

Original paper

Effect of Cardiac Catheterization on Certain Hematological Parameters

Ahmed Bader Abdulwahid^{^*}

[^] Department of Physiology, College of Medicine, Basrah University, Basrah, Iraq

Abstract

B **Background:** Cardiac catheterization is a procedure used to check the heart for blocked arteries and valve abnormalities by using a coronary angiogram, through which the patient will be exposed to the hazardous effect of radiation and contrast media used.

Aim of the study: Our study aimed to see the effect of cardiac catheterization on certain hematological parameters

Methods and subjects: This study was carried out in the cardiac catheterization center in Al-Sader teaching hospital in Basrah city on 30 patients (20 were males and 10 were females), their ages ranged between 35 and 66 years with a mean of (53.62±8.98 years). Solution of Ultravist 370 injection was used during the procedure as contrast media in amount ranged between (25-600 ml) with an average of (41.56 ±13.75 ml). Fluoroscopy was also used and the fluoroscopy time was ranged between (0.54-8.9) minutes with an average of (2.085±1.18 min).

In this study and for all patients we estimated the number of RBCs, WBCs (total and differential) and platelets one hour before and one hour after the procedure of cardiac catheterization by using an automated hematology analyzer (Sysmex XT2000i Japan).

The results were analyzed using SPSS software, in which independent t test was used to compare the differences in the values of the included parameters obtained before and after cardiac catheterization.

Results: The comparative data revealed that there were decreases in most of the parameters one hour after cardiac catheterization which is statistically significant regarding the number of lymphocytes, monocytes and platelets, with significant increase in the number of neutrophils one hour after cardiac catheterization ($p < 0.05$).

Conclusion: The exposure to radiation and iodinated contrast media increases neutrophil count and decreases lymphocyte and platelet counts one hour after cardiac catheterization while it has no effect on the RBCs and total WBCs counts.

Key words: cardiac catheterization, hematological parameters

Introduction

Cardiac catheterization is a procedure used to check the heart for blocked arteries and valve abnormalities, in which the cardiologist inserts a long, thin catheter into an artery in the arm, neck or groin, threads it through to the heart, and then injects a contrast dye into the arteries and fluoroscopy is created as the contrast material moves through the heart's

chambers, valves and major vessels.⁽¹⁻⁴⁾ In medicine the human being exposure to radiation is mainly from the use of nuclear medicine and X-ray, and the mean effective dose is 1.0–3.0 mSv per head per year.⁽⁵⁾ It was found that the medical use of these procedures with high radiation has been increased⁽⁵⁻⁸⁾, and the interventional cardiac procedure which is responsible for 12% of these radiological examination has the highest radiation dose (up to 50% of the total collective effective dose).⁽⁹⁾ There are

*for correspondence E-mail: dr.ahmedbadir1@yahoo.com

two main biological effects of ionizing radiation: stochastic effects from the release of free radicals (carcinogenic and genetic effects) and deterministic effects (immediate tissue reactions which include in case of interventional cardiology: skin, hair changes, cataract and cardiovascular diseases).⁽¹⁰⁻¹²⁾ Iodine which is used in the contrast media is also regarded as an oxidizing agent.⁽¹³⁾

Aim of the study

Our study aimed to see the effect of cardiac catheterization on certain hematological parameters

Methods and subjects

This study was carried out in the cardiac catheterization center in Al-sader teaching hospital in Basrah city on 30 patients who were undergoing cardiac catheterization (they were controlled cases of hypertension and diabetes mellitus), 20 of them were males and 10 were females, their ages ranged between 35 and 66 years with mean of (53.62 ± 8.98) years. The amount of contrast media used differs in different patients according to the time of the procedure and the amount used ranged between (25-600ml) with an average of (41.56 ± 13.75) ml. Fluoroscopy also used during the procedure to visualize any blockage in the blood vessels and the fluoro-time for each individual was measured, which represent the time of exposure to the X-ray, which ranged between (0.54-8.9) minutes with an average of (2.085 ± 1.18) min).

In this study and for all patients we estimated the number of RBCs, WBCs (total and differential) and platelets one hour before and one hour after the procedure of cardiac catheterization by using automated hematology analyzer (Sysmex XT2000i Japan SN: 67487).

The results were analyzed using SPSS software, in which independent t test were used to compare the differences in the values of the included parameters obtained before and after cardiac catheterization and

were reported as mean \pm S.D. The P value ≤ 0.05 was regarded as statistically significant.

