic difference and a proportional difference between the two methods. However, the use of Passing-Bablok regression in method comparison studies has been criticized because it ignores random differences between methods [17]. The Deming method, also called the errors-in-variables model or the functional or structural relationship model in the statistical literature, takes measurement errors for both sets of measurements into account. In our case, the Deming regression indicates an equation of type $YArchitect = -0.7503 + 0.9938\ XIntegra$, indicating absence of any constant difference but a presence of a significant proportional difference between the two assays.

For the Architect ci 8200, the ALT Reagent Kit contains two ready-to-use liquid reagents packaged as follows: (R1: 10 * 70 ml, R2: 10 * 21 ml), with a number of tests per kit estimated at 3621. So, from a stability point of view, we have 360 tests per bottle. While for the Integra 400 plus, the estimated number of tests per kit is 500. It is presented in the form of a cassette, which prevents evaporation and oxidation of the reagents, thus allowing a long stability and reducing the consumption of calibrators. In our laboratory, we do an average of 50 ALT tests a day. Thus, by comparing our statistics with the data from both providers, we are within the stability limits for each reagent. Therefore, for a better stability of the reagents, it is recommended to define the only minimal of remaining tests before loading a new reagent for each parameter according to the rate of each laboratory. In a large laboratory like ours that serves the entire Eastern Moroccan population, the choice between the two instruments is not influenced by the stability of reagents. While for laboratories with a low rate, the choice should be more towards kits with fractional packaging.

Concerning the reference values raised by the two providers, they are given as an indication, and there is no interest in comparing them; but it is up to each laboratory of medical biology to develop its own reference values according to the population and the analyzer used.

In our work, we could not compare the high values of ALT between the two instruments; since they were not included in our sample. Which constitutes a limit of this study. Suggesting to ask questions about the probability of having the same correlation even for the high values of ALT, which remains to be verified! We should also note the importance of monitoring the biological parameters not only by respecting the same techniques, but also by ensuring that the assay was done with high performance techniques (repeatability, reproducibility …) that each laboratory must check and follow.

Thanks to the RANDOX EEQ RIQAS to which our laboratory is subscribed, we have been able to compare ourselves with 45,000 laboratories around the world, with a bias of 0.08% compared to the peer group and of 0.05% in comparison to any other technique. Our RIQAS performance criteria for the ALT parameter are acceptable, with a Target score (TS), which takes into account the variability of the parameter in the performance rating, that was always greater than 50. The SDI, or the Index of Standard deviation (Z-score) which allows the comparison between the participant's result and the average of comparison, was always less than two. The %DEV or percentage of error or bias, was compared to performance limits predefined by organizations scientists (Biological Variation) and those of RIQAS.

The central laboratory of the University Hospital Mohammed VI of Oujda is engaged in a quality policy that includes a verification method process according to scope A, and in an accreditation process. It will be represented as a regional laboratory that aims to be a reference laboratory in the Eastern moroccan Region and will serve a population that exceeds 2,314,346 inhabitants. It is the only specialized platform to cover relevant examinations in patients with basic health coverage (RAMED). This type of study will provide a solid basis for the establishment of a procedure for accreditation of tests used in our laboratory. Our laboratory is computerized, all the samples are code-barred. For a better mutualisation of work and staff and for a better organization of the functioning of the laboratory, the samples can be switched between the different platforms. Our goal is to obtain the same validated results and the same reliability, on any platform, this goes through verification and validation methods.

Conflicts of interest

The authors declare that they have no links of interest.

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