Malnutrition inflammation index in chronic haemodialysis patients with or without hepatitis C virus infection

Fardous Abdel Fattah Ramadan, Nancy Abdel Fattah Ahmed, Salah Elshahat Aref and Mona Abdel Ghani El Husseini

Abstract

Background: Hepatitis C virus infection is one of the main causes of chronic liver disease worldwide. Both chronic hepatitis C and chronic kidney disease are common and serious diseases; this work aimed to determine the clinical impact of HCV infection on malnutrition inflammation index score in chronic kidney disease patients.

This study was conducted on 96 patients on haemodialysis. They were divided into two groups. The first group was composed of 46 patients who were on maintenance haemodialysis and had chronic hepatitis C. The second group was composed of 50 patients on haemodialysis who were negative for hepatitis C.

Results: HCV-infected patients were associated with higher malnutrition inflammation score values (10% had MIS 16–20) compared to non-infected patients (2% only had MIS 16–20).

Conclusion: The prevalence of malnutrition was higher in the HCV-positive than the HCV-negative group.

Keywords: HCV, CKD, MIS

Background

HCV infection is one of the main causes of chronic liver disease worldwide [1]. The number of infected persons may be about 160 million, but most are unaware of their infection [2]. The long-term impact of HCV infection is highly variable from minimal changes to extensive fibrosis and cirrhosis with or without hepatocellular carcinoma [1]. Both HCV and chronic renal disease are common and potentially serious diseases [3]. Patients undergoing maintenance haemodialysis have a significantly higher prevalence of HCV infection and malnutrition inflammation complex syndrome (MICS) [4]. Malnutrition causes cardiovascular mortality in dialysis patients [5] and decreases the quality of life of haemodialysis patients [6].

This work aimed to determine the clinical impact of HCV infection on malnutrition inflammation index score in chronic kidney disease patients.

Methods

Design of the study

Our patients in this study were selected from those who attended Sherbeen Central Hospital (Dakahlia), Haemodialysis Unit.

Sample size and selection of the patients

This study was conducted on 96 patients (61 males and 35 females) on haemodialysis from April 2016 to December 2016, and they were divided into two groups: the first is 46 haemodialysis patients with positive HCV infection; the second is 50 haemodialysis patients with...
negative HCV infection. Patient ages range between 20 and 60 years.

**Inclusion criteria**
The inclusion criteria are as follows: chronic kidney disease patients on haemodialysis and patients aged from 20 to 60 years.

**Exclusion criteria**
The exclusion criteria are as follows: patients who had clinical or laboratory evidence of active infectious disease 1 month before the study onset and patients with history of tumours.

**Methods of the study**
They were evaluated by Malnutrition-Inflammation Score, and clinical examination with special stress on some items (Fig. 1).

**Laboratory investigations**
These are as follows: serum calcium, potassium, and sodium; complete blood count (CBC); blood urea; serum creatinine; C-reactive protein (CRP); ELISA for HCV antibody; PCR for hepatitis C-positive ELISA patients; total iron-binding capacity (TIBC); and serum transferrin.

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**MALNUTRITION INFLAMMATION SCORE (M.I.S.)**

![MALNUTRITION INFLAMMATION SCORE (M.I.S.)](image)

**Fig. 1** MIS. *Major comorbid conditions included congestive heart failure class III or IV, full-blown AIDS, severe coronary artery disease, moderate to severe chronic obstructive pulmonary disease, major neurologic sequelae, and metastatic malignancies or recent chemotherapy. Suggested equivalent increments for serum transferrin are > 200 (0), 170 to 200 (1), 140 to 170 (2), and <140 mg/dL [7].


