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ORIGINAL ARTICLE

SEVERITY AND OUTCOME OF PATIENTS WITH ACUTE KIDNEY INJURY IN THE INTENSIVE CARE UNIT

GRAVIDADE E DESFECHO DE PACIENTES COM LESÃO RENAL AGUDA NA UNIDADE DE TERAPIA INTENSIVA

GRAVEDAD Y RESULTADO DE PACIENTES CON LESIÓN RENAL AGUDA EN LA UNIDAD DE CUIDADOS INTENSIVOS

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ABSTRACT

Objective: identifying whether the presence of health problems interferes with the outcome of patients who evolve to acute kidney injury (AKI) in the intensive care unit (ICU). ***Method***: quantitative, longitudinal, prospective study conducted in the ICU at a public hospital with a sample of 19 patients and data collection through a structured questionnaire. Data was analyzed statistically by means of the Kruskal-Wallis and Fisher's exact tests, with a significance level of $p < 0.05$. ***Results***: 31.6% of the patients were at risk for AKI and 15.8% had kidney failure, according to the classification "risk, injury, failure, loss, end-stage kidney injury" (RIFLE). Increased body mass index (BMI) showed a significant association ($p = 0.01$) with renal injury; 68.4% of the patients were discharged from hospital. ***Conclusion***: patients who accumulated any health condition, such as increased BMI, were more predisposed to progress with AKI. The findings of this study contribute to show the importance of daily weight control in critically ill patients as a preventive measure against health problems and a measure that promotes mortality reduction. ***Descriptors***: Intensive Care Units; Acute Renal Injury; Health Evaluation; Weight Gain; Mortality.

RESUMO

Objetivo: identificar se a presença de agravos à saúde interfere no desfecho de pacientes que evoluem com lesão renal aguda (LRA) na unidade de terapia intensiva (UTI). ***Método***: estudo quantitativo, longitudinal, prospectivo realizado na UTI de um hospital público com amostra de 19 pacientes e coleta de dados por meio de questionário estruturado. Os dados foram analisados estatisticamente pelos testes de Kruskal-Wallis e exato de Fisher, com nível de significância de $p < 0,05$. ***Resultados***: 31,6% dos pacientes evoluíram com risco para LRA e 15,8% com falência renal, segundo a classificação "risk, injury, failure, loss, end-stage kidney injury" (RIFLE). O aumento do índice de massa corporal (IMC) mostrou associação significativa ($p = 0,01$) com lesão renal; 68,4% dos pacientes obtiveram alta hospitalar. ***Conclusão***: pacientes que acumularam alguma condição de agravo à saúde, como aumento do IMC, mostraram-se mais predispostos a evoluir com LRA. Os achados deste estudo contribuem por mostrar a importância do controle de peso diário de pacientes críticos como medida preventiva de agravos à saúde e medida promotora de redução da mortalidade. ***Descritores***: Unidades de Terapia Intensiva; Lesão Renal Aguda; Avaliação em Saúde; Ganho de Peso; Mortalidade.

RESUMEN

Objetivo: identificar si la presencia de problemas de salud interfiere con el desenlace de pacientes que evolucionan a lesión renal aguda (LRA) en la unidad de cuidados intensivos (UCI). ***Método***: estudio cuantitativo, longitudinal, prospectivo realizado en la UCI de un hospital público con muestra de 19 pacientes y recogida de datos a través de un cuestionario estructurado. Los datos se analizaron estadísticamente mediante la prueba de Kruskal-Wallis y la prueba de Fisher, con un nivel de significación de $p < 0,05$. ***Resultados***: 31,6% de los pacientes tenían riesgo de LRA y 15,8% tenían insuficiencia renal, según la clasificación "risk, injury, failure, loss, end-stage kidney injury" (RIFLE). El aumento del índice de masa corporal (IMC) mostró una asociación significativa ($p = 0,01$) con lesión renal; 68,4% de los pacientes tuvieron alta hospitalaria. ***Conclusión***: pacientes que acumularon alguna condición de salud, como un IMC aumentado, estaban más predispuestos a progresar con LRA. Los hallazgos de este estudio contribuyen a mostrar la importancia del control diario del peso de pacientes críticamente enfermos como una medida preventiva contra los problemas de salud y una medida que promueve reducción de la mortalidad. ***Descriptores***: Unidades de Cuidados Intensivos; Lesión Renal Aguda; Evaluación de Salud; Aumento de Peso; Mortalidad.

