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Prognostic clinical and pathological factors in intrathoracic solitary fibrous tumors: A retrospective single-center study

İntratorasik soliter fibröz tümörlerde prognostik klinik ve patolojik faktörler: Retrospektif tek merkezli çalışma

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ABSTRACT

Background: This study aims to emphasize the features that should be considered in the follow-up of patients with solitary fibrous tumors by analyzing the clinical and pathological parameters that are effective in the prognosis.

Methods: In this study, 53 patients (28 males, 25 females; mean age: 56.2±5 years; range, 24 to 76 years) diagnosed with solitary fibrous tumor and operated on between 2009 and 2023 were retrospectively examined. The patients included in the study were followed for at least one year. Patients with complete clinical and pathological data records were included in the study. Survival and recurrence rates were analyzed in relation to clinical and pathological parameters.

Results: The median follow-up was 44.9 months. Eight (15%) patients underwent anatomic resection, 23 (35.8%) patients underwent wedge resection, five (5.6%) patients underwent total pleurectomy, 26 (41.5%) patients underwent mass excision, and three (1.8%) underwent mass excision and chest wall resection. Survival analyses were conducted using the Kaplan-Meier method. Overall survival and disease-free survival were calculated in months from the date of surgery until the date of death or recurrence, respectively. Low mitotic rate was found to be a significant independent predictor of reduced mortality (odds ratio [OR]=0.46, 95% confidence interval [CI]: 0.243-0.877, p=0.018), indicating better survival outcomes in patients with low mitotic activity. In contrast, low Ki-67 expression was not a statistically significant predictor (OR=0.9, 95% CI: 0.880-1.116, p=0.885). Pleomorphism was strongly associated with increased mortality (OR=10.0, 95% CI: 1.316–76.081, p=0.026), highlighting the importance of pleomorphism as an important prognostic marker. Necrosis, although not statistically significant (OR=6.3, 95% CI: 0.497-79,123, p=0.156), showed a trend indicating worse outcomes. Similarly, CD34 negativity showed a trend in favor of mortality (OR=3.5, 95% CI: 0.429-28.990, p=0.241.

Conclusion: Solitary fibrous tumors are generally benign and have low recurrence and high survival rates. However, the recurrence rate is higher in malignant solitary fibrous tumors. According to the results of our study, high mitosis rate and pleomorphism are important independent predictors of increased mortality in solitary fibrous tumors. These findings emphasize the importance of detailed histopathological examination in prognostic evaluation.

Keywords: Mitotic count, pleomorphism, prognostic factors, solitary fibrous tumor, survival, recurrence.

ÖZ

Amaç: Bu çalışmada, soliter fibröz tümörlü hastaların prognozunda etkili olan klinik ve patolojik parametreler analiz edilerek bu hastaların takibinde dikkate alınması gereken özellikler vurgulandı.

Çalışma planı: Bu çalışmada 2009 - 2023 yılları arasında soliter fibröz tümör tanısı konulan ve ameliyat edilen 53 hasta (28 erkek, 25 kadın; ort. yaş: 56.2±5 yıl; dağılım, 24-76 yıl) retrospektif olarak incelendi. Çalışmaya dahil edilen hastalar en az bir yıl takip edildi. Klinik ve patolojik veri kayıtları tam olan hastalar çalışmaya dahil edildi. Sağkalım ve nüks oranları klinik ve patolojik parametrelerle ilişkili olarak analiz edildi.