Table 1 Baseline data for included HCV-non-infected and HCV-infected haemodialysis patients

| Parameter                              | HCV-non-infected | HCV-infected | P value |
|----------------------------------------|------------------|--------------|---------|
| No. (%)                                | 50 (52.1%)       | 46 (47.9%)   | –       |
| Gender (male/female)                   | 29/21            | 32/14        | 0.241   |
| Height (cm) (mean ± SD)                | 165.2 ± 0.5      | 164.2 ± 0.8  | 0.427   |
| Body weight (kg) (mean ± SD)           | 70.2 ± 2.2       | 66.1 ± 2.3   | 0.196   |

No number of patients, SD standard deviation, BMI body mass index. P value: P > 0.05 is non-significant and P < 0.05 is significant. The basic demographics of the two groups were similar, and there was no significant difference between the two groups of subjects; P > 0.05 in height, body weight, and BMI.

Statistical analysis

All statistical analyses were performed by using the Statistical Package for the Social Sciences (SPSS) software version 15.0 (SPSS Inc., Chicago, IL) and GraphPad Prism package v.5.0 (GraphPad Software, San Diego, CA). Continuous variables were expressed as mean ± standard deviation (SD). ANOVA or Student’s t test for continuous variables and chi-square (χ²) for categorical variables were used to determine differences between groups. A P value of < 0.05 was considered statistically significant. The correlation coefficients (r) were assessed by Pearson’s correlation coefficient or Spearman’s correlation coefficient as appropriate.

Results (Table 1)

Independent sample t test showed that there was no significant difference (P > 0.05) between the two groups of subjects in the count of red blood cells, white blood cells, and platelets. In addition, there was no significant difference (P > 0.05) in haemoglobin levels between the two groups (Tables 1 and 2).

Independent sample t test revealed that there were no significant differences (P > 0.05) between the two groups as regards serum iron markers (TIBC and serum transferrin) and CRP levels, while there were highly significant differences between the two groups in the albumin level (P < 0.001) (Tables 3 and 4).

Discussion

In the present study, we found that total MIS score was significantly higher in the HCV-infected group than the non-HCV group (Table 5).

Table 2 Comparison of haematology parameters between HCV-non-infected and HCV-infected haemodialysis patients

| Parameter                              | Mean ± SD | P value |
|----------------------------------------|-----------|---------|
| Haemoglobin (g/dL)                     | 8.8 ± 0.2 | 0.129   |
| RBCS (× 10¹²/L)                        | 3.2 ± 0.1 | 0.576   |
| WBCS (× 10⁹/L)                         | 6.5 ± 0.3 | 0.454   |
| Platelet count (× 10¹²/L)              | 205.3 ± 8.3 | 0.278 |

Reference ranges: red blood cell count: male 4.23–5.72 × 10¹² cells/L, female 3.90–5.03 × 10¹² cells/L; haemoglobin: male 13.5–17.5 g/dL, female 12.0–15.5 g/dL; white blood cell count—3.5–10.5 × 10⁹ cells/L; platelet count—150–450 × 10⁹/L.

Table 4 Association of iron metabolism markers and other biochemical parameters with HCV infection

| Parameter                              | Mean ± SD | P value |
|----------------------------------------|-----------|---------|
| TIBC (µg/dL)                           | 295.9 ± 6.7 | 0.707   |
| Serum transferrin                      | 645.1 ± 78.6 | 0.055   |
| Albumin (g/dL)                         | 3.7 ± 0.1  | 0.0001  |
| CRP (mg/L)                             | 183.2 ± 28 | 0.282   |

Reference ranges: total iron-binding capacity (TIBC), 250–410 µg/dL; serum transferrin, 200–350 mg/dL; albumin, 3.5–5.5 g/dL; C-reactive protein (CRP), 5–10 mg/L.

In the current study, the male to female ratio was 32/14 in infected HCV on haemodialysis that reflected increased incidence of HCV infection among males.

Our findings agreed with those recorded in Sudan among haemodialysis patients [8]. In both groups, there was decreased haemoglobin level which was below normal as it was 8.8 ± 0.2 g/dL in the non-HCV infection group and 8.4 ± 0.2 g/dL in the HCV infection group. That was in accordance with the findings of Boubaker et al. [9].

