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Practical aspects of providing intradialytic parenteral nutrition for patients undergoing hemodialysis in Indonesia: A review

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Abstract. *This paper conducts a comprehensive literature review on the administration of intradialytic parenteral nutrition (IDPN) for patients undergoing hemodialysis (HD) in Indonesia. The objective is to assess the current status and challenges associated with IDPN in the country and propose potential strategies for enhancement. The review, encompassing articles published between 2013 and 2023 from databases such as PubMed, Scopus, and Google Scholar, exposes significant risks and the prevalence of malnutrition, particularly protein-energy wasting (PEW), among patients undergoing HD. This patient cohort often necessitates nutritional therapy, and IDPN emerges as a viable option for both prevention and definitive treatment. However, detailed data on malnutrition among HD patients in Indonesia are limited. Challenges include a shortage of nutrition experts in kidney care, low patient adherence to dietary advice, and the inability of Indonesian hospitals to provide IDPN to malnourished hemodialysis patients. The non-uniform cost coverage by the National Health Insurance further complicates matters, despite consumable costs for HD being uniform across all hospitals. The payment system by BPJS does not accommodate the provision of parenteral IDPN with varying prices, as listed in the e-catalog by the national public procurement agency. To offer IDPN to patients, hospitals must achieve cost-efficiency within their HD units, or they risk financial losses. Currently, IDPN is exclusively administered to HD patients with acute conditions in an inpatient setting. A recommendation for policymakers is to explore the adoption of distinct tariffs for HD patients undergoing outpatient care, particularly those managing complex conditions such as PEW. This approach can contribute to improved nutritional support for hemodialysis patients in Indonesia.*

Keywords: *intradialytic parenteral nutrition, protein-energy wasting, chronic kidney disease, hemodialysis, nutrition supplementation.*

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Практичні аспекти забезпечення інтрадіалізного парентерального харчування пацієнтів, які лікуються методом гемодіалізу в Індонезії: огляд літератури

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Резюме. *У цьому документі міститься комплексний огляд літератури щодо застосування інтрадіалізного парентерального харчування (ІПХ) для пацієнтів, які лікуються методом гемодіалізу (ГД) в Індонезії. Мета полягає в тому, щоб оцінити поточний стан і проблеми, пов'язані з ІПХ в країні, і запропонувати потенційні стратегії для вдосконалення. Огляд, який охоплює статті, опубліковані між 2013 і 2023 роками з таких баз даних, як PubMed, Scopus і Google Scholar, розкриває значні ризики та поширеність недоїдання, зокрема білково-енергетичної недостатності (БЕН), серед ГД пацієнтів. Ця когорта пацієнтів часто потребує дієтичної терапії, де ІПХ може бути життєздатною опцію як для профілактики, так і для остаточного лікування БЕН. Проте детальні дані щоо розповсюдженості БЕН серед ГД пацієнтів Індонезії обмежені. Проблеми включають недостатню кількість дієтологів, нефрологів, низьку прихильність пацієнтів до дієтичних порад та нездатність індонезійських лікарень надати ІПХ ГД пацієнтам з БЕН. Нерівномірне покриття витрат Національним медичним страхуванням ще більше ускладнює ситуацію, незважаючи на те, що витрати на розхідні матеріали для лікування ГД є однаковими в усіх лікарнях. Медична платіжна система країни не підтримує надання ІПХ пацієнтам, як зазначено в електронному каталозі національного агентства з державних закупівель. Щоб запропонувати таке лікування пацієнтам, лікарні повинні досягти економічної ефективності у своїх відділеннях ГД. Тому, на сьогодні, ІПХ призначається виключно ГД пацієнтам з гострими станами в стаціонарних умовах. Цей огляд рекомендує надавачам медичних послуг розглянути можливість запровадження окремих тарифів для ГД пацієнтів з БЕН, які перебувають на амбулаторному лікуванні. Цей підхід може сприяти покращенню харчування ГД пацієнтів на гемодіалізі в Індонезії.*

Ключові слова: *інтрадіалізе парентеральне харчування, білково-енергетична недостатність, хронічна хвороба нирок, гемодіаліз.*

Introduction. Protein-energy wasting (PEW) frequently manifests as a complication in chronic kidney disease (CKD) patients undergoing hemodialysis (HD) [1]. Carrero et al reported the results of a meta-analysis study of the prevalence of PEW ranging from 28-54% of CKD patients undergoing hemodialysis [2]. There is no data available regarding PEW in HD patients in Indonesia. Research on malnutrition in HD patients in Indonesia is also very limited. The International Society of Renal Nutrition and Metabolism (ISRNM) defines PEW as a state of nutritional and metabolic disorders in patients with chronic kidney disease (CKD) characterized by systematic simultaneous loss of body protein and energy storage, ultimately leading to loss of muscle mass and fat and cachexia [3].