Bulgular: Medyan takip süresi 44.9 aydı. Hastaların sekizi (%15) anatomik rezeksiyon, 23'ü (%35.8) kama rezeksiyonu, beşi (%5.6) total plörektomi, 26'sı (%41.5) kitle eksizyonu ve üçü (%1.8) kitle eksizyonu ve göğüs duvarı rezeksiyonu geçirdi. Sağkalım analizleri, Kaplan-Meier yöntemi ile yapıldı. Genel hayatta kalma ve hastalıksız hayatta kalma sırasıyla ameliyat tarihinden ölüm veya nüks tarihine kadar ay olarak hesaplandı. Düşük mitotik oran, mortalitenin azalmasının önemli bir bağımsız belirleyicisi olarak bulunarak (odds oranı [OR]=0.46, %95 güven aralığı [GA]: 0.243-0.877, p=0.018) mitotik aktivitesi düşük hastalarda daha iyi sağkalım sonuçları olduğunu gösterdi. Buna karşın, düşük Ki-67 ekspresyonu istatistiksel olarak anlamlı bir belirleyici faktör değildi (OR=0.9, %95 GA: 0.880-1.116, p=0,885). Pleomorfizm, mortalite artışı ile güçlü bir şekilde ilişkilendirilerek (OR=10.0, %95 GA: 1.316-76.081, p=0.026) pleomorfizmin bir prognostik belirteç olarak önemini vurguladı. Nekroz, istatistiksel olarak anlamlı olmasa da (OR=6.3, %95 GA: 0.497-79,123, p=0.156), daha kötü sonuçlara işaret eden bir eğilim gösterdi. Benzer şekilde, CD34 negatifliği mortalite lehine bir eğilim gösterdi (OR=3.5, 95% GA: 0.429-28.990, p=0,241.

Sonuç: Soliter fibröz tümörler genellikle benigndir ve düşük nüks ve yüksek sağkalım oranlarına sahiptir. Ancak malign soliter fibröz tümörlerde nüks oranı daha yüksektir. Çalışmamızın sonuçlarına göre, yüksek mitoz oranı ve pleomorfizm soliter fibröz tümörlerde artmış mortalitenin önemli bağımsız belirleyicileridir. Bu bulgular, prognostik değerlendirmede ayrıntılı histopatolojik incelemenin önemini vurgulamaktadır.

Anahtar sözcükler: Mitoz sayısı, pleomorfizm, prognostik faktörler, soliter fibröz tümör, sağkalım, nüks.

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Although solitary fibrous tumors (SFTs) were previously thought to be limited to the pleura, it has been reported that it can be observed in different parts of the body, particularly in soft tissues, retroperitoneum, abdominal cavity, central nervous system, and head and neck regions.[1] This diversity reflects the heterogeneity in the histopathological and biological behavior of SFT. Clinically, the course of SFTs is quite variable. Although they mostly show a benign course, there are also subgroups with malignant potential.[2] Tumors with these characteristics can exhibit aggressive behaviors such as local invasion and distant metastasis.[3]

Histopathologically, SFTs are characterized by spindle-shaped cells within a dense collagen matrix. However, factors such as increased mitosis and elevated Ki-67 proliferation index increase the potential for malignancy.[4] High Ki-67 index has been associated with increased risk of recurrence and metastasis, providing clues about the biological behavior of the disease.[5] In addition, immunohistochemical markers such as p53 mutations and CD34 expression have been reported to be associated with malignant transformation.[6]

The heterogeneous behavior of SFTs causes confusion in their prognosis, and therefore, a comprehensive histopathological and immunohistochemical evaluation is necessary. The analysis of histological and immunohistochemical features is important for a more accurate clinical management. In our study, we aimed to emphasize the features that should be considered in the follow-up of this patient group by analyzing the clinical and pathological parameters that are effective in the prognosis of SFTs.

PATIENTS AND METHODS

This retrospective observational study evaluated 53 patients (28 males, 25 females; mean age: 56.2±5 years; range, 24 to 76 years) who were operated on with a diagnosis of SFT at the Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital, Department of Chest Surgery between 2009 and 2023. Fifty-three patients who were operated on with a diagnosis of SFT between 2009 and 2023 were examined. Patients who were diagnosed with SFT as a result of histopathological examination, had complete clinical data, and had at least one year of follow-up data were included in the study. As exclusion criteria, patients with missing clinical data, patients who developed malignancy other than PFT, and patients who died due to reasons other than PFT (e.g., traffic accident and coronavirus disease 2019) were excluded from the study (n=2). Written informed consent was obtained from all participants. The study protocol was approved by the Istanbul Training and Research Hospital Clinical Research Ethics Committee (Date: 21.03.2025 No: KAEK-64). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Demographic characteristics of the patients, tumor location, tumor dimensions, number of mitosis, presence of tumor stem, presence of necrosis, pleomorphism, immunohistochemical markers (Ki-67, vimentin, desmin, smooth muscle actin (SMA), CD31, CD34, Cd99, Bcl-2, and S-100) were recorded. The obtained data were used to analyze the biological behavior of the tumor, the risk of recurrence, and its effect on survival.

