ORIGINAL ARTICLE

DETERMINING THE RISK FACTORS FOR ACUTE KIDNEY INJURY IN HEART SURGERY WITH CIRCULATION EXTRACORPOREAL (CEC) LONG.

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ABSTRACT

Introduction: Despite the enormous advances in the management of postoperative care of heart surgery, renal complications secondary to prolonged cardiopulmonary bypass (CPB) are presented in almost all patients. Acute renal injury (ARI) after cardiac surgery is associated with increased mortality , increased incidence of complications, a longer stay in the intensive care unit (ICU) and a significant increase in costs in health care.

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Objective: Identify risk factors for acute kidney injury in cardiac surgery associated with cardiopulmonary bypass (CPB) long.

Materials and methods: The information was collected by researchers from the records of patients scheduled for heart surgery open heart admitted to the Intensive Care Unit of the Regional Hospital of Alta Specialty (HRAEV) and Siglo XXI Medical Center (IMSS) 01 January 2013 to December 1, 2013. Of the 450 files reviewed included 69 who had a time of over 120 minutes (CEC>120) extracorporeal circulation , general data of each patient, cardiovascular risk factors (CVRF) were recorded , the data of the variables were also recorded to study and made a database for statistical tests using SPSS 16 program.

Results: Analized 69 cases , age 53±21 (33-81) years, the 73% of the study group belonged to the male gender (n=51) and 27% female (n=18), the 44 % were older adults analyzed, comorbidities or cardiovascular risk factors (CVRF) who had more than 3 preoperative risk factors (62%) and only had 2 or fewer risk factors (38%). When stratified APACHE and EuroSCORE, we observed 11.55±2.02 APACHE (9-17) and 6.50±1.25 EuroSCORE (4-9) was performed at baseline PaO2/FiO2 of Qx and admission to ICU, watching <65 years preQx 310 ± 37 (234-389) mmHg in PostQx 226±27 (178-298) with p = < 0.05 , and > 65 years in preQx 298±27 (230-356) mmHg and 219±35 post Qx (167-290) with p=<0.05.

Surgical bleeding 877 ± 78 (689-1120 ml) , hemodynamics TAM 86 ± 10 (67-102) mmHg in over 65 years vs 80 ± 8.7 (68-99) mm Hg (p=NS), 9.5 ± 1.8 PVC (6-14) mmHg in over 65 years vs 14 ± 2.8 (10-23) mm Hg (p=NS), 3.1 ± GC 0.8 (2.7-3.4) L / min in over 65 years vs 3.4 ± 1.1 (2.8-4.2) L / min (p=NS). The decline in GFR greater than 50 of baseline was 39% and the association of risk was measured, with: comorbidities (> 3) OR 4, 40 (95% CI 1.40 to 13.80), hypoalbuminemia (<3.0gr/dL) OR 1.26 (95% CI 0.47-5.13), LVEF (<40%) OR 2.10 (95% CI 0.661-6.71) and EuroSCORE (>6 pts) OR1.75 (95% CI 0.53-5.71). The complications observed in this study were renal replacement therapy (RRT) in 10%, acute myocardial infarction (AMI) perioperative 3% systemic inflammatory response (SIRS) 6% syndrome, prolonged ventilation-associated pneumonia and mortality 10% 30%.

Conclusions: Patients with prolonged CPB present with greater kidney damage than expected in this study was observed in almost 40% of patients. The factors associated with renal injury were the presence of more than 3 comorbidities prior to surgery and LVEF less than 40%, less association we hipoalabuminemia <3.0gr/dL and EuroSCORE >6.

Key words: Acute renal injury. Heart surgery. Circulation extracorporeal (CEC).

RESUMEN

DETERMINACIÓN DE LOS FACTORES DE RIESGO DE LA INSUFICIENCIA RENAL AGUDA EN LA CIRUGÍA CARDIOVASCULAR CON CIRCULACIÓN EXTRACORPÓREA (CEC) PROLONGADA.

Introducción: A pesar de los enormes avances en el manejo de los cuidados postoperatorios de cirugía de corazón, las complicaciones renales secundarias a la derivación cardiopulmonar (CEC) prolongada se presentan en casi todos los pacientes. La lesión renal aguda (IRA) tras la cirugía cardíaca se asocia con un aumento de la mortalidad, una mayor incidencia de complicaciones, una estancia mayor en la unidad de cuidados intensivos (UCI) y un incremento importante de los costos en atención a la salud.