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INTRODUCTION

Acute kidney injury (AKI) is regarded as an abrupt condition that takes place in 7 days or less, potentially reversible, whose clinical reality is often seen in intensive care units (ICUs).[1,2] It is characterized by a rapid decline in glomerular filtration rate and this may be accompanied by retention of nitrogenous products and hydroelectrolytic disorders. Currently, its identification and staging are routinely guided by the classifications "risk, injury, failure, loss, end-stage kidney injury" (RIFLE), "Acute Kidney Injury Network" (AKIN), or "Kidney Disease Improving Global Outcomes" (KDIGO), which adopt for this purpose the criteria serum creatinine and urine output.[3]

Epidemiological data show that AKI is less frequent in the so-called 'healthy' community (0.4% to 0.9%) than in hospitalized patients (4.9% to 7.2%). The accumulation and severity of comorbidities make patients more and more vulnerable to AKI. Also, these factors, allied to advanced age, diabetes mellitus, and hypertension, often overlap and increase patient complexity and, consequently, mortality.[2] Given this reality, patients with severe AKI can achieve 80% of mortality. However, among survivors and those dependent on dialysis, this percentage is estimated around 13%. It is worth highlighting that 5% to 20% of patients admitted to the ICU have at least one episode of AKI associated with multiple organ and system failure.[4-5]

AKI is a severe disease associated with high morbidity and mortality. The hospital environment may predispose and aggravate this condition, contributing directly to increase the prevalence and severity of cases. The use of vasoactive drugs, stress, anxiety, and depression are factors that may contribute to the occurrence of comorbidities and, in turn, increase the AKI incidence.[3]

Evidence indicates that sepsis and systemic inflammatory processes are the main cause of AKI, especially when combined to advanced age and morbidities have a negative impact on the survival of AKI patients in ICUs.[3-6]

Reduction in the incidence, clinical worsening, and mortality of patients affected by AKI is related to the adoption of preventive measures and early diagnosis. Thus, identifying factors related to increased severity may be key and make a difference in the patients' outcome. In this direction, a crucial condition to be considered relates to the health professionals' ability, especially nurses, to identify these factors on an early basis, in order to mediate specific and unique interventions aimed at these patients' needs.[6,7]

OBJECTIVE

- Identifying whether the presence of health problems interferes with the outcome of patients who evolve to acute kidney injury in the intensive care unit.

METHOD

Quantitative, longitudinal, prospective study conducted in an adult general ICU at a public hospital of the State Health Department of the Brazilian Federal District (SES DF). Data collection occurred from January to June 2016.

The convenience sample consisted of patients who evolved to AKI after admission to the ICU. Patients older than 18 years were included and those with a previous history of kidney failure (glomerular filtration rate < 60 mL/min) were excluded, as well as those with staging of risk for AKI through the classification RIFLE.[8]

The classification RIFLE is based on the definition of 3 AKI stages (risk, injury, and failure), which are grounded in serum creatinine changes combined or not to urinary output changes, thus defining the renal dysfunction stages.[8]

Data collection was performed by filling out a structured instrument containing identification, sociodemographic, clinical, surgical, hemodynamic, and laboratory data, obtained from the electronic medical record provided by the Trakcare system of the SES DF. All 19 study participants signed the free and informed consent term.

