MODERN MEDICINE AND PRACTICE
https://inovatus.es/index.php/ejmmp

EUROPEAN JOURNAL OF MODERNMEDICINEAND PRACTICE
Vol. 4 No. 6 (Jun - 2024) EJMMP ISSN: 2795-921X

CARDIORENAL SYNDROME: PATHOGENESIS, DIAGNOSIS, PROGNOSIS AND TREATMENT OPTIONS

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Resume: Cardiorenal syndrome (CRS) is a cardiorenal relationship in which acute or chronic dysfunction of one organ leads to acute or chronic insufficiency of another. The primary incidence of diseases of the kidneys and cardiovascular system is conditional (cardiorenal or renocardial syndrome). The number of patients with morbid cardiovascular and renal lesions has a steady upward trend in the world and is associated with high overall and cardiovascular mortality. The article presents topical issues of cardiorenal relationships from the perspective of modern ideas about the cardiorenal continuum, the commonality of risk factors and pathogenetic mechanisms, as well as the prognostic role of renal and cardiac pathology, and discusses the principles of diagnosis and treatment of clinical cattle diseases.

Keywords: cardiorenal syndrome, acute cardiac insufficiency, acute renal injury, chronic kidney disease, chronic heart failure.

Cardiorenal syndrome (CRS) is кардиоренальные a cardiorenal-relationshipшенияin which acute or chronic dysfunction of one organ leadsto acute or chronic insufficiency of another. The primary incidence-of kidney and cardiovascular diseases is conditional (cardiorenal диоренальныйor renocardial syndrome). The number of patients with co- morbid cardiovascular and renal lesions hasa steady upward trend in the world and is associated with high overall and дечнocardiovascular mortality. The article presents topical issues of cardiorenal relationships from the perspective of modern concepts of the cardiorenal continuum, the commonality of risk factors and pathogenetic mechanisms, as well as the prognostic role of renal and cardiac pathology-гии, and discusses the principles of diagnosis and treatment of clinical variants of cattle.

Introduction: The number of patients with comorbid cardiovascular and pe- renal lesions has a steady upward trend. Modern cardiology and nephrology are closely integrated with each other on issues related to common факторами risk factors заболеваний for kidney and сердечно- cardiovascular diseases, universal pathogenetic mechanisms, вза- имоотягощающиман aggravating prognosis, and an interconnected therapeutic strategyfor nephro - and cardioprotection.

Definition and classification: Common risk factors and pathogenesis of the processes of maladaptive remodeling of renal tissue, vascular wall and myocardium are characteristic of cattle, which are built according to the feedback mechanism and are не- continuous in nature.

According to the proposed definition, cattle are pathologically interrelated- имообусловленныеconditions involving the heart and kidneys that develop as a result of acute or chronic dysfunction of one of the organs with subsequent acute or chronic dysfunction of the other.

Thus, bovine diseases include acute and chronic disorders ства, in which both the пораженным органом может быть heart and the kidney can be the primary affected organ сердце,так [1].

In 2008, at the ADQI conciliation conference in Venice, C. Ronco и etal. proposed a definition and classification of cattle, which identified five types [2].

Type 1-acute cattle. Acute cardiac dysfunction (кардиоген- ныйcardiogenic shock, acute decompensation of chronic heart failure – CHF)) significantly reduces cardiac output and increases venous pressure- ние. Renal perfusion and filtration capacity are reduced, which при- leads to acute повреждению kidney injury (AKI), and в later to the development of chronic kidney disease (CKD). AKI in acute coronary syndrome occurs in 9-19% of cases, and in cardiogenic shock- in 70% of cases.

Acute heart failure (AHF) and acute decompensation of CHF arecomplicated by the development of AKI in 24-45% of patients with high total and cep- cardiac mortality. In AH and acute decompensation of CHF, mortality is inversely proportional to glomerular filtration rate (GFR) and фрак- ции left ventricular ejection fraction (LVEF).

The risk of adverse outcomes increases significantly with a decrease in glomerular filtration rate (GFR) and even withповыа slightincreaseшении in serum creatinine concentration (by 0.3 mg/dl or 26.6 mmol/L). Resistance to diuretic therapy often develops: howeverприме- нение, the use of high doses or combinations of diuretics may be an additional iatrogenic mechanism for the progression of AKI. In this clinical ситуа- situationции, it is necessary to optimize cardiac output and use extra- corporate ultrafiltration. The presence of AKI with гиперкалиемиейor without hyperkalemia нее limits the use of angiotensin фер- converting enzyme (ACE) inhibitors, angiotensin II receptor antagonists (ARA), and- стоваldosterone antagonists among patients with CHF and myocardial infarction, which may negatively affect the outcome of the disease.

