https://doi.org/10.59459/1859-1655/JMM.1106

SURVEY OF INTRADIALYTIC HYPOTENSION IN THE END-STAGE RENAL DISEASE PATIENTS ON THEIR FIRST HEMODIALYSIS SESSION

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ABSTRACT

Objective: *To determine the rate of intradialytic hypotension and identify several related factors in patients with end-stage renal disease undergoing their first hemodialysis session.*

Methods: *A descriptive cross-sectional study was conducted on 54 patients diagnosed with end-stage renal disease who underwent their first hemodialysis session at the Hemodialysis Center, Thanh Hoa General Hospital, from January 2025 to October 2025.*

Results: *The prevalence of intradialytic hypotension among first-time hemodialysis patients with end-stage renal disease was 14.8%, of which 75% of hypotensive episodes occurred during the second half of the dialysis session. Patients aged > 60 years, blood glucose ≥ 10 mmol/l, serum albumin ≤ 30 g/l, and ultrafiltration rate > 750 ml/h had a significantly higher risk of developing intradialytic hypotension compared with the remaining groups (p < 0.05).*

Conclusion: *The prevalence of intradialytic hypotension in first-time hemodialysis patients with end-stage renal disease was relatively high (14.8%), occurring predominantly during the latter half of the dialysis session. Advanced age (> 60 years), hyperglycemia (≥ 10 mmol/l), hypoalbuminemia (≤ 30 g/l), and high ultrafiltration rate (> 750 ml/h) were significant risk factors associated with intradialytic hypotension.*

Keywords: Intradialytic hypotension; end-stage renal disease; first-time hemodialysis.

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Received: 12/5/2026; scientific review: 5/2026; accepted: 28/5/2026.

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1. INTRODUCTION

Chronic kidney disease (CKD) in general, and end-stage renal disease (ESRD) in particular, has become a major global public health issue with an increasing prevalence worldwide. CKD is among the leading causes of impaired quality of life and increased mortality [1]. When CKD progresses to ESRD, renal replacement therapies such as kidney transplantation, peritoneal dialysis, and hemodialysis become essential for sustaining life, among which hemodialysis accounts for the majority of treatment modalities [2]. Although hemodialysis prolongs survival and improves patients' quality of life, it is associated with various acute complications, particularly intradialytic hypotension (IDH), which may adversely affect treatment outcomes and long-term prognosis [3, 4].

In Vietnam, most CKD cases are secondary to chronic glomerulonephritis, a condition characterized by insidious progression and subtle clinical manifestations. Furthermore, poor treatment compliance and inadequate follow-up frequently lead to late presentation with acute disease exacerbation, requiring urgent dialysis initiation. Acute clinical conditions and insufficient preparation before dialysis are major factors affecting hemodynamic stability during the initial dialysis sessions. Numerous domestic and international studies have investigated hemodynamic complications during hemodialysis. Sands et al. [5] conducted a study on 1,137 maintenance hemodialysis patients and reported an IDH prevalence of 17.2%, with advanced age, female sex, elevated body mass index (BMI), and high ultrafiltration volume identified as significant risk factors. Khuc Thi Thuy Nga et al. [6] studied 100 patients undergoing first-time hemodialysis and found that 13% developed hypotension, with significant associations between BMI, anemia, elevated blood urea levels, and IDH.

At present, no systematic study has been conducted at Thanh Hoa General Hospital regarding intradialytic hypotension in patients with ESRD undergoing first-time hemodialysis. Therefore, we conducted this study with the objective: "To

determine the rate of intradialytic hypotension and identify several related factors in patients with end-stage renal disease undergoing their first hemodialysis session".

2. SUBJECTS AND METHODS

2.1. Subjects:

The study included 54 patients diagnosed with ESRD who underwent their first hemodialysis session at the Hemodialysis Center, Thanh Hoa General Hospital, from January 2025 to October 2025.

- Inclusion criteria: Patients over 16 years of age who agree to participate in the study.

- Exclusion criteria: Patients already receiving maintenance hemodialysis; patients experiencing septic shock, cardiogenic shock, hypovolemic shock, etc.; patients with indications for blood transfusion, fluid resuscitation, or the use of vasopressors or vasodilators during the dialysis session.

2.2. Methods

- Descriptive cross-sectional study.

- Study variables and data collection methods:

+ General patient characteristics: sex, age, duration of chronic kidney disease.

+ Clinical, paraclinical characteristics and dialysis parameters: edema status; severity of anemia; selected blood test results (urea, creatinine, glucose, albumin); ultrafiltration volume (UF) and ultrafiltration rate (UFR).

