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ORIGINAL RESEARCH

From Awareness to Implementation: Iron Deficiency Management in Heart Failure — A National Survey of Cardiologists in Türkiye

Çetin ALAK, Şeyda GÜNAY POLATKAN

Department of Cardiology, Faculty of Medicine, Bursa Uludag University, Bursa, Türkiye.

ABSTRACT

Iron deficiency (ID) is a common comorbidity in heart failure (HF). Current guidelines recommend systematic assessment of iron status using ferritin and transferrin saturation (TSAT) and intravenous iron therapy for eligible patients. This study evaluated awareness, diagnostic practices, treatment preferences, and perceived barriers related to ID management among cardiologists in Türkiye. A national cross-sectional survey was conducted among cardiology residents, specialists, and academic cardiologists. An 11-item questionnaire assessed guideline awareness, diagnostic testing patterns, treatment practices, and barriers to intravenous iron use in patients with HF and reduced or mildly reduced ejection fraction. A total of 267 cardiologists were included. Most participants were familiar with contemporary recommendations for ID management in HF (94.4%). Ferritin (91.0%) and hemoglobin (88.4%) were the most frequently requested tests, whereas TSAT was routinely assessed by 63.3%. The European Society of Cardiology definition of ID was correctly identified by 61.4% of respondents. Routine TSAT use was strongly associated with correct recognition of guideline-defined ID (75.7% vs. 36.7%, $p<0.001$). Although intravenous iron was preferred by 73.8% of participants, only 22.5% reported routine administration. The main barriers were infusion logistics (51.3%), workload (44.6%), and reimbursement/reporting procedures (34.8%). Despite high awareness of ID among cardiologists, important gaps remain in the implementation of guideline-recommended diagnostic and therapeutic strategies. Underuse of TSAT and low rates of routine intravenous iron administration indicate that the major challenge in contemporary ID management is implementation rather than recognition.

Keywords: Heart failure. Iron deficiency. Intravenous iron. Ferritin. Transferrin saturation. Survey.

Farkındalıktan Uygulamaya: Kalp Yetersizliğinde Demir Eksikliği Yönetimi — Türkiye'deki Kardiyologlar Arasında Ulusal Bir Anket Çalışması

ÖZET

Demir eksikliği (DE), kalp yetersizliğinde (KY) sık görülen ve klinik açıdan önemli bir eşlik eden durumdur. Güncel kılavuzlar, demir durumunun ferritin ve transferrin satürasyonu (TSAT) ile sistematik olarak değerlendirilmesini ve uygun hastalarda intravenöz demir tedavisinin uygulanmasını önermektedir. Bu çalışmada, Türkiye'deki kardiyologlar arasında demir eksikliği yönetimine ilişkin farkındalık düzeyi, tanısal yaklaşımlar, tedavi tercihleri ve algılanan engeller değerlendirilmiştir. Kardiyoloji asistanları, uzmanları ve akademisyenlerini kapsayan ulusal, kesitsel bir anket çalışması gerçekleştirildi. On bir sorudan oluşan anket ile düşük veya hafif azalmış ejeksiyon fraksiyonlu kalp yetersizliği hastalarında kılavuz farkındalığı, tanısal değerlendirme alışkanlıkları, tedavi uygulamaları ve intravenöz demir kullanımına yönelik engeller incelendi. Toplam 267 kardiyolog çalışmaya dahil edildi. Katılımcıların büyük çoğunluğu kalp yetersizliğinde demir eksikliği yönetimine ilişkin güncel önerilere aşinaydı (%94,4). En sık istenen testler ferritin (%91,0) ve hemoglobin (%88,4) iken, TSAT'ın rutin olarak değerlendirildiğini bildirenlerin oranı %63,3 idi. Katılımcıların %61,4'ü Avrupa Kardiyoloji Derneği'nin demir eksikliği tanımını doğru olarak belirledi. TSAT'ın rutin kullanımı, kılavuz temelli demir eksikliği tanımının doğru bilinmesi ile anlamlı düzeyde ilişkiliydi (%75,7'ye karşı %36,7; $p<0,001$). İntravenöz demir tedavisi katılımcıların %73,8'i tarafından tercih edilmesine rağmen, yalnızca %22,5'i bu tedaviyi rutin olarak uyguladığını bildirdi. Başlıca engeller infüzyon organizasyonu (%51,3), iş yükü (%44,6) ve geri ödeme/raporlama süreçleri (%34,8) olarak saptandı. Kardiyologlar arasında demir eksikliği konusunda yüksek farkındalık bulunmasına rağmen, kılavuzların önerdiği tanısal ve tedavi yaklaşımlarının uygulanmasında önemli eksiklikler devam etmektedir. TSAT'ın yetersiz kullanımı ve intravenöz demir tedavisinin rutin uygulamadaki düşük kullanım oranları, güncel demir eksikliği yönetimindeki temel sorunun farkındalıktan ziyade uygulama olduğunu göstermektedir.

