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RESPIRATORY CASE REPORTS

Solitary Fibrous Tumors: Analysis of 5 Cases and Literature Review

Soliter Fibröz Tümörler: 5 Olgunun Analizi ve Literatür İncelemesi

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Abstract

The solitary fibrous tumor (SFT) is a rare mesenchymal neoplasm derived from CD34+ dendritic stromal cells, primarily found in the pleura but also occurring in other sites like the lung and peritoneum. It accounts for approximately 5% of pleural tumors. Respiratory symptoms, such as cough and dyspnea, typically result from the compression of adjacent structures. The treatment of choice remains surgical, involving complete excision of the tumor, often requiring extensive resections. The prognosis is generally favorable for benign forms, although postoperative monitoring is crucial due to a risk of recurrence, particularly in more aggressive cases; surgery should also be considered in the event of local recurrence, if technically feasible. This study aims to analyze the clinical presentation, pathological findings, and outcomes of five patients diagnosed with SFT, emphasizing the importance of early diagnosis and effective management.

Keywords: *Solitary Fibrous Tumor, mesenchymal, surgery.*

Öz

Soliter fibröz tümör (SFT), CD34+ dendritik stromal hücrelerden türetilen nadir bir mezenkimal neoplazmdır ve öncelikli olarak plevrada bulunur, ancak akciğer ve periton gibi diğer bölgelerde de görülür. Plevral tümörlerin yaklaşık %5'ini oluşturur. Öksürük ve dispne gibi solunum semptomları tümörün genellikle komşu dokulara basısından kaynaklanır. Tercih edilen tedavi cerrahidir ve tümörün tamamen çıkarılmasını içerir ve genellikle kapsamlı rezeksiyonlar gerektirir. Prognoz genellikle benign formlar için iyidir, ancak özellikle daha agresif olgularda tekrarlama riski nedeniyle postoperatif takip çok önemlidir; teknik olarak mümkünse lokal tekrarlama durumunda da cerrahi düşünülmelidir. Bu çalışma, SFT tanısı konulan beş hastanın klinik sunumunu, patolojik bulgularını ve sonuçlarını analiz etmeyi ve erken tanı ve etkili tedavinin önemini vurgulamayı amaçlamaktadır.

Anahtar Kelimeler: *Soliter fibröz tümör, mezenkimal tümör, cerrahi.*

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Solitary fibrous tumors (SFTs) are rare neoplasms located primarily in the pleura, although they may also develop in other regions, such as the lungs and peritoneum. SFTs account for approximately 5% of all pleural tumors (1). While they can occur at any age, peak incidence is typically observed in those aged 50–70 years. While sex is generally not considered a risk factor, previous studies have reported a slight predominance in females (2,3). Although the majority of pleural solitary fibrous tumors are classified as benign, 10–20% are found to be malignant, characterized by rapid growth, local invasion, and a high rate of recurrence and metastasis (4). Historically, such tumors have often been misdiagnosed as benign pleural mesothelioma, although advances in the approach to classification have improved the delineation of their biological behaviors (3).

The clinical manifestations of SFTs can vary widely, ranging from asymptomatic presentations to respiratory symptoms such as dyspnea and chest pain. Such symptoms are frequently associated with tumor size, which can reach significant dimensions without apparent clinical effects (2). Surgical intervention remains the treatment of choice, typically involving radical resection (R0). Preoperative planning with detailed imaging is crucial for assessing the extent of the disease. While multiple thoracotomies may be necessary to ensure complete resection, a minimally invasive approach may also be considered. Recurrence is often linked to incomplete resection, and repeat operations can enhance prognosis (5).

CASE

Case 1: A 64-year-old female non-smoker with no significant medical history presented with dyspnea and a decline in her overall condition. Upon examination, her ECOG performance status was 0, with a peripheral oxygen saturation of 92% in ambient air. A pleuropulmonary examination revealed no particular abnormalities, while a chest CT scan revealed a tumor mass located in the left lower lobe, accompanied by mediastinal and axillary lymphadenopathy (Figure 1).

Bronchoscopic examination revealed extrinsic compression of the lingula, while a histopathological analysis of an ultrasound-guided biopsy of the mass confirmed a diagnosis of solitary fibrous tumor. A multidisciplinary oncology panel recommended surgical intervention, but the patient was later lost to follow-up.

