

Comparison of FGSI and HALP scores for mortality prediction in Fournier's Gangrene: A retrospective analysis

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ABSTRACT

BACKGROUND: This study aimed to compare the prognostic performance of the Fournier's Gangrene Severity Index (FGSI) and the hemoglobin-albumin-lymphocyte-platelet (HALP) score in predicting in-hospital mortality among patients diagnosed with Fournier's gangrene. As Fournier's gangrene remains a life-threatening and rapidly progressive soft tissue infection, early risk stratification is critical for improving patient outcomes. Validating practical scoring systems may support timely clinical decision-making and resource allocation.

METHODS: A retrospective analysis was performed on 52 patients who underwent surgical treatment for Fournier's gangrene at a tertiary referral center between December 2022 and June 2025. Demographic, laboratory, and clinical data were collected, and both FGSI and HALP scores were calculated at the time of admission. Receiver Operating Characteristic (ROC) curve analysis and multivariate logistic regression were used to assess the predictive value of both scores for in-hospital mortality.

RESULTS: The mean FGSI was 5.1 ± 2.2 , while the mean HALP score was 134.6 ± 100.2 . FGSI showed acceptable discrimination (AUC=0.7639; cutoff=5.0), with 72.7% sensitivity and 67.7% specificity. HALP had poor predictive ability (AUC=0.4018). In multivariate analysis, FGSI was an independent predictor ($p=0.0146$), while HALP was not ($p=0.9474$).

CONCLUSION: FGSI appears to be a reliable and independent prognostic tool in patients with Fournier's gangrene. HALP, however, does not offer additional prognostic benefit. FGSI should be prioritized in early risk assessment to guide management strategies.

Keywords: Fournier's gangrene; FGSI; HALP; mortality; prognostic score.

INTRODUCTION

Fournier's gangrene (FG) is a rapidly progressing and potentially fatal necrotizing infection that primarily affects the perineal and genital regions. Despite advancements in surgical techniques and intensive care, the condition continues to be associated with high morbidity and mortality, particularly in patients with underlying comorbidities such as diabetes mellitus, chronic kidney disease, or malignancy. Reported mortality rates range from 20% to 40%.^[1]

Accurate and early risk stratification is essential in guiding clinical decisions and improving patient outcomes in FG. Among the available prognostic tools, the Fournier's Gangrene Severity Index (FGSI) remains the most widely used disease-specific scoring system. Originally proposed by Laor et al.,^[2] FGSI integrates vital signs and laboratory markers to estimate disease severity and predict mortality.

Recently, the hemoglobin-albumin-lymphocyte-platelet (HALP) score has been suggested as a simple, inflammation and nutrition-based prognostic index in various clinical con-

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texts, including oncology and sepsis.^[3,4] However, its utility in necrotizing soft tissue infections, particularly in FG, remains unclear.

To date, no study has directly compared the prognostic value of FGSI and HALP in patients with Fournier's gangrene. This study aims to evaluate and compare the predictive performance of FGSI and HALP in estimating in-hospital mortality among patients undergoing surgical treatment for FG.

MATERIALS AND METHODS

Study Design and Patient Population

This retrospective observational study included adult patients diagnosed with Fournier's gangrene (FG) who underwent surgical treatment at a tertiary care center between December 2022 and June 2025. Patients were identified via electronic health records using ICD codes for necrotizing fasciitis of the perineal and genital regions.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Age ≥ 18 years
- Diagnosis of FG confirmed intraoperatively or via histopathology
- Complete admission clinical and laboratory data

Exclusion criteria:

- Incomplete records
- Necrotizing fasciitis outside the Fournier region
- Patients transferred prior to definitive surgical treatment

The overall patient flow from screening to final analysis is summarized in Figure 1. In brief, 68 records were screened; 16 were excluded (due to missing baseline data, non-Fournier anatomical site, or transfer/early discharge), and 52 patients were eligible and included. All included patients underwent final analysis.

