Original Article

Model of a Physician Group Practice on Hemodialysis Care in Thailand: A Cross-sectional Analysis of Clinical Outcomes

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Objective: To test an effect of a model of physician group practice which five nephrologists have joined running an out-source hemodialysis unit under common protocols since 2014.

Materials and Methods: Common protocols for how to deal with clinical problems and standing orders for emergency conditions have been developed and regularly practiced. The physicians share responsibility and visit frequency to provide at least twice a month for each patient. This retrospective review used records for point-prevalent patients receiving in-center hemodialysis in March 2017. The situation of dialysis outcomes was reviewed.

Results: There were one hundred and nineteen cases continued on the treatment with mean age 60.3±12 years old, male to female was 1:0.6. Dry weight was achieved at the end of sessions for 93.2% of patients, and only 5% gained weight more than 3.5 kgs/ session. The eighty-seven point three percent of patients achieved target Kt/V urea for either thrice- (1.2/session) or twice- (1.8/session) weekly dialysis with mean Kt/V urea 1.88±0.39/ session. Patients reached target hemoglobin (≥10 g/dL) for 70.6% with mean hemoglobin 10.6±1.5 g/dL.

Conclusion: Most of clinical parameters are in acceptable range. It indicates that patient care by group practice is feasible on aspects of patient safety and clinical satisfaction.

Keywords: hemodialysis outcome, nephrologist group practice, common protocol, hemodialysis protocol, hemodialysis visit frequency

J Med Assoc Thai 2018; 101 [Suppl. 7]: S41-S50
Website: http://www.jmatonline.com

Hemodialysis [HD] is renal replacement therapy available for end-stage renal disease [ESRD] patients[1]. Chronic kidney disease [CKD] is emerging non-communicable illness and lead to increased demand for dialysis unit[2]. After 2008, Thai universal health coverage expanded to dialysis resulting in growing demand for HD switched from peritoneal dialysis in which complications or contraindications occurred[3,4]. Increasing workload because of increasing burden of CKD is far outweighed the increasing number of nephrologists[5]. From 2014 TRT (Thailand Renal Replacement Therapy) registry report, 75.6% of government HD unit and 91.7% of private HD units had fulltime nephrologists[6]. It indicated that some centers were run solely by dialysis-trained internists with consulted part-time nephrologists. Up to now, many centers which have full-time nephrologists still need support services from the part-time workforce. In high demand situation, many nephrologists work both in full-time and part-time dialysis services either public or private sectors. The quality of service is perhaps questioning because of no medical staff work-hour restriction in Thailand[7]. A dialysis patient in Thailand

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How to cite this article: Chan-on C, Tonsawan P, Kritmetapak K, Kananuraks S, Sirivongs D. Model of a Physician Group Practice on Hemodialysis Care in Thailand: A Cross-sectional Analysis of Clinical Outcomes. J Med Assoc Thai 2018;101;Suppl.7: S41-S50.

is usually served by an individual nephrologist. Even those dialysis units have many nephrologists to serve many patients in same facilities, there are variations in clinical opinion and decision. Variation of practices from many experts in the same services makes confusion in work-flow in HD units. Professional group practice which improves quality of care and clinical outcomes in primary health care[8] might be applicable in nephrology field to increase performance in an area of tightened number of staff. The common protocols for clinical problems such as how to deal with anemia, hypertension, dry weight setting, calcium phosphate control and standing orders for emergency conditions have been created and applied in the dialysis practice. Sharing patient visit of the grouped physician is designed to optimize physician-patient visit frequency with part-time availability. Though there is limited research available on attending nephrologists' workload and impact on dialysis care, clinical outcome monitoring seems measurable and can represent overall efficacy of the dialysis unit. The retrospective analysis aims to test if the common protocols in the group practice can help dialysis facility to achieve the quality of HD care under the environment of the high workload nephrology staffs.

