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IMPAIRMENT OF RENAL FUNCTION IN THE CONTEXT OF HEPATITIS C VIRUS INFECTION

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KEYWORDS

HCC (hepatitis C virus)
CIC (circulating immune complexes)
Immunologically mediated glomerulopathies
Progressive renal failure
Glomerular filtration rate
DAA (direct antiviral therapies)

ABSTRACT

The mechanisms involved in the renal injury during liver disease are primarily by immune causes, by circulating immune complexes that are deposited at the level of the glomerular basal membrane, as well as by metabolic, toxic and infectious causes. Knowing and understanding the possible association of nephropathies with liver disease may be a possibility of preventing nephropathies with evolution towards acute or chronic renal failure. In the case of hepatitis C infection, renal impairment is one of the most important extrahepatic manifestations.

INTRODUCTION

Chronic hepatitis C is the most common cause of chronic liver disease and cirrhosis, being also the main indication for liver transplantation in the United States, Australia and most European countries. It is estimated that about 170 million people globally are infected with hepatitis C (HC), which represents about 3% of the world's population. This is the most common chronic infection transmitted through the blood and is responsible for 40% of the cases of chronic liver disease. According to estimates of the World Health Organization (WHO), about 58 million people live with chronic HCV infection, and annually, over 290,000 people die because of complications associated with this disease. One of the defining aspects of hepatitis C is its "silent" evolution; many infected people remain asymptomatic for years or even decades, without knowing that they are carriers of the virus. However, about 75% -85% of infected people develop a chronic form of the disease, which can lead to severe complications (Ciutan et al., 2024, Bentow et al., 2015, 2016; Babiuc et al., 2009; Bartenschlager R. et al., 2004).
The importance of early screening and diagnosis is essential in managing HCV infection, given that new direct antiviral therapies (DAA) provide high chances of complete healing. The hepatic C virus has a major impact on the different organs, including the kidneys producing significant effects. Studies have shown that chronic HCV infection is associated with various renal conditions, such as immunologically mediated glomerulopathies and progressive renal failure (Antaki et al., 2010; Boccaccio et al., 2014; Davis, 2010).
The mechanisms involved in the renal injury during liver disease are primarily by immune causes, by circulating immune complexes that are deposited at the level of the glomerular basal membrane, as well as by metabolic, toxic and infectious causes. Knowing and understanding the possible association of nephropathies with liver disease may be a possibility of preventing nephropathies with evolution towards acute or chronic renal failure. In the case

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of hepatitis C infection, renal impairment is one of the most important extrahepatic manifestations (Constantinescu, 2003; Lauer, 2001; Prisecaru et al., 2017, 2021; Sohal, 2024).
The essential biochemical parameters in the detection of renal damage are: uric acid, creatinine, urea and glomerular filtration rate. The degradation of nucleic acids leads to the formation of uric acid, this being the final product of purine metabolism. Elimination occurs mainly through the kidneys, and its growth can indicate renal dysfunction or metabolic disorders. Creatinine, derived from muscle metabolism and synthesized in the liver, is used as a parameter for estimating the glomerular filtration rate (RFG), a fundamental indicator of the renal function. Urea, the final product resulting from the metabolism of amino acids, is eliminated renally and synthesized by the liver, but also by the growing tissue (e.g. embryonic tissue). An increased level may reflect renal failure or metabolic imbalances (Tabatabaei, 2022; Engvall, 2009; Forster, 2009; Niepmann, 2020; Bădăluță, 2022).
The present study proposes to analyze some useful biochemical parameters in the early detection of kidney disease in patients with type C hepatitis, as well as pursuit of risk factors, highlighting the need to pay attention to renal changes associated with viral hepatitis and the relationship between hepatitis C virus, immunity and renal lesions.