The reference values adopted in laboratory examinations and hemodynamic measures followed the protocol provided by the SES DF. For instance: leukocytes = 3,800-9,800/mm^3; urea = 20-40 mg/dL; sodium = 138 or 135 mEq/L; potassium = 3.5 to 5.0 mEq/L; serum creatinine male = 0.7-1.2 mg/dL and female = 0.5-1.1 mg/dL; heart rate (HR) = 60-100 bpm/min; systolic blood pressure (SBP) = 120-80 to 139-89 mmHg; mean arterial pressure (MAP) = 60-80 mmHg; respiratory rate (RR) = 12-20 cycles/min; peripheral oxygen saturation (SPO^2) = 95-100%; temperature = 35.8-37°C.

For conducting the study, a database was prepared on the software *Epi Info*, version 7. Relative and absolute frequencies, average values, standard deviation, and median values (25 and 75 percentiles) were calculated. The Kruskal-Wallis test and Fisher's exact test were used for comparing the groups. The

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result was considered significant when $p < 0.05$.

This study was approved by the Research Ethics Committee of the Health Sciences Teaching and Research Foundation of the SES DF (FEPECS/SES DF), under the Expert Opinon no. 1.399.410 and the Brazilian Certificate of Submission for Ethical Assessment (CAAE) no. 51515515.0.0000.5553 - complying with Resolution CNS no. 466/2012.

RESULTS

We monitored 19 patients who progressed with AKI during the ICU stay. The average age of these patients was 58.8 ±20 years. Most of them (52.6%) declared themselves to be white-skinned, 26.3%, black-skinned, and 21.0% brown-skinned. However, out of those who progressed with AKI, most (64.2%) were black-skinned ($p = 0.02$).

The average Glasgow coma scale and the APACHE score (9 ±4; 21 ±7.5), respectively, revealed the patients' severity condition. As an example, most patients (78.9%) remained on mechanical ventilation in the controlled mode for 18.7 ±13.3 days. Only 10.5% remained in the spontaneous or controlled ventilatory mode. Positive end-expiratory pressure (PEEP) of most patients (68%) showed a tendency to increase during follow-up (9 to 12 cm/H_2O). Yet, 21% maintained PEEP from 5 to 8 cm/H_2O.

The patients' severity condition may be grounded in the major need of noradrenaline for 68% of the patients. The average time of administration of vasopressor drug (noradrenaline) was 9.4 ±4.9 days. Both arterial hypertension and sequelae of acute myocardial infarction were the most frequent pathological conditions (57.8%) that affected patients. Although discharge from hospital was obtained by most patients (68.4%), 26.3% died and 5.2% remained hospitalized. Sepsis was diagnosed in 47.3% and pneumonia in 42.1%, the most frequent clinical complications among patients during hospitalization. In addition, out of those who progressed with AKI, 50% were diagnosed with sepsis.

Most patients (31.6%) were at risk for AKI, but 21.1% of them showed kidney damage during ICU hospitalization. A lower percentage (15.8%) evolved to kidney failure, a condition of greater severity according to the classification RIFLE.

In general, patients progressed with acidosis. Serum creatinine initially showed a normal range (1 ±0.22 mg/dL), but from the second day of admission, there was a change in baseline/reference values. However, during the follow-up period, this value tended to normalize, as shown in Table 1.

Table 1. Variation in the biological exam values of patients during ICU hospitalization. Ceilândia (DF), Brazil, 2016.

Exams (serum level) (n = 19)	Average ± standard deviation
Gasometry (pH)	6.97 ± 1.69
Potassium (mEq/L)	3.56 ± 0.75
Urea (mg/dL)	56 ± 43.09
Creatinine 1_dia (mg/dL)	1 ± 0.22
Creatinine 2_dia (mg/dL)	1.66 ± 2.31
Creatinine 3_dia (mg/dL)	1.35 ± 0.79
Creatinine 4_dia (mg/dL)	1.28 ± 0.75
Creatinine 5_dia (mg/dL)	1.59 ± 1.963
Creatinine 6_dia (mg/dL)	1.53 ± 1.96
Creatinine 7_dia (mg/dL)	1.10 ± 0.8
Sodium (mEq/L)	140.79 ± 7.54