Data Collection

Collected data included:

- **Demographics:** age, sex
- **Comorbidities:** diabetes, hypertension, malignancy, chronic kidney disease
- **Laboratory values:** hemoglobin, albumin, lymphocytes, platelets, hematocrit, sodium, potassium, creatinine, bicarbonate, CRP, and lactate
- **Outcomes:** ICU admission, length of stay, number of debridements, in-hospital mortality

Scoring Systems

Two scoring systems were calculated:

- **HALP score** was calculated as:

$$\text{HALP} = \frac{\text{Hemoglobin (g/L)} \times \text{Albumin (g/L)} \times \text{Lymphocytes (/L)}}{\text{Platelets (/L)}}$$

- **FGSI score** was calculated by assigning individual scores (0–4) to nine physiological and laboratory parameters: body temperature, heart rate, respiratory rate, sodium, potassium, creatinine, bicarbonate, hematocrit, and white blood cell count. The sum of these components yielded the total FGSI.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics v26.0. Continuous variables were expressed as mean \pm standard deviation or median (IQR), while categorical variables were presented as counts and percentages.

Group comparisons (survivors vs. non-survivors) used:

- Student's t-test or Mann-Whitney U test (continuous variables)
- Chi-square or Fisher's exact test (categorical variables)

The discriminatory performance of FGSI and HALP in predicting mortality was evaluated using ROC curve analysis. AUC, sensitivity, specificity, and optimal cutoffs (Youden Index) were reported.

Multivariate logistic regression was performed to identify independent predictors of mortality. FGSI, HALP, gender, age, diabetes mellitus, and chronic kidney disease were included as covariates in the model. A p-value <0.05 was considered statistically significant.

Post-hoc power analysis estimated that the sample size (n=52) provided ~75% power to detect the observed mortality difference based on FGSI scores ($\alpha=0.05$, two-tailed). The modest sample size and retrospective design are acknowledged as limitations.

Ethical Considerations

The study protocol was approved by the Scientific Research Evaluation and Ethics Committee of Ankara Etlik City Hospital (Approval No: AESH-BADEK2-2025-162, dated 10 June 2025). Given the retrospective design, the requirement for informed consent was waived. The study was conducted in accordance with the Declaration of Helsinki (2013 revision).

RESULTS

A total of 52 patients diagnosed with Fournier's gangrene were included in the final analysis. The mean age was 56.7 ± 13.2 years (range: 21-85), and 61.5% (n=32) were male. The mean length of hospital stay was 9.8 ± 6.4 days (range: 1-35). The mean FGSI score was 5.1 ± 2.2 (median: 5, range: 1-11), and the mean HALP score was 134.6 ± 100.2 (median: 112, range: 7-453) (Table 1).

1. Mortality and Gender Distribution

The overall in-hospital mortality rate was 23.1% (n=12). A

Table 1. Descriptive statistics of the study population

Variable	Mean±SD	Median	Range
Age (years)	56.7±13.2	55	21-85
Hospital stay (days)	9.8±6.4	8	1-35
HALP score	134.6±100.2	112	7-453
FGSI score	5.1±2.2	5	1-11

Table 2. Gender distribution stratified by in-hospital mortality

Gender	Alive n (%)	Deceased n (%)	Total n (%)	p value
Male	29(90.6%)	3(9.4%)	32(61.5%)	
Female	11(55.0%)	9(45.0%)	20(38.5%)	
Total	40(76.9%)	12(23.1%)	52(100%)	0.0086