MATERIALS AND METHODS

The study included a batch of 112 patients diagnosed with hepatitis C (HCV) virus who were grouped by age and sex groups. Patients eligible for this study are acute and chronic patients diagnosed with hepatitis C virus, who have been clinically and paraclinically evaluated to monitor renal function and other biological parameters relevant to study. The biological material used to determine the biochemical parameters involved in renal impairment is venous blood (hemolysis blood, lipemic) is not processed, the harvest being à jeun or postprandial. The blood is harvested on the vacutainer without anticoagulant with/without separator gel. After harvesting, the complete coagulation is expected about 30 minutes, followed by the separation by centrifugation at 4000 rotations for 10 minutes (equipment used: Rubina 35). Minimum test volume being 0.5 ml serum.
The processing of the serum for determining the biochemical parameters is carried out according to standardized protocols, meant to ensure the accuracy and reproducibility of the results. For the screening of patients at risk of hepatitis C infection, modern laboratory methods have been used, based on immunological technology with chemiluminescence detection. The used analyzer being Advia Centaur CP. The detection of anti-HCV antibodies is done with the help of an immunological test based on the principle of immunometry with chemiluminescence.
The result is a qualitative one, according to the reference values we can have a reactive (positive), non - reactive (negative) or equivocal result. The analyzer calculates the cutoff index based on the cal1 and cal2 measurements, and the result is depending on the value of the sample/cutoff; negative <1.0 and positive > 1.0.

RESULTS AND DISCUSSION

The lot included 112 patients who had anti - VHC antibodies present, of which 72 patients are female, representing 64% and 40 males with a 36% percentage. The B/F ratio was 1: 1.18 which indicates a predominance of female sex. Patients in the studied group were distributed by sex and age categories:

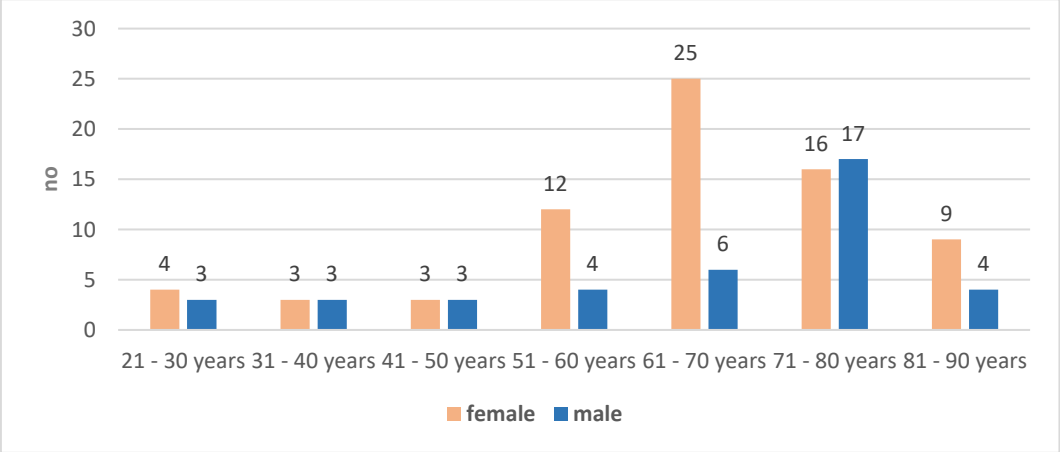

Figure 1. The sex and age-aged rejection of patients with anti-HCV antibodies

For female patients the largest number of cases registered was in the group of 61-70 years with 25 patients, followed by 71-80 years with 16 cases, and the smallest number was for the 41-50 years of age with 3 patients. The age category 21-30 years included 4 patients, group 51-60 registered 12 cases, and in the age category 81-90 years were registered 9 patients. From the figure 1 it was observed that a large number of cases for the male was registered in the 71-80 age group with 17 patients, followed by 61-70 years with 6 patients, 51-60 and 81-90 with the same number of patients, namely 4. If in the female gender the smallest number was for 41-50, for the male geneder there is the smallest number of 21-30, with 3 patients. As can be seen in the figure 2, the female sex has a greater incidence of hepatitis C, compared to the male, especially for the age category between 61-70 years.
The analysis of the environment of origin has led to the following results: the 112 patients were evaluated according to the environment of origin and sexes, so from the 72 patients, 50 (69.45%) came from the urban environment and 22 (30.55%). From the rural, and for the male, 29 (72.75%) were from urban and 11 (27.25%) of the rural area, with a total of 40 cases (figure 2). Making a comparison between the two sexes, most patients come from the urban area, which can be explained by the fact that there is an increased exposure to potential sources of infection (exposure to invasive medical practices, the consumption of injectable substances).

