

CONTINUOUS RENAL REPLACEMENT THERAPY IN PATIENTS WITH ACUTE KIDNEY INJURY EXPERIENCE FROM A TERTIARY CARE CENTER IN CROATIA

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Introduction

- Acute kidney injury (AKI) is a clinical syndrome characterized by sudden, severe reduction of renal filtration.
- Loss of kidney function is usually recognized as increase in serum creatinine, a marker of decline in glomerular filtration rate and metabolic acidosis.
- This accurately describes medical status before complete renal failure

Definition

- AKI can be defined as:
 - an increase in serum creatinine of ≥ 0.3 mg / dl (≥ 5.26 $\mu\text{mol} / \text{L}$) within 48 hours or
 - increase in serum creatinine of ≥ 1.5 times the recorded values of less than 7 days or diuresis <0.5 ml / kg / h for 6 hours
 - anuria <100 ml / 24 h,
 - oliguria 100-400 ml / 24h or
 - non-oliguria > 400 ml / 24 h

Etiology

- The most common causes of AKI are
 - bleeding,
 - dehydration,
 - congestive heart failure or
 - use of various drugs and contrast
- Patients who undergo various surgical treatments are at great risk of AKI development.

Principle

- All kinds of treatment replace excretory function of the kidney.
- The basic principle, except peritoneal dialysis, is extracorporeal blood circulation.
- Peritoneal dialysis is more physiological since the "cleaning" of blood is through peritoneal membrane.

CRRT

- CRRT is defined as extracorporeal blood purification therapy that replaces kidney function.
- The method is usually carried out in the ICU, the duration is expressed in days / weeks and individually prescribed by the patient's needs.

CRRT

- CRRT is a light, slow, continuous treatment of AKI.
- This slow method prevents sudden changes, further damage kidney function and promotes recovery. CRRT is a good nutritional support measure without volume overload.
- CRRT is often associated with other technological methods of treatment such as cardio-pulmonary bypass (CPB), intraaortic balloon pump (IABP) and extracorporeal mechanical oxygenator (ECMO).

Aim

- The aim of our study was to analyse the patients and treatment characteristics as well as effect of CRRT on the outcome of our patients with AKI.

Patients and methods

- In this retrospective study, we have analyzed 299 patients treated with CRRT in ICU in the period from 1st January 2010. to 30th June 2015.
- Patients' demographic characteristic, prescribed CRRT therapy and outcome were analyzed.
- Data on patients, demographic characteristics, medical history and laboratory data were obtained by medical record.

Patients and methods

- Patients were grouped into four classes based on CRRT:
 - Continuous veno-venous hemofiltration (CVVH)
 - Continuous veno-venous hemodialysis (CVVHD)
 - Continuous veno-venous hemodiafiltration (CVVHDF),
 - Continuous veno-venous hemodiafiltration (CVVHDF) used AN69 membrane.

Patients and methods

Co-morbid conditions included the presence of

- diabetes mellitus,
- arterial hypertension and
- cardiopathies obtained from medical history.

Laboratory data included

- potassium (K⁺),
 - blood urea nitrogen (BUN),
 - creatinine,
 - platelets,
 - prothrombin time (PT),
 - international normalized ratio (INR),
 - leukocytes,
 - C-reactive protein (CRP) level
-
- blood pressure (BP)
 - central venous pressure (CVP) were recorded at the time of CRRT initiation.

n=299	
Mean age (years)	65 (range 1 - 89 years)
Man, n (%)	201 (67%)
Female, n (%)	98 (33%)
Comorbidities	
Arterial hypertension, n(%)	152 (50,8%)
Diabetes mellitus, n(%)	68 (22,7%)
Cardiopathia, n(%)	198 (66,2%)

Results

Out of 299 analyzed patients, there were 201 (67%) men and 98 (33%) female with an average age of 65 years in the range of 1-89 years.

Initial laboratory and clinical parameters

Initial laboratory and clinical parameters		Mean values	Range
Creatinine	μmol/L	380,5	30-1328
Potassium	mmol/L	4,9	3,8-7,8
BUN	mmol/L	23,8	3,7-70,5
Leukocytes	x10 ⁹ L	16	3,4-68,5
CRP	mg/L	157	0,8-511,8
PT		0,67	0,08-1,33
INR		1,35	0,54-5,66
Plates	x10 ⁹ L	178	12-515
Hours diuresis	mL/h	26,8	0-203
24-hours diuresis	mL	580,4	0-4100
Systolic blood pressure	mmHg	105	60-190
Diastolic blood pressure	mmHg	58	34-110
Central venous pressure	mmHg	12	2-30

Based on the initial coagulation parameters, we have performed various anticoagulation strategies.

