

Verification of analytical performance of the microalbumin assay on the Abbott Alinity ci®: Experience of the central laboratory Mohammed VI Oujda

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Abstract

The verification of analytical methods is a requirement of the standard NF EN ISO 15 189. It consists of evaluating the performance of an analytical method according to a well-defined protocol and then comparing it with pre-established analytical objectives. The mastery of this approach must be the concern of any biologist. Through this work we present the results of the protocol of verification of the method of determination of microalbumin by comparing two automats: Alinity ci® and Architect ci-8200® Abbott. Microalbumin monitoring in urine is an important element in the treatment of diabetes mellitus types I and II. It can also be used to predict diabetic nephropathy, which is the leading cause of death in people with insulin-dependent diabetes.

Keywords: Microalbumin; Verification; Repeatability; Reproducibility; Alinity ci®; Architect ci8200®

1. Introduction

Monitoring microalbumin in urine is an important component in the treatment of type I and type II diabetes mellitus [1] Methods of monitoring microalbuminuria include measurement of protein excretion in 24-hour urine, urine collected over a period of time, or overnight urine, as well as determination of the albumin/creatinine ratio in a spontaneous urine sample. Microalbuminuria is a disease characterized by increased albumin excretion in the urine in the absence of overt kidney disease. It can be used for the prediction of diabetic nephropathy [2] [3] which is the main cause of death in people with insulin-dependent diabetes. Moreover, since it is accompanied by irreversible kidney damage and persistent proteinuria, it is the main indication for hemodialysis. Thus, an accurate result by the biology laboratory is essential, hence the interest of method verification, which is a requirement of standard NF EN ISO 15 189. It consists of evaluating the performance of an analytical method according to a well-defined protocol and then comparing it with pre-established analytical objectives. The mastery of this approach must be the concern of any biologist. Through this work we present the results of the protocol of the verification of the microalbumin assay method by comparing two automats: Alinity ci® and Architect ci8200® Abbott. This work constitutes an elementary basis for the implementation of an accreditation procedure, which is part of the quality process to which our laboratory is committed.

2. Material and methods

This is a comparative descriptive study that was conducted in the biochemistry laboratory of the Mohammed VI University Hospital of Oujda over a period from April 27 to July 15 18, 2022. The working methodology adapted by our study is based on the recommendations of the protocol of the COFRAC accreditation technical guide GTA 04. The

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verification of the method focused on the determination of microalbumin on the Alinity ci® automaton by immunoturbidimetric method in order to evaluate the analytical performance in terms of repeatability and reproducibility from samples of patients hospitalized at the Mohammed VI University Hospital Oujda as well as from internal quality controls. A comparison of methods was also carried out between the two automatons Alinity ci® and Architect ci8200®. We also used the Bland-Altman diagram, where the differences between the two techniques are plotted against the means of the two techniques. Statistical processing of the data was performed using the EVM middleware module of BYG Informatics. Subjects were randomly selected from the usual workflow. No exclusion criteria were applied with respect to age, sex, clinical status, or medication use. Urine samples were collected on a sterile container and centrifuged at 4000 rpm for 10 minutes at room temperature. The total number of samples was 110. The assays were performed on the same day of the request. The sample was first measured on Architect ci8200® and then repeated on the same date and by the same operator on Alinity ci® (Abbott Diagnostics). Method calibrations were performed on each instrument as well as corrective actions for quality control outliers, after batch changes, and after instrument maintenance. Internal quality controls were performed daily for both machines. Two levels of control were performed on each analyzer (Alinity ci: Level 1 target value = 20-40 mg/l, Level 2 target value = 75-105 mg/l) and standard Westgard rejection rules were applied of which no violations were found. All microalbumin results are expressed in mg/l.