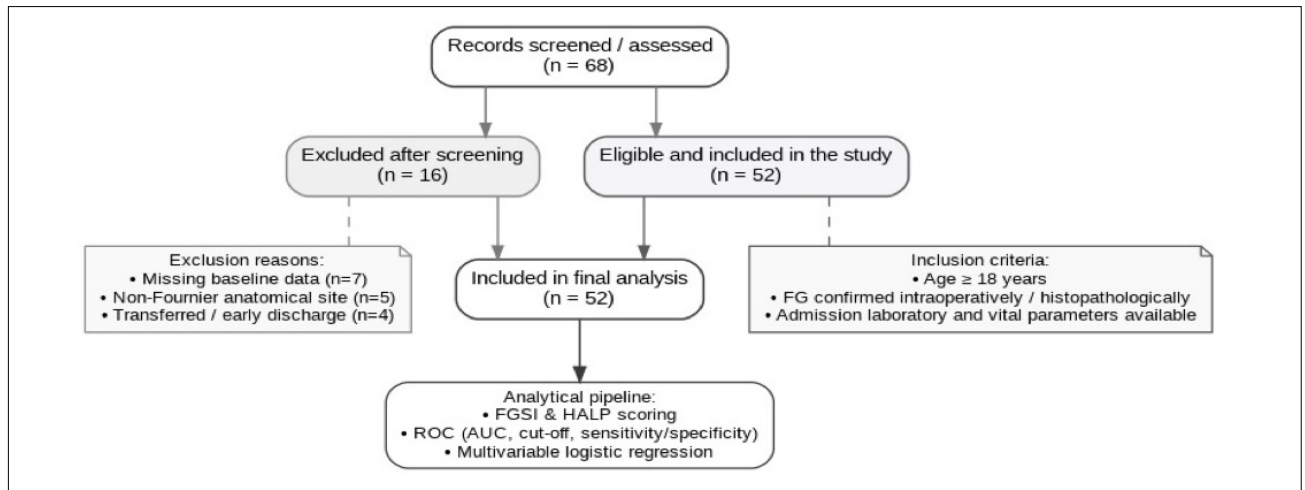


Figure 1. Symmetric study flow diagram. A total of 68 records were screened; 16 were excluded after screening (missing key data, non-Fournier anatomical site, or transfer/early discharge), and 52 patients were eligible and included in the study. All included patients were analyzed. The analytical pipeline comprised FGSI & HALP score calculations (with contextual reference to LRINEC, SOFA, and APACHE II), ROC analysis (AUC and optimal cut-off), and multivariable logistic regression.

significant gender-based difference in mortality was observed:

- Among male patients (n=32), 29 survived (90.6%) and 3 died (9.4%).
- Among female patients (n=20), 11 survived (55.0%) and 9 died (45.0%).

This difference was statistically significant (p=0.0086), indicating markedly higher mortality among female patients (Table 2). No significant differences were found between survivors and non-survivors in terms of age or comorbidities.

2. Severity Scores in Survivors and Non-Survivors

FGSI scores were significantly higher among non-survivors compared to survivors (median: 7 vs. 5, p<0.05). In contrast, HALP scores showed no statistically significant difference between the two groups (median: 95 vs. 140, p>0.05). Box plots illustrating the distribution of FGSI and HALP scores across survivor groups are shown in Figures 2 and 3, respectively.

3. ROC Curve Analysis

ROC curve analysis demonstrated that FGSI had modest discriminative ability in predicting in-hospital mortality, with an

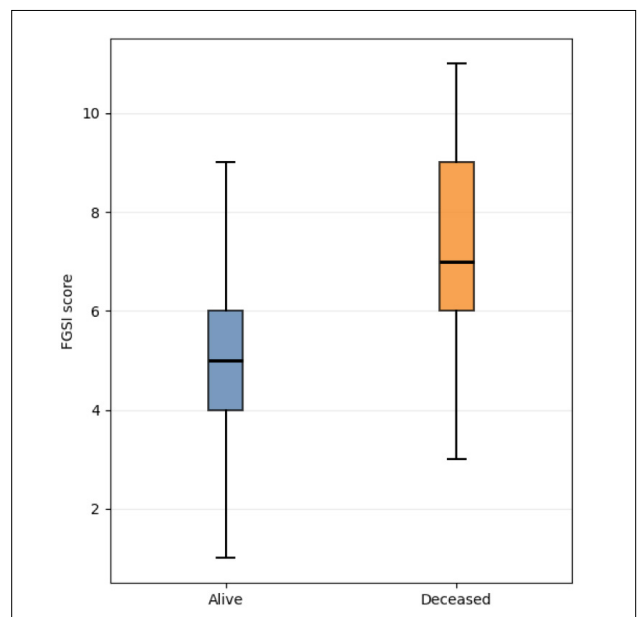


Figure 2. Boxplots of the FGSI stratified by mortality status. Non-survivors exhibited higher FGSI values compared with survivors, consistent with its independent prognostic significance.

