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Evaluation of Fall Risk in Hemodialysis Patients within the Scope of Quality Improvements: A Comparison of Two Assessment Scales

Kalite İyileştirmeleri Kapsamında Hemodiyaliz Hastalarında Düşme Riskinin Değerlendirilmesi: İki Ölçek Karşılaştırması

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ABSTRACT

Introduction: Patient falls are one of the most important quality indicators in healthcare.

Aim: It was aimed to compare two tools used to evaluate fall risk in hemodialysis patients.

Method: The mean age of the patients was 58.72 ± 14.49 years and 62% were male. The mean duration of treatment was 4.98 ± 4.71 years. Within the last year, 33% of the patients had a history of falling. The patients' fall risk was assessed using the Itaki Fall Risk Scale and Dialysis Fall Risk Index. The relationship between patients' age, gender, duration of hemodialysis treatment, and the status of having a chronic disease and falls were examined.

Results: According to the Itaki Scale, 57% were in the ''high-risk'' group. According to the Dialysis Fall Risk Index, 64% were in the "very high risk" group. The mean Itaki Fall Risk Scale score was 4.75 ± 3.92, and the mean of the Dialysis Fall Risk Index was 7.59 ± 1.92. According to the cut-off score, the sensitivity and specificity of the Itaki Fall Risk Scale were 97% and 99.6%, and the Dialysis Fall Risk Index was 93.9% and 99.6%. The positive and negative predictive value were 56.1% and 97.7%, respectively for the Itaki Fall Risk Scale. These points were 51.6% and 100% for the Dialysis Fall Risk Index.

Conclusion: Both scales were effective in improving care quality in hemodialysis centers. Itaki Scale may be preferred due to its ease of use and patient compliance.

Keywords: Accidental falls; hemodialysis; hospital; quality of health care; quality improvement.

ÖZ

Giriş: Hasta düşmeleri, sağlık hizmetlerinde kalitenin en önemli göstergelerinden biridir.

Amaç: Bu çalışmada hemodiyaliz hastalarında düşme riskini değerlendirmek için kullanılan iki aracın karşılaştırılması amaçlandı.

Yöntem: Hastaların yaş ortalaması 58,72 ± 14,49 yıldı ve %62'si erkekti. Ortalama hemodiyaliz tedavi süresi 4,98 ± 4,71 yıldı. Hastaların %33'ünde son bir yıl içinde düşme öyküsü vardı. Hastaların düşme riski, Itaki Düşme Riski Ölçeği ve Diyaliz Düşme Riski İndeksi kullanılarak değerlendirildi. Hastaların yaşı, cinsiyeti, hemodiyaliz tedavisi süresi ve kronik hastalığa sahip olma durumu ile düşme arasındaki ilişki incelendi.

Bulgular: Itaki skalasına göre %57'si "yüksek riskli" grupta yer almaktadır. Diyaliz Düşme Riski İndeksine göre hastaların %64'ü "çok yüksek risk" grubundaydı. Hastaların ortalama Itaki skoru 4,75 ± 3,92 ve Diyaliz Düşme Riski İndeksi ortalaması 7,59 ± 1,92 idi. Kesme puanına göre Itaki Düşme Riski Ölçeğinin duyarlılığı ve özgüllüğü %97 ve %99,6 iken Diyaliz Düşme Riski Endeksinin ise %93,9 ve %99,6 bulundu. Itaki Düşme Riski Ölçeği için pozitif ve negatif prediktif değerler sırasıyla %56,1 ve %97,7 iken Diyaliz Düşme Riski İndeksi için bu değerler %51,6 ve %100'dü.

Sonuç: Her iki değerlendirme aracının da hemodiyaliz merkezlerinde bakım kalitesini artırmada etkili olduğu bulundu. Bununla beraber kullanım kolaylığı ve hasta uyumu açısından Itaki Düşme Riski Ölçeği tercih edilebilir.

Anahtar Kelimeler: Düşme; hastane; hemodiyaliz; kalite iyileştirme; sağlık bakım kalitesi.