Malnutrition in hemodialysis patients is influenced by a hypercatabolic state induced by uremia, decreased food intake due to reduced appetite, systemic inflammation (as seen in diabetes), and other autoimmune conditions. The increased breakdown of muscle and fat, along with inadequate nutrition intake, systemic inflammation, nutrient loss, low physical activity, frailty, and the dialysis process itself, collectively contribute to PEW [4]. In patients with CKD, chronic inflammation persists and negatively affects the production and longevity of serum albumin, resulting in a decrease in plasma protein levels. HD can exacerbate this issue by causing insufficient nutritional intake due to reduced appetite and increased dietary limitations [5].

Several factors influence the occurrence of PEW in HD patients. Hemodialysis itself is one of the factors that play a role in causing PEW [6]. The dialysis process plays a significant role in the chronic loss of essential protein and amino acids. Approximately 6–12 grams of amino acids and 7–8 grams of protein are lost during each dialysis session, which can contribute to hypoalbuminemia, a strong predictor of malnutrition and mortality. The use of highly permeable HD membranes or high-flux and hemodiafiltration techniques may lead to even greater losses of albumin, as well as insensible removal of vitamins, larger protein molecules, and lipids [7].

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The incorporation of intradialytic parenteral nutrition (IDPN) as a means of nutritional supplementation emerges as a practical approach to address PEW. Particularly, it serves as a countermeasure against the development of PEW induced by side effects of hemodialysis. However, it is important to note that certain guidelines do not endorse IDPN as a routine and primary therapy for managing this issue [6, 8]. This review article will discuss the concept and application of IDPN as one of the preventive efforts and management of PEW in CKD in HD patients.

Based on information compiled by the Indonesian Nephrology Association (PERNEFRI) within the Indonesian Renal Registry (IRR) for the year 2018, it was found that 91% of individuals undergoing active chronic hemodialysis in Indonesia, totaling ~120,000 patients, rely on BPJS-Kesehatan (BPJS) for the funding of their hemodialysis treatments in an outpatient setting. BPJS acts as an organizing institution of Indonesia National Health Insurance (NHI). This institution has different payments for healthcare facilities providing HD based on their type. The Indonesian Minister of Health's Statute No. 3 of 2023, concerning the standard rates for health services under health insurance programs, specifies that the rates for healthcare facilities providing hemodialysis services within a range of 54.23 to 76.67 USD. The lowest rate applies to government-owned Type D hospitals, while the highest rate applies to specialized hospitals [9]. The different rates for HD treatments without differentiation for consumables, equipment, or additional therapies during the HD session can indeed impact the availability of hospitals to provide IDPN to malnourished patients.

Although there is ample evidence that malnutrition in hemodialysis patients can increase mortality rates and decrease the quality of life, there are not many articles discussing malnutrition in hemodialysis patients and its management in Indonesia. The only data provided by PERNEFRI indicates that each year, the mortality among dialysis patients remains high, and the poor nutritional status of patients continues to be a concern [10]. Therefore, it is crucial to conduct research on the status of IDPN for hemodialysis patients in Indonesia. By searching and analyzing existing literature that addresses IDPN administration in Indonesia, we hope to provide up-to-date insights into the IDPN status in Indonesia and the challenges in providing IDPN for patients. Additionally, we aim to offer recommendations for hospitals and the government on possible strategies to implement IDPN for hemodialysis patients in Indonesia. The goal of this paper is to outline the current status of the IDPN administration in Indonesia and propose potential strategies for implementation.

In this review, the literature search was conducted via PubMed, Scopus, and Google Scholar to identify articles related to IDPN in Indonesia. The search employed terms such as "parenteral nutrition," "parenteral nutrition on hemodialysis," "intradialytic parenteral nutrition," "protein-energy wasting", "Indonesia kidney nutrition", "hemodialysis malnutrition in Indonesia", "intradialytic parenteral nutrition in Indonesia," and "intradialytic parenteral nutrition on hemodialysis." Subsequently, studies relevant to the objectives of this review were selected and thoroughly reviewed. Other relevant supplementary data from PERNEFRI, National Regulation, and National Agency were also included to further fill the gap of our study.