Statistical analysis

All statistical analyses were performed using IBM SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). For univariate analyses, one-way analysis of variance was used to compare continuous variables, and the chi-square test was used to evaluate the relationships between categorical variables. Multinomial logistic regression was applied in multivariate analyses to identify independent predictors. Survival results were analyzed using the Kaplan-Meier method. A p-value <0.05 was considered statistically significant.

RESULTS

Eight (15%) of the patients underwent anatomic resection, 19 (35.8%) patients underwent wedge resection, three (5.6%) patients underwent total pleurectomy, 22 (41.5%) patients underwent mass excision, and one (1.8%) patient underwent mass excision and chest wall resection (Table 1).

In our analysis, some variables were found to be associated with mortality. Male sex was more common among patients who died (83.3%, p=0.092). Necrosis positivity was observed more frequently in patients who died (50.0%) compared to survivors (17.0%) and showed a tendency close to significance (p=0.061). Pleomorphism positivity showed a significant association with mortality and was observed more frequently in the group who died (50.0%) compared to survivors (10.6%, p=0.011; Table 1, Figure 1). Categorical clinicopathological variables were compared between survivors and deceased patients using the chi-square or Fisher

Table 1. Comparison of categorical clinicopathological variables between survivors and deceased patients

Variables	Group alive %	Group passed away %	*p*
Sex			0.092
Male	46.8	83.3	
Female	53.2	16.7	
Necrosis positivity	17.0	50.0	**0.061**
Pleomorphism positivity	10.6	50.0	**0.011***
CD34 positivity	85.1	50.0	0.038*
Vimentin positivity	14.9	33.3	0.257
Desmin positivity	4.3	0.0	0.606
SMA positivity	4.3	0.0	0.606
CD31 positivity	2.1	16.7	0.078
CD99 positivity	17.0	16.7	0.983
Bcl-2 positivity	12.8	16.7	0.790
S-100 positivity	2.1	0.0	0.718
Malignancy in SFT positivity	8.5	83.3	**0.000****
Bleeding positivity	12.8	33.3	0.185
Operative technique (lobectomy)	40.4	66.7	0.405
Recurrence (1)	12.8	66.7	**0.001****
Reoperation (1)	8.5	33.3	0.071

SMA: Smooth muscle actin; SFT: Solitary fibrous tumor; * p<0.05: Statistically significant; ** p<0.01: Highly statistically significant.; Chi-square test or Fisher exact test was used where appropriate. Statistically significant differences were observed in pleomorphism (p=0.011), CD34 positivity (p=0.038), malignancy in SFT (p<0.001), and recurrence (p=0.001). Variables such as necrosis and male sex showed a trend toward significance

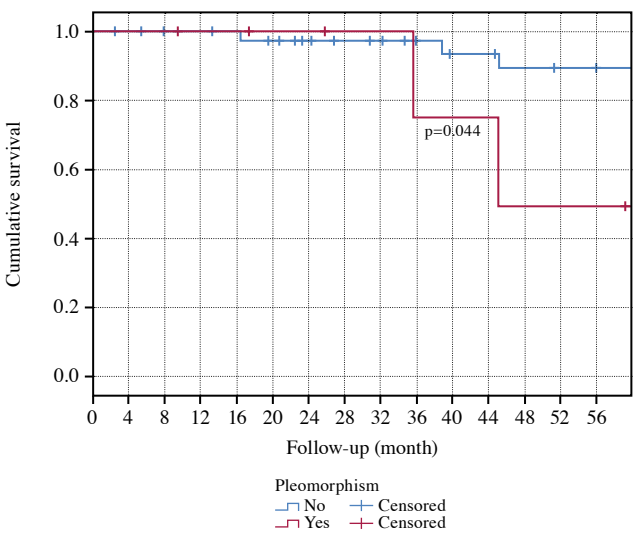

Figure 1. Overall survival according to pleomorphism in patients with SFTs.