Materials and Methods

This cross-sectional, observational study was carried out on HD flow charts of ESRD patients on HD. Patients enrolled in this analysis if they were diagnosed to have stage 5 CKD and entered in the HD unit in the Fort Sripatcharin hospital (public hospital in Khon Kaen province of Thailand) at least three months before March 1, 2017 and had available laboratory data for analysis. Demographic data including age, sex, health insurance scheme, underlying hypertension and diabetes, dialysis vintage, hepatitis serology were collected. Dialysis-related data including vascular access type, a frequency of dialysis session, body weight, pre-dialysis blood pressure [BP], dialysis adequacy, intra-dialytic complication, and hospitalization as well as laboratory assessment were obtained and filled in a pre-specified case record form for descriptive analysis.

Key performance indexes [KPI] of chronic HD unit from the Nephrology Society of Thailand [NST][9] as our benchmarks including the percentage of patients reaching targeted hemoglobin [Hb], dialysis adequacy, vascular access type, serum calcium level, serum albumin level and rate of visit frequency achievement (at least twice a month). Other outcomes are also considered such as hospitalization rate, positive hepatitis B virus [HBV] antibody rate, targeted dry weight-achievement rate and rate of averaged weight-gain more than 3.5 kgs per session.

The group practice model consists of 5 common protocols and a set of standing orders that were mutually reviewed and regularly practiced based on international guideline and patients' specific health scheme-budget-availability including anemia management, hypertension control, dry weight setting, calcium and phosphate control, a referral protocol and standing orders for emergency conditions. Besides, five part-time nephrologists have shared responsibility and visited frequency to provide at least twice a month for each patient. The incentive has been distributed equally based on evenly hours of service. These protocols were given details as following.

Anemia management

The protocol was designed to target hemoglobin as suggested in 2012 Kidney Disease: Improving Global Outcomes [KDIGO] recommendation[10]. After correctable causes were ruled out, iron profile assessment will be done to looking at indication for intravenous [iv] iron therapy. Erythrocyte stimulating agents [ESAs] will be considered later to achieve the target at 10 g/dL and not more than 12 g/dL. The actual delivered ESAs and iv iron therapy was provided by patients' health care insurance and household budget.

Hypertension control

BP was checked by the office digital sphygmomanometer when patients came to check-in before dialysis started routinely with other vital signs. Our pre-dialysis SBP/DBP was targeted at 130-160/ 60-99 mmHg. Home BP recording was used for antihypertensive therapy adjustment if patients had access to home automated sphygmomanometer BP monitoring or BP measurement in sub-district health promoting hospitals. Patients' taking of anti-hypertensive medications and self-BP monitoring were trained and reviewed by hemodialysis nurses to ensure safety that patients can follow the prescriptions. Antihypertensive medications were mainly adjusted after dry weight achievement.

Dry weight setting and controlling

Patients were assessed at an entered date in the HD unit for estimated dry weight. If patients had volume overload but had not had overt clinical

symptoms of pulmonary congestion, post HD weight was gradually reduced for up to 0.3 kg per session until reach target dry weight to avoid the risk of intra-dialytic hypotension. The target ultrafiltration would not exceed 3.5 to 4 liters per session or 1 liter per hour as tolerated. If patients could not reach target dry weight in that session, they would be asked to add more extra sessions to remove excessive leftover volume as soon as possible. If patients had overt pulmonary edema visiting for scheduled HD, the responsible nephrologist in that period would decide by weighing risk and benefit whether referring to admission or go on HD fluid removal before referral. Target dry weight achievement in this study is required achievement of target dry weight in every session in March 2017. Averaged weight gain comes from averaged weight gain of all sessions in March 2017.