Nutritional therapy in patients undergoing HD. There are four methods of supplementation of nutrition in HD patients, namely orally, enterally, or parenterally accompanied by IDPN, and total parenteral nutrition (TPN). The determination of this method of supplementation is mainly influenced by several factors related to oral access, the patient's gastrointestinal condition, as well as the patient's CKD stage [11].

ASPEN recommends nutritional counseling and oral supplementation as a first-line approach to hemodialysis-related PEW. If the provision of nutrients through the oral route cannot improve the patient's nutritional status, then the use of the enteral tube becomes the next recommended modality to provide nutrients directly to the patient's gastrointestinal tract. TPN is an option for patients who cannot tolerate the oral or enteral tube route due to gastrointestinal damage, chronic nausea, vomiting, or anorexia or for patients who failed in previous attempts with the oral and/or enteral tube route [12, 13].

IDPN is administered as a supplement during dialysis sessions and is scheduled regularly. Even though they have received nutritional intake through IDPN, patients still have to get oral nutritional intake outside the dialysis session to be able to meet their calorie and protein needs. Some guidelines recommend IDPN only be performed on hemodialysis patients who fail to respond or are unable to use oral and enteral tube pathways [8, 14], but IDPN is also often used by clinicians before attempting to provide nutrition through oral or enteral tubes [15].

Intradialytic parenteral nutririon. IDPN is the administration of intravenous nutrition during hemodialysis sessions taking place through an extracorporeal circuit [12]. ISRNM recommends IDPN as the last resource to supplement spontaneous nutrient intake in ESRD patients undergoing hemodialysis and diagnosed with PEW, or at risk for PEW [16]. IDPN typically contains three macronutrients consisting of glucose, amino acids, and fat emulsions, and is available as an all-in-one concentrated parenteral mixture (approx. 1 kcal/mL, 40-60 g of amino acids per liter). An IDPN using an all-in-one commercial formula can safely allow up to 1000 kcal and 50 g of amino acids to be administered in each hemodialysis session. With this amount of IDPN, the maximum daily extra energy and protein provided by IDPN for people 70 kg is 5-6 kcal/kg/d and 0.3 g amino acids/kg/d.65 on average during dialysis and nondialysis days [17]. Therefore, IDPN should only be considered for patients with a spontaneous intake of at least 20 kcal/kg/d and 0.8 g protein/kg/d [18].

Anderson et al reported that the cost required to perform an IDPN on a single hemodialysis session can be up to 300 times the cost of administering oral supplements [19]. Perhaps at this time, because there is not enough clinical evidence to support the use of IDPN, cost efficiency is a major factor in why IDPN is not recommended as a routine or first-line therapy in CKD on HD patients.

ESPEN and NKF/KDOQI do not state any absolute contraindication of the granting of IDPN [20]. The provision of IDPN is also non-invasive because it only uses pre-existing vascular access (hemodialysis access). As the name implies, "intradialytic", IDPN is only performed while the dialysis process is in progress and is not intended as a long-term permanent therapy, IDPN should be immediately stopped and oral nutrition supplementation (ONS) should be restarted based on a combination of the following three criteria: stable serum albumin >3.8 mg/dL for 3 months; increased subjective global assessment score (SGA) to A (well nourished) or B (moderately malnourished); clinical examination of improved nutritional status; increase in oral intake of protein and energy to >1.0 g/kg/d and to >30 kcal/kg/d. Although there is insufficient evidence regarding the benefits of IDPN on the mortality rate of CKD patients on HD, its benefits to nitrogen balance, anthropometric parameters, and serum prealbumin, substitute parameters for difficult outcomes in malnourished hemodialysis patients have been reported by several studies [13, 21, 22]. The initial benefits of such IDPN can be identified immediately after 1 month of treatment when prealbumin is monitored [13]. A study evaluating the efficacy of IDPN therapy in malnourished patients with refractory anemia reported improved nutritional status assessed by malnutrition inflammation (MIS), BMI, and albumin scores, as well as increased refractory anemia [22]. Despite the possible risks to consider, IDPNs appear to be metabolically secure [13]. We have gathered and analyzed several articles related to the provision of IDPN in Indonesia, and the results and recommendations from each article are compiled in the following Table 1.

