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Evaluation of Anemia Management in Hemodialysis Patients in Gezira Hospital, in Sudan

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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Original Research Article

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ABSTRACT

Anemia of kidney disease is a common but under recognized co-morbid condition that is known to place patients at greater risk of hospitalization, cognitive impairment, cardiovascular diseases and even death.

Aims: The aims of this work to investigate current practice of anemia management in hemodialysis patients and to assess the appropriateness of anemia management.

Study Design: The study was conducted in Gezira Hospital for Renal Diseases and Surgery. Data on anemia parameters, comorbidities, ESAs dosing and iron supplementation were collected. The data were collected for 6 months retrospectively from December 2005 to July 2006. Patients with ESRD undergoing hemodialysis were included. Patients were excluded if they have cancer or receiving chemotherapy or radiotherapy.

Results: Data were collected from 83 patients under hemodialysis. The base line hemoglobin levels in December 2005 revealed that of the 97% of the patients were anemic, because they had hemoglobin levels below the recommended target level (11.0 g/d1). The patients started treatment with erythropoietin (4000IU/wk) for six months, and we found that 6% of patients received regular EPO, 56.6% received it irregularly and 37.3% not received EPO, regarding intravenous iron (100 mg/wk or 100 mg/2wk), 7.2% of patients received regular intravenous iron, 48.2% received it

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irregularly and 44.6% of patients did not received it, Hemoglobin levels were measured in July 2006 to evaluate the effect of treatment in hemoglobin level, we found that 95% of patients were still anemic. This indicates that current treatment strategies were ineffective because the majority of patient failed to reach the recommended hemoglobin level after six months of treatment.
This study demonstrate that there is no regular periodical laboratory tests, follow up and treatment for renal anemia.

Keywords: Anemia; kidney disease; hemodialysis; erythropoietin; intravenous iron.

ABBREVIATIONS

CKD : Chronic kidney disease
CK/DOQI : Chronic kidney disease outcome quality initiative
EBPG : European best practice guidelines
EPO : Erythropoietin
ESAs : Erythropoiesis stimulating agents
ESRD : End stage renal disease
GFR : Glomerular filtration rate
Hb : Hemoglobin
Hct : Hematocrit
HD : Hemodialysis
NKF : National kidney foundation
TSAT : Transferrin saturation

1. INTRODUCTION

Renal failure is a major cause of morbidity and mortality. It is estimated that per million populations between 100-200 patients die each year in the United States from diseases of the kidney and urinary tract [1].

The number of patients with chronic kidney disease (CKD) in Sudan is increasing dramatically in recent few years. At present there are about 2000 patients on regular dialysis. Whether this a real increase or due to increase awareness is not clear (personal communication). Although improved dialysis and transplant techniques have increased patient survivals, mortality rates remain high due to secondary complication from sustained renal impairment and concomitant diseases.

Optimal management of patient with chronic renal disease is best achieved using a multi-disciplinary approach to address the concurrent medical problems and the complex pharmacotherapeutic regimens.

Alterations in drug disposition that occur with renal impairment and subsequent need for dosage adjustments present additional challenges when determining rational pharmacotherapy [2].

1.1 Etiology

End stage renal disease (ESRD) is most often the result of progressive decline in renal function caused by a primary renal disease or as secondary complication of certain systemic diseases, but it may also result from an acute event causing damage to the kidneys. Diabetes Mellitus, hypertension, and chronic glomerulo-nephritis are the most common causes of ESRD [2].

The World Health Organization defines anemia as hemoglobin concentration lower than 13.0 g/dl in men and postmenopausal women and lower than 12.0 g/dl in other women.

The European Best Practice Guidelines (EBPG) for the management of anemia in patients with chronic kidney disease propose that the lower limit of normal for hemoglobin be 11.5 g/dl in women, 13.5 g/dl in men aged 70 and under, and 12.0 g/dl in men older than age 70.

The National kidney Foundation's Kidney Dialysis Outcomes Quality Initiative (CK/DOQI) recommends work up for anemia in patient with chronic kidney disease if hemoglobin level is less than 11.0 g/dl (Hct<33%) in premenopausal women and prepubertal patients, and when the Hb is less than 12.0g/dl (Hct<37%) in adult men and post menopausal women [3].

1.2 Rationale of the Study

Conservative estimates suggest that the number of patients requiring dialysis for CKD is rising at rate of 6-8% per annum, so earlier identification of at risk subjects is needed and greater effort to control the known risk factors for CKD and co-morbidities associated with progressive kidney diseases. Therefore this study was designed to evaluate anemia management in hemodialysis patients.

1.3 Objectives of the Study

- Determination of hemoglobin level for patients under dialysis in Gezira Hospital for Renal Diseases and Surgery.
- Identification of how frequent dialyzed patients take intravenous iron and erythropoietin, and if they don't take it why?
- Identification of various regimen of treatment used and titration of these various regimens with increase in hemoglobin
- Address the possible causes of sub-optimal response to treatment.