Anahtar Kelimeler: Kalp yetersizliği. Demir eksikliği. Transferrin satürasyonu. İntravenöz demir. Ferrik karboksimaltoz. Anket. Kılavuz uygulamaları.

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Dr. Çetin ALAK
Department of Cardiology, Bursa Uludag University Faculty of Medicine, Gorukle Campus, Nilufer, Bursa 16059, Türkiye
E-mail: cetinalak10@gmail.com

AUTHORS' ORCID INFORMATION
Çetin ALAK: 0000-0003-1875-2078
Şeyda GÜNAY POLATKAN: 0000-0003-0012-345X

Iron deficiency (ID) frequently accompanies heart failure (HF) and affects nearly half to two-thirds of patients across the HF spectrum. Beyond its association with anemia, iron deficiency has been linked to diminished functional performance, poorer quality of life, increased risk of hospitalization, and unfavorable clinical outcomes[1,2].

Growing evidence generated over the last two decades has positioned iron deficiency as an important and treatable component of HF management. Landmark randomized studies such as FAIR-HF and CONFIRM-HF demonstrated that intravenous ferric carboxymaltose significantly improves symptoms, functional capacity, exercise tolerance, and quality of life in patients with HF and iron deficiency[3,4]. Subsequent large-scale trials together with contemporary meta-analyses have demonstrated reductions in recurrent HF hospitalizations and other clinically relevant outcomes, further strengthening the evidence supporting intravenous iron therapy as an integral component of contemporary HF management[5–8].

The growing evidence supporting intravenous iron therapy has been incorporated into contemporary ESC recommendations. Current guidelines advocate routine assessment of iron status in patients with HF and reduced or mildly reduced ejection fraction and emphasize the combined use of ferritin and TSAT when defining iron deficiency. Patients fulfilling these criteria are considered candidates for intravenous iron therapy because of its established benefits on symptoms, quality of life, and HF-related hospitalization risk[1,2].

Despite these recommendations, implementation of iron deficiency screening and treatment remains inconsistent in routine clinical practice. In our previously reported real-world cohort of 322 patients with HF and left ventricular ejection fraction below 50%, 280 patients (86.9%) fulfilled ESC criteria for iron deficiency. However, only approximately 13% received intravenous iron therapy despite meeting guideline-based eligibility criteria[9]. These findings underscore a considerable disconnect between the available evidence, contemporary guideline recommendations, and their translation into routine clinical care.

The reasons underlying this implementation gap are likely multifactorial and may vary across healthcare systems and clinical practice settings. Potential contributors may include limited awareness of guideline recommendations, underutilization of TSAT measurements, uncertainty regarding diagnostic and treatment thresholds, organizational barriers related to intravenous iron administration, reimbursement challenges, and variability in local healthcare infrastructure[10,11].

Therefore, we conducted a national survey among cardiology residents, specialists, and academic cardiologists across Türkiye to evaluate current awareness, diagnostic approaches, treatment preferences, and perceived barriers regarding iron deficiency management in patients with HF and reduced or mildly reduced ejection fraction.

Materials and Methods

Study design and participants

The current study was a cross-sectional, questionnaire-based survey designed to evaluate awareness, diagnostic practices, treatment preferences, and perceived barriers regarding iron deficiency management in patients with heart failure and reduced or mildly reduced ejection fraction. The target population consisted of cardiology residents, cardiology specialists, and academic cardiologists practicing in Türkiye.

The survey was created using Google Forms and distributed electronically through professional communication networks and mobile messaging platforms. To prevent duplicate submissions, Google Forms was configured to allow only one response per participant. Participation was voluntary, and responses were collected anonymously. A total of 268 physicians completed the questionnaire. One respondent was excluded because of substantially incomplete answers, leaving 267 participants for the final analysis.