Introduction

Chronic Kidney Disease (CKD) is an important public health concern. An estimated 850 million individuals worldwide have CKD (Bello et al., 2023). The prevalence of CKD in adults in 2018 is 15.7% in Türkiye (Ministry of Health, 2018). In the last stage of the CKD, kidney transplantation or dialysis treatment is mandatory for the patient to survive (Ministry of Health, 2020). According to the statistics of the Turkish Society of Nephrology, there are over 60 thousand CKD patients receiving hemodialysis treatment in 2020 (Turkish Society of Nephrology, 2020).

Hemodialysis has a negative impact on quality of life due to the physical and emotional restrictions it causes (Carvalho & Dini, 2020). Long-term hemodialysis treatment can cause many complications such as renal osteopathy, electrolyte imbalance, malnutrition, sarcopenia and fragility (Liu et al., 2023). Most CKD patients undergoing hemodialysis treatment are over 65 years of age and they often experience comorbidities and polypharmacy (Carvalho & Dini, 2020). Cellular and mechanical changes occur due to protein / energy loss in hemodialysis patients, resulting in loss of muscle mass and muscle strength (Çapar & Çapar, 2018).

Falls are frequently encountered in patients undergoing hemodialysis treatment due to both the clinical characteristics of the patients and the hemodialysis procedure itself. A study shows that 26.3% - 55% of patients undergoing hemodialysis treatment experience a fall at least once a year, and the incidence of falls / person-year are up to 3.5 times higher than for older adults in the community (Zanotto et al., 2020). Moreover, it is common for hemodialysis patients who have fallen once to fall again during the year (Van Loon et al., 2019).

Injuries due to falls seriously reduce the quality of life of patients and increase familial and social burdens (Liu et al., 2023). Moreover, fall-related fractures cause hospitalization of individuals, prolong hospital stay, and increase morbidity and mortality (Jafari et al., 2021). Even if no fracture occurs after a fall, head injury and bruises may occur on the body, or the individual may develop a phobia of falling, thereby restricting his mobility, causing patients to leave the house less frequently (Abdelhamid, Elsaid, Khater & Ali, 2022). For all these reasons it is important to evaluate the risk of falls and to prevent falls in CKD patients. Many hospitals conduct quality improvement studies to prevent falls. Hospitals use various guidelines to identify patients at high risk of falling and to reduce the risk of falls (LeLaurin & Shorr, 2019). One of these is fall risk assessment scales.

Scales have been developed to assess fall risk in the general population but these scales do not fully consider conditions arising from the characteristics of hemodialysis treatment (Liu et al., 2023). Healthcare providers must monitor patient falls and implement preventive measures as part of quality practices, in Türkiye. The Itaki Fall Risk Scale specific to Türkiye has been developed by the Ministry of Health as part of the Quality Standards in Health for the prevention of patient falls (Karaman, Özdemir & Akyol, 2020; Tezcan & Karabacak, 2021). The Itaki Fall Risk Scale is mostly used to measure the fall risk of patients in hospitals in Türkiye (Barış, İntepeler, İleri & Rastgel, 2020). A study evaluating the psychometric properties of the Itaki Fall Risk Scale revealed that the reliability of the scale was low (Cronbach alpha: 0.46); the ability to identify patients at high risk of falling was high, but the ability to accurately identify patients with low risk of falling was low. The study stated that because this scale was not developed specifically for hemodialysis patients, an assessment tool covering symptoms is needed to sensitively predict falls in these patients (Barış et al., 2020). Kono et al. (2018) developed the Dialysis Fall Risk Index (DFRI), which incorporates symptoms with a higher sensitivity than existing assessment methods to predict falls in hemodialysis patients. Researchers state that this scale has higher predictive validity than other scales used. Preventing falls is crucial because it has detrimental effects on both patients and healthcare providers. One of the most effective tools for preventing falls is to use scales that measure the risk of falling. However, for the scales to be effective and reliable, they must accurately predict the risk of falls. By doing so, we can ensure patient safety by preventing falls.