Case 2: A 62-year-old patient who had been a chronic smoker for 20 years but abstinent for the past 15 years presented with an isolated productive cough. Clinical examination indicated an Eastern Cooperative Oncology Group (ECOG) performance status of 0 and a peripheral oxygen saturation of 93% in ambient air, with dullness noted in the lower two-thirds of the right thoracic hemithorax. Thoracic computed tomography revealed a large mass in the parietal pleura measuring 175 mm on its longest axis, with homogeneous enhancement (Figure 2).

A percutaneous ultrasound-guided biopsy confirmed the presence of a solitary fibrous tumor, which tested positive for CD34 and STAT6, and exhibited a diffuse overexpression of P53, indicating an aggressive nature. The patient underwent a complete en bloc tumor resection, and the subsequent histopathological analysis classified the tumor as high risk, with tumor necrosis foci assessed at 10% and four mitoses per 2 mm^2. The patient was subsequently referred for adjuvant chemotherapy for further management, but was lost to follow-up.

Case 3: A 79-year-old female non-smoker patient with a history of hypertension managed for 12 years who was taking aspirin for the treatment of ischemic heart disease and insulin for the control of diabetes presented with stage II dyspnea, dry cough that was occasionally productive and unquantified weight loss over the past year. Her general condition was stable upon examination, with a saturation of 98% and dullness noted in the left basis thorax. Thoracic computed tomography revealed a circumscribed mass in the left lower lobe that was causing a mass effect on the mediastinum (Figure 3).

Bronchoscopic examination revealed compression of the lingula with an inflammatory appearance, while a bronchial biopsy revealed necrosis and hemorrhage without viable cells. Ultrasound-guided biopsy confirmed the diagnosis of a solitary fibrous tumor, and surgical intervention was recommended by a multidisciplinary panel; however, the patient was subsequently lost to follow-up.

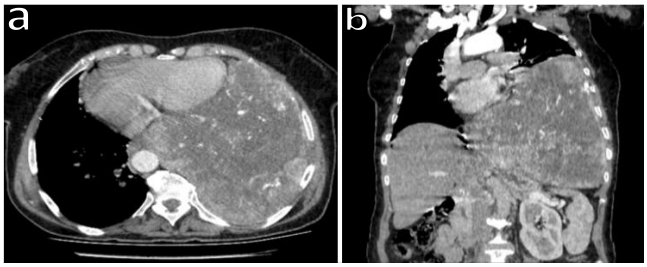

Figure 1: Axial (A) and sagittal (B) thoracic CT images revealing a large tumor mass in the left lower lung lobe

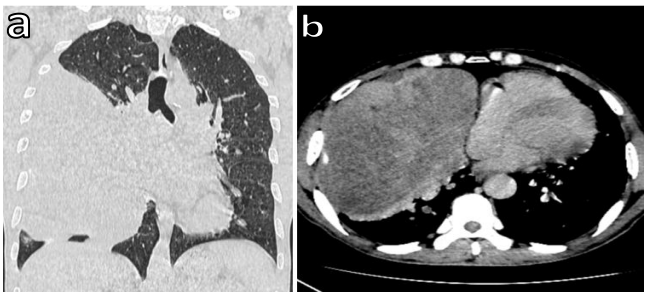

Figure 2: Thoracic CT in parenchymal (A) and mediastinal (B) windows showing a diffuse right pleural tumor mass compressing the right lung and mediastinal structures

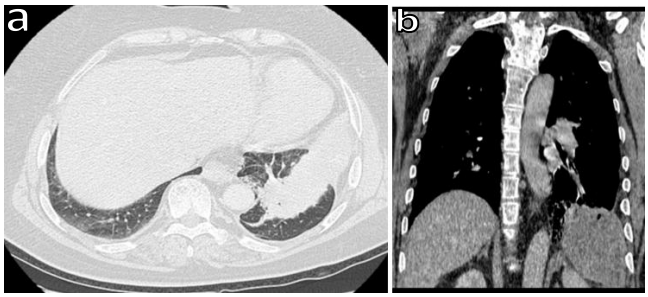

Figure 3: Thoracic computed tomography in parenchymal window (A) and mediastinal window (B) showing a well-defined tumor mass in the left lower lobe with clear margins against the lung parenchyma, suggesting a pleural origin