The severity observed according to the APACHE II was lower in survivors than in the non-survivors. Overweight characterized the group of non-surviving patients, as well as elevated serum creatinine. This could be confirmed mainly on serum creatinine monitoring days 3 and 4 ($p = 0.04$; $p = 0.02$), respectively. Arterial gasometry, average arterial pressure, and peripheral oxygen saturation did not show any difference between the groups. However, the

noradrenaline use was high in both groups (Table 2).

Table 2. Association of clinical variables and outcomes of patients during ICU hospitalization. Ceilândia (DF), Brazil, 2016.

Variable	Survivor (n = 13)		Non-survivor (n = 5)		*P* value
	Median (25-75)	N (%)	Median (25-75)	N (%)	
Age (years)	62(42-72)	-	46 (39-65)	-	0.8*
APACHE II (1st week)	18(13-28)	-	25 (22-25)	-	0.45*
Body mass index (kg/m^2)	22(20-28)	-	27 (22-30)	-	0.35*
Glasgow coma scale	10(8-14)	-	6 (3-6)	-	0.01*
Mechanical ventilation time (days)	17(8-24)	-	17 (16-19)	-	0.9
Serum Creatinines (mg/dL)					
Serum creatinine (day 1)	0.9 (0.8-1.1)	-	1.2 (0.8-1.2)	-	0.8*
Serum creatinine (day 3)	0.9(0.7-1.1)	-	2.5 (2.0-2.6)	-	0.04*
Serum creatinine (day 4)	0.9(0.7-1.2)	-	1.9 (1.8-2.4)	-	0.02*
Serum creatinine (day 7)	0.9(0.8-1.0)	-	1.9 (0.6-3.1)	-	0.6*
Gasometry (pH)	7.3(7.3-7.4)	-	7.4 (7.3-7.5)	-	0.1*
Average blood pressure (mmHg)	87(81-97)	-	85 (75-110)	-	0.9*
Peripheral oxygen saturation (%)	96(95-98)	-	98 (96-99)	-	0.2*
Norepinephrine use	-	8 (100.0)		5 (61.5)	0.2¹

*Kruskal Wallis test; ¹Fisher's test; Acute Physiology and Chronic Health disease Classification System (APACHE II).

Most patients progressed with AKI. So, severity, i.e. the risk of death observed through the APACHE II, was lower in patients without AKI. The median value of the Glasgow coma scale indicated greater severity in the patients affected by AKI. BMI was significantly higher in the most severe group, i.e. with AKI (p = 0.01) (Table 3).

Table 3. Association of clinical variables and the occurrence of acute kidney injury according to the classification RIFLE in 19 patients during ICU hospitalization. Ceilândia (DF), Brazil, 2016.

Clinical variable	AKI (injury and failure) (n = 14)		Non-AKI/risk (n = 5)		*P* value
	Median (25-75)	N (%)	Median (25-75)	N (%)	
Age	49.5 (40-79.5)	-	78 (74.5-82)	-	0.1[*]
APACHE II (1st week)	20 (15.5-22)	-	18 (17.5-23)	-	0.6[*]
Body mass index (kg/m2)	24.3 (21.9 29.8)	-	19 (18.4-21.5)	-	0.01[*]
Glasgow coma scale	8.5 (7-14.5)	-	6 (6-9)	-	0.2[*]
Mechanical ventilation time (days)	18 (13.5-19)		7 (7-8)		0.15[*]
Brown and black skin colors	-	9 (64.2)	-	0 (0.0)	0.02[1]
Norepinephrine use	-	10 (71.4)	-	4 (80.0)	0.6[1]
Sepsis	-	7 (50.0)	-	2 (40.0)	0.5[1]

[*]Kruskal Wallis test; [1]Fisher's test.