Platelet count was less in the HCV group than in the negative HCV group although this difference was still non-significant [10].

We found that serum albumin was significantly decreased in the HCV infection group when compared with the non-HCV infection group. These findings agreed with the findings of Barakat et al. [11].
In our study, we found that there was no significant difference in the level of transferrin in the HCV-infected group HD and HCV-non-infected group HD; however, the values in both groups were more than the normal range. These findings were matched with a previous study carried out by Bharadwaj et al. [12].

In maintenance haemodialysis patients (MHD), inflammation was also a well-known feature; we found that serum CRP in both groups showed increased level than the known normal level of CRP. That was in accordance with the findings of Al-Amir et al. [13]. The MIS is a comprehensive scoring system that considered prospective short-term hospitalisation, mortality, nutrition, inflammation, and anaemia in maintenance haemodialysis patients [14].

Table 5 The frequency distribution of the Malnutrition-Inflammation Score in HCV-infected group compared to non-infected group

| MIS* | HCV-non-infected (N = 50) | HCV-infected (N = 46) | P value |
|------|--------------------------|----------------------|---------|
| 0–5  | 12 (24%)                 | 3 (6%)               |         |
| 6–10 | 23 (46%)                 | 20 (40%)             | 0.035   |
| 11–15| 14 (28%)                 | 18 (36%)             |         |
| 16–20| 1 (2%)                   | 5 (10%)              |         |

*Data are presented as n (%), and P values were calculated using Pearson's chi-square test.

A previous study of HD patients reported that the presence of active HCV infection, detected by molecular-based testing, is associated with certain clinical features that are suggestive of MICS [4]. We found that HCV infection was associated with a higher MIS score values (Table 6) which was in accordance with the findings of Tsai et al. [15].

Limitations
Not all patients agree to be in a research easily in addition, high price of elastography so could not be done.

Conclusion
The prevalence of malnutrition is higher in patients with positive hepatitis C virus than non-hepatitis C virus haemodialysis patients.

Recommendations
Routine nutritional screening and assessment at diagnosis of chronic kidney disease patients.

Abbreviations
BMI: Body mass index; CBC: Complete blood count; CKD: Chronic kidney disease; CRP: C-reactive protein; ELISA: Enzyme-linked immunosorbent assay; HCV: Hepatitis C virus; MICS: Malnutrition inflammation complex syndrome; MIS: Malnutrition inflammation score; SPSS: Statistical Package for the Social Sciences

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Authors’ contributions
All authors have read and approved the manuscript. FAFR: manuscript review, design, and final revision. NAFA: idea of the study, manuscript editing, publishing, and follow-up (CA). SESA: laboratory studies. MAGH: literature search, clinical, statistics, and data collection.

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Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding on reasonable request.

Ethics approval and consent to participate
Study protocol was investigated and approved by the Medical Ethics Research Team, Faculty of Medicine, Mansoura University. Every case, after guaranteeing privacy, has given informed written consent (code number MS/ 906).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
1Faculty of Medicine, Mansoura University, Mansoura, Egypt. 2Dialysis Unit, Sherbeen Hospital, Dakalia, Egypt.

Table 6 Correlation of the MIS with demographic and laboratory parameters

| Parameter               | r   | P value |
|-------------------------|-----|---------|
| Height                  | −0.176 | 0.087  |
| Body weight             | −0.254 | 0.012  |
| BMI                     | −0.404 | 0.030  |
| Haemoglobin             | −0.043 | 0.677  |
| RBCS                    | −0.094 | 0.363  |
| WBCS                    | −0.130 | 0.207  |
| Platelet count          | −0.077 | 0.455  |
| Creatinine              | −0.018 | 0.860  |
| Blood urea              | −0.078 | 0.450  |
| S. sodium               | 0.029  | 0.780  |
| S. total calcium        | 0.158  | 0.072  |
| S. potassium            | 0.029  | 0.783  |
| Total iron-binding capacity | −0.063 | 0.544  |
| Serum transferrin       | 0.093  | 0.368  |
| Albumin                 | −0.378 | 0.0001 |
| C-reactive protein      | −0.072 | 0.486  |
| HCV infection           | 0.287  | 0.005  |
| Viral load              | 0.501  | 0.0009 |