Case 4: A 32-year-old female non-smoker with no notable medical history presented with progressive dyspnea and a deterioration of her general condition over the past 7 months, accompanied by the emergence of a parietal swelling. Clinical examination revealed an adherent, indurated and painful mass located on the left parietal region measuring nearly 20 cm, while thoracic computed tomography showed a left pleural effusion and a hypodense nodular mass measuring 133 mm in the left lower lobe that was compressing the adjacent structures. Thoracic magnetic resonance imaging suggested the presence of a left parietal thoracic tissue mass (Figures 4 and 5).

Ultrasound-guided biopsy confirmed the diagnosis of a solitary fibrous tumor. Following a staging workup that revealed no distant metastases, the patient underwent surgery for the complete excision of the tumor with negative surgical margins, and she was subsequently referred for Imatinib-based chemotherapy. Post-operative monitoring for 3 months indicated a favorable evolution of the patient's condition, with no signs of recurrence or associated complications.

Case 5: A 32-year-old male non-smoker presented with stage III dyspnea for 1 month, accompanied by a productive cough with hemoptysis and left-sided chest pain. An examination revealed an oxygen saturation of 95% in ambient air. Auscultation revealed an absence of vesicular breath sounds on the left, as well as dullness to percussion, and a subsequent thoracic computed tomography revealed a posterior thoracic mass measuring 133 x 107 x 80 mm that was predominantly cystic, along with another adjacent mass measuring 98 x 97 x 81 mm that was enhanced after contrast injection. Unilateral pleural thickening associated with the multifocal basis thoracic masses was also noted.

The patient underwent tumor excision and decortication, and the subsequent morphological examination and immunohistochemistry confirmed the diagnosis of a solitary fibrous tumor. The patient presented again 3 months later with stage III dyspnea, a productive cough with hemoptysis and 7 kg weight loss of. An examination revealed desaturation to 40% in ambient air, which was improved to 96% by non-invasive ventilation. Computed tomography confirmed the persistence of the left nodular pleural thickening primarily within the lower lobe, revealing it to have become diffuse and heterogeneous, measuring 106 mm in the anterobasal region (Figure 6).

The patient ultimately died following cardiorespiratory arrest, despite resuscitation efforts. The cause of death was attributed to respiratory distress and severe hypoxia secondary to a pulmonary infection.

The characteristic features of all our cases are shown in Table 1.

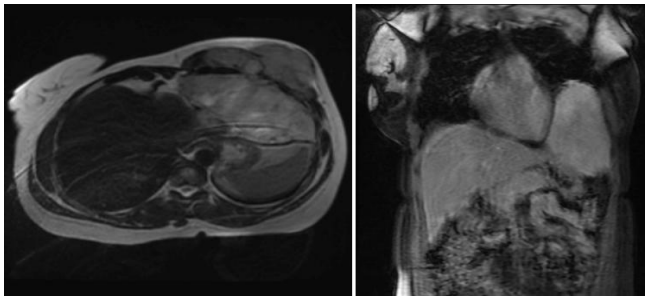

Figure 4: Thoracic magnetic resonance imaging (MRI) T1 sequence showing a tissue mass measuring 146 x 121 x 124 mm on the left anterior thoracic wall enveloping the anterior arches of the 6th, 7th and 8th left ribs, described as hypointense on T1 with heterogeneous enhancement after contrast injection

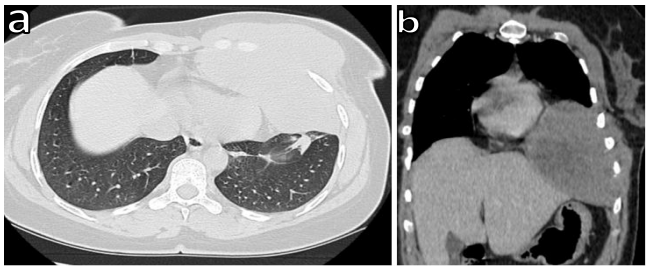

Figure 5: Thoracic computed tomography in parenchymal window (A) and mediastinal window (B) showing a tumor mass of the left thoracic wall measuring 15 cm along its longest axis eroding the anterior arches of the 7th and 8th left ribs, and displacing the diaphragm and pericardium without signs of infiltration

