Cristina Satoko Mizoi[1], Cassiane Dezoti[2], Maria de Fátima Fernandes Vattimo [3]

Renal function of intensive care unit patients: plasma creatinine and urinary retinol-binding protein

Função renal de pacientes de unidade de terapia intensiva: creatinina plasmática e proteína carreadora do retinol urinário

1. Master, Nurse from the Albert Einstein Hospital, São Paulo (SP), Brazil.
2. Master, Nurse from the School of Nursing, Universidade de São Paulo – São Paulo (SP), Brazil.
3. PhD, Professor from the School of Nursing, Universidade de São Paulo – São Paulo (SP), Brazil.

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Author for correspondence:
Maria de Fátima Fernandes Vattimo
Address: Avenida Dr Enéas de Carvalho Aguiar, nº 419.
CEP: 05403 000. São Paulo (SP), Brazil
Phone number: 55 11 3066 7549 Fax number: 55 11 3066 7546
E-mail: nephron@usp.br

ABSTRACT

Objectives: The early assessment of renal dysfunction using common markers does not provide either a sensitive or specific indication of renal dysfunction in critically ill patients. More specific and sensitive markers are desirable for the early detection of an initial renal pathophysiological process. Urinary retinol-binding protein could be an alternative method to early evaluation of renal function in these patients.

Methods: This study followed-up 100 critical care patients and assessed their clinical and laboratory variables, including plasma creatinine and urinary retinol-binding ratio, and demographic variables.

Results: The sample was characterized by geriatric (63.4±15.6 years), male (68%), being 53% surgical patients. Statistical analysis showed association between plasma creatinine and the following variables: gender (p-0.026), age (p-0.038), use of vasoactive drugs (p-0.003), proteinuria (p-0.025), Acute Physiological Chronic Health Evaluation (APACHE) II score (p-0.000), urea (p-0.000), potassium (p-0.003) and estimated creatinine clearance (p-0.000). Urinary retinol-binding protein was correlated with more variables: weight, use of invasive ventilation (p-0.000), use of nonsteroidal anti-inflammatory drugs (p-0.018), use of vasoactive drugs (p-0.021), high temperature (>37.5ºC) (p-0.005), proteinuria (p-0.000), bilirubinuria (p-0.004), urinary flow (p-0.019), minimal diastolic pressure (p-0.032), minimal systolic pressure (p-0.029), APACHE II (p-0.000), creatinine (p-0.001), urea (p-0.001), estimated creatinine clearance (p-0.000). Urinary retinol-binding protein also tended to associate with previous renal disease, vasculopathy and neoplasm. Sodium excretion fraction correlated with plasma creatinine and urinary retinol-binding protein in univariate analysis.

Conclusions: Urinary retinol-binding protein might be considered in clinical practice as a better marker regarding diagnostic performance in patients at risk of developing acute kidney injury, when compared with other markers routinely used. Moreover, urinary retinol-binding protein has other features of a good diagnostic test – it is a practical and non-invasive method.

Keywords: Kidney/phisiopathology; Creatinine; Retinol-binding protein; Intensive care units

INTRODUCTION

The early assessment of renal dysfunction using common markers has not reduced the incidence and mortality of acute kidney injury (AKI) in intensive care patients.

Similar to international data, in Brazil, AKI is associated with about 50%, or higher, mortality, a prolonged time of hospitalization and therapy-related high

costs.[1] It should be emphasized that this situation probably underestimates the true number of deaths of patients with AKI.

In clinical practice, urea and creatinine are considered to be markers of renal glomerular function; however, it has been more widely applied to the assessment of glomerular filtration since others, like the measurement of plasma urea, are influenced by factors related to nitrogen metabolism such as calorie and protein ingestion, excessive protein catabolism caused by trauma, infection and fever, corticosteroid use, absorption of blood in the gastrointestinal tract and excessive protein ingestion.[2]

Although routinely used in clinical evaluations, the sensitivity and specificity of creatinine and urea are questionable since none of them provides evolutive data immediately after the onset of renal dysfunction, compromising the choice of the best time for their assessment.[3-5]

The distortions in creatinine values, the disproportion between its increased levels and the degree of renal damage, and particularly its late manifestation impair the monitoring of AKI and indicate the need for the identification of other more sensitive, specific and early markers of renal function.

