

## Hemoglobin level of Libyan hemodialysis patients during treatment with recombinant human erythropoietin

Abdussalam A. M. Amara<sup>1\*</sup>, Hasnaa S. Addeeb<sup>1</sup>, Mohamed H. Algali<sup>2</sup> and Abusaa M. Ali<sup>1</sup>

<sup>1</sup>Department of Pharmaceutics, Faculty of Pharmacy, University of Tripoli and <sup>2</sup>Nephrology Unit, Medical Supply Organization, Tripoli, Libya

Correspondence: [draomara@yahoo.com](mailto:draomara@yahoo.com)

**Abstract:** During treatment of Libyan hemodialysis patients with recombinant human erythropoietin (r-HuEPO), this study was conducted at some hospitals of Tripoli to evaluate the use of this therapeutic agent in maintaining the hemoglobin of such patients at the target level. A total of 167 patients treated with r-HuEPO at a dose of 150 i.u./kg/week were involved in the present study. Hemoglobin concentration was measured before and after dosing for a period of 20 weeks. The results show that, after dosing, the hemoglobin level was increased. The target hemoglobin level (10-12 g/dl) was achieved in about 28 patients (50%) at Tripoli Kidney Center, in 27 patients (37%) at Zahra Hospital, and only in 14 patients (3%) at Tajoura Hospital. The present findings show no significant differences ( $P < 0.05$ ) in hemoglobin level after dosing between males and females. The use of r-HuEPO as a therapeutic agent in the control of hemoglobin level among Libyan hemodialysis patients is beneficial and well tolerated. The accepted and target hemoglobin levels are achieved in most cases and this allows to conclude that Epoetin alfa (EPREX®) is an effective alternative to blood transfusion. Although there are differences between hospitals in hemoglobin levels of patients, but this is a challenge to improve practice not to avoid the use of r-HuEPO.

**Keywords:** Recombinant human erythropoietin, Epoetin alfa, r-HuEPO, hemoglobin, hemodialysis patients, Libya

### Introduction

Epoetin alfa is a recombinant form of erythropoietin, a glycoprotein hormone which stimulates red blood cell production by stimulating the activity of erythroid progenitor cells (1). Recombinant human erythropoietin (r-HuEPO) has without doubt been the greatest important recent development in the management of anemia in patients with renal failure. Although the initial aim of r-HuEPO treatment

was to avoid blood transfusion, it has transformed the lives of many hemodialysis patients worldwide, allowing them to enjoy improvements in quality of life, exercise capacity and cardiac function (2). Optimizing the use of r-HuEPO involves choosing an appropriate dose regimen and target hemoglobin (Hgb) level. The r-HuEPO is administered either by the intravenous or the subcutaneous route. Setting a

target hemoglobin level will achieve the greatest possible benefits for patients. The practice is to aim for target hemoglobin of 10-12 gm/dl (2). Indeed, current evidence exists that a hemoglobin level > 11 gm/dl is associated with improvement in quality of life (3), with increase in physical performance (4), with reduced risk for hospitalization, and with lower relative risk for mortality (5). There is already evidence that increasing the target hemoglobin to a near-normal level improves exercise capacity (2, 6-8). It has been shown that if hemoglobin was lower than by 1 g/dl, mortality was greater by 18% (9). Further studies demonstrated that increasing hemoglobin improved the exercise-induced increase in blood lactate concentration and increased work capacity in parallel with more complete correction of hematocrit (10). In Libya, only in 1996 r-HuEPO was introduced as therapeutic agent to hemodialysis patients. The aim of this study is to evaluate if the use of r-HuEPO among Libyan hemodialysis patients at some hospitals of Tripoli area can control and maintain hemoglobin concentration at the target level leading to the achievement of greatest possible benefits to such important patients.

### Materials and methods

This study was carried out for a period of 20 weeks at hemodialysis department of Zahra Hospital (ZH), Tripoli kidney center (TKC) and the hemodialysis unit of Tajoura hospital (TH). A total of 167 patients were involved in

the present study. Epoetin alfa (EPR-EX<sup>®</sup> 4000 I.U., Cilag) is sterile, clear, colorless, and preservative-free solution. It is formulated in 0.25% buffered human serum albumin solution with a pH of 6.9 present in 1ml vial. In all three hospitals, Epoetin alfa was administered intravenously to patients at a dose of 50 I.U./kg three times per week (150 i.u./kg/week) under the supervision of physicians at the three hospitals. Dosing was performed after each dialysis session (patients were put on dialysis 3 times per week. Data of age, sex, body weight, and hemoglobin level before and after dosing were recorded. Statistical analysis was performed using one-way ANOVA computer program (11).