Objetivo: Identificar los factores de riesgo de daño renal agudo asociados en cirugía de corazón con circulación extracorpórea (CEC) prolongada.

Material y métodos: La información fue recolectada por los investigadores a partir de los expedientes de los pacientes programados de cirugía cardíaca a corazón abierto que ingresaron a la Unidad de Cuidados Intensivos del Hospital Regional de Alta especialidad (HRAEV) y del Centro Médico Siglo XXI (IMSS) del 1 de enero del 2013 al 1 de diciembre del 2013. De los 450 expedientes revisados se incluyeron 69 que tuvieron un tiempo de circulación extracorpórea superior a 120 minutos (CEC>120), se registraron los datos generales de cada paciente, factores de riesgo cardiovascular (FRCV), también se registraron los datos de las variables a estudiar y se realizó una base de datos para pruebas estadísticas con el programa SPSS 16.

Resultados: Se analizaron 69 casos, edad de 53±21 (33-81) años, el 73% del grupo en estudio pertenecían al género masculino (n=51) y 27% al femenino (n=18), 44% fueron adultos mayores, comorbilidades o factores de riesgo cardiovascular (FRCV) quienes tenían más de 3 factores de riesgo preoperatorio (62%) y los que solo tenían 2 o menos factores de riesgo (38%). Al estratificar APACHE y EUROscore, observamos APACHE 11.55±2.02 (9-17) y EUROscore 6.50±1.25 (4-9), se realizó PaO2/FiO2 al inicio de Qx y al ingreso a UCI, observando a < 65 años en preQx 310±37 (234-389)mmHg en el PostQx 226±27(178-298) con p=<0.05, y a >65 años en preQx 298±27(230-356)mmHg, y post Qx 219±35(167-290) con p=<0.05.

Sangrado quirúrgico 877±78 (689-1120 ml), hemodinamia TAM 86±10(67-102)mmHg en mayores de 65 años vs. 80±8.7(68-99)mmHg (p=NS), PVC 9.5±1.8(6-14)mmHg en mayores de 65 años vs 14±2.8(10-23)mmHg (p=NS), GC 3.1±0.8(2.7-3.4)L/min en mayores de 65 años vs. 3.4±1.1(2.8-4.2)L/min (p=NS). El descenso de la TFG mayor del 50% de su basal fue del 39% y se midió la asociación de riesgo con: comorbilidades (>3)OR4,40 (IC95%1,40-13,80), hipoalbuminemia (<3.0gr/dL) OR 1.26 (IC95%0.47-5.13), FEVI (<40%) OR 2.10(IC95%0.661-6.71) y Euroscore (>6 ptos)OR1.75(IC95%0.53-5.71). Las complicaciones observadas en este estudio fueron terapia de reemplazo renal (TRR) en el 10%, infarto agudo al miocardio (IAM) perioperatorio 3%, síndrome de respuesta inflamatoria sistémica (SIRS) 6%, neumonía asociada a ventilación prolongada 10% y mortalidad 30%.

Conclusiones: Los pacientes con CEC prolongada cursan con mayor daño renal de lo esperado en este estudios se observo casi en el 40% de los pacientes. Los factores asociados a mayor daño renal fueron la presencia de más de 3 comorbilidades previo a la cirugía y FEVI menor del 40%, con menor asociación tenemos la hipoalabuminemia <3.0gr/dL y el EUROscore > de 6.

Palabras Clave: Daño renal agudo. Cirugía de corazón. Circulación extracorpórea (CEC).

RESUMO

DETERMINAÇÃO DOS FATORES DE RISCO DA INSUFICIÊNCIA RENAL AGUDA NA CIRURGIA CARDIOVASCULAR COM CIRCULAÇÃO EXTRACORPÓREA (CEC) PROLONGADA

Introdução: Apesar dos enormes avanços nos cuidados pós-operatórios nas cirurgias de coração, as complicações renais secundárias por derivação cardiopulmonar (CEC) prolongada apresentam-se em quase todos os pacientes. A lesão renal aguda (IRA) pós cirurgia cardíaca é associada com um aumento da mortalidade, uma maior incidência de complicações, um período maior na unidade de cuidados intensivos (UCI) e um aumento importante dos custos de atendimento à saúde.

