Evaluation of Cardiac Catheterization effect on Patients' Renal Functions

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Abstract- Cardiac catheterization represents a significant medical diagnostic and treatment method that may refers as a risk for the development of acute kidney injury (AKI).

An Evaluation Descriptive Design is conduct from Dec. 2nd. 2014 to March30th. 2015, in Al-Najaf City/Al-Najaf Al-Ashraf Health Directorate / Open Heart Surgery Center, to evaluate the effect of the cardiac catheterization on renal functions. A Non-Probability (Convenience Sample) of (53) patients are included in the study. The data has been collect byusing of the questionnaire, and by means of structured interview technique with the study subjects, and by using the Telephone conversation with the patients or with their relatives.

With respect to the statistical mean and standard deviation, the study results indicate that there an elevation of the selected renal functionstests that mean that the cardiac catheterization affects the renal functions.

According to the study findings and discussion, the study concluded the following:The cardiac catheterization affect the patients' renal functions. In addition, the impairment in the patients' renal functions specified through the elevation of blood urea levels affected by the contrast volume, post-cardiac catheterization intravenous fluids, and the nephrotoxic medications. While the duration of disease, medical history, and the contrast volume affect the impairment of the renal functions specified by the elevation in serum creatinine levels.

The study recommends that other studies beconduct to evaluate the impact of the cardiac catheterization on patients' renal functions. In addition,training sessions should be conduct for the health staff members to use advanced methods to reduce the risk for renal problems after cardiac catheterization.

Index Terms- evaluation, cardiac catheterization, renal functions.

I. INTRODUCTION

Cardiac catheterization represents a significant medical diagnostic and treatment procedure that may refers as a risk for the development of acute kidney injury (AKI). Awareness of the importance of AKI is increasing, as investigators have demonstrated a link to increased mortality and progressive chronic kidney injury (CKD) [(1)].

The incidence of acute renal failure (ARF) after cardiac surgery is 1% to 30%. The development of renal failure not only increases patient morbidity but also predisposes them to other complications during the perioperative period. Acute renal failure requiring renal replacement therapy develops in 1% to 5% of patients and is one of the most important independent risk factors for postoperative mortality [(2)]. Overall, the mortality associated with ARF after cardiac surgery ranges from 28% to 63% [(3)].

The ability to predict postoperative ARF using well-defined baseline risk factors not only allows for earlier diagnosis and treatment, but also lead to an effective prophylaxis at the preoperative settings, and significantly improve patient outcome. A number of risk factors for the development of ARF after cardiac surgery that include baseline renal insufficiency (creatinine _ 120 umol/L), advanced age, diabetes mellitus, and peripheral vascular disease. Left ventricular ejection fraction less than 50%, the use of intra-aortic balloon pump device, and prolonged cardiopulmonary bypass (CPB) times are risk factors generally associated with reduced renal perfusion pressures. Other risk factors include emergency and reoperation cases. The patients undergoing cardiac surgery at the specialist institution commonly have more than one of the above baseline risk factors, yet the influence of these variables on the postoperative renal function of our patients has not been evaluate. Moreover, contrast induced nephropathy is a widely reported complication of post-operative cardiac catheterization, especially among patients with baseline renal impairment [(4)].

Renal dysfunction is a serious consequence of cardiac catheterization, and is commonly define as a 0.5 (mg/dL) increase in creatinine from baseline within 48 hours of exposure to contrast [(5)].

Renal dysfunction has been reported to occur up to 50% of patients and results in increased in-hospital and long-term mortality. Renal dysfunction is the third most common contributor of renal failure during hospitalization. Theoretically, damage to the renal tubules and function elevates creatinine within 48 hr of exposure and may return to baseline within two weeks. Creatinine elevations that return to baseline within two weeks are transient creatinine elevations, whereas elevations in creatinine not returning to baseline are persistent [(6).]

II. METHODOLOGY

Design of the Study:

An Evaluation Descriptive Design is conduct through the present study in order to achieve the early stated objectives. The period of the study is from Dec. 2nd. 2014 to March30th. 2015.

Administrative Agreements:

The researchers obtain an approval from the Nursing Specialties Department in the College of Nursing / University of Kufa. In addition, an official permission is attainedby the researcher from Al-Najaf Al-Ashraf Health Directorate/ Open

Heart Surgery Center, in order to interviewing each subject. Finally, subject agreement obtained from the nurses and the patients to answer the questionnaire.