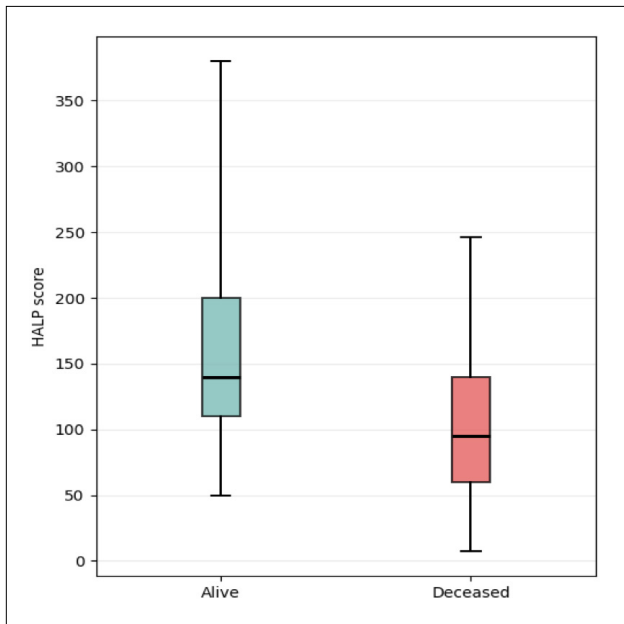


Figure 3. Boxplots of the HALP score stratified by mortality status. HALP distributions showed substantial overlap between groups, in line with its poor prognostic performance.

AUC of 0.7639. The optimal cutoff value was determined as 5.0, yielding a sensitivity of 72.7% and specificity of 67.7%.

Conversely, HALP exhibited poor performance in mortality prediction, with an AUC of 0.4018. At its optimal cutoff (246.29), sensitivity was 27.3% and specificity was 87.1% (Table 3, Figure 4).

These findings indicate that FGSI significantly outperformed

Table 3. ROC analysis of HALP and FGSI scores

Score	AUC	Cutoff	Sensitivity	Specificity
HALP	0.4018	246.29	27.3%	87.1%
FGSI	0.7639	5.00	72.7%	67.7%

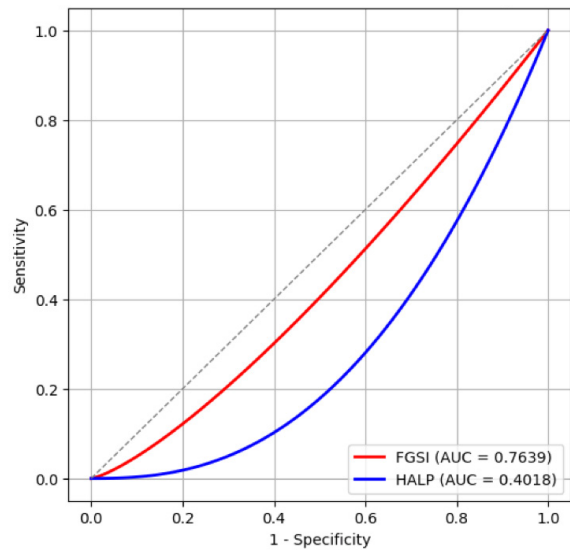


Figure 4. Receiver operating characteristic (ROC) curves of the Fournier's Gangrene Severity Index (FGSI) and the hemoglobin, albumin, lymphocyte, and platelet (HALP) score for predicting in-hospital mortality. FGSI demonstrated acceptable discriminatory ability (AUC=0.7639), whereas HALP did not show predictive significance (AUC=0.4018).

HALP in predicting patient outcomes.

4. Multivariate Logistic Regression Analysis

In multivariate logistic regression analysis that included FGSI, HALP, gender, age, diabetes mellitus, and chronic kidney disease, both FGSI ($\beta=0.411$, $p=0.016$) and female gender ($\beta=1.973$, $p=0.017$) emerged as statistically significant independent predictors of in-hospital mortality. The HALP score remained non-significant ($\beta=-0.0001$, $p=0.894$), and neither age ($p=0.540$) nor diabetes mellitus ($p=0.428$) demonstrated a meaningful association with mortality. Chronic kidney disease showed a borderline association ($p=0.065$). These findings suggest that, after adjusting for major clinical covariates, disease severity as measured by FGSI and patient sex remain the strongest determinants of outcome in this cohort (Table 4).