Survey instrument

The questionnaire consisted of 11 items and was developed to assess key domains relevant to iron deficiency management in patients with heart failure and left ventricular ejection fraction <50%. The survey included questions on professional title, age group, hospital type, awareness of guideline recommendations, routinely assessed iron parameters, frequency of iron status evaluation, diagnostic thresholds for iron deficiency, treatment thresholds, preferred iron replacement strategy, perceived barriers to intravenous iron administration, and the clinical department considered primarily responsible for managing iron deficiency. As no previously validated questionnaire specifically addressing iron deficiency management in heart failure was available, the survey instrument was developed by the investigators based on contemporary European Society of Cardiology (ESC) heart failure guidelines and clinically relevant aspects of routine practice. Before nationwide distribution, the questionnaire was reviewed by experts in cardiology and hematology to evaluate its clinical relevance, clarity, and content. Subsequently, it was pilot-tested among a small group of cardiology

residents and specialists to assess its comprehensibility and feasibility. This manuscript was prepared in accordance with the Consensus-Based Checklist for Reporting of Survey Studies (CROSS).

The full questionnaire is provided as Supplementary Material 1.

Statistical analysis

Categorical data are presented as counts and percentages. Survey responses were analyzed descriptively to summarize awareness, diagnostic strategies, treatment patterns, and perceived barriers related to iron deficiency management. Group comparisons were conducted using the chi-square test or Fisher's exact test when appropriate to evaluate associations between participant characteristics and survey responses. Statistical analyses were carried out using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA), and a two-sided p value <0.05 was considered indicative of statistical significance.

Ethics statement

The study was approved by the Bursa Uludag University Faculty of Medicine Clinical Research Ethics Committee on 10 June 2026 (Decision No: 2026-313/11). Participation was voluntary and anonymous. Completion of the survey was considered to imply informed consent.

Results

Participant characteristics

A total of 267 physicians were included in the final analysis. The largest age group was 25–30 years, accounting for 36.7% of respondents, followed by the 31–35 years and 41–50 years groups, each representing 20.2% of participants. Regarding professional status, 115 respondents (43.1%) were cardiology residents, 94 (35.2%) were cardiology specialists, and 58 (21.7%) held academic positions as associate professors or professors. Participants were recruited from a broad range of healthcare settings, with the majority practicing in university hospitals (30.0%) or training and research hospitals (27.0%). Detailed participant characteristics are presented in Table I.

Awareness and diagnostic assessment practices

Awareness of contemporary guideline recommendations regarding iron deficiency management in heart failure was high, with 252 respondents (94.4%) reporting familiarity with current recommendations. However, routine screening practices varied considerably. Only 127 physicians (47.6%) reported assessing iron parameters at diagnosis and during regular follow-up, while 62 physicians (23.2%) performed screening at least annually. In contrast, 40 respondents (15.0%) evaluated iron status only in the setting of worsening symptoms or decompensation, and 22 physicians (8.2%) restricted assessment to patients with anemia. Sixteen physicians (6.0%) reported not performing routine iron deficiency screening.

Table I. Characteristics of Survey Participants (N=267)

Characteristic	n (%)
Age group	
25–30 years	98 (36.7)
31–35 years	54 (20.2)
36–40 years	38 (14.2)
41–50 years	54 (20.2)
>50 years	23 (8.6)
Professional title	
Cardiology resident	115 (43.1)
Cardiology specialist	94 (35.2)
Associate professor	29 (10.9)
Professor	29 (10.9)
Hospital type	
University hospital	80 (30.0)
Training and research hospital	72 (27.0)
City hospital	54 (20.2)
State hospital (secondary care)	37 (13.9)
Private hospital	24 (9.0)

Ferritin (91.0%) and hemoglobin (88.4%) were the most frequently assessed parameters. Total iron-binding capacity and serum iron were routinely evaluated by approximately 70% of respondents, whereas transferrin saturation (TSAT), a key component of the ESC diagnostic criteria for iron deficiency, was routinely assessed by only 63.3% of physicians (Table II).