Calcium and phosphate control

Serum phosphate level at more than 4.5 mg/dL was used as a target for intervened by diet control, phosphate binders and dialysis frequency. Serum calcium is controlled to normal range at 8.4 to 10.2 mg/dL. Low calcium dialysate or non-calcium based phosphate binders were prescribed in case of serum calcium elevated more than 10.2 mg/dL. When serum calcium and phosphate levels which monthly checked are controlled, intact parathyroid hormone [iPTH] level which quarterly evaluated would be targeted toward normal range or less than 300 pg/mL[11] by 1-alpha-hydroxylase vitamin D. In patients who indicated for non-calcium-containing phosphate binder from reasons: serum calcium more than 10.2 mg/dL, the iPTH level lower than 150 pg/mL, manifested vascular calcification in plain lateral lumbar film or failed to reduce serum phosphate towards 4.5 mg/dL after oral calcium carbonate administration. For these instances, those patients would be prescribed lanthanum carbonate[11]. In some cases that lanthanum carbonate was not covered by their health care insurance, the 4-weeks course of oral aluminum hydroxide was prescribed instead[11]. Due to accumulated aluminum toxicity concerned, repeated courses were allowed but not in continuous fashion.

Hemoglobin level, serum calcium, and serum albumin level were monitored once a month, and dialysis adequacy was once a trimester based on the requirement of the Hemodialysis unit Certification Board (Thailand)[9]. Standing orders for emergency conditions were included cardiovascular instability, cardiac arrest, air emboli, cramps, chills, intradialytic hypotension and intradialytic hypertension. The frequency of nephrologist visit was assessed by attending HD nurse.

The study was approved by the Khon Kaen University Ethics Committee in human research. The manuscript is written as described in The Strengthening the Reporting of Observational Studies in Epidemiology [STROBE] statement guideline for cross-sectional study[12].

Results

In the demographic part, there were 119 cases had been evaluated with mean age ±SD of 60.3±12 years old (Table 1). Majority of participants were male (63%) with the mean of dialysis vintage was more than four years (54.6±4.45 months) (Table 1). Hypertension and diabetes were leading causes of ESRD (84% of hypertension and 61.3% of diabetes). More than half of patients were reimbursed from the Civil Servant Medical Benefit Scheme [CSMBS] (64.7%), left minorities were from the Social Health Insurance scheme [SHI] (19.3%) and the Universal Coverage Scheme [UCS] (16%) consecutively. Details of insured populations for each health care plan are provided elsewhere[13]. Small group of patients had a pre-existing coronary artery disease (9.2%) which controlled by medication therapy. Half of the patients had positive hepatitis B virus [HBV] antibody (51.2%). The small group of chronic HBV and chronic hepatitis C virus [HCV] infection had been serviced in the unit (10.9% and 10.1% respectively). Nearly all using arteriovenous fistula [AVF] (95%), and more than two-thirds were on regular thrice weekly dialysis (72.3%).

Visit frequency: The eighty-seven percent of patients were visited by the attending nephrologist at least every fortnight.

Anemia management: Mean Hb level ±SD of the study patients was 10.6±1.5 g/dL. More than two-thirds of patients achieved target Hb of at least 10 g/dL (70.6%) (Table 2). The number of patients who had Hb less than 10 g/dL was equal to the number of patients who had Hb more than 11.5 g/dL (29.4%). Nearly all cases were prescribed ESAs (93.3%) with mean dose ±SD 9,324.3±3,838.6 unit per week (Table 2). All of the patients were evaluated for iron profiles. Mean transferrin saturation level ±SD was 28.3±9.8% and around 80% of patients reached more than 20% of transferrin saturation (Table 2). Mean ferritin level ±SD was 551.2±678.60 ng/mL and only a few patients had ferritin less than 100 ng/mL (5.9%). However, more than one-fifth had ferritin level less than