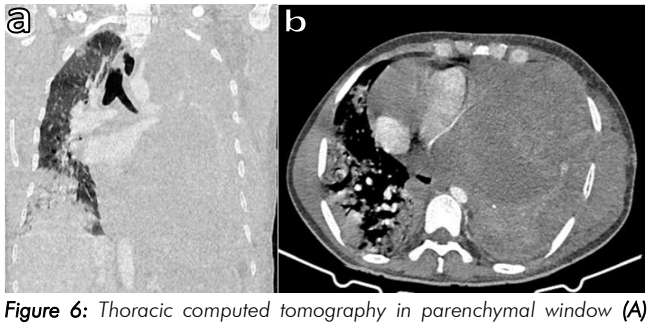

Figure 6: Thoracic computed tomography in parenchymal window (A) and mediastinal window (B) showing a tumor mass in the left posterior basis thoracic region that is predominantly cystic, measuring 133 x 107 x 80 mm, as well as a second lobulated adjacent posterior basis thoracic mass, measuring 98 x 97 x 81 mm enhanced after contrast injection. Also revealed is unilateral pleural thickening associated with the multifocal basis thoracic masses, likely indicative of local recurrence

Table 1: Characteristics of Solitary fibrous tumor cases

Case Number	Patient Age (years)	Patient Sex	Smoking History	Initial Symptoms	Clinical Findings	Imaging Results	Diagnosis	Treatment	Surgical Details	Outcome
Case 1	64	Female	No	Dyspnea	WHO performance status 0, oxygen saturation 92%	Tumor mass in left lower lobe, mediastinal and axillary lymphadenopathy	Solitary fibrous tumor	Recommended surgery; lost to follow-up		Lost to follow-up
Case 2	62	Male	Yes	Isolated productive cough	WHO performance status 0, oxygen saturation 93%	Large mass in right pleura, 175 mm, homogeneous enhancement	Solitary fibrous tumor	Recommended surgery; and adjuvant chemotherapy	Complete en bloc tumor resection	Lost to follow-up
Case 3	79	Female	No	Stage II dyspnea, dry cough, unquantified weight loss	WHO performance status 0, oxygen saturation 98%	Circumscribed mass in left lower lobe, mass effect on mediastinum	Solitary fibrous tumor	Recommended surgery; lost to follow-up		Lost to follow-up
Case 4	32	Male	No	Stage III dyspnea, productive cough, hemoptysis	Oxygen saturation 95%, absence of breath sounds on left	Cystic mass 133 x 107 x 80 mm, pleural thickening	Solitary fibrous tumor	Surgery	Tumor excision and decortication	Died following cardiorespiratory arrest
Case 5	32	Female	No	Progressive dyspnea, parietal swelling	WHO performance status 3, large left chest mass Indurated, painful mass on left parietal region	Left pleural effusion, hypodense nodular mass, 133 mm	Solitary fibrous tumor	Recommended surgery; and adjuvant chemotherapy	Complete excision of the tumor, Negative surgical margins	favorable evolution no recurrence or complications

DISCUSSION

Solitary fibrous tumors (SFT) are rare mesenchymal neoplasms that are localized primarily in the pleura, but that may also occur in other areas, such as the lungs and peritoneum. SFTs account for approximately 5% of all pleural tumors, with an estimated malignancy risk of 10–20% (1). Around 900 cases have been documented in the literature since 1931. While most SFTs exhibit benign histological features and show no tendency for recurrence following complete surgical resection, their biological behavior can vary widely, and SFTs that are at first benign may transform into malignant solitary fibrous tumors (MSFTs) over time (6).

Pleural tumors are predominantly secondary lesions, with adenocarcinomas, squamous cell carcinomas and melanomas being the most common types. Primary tumors of the pleura can differ considerably in terms of their morphology, histology, clinical presentation and radiological features. WHO (2021) categorizes such tumors into three main groups: mesothelial tumors, lymphoproliferative tumors and mesenchymal tumors. Among the mesenchymal tumors, SFTs belong to the fibroblastic tumor subset, and typically occur in patients aged 40 years and older with a sex ratio of 1:1. Their etiology remains unknown, with no established association with tobacco or asbestos exposure (7).