Setting of the Study:

The study conducts in Al-Najaf City/Al-Najaf Al-Ashraf Health Directorate / Open Heart Surgery Center.

Sample of the Study:

A Non-Probability (Convenience Sample) of (53) patients are included in the present study.

The Study Instrument:

An evaluation tool is adopt and developed by the researcher to evaluate the effect of the cardiac catheterization on patients' renal functions.The final copy consists of the following parts:

1- Patient's demographic data form.
2- Patient's clinical data form.
3- Renal functions tests (blood urea (mg/dl) and serum creatinine (mg/dl).

Data Collection:

The data are collectby the researcher through the utilization of the developed questionnaire, and by means of structured interview technique with the subjects, who are individually interviewing, by using the Arabic version of the questionnaire. In addition, some either of the clinical data collect with aid of the health staff members, or by using the Telephone conversation with the patients or with their relatives.

Statistical Analysis:

The following statistical data analysis approaches is used in order to analyze the data of the study under application of the statistical package (SPSS) Ver. (16), and the Microsoft excel (2007):

1. Descriptive Data Analysis:

a- Tables (Frequencies, Percentages, and cumulative Percent).
b- Statistical figures (Bar Charts).
c- Statistical mean and standard deviation.

2. Inferential Data Analysis:

This approach used to accept or reject the statistical hypothesis, which includesChi-Square test for testing the independency distribution of the observed frequencies, and for measuring the association between the studies variables according to its type.

III. RESULTS

Table (1): Distribution of the Study Sample According to their Demographic Data

Demographic data	Rating	Frequency	Percent	Cumulative Percent
Residency	Rural	10	18.9	18.9
	Urban	43	81.1	100
Gender	Male	36	67.9	67.9
	Female	17	32.1	100
Age / years	<= 35.00	2	3.8	3.8
	36.00 - 45.50	6	11.3	15.1
	45.51 - 56.00	14	26.4	41.5
	57.00 - 66.50	25	47.2	88.7
	66.51+	6	11.3	100
	Mean (56.7)		s.d. (10.0)	
Marital status	Married	49	92.5	92.5
	Widowed	4	7.5	100
Levels of education	Illiterate	10	18.9	18.9
	Able to read and write	10	18.9	37.7
	Primary school graduated	8	15.1	52.8
	Intermediate school graduated	5	9.4	62.3
	Secondary school graduated	5	9.4	71.7
	Institutes	7	13.2	84.9
	College or Post graduate	8	15.1	100
Occupational status	Governmental employee	14	26.4	26.4
	Free job	10	18.9	45.3
	Retired	12	22.6	67.9
	housewife	9	17	84.9
	Jobless	8	15.1	100

Socio-economic status	**Adequate**	**14**	**26.4**	**26.4**
	Adequate to some extent	**34**	**64.2**	**90.6**
	Inadequate	**5**	**9.4**	**100**

n (53)

This table shows that most of the patients are from urban residential area (81.1%), males (67.9%), within the age interval 57-66.5 years old (47.2%), married (92.5%), illiterates and some of them are able to read and write (18.9%), governmental employee (26.4%), their economic status is adequate to some extent (64.2%).

Table (2): Distribution of the Study Sample According to their Clinical Data

Clinical data	Rating	Frequency	Percent
Diagnosis	**Coronary obstruction**	**44**	**83**
	Angina	**9**	**17**
Duration of the disease	**<= 2.00**	**35**	**66**
	3.00 - 4.50	**10**	**18.9**
	4.51 - 7.00	**5**	**9.4**
	8.00 - 9.50	**1**	**1.9**
	9.51+	**2**	**3.8**
Medical history	**No previous diseases**	**17**	**32.1**
	Renal diseases, Diabetes mellitus, Heart diseases, Others	**5**	**9.4**
	Renal diseases, Heart diseases Others	**7**	**13.2**
	Renal diseases, Diabetes mellitus, Heart diseases	**1**	**1.9**
	Renal diseases, Heart diseases	**3**	**5.7**
	Diabetes mellitus, Heart diseases	**12**	**22.6**
	Heart diseases, Others	**6**	**11.3**
	Diabetes mellitus, Heart diseases	**2**	**3.8**
Type of procedure	**Diagnostic**	**16**	**30.2**
	Therapeutic	**33**	**62.3**
	Dual	**4**	**7.5**
Number of previous cardiac catheterization	**No previous cardiac cath.**	**23**	**43.4**
	1	**23**	**43.4**
	2	**3**	**5.7**
	3	**1**	**1.9**
	4	**1**	**1.9**
	6	**1**	**1.9**
	7	**1**	**1.9**
Type of contrast	**Iodinated contrast**	**53**	**100**
Volume of contrast	**<= 100.00**	**24**	**45.3**
	126.00 - 150.00	**22**	**41.5**
	176.00+	**7**	**13.2**
Intravenous fluids (pre-procedure)	**No**	**53**	**100**
Intravenous fluids (post procedure)	**No post cath. Fluids**	**26**	**49.1**
	Normal saline (500cc/24hours)	**23**	**43.4**
	Normal saline (1000cc/24hours)	**2**	**3.8**
	Dextrose water (500cc/24 hours)	**1**	**1.9**
	Normal saline (500cc/24hours) + Dextrose water (500cc/24 hours)	**1**	**1.9**

