https://doi.org/10.31689/rmm.2024.31.2.129

ORIGINAL PAPERS

The Effects of CT on Blood Components for Diabetic Patients

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Abstract

Objectives: Computed tomography CT scan is a medical device used in diagnosis; however, the radiation of CT will affect the human body such as blood components.

Materials and Methods: In this study, the blood component of diabetic patients will examine the effect of CT radiation on blood components by withdrawing samples of 2 cc from diabetes patients' blood before and after a CT scan on the body for patients who are exposed to the head, chest, and abdomen.

Results: There were no significant statistical differences were between blood counts (WBC, RBC, and Hg) before and after the CT scan for the head, chest, and abdomen.

Conclusions: The main conclusion of the current study is that, depending on the results, the CT scan is safe for patients.

Keywords: CT scan, Blood component, X-ray, Diabetes.

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INTRODUCTION

Many people use the abbreviation for computed tomography (CT) scan[1]. A CT scan is a diagnostic imaging procedure that generates images of the body's interior tthrough the combination of X-rays and computer technology[2]. It shows detailed images of any part of the body[3], including the bones, muscles[4], fat, organs and blood vessels[5]. The X-ray detector of the CT scanner is capable of detecting hundreds of distinct densities. Tissues within a solid organ can be seen[6]. A computing device then receives the information, constructs a three-dimensional cross-sectional image of the anatomical region, and displays it[7]. Computed tomography (CT) is a valuable diagnostic tool in the medical field[8]. However, it emits ionizing radiation, which has the potential to induce various complications in the human body, including cancer and blood disorders[9].

The number, amount, and developmental stage of the different blood cells within a given blood volume are quantified by a total blood cell count, which is an essential consideration[1,10]. A complete count of blood cells can reveal a variety of irregularities related to the production or breakdown of blood cells[11]. Blood cell abnormalities in quantity, size, or maturity can be used to diagnose infections or disease processes[12]. White blood cell counts are frequently higher during an illness. A variety of cancer types[13] can impact the marrow's ability to produce blood cells. Leukaemia may be linked to increased immature white blood cells in a total blood cell count.[14] Abnormally low haemoglobin levels are caused by anaemia and sickle cell disease[15]. The components of the complete blood count (CBC) are as follows: the count of platelets (PLT), red blood cells (RBCc), white blood cells (WBC), and haemoglobin concentration (HB)[16]. The previously stated characteristics have two functions: they aid in the identification and tracking of anaemia and other blood problems, such as some forms of diabetes and infections, and they evaluate how a patient is responding to cancer treatments, such as radiation and chemotherapy.[11,17]

The impact of diabetes mellitus (DM) on blood cells Williams is a well-established fact. Alterations in the mechanical properties of red blood cells[18], disruptions in the oxygen-binding of haemoglobin, and modifications in the erythrocyte membrane are all consequences of hyperglycemia[18]. A decrease in the functionality of polymorph nuclear leukocytes has been attributed to an alteration in the susceptibility of diabetic patients to infection[19]. The neutrophil function of diabetic patients with well-controlled glucose levels differs marginally from that of healthy individuals[20,21]. Diabetes mellitus induces substantial alterations in the metabolism and functions of lymphocytes[22]. Individuals diagnosed with acute coronary syndrome who also have diabetes are more likely to experience recurrent ischemic events and cardiovascular complications than those without diabetes[23]. Various mechanisms, including impaired endothelial function, heightened platelet activity, and irregular fibrinolysis and coagulation, have been associated with an elevated atherothrombotic risk[24]. Numerous additional alterations of blood cells occur as a result of DM, and numerous additional blood cell alterations occur[8]. The current review primarily examines alterations in blood cells induced by DM[25]. We then examined, as a second point, how the modifications impact the functions of platelets, white blood cells, and red blood cells[26]. Therefore, the primary goal is to investigate the impact of a CT scan X-ray on HGB, RBCs, and WBC counts before and following the diagnosis[27].

