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ORYGINALNY ARTYKUŁ NAUKOWY

# KNOWLEDGE LEVELS OF HEMODIALYSIS NURSES AND TECHNICIANS CONCERNING INTRADIALYTIC HYPOTENSION

# POZIOM WIEDZY PIELĘGNIAREK, PIELĘGNIARZY I TECHNIKÓW HEMODIALIZY NA TEMAT HIPOTONII ŚRÓDDIALIZACYJNEJ

**Ülkü Yılmaz**[1(A,B,D,E,F)] **Ayfer Hiçerimez**[2(B,C)]

[1]Department of Nursing, Faculty of Health Sciences, Istanbul Beykent University, Türkiye

[2]Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye

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**Address for correspondence / Adres korespondencyjny:** Ülkü Yılmaz, Department of Nursing, Faculty of Health Sciences, Istanbul Beykent University, Cumhuriyet Mahallesi, Beykent, Büyükçekmece / Istanbul, Türkiye, e-mail: ulkyilmz@gmail.com, phone: +90 444 1997 /6271

ORCID: Ayfer Hiçerimez https://orcid.org/0000-0001-5120-3105

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**Summary**

**Background.** Intradialytic hypotension (IDH) is a common complication of hemodialysis. The knowledge and skills of healthcare professionals are essential for them to perform the intervention correctly.

**Material and methods.** This study was designed as a descriptive and cross-sectional study to evaluate the knowledge levels of hemodialysis professionals concerning IDH. It was conducted with nurses and technicians (n=80) in five dialysis centers in Istanbul between March 2023 and March 2024. Data was collected face-to-face.

**Results.** In the study, 95% of the participants stated that using low sodium and high calcium dialysate causes IDH, and 97.5% thought that the temperature of the dialysis solution should be adjusted to 35.5-36°C in patients at risk of IDH. 95% of the participants argued that the amount of ultrafiltration causes IDH when it falls below the target weight. In cases where IDH developed, 90% of the individuals participating in the study placed the patient in the Trendelenburg position, 92.5% emphasized that the patient should be given fluid support, 67.5% stated that oxygen support should be given, and 97.5% pointed out that ultrafiltration should be turned off.

**Conclusions.** This study showed that the correct answers given by hemodialysis nurses and technicians to questions about IDH were high.

**Keywords:** hypotension, hemodialysis, complications, nursing, patient care

**Streszczenie**

**Wprowadzenie.** Hipotonia śródzabiegowa (ang. *intradialytic hypotension, IDH*) jest częstym powikłaniem hemodializy. Wiedza i umiejętności pracowników służby zdrowia są niezbędne do prawidłowego przeprowadzenia interwencji.

**Materiał i metody.** Niniejsze badanie zostało zaprojektowane jako badanie opisowe i przekrojowe w celu oceny poziomu wiedzy specjalistów hemodializy na temat IDH. Badanie przeprowadzono wśród pielęgniarek, pielęgniarzy i techników (n=80) w pięciu ośrodkach dializ w Stambule w okresie od marca 2023 r. do marca 2024 r. Dane zostały zebrane osobiście.

**Wyniki.** 95% uczestników badania stwierdziło, że stosowanie płynu dializacyjnego o niskiej zawartości sodu i wysokiej zawartości wapnia prowadzi do wystąpienia IDH, a 97,5% uważało, że u pacjentów z ryzykiem wystąpienia IDH temperatura płynu dializacyjnego powinna być ustawiona na poziomie 35,5-36°C. 95% uczestników twierdziło, że IDH występuje w przypadku, gdy poziom ultrafiltracji spada poniżej masy docelowej. Zaobserwowano, że w momencie wystąpienia IDH , 90% osób biorących udział w badaniu ułożyło pacjenta w pozycji Trendelenburga, 92,5% uczestników podkreśliło, że pacjent powinien otrzymać płyny, 67,5% stwierdziło, że należy podać tlen, a 97,5% wskazało, że ultrafiltracja powinna zostać wyłączona.