Table 1. Demographic data

	Subject numbers	Percent
Participants	119	100
Mean age ± SD (years)	60.3±12	
Gender		
Male	75	63
Dialysis vintage ±SD (months)	54.6±4.45	
Health insurance scheme		
CSMBS	77	64.7
SSS	23	19.3
UCS	19	16
Underlying hypertension	100	84
Underlying diabetes	73	61.3
Ischemic heart disease: on treatment including	11	9.2
Medication therapy	6	
PCI	4	
CABG	1	
Serological status		
Anti-HBV Ab positive	61	51.2
HBs-Ag positive	13	10.9
Anti-HCV Ab positive	12	10.1
Vascular access		
AVF	113	95
Hemodialysis frequency		
3 weeks	86	72.3
2 weeks	33	27.7

Table 2. Dialysis parameter: Outcomes of anemia management

n = 119 cases	Subject numbers	% or mean value ± SD
Mean hemoglobin ±SD (g/dL)		10.6±1.5
<10 g/dL	35	29.4
10 to 11.5 g/dL	49	41.2
>11.5 g/dL	35	29.4
Erythrocyte stimulating agents [ESA] usage	111	93.3
Mean ESA (iv. epoetin) usage ±SD unit/week		9,324.3±3,838.6
Iron profile		
Mean transferrin saturation ±SD (%)		28.3±9.8
Transferrin saturation <20	23	19.3
Transferrin saturation >20	96	80.7
Mean ferritin ±SD ng/mL		551.2±678.6
Ferritin <100 ng/mL	7	5.9
Ferritin <200 ng/mL	28	23.5
Ferritin 200 to 500 ng/mL	45	37.8
Ferritin 500 to 800 ng/mL	23	19.3
Ferritin >800 ng/mL	23	19.3
On iv. iron therapy	68	57.1

200 ng/mL (23.5%). Just above half of the patients had administered iv iron therapy (57.1%).

Blood pressure control and vascular access: Mean pre-dialysis systolic BP (SBP) and diastolic BP

[DBP] ±SD were 143.6±10.6 and 78.1±0.7 mmHg consecutively (Table 3). The significant part of cases obtained pre-dialysis SBP within 100 to 160 mmHg (84.9%).

Vascular access was found less than 5% which primary non-function and AVF stenosis were mainly problems (Table 3).

Dialysis adequacy includes fluid removal, Kt/V urea and biochemical parameters. Mean weight gain per session ±SD was 2.3±0.8 kg (Table 3). Dry weight was achieved at the end of sessions for 93.2% of patients, and only 5% gained weight more than 3.5 kg per session. Mean ultrafiltration rate ±SD was 9.9±3.3 (mL/hr/kg) and more than half had ultrafiltration rate less than 10 mL/hr/kg.

Mean Kt/V urea±SD was 1.9±0.4 per session (Table 3). The eighty-seven point three percent of patients achieved target Kt/V urea of either at least 1.2 per session in twice weekly or 1.8 per session in thrice weekly (Table 3).

Mean serum total calcium and serum phosphate ±SD were 8.8±0.8 and 4.2±1.5 mg/dL, respectively (Table 4). Only two patients had serum calcium level higher than 10.2 mg/dL (1.7%) while more than 20% of patients had serum phosphate more than 5 mg/dL (24.4%).

Mean PTH level ±SD was 426.6±492.8 pg/mL and just lower half of patients had optimum PTH level of 2 to 9 times of upper limit of normal [ULN] of local laboratory (45.4%) (Table 4). More than 20% percent of patients had PTH level higher than 9 times of [ULN] (22.7%). One-fifth of patients was prescribed for vitamin D therapy (23.5%).

Mean serum albumin and mean serum potassium ±SD were 4±0.4 g/dL and 5.2±0.07, respectively (Table 4). Less than 10% of patients were found serum albumin level lower than 3.5 g/dL (9.2%) and serum potassium level higher than 5 mEq/dL (9.2%).

Complications: In that period, 10% of cases were admitted. The most common reason was vascular access associated problems, followed by infectious causes and cardiovascular events. Two cases had intradialytic complications which including hypotension and chest pain.

