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Comparison of Efficacy and Safety of Epoetin Alfa and Epoetin Beta in Continuous Ambulatory Peritoneal Dialysis Anemic Patients

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SUMMARY*. Anemia is a very common complication in patients with chronic kidney disease (CKD) and its main etiology is due to the decrease in renal production of erythropoietin (EPO). The two most commonly used Erythropoietin-stimulating agents (ESAs) in Malaysian public hospitals are Epoetin alfa (Eprex®) and Epoetin beta (Recormon®). This study aims to compare the efficacy and safety of Eprex® and Recormon® in continuous ambulatory peritoneal dialysis (CAPD) anemia patients. This is a retrospective study included 72 CAPD patients in Hospital Serdang receiving Eprex® (n = 36) and Recormon® (n = 36) to maintain target Hb at 11-12 g/dL. Hb, Hct, ferritin and blood pressure (BP) levels at baseline and upon achieving target Hb were measured for each patient. The weekly EPO Index (defined as weekly epoetin dose/mean monthly Hct) and Erythropoietin Resistance Index (ERI) (defined as weekly weight-adjusted epoetin dose/Hb level) were derived for each patient at baseline, at target and at the end of 6th month follow-up, to evaluate ESA dose-response. There was no significant difference between the two preparations in terms of mean target Hb (p = 0.805) and Hct (p = 0.720) levels achieved. EPO index similarly decreased from baseline values in both groups. Analysis showed no significant difference on EPO index and ERI in both Eprex® and Recormon® group. However, percentage of patients improved from moderate stage of anemia was higher in Recormon® (55.6%) as compared to Eprex® (39.7%) group. Sub-analysis showed female gender and lower albumin were correlated with higher ESA treatment resistance. This may explain the higher ESA index and ERI in Recormon® group, which showed higher percentage of female gender patients. There was no statistically significant correlation between ERI with baseline ferritin level (r = -0.065, p = 0.586). Both the mean change BP, and SBP at the end of 6th month follow-up were not significantly different between two groups. It was concluded that both efficacy and safety profile were not significantly different between Eprex® and Recormon® group.

RESUMEN. La anemia es una complicación muy frecuente en pacientes con enfermedad renal crónica (ERC) y su principal etiología se debe a la disminución de la producción renal de eritropoyetina (EPO). Los dos agentes estimulantes de la eritropoyetina (AEE) más utilizados en los hospitales públicos de Malasia son Epoetin alfa (Eprex®) y Epoetin beta (Recormon®). Este estudio tiene como objetivo comparar la eficacia y seguridad de Eprex® y Recormon® en pacientes con anemia de diálisis peritoneal ambulatoria continua (CAPD). Este es un estudio retrospectivo que incluyó a 72 pacientes con CAPD en el Hospital Serdang que recibieron Eprex® (n = 36) y Recormon® (n = 36) para mantener la Hb objetivo en 11-12 g/dL. Se midieron los niveles de Hb, Hct, ferritina y presión arterial (PA) al inicio del estudio y al alcanzar el objetivo de Hb para cada paciente. El índice de EPO semanal (definido como dosis semanal de epoetina / Hct mensual medio) y el índice de resistencia a la eritropoyetina (ERI) (definido como dosis semanal de epoetina ajustada al peso/nivel de Hb) se derivaron para cada paciente

KEY WORDS: anemia, chronic kidney disease, continuous ambulatory peritoneal dialysis, erythropoietin-stimulating agents.