Aim

This study aimed to compare the effectiveness of two scales to determine the risk of falls in patients receiving hemodialysis treatment.

Research Question

1. Is the Dialysis Fall Risk Index more effective than the Itaki Fall Risk Scale in assessing the fall risk of patients receiving hemodialysis treatment?

Method

Study Design

This was a single-center, cross-sectional study.

Study Population and Sample

The number of patients treated at the center where the study was conducted is approximately 450 per year. Between July 12th and July 28th, 2021, researchers screened patients who were undergoing hemodialysis treatment to determine their eligibility for the study. Patients who were fully bedridden or had severe cognitive impairment or mental illness were excluded from the study. The sample for the study was not chosen, but instead, approximately 350 eligible patients who met the inclusion criteria were invited to participate. However, most of the patients declined to participate. In the end, data was collected from 100 patients, which is approximately 28% of the patients who met the inclusion criteria.

Data Collection Tools

Data were collected through a questionnaire prepared by the researchers (Zanotto et al., 2020; Karaman et al., 2020). The questionnaire contained Personnel Information Form, The Itaki Fall Risk Scale and Dialysis Fall Risk Index (DFRI). Personnel Information Form contained four question about the socio-demographic characteristics of the patients and two question about the presence of chronic disease.

Itaki Fall Risk Scale: The Itaki Falls Risk Scale was developed in 2011 by a commission established by the Ministry of Health. The goal was to develop a specific scale for Türkiye by analyzing literature and examining different fall risk scales used in institutions. This scale was designed to diagnose the risk of falls in adult patients

who receive inpatient treatment in hospitals (Tezcan & Karabacak, 2021). The Itaki Fall Risk Scale consists of 19 items for minor and major risks. If the score obtained from the evaluation of risks is between 0 and 4, the risk of falling is considered low; a score of 5 or more indicates the risk is high (Barış et al., 2020).

Dialysis Fall Risk Index (DFRI): There are 7 items in the DFRI developed by Kono et al., (2018): (i) patients' demographic information: age, gender, presence of diabetes, other medical history; (ii) malnutrition and inflammatory conditions: serum albumin, phosphorus, Geriatric Nutrition Risk Index (GNRI = [14.89 9 albumin (g/dl)] - [41.79 (body weight/ideal body weight)], (Body Mass Index), C-reactive protein; (iii) dialysis treatment management: dialysis time, Kt/V (dialysis adequacy parameter), intradialytic hypotension (more than 20 mmHg decrease in systolic blood pressure and more than 10 mmHg in mean arterial pressure); (iv) physical functional tests performed before hemodialysis: hand grip, lean mass index and standing balance test, chair standing test (5 times) and 4 meters walking test; (v) sum of scores on four questions about fall risk: history of falling in the past year (yes: 5 points), decreased walking speed (yes: 2 points), use of personnel (yes: 2 points), and conscious feeling of back bending (yes: 2 points). By index totals, 0 - 1.5 points indicates very low risk of falling; 2 - 3.5 points indicates low risk of falling; 4 - 6 points indicates high risk of falling; and 6.5 - 12 points indicates very high risk of falling (Kono et al., 2018).

Ethical Considerations

The study complies with the Declaration of Helsinki and was approved by İstanbul Medipol University Non-Invasive Clinical Research Ethics Committee (Date: 01.07.2021 and No: E-10840098-772.02-3152). Participants gave written informed consent to be studied.

Data Collection

The necessary data were collected by analyzing the files of the patients who volunteered to participate in the study. Patient demographic characteristics, blood values, dialysis treatment information and other disease information were obtained from patient files. The researcher measured body weight, height, balance tests, and hand grip strength individually for study participants before hemodialysis treatment. Using the obtained data, DFRI was calculated separately for each participant.

Data Analysis

The data were analyzed with Statistical Package for the Social Sciences Version 22.0 (SPSS, IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation (SD), median, minimum, and maximum. The normality analysis of variables was performed with Kolmogorov Smirnov test. The categorical variables were presented as number of cases (percentage) and compared using the Chi-square test. Nonparametric data was compared with the Mann-Whitney U test. Sensitivity, specificity, positive predictive value and negative predictive value of two scales were determined with Receiver-Operating Characteristic (ROC) analysis. The significance level was set at $p < 0.05$.