Analysis of enzymuria, specifically urinary retinol-binding protein (uRBP), represents a probable alternative that might safely broaden the possibilities of including the risk evaluation in the follow-up of patients.

Analysis of enzymuria is a noninvasive, sensitive and specific method and an early indicator of tubular dysfunction.[6] Among other low molecular weight proteins, uRBP offers advantages as a marker since its production is relatively constant, with no reports of clinical situations relating a high production with abnormal concentrations in urine, and it is stable at urinary pH. [7] uRBP is a glycoprotein that belongs to the alpha-globulin family and it is a low molecular weight enzyme (approximately 21.0 kDa) produced by hepatocytes. uRBP possesses a binding site for the retinol molecule and about 90% of it circulates in plasma bound to prealbumin in the form of a protein complex. [7-9]

The objective of the study was to evaluate the diagnosis performance of biomarkers of renal function, including uRBP for the identification of patients with AKI.

METHODS

The present clinical, exploratory descriptive, quantitative, cross-sectional uncontrolled study was conducted, at a 24-bed adult intensive care unit (ICU) of a large general private hospital.

Sample

The sample consisted of adult patients (older than 18 years) directly admitted to the ICU, who agreed to participate in the study after receiving instructions from the researchers and who signed a free informed consent form. All patients were evaluated regarding demographic characteristics, the relation between plasma creatinine and uRBP, clinical and laboratory variables as well as the sensitivity and specificity of uRBP as a marker of renal damage.

Data collection

Data were collected after approval of the study by the Ethics Committee of the Institution. The following data were obtained from the patient records: patient identification, date and time of admission to the ICU, origin, cause of hospitalization, clinical history, medications taken during the last 5 days, mean temperature, urinary flow, mean arterial pressure, type of ventilation, medications used during hospitalization, dialysis treatment, arterial pH and HCO_3, occurrence of coma and presence of jaundice.

The results of plasma creatinine, urea, sodium (Na) and potassium (K) analysis were also obtained from the records. The following laboratory values were considered to be normal in the present study: creatinine – 0.8 to 1.2 mg/dL (kinetic amidohydrolase method), urea - 10 to 40 mg/dL (urease calorimetric method), Na - 135 to 145 mEq/L (potentiometric method), and K – 3.5 to 5.0 mEq/L (potentiometric method). These were the parameters used as reference in the institution where the study was conducted and the serum creatinine reference, that considers some degree of renal dysfunction, is as published elsewhere.[10]

In addition to serum parameters, urine was collected from the patients. Ten milliliters (10 mL) of urine was collected from the bladder catheter or by spontaneous diuresis. A small part of the urine sample was used for urinalysis using a reagent strip for the identification of protein, pH, blood, billirubin, ketones and glucose. The remaining sample was sent immediately after collection to the laboratory of clinical analyses of the institution, where it was centrifuged, divided into two 5-mL tubes and frozen at -20ºC for later analysis of uRBP and urinary Na and creatinine.[7,11-12]

Urinary RBP was determined by nephelometry (uRBP up to 0.53 mg/L). Sodium excretion fraction (FE_{Na}) was calculated based on plasma Na and creatinine concentrations determined by the potentiometric and kinetic amidohydrolase methods, respectively, and urinary Na and creatinine concentrations in isolated samples measured by the potentiometric and enzymatic urease methods, respectively. The formula used for the calculation of FE_{Na} was

(NaU x CrS/ NaS x CrU) x 100, where NaU = urinary sodium, NaS = plasma sodium, CrU = urinary creatinine, and CrS = plasma creatinine.[13]

Calculation of estimated creatinine clearance (ClCr) was performed by the Cockcroft-Gault formula with normal estimated ClCr values of 80 to 120 mL/min.[14-15]

Plasma creatinine was considered to be the gold standard for the characterization of normal (≤1.2 mg/dL) or altered (>1.2 mg/dL) renal function in patients and to guide the analysis of the behavior of the other markers.