SFTs: Although solitary fibrous tumors. Overall survival was analyzed using the Kaplan-Meier method, and time is shown in months. Patients with positive pleomorphism had significantly shorter survival times. Pleomorphism was identified as an important prognostic marker associated with increased mortality.

exact test where appropriate. Statistically significant differences were observed in pleomorphism (p=0.011), CD34 positivity (p=0.038), malignancy in SFT (p<0.001), and recurrence (p=0.001). Pleomorphism and recurrence were more frequent in patients who died, while CD34 expression was notably lower in this group. Malignancy was identified in 83.3% of deceased patients compared to only 8.5% of survivors. Although not statistically significant, necrosis (p=0.061) and male sex (p=0.092) showed a trend toward increased mortality (Figure 2). These findings suggest that histopathological markers such as pleomorphism, malignancy status, and CD34 expression may have prognostic value in patients with SFT (Table 1, Figure 3). Malignancy showed a strong and significant relationship with mortality; malignancy was detected in 83.3% of patients who died, while it was detected in only 8.5% of survivors (p=0.000). In addition, recurrent PFT was observed in 66.7% of those who died, while it was found in only 12.8% of survivors, and this relationship

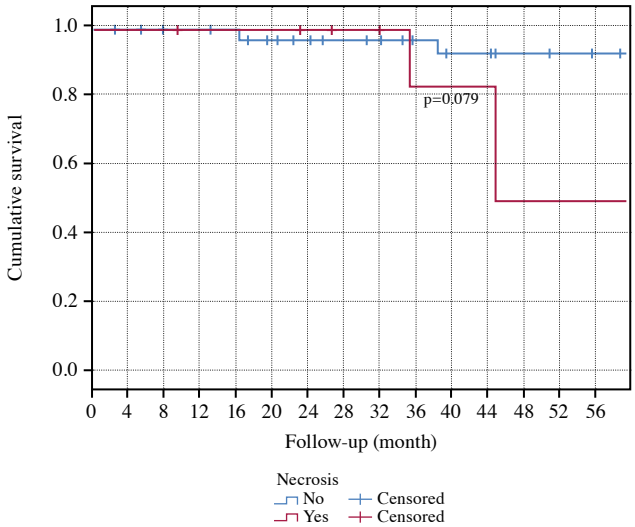

Figure 2. Disease-free survival according to presence of necrosis in patients with SFTs.

SFTs: Although solitary fibrous tumors. Disease-free survival was calculated using the Kaplan–Meier method, representing recurrence-free time in months from surgery. Patients with necrosis showed shorter disease-free survival compared to those without, indicating a trend toward worse outcomes associated with necrosis.

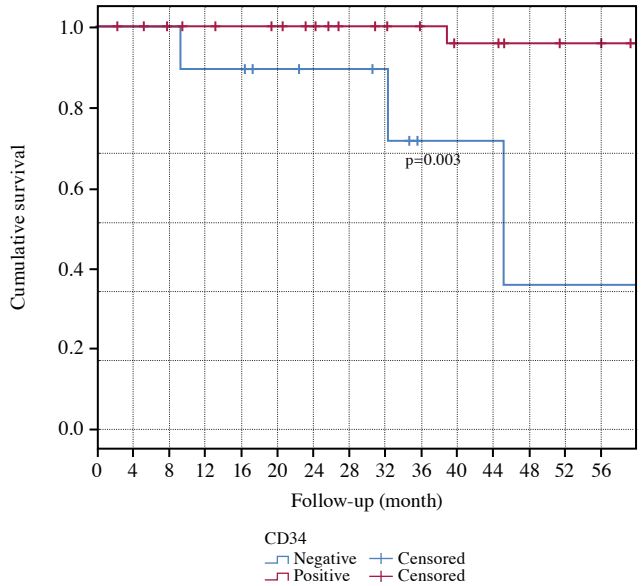

Figure 3. Overall survival according to CD34 expression in patients with SFTs.

SFTs: Although solitary fibrous tumors. Kaplan-Meier survival curves demonstrated that CD34-negative patients had shorter overall survival. Time is presented in months. Loss of CD34 expression may reflect a more aggressive biological behavior and increased malignant potential.

was found to be statistically significant (p=0.001; Table 1, 2).

