

# ACCURACY AND CONSTANCY TESTS OF DOSE CALIBRATOR AT AKUH, KARACHI: A CLINICAL AUDIT: "SAFETY IS QUALITY"

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## ABSTRACT

**OBJECTIVE:** Administration of precise dose of radiopharmaceutical to patients not only ensures permissible radiation dose to patient but also mandatory for optimization of the scan. For these important quality targets, precise and accurate functioning of dose calibrator in nuclear medicine pharmacy is mandatory. Aim of this clinical audit was to perform constancy and accuracy of DC to ensure safe radiation practice. **METHODS AND RESULTS:** This clinical audit was conducted at Nuclear Medicine Section, Department of Radiology, AKUH, Karachi from April 2, 2012 till June 15, 2012. We used Cobalt-57 and Cesium-137 sources as reference sources to check accuracy and constancy of dose calibrator on monthly and daily basis as per vendor's specifications. Benchmark of  $\pm 10$  of measured activity with reference to actual activity was used for both constancy and accuracy tests. All the values were within required limits. **CONCLUSION:** This clinical audit of constancy and accuracy of dose calibrator at Nuclear Medicine Section of Department of Radiology AKUH ensures precise and safe delivery of doses of radiopharmaceutical to patients having nuclear medicine procedures at our facility. This audit also proves good medical practice by AKUH in accordance with Pakistan Nuclear Regulatory Authority (PNRA), International Atomic Energy Agency (IAEA) and Joint Commission for International Accreditation (JCIA).

**Key words:** Dose Calibrator; Constancy; Accuracy; Cobalt-57; Cesium-137

## Introduction

Dose calibrator (DC) is an essential component of nuclear pharmacy for assaying activities in radiopharmaceutical vials and syringes and in other small sources. The quality control (QC) of DC is critically important as it ensures that the administered radioactivity is within a predefined acceptable range. It further ensures that delivered radiation dose to patient and technologist is within permissible limits. Among routine dose calibrator QC tests, constancy must be checked daily and accuracy least quarterly. Aim of this clinical audit was to perform constancy and accuracy of DC to ensure safe radiation practice.

## Material and Methods

This clinical audit was conducted at Nuclear Medicine Section, Department of Radiology, AKUH, Karachi from April 2, 2012 till June 15, 2012. Constancy and accuracy of DC (Veenstra Instruments and model VDC-404) was measured as a part of routine QC of nuclear pharmacy using Cobalt-57 (Co-57; photopeak: 122 KeV, Physical half-life: 122 days) and Cesium-137 (Cs-137; Photopeak: 662 KeV; physical half-life: 30 years) as reference sources. Constancy test was measured every morning (working days) using Co-57 and Cs-137 sources and 3 reading of each source were taken as per vendor's instruction. Similarly

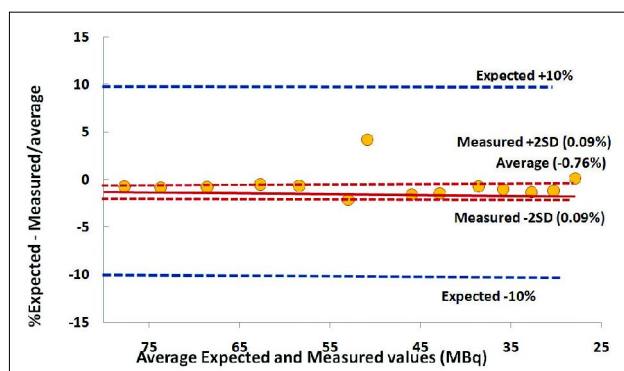
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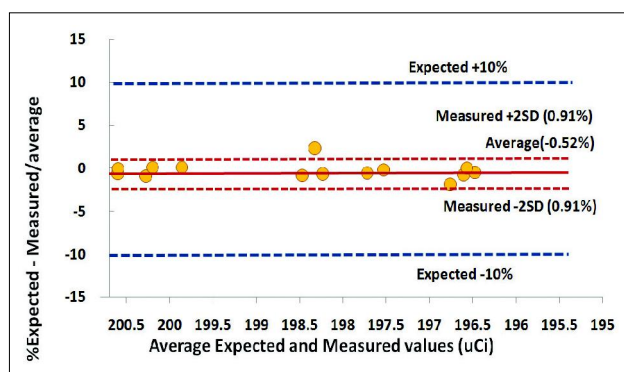
accuracy test was done on monthly basis using Co-57 and Cs-137 sources and 10 readings were acquired for each source as per vendor's instructions. Benchmark of  $\pm 10$  of measured activity with reference to actual activity was used for both constancy and accuracy tests.<sup>1</sup>