The overall objective of this study is to evaluate renal anemia management and therefore the quality of life of renal patients, and this could be achieved only through the appropriate work up to investigate anemia in chronic kidney disease.

2. PATIENTS AND METHODOLOGY

The study was conducted in Gezira Hospital for Renal diseases and Surgery. All patients with ESRD undergoing hemodialysis were included. Patients were excluded if they have cancer or are receiving chemotherapy or radiotherapy. Data on anemia parameters, erythropoietin (EPO) dosing, iron supplementation, in addition to demographic data were collected. The data were collected over a 6 months period retrospectively from December 2005 and July 2006.

Patients were divided into 5 groups according to the treatment they received:

1. Combination of erythropoietin, I.V iron and (ferrous sulphate+folic acid) capsule
2. Only (ferrous sulphate+folic acid)capsule
3. Erythropoietin with (ferrous sulphate+ folic acid) capsule
4. Erythropoietin plus I.V iron
5. Intravenous iron plus (ferrous sulphate+ folic acid) capsule

When database had been completed, it was downloaded into SPSS (Statistical package for social sciences) for windows version 10 for statistical analysis. Statistical significance was determined at a *p*-value lower than 0.05.

3. RESULTS

3.1 Demographic and Patients Characteristics

Data were collected from 83 patients .The majority of patients (43%) were at age 31-51 years, males (74%), married (68%) worker (35%).

Most incidences of the disease were in the last six years which represent 81% of the sample. Approximately 54% of patients in the survey had been on hemodialysis for 1-3 years

The etiology of the disease is unknown for the majority of patients (69%), on the other hand the most frequent cause of end stage renal disease is hypertensive nephrosclerosis (12%).

Table 1. Characteristic of the study patients

Characteristic	Total (n=83)	%
Age (years)		
10-30	26	31.3
31-51	36	43.4
51 and above	21	25.3
Marital status		
Married	56	68
Single	27	32
Prevalence of disease		
Male	61	73.5
Female	22	26.5
Occupation		
Workers	29	35
Idle	44	53
Students	10	12
Period of hemodialysis		
1-3 years		54
4 years and above		46
Etiology of the disease		
Unknown	57	69
hypertensive nephrosclerosis	10	12
Diabetic nephropathy	5	6
Urinary tract infection	5	6
others	6	7%

3.2 Hemoglobin Results

In December 2005, the majority of patients had Hb levels between 5-7 g/dl (64%), the rest of patients had Hb levels between 8-10 g/dl (33%) and 11-13 gm/dl (3%). In July 2006 those between 5-7 g/l represent (61%), 8-10 g/dl (34%) and 11-13 g/dl (5%) Table 2.

In order to test whether the average level of hemoglobin for patients in 12/2005 differ from the standard level, one sample t test was used, and the result revealed that there was very significant differences (P=0.000) compared with the standard level of EBPG (11 g/dl). When this test was repeated in 7/2006, the same result was obtained.

3.3 Treatment Analysis

3.3.1 Erythropoietin (EPO)

Of the entire sample 6% of patients received regular EPO(dose interval 4000IU/week) and the result is that one patient reached Hb level between 11-13 g/dl, three patients in level of 8-10 g/dl, and one patient in the level of 5-7 g/dl. Those who received EPO irregularly (56.6%), 35 of them attain Hb level between 5-7 g/dl, 12 patients in level between 8-10 g/dl and the rest of patients (37.3%) not receive EPO Table 3.

3.4 Intravenous Iron

Regarding intravenous iron the majority of patients (48.2%) received it irregularly (100 mg/week), 7.2% regular and 44.6% not received I.V iron for six months. The result of Hb levels July 2006 in comparison with that in December 2005 was shown in Table 3.

3.5 Treatment Practices

Table 4 shows data from the five cohort of patients regarding type of treatment they received and its effect in Hb levels July 2006 compared to Hb levels in December 2005.

4. DISCUSSION

Normal concentrations of hemoglobin are generally considered to be within the range of 13-15 g/dl for women and 14-16 for men. However, when treating anemia, the US NKF-DOQI Clinical practice guidelines recommended a target Hb concentration of 11-12 g/dl and Hct of 33-36% (NKF-DOQI).

In this study when Hb levels in December 2005 were compared to the target level of 11 g/dl according to the EBPG, we found that all patients were anemic (only 3% of patients in the level of 11-13 g/dl), and this is true as anemia often occurs early in the course of chronic renal insufficiency [4] and if patients

Table 2. Comparison of hemoglobin levels in 12/2005 and 7/2006

Hb level g/ dl	Before treatment (12/2005) no (%)	After treatment (7/2006) no (%)
5-7	53 (64)	51 (61)
8-10	27 (33)	28 (34)
11-13	3 (3)	4 (5)