+ Prevalence of IDH and analysis of several related factors.

Each patient underwent clinical and paraclinical examinations, with all characteristics and symptoms recorded using a standardized medical record form. Blood pressure (BP) was measured prior to the dialysis session and every 30 minutes from the start of dialysis or immediately when symptoms of hypotension occurred.

- Criteria applied in the study:

+ Definitive diagnosis of ESRD: Diagnosed according to the Kidney Disease: Improving Global Outcomes (KDIGO) 2012 guidelines when the glomerular filtration rate (GFR) is < 15ml/min or when renal replacement therapy is required [7].

+ Indications for dialysis: Based on the Vietnamese Ministry of Health Guidelines (issued under Decision No. 2482/QD-BYT) [8] and KDIGO recommendations.

+ Parameters for the first dialysis session: short duration (2.5 hours); low blood flow rate (200-250 ml/min); and limited ultrafiltration (maximum UF not exceeding 5% of body weight) [9].

+ Classification of anemia severity: Categorized based on hemoglobin (Hb) concentration according to World Health Organization (WHO) criteria [10].

+ Diagnosis of IDH: According to the Kidney Disease Outcomes Quality Initiative (KDOQI) clinical practice guidelines [11], defined as a decrease in systolic BP ≥ 20 mmHg or a decrease in mean arterial pressure ≥ 10 mmHg associated with symptoms such as abdominal pain, nausea, vomiting, muscle cramps, dizziness, syncope, or anxiety.

+ Blood biochemical indices were measured from venous blood samples collected before hemodialysis and analyzed within 2 hours at the ISO-certified central laboratory of Thanh Hoa General Hospital.

- Data analysis: Data were processed using the medical statistical software SPSS version 20.0.

- Research ethics: The study was approved by the Ethics Committee/Scientific Committee of Thanh Hoa General Hospital (Decision No. 4112/QD-BVDKT, dated November 11, 2025). Patients were fully informed about the study's purposes and voluntarily agreed to participate. All personal medical data of the patients remained strictly confidential and were used solely for scientific research purposes. This study did not interfere with or affect the patient's ongoing treatment process.

3. RESULTS

3.1. General characteristics of the study population

Table 1. Baseline clinical characteristics and hemodialysis parameters

Characteristics (n = 54)		n	%
Sex	Male	37	68.5
	Female	17	31.5
Age (years)	18-60	35	64.8
	> 60	19	35.2
Duration of CKD	Newly diagnosed ESRD	21	38.9
	Previous conservative treatment	33	61.1

Characteristics (n = 54)		n	%
Edema	(+)	30	55.6
	(-)	24	44.4
Severity of anemia	Severe anemia	19	35.2
	Moderate anemia	27	50.0
	Mild anemia	8	14.8
Ure (mmol/l)	≥ 30	43	79.6
	< 30	11	20.4
Creatinine (umol/l)	≧ 800	46	85.2
	< 800	8	14.8
Glucose (mmol/l)	≥ 10	6	11.1
	< 10	48	88.9
Albumin (g/l)	≤ 30	9	16.7
	> 30	45	83.3
UF (% body weight)	> 5%	0	0.0
	≤ 5%	54	100.0
UFR (ml/h)	> 750	12	22.2
	≤ 750	42	77.8

The mean age was 53.5 years (range 23–80 years), and the majority were male (68.5%) and of working age (64.8% of patients were under 60 years old). Most patients had already been diagnosed and conservatively treated for CKD before admission, although 38.9% were newly diagnosed at the end stage and required urgent dialysis. All patients presented with varying degrees of anemia, with moderate anemia being the most prevalent (50%). Elevated blood urea (≥ 30 mmol/l) and serum creatinine (≥ 800 µmol/l) were observed in 79.6% and 85.2% of patients, respectively. Meanwhile, hypoalbuminemia (≤ 30 g/l) and hyperglycemia (≥ 10 mmol/l) were observed in 16.7% and 11.1% of patients, respectively. The mean UF and UFR were 1,100 ml and 436 ml/h, respectively. All patients underwent ultrafiltration volumes below 5% of body weight, and 77.8% had UFR ≤ 750 ml/h.