Anticoagulant	Number of patients' n (%)
No anticoagulant	5 (1,67%)
Fractioned heparin	13 (4,35%)
Enoxaparin	268 (89,63%)
Nadroparin	7 (2,34%)
Fondaparinux	1 (0,33%)
Dalteparin	2 (0,67%)
Citrate	3 (1%)

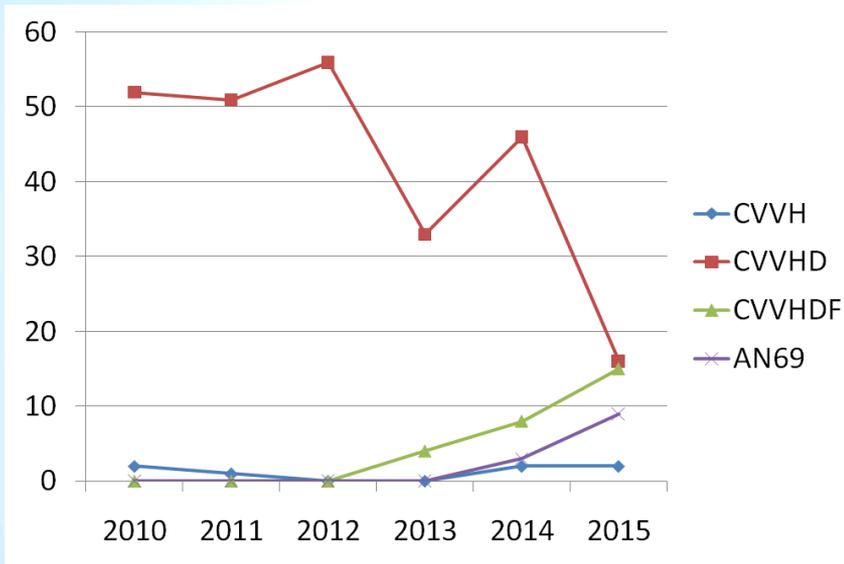
The most common CRRT was CVVHD (85%), followed by CVVH (2.3%) and CVVHDF (12.7%). CVVHDF using the AN69 membrane was applied in the 11 (28.95%) patients

n=299	
CVVH n (%)	7 (2,3%)
CVVHD n (%)	254 (85%)
CVVHDF n (%)	27 (9,03%)
CVVHDF AN69 n (%)	11 (3,67%)

Treatment parameters, start time and duration

Treatment parameters	Number of patients (n)	Mean values	Range
Blod flow (ml/min)	299	200	30-400
Dialysate flow (ml/h)	287	1488	500-3000
Replacement flow (ml/h)	12	1475	600-3000
Predilution flow (ml/h)	44	683	0-2000
Postdilution flow (ml/h)	45	957	0-2000
Ultrafiltration (ml/h)	299	135	0-400
Time of CRRT initiation (h)	299	55	2-450
Duration of CRRT (h)	299	72	1-489

Number of patient on each method trough observed years



- In the period from 2010–2012, CVVHDF was sporadically used in our Center, but since 2012, the number of patients treated with CVVHDF has been steadily increasing. Consequently, the number of patients treated with CVVHD is decreasing.

Results

- Of 299 analyzed patients, 107 (35.8%) of them died
- 7.7% did not recover renal function and continued further renal replacement therapy
- 56.5% patients had completely recovered renal function

Prevention

- Adequate hydration and maintenance of body fluids balance increase blood flow through the kidneys, enhance GFR and cleansing of potentially harmful substances from the tubule
- Compensation fluid and application of isotropic drugs in septic patients can prevent multiorgan failure and AKI
- Isotonic, crystalloid solutions are generally recommended for septic patients.