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al inicio, en el objetivo y al final de Seguimiento al sexto mes, para evaluar la dosis-respuesta de AEE. No hubo diferencias significativas entre las dos preparaciones en términos de niveles medios de Hb objetivo (p = 0,805) y Hct (p = 0,720) alcanzados. El índice de EPO disminuyó de manera similar con respecto a los valores iniciales en ambos grupos. El análisis no mostró diferencias significativas en el índice de EPO y el ERI en ambos grupos, Eprex® y Recormon®. Sin embargo, el porcentaje de pacientes que mejoraron desde la etapa moderada de anemia fue mayor en Recormon® (55,6%) en comparación con el grupo Eprex® (39,7%). El subanálisis mostró que el sexo femenino y una menor albúmina se correlacionaron con una mayor resistencia al tratamiento con AEE. Esto puede explicar el mayor índice ESA y ERI en el grupo Recormon®, que mostró un mayor porcentaje de pacientes del género femenino. No hubo correlación estadísticamente significativa entre el ERI con el nivel de ferritina inicial (r = -0,065, p = 0,586). Tanto el cambio medio de la PA como la PAS al final del sexto mes de seguimiento no fueron significativamente diferentes entre los dos grupos. Se concluyó que tanto el perfil de eficacia como el de seguridad no fueron significativamente diferentes entre el grupo Eprex® y Recormon®.

INTRODUCTION

Anemia is a very common complication in patients with chronic kidney disease (CKD) especially in later stages. The prevalence of anemia in stage 3 CKD is 5.2%, rising to 44.1% in stage 4, and becoming almost universal in stage 5 [1]. The main etiology of renal anemia is due to the decrease production of erythropoietin, other factors being such as vitamin B or iron deficiency and excessive blood loss [2]. The current management of renal anemia is by iron therapy and erythropoietin-stimulating agents (ESA) to achieve target hemoglobin (Hb) levels of 11-12g/dL. Blood transfusion is recommended with Hb < 7/g/dL or in patients with acute hemorrhage or severe blood loss. The main treatment goal of ESA therapy is to reduce patient's mortality [3], to avoid the need for regular blood transfusions [4] and to improve patient's quality of life.

Currently there are 26,159 patients in Malaysia who undergo dialysis, where 90% of them receiving ESAs. The two most commonly used ESAs in the government hospitals in Malaysia are Epoetin alfa (Eprex®) and Epoetin beta (Recormon®) [5]. Once ESA therapy is initiated, it is vital to monitor the effectiveness and safety in achieving desired Hb level to reduce the mortality risk associated with progressive rise of Hb level [6]. Based on the 19th Report of the Malaysian Dialysis and Transplant Registry 2011, despite the increasing number of ESAs users, the percentage of patients receiving blood transfusion remained high at 14-15%. This has opened the gate for further evaluation of the management guideline on ESAs usage for anemia in dialysis patients [7]. Due to the lack of studies and current evidence to compare Epoetin alfa and beta in clinical outcomes in Malaysia, this study aims to compare these two specific ESAs in achieving anemia correction, the hyporesponsiveness rate in continuous ambulatory peritoneal dialysis (CAPD) patients and their common drug-related adverse effect of hypertension.

MATERIALS AND METHODS

This retrospective study was conducted by reviewing records of patients who underwent CAPD and receiving ESAs treatment at Nephrology Department of Hospital Serdang between Jan 2010-May 2013. Electronic medical record system was utilized to retrieve patient's demographic and clinical data, including all medical progress data and laboratory results.

Eligibility criteria included all adult patients (≥ 18 years old) with documented ESRD on CAPD, with anemia receiving either subcutaneous epoetin alfa or beta. Additionally, this study excluded patients who meet the following criteria: (1) passed away in less than 24 weeks from the initiation of ESA, (2) with less than 24 weeks follow-up, (3) malignancy or known hematological disorder, (4) recent severe hemorrhage episodes, (5) presence of active infection/inflammation, (6) hemodialysis patients or those switched to hemodialysis, (8) receiving blood transfusion, (9) severe secondary hyperparathyroidism requiring parathyroidectomy. The medical notes of patients for whom there was missing data were also excluded from the study. All aspects of the study protocol were approved by the National Medical Research Register (NMRR), Malaysia. (Ref ID: 16931).