3.2. IDH and related factors

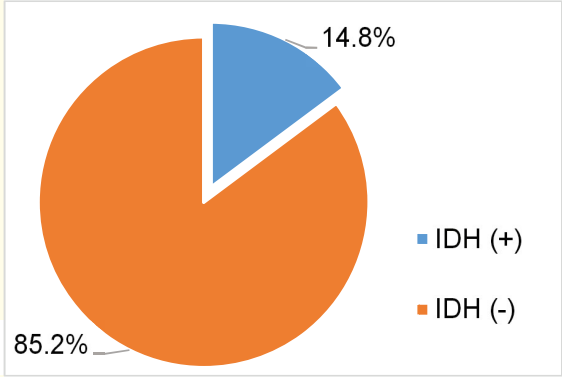

Figure 1. The rate of IDH in the study population (n = 54).

14.8% of patients developed IDH during their first hemodialysis session.

Table 2. Timing of intradialytic hypotension

Timing of IDH	n	%
First half of session	2	25.0
Second half of session	6	75.0
Total	8	100.0

Of the 8 patients with IDH, 75% occurred during the second half of the dialysis session.

Table 3. Intradialytic hypotension and related factors

		IDH (+)		IDH (−)		p	OR (95% CI)
		n	%	n	%		
Age group (years)	> 60	6	31.6	13	68.4	0.02*	7.6 (1.36-42.7)
	≤ 60	2	5.7	33	94.3		
Glucose (mmol/l)	≥ 10	3	50.0	3	50.0	0.04*	8.6 (1.4-54.6)
	< 10	5	10.4	43	89.6		
Albumin (g/l)	≤ 30	5	55.6	4	44.4	0.002*	17.5 (3.0-101.8)
	> 30	3	6.7	42	93.3		
UFR (ml/h)	> 750	4	33.3	8	66.7	0.04*	4.7 (1.1-23.1)
	≤ 750	4	9.5	38	90.5		
** Fisher's Exact Test*							

Statistically significant associations were identified between IDH and the following factors: patients aged > 60 years had a 7.6-fold higher risk of IDH compared with those aged ≤ 60 years; patients with blood glucose ≥ 10 mmol/l had an 8.6-fold higher risk of IDH compared with the remaining group; patients with serum albumin ≤ 30 g/l had a 17.5-fold higher risk of IDH compared with those with albumin > 30 g/l; patients with UFR > 750 ml/h had a 4.7-fold higher risk of IDH compared with those with lower UFR; these differences were statistically significant ($p < 0.05$).

4. DISCUSSION

4.1. General characteristics of the study population

The mean age of the study population was 53.5 ± 15.0 years, ranging from 23 to 80 years, with the majority being of working age (64.8%). Male patients accounted for 68.5% of the study population. The predominance of males and working-age individuals reflects the substantial socioeconomic burden associated with ESRD. This study also demonstrated that a relatively high proportion of patients (38.9%) presented for the first time with ESRD requiring immediate dialysis initiation. These findings indicate that disease control remains inadequate both in the community served by Thanh Hoa General Hospital in particular and in Vietnam in general. This situation highlights the need to improve health awareness and healthcare-seeking behavior among patients with chronic kidney disease as well as within the general community.

Anemia occurs early during CKD progression and becomes more severe as renal function deteriorates due to multiple contributing mechanisms. In this study, all patients had anemia of varying severity, with moderate-to-severe anemia (Hb < 110 g/l) accounting for 85.2% of cases. Furthermore, most patients exhibited markedly elevated serum urea and creatinine levels before dialysis initiation (79.6% had blood urea ≥ 30 mmol/l and 85.2% had serum creatinine ≥ 800 µmol/l). In addition, 16.7% of patients had hypoalbuminemia (≤ 30 g/l), suggesting malnutrition and reduced protein reserves before dialysis initiation. Hyperglycemia (glucose ≥ 10 mmol/L) was observed in 11.1% of patients, reflecting the presence of diabetic comorbidity, which is also one of the common risk factors contributing to CKD. These findings indicate poor disease control, with patients frequently presenting in acute clinical conditions such as severe uremia, profound anemia, electrolyte imbalance, and cachexia, thereby necessitating emergency hemodialysis with inadequate preparation

The mean UF in our study was 1100 ± 850 ml, and no patient underwent fluid removal exceeding 5% of body weight. The mean UFR was 436 ± 335 ml/h, with 77.8% of patients having UFR < 750 ml/h. These findings are consistent with routine clinical practice during the first hemodialysis session, when dialysis duration is typically shortened and UFR are restricted to below 750 ml/h (equivalent to 13 ml/kg/hour in a 50-kg patient) to minimize the risk of hypotension and other severe complications such as dialysis disequilibrium syndrome.