Type 2-chronic cattle. It is characterized by the presence of chronic cardiac pathology, primarily CHF, leading to the development or progression of CKD. Renal dysfunction in patients with CHF is detected in 45.0-63.6% of cases. Systolic and diastolic dysfunctions of the left ventricle (LV) lead to prolonged hypoperfusion of the kidneys against the background of micro - and macroangiopathies, pronounced neurohormonal disorders: повы-increasedшение production of vasoconstrictors (epinephrine, angiotensin II, эндоте- endothelin), changes in the sensitivity and release of endogenous вазодила- vasodilators (natriuretic peptides, nitric oxide). A combination of cardiovascular risk factors (hypertension, dyslipidemia, hyperuricemia- перурикемия) increases the likelihood of developing CKD.

Type 3 cattle – acute renocardial syndrome. It is characterized by primary, sudden deterioration of renal function (for example, in acute glomerulonephritis or pyelonephritis, acute tubular necrosis, acute urinary tract obstruction), which lead to acute cardiac dysfunction (AHF, arrhythmias, ischemia). AKI is often observed in hospitalized-тализированныхpatients and in patients in the intensive care unit, in 9 and 35% of cases, respectively. The prevalence of AKI in coronary angiography (contrast-induced nephropathy) and кардиохи- cardiac surgery ranges from 0.3 to 29.7% and is associated with high mortality.

A special form of this type of cattle is стеноз renal artery stenosis. Blockade of the renin-angiotensin-aldosterone system (RAAS) is a necessary component of therapy for such patients, but in patients with double- нем стенозе sided renal artery stenosis or stenosis of the artery of a single kidney , the use of these drugs can lead to decompensationof renal insufficiency. In severe AKI requiring renal те- replacement therapy (RRT), hypotension, rhythm and conduction disturbances, and myocardial ischemia may develop due to rapid movement of fluid and electrolytes- тролитов during dialysis [3].

Type 4 cattle – chronic renocardial syndrome. This is a situation where primary CKD leads to impaired cardiac functionгипер (ventricular hypertrophy, diastolic dysfunction, or an increased risk of developing adverse cardiovascular events). The main cause поражения of kidney damage is type 2 diabetes mellitus (DM) 2 типа and hypertension, заметную with atherosclerosis, CHF, and obesity playing a prominent role. In patients with predialysis CKD , the prevalence of cardiac pathology, total and cardiac mortality

correlate with the severity of renal dysfunction. As the-severity of CKD increases, leftventricular hypertrophy progresses, systolic or diastolic dysfunction develops,ускореatherosclerosis "accelerates"ние» атеросклероза, кальцификация, and the vascular bed calcifies [4].

The prevalence of cardiovascular diseases in the population of patients with reduced функциональной способностью renal function на is 64% вы-шеhigher than у лиц in those with preserved function. An independent feedback relationship was found between GFR <60 ml / min/1.73m^2 and an increased risk of death, cardiovascular- нocomplications, and hospitalization [5]. The incidence of new cardiovascular complications is 4.8% in patients with stage 2 CKD and возрастает almost doubles in 3-4 stage 3-4 patients. The risk of adverse cardiovascular outcomes in dialysis patients or у реципиентов kidney transplant recipients is ten times higher than in the general population.

Type 5 cattle – secondary cattle. It is characterized by the presence of combined renal and cardiac pathology due to acute or chronic systemic diseases, while a violation of the function of one organ affects the functional state of the other, and vice versa. Suchdiseases aresepsis, DM, amyloidosis, systemic lupus erythematosus, and sarcoidosis. Data on the prevalence of type 5 cattle are scarce due to the large number-of acute and chronic predisposing conditions.

Sepsis can lead to AKI, while simultaneously causing угнетение myocardial depression; the mechanisms of these conditions are not fully understood. Распро- The prevalence of AKI in sepsis is 11-64%, and the frequency of increasedtroponins is 30-80%, and their combination is associated with an increase in mortality compared to the presence of only one of the conditions. At the same time, the development of functional myocardial depression and inadequate cardiac output ве- lead to further deterioration of kidney function, as in type 1 cattle, and AKI affects the functional state of the heart, as in type 3 cattle, результа-sig возникаетina vicious circle.

Prevention and treatment of cardiorenal syndrome: In accordance with the pathogenetic mechanisms of the development of- cardiorenal syndrome, current recommendations for the management of patients with HF, CKD, AKI, to prevent the development and progression of- cardiorenal syndrome , the main principles of therapeutic strategy are formulated [9]. Nephroprotective and cardioprotective effects have a number of common mechanisms of implementation and target indicators: reduction of proteinuria- инурии, normalization of blood pressure(BP), dyslipidemia, компен-correcсация of anemia, calcium-phosphorus metabolism, insulin resistance, ги- hyperpathicotonia, hyperuricemia.

The main requirements for medicinal products- тамfor the treatment of patients with CKD and heart diseases should be meta- bolic neutrality, dual elimination pathways (hepatic and почеч- ныйrenal), improvement of endothelial function, доказанное наличие and proven nephro- and cardioprotective propertieskардиопротекции.