Data analyses

For therapeutic efficacy and safety monitoring all patients' hemoglobin, hematocrit levels, serum ferritin, and BP levels were evaluated at baseline and post-initiation of ESA at the interval of 24 weeks or upon target Hb achieved (11-12 g/dL and hematocrit 33-36%). A further comparison between epoetin alfa and beta was made based on (1) EPO Index required to achieve hemoglobin target; (2) Erythropoietin Resistance Index (ERI) to evaluate ESA hyporesponsiveness; and (3) mean change of BP over 24 weeks.

All analyses were performed using SPSS sta-

tistical software version 20 (SPSS Inc., Chicago, IL). The significance level was set at p-value less than 0.05. Both parametric and non-parametric tests were used for this study based on the normality of data distribution. Mann-Whitney test was used to compare the efficacy of epoetin alfa and beta by analyzing the median EPO Index and ERI, while independent t-test was used to compare the mean change of BP. Both paired t-test and Wilcoxon Signed-Rank test were used to evaluate relevant parameters at pre and post ESA treatment. Pearson correlation coefficient test was used to assess the association between ERI and few variables (age, incident co-morbidity, baseline ferritin, baseline albumin, BP, Hb and Hct levels). The association between changes of BP and ESA initial dose was analyzed to determine any significant relationship.

RESULTS

Patients' characteristics

A total number of 171 CAPD patients were initially screened. After considering exclusion criteria, a remaining total of 72 patients were included. A summary of the patients' demographic data is listed in Table 1.

Parameters assessment at baseline

The baseline values evaluated such as ferritin, iron, Hb, Hct levels, and blood pressure were not significantly different between both epoetin alfa and epoetin beta groups. Furthermore, the initial weekly dose of ESA treatment was within the recommended dose of 50-150 IU/kg/week for both epoetin alfa and epoetin beta. The overall baseline parameters being evaluated are listed in Table 2.

Parameter		Epoetin alfa (n = 36)	Epoetin beta (n = 36)	Total (n = 72)
Age (year)[a]		58.5 ± 18	56.5 ± 18	57.5 ± 18
Age group	< 44 years old	8 (11.1%)	8 (11.1%)	16 (22.2%)
	45-54 years old	6 (8.3%)	6 (8.3%)	12 (16.7%)
	55-64 years old	16 (22.2%)	14 (19.4%)	30 (41.7%)
	>65 years old	6 (8.3%)	8 (11.1%)	14 (19.4%)
Weight (Kg)[a]		63.15 ± 18.68	58.85 ± 23.75	61.3 ± 20.43
Gender	Male	21 (58.33%)	15 (41.67%)	36 (50%)
	Female	15 (41.67%)	21 (58.33%)	36 (50%)
Race	Malay	20 (27.8%)	19 (26.4%)	39 (54.2%)
	Chinese	12 (16.7%)	14 (19.4%)	26 (36.1%)
	Indian	4 (5.6%)	3 (4.2%)	7 (9.7%)
Co-morbidity	Diabetes mellitus	27 (37.5%)	27 (37.5%)	54 (75.0%)
	Hypertension	30 (41.7%)	29 (40.35)	59 (81.9%)
	Dyslipidemia	19 (26.4%)	12 (16.7%)	31 (43.1%)
	CVS	10 (13.9%)	6 (8.3%)	16 (22.2%)
Stage of anemia	Mild	0 (0.00%)	1 (1.4%)	1 (1.4%)
	Moderate	31 (43.1%)	32 (44.4%)	63 (87.5%)
	Severe	5 (6.9%)	3 (4.2%)	8 (11.1%)
ESA Type users		36 (50%)	36 (50%)	72 (100%)
Stage of ferritin level	Low (<100 ng/ml)	1 (1.4%)	2 (2.8%)	3 (4.2%)
	Moderate (100-500 ng/ml)	19 (26.4%)	16 (22.2%)	35 (48.6%)
	High (>500 ng/ml)	16 (22.2%)	18 (25%)	34 (47.2%)
Initial weekly ESA dosage	<50 IU/Kg	15 (20.8%)	14 (19.4%)	29 (40.3%)
	50-150 IU/Kg	21 (29.4%)	21 (29.4%)	42 (58.3%)
	>150 IU/Kg	0 (0.00%)	1 (1.4%)	1 (1.4%)

Table 1. Baseline demographic characteristics a median ± IqR.

