Influence of Clinical Pharmacist intervention on the Quality of Life of Anemic Patients with Chronic Kidney Diseases in the Hemodialysis Setting in Kirkuk-Iraq.

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Abstract:

Purpose

To assess the impact of pharmacist intervention on the health related quality of life (QoL) among anemic patients with chronic kidney diseases in a hemodialysis center.

Methods

A single blind, randomized control study was carried out at the hemodialysis center of Kirkuk Hospital in Kirkuk-Iraq. The patients were randomized into two groups; interventional group received clinical pharmacist services delivered by a qualified registered pharmacist and non-interventional group received usual hospital care and. The pharmacist proposed clinical interventions at the level of patients, drugs, hospital level to improve the patient's quality of life. The impact of clinical pharmacist's intervention on improving quality of life of patients was assessed by using the Rand 36-Item Short Form Health Survey questionnaire. The assessment of the QoL was carried out for both groups for a total of 4-month follow-up; at baseline, day 60 and day 120.

Results

A total number of 120 patients were recruited from the hemodialysis centers and 1437 interventions were applied for interventional group (n=60), 41.4% at the drugs level, 51.1% at the patient level and 7.5% at the hospital and administrative level. The health related QoL scores were significantly improved over time in the domains noticed with regard to the "physical functioning, general health, emotional role" of interventional group compared to the baseline and non-interventional group with conventional hospital care with $P < 0.05$.

Conclusion

Interventions provided by the pharmacist had a positive impact on QoL of anemic patients in the hemodialysis center of the city.

Key words: Clinical pharmacist, Intervention, Quality of life, Anemia, Chronic kidney disease

تاثير التداخل الصيدلاني على جودة الحياة المرضى الذي يعانون من فقرالدم الناتج عن العجز الكلوي المزمن في وحدة الديلزة.

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الخلاصة:

الهدف: صممت الدراسة الحالية لتقييم تاثير التداخل الصيدلاني على المسائل الصحية المتعلقة بجودة الحياة في مابين المرضى الذين يعانون من فقر الدم المصاحب لامراض الكلى المزمنة في وحداة غسل الكلى

الطريقة: وقد اجريت هذه الدراسة المفردة التعمية العشوائية في وحدة غسل الكلى في مستشفى كركوك العام في محافظة كركوك –العراق .تم تقسيم المرضى عشوائيا الى مجموعتين: مجموعة التداخلات التي تتلقى الخدمات الصيدلانية السريرية المقدمة بواسطة الصيدلاني المؤهل المرخص و مجموعة بلا تداخلات تتلقى العناية المعتادة في المستشفى .اقترح الصيدلاني تداخلات سريرية وادارية على مستوى الادوية, المريض ,وعلى مستوى المستشفى والادارة لتغيير وتحسين جودة حياة المرضى.

النتائج: العدد الكلي ل 120 مريض تم اختيارهم من وحدة غسل الكلى .تقييم جودة الحياة تم للمجموعتين لمدة اربعة اشهر متابعة :عند بدء الدراسة ,بعد60 يوم ,بعد120 يوم .عند انتهاء الدراسة ,المجموع الكلي ل1437 تداخل كان قد اجري لمجموعة التداخلات(عدد=60) , وكان 41.4% على مستوى الادوية ,51.1%على مستوى المرضى ,و7.5%على مستوى المستشفى والادارة.نتائج المسائل الصحية المتعلقة بجودة الحياة كانت قد تحسنت بشكل ملحوظ بمرور الوقت في المجالات التي تمت ملاحظتها بالنظر الى "تادية الوظائف الفيزيائية ,الصحة العامة,الدور العاطفي او الانفعالي"بالنسبة الى مجموعة التداخلات مقارنة بمجموعة بلا تداخلات مع عناية المستشفى التقليدية.

الأستنتاج: يمكن الأستنتاج بأن التداخلات المقدمة من قبل الصيدلاني لها تاثير ايجابي في المحافظة على جودة الحياة للمرضى الذين يعانون من فقر الدم في وحدة غسل الكلى.