Discussion

The study shows that the HD unit can achieve favorable clinical outcomes in three groups including BP controlling, dry weight control, Kt/V urea, and nutritional parameters. For more details, it can reach key performance indexes of chronic HD unit from NST[9] including the patient-physician visit frequency, serum ferritin level, Kt/V urea, serum calcium level and serum albumin concentration.

Demographic data

The character of participants in the study is

Table 3. Dialysis parameter: blood pressure, weight gain, vascular access and adequacy

n = 119 cases	Subject numbers	% or mean value ±SD
Mean pre-dialysis SBP ±SD (mmHg)		143.6±10.6
Mean pre-dialysis DBP ±SD (mmHg)		78.1±0.7
Pre-dialysis SBP within 110 to 160 mmHg	101	84.9
Vascular access problems	5	4.2
Primary non-function	2	
AVF stenosis	2	
Limited flow AVF	1	
Mean weight gain per session ±SD (kg)		2.3±0.8
Weight gain more than 3.5 kg	6	5
Reach target dry weight at the end of the session	111	93.3
Mean ultrafiltration rate ±SD (ml/hr/kg)		9.9±3.3
Ultrafiltration rate <10 mL/hr/kg	63	52.9
Ultrafiltration rate 10 to 13 mL/hr/kg	31	26.1
Ultrafiltration rate >13 mL/hr/kg	25	21
Mean Kt/V ±SD per session		1.88±0.39
Achieve target	104	87.3
2 week achive Kt/V at least 1.8	16	
3 week achive Kt/V at least 1.2	88	

close to the nature of Thai hemodialysis population reported from 2014 Thailand Renal Replacement Therapy [TRT][6] which had peak aged at 55 to 64 years old, male predilection, and diabetes and hypertension were the most common causes of ESRD (Table 1). Nevertheless, a vital difference feature between participants in the study and participants of the TRT is a distribution of healthcare insurance plans. The CSMBS reimbursement was found more than half in the study (Table 1) while was discovered only a one-third in TRT participants. On the contrary, the prevalence of the UCS insured in TRT participants (25.4%) is higher than in the study (16%). This difference affects outcomes because of limitation in iv iron and ESAs therapy in anemia management and non-calcium containing-phosphate binder availability in CKD-MBD management.

The group practice model components

The model of the study has two tangible elements managed under the group practice; that is, the common protocols with standing orders and sharing responsibility for patients. The grouped nephrologists have shared their idea creating the common protocols based on guideline implementation. They also have shared patient visits to optimize patients-provider visit frequency while having limited time for service.

The common protocols and standing orders improve interdisciplinary integration in HD care because HD nurses know work-flow direction[13]. The nurse team can supply patients' information and on time notification to nephrologists in order to assure protocols delivery punctually. Standing orders provide precise teamwork communication which reduces potential for medical errors[13]. Also, outcomes assessment can be done with less bias because of uniformity of care. When unsatisfied outcomes are found, they are well situated for root-cause analyses and protocols adjustment.

Patients undergoing hemodialysis require direct and continuous care[14]. Thus, attending nephrologists have to provide available time for appropriate visit frequency that influences patients' satisfaction and perception. Evidence has shown that decreased visit frequency associated with higher hospitalization rate[15,16], and higher visit frequency relates to reduced hospitalization[16]. Though majority of patients have seen by attending nephrologists, the results point out that thirteen percent of patients have not met this goal. Appointments readjusted by the administrative officer will be needed to cover all patients with aimed visit frequency, for instance, some patients might need to be re-scheduled their HD shift, or some attending nephrologists might need to adjust timing to visit to cover all patients.