Table 4. Multivariate Logistic Regression Analysis for In-Hospital Mortality

Variable	β (Beta)	SE (Standard Error)	OR (Odds Ratio)	95% CI for OR	p-value
FGSI	0.411	0.156	1.51	1.11–2.24	0.016
HALP	-0.0001	0.001	0.99	0.98–1.01	0.894
Gender (Female)	1.973	0.812	7.19	1.43–36.1	0.017
Age	0.021	0.035	1.02	0.95–1.11	0.540
Diabetes Mellitus	0.584	0.755	1.79	0.42–7.50	0.428
Chronic Kidney Disease	1.202	0.655	3.33	0.92–12.1	0.065

DISCUSSION

In this study, we compared the prognostic value of two scoring systems, the Fournier's Gangrene Severity Index (FGSI) and the hemoglobin–albumin–lymphocyte–platelet (HALP) score in predicting in-hospital mortality among patients with Fournier's gangrene (FG). Our findings demonstrate that FGSI remains a reliable and statistically significant predictor of mortality, while HALP provides no additional prognostic value in this clinical context.

In our multivariate logistic regression analysis, both FGSI and female gender independently predicted in-hospital mortality, consistent with previous validation studies confirming the independent prognostic strength of FGSI.^[2,5] Importantly, FGSI remained statistically significant even after adjusting for sex, age, and comorbidities such as diabetes and chronic kidney disease.^[6] This suggests that FGSI provides prognostic value beyond these known risk factors, supporting its role as an independent mortality predictor.^[7,8] While previous studies have raised concerns about potential confounding by sex, given the markedly higher mortality rates reported in female patients, our model indicates that FGSI retains its predictive power even when this effect is controlled.^[1,9,10]

FGSI, initially developed as a disease-specific severity index, has been validated across multiple studies and remains widely used in clinical practice.^[7,11] In our cohort, FGSI demonstrated acceptable discriminatory power (AUC=0.7639), consistent with a recent meta-analysis by Tufano et al.^[7] which reported pooled AUC values of 0.90 and reinforced the utility of FGSI and its variants in FG prognosis. FGSI has also been shown to correlate with length of ICU stay and the need for surgical debridement, further supporting its clinical value.^[12,13]

In contrast, the HALP score failed to predict mortality in our cohort (AUC=0.4018; $p=0.9474$), in line with previous findings by Keten et al.^[11] Although HALP has shown prognostic significance in cancer and sepsis settings due to its reflection of systemic inflammation and nutritional status,^[3,4] its performance in necrotizing soft tissue infections appears limited. The HALP score may not adequately capture the rapid physiologic deterioration and organ dysfunction associated with FG, highlighting the need for more disease-specific models in this context.

A striking observation in our study was the significantly higher in-hospital mortality among female patients compared with males (45.0% vs. 9.4%, $p=0.0086$). Although FG is far more commonly reported in men, our findings suggest that female patients may experience worse outcomes. Sorensen et al.^[1] similarly found higher mortality in women in a large population-based study, despite their lower incidence of FG. In contrast, other studies such as that of Kabay et al.^[9] reported higher mortality among male patients, while the low number of female cases precluded meaningful comparisons. Moreover, some series have focused exclusively on male cohorts, as in the study by Dahm et al.,^[14] leaving the question

of sex-specific differences underexplored. These data highlight a critical gap in the FG literature and support the need for further research into sex-related disparities in disease presentation and outcomes.

Fournier's Gangrene Severity Index (FGSI) remains the most widely utilized and disease-specific scoring system for assessing severity and predicting mortality in patients with FG. Although its performance may vary across different cohorts, its clinical value has been consistently supported by multiple studies.^[5] In contrast, general sepsis scores such as the quick Sequential Organ Failure Assessment (qSOFA) and the National Early Warning Score (NEWS) have demonstrated limited prognostic accuracy in FG, largely due to their lack of specificity for necrotizing soft tissue infections. The Charlson Comorbidity Index (CCI) has also been considered as an adjunct to evaluate baseline health status; however, its independent predictive value in FG remains controversial and inconsistent across studies.^[8] Taken together, current evidence supports FGSI as the most practical and reliable tool for routine clinical use in this patient population. Future research should aim to refine FG-specific prognostic models and further investigate gender-based disparities to enhance outcome prediction in this high-risk population.