**Wnioski.** W niniejszym badaniu zaobserwowano, że prawidłowe odpowiedzi udzielane przez pielęgniarki, pielęgniarzy i techników hemodializy na pytania dotyczące IDH stanowiły wysoki odsetek.

**Słowa kluczowe:** hipotonia, hemodializa, powikłania, pielęgniarstwo, opieka nad pacjentem

## Introduction

Chronic kidney disease (CKD) is a major global public health problem that often leads to end-stage renal disease (ESRD) requiring dialysis treatment or kidney transplantation [1]. Although there are high-income countries where the incidence of ESRD remains stable, the need for dialysis treatment remains essential due to the inadequacy of kidney transplantation [2,3]. Hemodialysis, one of the treatment methods for chronic kidney failure, also includes various complications. Intradialytic hypotension (IDH), with an incidence ranging from 5% to 40%, is one of the common complications during hemodialysis sessions [4]. IDH is a decrease in systolic blood pressure equal to or above 20 mm/Hg or mean arterial pressure equal to or above 10 mm/Hg [5,6]. IDH is accompanied by symptoms that will affect the hemodialysis session, such as nausea-vomiting, abdominal pain, muscle cramps, dizziness, restlessness, fainting, and anxiety. Despite some interventions to prevent the symptoms experienced, IDH is still a common complication during hemodialysis sessions. IDH precautions include interventions such as restricting the fluid intake between two dialysis sessions, adjusting the amount of ultrafiltration (UF) according to the patient's dry weight [7], applying pressure bandages to the legs, not using antihypertensive medications before the hemodialysis session, regularly monitoring blood pressure throughout the session, not consuming food during the hemodialysis procedure [8], using sodium profiles [9], and reducing the dialysate temperature (34-36°C). In addition to the precautions taken, there are interventions that the nurse should implement when IDH develops. Providing the Trendelenburg position, giving 0.9% NaCl, reducing or resetting the UF rate, and administering nasal oxygen are among the interventions [10].

The knowledge and skills of nurses who primarily work with IDH attacks concerning IDH are essential. Although there are studies on IDH in literature, studies measuring the knowledge level of hemodialysis nurses on this subject are rare.

## Aim of the work

This research was planned to evaluate the knowledge levels of hemodialysis nurses and technicians concerning IDH.

## Material and methods

This research was designed as descriptive and cross-sectional. The research was conducted with hemodialysis nurses and technicians in five private dialysis centers in Istanbul (Türkiye). This study was conducted between March 2023 and March 2024.

### *Population and sample of the research*

The population of the research consisted of 85 nurses and technicians working in the five dialysis centers where the research was conducted. Since it was aimed to reach all 85 employees, no sample calculations were made.

80 people who agreed to participate and met the inclusion criteria constituted the study sample. The inclusion criteria in this research are as follows: being 18 years of age or older, having worked in the field of hemodialysis for at least one year, and volunteering to participate in the study.

*Data collection and data tools*

The data collection form contained 21 questions, determined by the researchers using literature and considering the purpose of the research. The questions asked related to the topic of the participants' ages and genders, education levels, working hours as nurses in the relevant clinic, and technicians' information and interventions regarding IDH that develops during hemodialysis sessions. The data collection form was applied after obtaining expert opinions.

*Limitations of the research*

Due to the low number of nurses and technicians working in hemodialysis centers, working with a limited population and sample was necessary.

*Analysis and evaluation of data*

Data analyses were made using number and percentage tests in the IBM SPSS 22 statistical program.

**Results**

Of the individuals participating in the study, 60% were nurses, and 40% were dialysis technicians. 47.5% were between the ages of 26-33, 30% were 34 and above, and 22.5% were between 18-25. 62.5% of the individuals were female, 37.5% were male, the majority (62.5%) had an associate's degree, and 22.5% had a bachelor's degree. 35% of the employees had 10 years or more of service, 30% had 6-9 years, and 35% had 0-5 years of service (Table 1).