Table 1: Characteristics of Patients (n = 100)

Variables	n	%
Female	38	38
Male	62	62
Diabetes mellitus	50	50
Cardiovascular disease	29	29
Fall experience in last year	33	33
Intradialytic hypotension	22	22
Variables	**Mean**	**SD†**
Age	58.72	14.49
GNRI‡	107.59	68.88
Body mass index (kg/m^2)	26.05	5.42
Serum albumin (g/dl)	4.43	4.40
Serum phosphorus (mEq/l)	5.77	4.26
Serum PTH-intact (pg/ml)‖	307.65	387.37
Serum C-reactive protein (mg/dl)	15.50	22.62
Duration of hemodialysis treatment (years)	4.98	4.71
Kt/V ††	3.36	16.45
Hand grip	11.39	6.31
Fat-free mass index	51.67	9.21
SPPB (point) §	2.70	2.58

†SD: Standard Deviation; ‡GNRI: Geriatric Nutritional Risk Index; ‖: Serum PTH: Serum Parathormone; ††: Kt/V: Dialysis adequacy parameter; §: SPPB: Short Physical Performance Battery.

Results

The mean age of the patients was 58.72 ± 14.49 years, 62% were male, 50% have diabetes and 29% have cardiovascular disease, 33% have an experience of falling within the last year. The mean duration of hemodialysis treatment was 4.98 ± 4.71 years (Table 1). There was a statistically significant difference in falling incidence between the 65+ patient groups and the younger patient groups. On the other hand, the gender of the patients, the duration of hemodialysis treatment (years) and the presence of additional chronic disease did not make a significant difference in falling incidence (Table 2).

According to the Itaki Fall Risk Scale scores obtained from the patient files, 57% were "high risk" for falling. According to the DFRI, 64% in the "very high risk" group. The cut-off score of the scales determined sensitivity and specificity to be 97%, 99.6% in Itaki Fall Risk Scale and 93.9%, 99.6% in DFRI. Positive predictive value for Itaki Fall Risk Scale was 56.1% and for DFRI was 51.6%; negative predictive value for Itaki Fall Risk Scale was 97.7% and for DFRI was 100% (Table 3).

The mean score of the patients from the Itaki Fall Risk Scale was 4.75 ± 3.92 and the mean DFRI score was 7.59 ± 1.92. The difference in scores between patients who have had a fall experience and those who have not is statistically significant (Table 4). Figure 1. presents the ROC curves and the area under the curves (AUCs) to assess the overall validity of these scales. The area under the ROC curve resulting from the ROC analysis is 0.90 for the Itaki Fall

Table 2: Relationship Between Patient Characteristics and Fall Experience (n = 100)

Characteristics	Fall History						x^2	p
	Total		Yes (n=33)		No (n=67)			
	n	%	n	%	n	%		
Age (year)								
< 65	65	65	15	45.5	50	74.6	7.038	0.008*
≥ 65	35	35	18	54.5	17	25.4		
Gender								
Female	38	38	10	30.3	28	41.8	0.799	0.371
Male	62	62	23	69.7	39	58.2		
HD† treatment (year)								
< 5 years	63	63	21	63.6	42	62.7	0.001	1.000
≥ 5 years	37	37	12	36.4	25	37.3		
Additional chronic disease								
No	39	39	10	30.3	29	43.3	4.999	0.082
One disease	43	43	13	39.4	30	44.8		
Two diseases	18	18	10	30.3	8	11.9		

†HD: hemodialysis; x^2: Chi-square analysis; *p < 0.05.