BMI: body mass index, MIS: Malnutrition-Inflammation Score, r: correlation coefficient; P value: P > 0.05 is non-significant and P < 0.05 is significant.
References

1. Mutimer D, Aghemo A, Diepolder H, Negro F, Robaeys G, Ryder S (2014) EASL clinical practice guidelines: management of hepatitis C virus infection. J Hepatol 60:392–420
2. Pawlotsky JM, Panel members, Alessio Aghemo, David Back, Geoffrey Dusheiko, Xavier Forns et al (2015) EASL recommendations on treatment of hepatitis C. J Hepatol 63:199–236
3. Norberto P, Dario C, Bikbov B, Giuseppe R (2009) Hepatitis C infection and chronic renal diseases. Clin J Am Soc Nephrol 4:207–220
4. Kalantar-Zadeh K, Miller LG, Daar ES (2005) Diagnostic discordance for hepatitis C virus infection in hemodialysis patients. Am J Kidney Dis 46:290–300
5. Kuhlmann MK. and Levin N.W. Interaction between nutrition and inflammation in hemodialysis patients. Contrib Nephrol 2005 l; 149:200-207.
6. Ekramzadeh M, Sohrabi Z, Salehi M, Ayatollahi M, Hassanzadeh J, Geramzadeh B et al (2014) Adiponectin as a novel indicator of malnutrition and inflammation in haemodialysis patients. Iran J Kidney Dis 7(4):304
7. Steiber AL, Kalantar-Zadeh K, Secker D, McCarthy M, Sehgal A, McCann L (2004) Subjective global assessment in chronic kidney disease. J Ren Nutr 14(4):191–200
8. Abdalla EAM, Shabban KMA, Elkhidir IM (2016) Haemodialysis patients at dialysis centers in Khartoum State – Sudan. OSR-JOMS 16(3):85–88
9. Boubaker K, Mahfoudhi M, Battikh A, Bounemra A, Maktouf C, Kheder A (2015) Higher endogenous erythropoietin levels in hemodialysis patients with hepatitis C virus infection and effect on anaemia. Open Journal of Nephrology 5:29–34
10. Wai CT (2013) and his colleagues: Correcting thrombocytopenia in patients with liver diseases: a difficult hurdle. J Gastroenterol Hepatol 28:207–221
11. Barakat AA, Nasr FM, Mkwaila AA, and Monty S Eldamarawy M. Atherosclerosis in chronic hepatitis C virus patients with and without liver cirrhosis. Egypt Heart J 2017 31; 69(2): 139-147.
12. Bharadwaj S, Ginoya S, Tandon P, Tushar D, Goel TD, Guirguis J et al (2016) Malnutrition: laboratory markers vs nutritional assessment. Gastroenterology Report 4:272–280
13. Al-Amir MA, Hassan AA, Elshafie SM, ZeinElabdin HM, Taha SA (2017) The relationship between anemia, serum hepcidin levels, and chronic hepatitis C in chronic hemodialysis patients. Egypt J Intern Med 29(6):112
14. Ho LC, Wang HH, Peng YS, Chiang CK, Huang JW, Hung KY, Hu FC, Wu KD (2008) Clinical utility of malnutrition inflammation score in maintenance hemodialysis patients: focus on identifying the best cut-off point. Am J Nephrol 28:840–846
15. Tsai H-B, Chen P-C, Liu C-H, Hung P-H, Chen M-T, Chiang C-K, Kao J-H et al (2012) Association of hepatitis C virus infection and malnutrition–inflammation complex syndrome in maintenance hemodialysis patients. Nephrol Dial Transplant 7:1176–1183

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