**Table 1.** Information on descriptive characteristics (n=80)

| Variables | | n | % |
|---|---|---|---|
| **Employment** | **Nurse** | 48 | 60 |
| | **Dialysis technician** | 32 | 40 |
| **Age** | **18-25** | 18 | 22,5 |
| | **26-33** | 38 | 47,5 |
| | **34 and above** | 24 | 30 |
| **Gender** | **Female** | 50 | 62,5 |
| | **Male** | 30 | 37,5 |
| **Educational status** | **High school** | 4 | 5 |
| | **Associate's degree** | 54 | 62,5 |
| | **University** | 18 | 22,5 |
| | **Postgraduate** | 4 | 5 |
| **Working time** | **0-5 years** | 28 | 35 |
| | **6-9 years** | 24 | 30 |
| | **10 years and above** | 28 | 35 |

Notes: n=number of persons, %=percentage.



90% of the study participants received training on preventing IDH. It was determined that 47.5% of the individuals received training on preventing IDH at school, 40% received in-service training at work, and 12.5% did not receive training on this subject. 65% of the individuals used a protocol in their institutions for preventing IDH, and 35% did not have a protocol in their institutions. It was observed that 60% of the individuals trained patients coming to the dialysis center to prevent IDH, while 40% did not train patients on this subject.

95% of the individuals stated that the use of dialysate with low sodium and high calcium was one of the reasons for IDH, all of the participants in the study emphasized that the high ultrafiltration rate in hemodialysis had an effect on the development of IDH, and 97.5% of the individuals pointed out that the temperature of the dialysis solution should be adjusted to 35.5-36°C in patients at risk for IDH. 87.5% of the individuals stated that patients should not use antihypertensive medications on the days they were on dialysis and 95% of the participants in

the study argued that the amount of ultrafiltration to be performed on the patient would cause IDH if it fell below the target weight (Table 2).

**Table 2.** Information on IDH knowledge level

| Variables | | n | % |
|---|---|---|---|
| **Have you received training in preventing IDH?** | **Yes** | 72 | 90 |
| | **No** | 8 | 10 |
| **Where did you receive training in preventing IDH?** | **Nowhere** | 10 | 12.5 |
| | **School** | 38 | 47.5 |
| | **In-service training** | 32 | 40 |
| **Does your institution have a protocol for preventing IDH?** | **Yes** | 52 | 65 |
| | **No** | 28 | 35 |
| **Do you educate patients about preventing IDH in your institution?** | **Yes** | 48 | 60 |
| | **No** | 32 | 40 |
| **Is the use of dialysate with low sodium and high calcium a cause of IDH?** | **Yes** | 76 | 95 |
| | **No** | 4 | 5 |
| **Does a high ultrafiltration rate in hemodialysis affect the development of IDH?** | **Yes** | 80 | 100 |
| | **No** | 0 | 0 |
| **Should the temperature of the dialysis solution be adjusted to 35.5-36°C in patients at risk for IDH?** | **Yes** | 78 | 97.5 |
| | **No** | 2 | 2.5 |
| **How should antihypertensive medications be used when patients are on dialysis?** | **Should use** | 10 | 12.5 |
| | **Should not use** | 75 | 87.5 |
| **Will the amount of ultrafiltration from the patient falling below the target weight cause IDH?** | **Yes** | 76 | 95 |
| | **No** | 4 | 5 |
| **At what intervals do you monitor the blood pressure of a patient who receives hemodialysis treatment for 4 hours, 3 days a week, during the hemodialysis session?** | **1 per hour** | 46 | 57.5 |
| | **1 in half an hour** | 34 | 42.5 |
| **Does the patient's food intake during the hemodialysis session cause IDH?** | **Yes** | 74 | 92.5 |
| | **No** | 6 | 7.5 |
| **Is a salt-restricted diet recommended when giving nutritional education to the patient?** | **Yes** | 80 | 100 |
| | **No** | 0 | 0 |
| **What position would you give to the patient if IDH develops?** | **Fowler** | 4 | 5 |
| | **Lateral** | 2 | 2.5 |
| | **Semi-fowler** | 2 | 2.5 |
| | **Trendelenburg** | 72 | 90 |
| **Does using ultrafiltration-controlled devices and adjusting the sodium profile affect the development of IDH?** | **Yes** | 76 | 95 |
| | **No** | 4 | 5 |
| **Should the patient be provided with fluid support to treat IDH?** | **Yes** | 74 | 92.5 |
| | **No** | 6 | 7.5 |