الكلمات المفتاحية: الصيدلي السريري، التداخلات، جودة الحياة، فقر الدم، عجز الكلى

Introduction:

Chronic kidney disease (CKD) is associated with cardiovascular, neurological and bone diseases [1]. It is well accepted that patients with CKD are also at increased risk of developing anemia [2]. Anemia is a serious complication in patient with CKD, it has been reported to further increase the risk of complications such as cardiovascular disease, cognitive impairment [3,4]. The tiredness related to CKD associated anemia may limit a patient ’s ability to deal with this multifaceted condition and increase the disease burden at all stages of CKD, an impaired ability to perform daily activities may lead to progressive worsening of patient’s mood, functional impairment, mobility impairment, increased risk of falls, and eventually diminished health-related quality of life (QoL) [5].

Effect of anemia is linked with a decline in physical function, independently of its association with renal impairment, which can diminish a patient’ s ability to perform activities related to daily living [6]. The humanistic burden, displayed in impaired health related QoL and other patient-reported outcomes is also associated with anemia in patients with CKD. A systematic review verified that those with lower haemoglobin (Hb) or haematocrit levels had a poorer health related QoL based on the tools that used to measure the quality of life such as 36-Item Short Form Health Survey (SF-36) compared with CKD patients with higher levels of these hematological indices. Additionally, an inverse association between the severity of anemia and scores on the physical and mental component summaries of the SF-36 was also highlighted in the review [7]. The potentially deleterious consequences of anemia in CKD necessitates an early diagnosis and management. Consequently, monitoring of hematological indices and detecting anemia in patients with CKD is essential.

Treatment of anemia associated with CKD has also been shown to result in improvements in cardiac function, physical performance features such as endurance energy; and physical mobility [8]. When anemia is corrected, patient satisfaction elevated, which can be reflected by higher scores of quality-of-lives, less depression, better socialization, improved sexual function and better cognition [9]. Anemia correction in dialysis patients has been displayed a positive correlation with an improvement in health-associated quality of life [10]. Furthermore, correcting anemia has the potential to improve other clinical and economic outcomes in patients with chronic kidney disease [11]. However, anemia correction in CKD is recognized as a major challenge for health system, therefore multidisciplinary health care teams of nephrologists, nurses, dieticians, and clinical pharmacists are required to share the goal of preventing this complication to provide

therapeutic optimization and consequently improving the health-related quality of life. Several decades ago, efforts for management of anemia by applying clinical pharmacist-led services has been experienced in many studies [12,13]. The involvement of clinical pharmacists in several disease areas are supported by many documents in the literature which highlight the positive clinical outcomes [14]. Most of the controlled studies that were reporting clinical, economic and humanistic outcomes found a positive association between pharmacist intervention and clinical outcomes improvement reflected as an increase in health-related quality of-life scores [15].

Erythropoiesis stimulating agents (ESA) and iron supplement therapy are the main tools for treating the anemia associated with CKD [16]. Incorporating ESA therapy into a clinical pharmacist intervention has the potential impact to correct anemia by improving patient clinical outcomes and patient safety, as well as by decreasing medication costs [17].

The clinical pharmacist intervention has implemented in various pharmacist-physician-collaborative practice models such as in diabetes, hypertension and hyperlipidemia, neurological [18], rheumatological [19] and cardiovascular [20] and the role of the clinical pharmacist in the dialysis unit has been established in some developed countries [21,22]. However, to our knowledge, the overall level of clinical pharmacist services provided by developing nations is still low [23] and the potential impact of clinical pharmacist interventions in improvement of clinical status, quality of life and correction of anemia in dialysis patient in the developing countries including Iraq has not well documented yet. Therefore, the purpose of the current study was to know whether the effort of clinical pharmacist by providing various clinical interventions in aim to correct CKD-associated anemia would lead to improvement of health-related quality of life of anemic patient in dialysis settings in Kirkuk city.

Aim of the study

The present study was designed to determine the impact of the clinical pharmacist's interventions in health-related quality of life improvement in patients with CKD in dialysis centers of Kirkuk city.

Study design

The study was an interventional single-blinded randomized control trial, it was carried out at the dialysis center of Kirkuk General Hospital-Directorate of Health in Kirkuk city; it is a hospital of 250 beds for hospitalization of chronic kidney disease patients. The study was conducted as a joint program with the university of Sulaimani and Dialysis centers in Kirkuk City.

Ethical approval

The protocol of the study was approved by the ethical committee of college of Medicine – University of Sulaimani with (Registration number # 8, 2019) and the permission for work was obtained from the dialysis center– Teaching Hospital-Directorate of Health in Kirkuk.