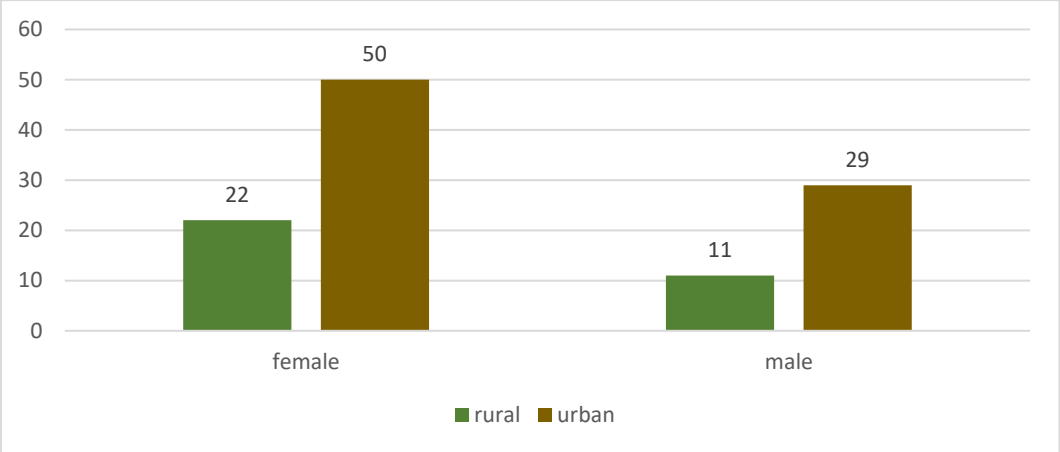

Figure 2. Graphic representation of patients according to the environment of origin

As a result of the determinations of the biochemical parameters in the patients taken the following results, the following results were obtained (Table 1):

Table 1. The results of the biochemical profile in the patients taken under study

Biochemical parameters	Female		Male	
	Number	Percentage (%)	Number	Percentage (%)
Uric acid	16	22,22	9	22,5
Creatinine	28	38,89	8	20
Urea	11	15,27	11	27,5
eGFR	54	75	28	70

HCV infection is associated with a number of renal complications, which may reflect changes in biochemical parameters (uric acid, creatinine, urea and glomerular filtration rate). However, the severity and number of parameters affected varies significantly between patients, being influenced by both individual factors and biological differences between sexes. The incidence of renal dysfunction and its complications in patients diagnosed with hepatitis C led to the following results:

Table 2. Comparison of Patient Groups Depending on EGFR

Biochemical parameters	Female		Male	
	Number	Percentage (%)	Number	Percentage (%)
eGFR<60	24	33.33	8	20
eGFR 60-90	34	47.22	20	50

The analysis of the results obtained from determining the biochemical parameters (uric acid, creatinine, urea and rate of glomerular filtration) led to the following conclusions (table.1, table.2, fig.4): In the case of women, the most affected renal parameter was creatinine with a number of 28 cases (38.89%) male in which only 8 cases (20%) were registered. Increased uric acid values were observed in 16 female (22.22%) and 9 male patients (22.50%), and in urea were the same number of patients 11, both in female patients and male patients.