To achieve nephro-and cardioprotection, the followingapproaches are recommended:

Episodes of acute decompensation хронической сердечной of chronic heart- точности failure (CHF) predispose to the development of AKI, the appearance and progression of грессированию CRF. For the purpose of nephroprotection , it is extremely important to prescribe competent **drug therapy for HF** in accordance современным with current-recommendationsмендациям c in order to prevent and reduce the frequency декомпенса- of decompensation [10]. In most patients , it should include ингибиторы ACE inhibitors/angiotensin receptor antagonists, beta-blockers, ди- diuretics, антагонисты and mineralocorticoid receptor antagonists. If неэффек- this combination is ineffective комбинации , if systolic blood pressure is>100 mm Hg, it is. possible to replace ACE inhibitors or angiotensin receptor ангио- antagonists with sacubitril/valsartan, if sinus rhythm with HR≥70-- the addition of ivabradine, if QRS≥130 ms - discussion of cardiac ресинхрони- resynchronization therapy.

At the same time, to prevent episodes of hypovolemia and hypotension that contribute to the development of AKI, it is necessary to start drug therapy with minimal doses, slowly titratethe doses and в adjust them according to GFR [11].

1. **Diet.** Для предотвращения прогрессирования А эф- фективность диеты low - низким salt diet соли (salt <6 g/day, sodium) has been shown to be effective in preventing the progression of CKD, натрия

<2.4 g /day), protein (1 g / kg /day in 1-2 stages 1-2 of CKD and 0.6-0.8 g/kg /day in stages 3a-4 of CKD), replacement of animal proteins with vegetable ones, which зываютcause less stress on the kidneys (soy proteins have no less negative impact on the renal system). hemodynamics and have nephro -, cardio-protective and antisclerotic effects), low potassium content (>4 g /day in stage 1-2 CKD and 2-4 g /day in stage 3a-4 CKD), low phosphate content (1.7 g/day in stage 1-2 CKD and 0.8-1.0 g/day in stage 3a-4 CKD).day instage 3a-4 CKD) [12].

2. **Quitting smoking** due to the fact that it is a dose фактором -dependent risk factor for lowering GFR and developing microalbuminuria [12].
3. **Restriction потребления of alcohol consumption [12].**
4. **Elimination or minimization of modifiable факторов risk factors** for the development and progression of CKD.
5. Следует Avoid prescribing nephrotoxic medications, including non- ныхsteroidal anti-inflammatory drugs (NSAIDs), nephrotoxic anti- тиков, рентгенконтрастных biotics, X-ray contrast agents, and dietary supplements (including Thai herbs,сжигателей fat burners, and muscle building formulas) that may adversely affect на функцию kidney function.
6. Maintaining **the body mass index** (BMI) in the range of 20-25 kg /^{m2} за by correcting the caloric content of the diet and sufficient physical activity(30 minutes of aerobic exercise не at least 4-5 times a week), since an increase in BMI >25 kg/^{m2} even in young healthy people is associated with повышени- еман increased riskofdeveloping terminal CRF [15].
7. **Strict blood pressure control.** Target blood pressure<140/90 mmHg рт.стwith optimal urinary albumin excretion (EAM) <10 mg / g (A0), with a higher degree of albuminuria (A1-A4) <130/80 mmHg. рт.стIt is very important to avoid lowering systolic blood pressure to prevent a decrease in renal blood flow-ния систолического <120 мм mmHg. [16].
8. **Strict glycemic control**. The target level of glycated hemoglobin- моглобинаHbA1c depends on age and existing complicationsбольшин-; in most patients , it is <7%.
9. Administration **ингибиторов of ACE/ARA/ARNI inhibitors**. The nephroprotective effect of ACE and ARA inhibitors is due to the fact that they increase renal blood flow due to dilatation of the bearing arterioles and increase cardiac output, and block the adverse effects тензинаof angiotensin II on the kidneys, including proliferation and hypertrophy of mesangial cells. Long - term use of ACE/ARA inhibitors prevents hyperfiltration and reduces albuminuria by dilating the arteriol effectors [17]. All this leads to a slower progression of CKD and a lower risk разви- of developing end-stage CRF.

Conclusion

The primary заболеваний character of kidney and cardiovascular diseases системы но-sconditional (cardiorenal or renocardial syndrome), так since damage to one organ leads to the need for preventive and therapeutic measures in relation to another organ. Нали- чие KPC The presence of cattle is currently время a multidisciplinary problem that requires the efforts of clinicians of different specialties (cardiologist, nephrologist). This indicates the emergence of a new interdisciplinary field of science – cardionephrology.

The study of the causes and mechanisms of the formation типов of cattle types, early detection of biomarkers of damage and факторов risk factors will help determine- литьthe optimal methods of cattle correction in order to improve survival сти, improve the quality of life of patients, and determine approaches to вентивной и preventive and therapeutic tactics.

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