### Results and discussion

The patients' age was between 19 and 61, with a mean of 42 years for TH, 19 and 65, with a mean of 43 years for TKC, while between 9 and 55 with a mean of 37 years for ZH. As 65 years old and over is considered as elderly, all patients involved in the present study are defined as young except for one patient (65 yrs old). Body weight range was 35 – 82 kg with a mean of 58 kg, 38 – 96 kg with a mean of 63 kg, and 28 – 90 kg with a mean of 60 kg for TH, TKC and ZH, respectively. The mean hemoglobin concentrations before and after dosing of erythropoietin are presented in Table 1. The mean hemoglobin plasma levels profiles at Zahra Hospital, Tripoli kidney Hospital and Tajoura Hospital are shown in Figure 1.

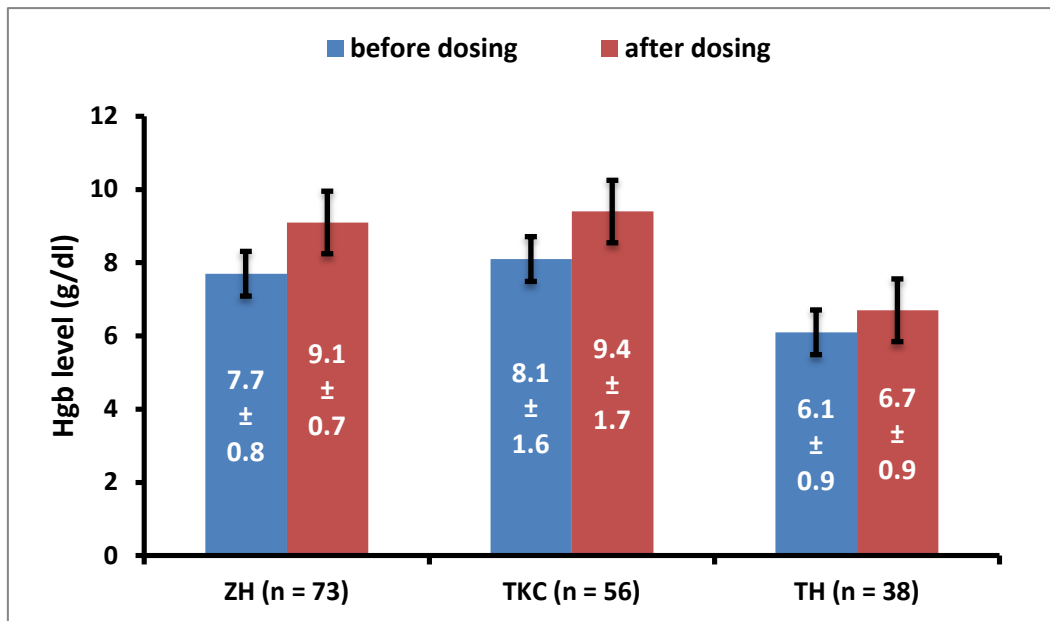
**Table 1:** Hemoglobin (Hgb) concentration before and after dosing of erythropoietin (gm/dl)

Hospital	No. of patients	Before dosing			After dosing			No. of patients achieved target Hgb level *
		lowest	highest	Mean $\pm$ SD	lowest	highest	Mean $\pm$ SD	
ZH	73	5.5	9.3	7.7 $\pm$ 0.8	6.3	10.1	9.1 $\pm$ 0.7	27 (37%)
TKC	56	4.4	11.4	8.1 $\pm$ 1.6	5.7	12.5	9.4 $\pm$ 1.7	28 (50%)
TH	38	3.8	8.2	6.1 $\pm$ 0.9	3.8	8.9	6.7 $\pm$ 0.9	14 (3%)

\*The target Hgb level is 10-12 gm/d

The target hemoglobin level is 10-12 gm/dl, but 8-9 gm/dl is considered as an accepted level (12). As Table 1 reveals, the target hemoglobin level was achieved in about 28 patients (50%) at TKC, in 27 patients (37%) at ZH, and only in 14 patients (3%) at TH. The accepted level (8-9 gm/dl) at TKC was achieved in 21 patients (37.5%) and in 69 patients (94.5%) at ZH, while at TH; the accepted level was achieved only in 3 patients (7.9%). This partial response did not quite reach the set target of Hgb. Moreover,