Among continuous variables, mitosis rate and Ki-67 positivity showed a strong association with mortality. Mitosis rate was significantly higher in patients who died (4.80±1.30) than in survivors (1.48±1.70, p=0.000). Similarly, Ki-67 positivity was significantly higher in patients who died (17.67±19.25%) than in survivors (3.09±5.06%, p=0.000; Table 1, 2).

The mean tumor size was 8±15 cm (range, 1.5 to 25.5 cm), and the mean tumor volume was 61.5±15 cm^3 (range, 9 to 36.6 cm^3). Tumor dimensions (p=0.749) or tumor volume (p=0.351) were not observed as a significant parameter in terms of survival. In the multivariate logistic regression analysis, low mitotic rate emerged as an independent protective factor against mortality (odds ratio [OR]=0.46, 95% confidence interval [CI]: 0.243-0.877, p=0.018). In contrast, pleomorphism was found to be a strong and significant predictor of mortality (OR=10.0, 95% CI: 1.316-76.081, p=0.026). Other variables such as necrosis and CD34 negativity demonstrated elevated ORs but did not reach statistical significance. These findings underscored the prognostic value of mitotic activity and pleomorphism in SFTs (Table 2).

In multivariate analysis, low mitotic rate was found to be a significant protective factor (OR=0.46, 95% CI: 0.243–0.877, p=0.018) and mortality was observed to be reduced in patients with low mitotic activity. In contrast, pleomorphism showed a strong

Table 2. Multivariate logistic regression analysis of factors associated with mortality

Variables	*p*	OR	95% CI for Exp(B)
Mitosis rate (low)	0.018	0.46	0.243-0.877
KI-67 (low) (%)	0.885	0.9	0.880-1.116
Pleomorphism	0.026	10.0	1.316-76.081
Necrosis	0.156	6.3	0.497-79.123
CD34 negativity	0.241	3.5	0.429-28.990

OR: Odds ratio; CI: Confidence interval. Low mitotic rate was identified as an independent protective factor (p=0.018), while pleomorphism significantly increased the odds of mortality (p=0.026). Although necrosis and CD34 negativity showed elevated ORs, these did not reach statistical significance.

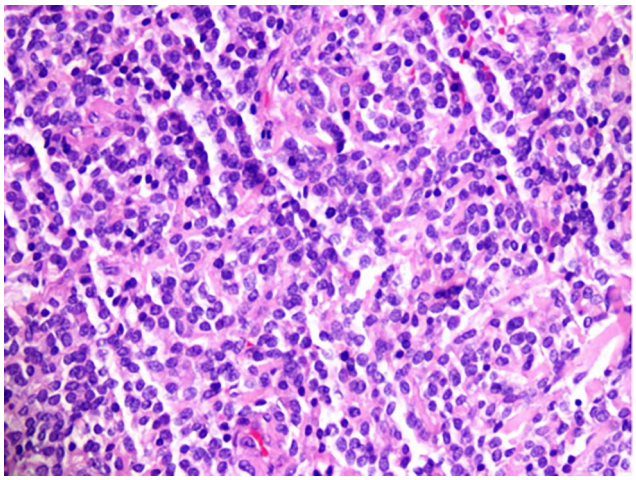

Figure 4. Histological section showing markedly increased mitotic activity (H&E, ×400).

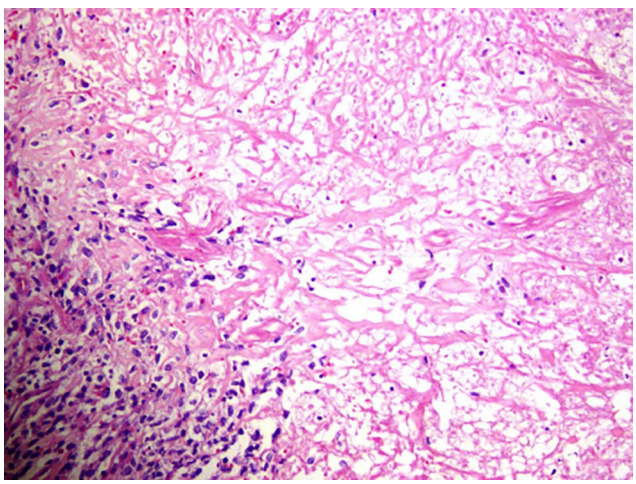

Figure 5. Extensive necrotic areas observed in a malignant SFT (H&E, ×200).