## Results

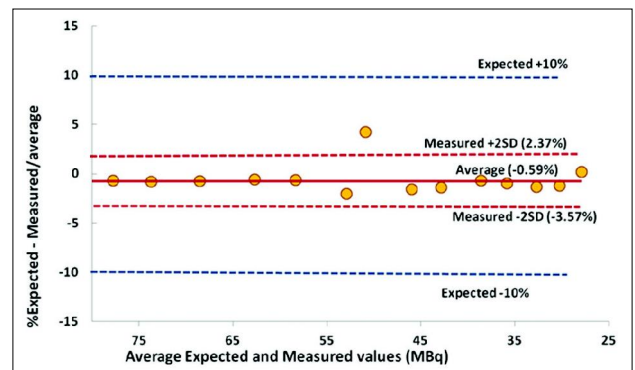
For accuracy measurement with Co-57, the measured activity had an average deviation of 0.76% from the expected (actual activity) and for Cs-137 it was 0.52% (Fig. 1 & 2). For constancy measurement with Co-57, the measured activity had an average deviation of -0.59% from the expected (actual activity) and for Cs-137 it was -0.32% (Fig. 3 & 4).



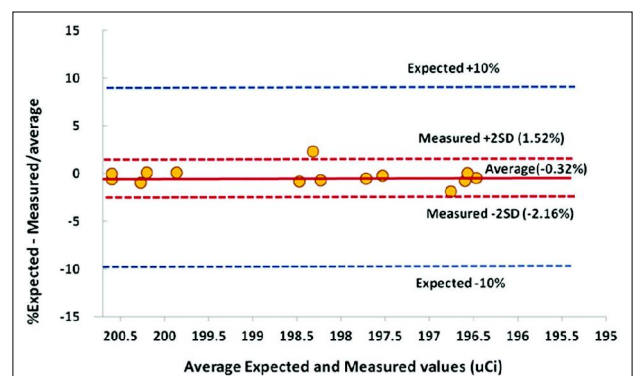
**Figure 1:** Bland Altman's comparative analysis for expected and measured values of accuracy tests of dose calibrator with Cobalt -57 source.



**Figure 2:** Bland Altman's comparative analysis for expected and measured values of accuracy tests of dose calibrator with Cesium -137 source.



**Figure 3:** Bland Altman's comparative analysis for expected and measured values of constancy tests of dose calibrator with Cobalt -57 source.



**Figure 4:** Bland Altman's comparative analysis for expected and measured values of constancy tests of dose calibrator with Cesium -137 source.

## Discussion

The DC is a gas-filled radiation detector that detects the exposure of a radiation source which once detected (in a syringe or vial), the DC converts it to units of activity in Curie or Becquerel (Ci or Bq), based on the radionuclide's gamma constant.<sup>2</sup> DCs are useful in the assay of generator eluents', <sup>99</sup>Mo breakthrough measurements, preparation of radiopharmaceuticals, and dispensing dosages of radiopharmaceuticals for patients. To ensure the proper operation of the dose calibrator, certain quality control procedures must be performed like accuracy, constancy, linearity, and geometry on annual, daily, quarterly and at time of installation<sup>3</sup> respectively. Some dose calibrators are specially designed for beta emitters, and some for Positron Emission Tomography (PET) radiopharmaceuticals.<sup>4</sup> All radionuclide calibrators show some dependence on measurement geometry; this effect diminishes with increasing depth in the well.<sup>2</sup>

This clinical audit of QC of DC of our nuclear medicine section was done to ensure administration of right dose of the radiopharmaceutical to our patients. This is a mandatory step of good medical practice by administering correct doses measured by a well-functioning DC. To ensure this required standard DC, a stringent QC schedule has been designed and being practices scrupulously to exhibit GMP in our nuclear pharmacy. Furthermore, AKUH being a JCIA the only accredited institute of country and a declared Centre of Excellence by Pakistan Nuclear Regulatory Authority (PNRA) feels its moral obligation to abide sentinel radiation safety rules of justification and optimization of International Atomic Energy Agency (IAEA). This clinical audit of constancy and accuracy of dose calibrator at Nuclear Medicine Section of Department of Radiology AKUH ensures precise and safe delivery of doses of radiopharmaceutical to patients having nuclear medicine procedures at our facility. This audit also proves good medical practice by AKUH in accordance with PNRA, IAEA and JCIA.

## References

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