4.2. IDH and related factors

In this study, 14.8% of patients developed intradialytic hypotension during their first hemodialysis session. This prevalence was lower than the commonly reported prevalence among maintenance hemodialysis patients, which ranges from 20% to 30% [5, 11]. This difference may be explained by the characteristics of the study population, in which dialysis duration was generally shortened and ultrafiltration parameters were adjusted conservatively to minimize complications. Regarding the timing of hypotension, 75% of hypotensive episodes occurred during the second half of the dialysis session. This finding is consistent with the pathophysiological mechanisms described in previous literature, in which the risk of hypotension progressively increases toward the end of dialysis due to cumulative fluid removal, reduced plasma osmolality, and impaired compensatory responses of the sympathetic nervous system and the renin–angiotensin–aldosterone system. Our findings are comparable with previous domestic and international studies. Khuc Thi Thuy Nga et al.[6] reported an IDH prevalence of 13% among 100 first-time hemodialysis patients at Bach Mai Hospital in 2020, with blood pressure gradually decreasing toward the end of dialysis sessions. Similarly, Sands et al. [5] reported an IDH prevalence of 17.2% in 2014.

Advanced age, high ultrafiltration rate, and abnormalities in biochemical parameters such as glucose and albumin levels have been recognized as important risk factors for intradialytic hypotension. In our study, patients aged > 60 years had a 7.6-fold increased risk of IDH compared with younger patients. This may be explained by impaired autonomic reflexes and reduced sympathetic nervous system responsiveness in elderly individuals. Moreover, vascular sclerosis and decreased vascular elasticity in older patients

impair vascular adaptation to rapid intravascular volume changes during ultrafiltration. Our study also demonstrated statistically significant associations between IDH and serum albumin and glucose levels. Patients with serum albumin ≤ 30 g/l had a 17.5-fold increased risk of IDH compared with those with normal albumin levels, whereas patients with blood glucose ≥ 10 mmol/l had an 8.6-fold higher risk of IDH compared with normoglycemic patients. These findings highlight the important role of albumin and glucose homeostasis in the pathogenesis of IDH. Hypoalbuminemia reduces plasma oncotic pressure, while hyperglycemia contributes to fluid imbalance and hemodynamic instability. Therefore, nutritional optimization and adequate glycemic control are essential strategies for reducing IDH events. In addition, patients with UFR > 750 ml/h had a 4.7-fold increased risk of IDH compared with those with lower UFR. This finding is consistent with established pathophysiological mechanisms, whereby rapid ultrafiltration exceeds the capacity for plasma refilling from the extravascular compartment, leading to decreased effective circulating volume and hypotension. Previous studies have similarly demonstrated strong associations between high ultrafiltration rates and hemodynamic instability, particularly among patients with poor cardiovascular reserve or multiple comorbidities.

Currently, there remains no universally accepted definition of intradialytic hypotension, which may partly explain variations in reported risk factors across studies. Sands et al. identified advanced age, female sex, diabetes mellitus, elevated BMI, high ultrafiltration volume, and low predialysis systolic blood pressure as risk factors for IDH, whereas Flythe et al.[12] emphasized the roles of sex and hypoalbuminemia. In Vietnam, Nguyen Thi Thu Hai [13] reported associations between IDH and elevated predialysis urea, low hemoglobin, and hypoalbuminemia. Nguyen Van Tuan et al. [14] also found that advanced age, large ultrafiltration volume, and biochemical parameters such as urea, creatinine, and albumin levels were associated with blood pressure changes during hemodialysis. Our findings are generally consistent with both domestic and international studies, confirming that advanced age, hypoalbuminemia, and high ultrafiltration rate are important risk factors for intradialytic hypotension.

5. CONCLUSION

From the study conducted on 54 patients with ESRD undergoing first-time hemodialysis at the Hemodialysis Center, Thanh Hoa General Hospital, from January 2025 to October 2025, we draw the following conclusions: The prevalence IDH among first-time hemodialysis patients with ESRD was 14.8%, with most episodes (75%) occurring during the second half of the dialysis session. Advanced age (> 60 years), hyperglycemia (≥ 10 mmol/l), hypoalbuminemia (≤ 30 g/l), and high UFR (750 ml/h) were significantly associated with increased risk of intradialytic hypotension ($p < 0.05$).

Close monitoring and proactive management of risk factors in first-time hemodialysis patients with end-stage renal disease are essential, particularly in elderly patients and those with hyperglycemia, hypoalbuminemia, or high ultrafiltration requirements. Such interventions may not only reduce the incidence of intradialytic hypotension and prevent severe cardiovascular complications but also improve dialysis adequacy and overall treatment outcomes.

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