3. Results and discussion

The microalbumin assay is an immunoturbidimetric assay using polyclonal antibodies to human albumin. When a sample is mixed with the reagents, the albumin in the sample combines with the anti-human albumin antibodies in the reagent to form an insoluble aggregate which increases the turbidity of the solution. The degree of turbidity is proportional to the albumin concentration in the sample and can be measured optically. The results obtained for the different verification criteria of the microalbumin assay show a satisfactory repeatability for both levels (1: low / 2: high) with respectively CV1 = 1.04% (figure 1), CV2= 1.11% on 35 samples. The intra-laboratory reproducibility was satisfactory for both levels with respectively CV1= 3.98%, CV2=3.01% on 35 samples (figure 2). By comparing these results with the CV retained by the SFBC and RICOS, we note that the results are in conformity and inferior to the tolerated limits. The method comparison was performed on 40 samples. The Bland-Altman diagram (figure 3) shows that the average bias between the two automata is about 2.50 %, with a linear regression equation $Y= 1.01 X + 1.11$. The mean of the differences is 1.59 mg/l and the standard deviation of the differences is 2.402 mg/l.

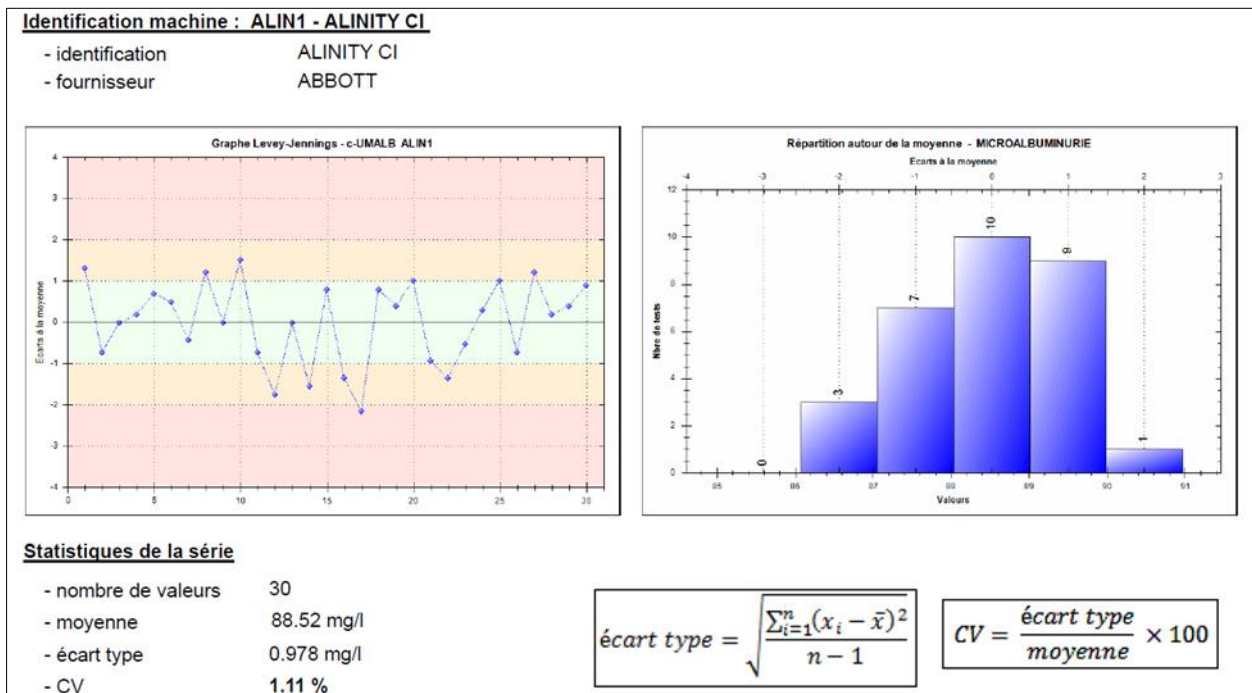


Figure 1 Repeatability result of low level microalbumin

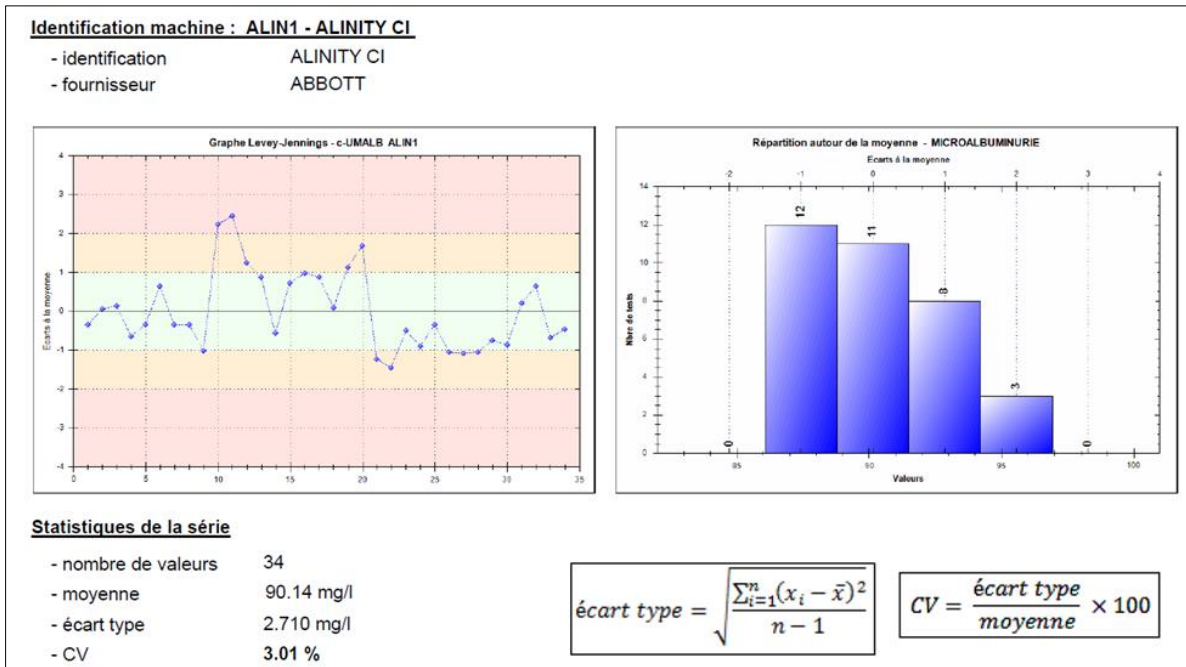


Figure 2 Reproducibility result of the high level of microalbumin

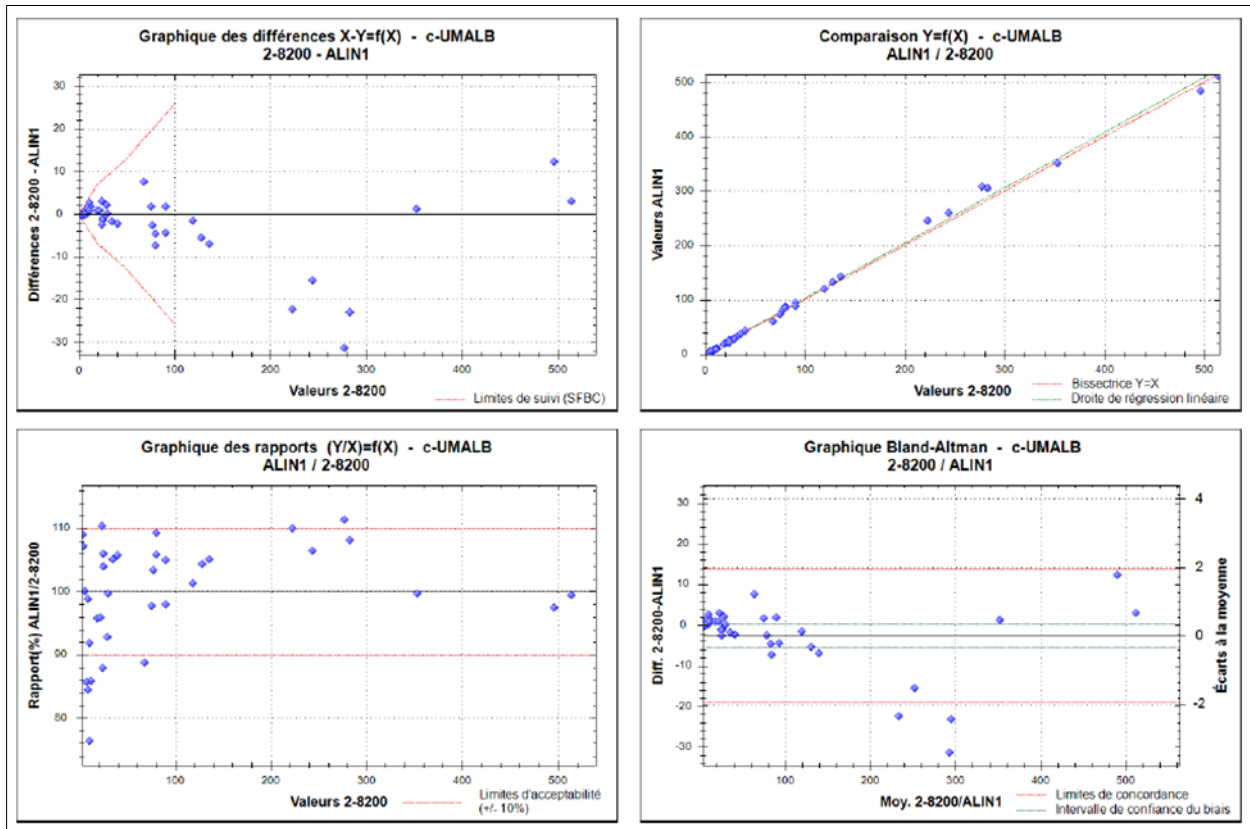


Figure 3 Microalbumin method comparison result between Alinity C® and Architect ci8200® according to Bland-Altman diagram

4. Discussion