Table II. Awareness and Diagnostic Assessment Practices

Variable	n (%)
Aware of guideline recommendations	252 (94.4)
Not aware of guideline recommendations	15 (5.6)
Iron deficiency screening frequency	
At diagnosis and regular follow-up	127 (47.6)
At least annually	62 (23.2)
Only during worsening symptoms/decompensation	40 (15.0)
Only if anemia is present	22 (8.2)
No routine assessment	16 (6.0)
Iron Parameters Routinely Assessed	
Hemoglobin	236 (88.4)
Ferritin	243 (91.0)
Serum Iron	187 (70.0)
Total iron-binding capacity	191 (71.5)
Transferrin saturation (TSAT)	169 (63.3)

Multiple responses were permitted.

Diagnostic criteria used for iron deficiency

When asked to identify the diagnostic criteria for iron deficiency in patients with heart failure, 164 respondents (61.4%) correctly selected the ESC-recommended definition, namely ferritin <100 ng/mL or ferritin 100–299 ng/mL in combination with a transferrin saturation (TSAT) <20%. However, 75 physicians (28.1%) relied on incomplete diagnostic definitions based on either ferritin <100 ng/mL alone or ferritin 100–299 ng/mL with TSAT <20% alone. Fourteen respondents (5.2%) reported relying primarily on hemoglobin levels, while another 14 (5.2%) indicated that they did not use a specific diagnostic threshold (Table III).

Table III. Diagnostic Criteria Used to Define Iron Deficiency

Diagnostic criterion	n (%)
Ferritin <100 ng/mL	49 (18.4)
Ferritin 100–299 ng/mL and TSAT <20%	26 (9.7)
Ferritin <100 ng/mL **or** ferritin 100–299 ng/mL and TSAT <20%	164 (61.4)
Hemoglobin-based definition	14 (5.2)
No specific threshold	14 (5.2)

Routine assessment of transferrin saturation (TSAT) was strongly associated with correct identification of the ESC diagnostic criteria for iron deficiency. Among physicians who routinely assessed TSAT, 128 of 169 respondents (75.7%) correctly selected the guideline-recommended definition, compared with only 36 of 98 respondents (36.7%) among those who did not routinely assess TSAT. This association was highly significant (χ^2=43.851, p<0.001) and demonstrated a moderate-to-large effect size (Cramer's V=0.405) (Table IV).

Table IV. Association Between Routine TSAT Assessment and Correct Identification of ESC Iron Deficiency Diagnostic Criteria

TSAT use	Correct ESC definition n (%)	Incorrect definition n (%)
No (n=98)	36 (36.7)	62 (63.3)
Yes (n=169)	128 (75.7)	41 (24.3)

Pearson χ^2 = 43.851, p <0.001; Cramer's V = 0.405.

Ferritin thresholds used for treatment initiation

Considerable variability was observed regarding the ferritin threshold used to initiate iron therapy in patients with heart failure. The most frequently selected threshold was ferritin <100 ng/mL, reported by 138 respondents (51.7%). However, only 47 physicians (17.6%) indicated that they would initiate treatment in patients with ferritin levels <300 ng/mL when accompanied by a low transferrin saturation (TSAT), consistent with the broader ESC definition of iron deficiency. More restrictive thresholds, including ferritin <30 ng/mL and <50 ng/mL, were reported by 12.7% and 12.0% of respondents, respectively. Sixteen participants (6.0%) stated that ferritin levels did not influence their treatment decisions (Table V).

Table V. Ferritin Thresholds Used for Initiating Iron Therapy

Ferritin threshold	n (%)
<30 ng/mL	34 (12.7)
<50 ng/mL	32 (12.0)
<100 ng/mL	138 (51.7)
<300 ng/mL with low TSAT	47 (17.6)
Do not base treatment decisions on ferritin level	16 (6.0)

Although 164 respondents (61.4%) correctly identified the ESC definition of iron deficiency, treatment thresholds were frequently more restrictive than those recommended in contemporary heart failure guidelines. While 61.4% selected the ESC diagnostic definition (ferritin <100 ng/mL or ferritin 100–299 ng/mL with TSAT <20%), only 17.6% reported initiating iron therapy in patients with ferritin levels <300 ng/mL accompanied by low TSAT. In contrast, 51.7% indicated that they would initiate treatment only when ferritin levels fell below 100 ng/mL, and 24.7% reported even lower ferritin thresholds (<30 or <50 ng/mL).

