Ramadan et al. Egyptian Liver Journal (2020) 10:20
https://doi.org/10.1186/s43066-020-00026-y

Egyptian Liver Journal

ORIGINAL RESEARCH ARTICLE Open Access

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

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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

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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.

MALNUTRITION INFLAMMATION SCORE (M.I.S.)

(A) Patients' related medical history:			
1- Change in end dialysis dry weight (overall change in past 3-6 months):			
0	1	2	3
No decrease in dry weight or weight loss <0.5 kg	Minor weight loss (≥0.5 kg but <1 kg)	Weight loss more than one kg but <5%	Weight loss >5%
2- Dietary intake:			
0	1	2	3
Good appetite and no deterioration of the dietary intake pattern	Somewhat sub-optimal solid diet intake	Moderate overall decrease to full liquid diet	Hypo-caloric liquid to starvation
3- Gastrointestinal (GI) symptoms:			
0	1	2	3
No symptoms with good appetite	Mild symptoms, poor appetite or nauseated occasionally	Occasional vomiting or moderate GI symptoms	Frequent diarrhea or vomiting or severe anorexia
4- Functional capacity (nutritionally related functional impairment):			
0	1	2	3
Normal to improved functional capacity, feeling fine	Occasional difficulty with baseline ambulation, or feeling tired frequently	Difficulty with otherwise independent activities (e.g. going to bathroom)	Bed/chair-ridden, or little to no physical activity
5- Co-morbidity including number of years on Dialysis:			
0	1	2	3
On dialysis less than one year and healthy otherwise	Dialyzed for 1-4 years, or mild co-morbidity (excluding MCC*)	Dialyzed >4 years, or moderate co-morbidity (including one MCC*)	Any severe, multiple co-morbidity (2 or more MCC*)
(B) Physical Exam (according to SGA criteria):			
6- Decreased fat stores or loss of subcutaneous fat (below eyes, triceps, biceps, chest):			
0	1	2	3
Normal (no change)	mild	moderate	Severe
7- Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous):			
0	1	2	3
Normal (no change)	mild	moderate	Severe
(C) Body mass index:			
8- Body mass index: BMI = Wt(kg) / Ht^2(m)			
0	1	2	3
BMI≥20 kg/m^2	BMI: 18-19.99 kg/m^2	BMI: 16-17.99 kg/m^2	BMI<16 kg/m^2
(D) Laboratory Parameters:			
9- Serum albumin:			
0	1	2	3
Albumin≥ 4.0 g/dL	Albumin: 3.5-3.9 g/dL	Albumin: 3.0-3.4 g/dL	Albumin: <3.0 g/dL
10- Serum TIBC (total Iron Binding Capacity): ♣			
0	1	2	3
TIBC≥ 250 mg/dL	TIBC: 200-249 mg/dL	TIBC: 150-199 mg/dL	TIBC: <150 mg/dL
Total Score = sum of above 10 components (0-30):			

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 (χ^2) 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 two the groups in the albumin level ($P = 0.0001$) (Tables 3 and 4).

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 3 Comparison of renal function parameter between HCV-non-infected and HCV-infected haemodialysis patients

Parameter[a]	Mean ± SD[b]		*P* value
	HCV-non-infected	HCV-infected	
Creatinine (mg/dL)	5.6 ± 0.3	5.9 ± 0.2	0.426
Blood urea (mg/dL)	128.6 ± 5.7	125.3 ± 6.6	0.709
S. sodium (mmol/L)	142.1 ± 0.6	142.3 ± 0.7	0.877
S. total calcium (mg/dL)	8.3 ± 0.1	8.4 ± 0.1	0.378
S. potassium (mmol/L)	4.7 ± 0.1	4.6 ± 0.1	0.672

[a]Reference ranges: creatinine, 0.7–1.4 mg/dL; blood urea, 20–40 mg/dL; S. sodium (Na), 135–145 mmol; S. total calcium (Ca), 2–2.6 mmol/L (8.5–10.2 mg/dL); S. potassium (K), 3.5–5 mmol/L
[b]*SD* standard deviation between the two groups in renal function parameters

Discussion

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].

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

Parameter[a]	Mean ± SD[b]		*P* value[c]
	HCV-non-infected	HCV-infected	
Haemoglobin (g/dL)	8.8 ± 0.2	8.4 ± 0.2	0.129
RBCS ($\times 10^{12}$/L)	3.2 ± 0.1	3.1 ± 0.1	0.576
WBCS ($\times 10^{9}$/L)	6.5 ± 0.3	7.0 ± 0.4	0.454
Platelet count ($\times 10^{9}$/L)	205.3 ± 8.3	196.7 ± 7.7	0.278

[a]Reference ranges: red blood cell count: male 4.32–5.72 $\times 10^{12}$ cells/L, female 3.90–5.03 $\times 10^{12}$ 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 $\times 10^{9}$ cells/L; platelet count—150–450 $\times 10^{9}$/L37
[b]*SD* standard deviation
[c]*P* value: $P > 0.05$ is non-significant and $P < 0.05$ is significant

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

Parameter[a]	Mean ± SD[b]		*P* value[c]
	HCV-non-infected	HCV-infected	
TIBC (μg/dL)	295.9 ± 6.7	292.6 ± 5.1	0.707
Serum transferrin	645.1 ± 78.6	457.3 ± 53.3	0.055
Albumin (g/dL)	3.7 ± 0.1	3.2 ± 0.1	0.0001
CRP (mg/L)	18.3 ± 2.8	22.9 ± 3.2	0.282

[a]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
[b]*SD* standard deviation
[c]*P* value: $P > 0.05$ is non-significant and $P < 0.05$ is significant

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

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 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

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

Acknowledgements

Much gratitude is paid to all persons who helped in this work.

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.

Funding

Not applicable.

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.

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Received: 8 August 2019 Accepted: 28 February 2020
Published online: 01 May 2020

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