Among the degenerative complications of diabetes, diabetic nephropathy holds a special place because of its inexorable evolution towards renal failure in the absence of any early management. This evolution is all the more rapid when diabetes is associated with arterial hypertension. Diabetic nephropathy is responsible for 15% of deaths, with a frequency of 25% of all diabetics whose disease has been evolving for 30 years [4]. In diabetics, the prevalence of microalbuminuria is estimated at 15 to 20%. It is considered that one third of diabetics worldwide will develop nephropathy. The first sign of renal damage is microalbuminuria, which appears in 2 to 5% of patients per year [5]. Today, it seems interesting to consider microalbuminuria as a continuous variable, allowing to evaluate the level of risk at the time of screening and the effect of treatment during follow-up. Conventionally, microalbuminuria is defined as present or absent based on the dosage within or outside the range of 30-300mg/24H. The onset and evolution of microalbuminuria depends on the duration of diabetes and whether it is associated with hypertension [6]. It remains the first preclinical sign of diabetic nephropathy and its measurement allows to realize the existence of a beginning renal damage. In all cases, microalbuminuria is accessible to treatment and the essential targets are always glycemic control and blood pressure control in hypertensive patients [7]. Certain therapeutic classes such as ACE inhibitors and ARBs have largely demonstrated their superiority in controlling albuminuria, although other therapeutic classes have also produced interesting results [8]. A risk factor that has been underestimated for too long, microalbuminuria must be part of the evaluation and follow-up of many diabetic, hypertensive or metabolic syndrome patients, and its presence suggests changes in management that can improve the renal and general prognosis of our patients [9],[10].