| | | | |
|---|---|---|---|
| **Should the patient be provided with oxygen support when IDH develops?** | **Yes** | 54 | 67.5 |
| | **No** | 26 | 32.5 |
| **Should ultrafiltration be turned off when IDH develops?** | **Yes** | 78 | 97.5 |
| | **No** | 2 | 2.5 |

Notes: n=number of persons, %=percentage.

It was observed that 57.5% of the patients who received hemodialysis treatment 3 days a week and 4 hours a day monitored their blood pressure every hour during the hemodialysis session, and 92.5% of the patients reported that food intake during the hemodialysis session caused IDH. All individuals recommended a salt-restricted diet while providing nutritional education to the patient.

In cases where IDH developed, 90% of the individuals participating in the study gave the patient the Trendelenburg position, 2.5% gave the lateral and semi-fowler position, and 5% gave the Fowler position. It was emphasized that 95% of the individuals used an ultrafiltration-controlled device and adjusting the sodium profile affected the development of IDH.

92.5% of the individuals participating in the study thought that the patient should be provided with fluid support when IDH develops, 67.5% stated that oxygen support should be provided, and 97.5% of the individuals pointed out that ultrafiltration should be turned off.

## Discussion

Many acute and chronic complications are seen in patients requiring hemodialysis, which is increasing worldwide. The most important of these complications are intradialytic complications, which require healthcare professionals to be equipped in complication management.

Of the individuals participating in our study, 60% were nurses, 40% were dialysis technicians, and 47.5% were between the ages of 26 and 33. In the study by Ali et al. [11], it

was observed that the majority of the participants (62.9%) were between the ages of 18 and 28, 82.9% were female, and the participants were nurses. Another study, evaluating the knowledge and practices of nurses regarding hemodialysis complications in intensive care patients, showed that 86.7% of the participants were between the ages of 20 and 40 [12].

In this study, dialysis technicians work in dialysis clinics in Türkiye. Therefore, it was seen that 62.5% of the participants in the study had an associate's degree, and the number of individuals with 0-5 years and over 10 years of clinical experience was equal. Studies have shown that 48.6% of the study participants had a nursing undergraduate degree, and 40% had 5 to 10 years of experience [11]. Another study showed that 56.7% of the participants had a nursing degree, and 40% had more than 10 years of experience [12].

In Türkiye, education on preventing IDH is provided as in-service training in schools and workplaces, and many dialysis centers have a protocol for preventing IDH. Literature includes recommendations such as careful evaluation of subjective symptoms, minimizing weight gain between dialysis sessions, individualizing dialysis prescriptions, and adjusting the dialysis procedure according to patients' risk factors to prevent intradialytic complications [3]. In literature, the Intradialytic Hypotension Prevention Algorithm was created by the American Association of Nephrology Nurses in 2017, considering the burden of symptomatic and asymptomatic IDH for hemodialysis patients [13].

In our study, 95% of the individuals who participated stated that the use of dialysate low in sodium and high in calcium was the cause of IDH. All of the study participants agreed that the high ultrafiltration rate in hemodialysis caused IDH, and 97.5% thought that the temperature of the dialysis solution should be adjusted to 35.5-36°C in patients at risk for IDH. The dialysate calcium concentration should not reduce serum calcium, especially in patients at risk of hypocalcemia at the end of the dialysis session. The dialysate calcium level should be kept high to prevent cardiac problems caused by calcium imbalance. It has been emphasized in literature

that the sodium in the dialysate should be adjusted according to the patient's condition to prevent high IDH associated with UFR [14,15].