SFT: Although solitary fibrous tumor.

and significant association with mortality (OR=10.0, 95% CI: 1.316-76.081, p=0.026) and was found to be a high risk factor. Although CD34 negativity increased the mortality rate, the difference was not statistically significant (OR=3.5, 95% CI: 0.429-28.990, p=0.241).

Histological evaluation of malignant SFT cases revealed areas of prominent necrosis and markedly increased mitotic activity. These features were consistent with aggressive tumor behavior and aligned with the parameters identified as adverse prognostic indicators in our analysis (Figure 4, 5).

DISCUSSION

Solitary fibrous tumors are rare tumors of mesenchymal origin and were first described as pleural tumors by Klemperer and Coleman[1] in 1931. Although they may have a benign course, they can also exhibit malignant potential in some cases. Malignant SFTs are histologically defined by features such as marked increase in cellular density, increased mitotic activity (≥4 mitoses/10 high-power fields), nuclear pleomorphism, marked atypia, and intratumoral necrosis.[7]

In symptomatic patients, larger tumors are usually detected, and it has been stated that such tumors are associated with stromal and vascular invasion, which may result in poor prognosis and high recurrence rates.[8,9] Tumors larger than 10 cm stand out as a group in which metastatic potential becomes evident.[1] There are many clinical and pathological factors that are effective in prognosis and treatment planning. In this study, histological findings such as tumor diameter, mitosis rate, proliferation index, nuclear pleomorphism, as well as the presence of stem, necrosis, Ki-67 value, and immunohistochemical parameters were evaluated.

Mitotic rate and proliferative activity are among the most important parameters used to determine the malignant potential of SFTs. In tumors with a high mitotic rate, malignancy potential becomes evident, and the probability of recurrence increases.[9-18] In our study, a low mitotic rate was found to be a significant independent determinant of disease-free survival (OR=0.46, 95% CI: 0.243-0.877, p=0.018), indicating better results in patients with low mitotic activity. In a study conducted by Demicco et al.,[10] it was reported that a mitotic count of 4 or more in 10 high-power fields was associated with increased metastasis and disease-specific mortality. Similarly, Reisenauer et al.[11] reported a significant association of mitotic count and Ki-67 index (≥2%) with recurrence and survival.

Nuclear pleomorphism plays an important role in assessing the malignancy risk of SFTs. In tumors with increased pleomorphism, cellular heterogeneity becomes more pronounced and the malignant potential clearly emerges.[3,8,19] In our study, pleomorphism also showed a strong association with increased mortality (OR=10.0, 95% CI: 1.316-76.081, p=0.026), emphasizing that increased pleomorphism is an important prognostic determinant. Low pleomorphism may be associated with a benign course. Vallat-Decouvelaere et al.[8] reported that high pleomorphism, hypercellularity and necrosis are associated with aggressive clinical behavior in SFTs.

The Ki-67 proliferation index is an important marker used to determine the biological behavior of tumors. It has been reported in the literature that tumors with Ki-67 above 10% have a more aggressive course and higher recurrence rates.[5-10] This cutoff value makes an important contribution to the clinical decision-making process in the evaluation of malignant potential. In our study, Ki-67 positivity was significantly higher in those who died (17.67±19.25%) compared to those who survived (3.09±5.06%, p=0.000). However, low Ki-67 expression was not a statistically significant predictor (OR=0.9, 95% CI: 0.880-1.116, p=0.885). However, in multivariate analysis, Ki-67 did not show statistical significance as an independent predictor (OR=0.9, p=0.885). Brozzetti et al.[12] stated that the tumor followed an aggressive course with the increase in Ki-67, but more accurate results would be obtained when evaluated together with other histological parameters.