Table 3: Fall Risk Grouping of Patients by Scale Scores and Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value by Scales at Cut-off Point (n = 100)

Scale	Risk Classification	Score Range (point)	n	Cut off point	Sensitivity %	Specificity %	PPV† %	NPV‡ %
Itaki Fall Risk Scale	Low risk	0 - 4	43	5	97	99.6	56.1	97.7
	High risk	5 and above	57					
Dialysis Fall Risk Index	Group 1 (Very low risk)	0 - 1.5	0	6.5	93.6	99.6	51.6	100
	Group 2 (Low risk)	2 - 3.5	0					
	Group 3 (High risk)	4 - 6	36					
	Group 4 (Very high risk)	6.5 - 12	64					

†: PPV: Positive Predictive Value; ‡: NPV: Negative Predictive Value.

Risk Scale and 0.86 for the DFRI (Itaki Fall Risk Scale; p < 0.001, 95% Confidence Interval = 0.84 - 0.96 and DFRI; p < 0.001, 95% Confidence Interval = 0.78 - 0.93) (Figure 1.).

Discussion

Falling is common in patients with final-stage chronic kidney disease, and fall incidence increases with hemodialysis treatment (Bowling, Hall, Khakharia, Franch & Plantinga, 2018). The fall rate was 33% amongst the patients in the study. This rate varies between 20 - 47% in different studies (Kono et al., 2018; van Loon et al., 2019; Zanotto et al., 2020; Jafari et al., 2021; Liu et al., 2023). Since patients receiving hemodialysis treatment experience a high frequency of falls, it is essential to evaluate the risk and prevent falls. Preventive actions are crucial as patient falls can lead to serious negative consequences. In this context, fall risk assessment scales are the most frequently used tools. However, it is desired that these scales are both highly effective in calculating risk and user-friendly.

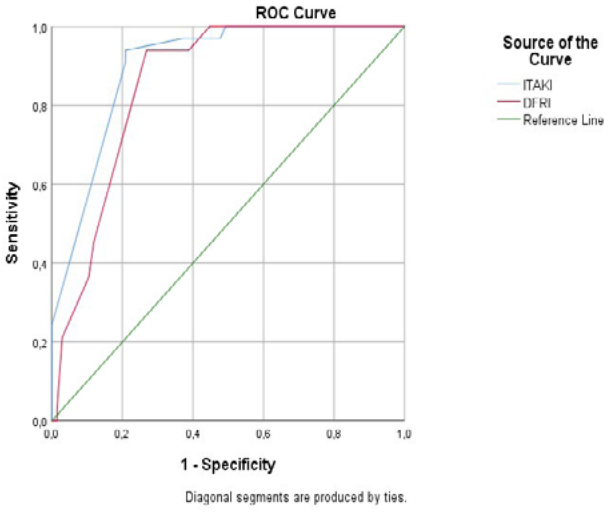

Figure 1: Receiver Operating Characteristic (ROC) curves of two fall risk assessment scales

Table 4: The Comparison Two Fall Risk Assessment Scales Scores according to Fall Experience of the Participants (n = 100)

Scales	Total		Fall group		Non-fall group		*Z*	p
	Mean ± SD†	Median (Min. - Max.)	Mean ± SD†	Median (Min. - Max.)	Mean ± SD†	Median (Min. - Max.)		
ITAKI	4.75 ± 3.922	6 (0 - 11)	8.36 ± 1.884	8 (1 - 11)	2.97 ± 3.407	0 (0 - 8)	6.797	0.001*
DFRI‡	7.59 ± 1.918	8 (4 - 12)	9.11 ± 1.130	8.5 (7 - 12)	6.84 ± 1.784	6 (4 - 12)	5.869	0.001*

†SD: Standard Deviation; ‡DFRI: Dialysis Fall Risk Index; *p < 0.001.

The Itaki Fall Risk Scale is the fall risk scale most often used in Türkiye, developed by the Ministry of Health of Türkiye. This scale has been developed as a general scale for all adult inpatients (Barış et al., 2020). However, Kono et al. (2018) developed the DFRI to assess the risk of falls in patients undergoing hemodialysis. The DFRI takes into account certain medical values of the patients. This study compared two scales using four validity criteria: sensitivity, specificity, positive and negative predictive values. These are widely used indices for diagnostic tests and for interpreting the accuracy and validity of assessment tools.