Results

A comparison between the numbers of RBCs, WBCs (total and differential) and platelets that have been measured one hour before and one hour after cardiac catheterization revealed that there were no significant changes in the number of RBCs and total number of WBCs after cardiac catheterization whereas there were significant decrease in the number of lymphocytes, monocytes and platelets, with significant increase in the number of neutrophils after cardiac catheterization ($p < 0.05$) as shown in Table (1) and figures (1- 4).

Discussion

The results of the present study showed that there were decreases in most of the measured parameters after cardiac catheterization. This effect can be attributed to the exposure of the patients to a considerable dose of radiation and contrast media during this procedure. Radiation may cause severe damage to the cell membrane, nuclei and enzymes.⁽¹⁴⁾ The first stage of its damage in cells is radiolysis of water. These reactions, which involve mainly activated oxygen products, are propagators of damage in irradiated cells.⁽¹⁵⁻¹⁷⁾

Radiologic contrast substances can produce adverse reaction that can vary from mild to severe modifications that can threaten the patient's life.⁽¹⁸⁾

Regarding the RBCs, our study shows insignificant decrease in the number of RBCs after cardiac catheterization which means that the radiation used has mild effect on the RBCs which is in agreement with Meo study.⁽¹⁹⁾ RBCs have a protective system. Glutathione (GSH) protects the RBCs from the toxic effects of reactive oxygen compound.⁽²⁰⁾ Some studies have suggested a radiation protection role for

protein thiol groups in RBC. Thiol groups are present in glutathione reductase (GR) glutathione peroxidase (GP).⁽²⁰⁾ Regarding the effect of the contrast media on the

RBCs, several studies showed that the contrast media cause a change in the shape of RBCs⁽²¹⁻²⁶⁾ rather than their number⁽¹⁹⁾.

Table 1. Comparison between the results of the measured parameters one hour before and one hour after cardiac catheterization.

Parameters	one hour before cardiac catheterization M±S.D(No.30)	one hour after cardiac catheterization M±S.D(No.30)	Mean difference M±S.D	P value
RBCs*10 ⁶ /ml	5.096 ± 0.717	4.912856 ± 0.697	0.138 ± 0.381	0.142
WBCs*10 ³ /ml	8.671 ± 2.446	7.505 ± 3.5959	1.171 ± 3.647	0.107
Neutrophils%	52% ± 0.138%	67% ± 0.101%	12.585 ± 13.033	0.000
Lymphocytes%	38% ± 0.118302%	26% ± 0.087	10.044 ± 10.087	0.000
Monocytes%	7% ± 0.029959%	4.02% ± 0.0017%	2.177 ± 3.947	0.008
Eosinophils%	5% ± 0.095425%	2% ± 0.019	0.257 ± 2.22	0.553
Basophils%	0.38% ± 0.006191%	0.43% ± 0.005%	0.064 ± 0.798	0.692
Platelets/ml	256.3125 ± 61.90715	242.75 ± 67.057	43.33 ± 87.22	0.016

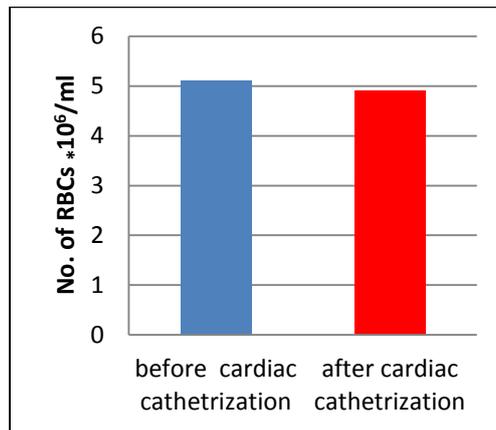


Figure 1. Number of RBCs one hour before and one hour after cardiac catheterization (p≤ 0.05).

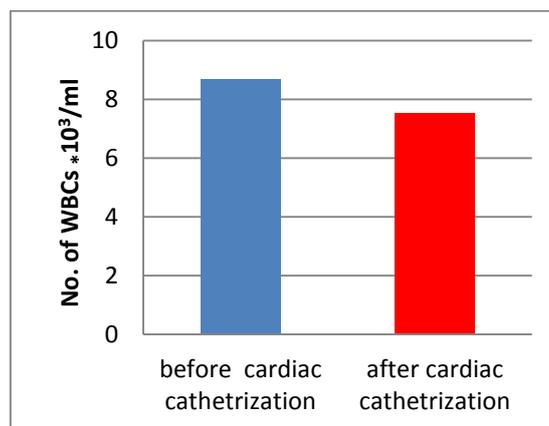


Figure 2. Number of WBCs one hour before and one hour after cardiac catheterization (p≤ 0.05).