APACHE (Acute Physiologic and Chronic Health Evaluation) scores were obtained from the patients to determine a possible relationship between renal function and other clinical signals. APACHE was ought to be evaluated in the first 12 hours after the patient admission in intensive care unit [16]

Statistical analysis

The chi-square test was used to identify associations between the classes of variables, with $p<0.05$ being considered significant.[17] The non-parametric Mann-Whitney test was applied for comparison between all variables studied and creatinine (higher or lower than 1.2 mg/dL) and uRBP concentrations (higher or lower than 0.53 mg/L), with the level of significance set at 0.05.[17-19]

Sensitivity and specificity measures were applied and they were determined by the location of a cut-off point between normal and abnormal values and based on the receiver operating characteristic (ROC) curve.[20]

RESULTS

One hundred patients were included. Sixty-eight percent of the patients were males and 32% were females. The mean age was 63.4 ± 15.6 years. The sample was characterized by a predominantly geriatric population older than 65 years (47%). The cause of ICU admission was clinical in 47% of the patients and surgical in 53%. With respect to origin, 12% of the patients were referred from home, 27% from emergency departments, 44% from a surgical center, and 17% from other places (other hospitals, diagnostic centers, etc.). Data were collected during the first 13.9 ± 8.3 hours after admission of the patient to the ICU.

Eighty-one (81%) patients presented creatinine values up to 1.2 mg/dL during the first hours of admission, while values higher than 1.2 mg/mL were observed in 19 patients (19%). Urinary RBP was lower than 0.53 mg/L in 68 patients (68%) and higher than 0.53 mg/L in 32 (32%). Table 1 shows the relationship between plasma creatinine and uRBP and the demographic and clinical variables studied.

With respect to the other clinical variables, an association was observed between elevated creatinine (1.4±1.4 mg/dl, $p<0.001$) and uRBP and higher APACHE II scores (18±7, $p=0.000$) and between normal uRBP concentrations and higher urinary flow (128±94 ml/min, $p<0.019$). Altered uRBP values showed an association with lower minimum diastolic (55±14 mmHg, $p<0.032$) and systolic arterial (100mmHg±24, $p<0.029$) pressures.

Table 2 shows the relationship between plasma creatinine and uRBP and the laboratory variables studied. Normal creatinine concentrations were associated with normal urea and K levels and an elevated estimated ClCr. Normal uRBP levels showed an association with normal creatinine and urea levels and an elevated estimated ClCr. No association was observed between uRBP and Na or K.

Variables showing an association or a tendency toward an association with creatinine in the univariate analysis were age, gender, estimated ClCr, urea, K, FE_{Na}, APACHE II, protein, and urinary billirubin. Table 3 lists only the variables that showed an association with creatinine.

Patients with creatinine values above 1.2 mg/dL were nine times more likely to show urea levels above 40 mg/dL and approximately four times more likely to have a FE_{Na} above 1.1%.

Variables showing an association or a tendency toward an association with uRBP upon univariate analysis were age, weight, body mass index, estimated ClCr, creatinine, urea, Na, FE_{Na}, a history of renal disease, vasculopathy and neoplasm, use of nonsteroidal anti-inflammatory and neoplastic drugs, APACHE II, minimum systolic and diastolic arterial pressure, protein, and urinary bilirubin. Table 4 lists only the variables that showed an association with uRBP.