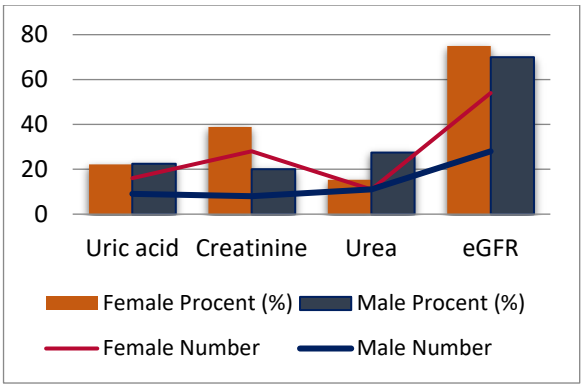

Figure 3. Biochemical profile of patients in the studied group

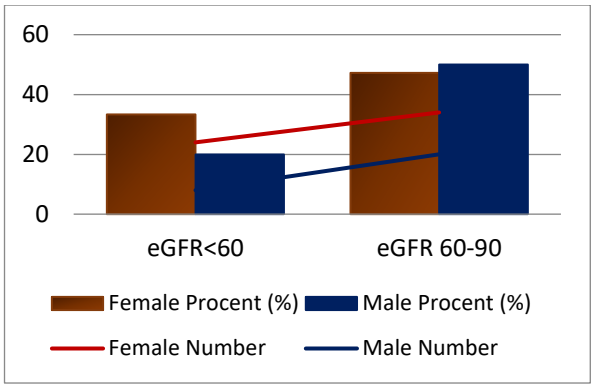

Figure 4. Evaluation of renal function for patients taken in study

An extremely relevant parameter in monitoring of renal function is the glomerular filtration rate, in which for female patients there were 54 cases (75%), and for male patients 28 cases (70%). These data suggest that the filter rate is significantly low among women, compared to men due to the physiological differences and the variability of the response to renal pathology. The distribution of patients by sex according to the filter rate that concludes a higher prevalence of pathological values among women compared to men. Of the total of 72 patients, 24 (33.33%) had the filter rate less than 60 ml/min/1.73 m^2 and 34 (47.22%) with a rate between 60-90 ml/min/1.73 m^2. In the case of male patients, 8 (20%) had a rate below 60 ml/min/1.73 m^2 and 20 between 60-90 ml/min/1.73 m^2. Values below 60 ml/min/1.73 m^2 indicate both in the case of women and men, a significant impairment of the renal function that corresponds to the evolution of viral hepatitis C. The range 60-90 ml/min/1.73 m^2 corresponds to a moderate renal impairment with a slower or less aggressive evolution of the infection with VHC. Following the serological determinations, on the studied lot it is concluded that 80.55% of female patients and 70% of male patients with hepatitis C had renal impairment, indicating a clear recommendation for additional investigations in the urology section.

CONCLUSION

Hepatitis C virus is a major public health problem with a systemic impact due to multiple pathogenic mechanisms. HCV infection is recognized as a "silent enemy", because it evolves slowly and remains asymptomatic in most cases. For this reason, the changes of the biochemical parameters are not visible for a long period of time, appearing in a more advanced phase or when liver cirrhosis has already been installed.

The affect is predominantly at the hepatic level, but over time without treatment it affects the kidneys according to the stage of the disease.

Changes in biochemical parameters, such as uric acid, creatinine, urea and glomerular filtration rate best reflect the degree of renal impairment, which is why monitoring is essential to avoid nephropathy with progressive evolution.

From the distribution by gender, a predominance of female patients was observed in the studied group compared to male patients, as women tend to access medical services frequently due to biological factors related to reproductive functions, which require monitoring and specialized medical care, as well as the important role they play in maintaining family health. Cultural perception plays an important role, as women are often encouraged to be more attentive to their health and to seek medical help for various problems.

Regarding the environment of origin of the patients studied, both sexes had a higher share in the urban environment; this aspect can be deduced from the fact that there is easier access to medical facilities in the urban environment.

Renal biochemical parameters underwent changes in both women and men.

The filtering rate is one of the most sensitive and specific indicators of renal function, being calculated on the basis of serum creatinine, age and sex values, allowing the precise staging of chronic kidney disease.

Following serological determinations, in the studied group it was found that two-thirds of the patients diagnosed with hepatitis C had renal damage, indicating a clear recommendation for additional investigations in the urology department.

Continuous monitoring of patients with hepatitis C implies not only the periodic performance of medical analyzes, but also the patient's medical education in order to be aware that this disease can have quite serious consequences.