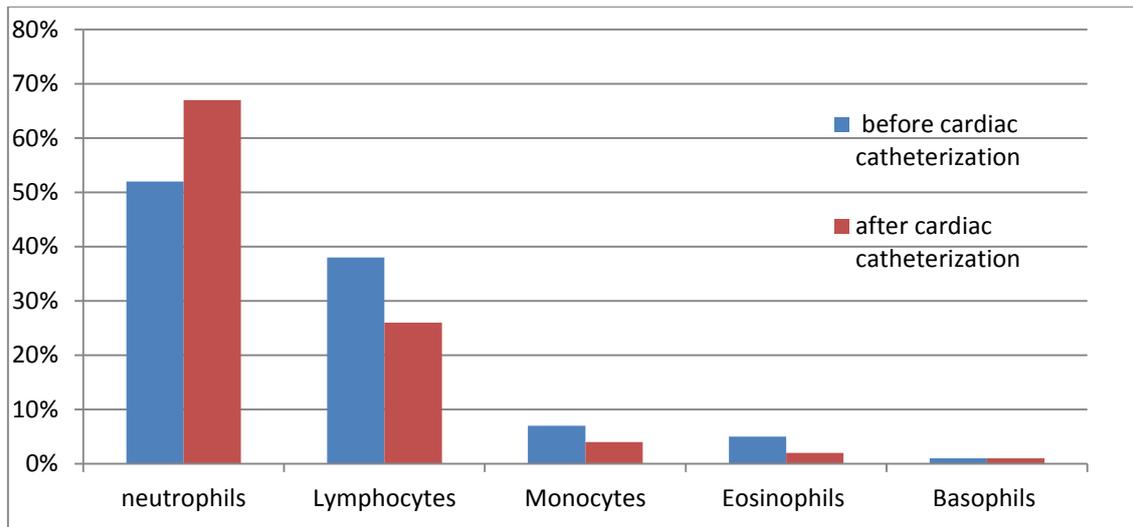


Figure 3. Differential WBCs counts one hour before and one hour after cardiac catheterization ($p \leq 0.05$).

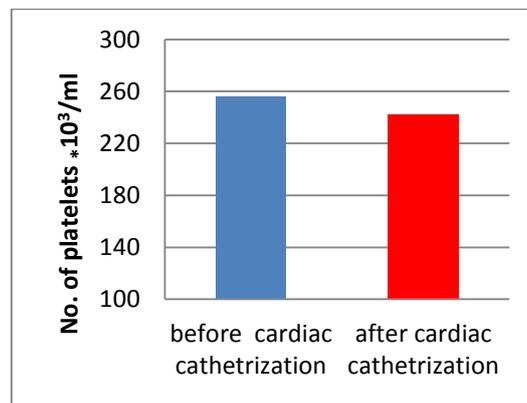


Figure 4. Number of platelets one hour before and one hour after cardiac catheterization ($p \leq 0.05$)

Regarding the WBCs, our study showed that there was no significant change in total WBCs number but there is significant increase in the number of neutrophils which is in agreement with Blakely et al.⁽²⁷⁾ with significant decrease in the number of lymphocytes which is in agreement with several studies.⁽²⁸⁻³³⁾ It seems to be that the number of neutrophils increases due to two factors, first because both the circulating neutrophils and the granulocytes that are stored in the bone marrow are not radiosensitive.⁽³⁴⁾ Second due to demargination of granulocytes and release of mature and early precursors from the large store of granulocytic cells within the bone marrow.⁽³⁵⁾ Lymphocytopenia usually follows exposure to radiation because

lymphocytes are the most sensitive cells to even mild radiation.⁽³⁶⁻³⁸⁾

Mechanisms by which rapid lymphocytopenia takes place have been investigated. Radiation-induced apoptosis and/or redistribution of lymphocytes from the circulation to lymph nodes may take place within few hours.⁽³⁹⁾

Regarding the platelets count, our results showed that there was significant decrease in the number of platelets after catheterization which may be due to the effect of the contrast media used. Acute thrombocytopenia had been reported as a complication of iodinated contrast media by several studies.⁽⁴⁰⁻⁴⁵⁾ This thrombocytopenia may be due to rapid platelet destruction, presumably through an

antibody effect, or peripheral platelet activation and consumption. ^(42,46) Also some studies found that the ionizing radiation cause thrombocytopenia and the duration of thrombocytopenia correlates directly with the radiation dose. ⁽³⁵⁾

Conclusion

The present study suggests that exposure to radiation and iodinated contrast media causes increased neutrophils count and decreased lymphocyte and platelets counts one hour after cardiac catheterization while the RBCs and total WBCs counts are not affected. Further studies are needed to evaluate whether these hematological changes can cause any medical complications after the procedure of cardiac catheterization or not.

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