Objetivo: Identificar os fatores de risco de dano renal agudo associados às cirurgias de

coração com uso da circulação extracorpórea (CEC) prolongada.

Material e métodos: A informação foi recolhida pelos pesquisadores a partir dos expedientes dos pacientes programados para cirurgia cardíaca a coração aberto que ingressaram na Unidade de Cuidados Intensivos do Hospital Regional de Alta Especialidade (HRAEV) e no Centro Médico Siglo XXI (IMSS) de 1 de janeiro de 2013 a 1 de dezembro de 2013. Dos 450 expedientes estudados, incluíram-se 69 que tiveram um tempo de circulação extracorpórea superior a 120 minutos (CEC>120), registraram-se os dados gerais de cada paciente, fatores de risco cardiovascular (FRCV), além dos dados das variáveis a estudar e realizou-se uma base de dados para provas estatísticas com o programa SPSS 16.

Resultados: Analisaram-se 69 casos, idade: 53±21 (33-81) anos, 73% do grupo de estudo pertencia ao gênero masculino (n=51) e 27% feminino (n=18), 44% adultos maiores, comorbilidades ou fatores de risco cardiovascular (FRCV) que tinham mais de 3 fatores de risco pré operatório (62%) e os que só tinham 2 ou menos fatores de risco (38%). Ao estratificar APACHE e EUROscore, observamos APACHE 11.55±2.02 (9-17) e EUROscore 6.50±1.25 (4-9), realizou-se PaO2/FiO2 ao início de Qx (cirurgia) e ao ingresso à UCI, observando a < 65 anos em pré Qx 310±37 (234-389)mmHg no Pós Qx 226±27(178-298) com p=<0.05, e a >65 anos em pré Qx 298±27(230-356)mmHg, e pós Qx 219±35(167-290) com p=<0.05.

Sangrado cirúrgico 877±78 (689-1120 ml), hemodinâmica TAM 86±10(67-102) mmHg nos pacientes maiores de 65 anos vs 80±8.7(68-99)mmHg (p=NS), PVC 9.5±1.8(6-14)mmHg em maiores de 65 anos vs 14±2.8(10-23)mmHg (p=NS), GC 3.1±0.8(2.7-3.4)L/min em maiores de 65 anos vs 3.4±1.1(2.8-4.2)L/min (p=NS).

A diminuição da TFG maior de 50% de sua taxa basal foi de 39% - mediu-se a associação de risco com: comorbilidades (>3)OR4,40 (IC95%1,40-13,80), hipoalbuminemia (<3.0gr/dL) OR 1.26 (IC95%0.47-5.13), FEVI (<40%) OR 2.10(IC95%0.661-6.71) e Euroscore (>6 ptos) OR1.75(IC95%0.53-5.71).

As complicações observadas neste estudo foram terapia de substituição renal (TRR) em 10%, infarto agudo do miocárdio (IAM) Peri operatório 3%, síndrome de resposta inflamatória sistêmica (SIRS) 6%, pneumonia associada à ventilação prolongada 10% e mortalidade de 30%.

Conclusões: Os pacientes com CEC prolongada cursam com maior dano renal do que o esperado, comprovando-se em quase 40% dos pacientes estudados. Os fatores associados a maior dano renal foram a presença de mais de 3 comorbilidades prévias ao momento da cirurgia e FEVI menor de 40%, com menor associação temos a hipoalabuminemia <3.0gr/dL e o EUROsponta pontacore > de 6.

Palavras Clave: Dano renal agudo. Cirurgia de coração. Circulação extracorpórea (CEC).

INTRODUCTION

Despite the enormous advances in the management of postoperative care of heart surgery, secondary renal complications to prolonged extracorporeal circulation are presented in almost all patients. Acute renal injury (ARI) after cardiac surgery is associated with increased mortality, increased incidence of complications, a longer stay in the intensive care unit (ICU) and a significant increase in costs in health care. The Acute Kidney Injury Network (AKIN) has reported Acute kidney injury currently in 30-40% of patients undergoing cardiac surgery, however the true incidence of ARI is difficult to estimate because of the different definitions used in the studies.

Recently the severity of acute kidney injury has been reported as a determinant of mortality in the short and medium term, patients with ARF requiring renal replacement therapy have mortality rates of over 40% to 50%.