REFERENCES

1. Antaki N., Craxi A., Kamal S., Moucari R., Van der Merwe S., Haffar S., Gadano A., Zein N., Lai C.L., Pawlotsky J.M., Heathcote E.J., Dusheiko G., Marcellin P. *The neglected hepatitis C virus genotypes 4, 5 and 6: An international consensus report*. Liver International, 2010, 30 (3): 342-355.
2. Babiuc C., Dumbrava V. *Gastroenterologie, hepatologie, reumatologie, Medicina internă. Volumul II., Ed a 2-a*, Chișinău, 2009.
3. Badăluță N., Răducanu D., Ilișescu M.A., Georgescu A.M. *Research on the antimicrobial activity of propolis and the degree of use of this product.* Scientific Studies & Research. Series Biology, 2022, 31 (1): 62-69.
4. Bartenschlager R., Frese M., Pietschmann T. *Novel insights into hepatitis C virus replication and persistence*. Advances in Virus Research, 2004, 63: 71-180.
5. Bentow C., Lakos G., Martis P., Wahl E., Garcia M., Viñas O., Espinosa G., Cervera R., Sjöwall C., Carmona-Fernandes D., Santos M.J., Hanly J.G., Mahler M. *International multi-center evaluation of a novel chemiluminescence assay for the detection of anti-dsDNA antibodies.* Lupus, 2016, 25 (8): 864-872.
6. Bentow C., Lakos G., Rosenblum R., Bryant C., Seaman A., Mahler M. *Clinical performance evaluation of a novel, automated chemiluminescent immunoassay, QUANTA Flash CTD Screen Plus.* Immunology Research, 2015, 61 (1-2): 110-116.
7. Boccaccio V., Bruno S. *Management of HCV patients with cirrhosis with direct acting antivirals.* Liver International, 2014, 34, S 1: 38-45.
8. Ciutan M., Carmen S.A.S.U. *Ciroza și Hepatita Alcoolică - Studiu descriptiv privind situația episoadelor de spitalizare, Romania, 2014-2023*. Management in Health, 2023, 27 (4), 15-20.
9. Constantinescu I. *Aspecte ale diagnosticului virusologic în bolile hepatice*. Ed. Editorro, București, 2003.
10. Davis F.A. *Clinical Immunology and Serology. A laboratory perspective*. 3rd ed., Philadelphia, 2010.
11. Engvall E. *The ELISA, enzyme-linked immunosorbent assay.* Clinical Chemistry, 2010, 56 (2): 319-320.
12. Forster R.J., Bertoncello P., Keyes T.E. Electrogenerated chemiluminescence. Annual Review of Analytical Chemistry, 2009, 2: 359-385.
13. https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/hepatitis/overview2024.
14. Lauer G.M., Walker B.D. *Hepatitis C virus infection.* The New England Journal of Medicine, 2001, 345 (1): 41-52.
15. Niepmann M., Gerresheim G.K. *Hepatitis C Virus Translation Regulation*. International Journal of Molecular Science, 2020, 21 (7): 2328.
16. Prisecaru M., Stoica I.V., Tiță D., Prisecaru F. *Ghid de educaţie pentru sănătate şi de patologie umană*. Ed. Alma Mater Bacau, vol. IV, 2021.
17. Prisecaru M., Stoica I.V. *Imunologie generală şi clinică*. Ed. Alma Mater Bacau, 2017.
18. Raducanu D., Ungureanu C.V. *Activitatea antimicrobiană și antifungică a extractului etanolic din propolis românesc.* In *Perspectivele și Problemele Integrării în Spațiul European al Cercetării și Educației*, 2024, 11, 347-353.
19. Sohal A., Singh C., Bhalla A., Kalsi H., Roytman M. *Renal manifestations of chronic hepatitis C: A review.* Journal of Clinical Medicine, 2024, 13 (18): 5536.
20. Tabatabaei M.S., Ahmed M. *Enzyme-Linked Immunosorbent Assay (ELISA).* Methods of Molecular Biology, 2022, 2508: 115-134.