Advantages of group practice have observed in the literatures. First of all, practicing in group prevents burnout of solo physician[17] especially in the setting

Table 4. Dialysis parameter: Calcium, phosphate, albumin and potassium Abbreviation: iPTH stand for intact parathyroid hormone

n = 119 cases	Subject numbers	% or mean value ±SD
Mean serum total calcium ±SD mg/dL		8.8±0.8
Serum calcium >10.2 mg/dL	2	1.7
Mean serum phosphate ±SD mg/dL		4.2±1.5
Serum phosphate <3.5 mg/dL	43	36.1
Serum phosphate 3.5 to 5.5 mg/dL	54	45.4
Serum phosphate >5.5 mg/dL	22	18.5
Serum phosphate >5 mg/dL	29	24.4
Mean iPTH ±SD (pg/mL)		426.6±492.8
Optimum iPTH (130 to 585 pg/mL)	54	45.4
iPTH <300 pg/mL	69	57.9
iPTH >585 pg/mL (x9 times of UNL)	27	22.7
Vitamin D therapy	28	23.5
Mean serum albumin ±SD g/dL		4±0.4
Serum albumin <3.5 (g/dL)	11	9.2
Minimum serum albumin (g/dL)		3
Mean serum potassium ±SD mEq/L		5.2±0.1
Serum potassium >5 mEq/L	11	9.2

of undersupply physician[18]. Furthermore, the collaborative practice strengthens patients' satisfaction and improves patient outcomes[18].

Even though the group practice model seems to have many benefits as mentioned above, it demands considerable attempt which limits generalizability of the model. When getting closer look, integrate health care team requires clear goal, measurable outcomes, clinical and administrative systems, member training and effective communication[19]. Those requirements are important challenges to overcome before the group can be formed. Multiple barriers exist such as difficulties to deal with complicated human personalities and relationship, requiring robust effort for protocol creation and trust to maintain a good collaboration along the way. Likewise, group practice has some limitations and controversial issues. Studies found that group practice increases technical quality of care but decrease service accessibility and continuity of care[19]. Some studies found equal in outcomes between group practice and independent practice[20]. Additionally, when the group grows, it becomes less flexible operationally, and strict policies in the clinical decision made that must be followed by all[21]. For now, published research for group practice and outcomes in nephrology field is quite limited because most of the studies emphasize on primary care practice more than specialties or sub-specialties[17,19].

Favorable outcomes

There are three groups of favorable clinical outcomes including BP controlling, dry weight control, Kt/V urea, and nutritional parameters.

The target range of pre-dialysis BP in the protocol was modified from the range of lowest mortality in the significant observational study and the guideline to suit with our context[22,23]. Promotion of using home BP record and medication reviews by dialysis nurses in the protocols are giving the important role to patients' self-care as part of patients' empowerment and might support patients' adherence[24]. Dry weight control is also important contributing factor of BP control and even might increase long-term survival[25]. The high prevalence of target dry weight achievement and low prevalence of excessive weight gain in the results support favorably pre-dialysis BP outcomes.

On the other side, the strict control of ultrafiltration removal in each session is an effective modality to avoid serious intra-dialytic complications which seen only a few cases (Table 5). In this model, maximum 3.5 to 4 liters of ultrafiltration removal per session was adapted from observation studies[26,27] to minimize the risk of excessive ultrafiltration rate. In the results, more than half of patients had ultrafiltration rate less than 10 mL/hr/kg, and two-thirds of them had ultrafiltration rate less than 13 mL/hr/kg (Table 3). Limiting ultrafiltration rate reduces intra-dialytic complications but at the same time can increase the risk of inter-dialytic volume overload and many sequelae. The pivotal preventive measures are controlling dry weight achievement during initial enrollment into the HD unit, giving tailor-made water intake prescription and encouraging patients to get extra HD sessions to remove leftover volume as soon as possible.

The protocols were designed to reduce dialytic-related events leading to minimizing the risk of referral and hospitalization. Because the HD unit is in a small public hospital setting, it has insufficient multidisciplinary sub-specialties to handle high-risk cases. The referral protocol and standing orders have already provided but there are many obstacles to face if serious adverse events occur, for example, limited bed availability in referral centers, non-medical out-of-pocket expense in patients' family, and high mortality risk from admission-related complications. However, around 20% of patients remained at risk because of rapid fluid removal more than 13 mL/hr/kg which have a higher risk of all-cause mortality, cardiovascular morbidity, and mortality[26,27].