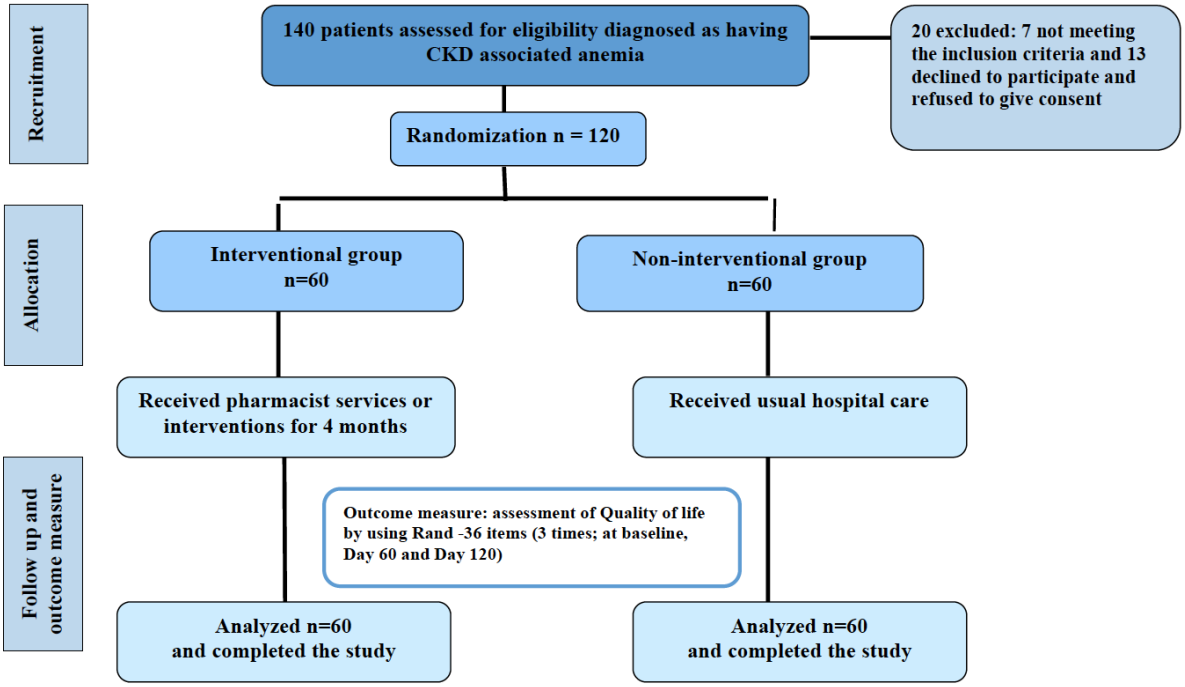

Figure (1): Flow chart of the study design includes recruitment, allocation and the outcome measures.

Recruitment and randomization

Recruitment process began in February 2019 and the study duration lasts eight months. Patients with confirmed diagnoses of end stage renal disease (ESRD) at both screening and baseline visits, as defined by the United State Kidney Foundation and serum creatinine clearance, glomerular filtration rate tests and met the up-to-date revised criteria of diagnosis of CKD with anemia [2] were included. And they were on hemodialysis continuously for preceding three months with one to two sessions of hemodialysis per week. Having anemia complicated by ESRD and their hemoglobin level were $\leq$ 8.0 g/dl at the screening and baseline visit. The patients who were not willing to participate not enrolled in the study.

After the screening process, simple randomization was carried out at the first visit before baseline data collection by the pharmacist; eligible patients were divided into two groups: first group was interventional group contains 60 patients and clinical pharmacist services were applied to them, the second group were non-interventional (control) group including 60 patients. All patients in non-interventional (control) group received usual hospital care and anemia treatment protocol of the hospital without any clinical pharmacist intervention (Figure 1). Patients were notified verbally about the study protocol by the clinical pharmacist and they were being blinded to the services applied by the clinical pharmacist. Before enrollment and at the first visit, a written informed consent was provided by all the patients in both groups to participate. Patients were interviewed by the clinical pharmacist using a self-structured questionnaire to collect the data. Data included were demographics and clinical characteristics of the participants such as age, sex, body weight, occupation and others. Other relevant information such as history regarding co-morbid diseases and medications that may increase the risk of anemia in CKD also included.