Patients with altered uRBP were three times more likely to have urea levels above 40 mg/dL, four times more likely to have creatinine values above 1.2 mg/dL, two times more likely to have Na levels above 145 mEq/l and one time more likely to have a FE_{Na} above 1.1%.

Patients with uRBP higher than 1.47 mg/L were 4.63 times more likely to show a creatinine concentration higher than 1.2 mg/dL.

The overall accuracy of uRBP as a diagnostic test demonstrated by the area under the receiver operating characteristic (ROC) curve was not so high. This is presented in the Figure 1 which summarizes the results of the analysis of sensitivity and specificity using the ROC curve.

Table 1 - Relationship between plasma creatinine and urinary retinol-binding protein values and demographic and clinical variables studied (n=100)

Variable	Creatinine			uRBP		
	≤1,2 mg/dl	>1.2 mg/dl	P value	≤0,53 mg/l	>0,53 mg/l	P value
Gender						
Male	51 (63)	17 (90)	0.03	47 (70)	21 (68)	0.89
Female	30 (37)	2 (11)		21 (31)	10 (32)	
Age (years)						
<65	47 (58)	6 (32)	0.04	39 (57)	14 (45)	0.26
>65	34 (42)	13 (68)		29 (43)	17 (56)	
History – renal disease						
No	79 (98)	17 (90)	0.11	67 (99)	28 (90)	0.05
Yes	2 (3)	2 (11)		1 (2)	3 (10)	
History – vasculopathy						
No	80 (99)	18 (95)	0.26	68 (10)	29 (94)	0.01
Yes	1 (1)	1 (5)		-	2 (7)	
History – neoplasm						
No	58 (72)	17 (90)	0.11	55 (81)	20 (65)	0.08
Yes	23 (28)	2 (11)		13 (19)	11 (36)	
Mechanical ventilation						
No	60 (74)	10 (53)	0.09	57 (84)	13 (42)	0.00
Yes	21 (26)	9 (47)		11 (16)	18 (58)	
Nonsteroidal anti-inflammatory drugs						
No	71 (88)	18 (95)	0.38	57 (84)	31 (100)	0.02
Yes	10 (12)	1 (5)		11 (16)	-	
Beta-lactam antibiotics						
No	43 (53)	7 (37)	0.20	38 (56)	12 (39)	0.11
Yes	38 (47)	12 (63)		30 (44)	19 (61)	
Vasoactive drugs						
No	70 (88)	11 (58)	0.00	60 (88)	20 (68)	0.02
Yes	10 (13)	8 (42)		8 (12)	10 (33)	
Temperature >37.5ºC						
No	73 (92)	15 (83)	0.36	63 (97)	24 (78)	0.01
Yes	6 (8)	3		2	7 (23)	
Protein (reagent strip)						
Negative	47 (58)	6	0.03	48	5 (16)	0.00
traces	20 (25)	5		18	7 (23)	
++	8 (10)	3		1	9 (29)	
+++	5 (6)	2		1	6 (20)	
>+++	1 (1)	3		-	4 (13)	
Bilirubin (reagent strip)						
Negative	64 (79)	14	0.07	58	19 (61)	0.004
traces	13 (16)	1		8	6 (19)	
++	1 (1)	2		2	1 (3)	
+++	3 (4)	2		-	5 (16)	

uRBP = urinary retinol-binding protein. Results are expressed in N(%); Chi-square test

Table 2 - Relationship between plasma creatinine and urinary retinol-binding protein values and laboratory variables studied (n=100)

Variable	Creatinine			uRBP		
	≤1.2 mg/dl	>1.2 mg/dl	P value	≤0.53 mg/l	>0.53 mg/l	P value
Creatinine (mg/dl)	-	-	-	0.9±0.4	1.4±1.4	0.00
Urea (mg/dl)	36±15	63±2	0.00	37±18	49±19	0.00
Sodium (mEq/l)	140±4	139±3	0.17	140±4	140±4	0.58
Potassium (mEq/l)	4.2±0.4	4.8±0.8	0.00	4.3±0.6	4.3±0.5	0.83
FE_{Na} (%)	1.1±1.1	1.6±1.4	0.14	1.2±1.1	1.4±1.4	0.72
ClCr (ml/min)	111±39	49±23	0.00	102±39	68±40	0.00