DISCUSSION

About 5% of general hospitalizations and up to 30% of ICU hospitalizations are determined by the AKI. The prevalence of this pathology oscillates according to the serum creatinine reference values, local geographical conditions, and the definition taken by health care teams in clinical practice.[7] Studies show that the complete and sustained reversal of AKI from 48 to 72 hours after its initiation is associated with better outcomes. In our study, patients were affected by AKI for a longer period, something which confirms a severity condition.[9-10]

The classification RIFLE has shown that patients predisposed to AKI require a longer period of hospital care, a condition that predisposes to a higher mortality rate.[11]

In this way, patients who accumulate severity, in our study, characterized by a high APACHE II index (21 ±7.5) are more predisposed to AKI. A high APACHE II translates itself into an index that represents approximate probability of 40% of risk of death. Scientific evidence points out that this index, when above 16, has a close relationship with the occurrence of AKI.[12] A situation observed in the results of this study.

The severity condition expressed in this study may be identified among some patients' characteristics, namely advanced age, a condition susceptible to reduced glomerular filtration rate. This situation is established physiologically by the natural body aging process and this can be aggravated by the combination of pathologies.[13-4]

Overweight was also observed in patients who progressed with AKI. It is known that the metabolic overload caused by excess lipid in the clinic constitutes overweight or obesity. These conditions, when combined to systemic arterial hypertension and diabetes mellitus, increase the risk of death in patients with AKI, mainly admitted to the ICU environment.[15-6]

The Glasgow coma scale is an instrument adopted for evaluating critically ill and comatose patients. It is scientifically proven that values from 4 to 9 points indicate severity, given the state of unconsciousness and impaired respiratory drive, conditions that indicate a need for ventilatory support.[17] This severity was identified among patients in this study, a fact that may have contributed to the renal dysfunction of most of them.

Another severity factor in patients of this study was prolonged mechanical ventilation time, so studies show that the use of invasive mechanical ventilation is associated with a three-fold increased chance of AKI in critically ill patients. Also, PEEP associated with mechanical ventilation is also a major risk factor for renal dysfunction. This is due to the hemodynamic and biohumoral effects, blood gas and biotrauma disorders resulting from invasive mechanical ventilation, as well as increased intra-abdominal pressure resulting from the institution of high PEEP values.[18-9] Based on this theory, patients in this study accumulate conditions to evolve to AKI.

Noradrenaline, administered to patients at critical risk, optimizes blood pressure, favoring better organ perfusion and lesser need for volume to maintain renal function.[20] In this study, 68% of the patients used noradrenaline, with an average time of 9.4 ±4.9 days.

On the contrary, systemic arterial hypertension, observed in more than half of the patients in this study, causes damage to the kidney filter units, as a consequence these organs can interrupt waste removal and excess fluid from the blood, something which causes instability on systemic arterial pressure and causes worsening of the patient's clinical condition, predisposing to AKI.[21] A situation identified in most patients in this study.

Scientific evidence has shown that black-skinned individuals are associated with increased risk for AKI when compared to white-skinned individuals. In our study, the black-skinned individuals were significantly associated (p = 0.02) with AKI. Several factors are postulated to explain the increased risk for nephropathy in black-skinned people, such as diabetes mellitus itself, including biological factors, individual risky behaviors, and physical, social, and health-related contexts.[22] In the ARIC study, a high risk of AKI among black-skinned people was attenuated after adjustment for income differences, suggesting that socioeconomic factors and access to health care may be mediating racial disparity in AKI.[23]

CONCLUSION

Patients who accumulated any health condition, such as increased BMI, were more likely to develop AKI. The findings of this study contribute by showing the importance of daily weight control in critically ill patients as a preventive measure against health problems and a measure that promotes mortality reduction.