In histopathological examinations, the presence of necrosis and hemorrhage areas in malignant SFTs has been associated with poor prognosis. The prognosis is poorer in tumors with extensive necrosis, and these tumors have a high potential for recurrence.[15] According to our results, although necrosis was not statistically significant (OR=6.3, 95% CI: 0.497-79.123, p=0.156), its presence showed a tendency to indicate worse outcomes. Salas et al.[17] reported in their study that necrosis was a strong predictor of metastasis and recurrence in high-risk SFT subgroups. According to some authors, necrosis should be added to the parameters used in staging SFTs.[20]

Malignant SFTs have been associated with poor prognosis.[20] Malignancy was also found to be significantly associated with mortality and recurrence in our study (p<0.001). Malignant SFTs were detected in 83.3% of patients who died, while only 8.5% of those who survived (p<0.001). In addition, mortality was detected at a higher rate in recurrent SFTs, with recurrence observed in 66.7% of those who died and in 12.8% of those who survived, and this relationship was found to be statistically significant (p=0.001). England et al.[3] reported that malignant SFTs showed high rates of invasion, recurrence, and metastasis despite surgical resection. Studies by Ajouz et al.[19] and de Perro et al.,[14] which emphasized early and complete surgical resection, also draw attention to the increased risk of recurrence and metastasis in malignant SFTs.[3-14] Therefore, in cases with a high risk of recurrence, six-month intervals for the first two years after surgery and annual follow-up is recommended. This close follow-up is recommended, specifically in the first two years, considering the high rate of recurrence and mortality.[3]

It is reported in the literature that tumor diameter plays an important role in the prognosis of SFTs. It has been reported that the risk of malignancy significantly increases and recurrence rates are high, particularly in tumors larger than 10 cm.[1] In our study, no significant relationship was found between tumor size (p=0.749) or tumor volume (p=0.351) and recurrence or survival. According to the study by Demicco et al.,[10] large-diameter tumors have a high probability of recurrence even after surgery, which has a negative effect on prognosis. In the study by Cardillo et al.,[13] no statistically significant relationship was found between tumor size and prognosis for SFTs.

Among immunohistochemical parameters, CD34 negativity is remarkable. In our study, although there was no statistically significant relationship between CD34 negativity and prognosis, it showed an increase in mortality (OR=3.5, 95% CI: 0.429-28.990, p=0.241). This supports the potential for more aggressive biological behavior, particularly in patients with CD34 negativity. In the study by Yokoi et al.[6] a significant decrease or complete loss of CD34 expression was observed in malignant or recurrent tumors. This finding shows that CD34 negativity can be associated with malignancy. According to the study by Franzen et al.,[18] no statistically significant relationship was found that CD34 expression directly affects the prognosis or clinical course of the disease.

When further examination was made in terms of sex distribution in our study, male sex was found to have higher rates of deceased patients (83.3%). However, this difference was not statistically significant (p=0.092). In the analyses made in terms of sex in existing studies, although both sexes were equal in terms of the frequency of SFT, male sex was associated with a higher risk of recurrence in SFTs.[16,17]

Pedunculated tumors are generally benign, while sessile tumors may have a higher malignant potential.[1,19] In our study, no significant findings were found in terms of recurrence and survival in the statistical analysis performed between pedunculated and sessile tumors (p=0.235). Similarly, in the study of Franzen et al.,[18] no significant difference was

found between pedunculated or sessile SFTs in terms of prognostic significance. In the study of de Perrot et al.,[14] it was reported that the removal of pedunculated tumors was generally sufficient, and the risk of recurrence was low. On the other hand, they emphasized the importance of complete surgical resection in sessile tumors. Cardillo et al.[13] also emphasized the negative surgical margins in sessile tumors in their study and stated that recurrence rates were higher when negative surgical margins could not be obtained. Due to methodological differences in studies, sample sizes and the effects of other prognostic factors, data on prognosis in sessile or pedunculated tumors are variable.