Table (2) shows that most of the patients are: suffer from coronary obstruction (83%), suffers for 2 years and less (66%), have no previously diseases (32.1%), exposure to a therapeutic cardiac catheterization (62.3%), have a no or as maximum one previously

cardiac catheterization (43.4%). All of the patients' exposure to the iodinated contrast, and most of them receive about 100 ml of contrast dye (45.3%). In addition all the patients did not received an intravenous fluids pre catheterization, and (49.1%) of them did not received an intravenous fluids post cardiac catheterization.

Table (3): Distribution of the Study Sample According to their using of Nephrotoxic Medications

Taking of Nephrotoxic medication	Frequency	Percent
Aminoglycosides Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors, Diuretics.	4	7.5
Aminoglycosides Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors Immunosuppressive Agents, Diuretics.	2	3.8
Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors Immunosuppressive Agents, Diuretics.	13	24.5
Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors , Antiviral Agents Diuretics.	10	18.9
Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors, Immunosuppressive Agents, Antiviral Agents, Diuretics.	2	3.8
Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors, Diuretics.	13	24.5
Non-Steroidal Anti-Inflammatory Drugs, Antiviral Agents, Diuretics.	2	3.8
Non-Steroidal Anti-Inflammatory Drugs, Immunosuppressive Agents, Diuretics.	1	1.9
Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors , Antiviral Agents	2	3.8
Non-Steroidal Anti-Inflammatory Drugs (NSAIDS), Angiotensin-Converting Enzyme Inhibitors	2	3.8
Non-Steroidal Anti-Inflammatory Drugs, Diuretics.	2	3.8

Table (3) shows that most of the patients using of the Non-Steroidal Anti-Inflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors Immunosuppressive Agents, Diuretics (49%).

Table (4): Distribution of the Study Sample According to their selected Renal Functions Tests Pre and Post the Cardiac Catheterization

Renal Function Tests	Baseline level (Pre-Cardiac Catheterization)		Post Cardiac Catheterization (after 1 week)	
	Mean	S.D.	Mean	S.D.
Blood Urea / mg/dl	34.50	13.5424	42.5189	33.0
Serum Creatinine / mg/dl	0.84	0.37	1.72	4.99

With respect to the statistical mean and standard deviation calculated for the blood urea and serum creatinine pre and post the cardiac catheterization, the study results indicate that there is a significant elevation of these tests, that mean that the cardiac catheterization affect the renal functions.