In the absence of a standard guidelines for the treatment of CKD- associated anemia in the dialysis patient and lack of an extensive follow up- program for monitoring the anemic patients in the hemodialysis centers in Kirkuk hospitals and for the purpose of the present study, the pharmacist performed three main clinical activities to conduct the present study including: 1) compiling in-Hospital guideline for proper use of recombinant human erythropoietin in collaboration with physicians based on international guidelines for treatment

of anemia [24,25] ; 2) providing drug information on renal anemia to the physicians and the nurses; 3) made interventions and recommendations particularly about changes in the doses of erythropoietin and administration of iron preparations to the physicians based on laboratory test data. The interventions and recommendations proposed by the clinical pharmacist were at the drugs, patients and hospital level as described in figure 2.

The entire clinical pharmacist services delivered by a qualified registered pharmacist and the interventions were exclusively applied to the interventional group till the end of the study period. All the interventions made by the pharmacist during ward rounds and direct physician- pharmacist communication in the hemodialysis center were recorded and classified in an excel spreadsheet. The types and classification of clinical pharmacist interventions were adopted from previous studies [18]. The types and number of interventions per each visit (1st month, 2nd month, 3rd month and 4th month) per each patient and over 4-month period were immediately documented and classified electronically to different level using an excel program to be ready for statistical analysis.

Most of the interventions at the drug level mainly entailed erythropoietin dose adjustment, route of administration problem and add or stop iron supplementation. Furthermore, at the patient level different strategies were used to enhance medication adherence such as patient education through recurrent and personalized telephone counseling via in-person and telephone follow-up and refill reminder. At the hospital level the pharmacist recorded the interventions into patient's medication records to ensure patient safety and improve the quality and continuity of care. Additionally, the prescription order was checked regularly by the pharmacist to ensure the correct medication.

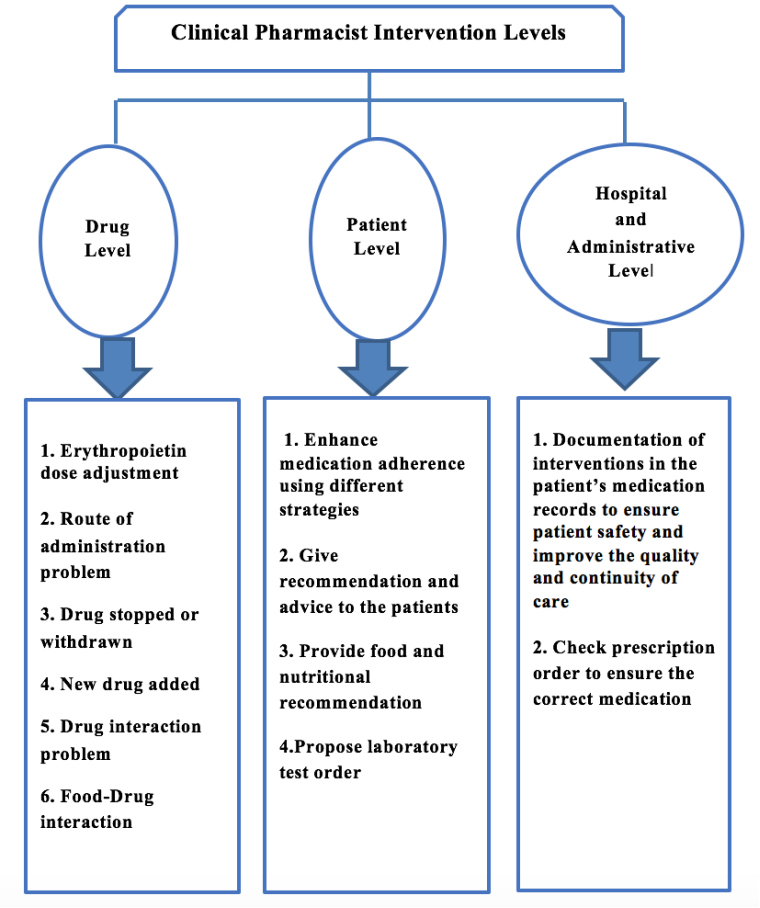

Figure (2): Pharmacist's interventions at drug level, patient level and hospital level

Outcome measures

As a primary outcome measure the impact of clinical pharmacist intervention on improving health status and quality of life (QoL) of patients with chronic kidney disease was assessed by using the Rand 36-Item Short Form Health Survey version-1questionnaire (SF-36) [26] which is a very popular instrument for evaluating health- related QoL. The Medical Outcomes Study Short Form-36 (SF-36) is a self-administered general health survey composed of 36 questions spanning eight physical and mental health domains [27], it measures eight scales: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. The Questions are rated by Likert Scale and ranged from 0 to 100, or 100 to 0 where higher points indicate a more favorable situation [28]. Scores for the eight domains are calculated from a subset of the 36 questions that pertain to that specific domain. Responses range from dichotomous answers to a maximum of six possible choices, with each choice being numerically coded and translated into a score, with higher scores indicating better health status.