Future prospective studies with larger, multicenter cohorts are needed to validate the prognostic accuracy of FGSI across diverse populations. In addition, combining FGSI with dynamic biomarkers such as lactate or CRP/albumin ratio may yield more robust risk stratification models. The observed gender disparity in mortality also warrants further research to explore potential anatomical, physiological, or health-system related contributors to this outcome gap.

Limitations

This study is limited by its retrospective design and modest sample size, which may affect generalizability. Although a post-hoc power analysis estimated approximately 75% power to detect the observed mortality difference based on FGSI, prospective multicenter studies are warranted to validate these findings. Additionally, only two scoring systems (FGSI and HALP) were compared; other emerging tools may offer further insights if included in future research. FGSI showed modest discriminatory power (AUC = 0.7639), and while statistically significant, its predictive performance may be limited in certain subgroups.

CONCLUSION

FGSI remains a strong and independent predictor of in-hospital mortality in Fournier's gangrene and should continue to serve as a primary tool for early risk stratification. HALP, while useful in other inflammatory conditions, appears inadequate for mortality prediction in this context. The significant mortality disparity observed among female patients requires further clinical and epidemiological investigation.

Ethics Committee Approval: This study was approved by the Scientific Research Evaluation and Ethics Committee of Ankara Etlik City Hospital (Date: 10.06.2025, Decision No: AESH-BADEK2-2025-162).

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Conflict of Interest: None declared.

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ORIJİNAL ÇALIŞMA - ÖZ

Fournier gangreninde mortalite öngörüsünde FGSİ ve HALP skorlarının karşılaştırılması: Retrospektif bir analiz

AMAÇ: Bu çalışma, Fournier gangreni tanısı almış hastalarda hastane içi mortaliteyi öngörmeye Fournier's Gangrene Severity Index (FGSİ) ile hemoglobin–albümin–lenfosit–trombosit (HALP) skorunun prognostik performansını karşılaştırmayı amaçlamaktadır. Fournier gangreni, yaşamı tehdit eden ve hızlı ilerleyen bir yumuşak doku enfeksiyonu olmaya devam ettiğinden, erken risk sınıflandırması hasta sonuçlarını iyileştirmek açısından kritik öneme sahiptir. Pratik skorlama sistemlerinin doğrulanması, zamanında klinik karar alma ve kaynak yönetimini destekleyebilir.

GEREÇ VE YÖNTEM: Aralık 2022 ile Haziran 2025 tarihleri arasında bir üçüncü basamak sağlık merkezinde Fournier gangreni nedeniyle cerrahi tedavi uygulanan 52 hasta retrospektif olarak analiz edildi. Demografik, laboratuvar ve klinik veriler toplanarak, her hasta için FGSİ ve HALP skorları başvuru anında hesaplandı. Hastane içi mortaliteyi öngörme açısından her iki skorun prediktif değeri ROC eğrisi analizi ve çok değişkenli lojistik regresyon ile değerlendirildi.

BULGULAR: Ortalama FGSİ skoru 5.1 ± 2.2 , HALP skoru ise 134.6 ± 100.2 olarak saptandı. FGSİ, hastane içi mortalite için kabul edilebilir düzeyde ayırt edicilik gösterdi (AUC=0.7639; eşik değer=5.0; duyarlılık=%72.7; özgüllük=%67.7). HALP skoru ise zayıf prediktif yetenek sergiledi (AUC=0.4018). Çok değişkenli analizde, FGSİ istatistiksel olarak anlamlı ve bağımsız bir prediktör olarak belirlendi ($p=0.0146$); HALP skoru ise anlamlı bulunmadı ($p=0.9474$).

SONUÇ: FGSİ, Fournier gangreni hastalarında güvenilir ve bağımsız bir prognostik araç olarak öne çıkmaktadır. HALP skoru ise ek bir öngörü değeri sağlamamaktadır. Erken risk değerlendirmesinde FGSİ'ye öncelik verilmesi, hasta yönetim stratejilerinin yönlendirilmesi açısından önem arz etmektedir.

Anahtar sözcükler: Fournier gangreni; FGSİ; HALP; mortalite; prognostik skor.

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