Parameters	Epoetin alfa (n = 36) Mean (SD) / Median (IqR)	Epoetin beta (n = 36) Mean (SD) / Median (IqR)	Mean Difference[a] (95% CI) Z-statistic[b]	*p* value
Pre-Fe (ng/ml)	455.15 (66 - 4497.88)	512.81 (43.1 - 4129)	-0.45	0.652[b]
Pre-Iron (umol/L)	9.75 (2.9 – 32.3)	9.7 (0.8 – 32.0)	-0.68	0.946[b]
Pre-Hb (g/dL)	9.20 (0.88)	9.38 (0.84)	-0.18 (-0.59, 0.22)	0.376[a]
Pre-Hct (%)	27.86 (3.68)	30.22 (9.15)	-2.36 (-5.65, 0.92)	0.156[a]
Pre-SBP (mmHg)	150.08 (24.00)	144.611 (23.60)	-5.72 (-5.72, 16.66)	0.333[a]
Pre-DBP (mmHg)	79.44 (14.89)	76.02 (17.89)	3.43 (-4.31, 11.15)	0.381[a]
ESA initial dose (IU/ Kg/Week)	62.97 (33.29)	67.60 (43.66)	-4.62 (-22.88, 13.62)	0.615[a]
EPO Index (IU/ week/%)	148.98 (57.8 – 306.51)	140.85 (55.87 – 307.69)	-0.97	0.330[b]
Age (years old)	58.5 (32 - 73)	56.5 (20 - 76)	-0.10	0.919[b]

Table 2. Baseline parameters evaluation. [a]Independent t-test (mean, SD). [b]Mann-Whitney test (median, IqR).

	Median (IqR)		z-statistic[a]	*p* value
	Epoetin alfa	Epoetin beta		
Hb (g/dL)*	11.40 (1.15)	11.40 (0.65)	-0.25	0.805
Hct (%)*	34.30 (3.05)	34.30 (3.43)	-0.36	0.720
EPO Index* (IU/week/%)	128.82 (127.56)	129.33 (92.52)	-0.19	0.851
ERI (IU/kg/week/g per 100 ml)	5.53 (5.36)	6.02 (4.97)	-0.46	0.644

Table 3. Comparison between Epoetin alfa and Epoetin beta regarding Hb, Hct, EPO index and ERI achieved. aMann-Whitney, * n = 51.

Efficacy comparison between Epoetin alfa and beta

There was no significant difference between the two preparations in terms of mean target Hb (p = 0.805) and Hct (p = 0.720) levels achieved. EPO index similarly decreased from baseline values in both groups. Furthermore, analysis showed no significant difference on EPO index and ERI in both epoetin alfa and epoetin beta groups. However, percentage of patients improved from moderate stage of anemia was higher in epoetin beta (55.6%) as compared to epoetin alfa (39.7%) group. On the other hand, 15.28% of patients on epoetin alfa and 13.89% of patients on epoetin beta showed hypo-response to the ESA treatment, where target hemoglobin level was not achieved at the end of 6 months follow-up (Table 3).

Safety comparison between Epoetin alfa and beta

In term of blood pressure safety profile, both epoetin alfa and beta patients had higher SBP (> 140 mm Hg) at the end of six months follow-up. However, it was observed that the mean SBP after 6 months follow-up was not significantly different (p = 0.330) between epoetin alfa (151.56 ± 26.26) and epoetin beta (145.58 ± 25.34) groups. Furthermore, the mean change in SBP and DBP were also not significantly different between epoetin alfa and epoetin beta groups (Table 4).