MATERIALS AND METHODS

Sampling

The AL-Numen General Hospital served as the venue in Baghdad from November 2022 to April 2023 to assess the effects of the CT scan on the blood component (CBC, RBC, and HGB) of debit patients. Two millilitres of blood were withdrawn from the debited patient before and after the body CT scan. The name of the material was Philips device 128 slices, Manufactured in Holland. The Physiology Department (Medical College), The University of Baghdad, Baghdad, Iraq, and the research ethics committee approved the study's protocol. The blood samples of humans were collected from adult donors (60 females and males) aged 35-70 years, and the donors signed written agreements. We divided them into three sections patients.

Sample collection of blood and processing

After their preservation, the head, chest, and abdomen were in containers containing EDTA. Section One consisted of a chest CT scan; The mass dose of the head CT scan is 4654, the time is 19.52, the CTDI volume is 25.10, and the DLP (mGycm) is 466.80. the mass dose of the chest CT scan is 2053, the time is 14.10, the CTDI volume is 18.00, and the DLP (mGycm) is 550.80. The mass dose of the abdomen CT scan is

5061, CTDI volume: is 38.00, and DLP time: is 23.9 milliseconds. Preceding the CT scan, blood samples were obtained from the diabetic patient in each of the three sections; further blood samples were collected following the examination.

Statistical analysis

Our statistical analyses were performed with IBM Inc.'s SPSS for Windows, version 22, which is the Statistical Package for the Social Sciences. We analyze the variations in patient blood samples before and after a body CT scan. We used pairwise and unpaired t-tests for statistical analysis to represent the sample size. We provided the mean and the standard error mean, with the p-value of significance being less than or equal to 0.05[28].

RESULTS

The study involved 90 subjects who were randomly selected as diabetic patients. We divided them into three sections. Patients examine the head, chest, and abdomen after preserving them in EDTA-containing containers. The doses of the CT scan for the head, chest, and abdomen. The patients' average height was their main characteristic 172.85 ± 1.68cm, and their average weight was
80.8 ± 4.5kg. All participants in this study ranged in age from 30 to 70 years. These samples of the diabetic patient's blood components were withdrawn before and after the CT examination. The sample of participants were RBCs, WBCs, and HGB. Table 1 illustrates the counts of WBCs, RBCs, and HGBs before and after CT scans of diabetes patients for the head, chest, and abdomen. No significant statistical difference was found between the counts of these parameters before and after the CT scan; see Figures 1, 2, and 3.

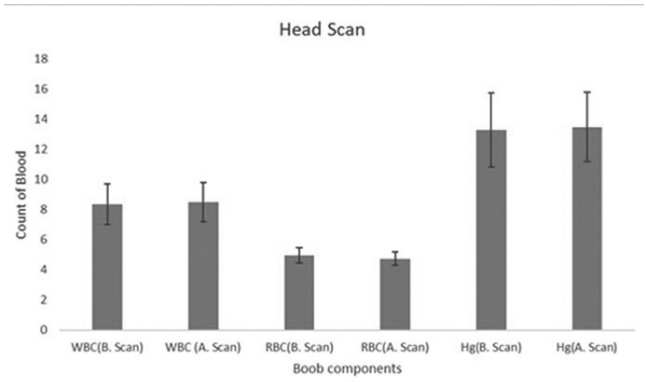

Figure 1: Represents the relationship between counts of WBCs, RBCs, and HGBs of the blood of the patients exposed to a CT scan of the head.

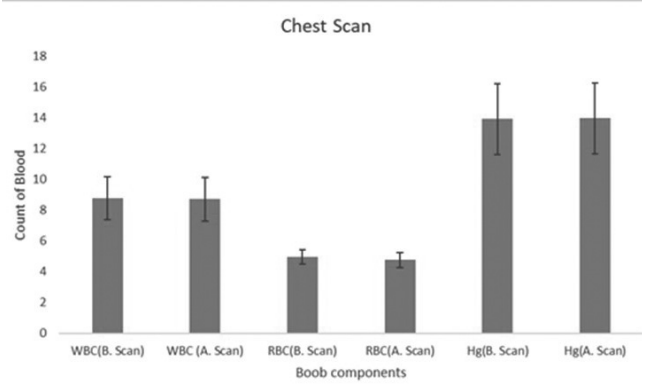

Figure 2: Represents the relationship between counts of WBCs, RBCs, and HGBs of the blood of the patients exposed to a CT scan of the chest.