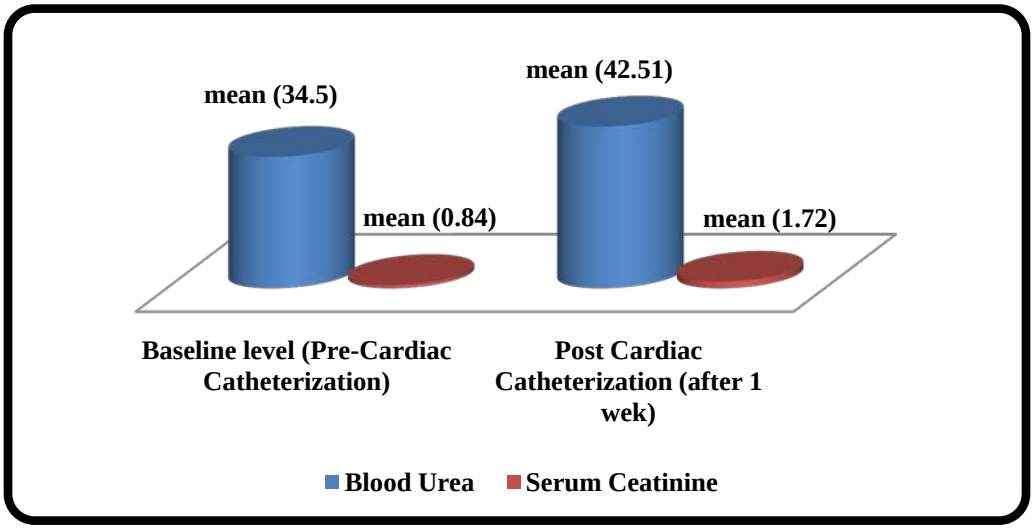

Figure (1) Distribution of the study sample according to the statistical mean differences among selected renal functions tests pre and post the cardiac catheterization.

Table (5): Association between the Patients' Clinical Data and the changes in the Blood Urea Levels

Clinical data / change in blood urea levels	Significant Value (chi-square)	df	Significant level (p-value)
Diagnosis	42.29	38	0.291 NS
Duration of disease	81.58	76	0.310 NS
Medical history	1.51	133	0.132 NS
Type of procedure	50.51	57	0.715 NS
number of previous cardiac catheterization	1.32	114	0.111 NS
Contrast volume	83.19	57	0.013 S
Intravenous fluids (post procedure)	1.05	76	0.015 S
Nephrotoxic medications	2.25	190	0.042 S

This table shows that there is a non-significant association between the changes in the blood urea levels and the patients' clinical data, except with the contrast volume, intravenous fluids (post cardiac catheterization), and the nephrotoxic medications, the results indicate that there is a significant association at p-value less than 0.05.

Table (6): Association between the Patients' Clinical Data and the changes in the serum creatinine Levels

Clinical data / change in serum creatinine levels	Significant Value (chi-square)	df	Significant level (p-value)
Diagnosis	5.68	28	1.00 NS
Duration of disease	78.00	56	0.02 S
Medical history	1.50	98	0.00 HS
Type of procedure	35.79	42	0.73 NS
number of previous cardiac catheterization	71.76	84	0.82 NS
Contrast volume	61.29	42	0.02 S
Intravenous fluids (post procedure)	62.28	56	0.26 NS
Nephrotoxic medications	1.52	140	0.22 NS

This table shows that there is a non-significant association between the changes in the serum creatinine levels and the patients' clinical data, except with the duration of disease, medical history, and the contrast volume, the results indicate that there is a significant association at p-value less than 0.05.

IV. DISCUSSION

With respect to the statistical mean and standard deviation calculated for the blood urea and serum creatinine pre and post the cardiac catheterization, the study results indicate that there a significant elevation of these tests that mean that the cardiac catheterization affects the renal functions negatively and the renal problems could be occurred.In addition, there is a significant effect of the duration of the diseases, health history, contrast volume, intravenous fluids (post cardiac catheterization), and the nephrotoxic medications on the change in the renal functions tests (blood urea, and serum creatinine). These results comes because that the contrast dye that used in cardiac catheterization is a nephrotoxic substance.That may irritate the renal lining structures when its excrete through the renal, with the aid of some risk factors such as health history, age, nephrotoxic medications and the other risk factors related to the cardiac catheterization, these dye may affect the renal functions and may cause an acute renal injury. These results are supported by **Del Duca, *et. al.*, 2007**, they find that there is a significant changes in renal functions tests after cardiac catheterization[(4)]. Also **Brown, *et. al.*, 2008** find that there is a significant impact of the health history, duration of diseases, contrast type and volume, receiving intravenous fluids after the procedure, nephrotoxic medications and the renal functions impairment after cardiac catheterization[(6)].

V. CONCLUSION

According to the study findings and discussion, the study concluded the following:

1- The cardiac catheterization affect the patients' renal functions.
2- The impairment in the patients' renal functions specified through the elevation of blood urea levels affected by the contrast volume, post-cardiac catheterization intravenous fluids, and the nephrotoxic medications. While the duration of disease, medical history, and the contrast volume affect the impairment of the renal functions specified by the elevation in serum creatinine levels.

VI. RECOMMENDATIONS

Based on the study conclusion, the study recommends the following:

Other studies could be conduct to assess the impact of the cardiac catheterization on patients' renal functions. In addition,training sessions should be conduct for the health staff members to use advanced methods to reduce the risk for renal problems after cardiac catheterization.

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