REFERENCES

1. Kane-Gill SL, Sileanu FE, Murugan R, Trietley GS, Handler SM, Kellum JA. Risk factors for acute kidney injury in older adults with critical illness: a retrospective cohort study. Am J Kidney Dis [serial on the internet]. 2014 [cited 2017 July 5];65(6):860-9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4442750/

2. Chawla LS, Bellomo R, Bihorac A, Goldstein SL, Siew ED, Bagshaw SM, et al. Acute kidney disease and renal recovery: consensus report of the Acute Disease Quality Initiative (ADQI) 16 Workgroup. Nature Reviews Nephrology [serial on the internet]. 2017 [cited 2017 July 5];13(4):241-57. Available from: https://www.nature.com/nrneph/journal/v13/n4/pdf/nrneph.2017.2.pdf

3. Pereira M, Rodrigues N, Godinho I, Gameiro J, Neves M, Gouveia J, et al. Acute kidney injury in patients with severe sepsis or septic shock: a comparison between the 'Risk, Injury, Failure, Loss of kidney function, End-stage kidney disease' (RIFLE), Acute Kidney Injury Network (AKIN) and Kidney Disease: Improving Global Outcomes (KDIGO) classifications. Clinical Kidney Journal [serial on the internet]. 2017 [cited 2017 July 5];10(3):332-40. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5466088/

4. Oliveira Júnior WV, Sabino Ade P, Figueiredo RC, Rios DR. Inflammation and poor response to treatment with erythropoietin in chronic kidney disease. J Bras Nefrol [serial on the internet]. 2015 [cited 2017 July 5];37(2):255-63. Available from: http://www.scielo.br/pdf/jbn/v37n2/en_0101-2800-jbn-37-02-0255.pdf

5. Gaião SM, Gomes AA, Paiva JA. Fatores prognósticos para mortalidade e recuperação da função renal em doentes com lesão renal aguda e necessidade de suporte renal em cuidados intensivos. Rev Bras Ter Intensiva [serial on the internet]. 2016 [cited 2017 July 5];28(1):70-7. Available from: http://www.scielo.br/pdf/rbti/v28n1/0103-507X-rbti-28-01-0070.pdf

6. Silva CMS, Silva DAN, Silva GGP, Maia LFS, Oliveira TS. Insuficiência renal aguda: principais causas e a intervenção de enfermagem em UTI. Revista Recien: Revista Científica de Enfermagem [serial on the internet]. 2016 [cited 2017 July 10];6(16):48-56. Available from: http://www.recien.com.br/index.php/Recien/article/view/134/204

7. Abrão JMG. Hemodiálise prolongada na lesão renal aguda associada a sepse: sobrevida dos pacientes de acordo com o momento da indicação e a dose de diálise recebida. Botucatu (SP): Universidade Estadual Paulista Júlio de Mesquita Filho; 2016.

8. Kidney Disease: Improving Global Outcomes (KDIGO). Clinical Practice Guideline for Acute Kidney Injury. Kidney Int [serial on the internet]. 2012 [cited 2017 July 10];2(Suppl 1):1-138. Available from: http://www.kdigo.org/clinical_practice_guidelines/pdf/KDIGO%20AKI%20Guideline.pdf

9. Kellum JA, Sileanu FE, Murugan R, Lucko N, Shaw AD, Clermont G. Classifying AKI by urine output versus serum creatinine level. J Am Soc Nephrol [serial on the internet]. 2015 [cited 2017 July 10];26(9):2231-8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552117/

ISSN: 1981-8963 DOI: 10.5205/reuol.23542-49901-1-ED.1111201707

10. Perinel S, Vincent F, Lautrette A, Dellamonica J, Mariat C, Zeni F, et al. Transient and persistent acute kidney injury and the risk of hospital mortality in critically ill patients: results of a multicenter cohort study. Crit Care Med. 2015;43(8):e269-75.