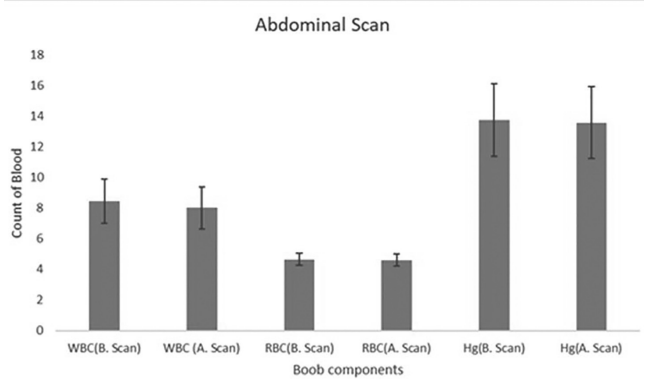

Figure 3: Represents the relationship between counts of WBCs, RBCs, and HGBs of blood patients exposed to CT scan for Abdominal.

Table 1. Illustrate the counts of WBCs, RBCs, and HGBs before and after CT scans of diabetes patients for the head, chest, and abdomen.

Scan	WBC (B.scan)	WBC (B.Scan)	RBC (B.Scan)	RBC (A.Scan)	Hg (B.Scan)	Hg (A.Scan)
Head	8.35±1.35	8.5±1.3	4.95±0.5	4.75±0.45	13.27±2.45	13.48±2.3
Chiest	8.7±1.39	8.7±1.4	4.95±0.48	4.75±0.48	13.9±2.29	13.95±2.31
Abdominal	8.45 ±1.45	8.01±1.37	4.65±0.4	4.6±04	13.74±2.39	13.57±2.36

DISCUSSION

The scanner exposes many patients to X-rays during examinations, but it's important to note that it is safe for patients29. Despite the known effects of X-rays on the body's cells30, whether direct or indirect, laboratory X-rays on blood have demonstrated complete safety29. The present investigation's findings showed no statistically significant variations in the quantity of white blood cells.

Red blood cells and haemoglobin before and after exposure to X-rays from the laboratory31 (Fig. 1). We study the effect of (X-ray) radiation used in CT scans on blood components (RBC, WBCs, HGB, PLT) that drown from the patient's diabetes32. A comparison between the lab results of the radiation of CT will affect the human body, such as blood components33. Then, we will compare the lab test results for radiated and non-radiated blood samples of these components for each case as has been mentioned earlier (introduction), the effect of radiation(X-ray) that both have different effects on the human body spatially human blood cells. Following establishing inclusion and exclusion criteria, we gathered and analyzed a cohort of sixty patients as study samples. The age distribution of the patients was approximately normal between the ages of 18 and 70. the average age for both sexes was 44.45 ± 1.43 years.

CONCLUSIONS

Because there were no significant differences between the blood counts before and after the CT scan, the current study's main conclusion, based on these results, is that the CT scan is safe for patients.

Acknowledgement: The AL-Numen General Hospital staff in Baghdad assisted in collecting samples and analyzing them, and the authors are grateful for their help.

Ethical Approval: The Iraqi Ministry of Health/ Environment, Public Health Directorate's ethical commission gave its clearance for this study (no. 20135).

Finance: No funding.

Conflicts of interest: No conflicts of interest.

Protection of persons and animals: The Institutional Scientific Committee at the University of Basrah approved this study according to the Declaration of Helsinki for Human Studies 1975, and all were followed for the care and use.

Declaration: We confirm that the manuscript "The effects of CT on blood components for diabetic patients" has been read and approved by all the named authors, and they have contributed significantly to the paper. This is also to declare that the paper has yet to be published earlier in whole or as part of it or has been sent to some other journal for consideration for publication. The paper is also accessible from any plagiarism/self-plagiarism. There are no conflicts of interest associated with this paper. The authors would be fully responsible if the paper is found to violate any copyright law in the future.

Author Contributions: Farah Hasan, Aedah Al Kaisy, and Mohamed Hasan: Conception, design, performed statistical analysis, explanation; Collecting data, achieved laboratory investigations. All the authors agreed on the final form of the article before the publication and expressed their consent to be responsible for all parts of the work.

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