Table 1

Summary of findings and recommendations across articles on IDPN administration in Indonesia

Articles	Findings	Suggestions
Marsen et.al [13]	• IDPN can help maintain or improve nutritional status in patients on hemodialysis who struggle with oral intake. • Monitoring of patients on IDPN includes checking dry weight, blood glucose, and liver tests. • The effectiveness of IDPN can be assessed using various nutritional status markers, such as body weight, albumin, and prealbumin levels. • Clinical outcomes from IDPN include improvements in nutritional status, which are linked to better survival rates and fewer hospital stays	• Consider IDPN when an HD patient cannot follow dietary advice or cannot take ONS • IDPN should be seen as a complement to ONS to meet dietary requirements • Three-month courses of IDPN are needed before reassessing nutritional status • Clinicians' strategy to balance energy and protein levels using currently available product • Clinicians, dietitians, nurses, patients, and caregivers should work together to ensure nutritional intervention success
Karupaiah et. al. [23]	• Severe shortage of dietitians in kidney care, especially in low and middle-income countries. • Nutrition screening, assessment, and counseling are lacking in selected Asian Countries. • The hesitance of doctors to engage with nutritionists and concerns about their knowledge of kidney disease. • Need for interprofessional collaboration and task sharing to improve kidney nutrition care. • Indonesia has various levels of nutrition and dietetics education. There is a stronger structural framework for training nutritionists and dietitians in Indonesia compared to some other countries. Multitier of nutritionist workforce in Indonesia. There are experienced general dietitians dedicated to kidney nutrition tasks. Most health facilities perform formal nutritional status assessments on CKD patients. However, formalized training in renal nutrition is lacking	• Create regional institutional coalitions for culture-sensitive capacity building. • Build interprofessional collaboration to fill gaps in essential dietitian services • Train other health professionals to provide basic patient counseling and nutrition screening in the absence of dietitians • Advanced renal nutrition courses to upskill dietitians. • Incentivize dietitians through higher wages and recognition of specialization in renal nutrition • Implement regular nutritional screening and assessment in healthcare settings

Continuation of Table 1

Articles	Findings	Suggestions
Kittiskulnam et. al. [12]	• Higher serum albumin level in the IDPN group after 3 months • Spontaneous dietary intake improved • Malnutrition inflammation score improved • No significant changes were found in muscle mass, strength, serum prealbumin, interleukin-6, high sensitivity-c reactive protein, and acylated ghrelin • Higher leptin in the control group after 3 months • No volume overload or uncontrolled hyperglycemia was observed	• IDPN may be beneficial for hemodialysis patients who cannot tolerate oral nutritional supplements (ONS) due to adverse effects. • IDPN should be considered as a supplemental nutrition strategy for improving serum albumin, body weight, spontaneous oral intake, and malnutrition inflammation score (MIS). • Monthly individualized nutritional counseling should be provided to patients receiving IDPN as part of standard care.
Suryantoro et al [5]	• IDPN offers the fastest elevation of albumin level. Nevertheless, other nutritional support improved comparable stable albumin levels in later months. • Different types of nutritional therapy (counseling, oral therapy, and IDPN) were compared, and all showed some benefits. • Patients' body measurements, like arm size and skinfold thickness, got better with nutritional therapy.	• Different ways of helping patients with their diet, like talking with a nutritionist, taking supplements, or getting nutrition during dialysis, all seem to work. • Nutritional therapy can improve blood protein levels in patients with kidney problems on dialysis

IDPN type. There are 2 main types of IDPN on the market, namely compounded admixture-based and commercial admixture-based IDPN. In compounded admixture-based IDPN, all-in-one IDPN bags are formulated based on individual patient needs while in commercial admixture-based IDPN, premixes are provided for general use. Commercial Premixed is much more popular because the compounding process based on specific patient needs is time-consuming and adds to the cost [24]. Typically IDPNs use high-concentration formulas to reduce the risk of volume overload and adjust the treatment within the usual time constraints of a standard hemodialysis session [25].

Current IDPN status and importance in Indonesia. Malnutrition remains a significant factor affecting the quality of life of HD patients in Indonesia. Research on malnutrition in HD patients in Indonesia is still very limited and mainly relies on the Subjective Global Assessment (SGA) questionnaire. As an example, a study in Lampung, Sumatra, found that 18% of HD patients suffer from malnutrition [26]. Another study in Bali indicates that approximately 42.4% of HD patients experience malnutrition [27]. Although there is no current data recording HD patient's muscle and/or fat mass, according to Indonesian Renal Registry 2018 (IRR) data, 47% of HD patients have low albumin levels, and 81% have not yet achieved the target Kt/V of 1.8 [10]. While urea clearance does not significantly affect nutritional status markers, it does impact the normalized protein catabolic rate (nPCR) [28]. It is suspected that uremic toxins can indeed cause changes in taste perception [29]. Further increasing malnutrition in Indonesian HD patients. Under these conditions, it is necessary to conduct further assessments concerning patients who are experiencing PEW and require IDPN.