Statistical analysis

Data were analyzed using Graph pad prism software version 8.2.1. Chi square test was utilized for categorical variables and independent sample t-test for continuous variable to predict significant differences among demographic variables. Descriptive statistics were calculated for variables relating to frequency of pharmacist intervention. A paired sample t-test was used for comparing baseline (initial) and follow-up visit of the quality of life domain's score within each group. An independent sample t-test was used for comparing the change in the score of the domains between the interventional and non-interventional groups. *P*- value of < 0.05 was considered statistically significant.

Results

One hundred and forty patients were screened for eligibility, 20 patients were not eligible as seven of them were not meeting inclusion criteria,13 of them declined to participate and refuse to give informed consent, while the rest (120) patients were recruited and divided into two groups. All of the patients were followed up for the study duration (four months) as shown in figure 1. The average age for the interventional group was 49.43±14.62 years while it was (51.58±17.76) years for the control group with a *p*-value=0.47, there was a non-significant difference between male and female patients (*p*-value =0.86), nearly other demographic data and basic characteristics including body weight, occupation, number of dialysis sessions per week were similar at the screening and baseline visit and there were non-significant differences between interventional and non-interventional group as shown in table 1. Co-morbid diseases including hypertension and diabetes were comparable in both interventional and control group; 34(56.6%) and 36(60%) respectively.

Table (1): Demographic data and basic characteristic of the participants (n=120)

	Group		P-value
	Interventional (n=60)	**Non-interventional (n=60)**	
Age; Mean±SD (year)	49.43±14.62	51.58±17.76	0.47
Sex n (%)			
Male	32(53.3)	33(55.0)	0.86
Female	28(46.7)	27(45.0)	
Body weight (Kg)	62.93±1.49	62.78±1.59	0.945
Occupation n (%)			
Not working	58(96.7)	60(100.0)	0.496
Working	2(3.3)	0(0.0)	
Duration of disease; Mean±SD(year)	2.77±0.12	2.39±1.69	0.06
Number of dialysis session / Week			
1.0	37(61.7)	33(55.0)	0.4
2.0	23(38.3)	27(45.0)	
Patients with Hypertension and Diabetes n (%)			
Yes	34 (56.6%);	36 (60%)	0.87
No	26 (43.4%)	24 (40.0%)	
Patients with other comorbidities n (%)			
Yes	17 (28.3%)	18 (30%)	0.7
No	43(71.6%)	42 (70%)	

Values are presented as percent or mean±S.D; *n*: number of patients. Chi-square and independent - sample t-test were utilized to predict significance at $P<0.05$.

Throughout the duration of the study the total number of interventions and recommendations regarding CKD-associated anemia management made by the clinical pharmacist for interventional group (n=60) was 1437. The interventions performed at the drugs, patients, hospital and administrative level to change and improve the patient's quality of life. Table 2 summarizes the types of interventions provided by the clinical pharmacist during the four-month period.

Table (2): Types and frequency of interventions provided by the clinical pharmacist at drugs, patients, hospital and administrative level during four- months period.

Interventions and recommendations made by clinical pharmacist at drug level, patient level and hospital level during four- month period				
Levels	**Interventions and Recommendations**	**Total No of interventions and recommendations**	**Percentage of interventions and recommendations**	**Total % of intervention per each level**
At drug level	Erythropoietin dose adjustment	102	7.1	41.4
	Route of administration problem	98	6.8	
	Drug stopped or withdrawn	101	7.0	
	New drug added	82	5.7	
	Drug interaction problem	90	6.3	
	Food-Drug interaction	122	8.5	
At patient level	Enhance medication adherence by different strategies	188	13.1	51.1
	Give recommendation and advice to the patients	174	12.1	
	Provide food and nutritional recommendation	184	12.8	
	Propose laboratory test order	188	13.1	
At hospital level	Documentation of interventions in the patient's medication records to ensure patient safety and improve the quality and continuity of care	60	4.2	7.5
	Check prescription order to ensure the correct medication	48	3.3	
Total number of interventions and recommendations		**1437**	**100.0**	**100.0**

Descriptive statistics such as frequency and percentage were calculated.