Table 5. Dialysis parameter: complications

n = 119 cases	Subject numbers	% or mean value ±SD
Hospitalization within 4 weeks with reasons below	12	10.1
Infection	3	
Cardiovascular cause	3	
Vascular access associated	4	
Miscellaneous: hemarthrosis, severe hyperglycemia	2	
Intradialytic hypotension/chest pain/palpitation	2	1.7

Other factors that also have affected mortality are Kt/V urea and nutritional parameters which are serum potassium and serum albumin concentration[28,29]. Urea clearance, serum potassium, and albumin concentration indirectly reflect diet compliance and dialysis adequacy either solute removal or ultrafiltration. In the study, the greater part of patients could achieve target Kt/V urea. Thus, the results of high serum albumin and high mean serum potassium represent good nutritional status.

Unfavorable outcomes

Clinical outcomes that require improvement are some anemia outcomes and some CKD-MBD parameters. Anemia and CKD-MBD treatment modalities depend mainly on individual health care insurance.

In anemia parameters, even with vigilant observation and the greater part of patients reached adequate serum ferritin, target Hb is still hard to achieve in many cases (Table 2) (NST KPI requires less than 20% of patients have Hb less than 10g/dL[9]). Because in some health schemes such as the UCS and the SHI, iv iron therapy is not covered. In addition, ESAs which are expensive treatments have been subsidized with limited dose. The cost of either iv iron or ESAs is unaffordable by patients' out-of-pocket in most cases. Though the prevalence of optimal serum phosphate level and iPTH level did not achieve the target (NST KPI requires less than 20% prevalence of serum phosphate over than 5 mg/dL and less than 20% prevalence of iPTH higher than 9 times of ULN), the serum calcium was in good controlled. As shown that the prevalence of serum calcium over than 10.2 mg/dL is quite rare. It may be because the majority of patients in the study were reimbursed by the CSMBS scheme which covering non-calcium containing phosphate binder, and then patients had more flexible options to control iPTH without the high prevalence of hypercalcemia. The calcium phosphate protocol has provided clearly plan to manage. However, high serum phosphate and high iPTH are still common problems. Behavioral interventions for diet nonadherence might be beneficial[24].

Limitations

The analysis has challenged by retrospective nature and lack of control group to emphasize the model efficacy. There are many weak points of the research because of lacking information in ESAs types, the prevalence of phosphate binders either calcium or non-calcium containing or dialyzer details either types or reuse rate. It urges that database should be improved. Another bias is the high prevalence of participants reimbursed by the CSMBS contributing better clinical outcomes compared to TRT participants. Though, the results provide materialistic clinical outcomes as quality audits, service management is an only one part of the efficient HD care which requiring contribution both patients' adherence and adequate health care insurance coverage.

Conclusion

Common protocols with standing orders help for obtaining uniformity of care and effective communication. Sharing of patient visits among grouped nephrologists means to make a possible practical HD care while surrounded by high workload constraints. The cross-sectional observational study conveys the model of dialysis practice and measured outcomes that can be utilized for a better care in the future. Many findings reaching key performance indexes demonstrate implication of the model.

What is already known on this topic?

The study regarding the group practice physician or patients-provider visit frequency in HD care is lacking in Thailand.

What this study adds?

The group practice model which including the common protocols, standing orders and sharing service for patients is proposed in the study to obtain acceptable HD care by the part-time grouped nephrologists.

The study found that the HD unit run by the group practice model can achieve several favorable clinical outcomes. It indicates that patient care by the model is feasible on aspects of patient safety and clinical satisfaction in high workload circumstance.

Acknowledgements

The authors of this study would like to thank Thailand Research Fund (number IRG 5780016) for the publication grant.

Potential conflicts of interest

The authors declare no conflict of interest.

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