The predisposing factors for development of ARI can be divided into preoperative and intraoperative factors. (Table 1)

Furthermore the role of cardiopulmonary bypass (CPB) in cardiac surgery is crucial because it allows the possibility to stop the heartbeat during the perioperative and the ability to maintain peripheral circulation and oxygenation of the patient, before the development of the cardiopulmonary bypass techniques only interventions "overcast" as mitral comisurotomy and even myocardial revascularization with considerable limitations with the heart beating.

Currently its appropriate function or efficiency translates into good tissue homeostasis, with minor side effects such as blood in contact with nonbiological surfaces a systemic inflammatory response is induced, so it is necessary to use heparin, hemodilution, some degree of hypothermia and an external pump to boost blood flow which in turn subjected to various physical stresses and strains; in that sense the alterations observed when the circulation pump is extended can be enhanced by surgical aggression and a syndrome of post-ischemic at the end of CPB reperfusion, initially identified as lung problems manifested after CPB, but soon found in other organs as the kidney, intestine, nervous system and hematológical system.

During CPB, elements of the blood, erythrocytes, leukocytes and platelets, plasma and proteins, are subject to different forces generated by the roller of the pump, suction cannulas and by the pressures generated at the end of the arterial cannula. Thus, by acting on the erythrocytes reduce its deformation and transportation of O2 to tissues, changes in the pumps of ionic exchange of membranes with cation entry into the cell, decreasing the mean life of the erythrocytes and hemolysis free of hemoglobin appears, this free hemoglobin increases tissue oncotic pressure and viscosity, being able to produce renal dysfunction.

Finally, the auto-oxidation of hemoglobin can release O2 radicals, which are cellular toxics to the kidney and the forces produced by the CEC also act on leukocytes, activated by changing their migration and phagocytosis capacity, being able to produce a leukopenia, generally followed by a leukocytosis after completion of CPB,

Preoperatives	Previous renal dysfunction
	Diabetes Mellitus (DM)
	Systolic cardiac dysfunction
	Hepatic Impairment
	Age over 65 years
	Nephrotoxic agents
Intraoperative	Hypovolemia
	Hypoperfusion
	Increased intra-abdominal pressure
	Embolism
	Renal ischemia
	Inflammation
	ECC prolonged (> 120 minutes)

Table 1. Most common risk factors for Acute Renal Failure.

which can be maintained for several days, the activation of leukocytes and platelets, together with erythrocytes and fibrin, results in the formation of microaggregates, these formations can pass through circulation as microemboli, embolizing tissue microcirculation, with special reperfusion in the kidney. In addition to the changes caused by hemodilution, hypothermia, and/or low output, the kidney may be affected by the impaction of microemboli cell debris and resulting free hemoglobin RBC hemolysis.

The increased mortality and complications observed in patients requiring renal replacement therapy (RRT). The incidence of ARF after cardiac surgery varies widely depending on the aggregate factors during the surgical procedure and immediate postoperative. Zanardo et al (1994) demonstrated IRA between 8-16% and the requirement of between 0.3-3.7% TRR. Therefore we conducted this study in our intensive care unit (ICU) to determine risk factors.

MATERIALS AND METHODS

The information was collected by researchers from the records of patients scheduled for heart surgery open heart admitted to the Intensive Care Unit of the Regional Hospital of High specialty (HRAEV) and XXI Century Medical Center (IMSS) 1 January 2013 to December 1, 2013, from a secondary source, this data collection was carried out in a form designed for this purpose. (Table 2)

Of the 450 files reviewed 69 were included who had a time of over 120 minutes (ECC> 120) extracorporeal circulation, general data of each patient, cardiovascular risk factors (CVRF) were recorded, data variables are also recorded to study and made a database for statistical tests determining the risk factors associated with acute renal impairment increased further to 120 minutes postoperative heart patients with cardiopulmonary (ECC).

The study was observational, descriptive, retrospective series of cases, the correlation between the preoperative and postoperative variables with renal dysfunction were studied by univariate analysis using the student test, and odds ratio (OR), a P value less than 0.05 was considered a significant risk factor, analyzes were performed using SPSS (version 10.0, Chicago, Illinois).