Preferred treatment modality

When asked about their preferred treatment strategy for iron deficiency in patients with HF and reduced or mildly reduced ejection fraction, the majority of respondents (73.8%) selected intravenous iron preparations. Oral iron therapy was preferred by 53 physicians (19.9%), whereas 17 respondents (6.4%) reported that they did not routinely use iron therapy and would reserve treatment for cases of severe anemia requiring blood transfusion (Table VI).

Table VI. Preferred Treatment Modality for Iron Deficiency in Heart Failure

Treatment preference	n (%)
Oral iron preparations	53 (19.9)
Intravenous iron preparations	197 (73.8)
Iron therapy is not routinely used; transfusion only in severe anemia	17 (6.4)

Preferred treatment modality differed significantly according to hospital type (χ^2=26.888, p<0.001; Cramer's V=0.224). Physicians working in university hospitals reported the highest preference for intravenous iron therapy (88.8%), whereas respondents from city hospitals reported the lowest

rate (59.3%). Intermediate rates were observed in training and research hospitals (69.4%) and state hospitals (64.9%), while physicians practicing in private hospitals also demonstrated a high preference for intravenous iron treatment (83.3%) (Table VII).

Table VII. Association Between Hospital Type and Preferred Treatment Modality

Hospital type	Oral iron n (%)	Intravenous iron n (%)	Rarely uses iron therapy n (%)
University hospital (n=80)	7 (8.8)	71 (88.8)	2 (2.5)
Training and research hospital (n=72)	16 (22.2)	50 (69.4)	6 (8.3)
City hospital (n=54)	20 (37.0)	32 (59.3)	2 (3.7)
State hospital (n=37)	9 (24.3)	24 (64.9)	4 (10.8)
Private hospital (n=24)	1 (4.2)	20 (83.3)	3 (12.5)

Routine intravenous iron administration

Overall, only 60 of 267 respondents (22.5%) reported that they routinely administer intravenous iron to eligible patients with heart failure and iron deficiency (Question 10, Supplementary Material 1). Although 73.8% of respondents identified intravenous iron as their preferred treatment strategy, only about one in five physicians reported routinely implementing this treatment in daily practice, underscoring a substantial gap between treatment preference and real-world implementation.

Barriers to intravenous iron implementation

The most frequently reported barriers to intravenous iron administration were difficulties related to day-care admission and infusion organization (51.3%), followed by high workload (44.6%) and reimbursement/reporting procedures (34.8%). Concerns regarding adverse reactions were reported by 27.7% of respondents, whereas insufficient hospital infrastructure and referral of patients to internal medicine or hematology services were reported by 16.1% and 15.7% of participants, respectively. Notably, only 3.4% of physicians considered oral iron therapy sufficient, and fewer than 1% expressed doubts regarding the clinical benefit of intravenous iron therapy (Table VIII).

Workload-related barriers differed significantly according to hospital type (χ^2=26.9, p<0.001, Cramer's V=0.318). The proportion of respondents reporting workload as a barrier ranged from 8.3% in private hospitals to 73.0% in state hospitals, with intermediate rates observed in university hospitals (37.5%), training and research hospitals (47.2%), and city hospitals (48.1%). In contrast, no significant differences according to hospital type were observed for reimbursement-related barriers, infrastructure limitations, infusion logistics, infection concerns, or adverse-effect concerns (all p>0.05).

Table VIII. Barriers to Intravenous Iron Therapy Implementation

Barrier	n (%)
Day-care admission / infusion organization difficulties	137 (51.3)
High workload	119 (44.6)
Reimbursement / reporting difficulties	93 (34.8)
Concern regarding adverse reactions	74 (27.7)
Insufficient hospital infrastructure	43 (16.1)
Referral to internal medicine / hematology	42 (15.7)
Concern regarding infection	34 (12.7)
Oral iron considered sufficient	9 (3.4)
Lack of belief in the clinical benefit of IV iron	2 (0.7)

Multiple responses were permitted.

TSAT utilization differed significantly according to hospital type (83.8% in university hospitals, 51.4% in training and research hospitals, 61.1% in city hospitals, 54.1% in state hospitals, and 50.0% in private hospitals; χ^2=22.1, p<0.001, Cramer's V=0.288). In contrast, adherence to the ESC diagnostic definition did not differ significantly across hospital types (p=0.148).