11. Koeze J, Keus F, Dieperink W, Van der Horst IC, Zijlstra JG, Van Meurs M. Incidence, timing and outcome of AKI in critically ill patients varies with the definition used and the addition of urine output criteria. BMC Nephrology [serial on the internet]. 2017 [cited 2017 July 15];18(1):70. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5319106/

12. Gomes TM, Valadares AFM, Duarte TTP, Magro MCS. Septic patients with acute kidney injury: the reality of intensiva care units. Rev Enferm UFPE On Line [serial on the internet]. 2016 [cited 2017 July 25];10(9):3190-6. Available from: http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/view/9571/pdf_10929

13. Pereira ERS, Pereira AC, Andrade CB, Naglettinni AV, Pinto FKMS, Batista SR, et al. Prevalência de doença renal crônica em adultos atendidos na Estratégia de Saúde da Família. J Bras Nefrol [serial on the internet]. 2016 [cited 2017 July 10];38(1):22-30. Available from: http://www.scielo.br/pdf/jbn/v38n1/0101-2800-jbn-38-01-0022.pdf

14. Summa KC, Jain B. Acute anuric renal failure in an 80-year-old man. JAMA. 2017;317(14):1471-2.

15. Suneja M, Kumar AB. Obesity and perioperative acute kidney injury: a focused review. J Crit Care. 2014;29(4):694.e1-6.

16. Kovesdy CP, Furth S, Zoccali C, World Kidney Day Steering Committee. Obesity and kidney disease: hidden consequences of the epidemic. Clinical Kidney Journal [serial on the internet]. 2017 [cited 2017 July 15];10(1):1-8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5469573/

17. Santos WC, Vancini-Campanharo CR, Lopes MCBT, Okuno MFP, Batista REA. Assessment of nurse's knowledge about Glasgow coma scale at a university hospital. Einstein [serial on the internet]. 2016 [cited 2017 July 20];14(2):213-8. Available from: http://www.scielo.br/pdf/eins/v14n2/pt_1679-4508-eins-14-2-0213.pdf

18. Santos LL, Magro MCS. Ventilação mecânica e a lesão renal aguda em pacientes na unidade de terapia intensiva. Acta Paul Enferm [serial on the internet]. 2015 [cited 2017 July 25];28(2):146-51. Available from: http://www.scielo.br/pdf/ape/v28n2/1982-0194-ape-28-02-0146.pdf

19. Bouchard J, Acharya A, Cerda J, Maccariello ER, Madarasu RC, Tolwani A, et al. A prospective international multicenter study of AKI in the intensive care unit. Clin J Am Soc Nephrol [serial on the internet]. 2015 [cited 2017 July 25];10(8):1324-31. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/26195505/

20. Melo EM, Cavalcante HPO, Marques AM, Ferreira AMM, Abreu MAF, Lima VF, et al. Nurses on knowledge vasoactive drugs in critical pacients. J Nurs UFPE on line [serial on the internet]. 2016 [cited 2017 July 29];10(8):2948-55. Available from: file:///D:/11364-25935-1-PB.pdf

21. Cruz MG, Dantas JG, Levi TM, Rocha Mde S, Souza SP, Boa-Sorte N, et al. Lesão renal aguda séptica versus não séptica em pacientes graves: características e desfechos clínicos. Rev Bras Ter Intensiva [serial on the internet]. 2014 [cited 2017 July 29];26(4):384-91. Available from: http://www.scielo.br/pdf/rbti/v26n4/0103-507X-rbti-26-04-0384.pdf

22. Mathioudakis NN, Giles M, Yeh HC, Haywood C Jr, Greer RC, Golden SH. Racial differences in acute kidney injury of hospitalized adults with diabetes. J Diabetes Complicat [serial on the internet]. 2016 [cited 2017 July 29];30(6):1129-36. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4949082/

23. Grams ME, Matsushita K, Sang Y, Estrella MM, Foster MC, Tin A, et al. Explaining the racial difference in AKI incidence. J Am Soc Nephrol [serial on the internet]. 2014 [cited 2017 July 29];25(8):1834-41. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4116065/

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