The populations included were: Patients over 18 years of age, baseline creatinine <1.2 mg, postoperative cardiac surgery of any myocardial revascularization, valve replacement with a mechanical or biological prosthesis, closing interatrial and interventricular communications and those patients requiring reoperation of chest surgery, patients requiring reoperation, patients without measurement of LVEF before surgery and ECC <120 minutes.

Variable	Description	Type of variable	Scale	Value
Age	Time since birth	Continuous	Ratio	Years
Genre	Difference between male and female	Discrete	nominal and dichotomous	1.Male 2 Female
FEVI<40%	Strength of left ventricular ejection	Discrete	nominal and dichotomous	1.Less 40% 2.Greater 40%
Hipoalbuminemia	Depreciation pathological albumin	Discrete	nominal and dichotomous	1.Less 3.0gr/dL 2.Greater 3.0gr/dL
Glomerular filtration	Filtration volume per unit time	Continuous	Interval	ml/min

Table 2. Few core variables of the study are shown

The overall prevalence of renal damage was determined by the scale of RIFLE and glomerular filtration rate (GFR) was calculated using Modification of Diet in Renal Disease (MDRD-7 = 170 × [serum creatinine (mg / dL)] × -0999 [age] -0.176 × [0.762 if patient is female] × [1.18 if patient is black] × [serum urea nitrogen concentration (mg/dL)] -0.170 × [serum albumin concentration (g/dL)] .0.318) is pooled in patients who had acute kidney injury without acute kidney injury defined by a decrease in GFR of 50% in the first 24 hrs.

Data from conventional hemodynamic monitoring were obtained, invasive blood pressure and non-invasive, is supported with mechanical ventilation, removal thereof gradually according to conventional parameters performed and sedation was discontinued, the overall prevalence of renal damage was estimated observed in postoperative CPB> 120 minutes. P was calculated for continuous and dichotomous variables OR discrete variables.

The demographic variables were age, gender, stay in the intensive care unit (ICU), the independent variables were, EuroSCORE scale, APACHE (Acute Physiology and Chronic Health Evaluation II-tion System), oxygenation index (PaO2/ FiO2) by maneuver PEEP and Vt increased in stages, surgical bleeding, mean arterial pressure (MAP), central venous pressure (CVP), glomerular filtration rate (GFR) by MDRD was measured after surgery; hours of mechanical ventilation (MV), serum albumin post CEC, decreased Hb postQx, diuresis (ml/hr), nitrogenous postQx. Postoperative complications were grouped condition: cardiovascular, renal, hematologic, neurologic and mortality was assessed.

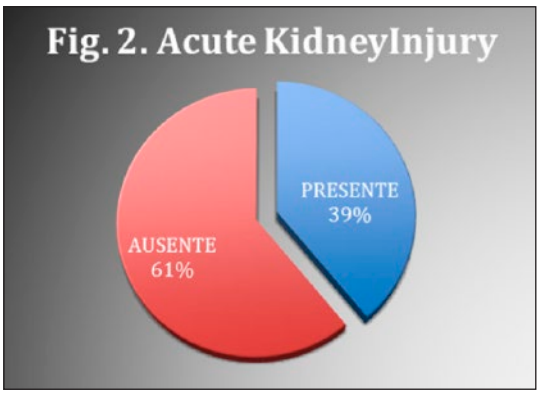

Fig 2. Percentage of acute renal damage observed in the immediate postoperative period of patients studied

RESULTS

69 cases were admitted in 2013 in the cardiovascular postoperative care units were analyzed; the highly specialized regional hospital (HRAEV) and Cardiology

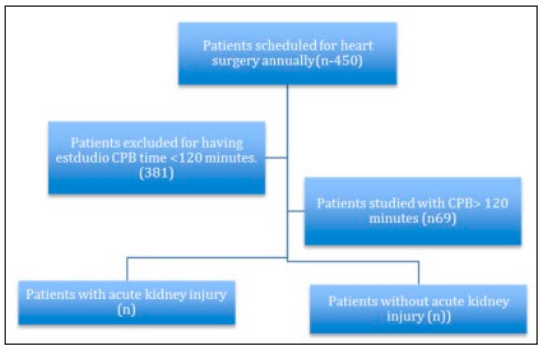

Fig 1. Diagram of patients in both study hospitals (Regional Specialty Hospital and Victoria Hospital Cardiology XXI)