It has been presented in literature that lowering dialysate temperature can prevent IDH, but more studies are needed on this subject, and the results are uncertain [16].

87.5% of the individuals participating in our study stated that the patients should not use antihypertensive drugs on the days they enter dialysis. Literature has shown that taking blood pressure medications before hemodialysis reduces the occurrence of uncontrolled hypertension. Instead of not taking hypertension medications, it emphasizes the importance of nonpharmacological approaches [17]. 95% of the participants in the study stated that the amount of ultrafiltration to be performed on the patient, falling below the target weight, caused IDH. In general, it is indicated in literature that high UF of 10 mL/kg/hour should be avoided [14]. 57.5% of the healthcare personnel participating in the study measured the patient's blood pressure every hour in the 4-hour hemodialysis treatment area.

It was observed that the food intake of the patients during hemodialysis session caused IDH, and a sodium-restricted diet was recommended in their diet. It has been underlined in literature that food intake should be avoided during treatment to reduce the frequency of IDH without compromising the general nutritional status [18]. 90% of the individuals participating in the study stated that the patient should be placed in the Trendelenburg position in case of IDH. Among the interventions that should be applied in the case of IDH development is the Trendelenburg position. There is no study regarding the Trendelenburg position and the supine position during a hypotensive attack in adults undergoing hemodialysis. In addition, no evidence-based guideline has been determined regarding the Trendelenburg position during a hypotensive attack in adults undergoing hemodialysis [6]. 95% of the individuals participating in the study stated that using ultrafiltration-controlled devices and adjusting the sodium profile prevented the development of IDH. A study investigating the effect of the combination of

sodium and ultrafiltration profile and cold dialysate on IDH during hemodialysis showed that the combined use of these three applications could prevent IDH [19].

Of the individuals participating in the study, 92.5% stated that the patient should be provided with fluid support when IDH develops, 67.5% thought that oxygen support should be provided, and 97.5% indicated that ultrafiltration should be stopped when IDH develops. It has been emphasized in literature that isotonic saline should be infused in patients who do not respond to stopping ultrafiltration and the Trendelenburg position during a IDH attack [20,21].

Nurses need to care for the individual holistically, knowing the symptoms that may occur during the hemodialysis process, and to take an active role in the treatment through a multidisciplinary study. It is also important to identify the missing information in this field and provide the necessary training [22]. It is stated in literature that individuals undergoing hemodialysis need training to increase their compliance with diet and fluid restriction [23]. In their study, Barnett et al. [24] trained patients who did not comply with fluid restriction about the importance of fluid control, water and sodium intake, controlled weight gain, and the complications of excessive fluid intake. They found that at the end of the training, there was a decrease in the average weight gain between two dialysis sessions [24,25]. To increase the quality of patient education, nurses also need to receive regular training.

## Conclusions

Hemodialysis treatment, which is frequently used all over the world and in our country, causes acute and chronic complications. IDH is a common complication of hemodialysis that requires intervention. To prevent and manage these complications correctly, healthcare professionals who directly care for patients must have knowledge and skills. The knowledge levels of the individuals participating in this study were generally compatible with literature.

However, although there are some attempts to intervene in IDH, which is the most common complication, no evidence-based studies have been found yet. Since our study is cross-sectional, conducting studies with a larger sample group is recommended. As a result, most of the answers about IDH procedures that the hemodialysis nurses and technicians who participated in the study gave, were correct. The correct answers given showed that the IDH knowledge was high.

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The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee. To conduct the study, written permission was obtained from the Istanbul University-Cerrahpaşa Non-Interventional Clinical Research Ethics Committee (Date-Number: 15.03.2023-644867), the dialysis centers where the research would be conducted, and the nurses and technicians who agreed to participate in the study. Participants in the study signed an informed consent form. Data was stored on a computer and was used only for this study.

Artificial intelligence (AI) was not used in the creation of the manuscript.

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