Table 3. Effect of type of medication in hemoglobin levels in July 2006

Hb level g/dl	Before treatment (12/2005)				After treatment (7/2006)			
	EPO4000IU/W		IV Iron 100 mg/W		EPO4000IU/W		IV Iron 100 mg/W	
	Regular N=5	Irregular N= 47	Regular N=6	Irregular N=32	Regular N=5	Irregular N=47	Regular N=6	Irregular N=32
5-7	2	31	3	3	1	35	2	32
8-10	3	15	28	12	3	12	3	8
11-13	-	1	-	-	1	-	1	-

Table 4. Type of treatment and resulting hemoglobin levels in 7/2006 compared to hemoglobin in 12/2005

Hb level g/dl	EPO4000IU/W				IV Iron100 mg/W			
	Before treatment (12/2005)		After treatment (7/2006)		Before treatment (12/2005)		After treatment (7/2006)	
	Regular N=5	Irregular N=47	Regular 5	Irregular N=47	Regular N=6	Irregular N=32	Regular N=6	Irregular N= 32
5-7	2	31	1	35	3	28	2	32
8-10	3	15	3	12	3	12	3	8
11-13	-	1	1	-	-	-	1	-

**Tow patients not received medication, P=0.05*

started treatment with extremely low Hb concentrations, they should reach this target within 4 months of starting treatment regardless of age, gender or ethnicity (EBPG). In this study after six months of treatment the resulting Hb in July 2006 is still so far from the target level (only five patients were in the level of 11-13 g/dl, and the majority of patients failed to be near or reach the target level and this due to lack of proper evaluation of individual patient's needs, coupled to concerns regarding funding, in addition to poor follow up and lack of both periodical laboratory tests and clear regimen to follow.

The primary cause of anemia in patients with CKD is insufficient production of erythropoietin by the diseased kidneys [5]. Erythropoiesis stimulating agents should be given to all patients with CKD with Hb levels consistently below 11 g/dl where all causes of anemia have been excluded [6]. In the present study we found that 31 patients not received EPO and even those who received it only 5 of them took it regularly and its positive effect is that one patient reached level of 11-13 g/dl, so this interpret that Hb levels consistency after six months of treatment was due either to irregular use of EPO or absence of EPO treatment.

Although there is synergistic relationship between EPO and I.V iron, regular I.V iron was taken by only six patients and its positive effect in Hb levels in July 2006 was clear although it is mild. All patients should take I.V iron, because iron deficiency may develop secondary to sustained stimulation of RBCs production with administration of exogenous EPO and chronic blood loss, which increase the demand for iron. Identification and management of iron deficiency through regular follow up testing and iron supplementation is essential for adequate RBCs production [2], however in this study no test done to check iron status in our patients and this may be the main cause of failure of treatment.

Regarding treatment, we observed that there were five different groups of treatment practices and all failed to correct anemia, except mild improvement on those who received combination of EPO plus I.V iron and Ferrous sulphate plus folic acid capsule.

Many causes contribute to the failure of treatment or suboptimal response to treatment. One of these causes is that some patients stop treatment according to their own evaluation (e.g. in case of those who take EPO if their blood pressure increases they stop treatment) and this reflect the poor communication between patients and their doctors. Another causes for suboptimal response to treatment which are not evaluated are:- chronic blood loss, hyperparathyroidism, aluminum toxicity, hemoglobinopathies (e.g. alfa and beta thalassaemia), vitamin deficiencies (e.g. folate or vitamin B12 deficiency), malnutrition, hemolysis, inadequate dialysis, and adverse effects of certain drugs (e.g. cytotoxic and immunosuppressive agents, and angiotensin converting enzyme inhibitors). From what mentioned above, extensive work should be done and regular follow up is very important to make proper evaluation of individual patients' need, in addition to regular tests for Hb, ferritin, TSAT, reticulocyte hemoglobin content because Hb concentration was the only test done for our patients and it was done every six months.

More than 80% of patients had not received treatment due to financial problems and as a result they received EPO and I.V iron irregularly and sometimes took one of them and this lead to inadequate response to treatment, so patient's financial state is considered the backbone upon which all attempts to optimize treatment and improve patient's outcomes depend. From our adherence to patients, the majority of them are very poor and idle (53%) and if we had a look on those who are still working (about 35%) they had a problem in balancing their need for regular treatment and their responsibilities toward their families and they prefer to support their families and received treatment when their financial state improved. In addition those who came from outside Wad Medani for dialysis session had additional burden, they must had enough money both to meet their life needs and treatment.

Lastly, lack of closer collaboration between patients and physicians lead to failure of treatment. In this study the majority of patients lack understanding of benefit of correcting anemia and some of them declare that they made changes in their treatment depending on their own evaluation(sometimes increase or decrease doses and sometimes disappointed an stop treatment) without consideration of physician instructions, so educational programme which involve discussion on renal function, blood pressure control, bone disease and dietary advice is very important because it will result in greater willingness to comply with treatment and achieved successful therapy.

5. CONCLUSION

In conclusion, early intervention improve anemia management in hemodialysis patients particularly through evaluation of causes of inadequate response. Further studies should be done because the area need more extensive work to put a clear policy in treatment of renal anemia.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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