DISCUSSION

The ESA treatment is dose-dependent. The response can vary widely over time and depending on the drug given, the different physiologic factors

Mean change BP (mm Hg)	Epoetin alfa (n = 36) Mean (SD)	Epoetin beta (n = 36) Mean (SD)	Mean difference (95% CI)	*P* value [a]
SBP	1.47 (27.77)	0.97 (27.51)	0.50 (-12.49, 13.49)	0.939
DBP	6.31 (16.35)	5.53 (12.01)	0.78 (-6.0, 7.5)	0.819

Table 4. Comparison of mean change BP between Epoetin alfa and Epoetin beta. [a] Independent t-test.

both between patients and even within a given individual. Among the causes that may affect the ESA response, iron deficiency has been the most frequently studied [8]. Due to the wide usage of ESA treatment in renal anemia, other factors that may possibly contribute to treatment resistance have attracted increasing attention. Those related factors that may contribute to dose-response of ESA treatment are such as varied baseline iron, ferritin, hemoglobin, hematocrit or even blood pressure levels, gender, age, co-morbidity and the initial ESA weekly dose. These factors are studied in relationship to dialysis patients' mortality [9].

For the purpose of this comparison study, the baseline laboratory values were evaluated. There was no statistically significant difference on the baseline values of hemoglobin, hematocrit, blood pressure, iron and ferritin levels, age and EPO index between epoetin alfa and epoetin beta groups.

Both the baseline means hemoglobin and hematocrit levels in epoetin alfa and epoetin beta groups were < 10 g/dL and < 30%, which warranted the initiation of ESA treatment that aligned with KDIGO guideline, 2012. The mean weekly initial ESA dose in epoetin alfa and epoetin beta groups were 62.97 ± 33.29 IU/Kg/week and 67.60 ± 43.66 IU/Kg/week respectively. Both doses were aligned with the recommended dosage of 50-150 IU/Kg/week. However, there were 40.3% of patients prescribed with initial dose of < 50 IU/Kg/week, and 1.4% of patients prescribed with > 150 IU/Kg/week. This initial dosage variation may be one of the confounding factors that attribute to ESA treatment efficacy and safety. A higher initial dose was associated with higher monthly hemoglobin increment rate that may lead to hypertension, cardiovascular events, hospital admission and death [10-12], while a lower initial ESA dose may lead to ESA hyporesponsiveness and higher frequency of dosage adjustment required to achieve hemoglobin target.

The mean baseline ferritin level for epoetin alfa and epoetin beta were 455.15 ± 446.19 ng/ml and 512.81 ± 441.1 ng/ml respectively. Both levels were within the recommended targeted range of 100-500 ng/ml as suggested by another study for peritoneal dialysis patients [13]. All patients were prescribed with oral iron therapy, which was aligned with KDOQI guideline recommendation that suggests iron supplement for ferritin level < 500 mg/ml. Both iron level and TSAT were not routinely monitored for patients in Serdang Hospital, thus for the purpose of correlation study of ESA hyporesponsiveness, only baseline ferritin level was monitored and evaluated.

The introduction of recombinant human erythropoietin (rHuEPO) into clinical practice in the 1980 s was a major breakthrough in the treatment of anemia in CKD patients. Its use was extensively extended to dialysis patients with renal anemia and successfully increased substantially the hemoglobin target into the range of normal values. In this study, the mean baseline hemoglobin was 9.50 ± 0.72 g/dL, which justified the ESA initiation as recommended. Both hemoglobin and hematocrit values appeared to achieve the targeted range after ESA treatment. The mean target hemoglobin (11.62, SD 0.55) and mean target hematocrit (33.95, SD 3.94) achieved were both within the recommended range of 11-12 g/dL and 33-36%, in accordance with the targets set by both KDOQI and European Association Guidelines [14]. Recently published two systematic reviews suggested that the maximized hemoglobin target within 11-12 g/dL may improve physical function, exercise tolerance and patient's quality of life (QoL) [15,16]. Hence, both of the above results observed from this study met the main goal therapy of ESA treatment and none of the patients receive blood transfusion during the study period.