Providing IDPN to patients with PEW in Indonesia is a challenge that needs to be overcome. This is because the majority of patients rely on BPJS as their primary funding source for HD [10]. It is necessary to calculate the difference between the claims received by the hospitals and the unit cost of HD at those hospitals to determine the hospitals' ability to provide IDPN. Additionally, providing IDPN should be formulated to the nutritional composition required by the patient and the available pricing. In Table 2, you can see data regarding the prices of parenteral nutrition available in Indonesia, provided by the website of the Indonesian National Public Procurement Agency.

Table 2

Commercial admixture-based IDPN price in Indonesia

Product Name	Composition		Price (USD)
Nephrosteril (250ml)	Amino acids	70g AA, 10.8g N, 280kCal/250ml	3.06
Ranxamin (200ml)	Amino acids	89.49g AA, 15.2g N/L	3.21
Kidmin (200ml)	Amino acids	14.41g AA, 2g N/200mL	3,52

Continuation of Table 2

Product Name	Composition		Price (USD)
Aminofusin L 600 (500ml)	Amino acids	50g AA, 50g Sorbitol, 50g Xylitol/L	3.4
Amiparen 10% (500ml)	Amino acids	100g AA, 15.7g N/L	6.23
Gabaxa 100 (100ml)	l-alanyl-l-glutamine	200mg/L	15.66
Glutalan (100ml)	l-alanyl-l-glutamine		15.79
Glutiven (100ml)	l-alanyl-l-glutamine		15.79
Ahep (500ml)	Amino acids, glucose, l-ornithine-l-aspartate	50g AA, 7.53N, 400kCal/L	5.06
Comafusin Hepar (500ml)	Amino acids, glucose, l-ornithine-l-aspartate	50g AA, 7.53N, 400kCal/L	5.67
Valamin (500ml)	Amino acids, sorbitol	29.2g AA, 4.2g N/L	3.12
Pan Amin G (500ml)	Amino acids, sorbitol,	2.72% AA (w/v), 4.2g N/L	3.12
Aminoleban (500ml)	Amino acids, electrolytes	7.99% AA (w/v), 12.2g N/L	4.8
Benutrion VE (250ml)	Amino acids, vitamins, electrolytes		4.04
Bfuid (500ml)	Amino acids, glucose, electrolytes		6.31
Bfuid (1000ml)	Amino acids, glucose, electrolytes		11.61
Lipomed 20% (100ml)	Essential fatty acids	100g soya oil & MCT, 2000kCal/L	4.97
Lipomed 20% (250ml)	Essential fatty acids		9.79
Clinoleic 20% (100ml)	Essential fatty acids	20g olive oil & soya oil, 2000kCal/L	10.8
Clinoleic 20% (250ml)	Essential fatty acids		11.27
Martos – 10 (500ml)	Maltose	100mg Maltosa/ml	2.22
SmofKabiven (493ml)	Amino acids, glucose, fatty acids, electrolytes	5.1% AA, 3.8% lipid, 12.7% glucose, 0.7% electrolytes	16.88
SmofKabiven (1206ml)	Amino acids, glucose, fatty acids, electrolytes		25.31
SmofKabiven (1448ml)	Amino acids, glucose, fatty acids, electrolytes		29.11

The use of IDPN in Indonesia is covered by BPJS through a package of dialysis procedure costs under the Minister of Health Regulation No. 3 of 2023. The cost varies depending on the type of hospital and the regional location of the hospital. Therefore, The Indonesian Nephrology Association establishes the unit cost of HD for each session at different hospitals (Table 3).

Table 3

The average cost of standard HD sessions across various hospital categories in Indonesia

Item	HD Unit Cost (USD)			
	Type A Hospital	Type B Hospital	Type C Hospital	Type D Hospital/ Clinic
Consumables	38.46	38.46	38.46	38.46
Labor fee	9.68	6.97	6.32	5.74
Depreciation	4.84	4.84	4.84	4.84
Total	52.98	50.27	49.62	49.04

In terms of consumables and depreciation, there is no difference. The variation lies solely in the labor fee, which depends on the number of healthcare personnel and the qualifications of medical staff differing among different types of hospitals.