SD – standard deviation; FE_{Na} – sodium fractional excretion; ClCr – estimated creatinine clearance; uRBP = urinary retinol-binding protein. Results are expressed in mean±standard deviation; p<0.05 (Mann-Whitney test)

Table 3 - Univariate analysis between creatinine values and laboratory variables (n=100)

Variable	Urea		OR(95%CI)
	≤40 mg/dl	>40 mg/dl	
Creatinine			
≤1.2 mg/dl	51 (94)	30(65)	1
>1.2 mg/dl	3(6)	16(35)	9.07(2.44-33.70)
	FENa		
	≤1%	>1.1%	
Creatinine			
≤1.2 mg/dl	49(90)	34(71)	1
>1.2 mg/dl	5(10)	14(29)	3.79 (1.24-11.53)

OR – odds ratio; CI – confidence interval; FE_{Na} – fractional excretion of sodium. Results are expressed in N (%) and OR (95%CI, lower and upper limits)

Table 4 - Univariate analysis between urinary retinol-binding protein (uRBP) values and laboratory variables (n=100)

Variable	Urea		OR(95%CI)
	≤40 mg/dl	>40 mg/dl	
uRBP			
≤0.53 mg/l	43(80)	25(56)	1
>0.53 mg/l	11(20)	20(44)	3.13(1.29-7.58)
	Creatinine		
	≤1.2 mg/dl	>1.2 mg/dl	
uRBP			
≤0.53 mg/l	60(75)	8(42)	1
>0.53 mg/l	20(25)	11(58)	4.13(1.46-11.69)
	Sodium		
	≤145 mEq/l	>145 mEq/l	
uRBP			
≤0.53 mg/l	66(97)	29(94)	1
>0.53 mg/l	2(3)	2(7)	2.28(0.31-16.95)
	FE_{Na}		
	≤ 1%	>1%	
uRBP			
≤0.53 mg/l	36(71)	32(67)	1
>0.53 mg/l	15(30)	16(33)	1.20(0.51-2.81)

OR – odds ratio; CI – confidence interval; FE_{Na} – fractional excretion of sodium; uRBP = urinary retinol-binding protein. Results are expressed in N (%) and OR (95%CI, lower and upper limits)