Another observation compiled from this study was the mean hemoglobin rise per month in epoetin alfa and epoetin beta, at 0.46 ± 0.36 g/dL and 0.52 ± 0.51 g/dL respectively, which was below the targeted level of 1-2 g/dL per month as recommended by Clinical Practice Guidelines on Renal Replacement Therapy, 2nd Edition, Ministry of Health Malaysia, 2005 [17]. These below targeted values were probably related to various factors such as underutilization of erythropoietin, unrecognized iron deficiency or inflammation state as

suggested by Brimble *et al.* [18], or infrequency of parameters monitoring that affect the frequency of dosage adjustment required.

The inadequate parameters monitoring and dosage adjustment are one of the main pharmaceutical care issues in renal anemia management, which indirectly reduced the efficacy of ESA treatment as observed in this study. Based on the above-mentioned guideline, titration of ESA dose should be increased by 2000-4000 units every 2-4 weeks if hemoglobin rise is < 0.5 g/dL over the 2-4 weeks. Thus, it was expected that hemoglobin and hematocrit monitoring should be consistent with the monitoring protocol, which recommends monitoring of end-points parameters at least the first month and subsequently every three months after ESA treatment. However, only 12 patients from epoetin alfa group (n = 36) and 14 patients from epoetin beta group (n = 36) were monitored on hemoglobin and hematocrit levels after one month ESA treatment. Furthermore, hemoglobin level at first month follow-up for epoetin alfa group was significantly different from baseline, which indicated that there may be missed opportunities for adequate monitoring in the studied population. This significant difference of hemoglobin level provided informative measure for any necessity in ESA dosage adjustment, that may prevent the possibility of ESA hyporesponsiveness, or the possible risk associated with higher hemoglobin level.

Both target median hemoglobin and median hematocrit achieved in epoetin alfa and epoetin beta were significantly higher than baseline values. However, these values were not significantly different between the epoetin alfa and epoetin beta groups. Both achieved similar median hemoglobin target at 11.4 g/dL and median hematocrit target at 34.3%. This finding was consistent with another study [19] that showed both products to be bioequivalent and equally efficacious. However, this recent study was carried out on healthy volunteers that did not take into consideration of worsening creatinine clearance. The reduced kidney function and renal failure has been shown to affect the ESA responsiveness [20]. Therefore, a comparison of the potency of ESA in those studies may not directly apply to CAPD patients in this study.

The results showed similar efficacy in achieving hemoglobin and hematocrit levels with epoetin alfa and epoetin beta. EPO index was further evaluated in this study to allow the use of a single variable to analyze the response to ESA treatment [21,22]. For both epoetin alfa and epoetin beta, baseline and target EPO index were computed to indicate the dose requirement to achieve end-point parameters. The EPO index for epoetin alfa and epoetin beta were similarly decreased from 144.40 IU/week/% to 128.82 IU/week/% (p = 0.001) and from 135.94 IU/week/% to 129.33 IU/week/% (p = 0.025) respectively. This finding further supported the ESA therapy efficacy, that indicated the increased of hematocrit level resulting in reduced EPO index (EPO Index = weekly epoetin dose/ mean monthly Hct).

Upon achieving the target hemoglobin and hematocrit, it was observed that the EPO index was not significantly different (p = 0.851) between epoetin alfa and epoetin beta group. This was in contrast with existing studies done by Millikin *et al.* [23] and Loughnan, A. *et al.*[19], which demonstrated that a higher dose for epoetin alfa was required to achieve target. This discrepancy was probably due to small sample size, inter-patient variation in ESA treatment, the underlying co-morbidities and the natural changes on disease progression that were not accounted for in this study.