At the drug level, the pharmacist provided 595(41.4%) interventions which were mainly circulating around the drugs used in treatment of CKD-associated anemia including erythropoiesis stimulating agents and iron which comprise recommendations for the dose adjustment, changing route of administration, the withdrawal or the replacement of a drug. At the patient level also 734 (51.1%) interventions have been made by the clinical pharmacist including patient recommendations to improve medication adherence using various strategies, food and nutritional recommendation, and laboratory monitoring and follow up.

Furthermore, the pharmacist also interacted with the administrative department of the hospital for documentation of interventions into medication records. The total number of interventions performed by the pharmacist at the hospital and administrative level was 108 (7.5%).

Additionally, clinical pharmacist was with continuous interaction with the physicians in the centers. Depending on the in-Hospital guideline that compiled by the pharmacist in

collaboration with the physician, some recommendations and interventions proposed by the pharmacist thereafter approved by the physician while very few suggestions were refused by the physicians.

In the present study the clinical pharmacist-delivered services for the interventional group potentially led to improvement of some components of physical and mental dimensions compare to the group received usual care at different time intervals. The study revealed a remarkable difference in the QoL of hemodialysis patients in the interventional group during the first, second and third assessment, while non-interventional group showed a significant reduction in the QoL scores (Table 3). There was an increase in scores of some of domains of QoL of the interventional group patients when compared with the control group, although the baseline values were nearly similar. The increase in health related QoL domains scores noticed with regard to the physical functioning, general health and role emotional in interventional group compared to the baseline and the control group with a statistically significance of p <0.05. While statistically significant reduction in almost all of the domains scores of health related QoL of non-interventional group at day 120 were noticed including physical functioning, physical role, general health, social functioning, role emotional and mental health (p <0.05) compare with the baseline. The changes in health related QoL domains scores across the study period of the hemodialysis patients are presented in table 3.

Table (3): Effect of clinical pharmacist intervention on the Quality of Life (QoL) of anemic patients with chronic kidney diseases in the hemodialysis setting. (n=120)

Domains or Subscales	Interventional group (n=60)			Non-interventional group (n=60)		
	Baseline	60 day	120 day	Baseline	60 day	120 day
Physical functioning	25.96 ± 20.54	38.50 ± 13.29*	35.67 ± 14.07*a	28.67± 13.105b	25.42 ± 14.30b	18.08 ± 19.94*
Role (physical)	47.60 ± 17.98	46.77 ± 26.85	48.10 ± 19.36 a	45.63 ± 27.53	43.35 ± 18.36b	35.48 ± 13.74*
Bodily pain	53.88 ± 7.41a	53.13 ± 19.82	54.42 ± 19.19	47.88 ± 15.52	55.17 ± 16.47*	56.28 ± 69.75
General health	45.29 ± 13.67a	52.17 ± 13.13*	49.50 ± 12.48*a	59.17 ± 13.44	56.50 ± 11.21b	41.29 ± 12.79*
Vitality	45.83 ± 12.59	44.38 ± 29.42	48.79 ± 19.43 a	46.85 ± 28.97	52.60 ± 19.94b	39.06 ± 27.70
Social functioning	53.96 ± 110.24	50.00 ± 24.68 b	40.00 ± 29.27	49.17 ± 24.67	41.33 ± 33.36	36.79 ± 16.35*
Role (emotional)	40.53 ± 24.86	43.75 ± 15.71a b	51.77 ± 19.52*a	56.26 ± 69.35	53.34 ± 18.92b	26.93 ± 11.64*
Mental health	33.50 ± 10.56	36.52 ± 19.36*a b	47.250 ± 11.37a	37.92 ± 18.42	44.92 ± 11.07*b	30.00 ± 17.247*

Values are presented as mean±S.D; n: number of patients; * significantly different compared with baseline values within the same group (paired t-test); values with superscripts (a) are significantly different between different groups (independent t-test; P<0.05). while values with superscripts (b) are significantly different among different times within the same group (P<0.05).