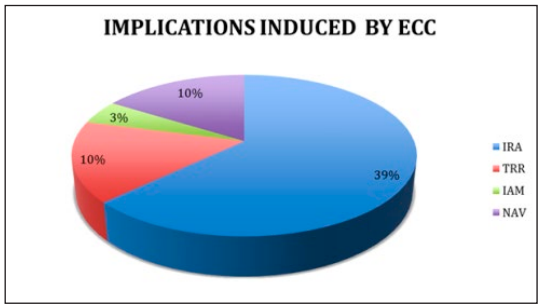

Fig 3. March. Acute Renal Failure (ARF), Renal Replacement Therapy (RRT), Acute Myocardial Infarction (AMI), Ventilation Associated Pneumonia (VAP).

Hospital XXI century all with prolonged extracorporeal > 120 minutes (Fig. 1), circulation time observed the average age was 53 with a standard deviation of 21, finding patients between 33 and 81 years, 73% of the study group belonged to the male gender (n=51) and 27% female (n=18), only 44% of the study group were older adults. Among the comorbidities or cardiovascular risk factors (CVRF) were grouped in patients who had more than 3 preoperative risk factors (62%) and only had 2 or fewer risk factors (38%). To stratify patients with APACHE severity scales and EuroSCORE observed in average 11.55±2.02 APACHE (9-17) and 6.50±1.25 EuroSCORE (4-9) in the PaO2/FiO2 ratio of patients seen a big difference on the beginning of surgery with respect to the first of its immediate postoperative period in the intensive care unit. (Table 3). Mean operative bleeding 877±78 (689-1120 ml) with support of blood.

The hemodynamic status of patients on admission to the intensive care unit were averaged:

- TAM 86±10 (67-102) mmHg in over 65 years vs 80±8.7 (68-99) mm Hg (p=NS).
- PVC 9.5±1.8 (6-14) mmHg in over 65 years vs 14± 2.8(10-23) mm Hg (p=NS).
- GC 3.1±0.8 (2.7-3.4) L/min at age 65 years vs. 3.4±1.1 (2.8-4.2) L/min (p=NS).

Urine output, elevation of nitrogenous and declining GFR determined by MDRD grouped patients with acute kidney injury using RIFLE score, the decline in GFR greater than 50% of baseline in the immediate postoperative patients in the study group was 39% (Fig. 2), plus the association of the following variables risk patients presenting with renal damage was measured. (Table 4)

The complications observed in this study were renal replacement therapy (RRT) in 10%, acute myocardial infarction (AMI) perioperative 3% systemic inflammatory response (SIRS) 6% syndrome, prolonged ventilation-associated pneumonia and mortality 10% 30%. (Fig. 3)

DISCUSSION

According to the high incidence of acute renal failure (ARF) of multifactorial origin in postsurgical patients and their clinical impact, early recognition of risk factors that help the early detection of acute renal failure in patients after cardiac surgery is necessary with prolonged extracorporeal pump; first of all it is important to mention that recent studies show that acute renal failure detection is a major risk factor for the development of non-renal complications and independently contributes to mortality in patients with cardiovascular surgery.

This, together with a better understanding of the evolutionary phases and the molecular mechanisms of renal dysfunction, has aroused the interest by getting an early detection of kidney injury by novel biomarkers of kidney damage, which could contribute in the future to a new definition universal of acute renal failure.

Currently, new functional classifications (RIFLE, AKIN and kinetic) advance to establish an agreed definition, but in practice continue based on the decrease in

Oxygenation index (Pa02/Fi02)	Pre-Qx	Post-Qx (UTI)	p value
Less than 65 years	310±37 (234-389)	226±27 (178-298)	p=>0.05
65 years and over	298±27 (230-356)	219±35 (167-290)	p=>0.05

Table 3. Comparison derecruitment observed during the time of secondary surgery with atelectasis.

glomerular filtration and/or elevation of nitrogenous products, the utility of RIFLE has proven effective to diagnose acute renal insufficiency and classify patients according to their functional severity, but it has also proven correlation as a prognostic marker.

In a systematic review, which included more than 71,000 patients, found 13 studies comparing mortality in patients with and without acute renal failure estimated by the RIFLE system, mortality was 6.95 and 31.2% respectively, in this study we found a mortality of 30% for as estimated in various studies, but it seems appropriate because all patients had systemic inflammatory response secondary to prolonged cardiopulmonary bypass.