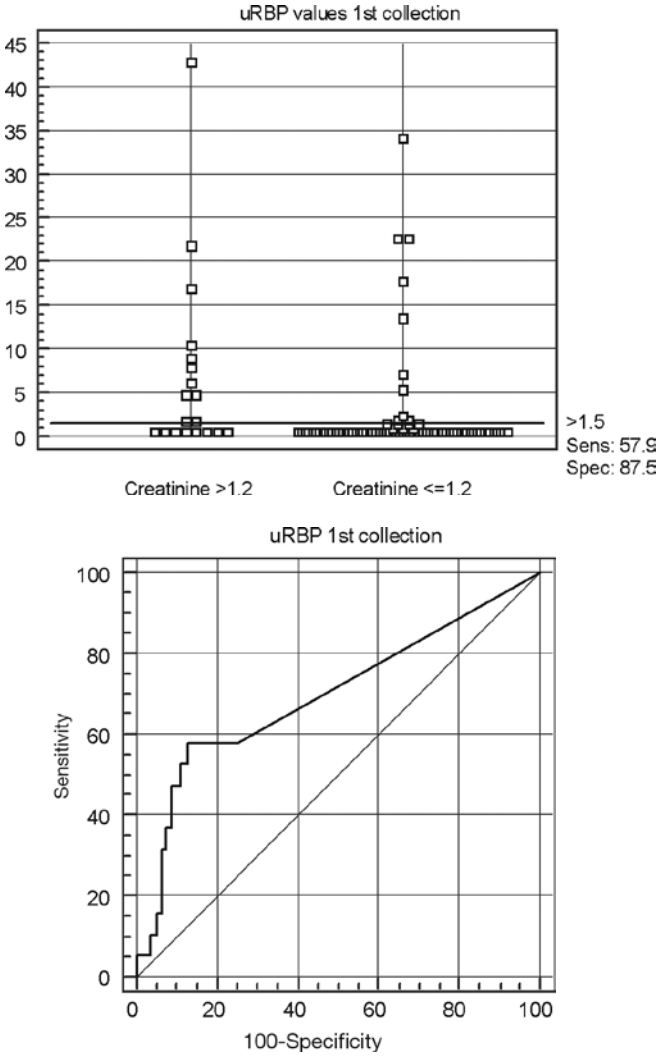

Figure 1- ROC curve obtained for urinary retinol-binding protein (uRBP). (n=100).

DISCUSSION

The overall hospital mortality related to AKI has been mentioned to be more than the usual 50%.[20] Early recognition of that syndrome could help clinical management, but current indices lack in offering sufficient predictive value for AKI.

The availability of urinary markers as non invasive instrument to identify early AKI may provide important diagnostic and prognostic data for critically ill patients. Also, the detection of any abnormality in urinary markers consistent with AKI may allow initiation of supportive therapies and interventions before the development of total dysfunction. This study evaluated the uRBP performance in contrast to the crea-

tinine performance in indicating renal damage.

Characterization of the study sample showed a discrete prevalence of surgical patients compared to clinical patients. Cardiovascular changes were the most frequent systemic alterations. There was also a predominance of males and individuals older than 65 years. These characteristics, i.e., male sex, geriatric and surgical patients and patients with cardiovascular system diseases, characterize the profile of ICU patients. It must be pointed out that if, on the one hand, aging of the general population together with technological advances has improved the life expectancy of ICU patients, on the other hand, it has contributed to an increase in severity, with a clear change in the risk profile being observed.[21,22-26] Coronary disease has accompanied the aging process of the population. In Brazil, according to data of the Brazilian public health system, 398,000 hospitalizations are due to coronary insufficiency. In the group of patients older than 60 years, coronary disease was the main cause of hospitalization.[27] Brivet et al.[24] showed that age and clinical history are factors predictive of AKI in intensive care patients. These data were corroborated by Liãno et al.[28] who described previous renal failure, age, gender, mechanical ventilation, hypotension and oliguria to be associated with the syndrome.

With respect to renal function, in the present study most patients admitted to the ICU showed no dysfunction with creatinine concentrations below 1.2 mg/dL. Instead, at the same point, uRBP was altered in most of them. This finding suggests that uRBP may signal renal disturbance, possibly tubular, still not detected by the determination of serum creatinine concentration. An increase in the excretion of urinary markers, while only a part of the cellular sample sediments showed pathological results, was observed in a clinical study that included 400 urine samples. Taking together, the data suggest that quantitative measurement of urine proteins from both glomerular and tubular sides should be used upfront as screening parameters for the early detection of renal disorders .[23]

Moreover, when the clinical history of the patients was compared with creatinine and uRBP concentrations, the presence of renal disease, vasculopathy and neoplasm tended to be associated with altered uRBP. These morbidities are considered to be important variables in the identification of patients at risk of renal dysfunction, and also influence the prognosis. This finding, together with the fact that the data were collected within the first hours after admission to the ICU, suggests that uRBP can be considered, probably with advantages over creatinine, in the identification of patients at risk of developing renal dysfunction.[24]

With respect to drug treatment, no association was observed between creatinine and uRBP and current use of nephrotoxic drugs such as certain classes of antibiotics, converting enzyme inhibitors, antineoplastic and immunosuppressive drugs, diuretics, and radiologic contrast media. However, the use of vasoactive drugs was associated with altered creatinine and uRBP levels. In the present study, the most frequently used vasoactive drugs were noradrenaline, nitroglycerine, dobutamine and sodium nitroprusside.