Even though the target Hb, Hct and EPO Index were not significantly different between epoetin alfa and epoetin beta group in our study population, it was noticed that the percentage of patients improved from the moderate stage anemia was higher with epoetin beta (55.6%) as compared to epoetin alfa (39.7%). However, the total number of patients with non-anemia status at 6th month follow-up were not significantly different in these two studied groups (p = 0.358), which the small sample size may be the main limiting factor. Hypertension developed in 20-30% of renal anemia patients treated with ESA and its effect is dose-dependent [24]. Based on Malaysia Society of Nephrology [25], it was reported majority (74%) of dialysis patients with ESA had systolic blood pressure above 140 mm Hg. According to the Canadian Erythropoietin Study Group which examined the effect of ESA on blood pressure, there was a significant marked increased mean change of SBP and DBP (p = 0.001) in ESA treated patients that required increased of antihypertensive agents.

In this study, it was observed that both higher ESA dose at 6th month of follow-up and average monthly Hb level rise, were not significantly associated with both mean change SBP and DBP in the population. This was in contradictory with the study done by another study [26] that demonstrated positive dose-dependent of hypertension with ESA treatment. This discrepancy was prob-

ably due to the inter-patient variation on differ hypertension severity and progression during the dialysis period, resulting in many outliers skewing the results in this study.

Both epoetin alfa and epoetin beta patients had high SBP at the end of six months follow-up with 151.56 ± 26.26 mmHg in epoetin alfa and 145.58 ± 25.34 mmHg in epoetin beta group. Both levels were above 140 mmHg, which was consistent with the survey from Malaysia Society of Nephrology [7]. Both the mean change SBP and DBP were not significantly difference between epoetin alfa and epoetin beta group, with mean change SBP at 1.47 ± 27.22 vs 0.97 ± 27.51 (p = 0.939), and mean change DBP at 6.31 ± 16.35 vs 5.53 ± 12.01 (p = 0.819). It was also observed that the mean SBP after 6 months follow-up was not significantly different (p = 0.330) between epoetin alfa (151.56 ± 26.26) and epoetin beta (145.58 ± 25.34) group. This study concluded that there was no significant difference observed between epoetin alfa and epoetin beta in term of blood pressure safety profile. These findings were in contrast with the few studies done by Kleophas *et al.* [27] and Locatelli *et al.* [14], who indicated favorable safety and tolerability profile with epoetin beta due to its longer duration of action allowing lesser weekly frequency of administration. This discrepancy was mainly due to the limiting small-scaled studied population.

CONCLUSION

The present study provides an insight into the safety and efficacy of Epoetin Alfa and Epoetin beta in continuous ambulatory peritoneal dialysis patients. In summary, this study has shown that majority of CAPD patients were at moderate stage of anemia prior to ESA treatment. Both epoetin alfa and beta effectively achieved hemoglobin and hematocrit levels within the KDOQI targets. All the end-point parameters of hemoglobin, hematocrit and EPO Index improved with ESAs treatment. The dosage required to achieve the targeted levels were not significantly different between epoetin alfa and beta. However, there was strong evidence from this study to suggest this discrepancy, which was due to the unequal female gender between two groups, small ESA-responded sample size (n < 30), co-morbidity variation and higher subclinical inflammation incidence in epoetin beta group.

This study results also showed that ESA hyporesponsiveness, reflected by ERI, was insignificantly related to lower serum ferritin level, although ferritin is not a better marker to assess iron requirement as compared to TSAT monitoring which was not carried out in this study population. In term of safety profile, this study showed that both SBP and mean change of blood pressure were not significantly different between epoetin alfa and epoetin beta. It is recommended to conduct an in-depth review on this similar efficacy and safety comparison study, which look into the few suggested confounding factors. The result from this study may be used as a preliminary local data for future further investigation, in accordance to the local population.

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