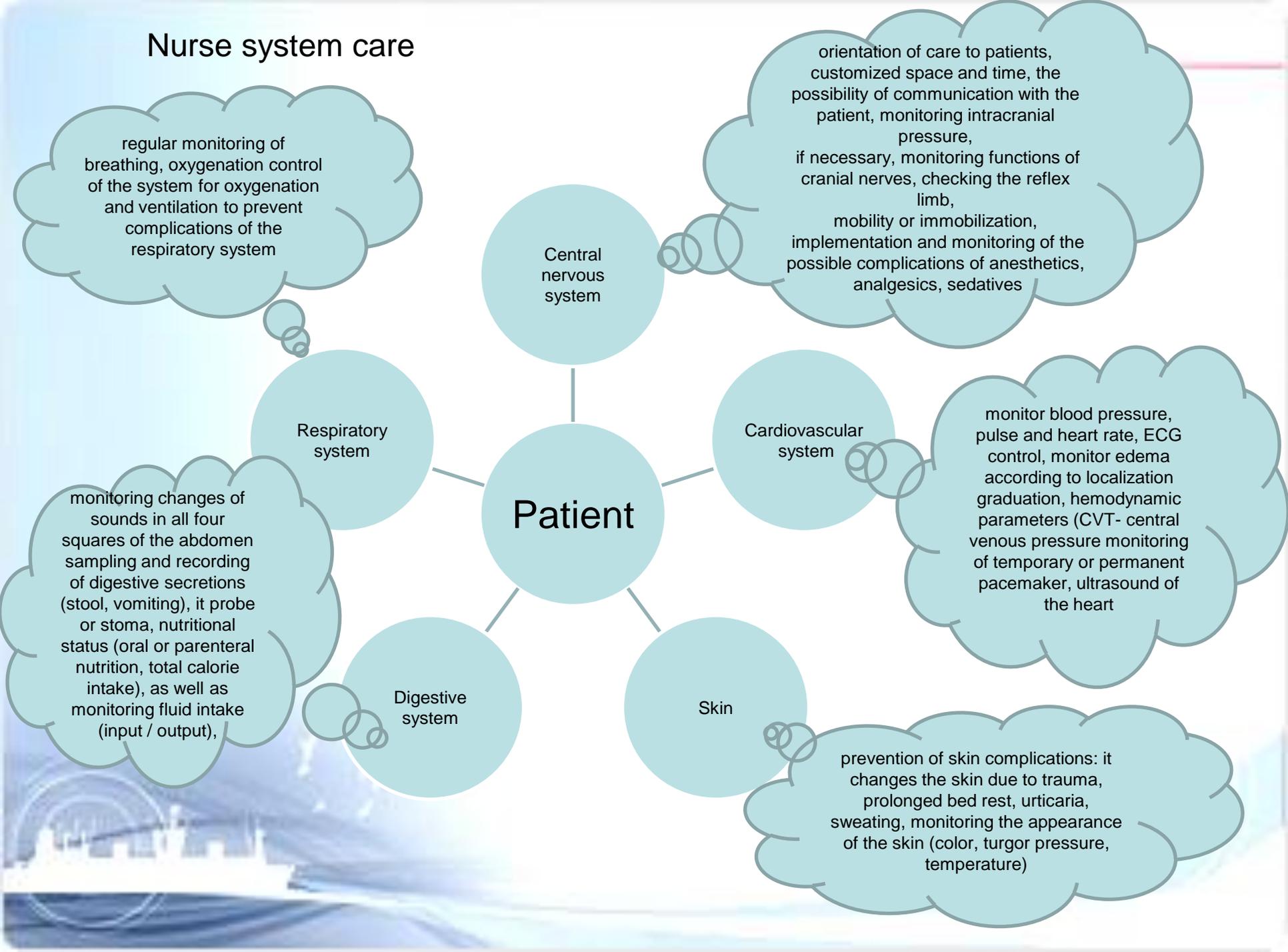
Nurse care – prevention of complications

- nursing care
- patient management,
- blood pressure monitoring,
- heart rate,
- central venous pressure measurement, monitoring hourly fluid intake and diuresis including the total loss of body fluids (breathing, sweating, fiddle / stoma, nasogastric tube) prevention the development of complications

Common measures we can summarize as:

- maintaining blood flow through the kidneys,
- fluid balance,
- compensation of lost fluids,
- "Risk / Benefit" evaluation of nephrotoxic drugs,
- correction electrolyte imbalance (eg. Hyperkalemia)
- correction of metabolic acidosis (pH <7.2; bicarbonate <15 mmol/L).

Nurse system care



Central nervous system

orientation of care to patients, customized space and time, the possibility of communication with the patient, monitoring intracranial pressure, if necessary, monitoring functions of cranial nerves, checking the reflex limb, mobility or immobilization, implementation and monitoring of the possible complications of anesthetics, analgesics, sedatives

Cardiovascular system

monitor blood pressure, pulse and heart rate, ECG control, monitor edema according to localization graduation, hemodynamic parameters (CVT- central venous pressure monitoring of temporary or permanent pacemaker, ultrasound of the heart

Skin

prevention of skin complications: it changes the skin due to trauma, prolonged bed rest, urticaria, sweating, monitoring the appearance of the skin (color, turgor pressure, temperature)

Digestive system

monitoring changes of sounds in all four squares of the abdomen sampling and recording of digestive secretions (stool, vomiting), it probe or stoma, nutritional status (oral or parenteral nutrition, total calorie intake), as well as monitoring fluid intake (input / output),

Respiratory system

regular monitoring of breathing, oxygenation control of the system for oxygenation and ventilation to prevent complications of the respiratory system

Patient

Conclusion 1.

- The mortality rate of our AKI patients on CRRT was around 50%.
- Although, the mortality rate is still high, the percentage of patients with preserved renal function is increasing.

Conclusion 2.

- Mortality in patients with sepsis is around 30%, and in patients with septic shock 50-80%.
- Continuous replacement therapy minimizing the inflammatory response and is usually more effective in reducing tissue injury than measures aimed at suppressing the inflammatory response.
- In recent years, after a great deal of attention dedicated to the optimal dose of CRRT in patients with sepsis and systemic inflammatory response syndrome (SIRS), great attention is paid to the new membranes.

Conclusion 3.

- The intervention nurse team provides better patient care, reducing failure and preventing serious side effects.
- Availability and education of renal nurses is the most important key to successful treatment.



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Thank you for your attention

Best regards from Rijeka
Croatia