Vasoactive drugs are used to increase cardiac output or mean arterial pressure, improving blood flow and, consequently, protecting the kidney. However, controlled clinical trials must be developed to describe conclusive data.[29] The use of noradrenaline in intensive care patients with hypotension and evidence of renal dysfunction is still controversial.

However, there are reports indicating that the use of noradrenaline is related to a reduction in renal blood flow, since the drug induces vasoconstriction through alpha-adrenergic stimulation, thus causing a decrease in organ perfusion. Vascular resistance might increase proportionally to the perfusion pressure, with a reduction in blood flow, particularly in the kidney.[30] Normal uRBP values were associated with the use of nonsteroidal anti-inflammatory drugs. This finding confirms previous reports regarding the use of these drugs and the occurrence of renal damage. Although these drugs are known to interfere with the synthesis of renal protective prostaglandins through the inhibition of cyclo-oxygenases I and II, their nephrotoxic potential is questionable when they are administered alone or in the absence of other risk factors of AKI.[31] Despite the risk factors of AKI observed in the present study (advanced age and cardiovascular disease), no association was observed between uRBP and the use of these drugs.

The risk of developing hospital AKI is generally associated with different clinical disorders. Frequently, a combination of acute conditions is observed, such as exposure to aminoglycoside antibiotics and sepsis, the use of radioactive drugs and angiotensin inhibitors, or treatment with nonsteroidal anti-inflammatory drugs and the presence of congestive heart failure.[21,32]

The urine analysis using reagent strips, in the present study showed an association between the absence of urinary protein and normal creatinine and uRBP

values. Normal urinary bilirubin and protein, together with high urinary flow, were correlated with normal uRBP concentrations.

Increased proteinuria, more specifically albumin, is associated with glomerular dysfunction due to an increase in membrane permeability, so that protein is only detected in urine in the presence of glomerular dysfunction.[18] The presence of bilirubin in urine may indicate hepatic dysfunction and is therefore associated with jaundice which, according to Liãno et al.[28], might be related to the evolution of AKI. The results of the present study confirm these data since the absence of urinary proteinuria and bilirubin, together with normal urinary flow, was correlated with normal creatinine and uRBP values.

Analysis of the clinical variables showed no correlation between arterial pressure and altered creatinine; however, minimum systolic and diastolic arterial pressures were significantly lower in the group of patients with altered uRBP. The mean arterial pressure compatible with adequate renal perfusion has not been well established, but a mean of about 70 mmHg has been considered to be adequate, with lower values being observed in the present study.[33] As mentioned earlier, according to Liãno et al.[28], hypotension characterized by a decline in minimum diastolic pressure has been considered an indicator of poor prognosis of AKI.

An association was observed between high APACHE II scores and elevated creatinine and uRBP concentrations. It should be emphasized that elevated creatinine, as a variable of APACHE II, might have contributed to the higher total score among others. Similarly, clinical variables showing an association with uRBP in the present study, i.e., plasma Na and creatinine, mean arterial pressure and the presence of chronic disease, are also components of APACHE II.

It should also be considered that, according to studies on AKI, mortality and severity scores such as APACHE II are of low accuracy when used as predictors of patient mortality.[22,28] The association between admission and subsequent outcome suggests that the patient did not receive treatment and therefore the use of these parameters is not appropriate for longitudinal assessment of morbidity during the patient's stay in the ICU without additional validation.[3]

Regarding laboratory variables, the findings of the present study confirmed the correlation between plasma creatinine and uRBP and classically used markers of renal function: urea, creatinine and estimated ClCr. When the data were submitted to univariate analysis, an association was also identified between plasma creatinine and uRBP and FE_{Na}.