Falls are more common with increasing age (Van Loon et al., 2019; Montero - Odasso et al., 2021). In this study, the incidence of falls was significantly higher in patients over 65 years of age. Liu et al. found the average age of patients experiencing a fall to be higher than the average age of the patients who did not (Liu et al., 2023). Yet, evaluation of all other variables (gender, duration of hemodialysis treatment, presence of additional chronic disease) revealed no difference between the patient groups who fell and those who did not. In this study, there was no relationship between gender and falls. This is consistent with previous studies that have also shown gender to have no impact on falling (Carvalho & Dini, 2020; Anar, 2021; Liu et al., 2023). On the other hand, there are some studies that suggest that men are more likely to experience falls (Kantaş Yılmaz, Polat & Bilici, 2022). In fact, the Hendrich II Fall Risk Model, which is a tool that is used to assess the probability of patients falling, assigns an additional point to men to adjust for their heightened risk (Hendrich, Bender & Nyhuis, 2003).

The prevalence of frailty is high in patients receiving hemodialysis treatment (Zhao, Liu & Ji, 2020). As the duration of hemodialysis increases, frailty also increases in patients, and there is a close relationship between frailty and falling (Jafari et al., 2021). However, there was no significant difference between patient groups in hemodialysis treatment years. Studies have found the relationship between the duration of hemodialysis treatment and falling to be insignificant, which supports the findings of our study (Zanotto et al., 2020; Matsufuji et al., 2021; Liu et al., 2023). Though studies show a relationship between diabetes and falling and reveal patients with diabetes to be twice as likely to fall, this study did not find a relationship between the presence of additional chronic disease and falling (Carvalho & Dini, 2020). However, further research is recommended to examine the effect of treatment duration and comorbidities on fall risk among a larger population.

The difference between the scores of falling and non-falling patients from both scales was statistically significant. The study evaluated sensitivity and specificity values of the scales compared. Sensitivity (the ability to accurately identify patients at high risk of falling) was found to be high for both scales. The specificity value, which expresses the ability to accurately identify patients with low risk of falling, was found to be close for both scales; however, the specificity value of the Itaki Fall Risk Scale is higher than that of the DFRI. Barış et al. (2020) found the sensitivity of the Itaki Fall Risk Scale to be high, but the specificity quite low. Another study expressed the specificity value of the Itaki Fall Risk Scale as low, stating that the Itaki Fall Risk Scale was much superior to another scale compared to sensitivity (Kantaş Yılmaz et al., 2022).

Kono et al., (2018) developers of the DFRI, state that patient malnutrition and uremic sarcopenia cause a decrease in muscle mass; this should be considered in evaluating dialysis patients' the risk of falling. In addition, evaluating patients' inflammatory status and nutritional status and identifying the presence of intradialytic hypotension would aid in determining the risk of falling. According to the results of the study, the DFRI is a valid tool for determining the fall risk in hemodialysis patients, thanks to its clinical indicators (Kono et al., 2018). From this point of view, the DFRI provides a more detailed assessment than the "Itaki Falls Risk Scale" because it includes the patient's clinical values.

This study compares two scales that determine the risk of falling in hemodialysis patients; neither of the scales compared show significant superiority in terms of sensitivity, specificity, positive predictive value and negative predictive value. However, patients were reluctant to participate in the study because measurements such as balance tests and hand grip strength measurement took time and were troublesome to them. Further, because these measurements are outside the routine work of the hemodialysis center, the hemodialysis center personnel must be trained to make the measurements needed. From this point, using the Itaki Fall Risk Scale can result in better outcomes in terms of patient and staff acceptance and ease of use.

Study Limitations

This study was conducted in only one center and included only a small group of patients due to the low number of volunteers.

Conclusion

Both the Itaki Fall Risk Scale and DFRI are effective in improving care quality in hemodialysis centers. They are reliable tools to determine the risk of falls in patients receiving hemodialysis treatment. However, there are some differences between the two scales in terms of usage. For instance, the Itaki Fall Risk Scale may be more advantageous for patient compliance and ease of use. On the other hand, the DFRI requires some patient measurements, which may require additional training of health personnel.