Immunohistochemical markers such as Bcl-2, S-100, vimentin, and desmin are helpful in the diagnosis of SFT, but it is controversial whether they are determinant in terms of prognosis.[3] In our study, immunohistochemical parameters did not give significant results in terms of prognosis (S-100, p=0.718; Bcl-2, p=0.790; vimentin, p=0.257; desmin, p=0.606; SMA, p=0.606; CD-31, p=0.078; CD-99, p=0.983). In some studies, it has been reported that immunohistochemical markers such as Bcl-2, S-100, vimentin, and desmin gave significant results in evaluating the biological behavior of SFTs.[3-16] It has been stated that Bcl-2 expression is useful in distinguishing histological subtypes of SFT, but these markers have no prognostic value on disease recurrence or survival.[3-10]

In line with our findings, Georgiesh et al.[21] conducted a retrospective cohort study involving 100 extrameningeal STAT6 (signal transducer and activator of transcription 6)-positive SFT cases and developed a novel risk score predicting both early and late recurrence based on mitotic index, necrosis, and male sex as independent prognostic factors. Similarly, in our cohort, high mitotic activity and pleomorphism were significantly associated with recurrence and mortality, supporting the prognostic utility of these markers in thoracic SFTs. Furthermore, Hwang et al.[22] emphasized the clinical significance of NAB2-STAT6 fusion, molecular subtyping, and histopathologic variants in the classification and prognosis of SFTs, particularly in central nervous system involvement. Although our study did not perform molecular analysis, it complements these insights by highlighting the real-life clinical relevance of conventional histopathologic markers such as mitosis, pleomorphism, and Ki-67 in a thoracic surgical cohort. In a multinational study including data from Türkiye, Ghanim et al.[23] reported that intrathoracic SFTs were associated with significant molecular heterogeneity and emphasized the potential role of circulating biomarkers in risk stratification. Our findings contribute to clinical and pathological data that can complement such molecular insights.

Surgical resection remains the cornerstone of treatment for SFTs. Complete resection with negative margins has been associated with improved survival and lower recurrence rates. In the national literature, Mısırlıoğlu et al.[24] reported a series of 11 patients with pleural SFTs, highlighting complete surgical resection as the cornerstone of management and noting a recurrence in one patient after 32 months, despite initial resection. Similarly, Doğruyol et al.[25] emphasized in their textbook chapter that complete resection remains the most critical factor in prognosis and discussed the importance of CD34 and vimentin positivity in diagnosis and follow-up. In our series, although different surgical techniques (lobectomy, wedge resection, total pleurectomy, and mass excision) were applied depending on tumor location and size, margin status could not be standardized retrospectively. However, recurrence and mortality rates were higher in patients with incomplete or palliative resections, supporting the importance of aggressive surgical management, particularly in malignant SFTs.

Although all of the immunohistochemical markers used in our study are considered conventional in routine pathology, the current study provides a comprehensive evaluation of their combined prognostic significance in a large intrathoracic SFT cohort. This contributes to the understanding of their real-life clinical utility in a surgical series. In addition, this is one of the largest single-center intrathoracic SFT series from Türkiye and provides regional data for comparative literature analyses.

This study had some limitations. Data regarding adjuvant therapies, such as chemotherapy, radiotherapy, or subsequent surgical interventions, were not consistently available across all patient records. Therefore, survival comparisons based solely on clinicopathological features might be limited in fully capturing the prognostic impact of therapeutic strategies. Future prospective studies with standardized treatment and follow-up data are warranted to more accurately delineate survival determinants in SFTs.

In conclusion, the prognosis of solitary fibrous tumors exhibits a heterogeneous biological

behavior that requires careful evaluation of histological and immunohistochemical parameters. In our study, it was shown that low mitotic rate and nuclear pleomorphism were associated with benign course, whereas high Ki-67 proliferation index and marked pleomorphism were strongly associated with malignancy and recurrence. Mitotic activity stood out as an independent marker in predicting malignancy. In addition, it was determined that features such as intratumoral necrosis and hemorrhage in malignant solitary fibrous tumors were poor prognostic factors, but the role of immunohistochemical markers on prognosis was not clear. This study provides one of the most comprehensive retrospective analyses of intrathoracic solitary fibrous tumors in the regional literature. By evaluating conventional histopathological markers in a relatively large patient cohort, our study contributes to real-world prognostic profiling and emphasizes the continued importance of mitotic activity and pleomorphism in clinical decision-making. Our findings indicate that histological and immunohistochemical parameters should be carefully analyzed in the evaluation of malignant potential of solitary fibrous tumors. In clinical management, early detection of patients with malignant potential, ensuring negative surgical margins, and close follow-up are important. Prospective studies may help define prognostic parameters in solitary fibrous tumors and further improve treatment strategies for these rare tumors.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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