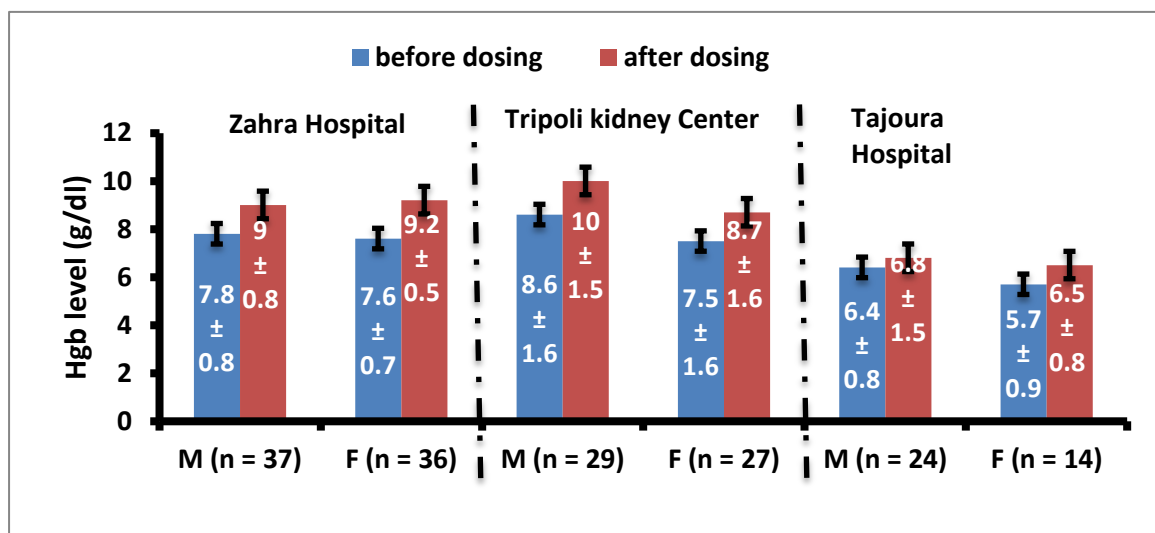
it is obvious that the mean hemoglobin levels at TKC and ZH are almost the same (no significant difference,  $p < 0.05$ ) and the target level was achieved in both hospitals. These two hospitals have specialized departments of dialysis and been open since a long time. The mean hemoglobin level at TH is significantly difference than TKC and ZH. It was below the accepted level which may attribute to lack of good practice. Unit of dialysis at TH is recent in comparison to ZH or TKC.



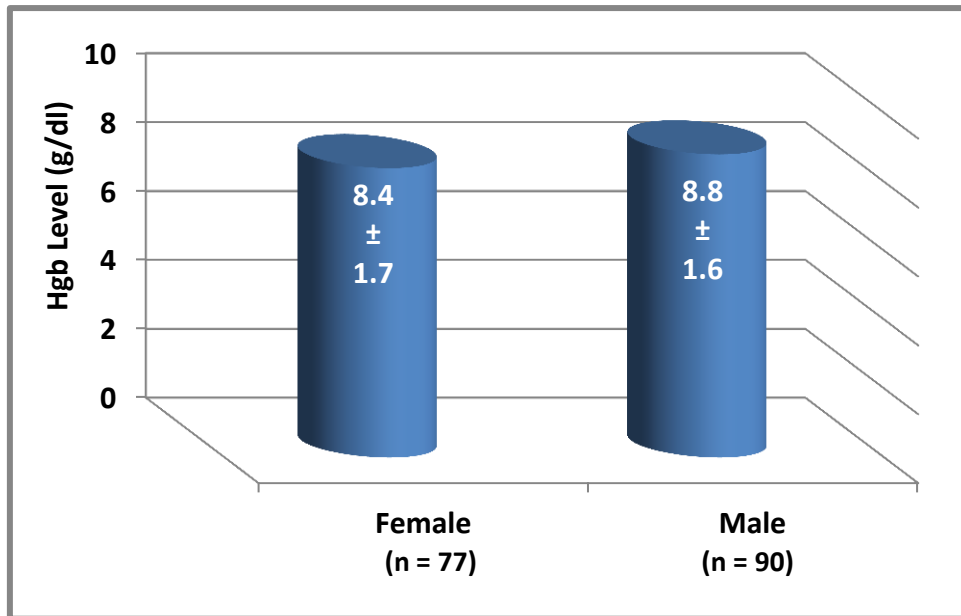
**Figure 1:** Hemoglobin plasma levels (mean ± SD) before and after dosing of 150 i.u/kg/week of erythropoietin to hemodialysis patients.