Based on a rough calculation of unit costs and payments provided by BPJS for each regular HD session at hospitals, not every hospital can afford to provide IDPN to HD patients. Only hospitals categorized as type A, (certain) type B, and specialty have the financial capacity to offer IDPN to patients. Even in these hospitals, careful calculations must be made, and IDPN should be administered with formulations that align with the specific needs of the patients.

In the next part of our review, we're going to summarize what we learned from looking at different articles and data. This information helps us figure out the problems and possible solutions for giving intradialytic parenteral nutrition in Indonesia. We carefully checked various articles and data to understand the challenges of providing IDPN in Indonesia. By combining what we found in our research, we can discuss the problems that come up when trying to give intradialytic parenteral nutrition in Indonesia. We also explore practical solutions based on what we learned from other studies around the world and what makes sense for the situation in Indonesia. The summarized challenge and possible solution are presented in Table 4.

Table 4

Challenges and possible solutions for IDPN Administration in Indonesia

No	Challenge	Possible Solution
1	Severe shortage of dietitians in kidney care	Establish regional institutional coalitions for culturally sensitive capacity building, providing advanced renal nutrition courses to upskill dietitians, and training other health professionals for basic patient counseling and nutrition screening in the absence of dietitians.
2	Lack of patient adherence to dietary advice	Start implementing nutrition counseling and monitoring dietary intake for patients, and collaborate with the patient's caregiver.
3	The current IDPN can only be administered in an inpatient setting	Clinicians need to be more precise and regularly assess HD patients' nutritional status or collaborate with nutritional experts. They should promptly administer sufficient nutritional interventions, including IDPN, in an inpatient setting, allowing more freedom based on NHS claims.
4	Lower-tier hospitals will incur losses if administering IDPN in an outpatient setting	The government, in this case, the Minister of Health, who holds a position above BPJS, can consider providing a special outpatient care rate for HD patients with malnutrition conditions.

Conclusions. PEW poses a prevalent challenge for CKD patients undergoing HD. Among the mechanisms for administering supplemental therapy, Intraperitoneal Dialysis Parenteral Nutrition (IDPN) stands out as a potential intervention for preventing and managing PEW in CKD in HD patients. While certain guidelines may not prioritize IDPN as the initial choice for addressing PEW, clinicians often opt for its use before exploring the oral or enteral tube pathway.

Addressing the lack of specialized nutrition experts in kidney care and low adherence to dietary interventions among Asians, regional coalitions need to be established for capacity building. This includes advanced renal nutrition courses for dietitians and basic patient counseling and nutrition screening training for other health professionals. Those strategies will support the initiatives like implementing nutrition counseling, monitoring dietary intake, and collaborating with caregivers to improve patients' nutritional status, facilitating the provision of IDPN as a supplementary measure.

In higher-tier and specialized hospitals, the flexibility to incorporate IDPN into the inpatient HD procedure is observed, allowing for effective PEW management while minimizing financial losses. Conversely, patients in lower-tier hospitals may face challenges in accessing therapy for the PEW they experience. This discrepancy arises from the incomplete coverage of HD and IDPN unit costs by the BPJS (Badan Penyelenggara Jaminan Sosial), the national health insurance program. As a result, an alternative approach emerges, wherein IDPN is administered within the inpatient setting when routine hemodialysis patients are admitted due to acute conditions warranting IDPN supplementation.

This situation is exacerbated by the fact that BPJS coverage falls short of fully meeting the expenses associated with HD and IDPN. Looking ahead, it becomes imperative for the Minister of Health to consider revising rates for HD services. Additionally, the allocation of separate tariffs for HD patients experiencing PEW or other HD-related complications could significantly improve the accessibility and affordability of essential therapies. In doing so, a more interconnected and comprehensive approach to addressing the complexities of PEW in CKD on HD patients can be achieved.

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Authors' contribution.

Jonny Jonny: conceptualization, provision of study materials, data analysis and interpretation, final approval of manuscript;

Taufiq Fredrik Pasiak: conceptualization, provision of study materials, final approval of manuscript;

Zikril Ariliusra: collection and assembly of data, data analysis, and interpretation, manuscript writing, and final approval;

Bhimo Aji Hernowo: collection and assembly of data, data analysis, and interpretation, manuscript writing, and final approval.

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