Certainly as evidenced various area studies, our population was predominantly male with OR 1.6 (95% CI 0.54-4.66), the comorbidities present in cardiac patients were grouped to demonstrate the possibility of damage or impact on their postoperative early, knowing that these comorbid factors are causes of renal and cardiac damage, our study showed that 62% of patients met more than 3 factors obtaining a clear association with renal damage obtained by an OR 4.40 (95% CI 1 40 to 13.80).

Regarding the type of cardiac surgery influences postoperative renal dysfunction, it is known that procedures with prolonged cardiopulmonary bypass time present higher risk damage to all systems, although most models of risk stratification were primarily designed to predict mortality, postoperative morbidity has been recognized as the major determinant of hospital costs and quality of post-surgery life for that reason it is important to mention that the 2 severity scales in this study performed before surgery showed a patients with a mean score with some gravity, obtaining an association of EuroSCORE OR 1.75 (95% CI 0.53-5.71) for acute kidney injury in relation to the severity scale APACHE (Acute Physiology and Chronic Health Evalua-tion System II), estimated mortality of 15%, yet our mortality was higher due to independent risk patients being postoperative heart and all have impact due to systemic endothelial prolonged circulation, we obtained a 11.5 average APACHE no direct association with renal damage.

On average no direct association with renal damage. Upon receiving patients in intensive care units (ICUs) is necessary to evaluate the oxygenation index (PaO2FiO2), numerous studies supporting the need for alveolar recruitment in peri-chest surgery, this study demonstrates the importance to recover the oxygenation index arrival of patients to the intensive care unit, "Open Lung Concept" was performed by Grasso and cols maneuver; statistical significance in adults over 65 and adults <65 years was demonstrated, this result is already widely known by anesthesiologists and intensivists, because the recovery of PaO2, the decrease of dead space and PaCO2 improved

Variable	LVEF (less than 40%)	Absense of acute renal injury (ARI) n=42	Comparison
Comorbidities (greater than 3)	81.50%	50%	OR 4.40 (IC95% 1.40 - 13.80)
Gender (male)	66.70%	23.80%	1.6 (IC95% 0.54 - 4.66)
Hypoalbuminemia (<3.0gr/dL)	81.50%	26.20%	1.26 (IC95% 0.47 - 5.13)
Euroscore (over 6 points)	74.10%	16.70%	1.75 (IC95% 0.53 - 5.71)
LVEF (less than 40%)	70.40%	16.70%	2.10 (IC95% 0.661 - 6.71)

Table 4. Odds ratio (OR) of the core variables that are associated with acute kidney injury in patients after heart surgery with CPB increased to 120 minutes.

ventilation -perfusion (V/Q) minutes after the maneuver, and clinical implications since it significantly reduces the hours in ventilation without mentioning that also reduces costs by lowering ventilation hours.

During his stay in the ICU hemodynamic stability was observed with vasopressor and inotropic support to obtain a suitable low-dose vascular resistance (TAM), venous return or preload (CVP) and cardiac output (CO) in the first 24 hours of surgery.

As shown in Figure 2, acute renal damage was observed in 39% of the patients most in relation to international studies, it is important to mention that the type of population studied were patients with high clinical complexity from their comorbidities to surgical time, it is certainly necessary to extend this relationship of patients and reduce all the factors that were associated with acute kidney injury, such as decrease hypoalbuminemia (OR 1.26) and postoperative which alone is a direct factor of complications and mortality.

A clear association of acute renal failure with LVEF <40% with OR 2.10 (95% CI 0.661-6.71), manifesting mostly patients with a low cardiac output, with gradual recovery during the early postoperative hours without reaching the shock was demonstrated cardiogenic in most of them.

The complications observed in our study is similar to studies related to the postoperative heart surgery, acute renal failure was the most common complication and especially that more was related to our observed mortality.

CONCLUSIONS

Patients with prolonged extracorporeal circulation present greater renal damage than expected. In this study was observed in almost 40% of patients. The factors associated with renal injury were the presence of more than 3 comorbidities prior to surgery and LVEF less than 40%, less association we hipoalbuminemia <3.0gr/dL and EuroSCORE>6.

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