Ethical Considerations: Ethical approval was obtained from the Ethics Committee of Istanbul Medipol University for this study (Date: 01.07.2021 and No: E-10840098-772.02-3152).

Author Contribution: Study Idea (Concept) and Design – ÖG; Data Collection / Literature Review – ÖG; Analysis and Interpretation of Data – ÖG; Preparation of the Article – ÖG; Approval of the Final Version to be Published – ÖG.

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References

Abdelhamid, E., Elsaid, S., Khater, M., & Ali, S. (2022). Prevalence of fatigue and risk of fall among elderly with chronic kidney disease. *The Egyptian Journal of Hospital Medicine, 89*(1), 5788-5794. doi: 10.21608/ejhm.2022.266052

Anar, D. (2021). Hemodiyaliz hastalarında düşme riski ve etkileyen etmenler. Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi Aile Hekimliği Anabilim Dalı. Uzmanlık Tezi.

Barış, V. K., İntepeler, Ş. S., İleri, S. ve Rastgel, H. (2020). İtaki Düşme Riski Ölçeği'nin psikometrik özelliklerinin değerlendirilmesi. *Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Dergisi, 13*(4), 214-221. doi: 10.46483/deuhfed.732097

Bello, A. K., Okpechi, I. G., Levin, A., Ye, F., Saad, S., Zaidi, D., ..., & Johnson, D. W. (2023). ISN–Global kidney health atlas: A report by the international society of nephrology: An assessment of global kidney health care status focusing on capacity, availability, accessibility, affordability and outcomes of kidney disease. International Society of Nephrology, Brussels, Belgium. Retrieved date: 28.06.2023. Retrieved from: https://www.theisn.org/wp-content/uploads/media/ISN%20Atlas_2023%20Digital_REV_2023_10_03.pdf

Bowling, C. B., Hall, R. K., Khakharia, A., Franch, H. A., & Plantinga, L. C. (2018). Serious fall injury history and adverse health outcomes after initiating hemodialysis among older U.S. adults. *The Journals of Gerontology a Biological Sciences and Medical Sciences, 10;*73(9), 1216-1221. doi: 10.1093/gerona/glx260

Carvalho, T. C., & Dini, A. P. (2020). Risk of falls in people with chronic kidney disease and related factors. *Revista Latino-Americana de Enfermagem, 8*(28), e3289. doi: 10.1590/1518-8345.3911.3289

Çapar, E. ve Çapar, A. (2018). Yaşlı diyaliz hastalarında geriatrik sorunlar. *Geriatrik Bilimler Dergisi, 1*(3), 119-125.

Jafari, M., Anwar, S., Kour, K., Sanjoy, S., Goyal, K., & Prasad, B. T. (2021). Scores, FRAX, frailty phenotype, falls, and its relationship to fractures in patients on maintenance hemodialysis. *Canadian Journal of Kidney Health and Disease, 24*(8), 20543581211041184. doi: 10.1177/20543581211041184

Hendrich, A. L., Bender, P. S., & Nyhuis, A. (2003). Validation of the Hendrich II Fall Risk Model: A large concurrent case/control study of hospitalized patients. *Applied Nursing Research, 16*(1), 9-21. doi: 10.1053/apnr.2003.YAPNR2

Karaman, E., Özdemir, Ş. ve Akyol, A. (2020). Hemodiyaliz tedavisi alan hastalarda düşme riskinin belirlenmesi. *Nefroloji Hemşireliği Dergisi, 15*(3), 217-25. doi: 0.47565/ndthdt.2020.18

Kantaş Yılmaz, F., Polat, S., & Bilici, R. (2022). Turkish adaptation of Wilson-Sims psychiatric fall risk assessment scale. *Perspectives in Psychiatric Care, 58*(4), 1324-1332. doi: 10.1111/ppc.12934