These data indicate a satisfactory discriminatory power of these markers, specially uRBP, considering that serum creatinine uses to be a late marker of kidney dysfunction and injury, that this is the major limitation in improving outcomes of AKI and reinforcing that presently, no available commercial test offers diagnosis, nor the ability to stratify patients by severity of injury, early in the course of disease when therapy may be beneficial, it ought to be pointed out the better global performance of uRBP, once in this study it showed a wider range when the clinical variables related to the occurrence of renal damage was considered.[34]

Despite the accuracy of uRBP as a diagnostic test was not high, this finding does not contradict the qualities of this enzyme as a good marker of renal function, but longitudinal studies are necessary to obtain more conclusive data.

CONCLUSION

In summary, the present results further indicate a profile of intensive care patients corresponding to geriatric male subjects with cardiovascular disease and normal renal function on admission to the ICU. The markers of renal function that showed the best discriminatory power were plasma creatinine and urea, estimated ClCr and uRBP. Although the sensitivity and specificity of uRBP observed in the present study were low, in clinical practice this might be considered a good marker for patients at risk of developing AKI, compared to other routinely used markers. Moreover, uRBP shows other features of a good diagnostic test it is a practical and noninvasive method.

RESUMO

Introdução: A avaliação precoce da disfunção renal usando marcadores usuais não supre uma indicação quer da sensitividade e da especificidade da disfunção renal de pacientes críticos. Seriam desejáveis marcadores mais específicos e sensíveis para a detecção precoce de um processo fisiopatológico renal em fase inicial. A proteína carreadora do retinol urinário poderia ser um método alternativo para avaliação precoce da função renal destes pacientes.

Métodos: O estudo acompanhou 100 pacientes em terapia intensiva e avaliou suas variáveis clinicas e laboratoriais, incluindo a dosagem de creatinina plasmática e proteina carreadora do retinol urinário e as variáveis demográficas.

Resultados: A amostra foi caracterizada por pacientes geriátricos (63,4±15,6 anos), homens (68%), sendo 53% cirúrgicos. Análise estatística mostrou associação entre creatinina plasmática e as seguintes variáveis: gênero (p=0,026), idade (p=0,038), uso de medicação vasoativa (p=0,003), proteinúria (p=0,025), escore *Acute Physiological Chronic Health Evaluation* (APACHE) II (p=0,000), uréia (p=0,000), potássio (p=0, 003) *clearance* de creatinina estimado (p=0, 000). A proteína carreadora do retinol urinário correlacionava-se com outras variáveis: peso usa de ventilação invasiva (p=0,000), uso de medicamentos antinfamatórios não-esteróides (p=0,018), uso de medicação vasoativa (p=0, 021), temperatura alta (>37,5ºC) (p=0, 005), proteinúria (p=0, 000), bilirubinúria (p=0, 004), fluxo urinário (p=0, 019), pressão diastólica mínima (p=0, 032), pressão sistólica mínima (p=0, 029), APACHE II (p=0.000), creatinina (p=0,001), uréia (p=0,001) e *clearance* de creatinina estimado (p=0,000). A proteína carreadora do retinol urinário também tende a ser associada com doença renal anterior, vasculopatias e neoplasias. Na análise univariada, a fração de excreção de sódio se correlacionou com creatinina plasmática e proteina carreadora do retinol urinário.

Conclusão: A proteina carreadora do retinol urinário, na prática clínica, pode ser considerada um marcador mais apropriado para o diagnóstico em pacientes com risco de desenvolver uma insuficiência renal aguda, quando comparada com outros marcadores usados rotineiramente. Ademais, a proteina carreadora do retinol urinário apresenta outros aspectos de um bom teste diagnóstico – é um método prático e não-invasivo.

Descritores: Rim/fisiopatologia; Creatinina; Proteínas de ligação ao retinol; Unidades de terapia intensiva

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