TSAT utilization differed modestly according to professional title (χ^2=8.34, p=0.040, Cramer's V=0.177). The highest rates were observed among residents (71.3%) and professors (69.0%), whereas lower rates were reported by specialists (52.7%) and associate professors (58.6%). In contrast, correct use of ESC diagnostic criteria was similar across all professional levels (59.1%, 62.4%, 62.1%, and 65.5%, respectively; p=0.920).

When asked which specialty should be primarily responsible for the management of iron deficiency in patients with heart failure, the most common response was a multidisciplinary approach (42.3%), followed by cardiology (31.8%) and internal medicine (23.6%). Only 1.9% of respondents considered hematology to be the primary specialty responsible for management (Table IX).

Table IX. Preferred Specialty Responsible for Iron Deficiency Management in Heart Failure

Specialty	n (%)
Multidisciplinary approach	113 (42.3)
Cardiology	85 (31.8)
Internal Medicine	63 (23.6)
Hematology	5 (1.9)
No opinion	1 (0.4)

Discussion and Conclusion

Our nationwide survey revealed a marked disconnect between awareness of iron deficiency recommenda-

tions and their integration into everyday heart failure care. Although guideline awareness was high and intravenous iron was widely regarded as the preferred treatment strategy, routine use of intravenous iron remained low. In addition, while ferritin was frequently used for diagnostic evaluation, TSAT was less consistently incorporated into clinical decision-making. These findings are clinically important because current ESC guidelines emphasize systematic screening for iron deficiency using both ferritin and TSAT, as well as treatment with intravenous iron in appropriately selected patients with heart failure[1,2]. Collectively, these findings indicate that the principal obstacle in contemporary iron deficiency management lies not in disease recognition but in the effective incorporation of evidence-based recommendations into clinical practice. The principal findings of the present study are summarized in the Central Illustration.

A key observation of the present survey was the close relationship between routine TSAT assessment and accurate recognition of guideline-defined iron deficiency. Respondents who routinely assessed TSAT were significantly more likely to correctly identify the ESC diagnostic definition compared with those who did not routinely use TSAT (75.7% vs. 36.7%, $p<0.001$). This finding is clinically relevant because the ESC definition of iron deficiency requires serum ferritin <100 ng/mL, or serum ferritin 100–299 ng/mL with TSAT <20%[1,2]. Accordingly, diagnostic strategies based solely on ferritin measurements may overlook a substantial proportion of patients with functional iron deficiency. Previous studies have similarly shown that the estimated prevalence of iron deficiency in heart failure varies substantially according to the diagnostic criteria applied, particularly when TSAT is not incorporated into the definition[12,13,15]. Our findings support the view that TSAT is not an optional additional test, but a central component of guideline-concordant iron deficiency assessment.

An interesting observation emerged when diagnostic and treatment decisions were considered together. While nearly two-thirds of respondents correctly identified the ESC definition of iron deficiency, fewer than one in five reported using the full guideline-based criterion when deciding whether to initiate treatment. In practice, ferritin <100 ng/mL remained the dominant trigger for intervention. Consequently, a substantial group of patients with ferritin levels between 100 and 299 ng/mL and TSAT <20% may not receive treatment despite fulfilling current guideline recommendations. Given the clinical importance of functional iron deficiency in HF, this gap between knowledge and therapeutic action may have meaningful consequences for patient care[1,2,12,13].

Perhaps the most striking observation was the contrast between treatment preference and actual practice. Although 73.8% of respondents preferred intravenous iron, only 22.5% reported administering it routinely. This finding suggests that low implementation cannot be explained solely by lack of acceptance of intravenous iron therapy. Randomized trials including FAIR-HF, CONFIRM-HF, AFFIRM-AHF, HEART-FID, and FAIR-HF2 have provided the evidence base for intravenous iron therapy in patients with heart failure and iron deficiency[3–7]. Although recent trials have shown variable effects on hard clinical outcomes, improvements in symptoms, exercise capacity, and quality of life have been consistently demonstrated, supporting the current guideline recommendations for systematic assessment and treatment of iron deficiency in heart failure[1,2,8,14].