A comparison between males and females of hemoglobin levels is shown in Figure 2. For the three hospitals together, the results have shown no

significant differences ( $p < 0.05$ ) between male ( $n = 90$ ) and female ( $n = 77$ ) and conforming no effect of sex (Figure 3).



**Figure 2:** A comparison between male (M) and female (F) of hemoglobin levels (mean ± SD) before and after dosing of 150 i.u/kg/week of erythropoietin to hemodialysis patients.



**Figure 3:** Effect of sex at the three Hospitals (no significant differences,  $p < 0.05$ ).

In conclusion, the use of erythropoietin as a therapeutic agent in the control of hemoglobin level among Libyan hemodialysis patients is of great value. Epoetin alfa (EPREX<sup>®</sup>) is an effective alternative to blood transfusion, producing consequent improvements in quality of life in many hemodialysis patients (13). The target hemoglobin concentration (10 gm/dl) is achieved in about 41% of the cases in the three hospitals. After erythropoietin dosing, although findings show differences in

levels of hemoglobin between hospitals in a significant means but this is a challenge to improve practice not to avoid its use. Patient to patient variations in hemoglobin levels after erythropoietin dosing may be due to short of supply which leads to missing a dose and not allowing for good follow up requirements. The need for further studies is recommended particularly to investigate the difference in effect between erythropoietin alfa and erythropoietin beta where both are used in Libya.

## References

1. Dunn CJ and Wagstaff AJ (1995) Epoetin alfa. A review of its clinical efficacy in the management of anaemia associated with renal failure and chronic disease and its use in surgical patients. *Drugs Aging*. 7 (2): 131-156.
2. Macdougall IC (1998) Meeting the challenges of a new millennium: optimizing the use of recombinant human erythropoietin. *Nephrol. Dial. Transplant*. 13 (Suppl. 2): 23-27.
3. Moreno F, Sanz-Guajardo D, Lopez-Gomez JM, Jofre R and Valderrabano F (2000) Increasing the hematocrit has a beneficial effect on quality of life and is safe in selected hemodialysis patients. *J Am Soc Nephrol*. 11: 335-342.
4. McMahan LP, Johns JA, McKenzie A, Austin M and Fowler R (1992) Hemodynamic changes and physical performance at comparative levels of hemoglobin after long-term treatment with recombinant erythropoietin. *Nephrol Dial Transplant* 7: 1199-1206.
5. Xia H, Ebben J, Ma JZ and Collins AJ (1999) Hematocrit levels and hospitalization risks in hemodialysis patients. *J Am Soc Nephrol*. 10: 1309-1316.
6. Ma JZ, Ebben J, Xia H and Collins AJ (1999) Hematocrit level and associated mortality in hemodialysis patients. *J Am Soc Nephrol*. 10: 610-619.
7. Collins AJ, Li S, St Peter W, Ebben J, Roberts T, Ma JZ and Manning W (2001) Death, hospitalization, and economic associations among incident hemodialysis patients with hematocrit values of 36 to 39%. *J Am Soc Nephrol*. 12: 2465-2473.
8. Winearls CG (1998) Recombinant human erythropoietin: 10 years of clinical experience. *Nephrol Dial Transplant*. 13 (Suppl. 2): 3-8.
9. Al-Rohani M. (2001) Factors affecting successful use of erythropoietin in the treatment of anemia in patients on hemodialysis: Experience in Hajjah region, Yemen. *Saudi J Kidney Dis Transpl*. 12 (2): 220-223.
10. Tonelli M, Winkelmayer WC, Jindal KK, Owen WF and Manns BJ (2003) The cost-effectiveness of maintaining higher hemoglobin targets with erythropoietin in hemodialysis patients. *Kidney Int*. 64: 295-304.
11. Fast Statistics, FATESOFT™ V2, (2013), The Intelligent Solutions Company, USA.
12. Ritz E and Schwenger V (2000) The optimal target hemoglobin. *Semin Nephrol* 20: 382-386.
13. McMahan LP, Mason K, Skinner SL, Burge CM, Grigg LE and Becker GJ (2000) Effects of hemoglobin normalization on quality of life and cardiovascular parameters in end-stage renal failure. *Nephrol Dial Transplant* 15, 1425-1430.