Kono, K., Nishida, Y., Yabe, H., Moriyama, Y., Mori, T., Shiraki, R., & Sato, T. (2018). Development and validation of a Fall Risk Assessment Index for dialysis patients. *Clinical and Experimental Nephrology, 22*(1), 167-172. doi: 10.1007/s10157-017-1431-8

LeLaurin, J. H., & Shorr, R. I. (2019). Preventing falls in hospitalized patients: State of the science. *Clinics in Geriatric Medicine, 35*(2), 273-283. doi: 10.1016/j.cger.2019.01.007

Liu, X., Chen, S., Liu, C., Dang, X., Wei, M., Xin, X., & Gao, J. (2023). Novel risk-factor analysis and risk-evaluation model of falls in patients receiving maintenance hemodialysis. *Renal Failure, 45*(1), 2182608. doi: 10.1080/0886022X.2023.2182608

Matsufuji, S., Shoji, T., Yano, Y., Tamaru, A., Tsuchikura, S., Miyabe, M., Kishimoto, ..., & Emoto, M. (2021). Difficulty in activities of daily living and falls in patients undergoing hemodialysis: A cross-sectional study with nondialysis controls. *Hemodialysis International, 25,* 338 - 347. doi: 10.1111/hdi.12930

Montero-Odasso, M., Van Der Velde, N., Alexander, N. B., Becker, C., Blain, H., Camicioli, R., ..., & Task Force on Global Guidelines for Falls in Older Adults. (2021). New horizons in falls prevention and management for older adults: a global initiative. *Age and Ageing, 50*(5), 1499-1507. doi: 0.1093/ageing/afab076

Ministry of Health of Türkiye. (2018). Türkiye böbrek hastalıkları önleme ve kontrol programı (2018-2023). Ankara. Retrieved date: 28.06.2023. Retrieved from: https://hsgm.saglik.gov.tr/depo/birimler/kronik-hastaliklar-engelli-db/hastaliklar/bobrek_hastaliklari/kitap_ve_makaleler/Turkiye_Bobrek_Hastaliklari_Onleme_ve_Kontrol_Programi_2018-2023.pdf

Ministry of Health of Türkiye. (2020). Kronik Böbrek Hastalığı Klinik Protokolu. T.C. Sağlık Bakanlığı Yayın Numarası: 1180. Retrieved date: 28.06.2023. Retrieved from: https://dosyamerkez.saglik.gov.tr/Eklenti/38987,kronikbobrekhastaligikpyayin-verspdf.pdf?0

Tezcan, B. ve Karabacak, B. G. (2021). Klinik uygulamada sık kullanılan düşme riski tanılama ölçekleri. *Journal of Academic Research in Nursing, 7*(2), 105-112. doi: 10.55646/jaren.2021.88598

Turkish Society of Nephrology. (2020). Türkiye'de nefroloji, diyaliz ve transplantasyon. T.C. Sağlık Bakanlığı ve Türk Nefroloji Derneği ortak raporu. Ankara; 2020. Retrieved date: 18.06.2023. Retrieved from: https://nefroloji.org.tr/uploads/folders/file/REGISTRY_2020.pdf

Van Loon, I. N., Joosten, H., Iyasere, O., Johansson, L., Hamaker, M. E., & Brown, E. A. (2019). The prevalence and impact of falls in elderly dialysis patients: Frail elderly Patient Outcomes on Dialysis (FEPOD) study. *Archives of Gerontology and Geriatrics, 83*, 285-291. doi: 10.1016/j.archger.2019.05.015

Zanotto, T., Mercer, T. H., Linden, M. L. V., Traynor, J.P., Doyle, A., Chalmers, K., ..., & Koufaki, P. (2020). Association of postural balance and falls in adult patients receiving haemodialysis: A prospective cohort study. *Gait & Posture, 82,* 110-117. doi: 10.1016/j.gaitpost.2020.08.128

Zhao, Y., Liu, Q., & Ji, J. (2020). The prevalence of frailty in patients on hemodialysis: a systematic review and meta-analysis. *International Urology and Nephrology, 52*(1), 115-120. doi: 10.1007/s11255-019-02310-2