Discussion

The assessment of QoL is an essential element of health-care evaluation and helps in providing suitable measures to increase the QoL of ESRD patients with reduced and deteriorated health status [29,30]. In the current study integration of pharmacist services in the aim of QoL improvement was investigated, a total of 1437 interventions were recorded by the clinical pharmacist during a 4-month period demonstrating the necessity for the

clinical pharmacists being part of the multidisciplinary team. As more than one-third of interventions were at the drug level and half of interventions were at the patient level. The role of the qualified pharmacist during ward rounds was very helpful for the optimization of the treatment of CKD-associated anemia and increase patient's medication adherence. These interventions had direct influence on the elevation of hemoglobin level to reach the targeted level (data not shown) and on improvement of quality of life scores. The results of the current study in regard to provision of the pharmacist services show high level of intervention in comparison with the finding of other longer studies conducted in the hospitals of the developed countries [31]. On one hand this can be explained by the fact that the integration of clinical pharmacist in multidisciplinary team to emphasize on the optimization of the therapy through implementation and activation of the role of clinical pharmacist in the current study had a significant impact in recording the tremendous number and serviceable interventions. On the other hand, complications-associated with chronic kidney disease is underestimated in our region and anemia in patients with CKD on continuous hemodialysis is not fully defined as a serious problem therefore they displayed more necessity for clinical pharmacist interventions.

In our region, the significant and direct clinical impacts of these interventions on patient outcomes were often left unevaluated in hemodialysis settings, for this reason our study used a popular instrument; SF-36 items for assessment of the quality of life of those patients in different times after provision of the pharmacist intervention. SF-36 item is one of the widely used generic form of health related QoL instrument that was used in the present study [32]. The SF-36 instrument has been used in hemodialysis patients by other researchers as well [33] good correlation between SF-36 and renal quality of life profile that is a hemodialysis-specific health related QoL survey has been reported in patients receiving pharmaceutical care [34].

All the eight domains in the SF-36 items have been measured before and after clinical pharmacist intervention however a valid single index of health-related quality of life could not be generated, as the developers of the SF-36 items state that it is not appropriate to try and come up with one overall score of SF-36 [35].

There was an increase in the most of the domains of QoL of the interventional group patients when compared with non-interventional group. It showed that most of the domain scores of the interventional group was significantly higher than the non-interventional group. In contrary significant reduction in some domains of QoL of the non-interventional group was noticed, this reduction can be explained by progressive deterioration of the clinical status of the patients as a result of frequent and long-term dialysis and pharmacist service was restricted to the patients in interventional group. Thus, clinical pharmacist intervention seemed to play an important role in improving the QoL of the patients by changing their attitude toward more adherence to their medications and modifying their life style and their nutrition to avoid drug-food interaction and consequently positive impact on their health status. The results of the present study were in line with a previous study that reported a significant increase in health-related quality-of-life scores subsequent to pharmacist intervention for the dimensions of general health, social functioning and role emotional [36].

In contrary, another study conducted to assess the relationship between health-related quality of life and pharmaceutical care provision and to measure the impact of the intervention, it showed a small to medium impact of the pharmacist at year 2 between intervention and control groups [34]. Meanwhile in a randomized study a significant improvement in health related QoL was demonstrated in a group of haemodialysis patients receiving pharmaceutical care compared to control over a 6-month period [37]. More recently Mateti stated that providing pharmaceutical services by trained pharmacist set a positive impact on health-related quality of life of hemodialysis patients [38], also another study on the impact of providing patient counselling regarding diet, exercise, life style modification on health quality of life demonstrated an important role in improving the QoL in patients on hemodialysis by changing their psychological thinking and bringing them toward spirituality [39].

Most recent systematic review provided a remarkable evidence from the controlled studies and it showed that pharmacist

interventions improved patients' clinical outcomes such as hemoglobin, creatinine clearance, parathyroid hormone, blood pressure, and calcium levels. However, the detail on humanistic outcomes in these studies were deficient and this evidence was generally of low quality and insufficient volume [40].
Based on the limitation and strength criteria, the present study has many limitations that may have affected the interpretation and generalization of its results, these include small sample size, involvement of a restricted number of pharmacist, contamination of the non-interventional group with the interventional one in the hemodialysis center due to space limitation may create a bias in their response during filling the QoL questionnaire.

Conclusion

In conclusion clinical pharmacists' interventions and recommendations assisted in improvement of quality of life of anemic patients with ESRD on long term dialysis.

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Authorship contribution: Conceptualized and designed the study, the acquisition, analysis, of data and drafted the manuscript: Bushra Hassan Marouf. Collected the data, made clinical pharmacist interventions and follow up: Intisar Ahmed Yusif. Data entry, follow up of interventions at the hospital levels: Raad Hassan Najim.

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