It is therefore important to measure microalbuminuria systematically in all diabetic patients [11], in order to identify early onset of renal damage and to adopt an appropriate treatment in order to regress, if not slow down, its evolution towards patent diabetic nephropathy, which is a prelude to the onset of renal failure. [12]. Therefore, analytical errors in the determination of microalbumin can have important consequences on the management of these patients. We note that the repeatability of the Alinity ci® microalbumin assay is less than 7.27% (CV of SFBC) for the low control and less than 4.50% (CV of SFBC) for the high controls. It is also observed that the intermediate fidelity is less than 6% (SFBC CV) for the low control and less than 5% (SFBC CV) for the high controls. A study was performed according to the CLSI EP7-P NCCLS protocol using urine samples containing approximately 27 ug/ml of microalbumin to which the substances listed below were added. The potential interference with the microalbumin assay is less than 10% for the urine preservatives at the concentrations listed below. At the end of this work, several elements have to be taken into account in the interpretation of a microalbumin value, in particular the following interfering substances: bilirubin, calcemia, glucose, creatinine, uric acid.

5. Conclusion

The results of our study allowed us to verify the performance of the microalbumin assay method and to compare it to the analytical objectives set in the accreditation process in which our laboratory is involved. Thus, the two automatons Alinity ci® and Architect ci-8200® are comparable.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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