The pattern of reported barriers further supports the interpretation that the main problem is implementation rather than awareness**.** Infusion-related logistics, workload burden, and reimbursement issues were the most frequently reported obstacles**,** whereas concerns regarding adverse reactions were less common. In Türkiye, reimbursement for intravenous iron therapy is regulated by the national Social Security Institution (SGK) through the Health Implementation Communiqué (SUT). Although reimbursement pathways are available for eligible patients, treatment initiation requires appropriate diagnostic coding, documentation, and compliance with reimbursement criteria. Because our survey did not explore the specific reasons underlying this perception, it remains uncertain whether this barrier reflects administrative requirements, variation in familiarity with reimbursement procedures, or local institutional practices. This profile is consistent with recent implementation-focused literature emphasizing that organizational and healthcare-system factors are major determinants of intravenous iron uptake in heart failure care[10]. Similarly, multidisciplinary consensus documents have highlighted the need for standardized diagnostic pathways, dedicated infusion services, and coordinated care models to improve the practical delivery of intravenous iron therapy[11]. Therefore, the gap observed in our study appears to reflect structural barriers in the care pathway rather than uncertainty about the clinical relevance of iron deficiency. Importantly, national expert consensus documents in Türkiye have emphasized the importance of systematic iron deficiency screening, the complementary use of ferritin and TSAT, and the clinical benefits of intravenous iron therapy in heart failure for several years, suggesting that awareness of the condition may have preceded successful implementation in routine practice[16].

Interestingly, although workload burden was frequently reported as a barrier overall, we did not observe a significant association between workload perception and TSAT utilization. This finding

suggests that underuse of TSAT may not be explained simply by individual time constraints. Instead, differences in TSAT use may reflect institutional practice patterns, laboratory reporting systems, local diagnostic workflows, or variable exposure to heart failure-specific iron deficiency management. Therefore, educational interventions alone may be insufficient unless they are accompanied by system-level strategies that make guideline-concordant assessment easier to perform in routine practice.

Our findings have several practical implications. First, ferritin and TSAT should be promoted as complementary components of a single diagnostic strategy rather than separate or optional tests. Second, laboratory panels for patients with heart failure should ideally include automatic reporting of TSAT when serum iron and total iron-binding capacity are measured. Third, heart failure clinics should consider protocolized screening pathways to identify eligible patients systematically. Finally, dedicated outpatient infusion pathways, nurse-led programs, and standardized institutional protocols may help overcome the logistical and organizational barriers limiting the use of intravenous iron therapy[10,11]. In this context, routine TSAT assessment may also serve as a practical quality indicator of guideline-concordant iron deficiency care.

Several methodological considerations should be taken into account when interpreting these findings. Survey responses reflected physicians' self-reported practices and may therefore differ from actual clinical behavior. In addition, as with all questionnaire-based studies, responses may have been influenced by recall bias or social desirability bias, potentially leading to an overestimation of adherence to guideline-recommended practices. Second, participation was voluntary, which may have led to overrepresentation of cardiologists with greater interest in heart failure or iron deficiency. Third, the cross-sectional design does not allow causal inference regarding the determinants of diagnostic or therapeutic decisions. Finally, although the survey identified important barriers to implementation, it was not designed to evaluate institutional protocols, laboratory reporting systems, or reimbursement pathways in detail. Nevertheless, the national design and inclusion of cardiologists from different practice settings provide a contemporary overview of iron deficiency management in heart failure care.

Despite high awareness of iron deficiency among cardiologists caring for patients with heart failure, important gaps remain in the implementation of guideline-directed diagnostic and therapeutic strategies. Routine TSAT assessment was strongly associated with correct identification of guideline-defined iron deficiency, whereas routine intravenous iron administration remained low despite broad preference for intravenous treatment. These findings suggest that the primary challenge in contemporary iron deficiency management is no longer recognition, but implementation. Future efforts should focus on standardizing ferritin–TSAT-based diagnostic pathways, improving laboratory reporting systems, and facilitating access to intravenous iron therapy through dedicated institutional care pathways. The next frontier in iron deficiency management is therefore not recognition, but execution.

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Idea and design: C.A., Ş.G.P.
Data collection and processing: C.A., Ş.G.P.
Analysis and interpretation of data: C.A., Ş.G.P.
Writing of significant parts of the article: C.A., Ş.G.P.
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