Benign solitary fibrous tumors (SFTs) typically develop slowly and often remain asymptomatic, often being discovered incidentally during imaging examinations. Possible symptoms include chest pain, chronic cough and dyspnea, with chest pain being the most common complaint. (8).

In contrast, malignant solitary fibrous tumors (MSFTs) tend to present earlier with severe symptoms related to their rapid growth and invasive nature, such as exacerbated chest pain, hemoptysis and respiratory failure. Studies report symptoms to be present in 58–75% of patients with MSFTs. (8)

Computed tomography (CT) with contrast enhancement remains the optimal reference examination for the characterization of the nature of the lesion. A standard CT scan can determine the size and location of the tumor, while multi-slice CT can be used for three-dimensional reconstruction, aiding in the better characterization of the internal structure and boundaries of the lesion. This information is essential for the differentiation of benign and malignant tumors, and for the creation of treatment plans. Enhanced CT can also identify the feeding arteries of the tumor, thus facilitating diagnosis and guiding surgical procedures (1).

Magnetic resonance imaging (MRI) is a valuable tool for distinguishing between solitary fibrous tumors (SFTs) and pleural effusions, and for assessing their relationships with adjacent structures. SFTs exhibit mixed intensity signals with low to intermediate intensity on T1-weighted images (T1WI) and heterogeneous hyperintensities on T2-weighted images (T2WI) in necrotic areas. Under contrast, there is marked and uneven enhancement, however, past studies have suggested that MRI cannot reliably distinguish malignant solitary fibrous tumors (MSFTs) from

benign lesions, except in cases with obvious signs of invasion (1).

Solitary fibrous tumors of the pleura (SFTP) are diagnosed based on anatomopathological examinations. Macroscopically, these tumors can reach sizes of up to 30 cm and are classified as giant when they measure at least 15 cm or occupy more than 40% of a hemithorax (9).

Histologically, SFTs exhibit hypo- and hypercellular areas with spindle-shaped cells and branching capillaries, and a low number of mitoses is typically observed (< 3 mitoses/mm^2) without atypia or necrosis. Immunohistochemistry, particularly positive staining for STAT6, is essential for the confirmation of diagnosis (10).

Patients with SFTs should be managed in specialized centers with experience in oncological thoracic surgery (9). Surgery remains as the only validated and recommended treatment, and may be combined with postoperative radiotherapy.

In inoperable cases, treatments such as radiotherapy, chemotherapy, targeted therapy and immunotherapy may be considered on a case-by-case basis, while asymptomatic tumors in patients with significant comorbidities or advanced age may benefit from therapeutic abstention.

The surgical treatment of solitary fibrous tumors of the pleura (SFTPs) and their malignant forms (MSFTs) relies on complete tumor resection, being the primary factor influencing prognosis. The goal is to achieve a negative margin while preserving pulmonary parenchyma. The choice of procedure depends on the size, location, the relationship of the tumor with adjacent tissues, and the overall health of the patient.

Pedunculated tumors are generally treated with wedge resections, while sessile or large tumors may require lobectomy or pneumonectomy. Video-assisted thoracoscopic surgery (VATS) is recommended for pedunculated tumors smaller than 5 cm due to its postoperative advantages, however, thoracotomy remains the standard approach to MSFTs or invasive tumors.

Preoperative preparation, including tumor embolization or ligation of the vascular pedicle, is recommended for highly vascularized tumors to reduce the risk of bleeding. Reconstruction of the thoracic wall may be necessary after resection to restore thoracic morphology (11).

Adjuvant radiotherapy is recommended for patients with close surgical margins (R1/R2) or those with high-risk SFTPs, allowing for better local control of the disease, although its benefit on overall survival has yet to be clarified. In the event of local recurrence, surgical resection is preferred if the patient is eligible, or if R0 resection is not possible, adjuvant radiotherapy can be considered as an alternative (5,12).

Neoadjuvant chemotherapy based on anthracyclines is an option for locally advanced tumors when R0 resection is not feasible. In cases of synchronous pulmonary metastases or extra-pulmonary disease, systemic treatment has been proposed, although supporting data are limited and past results have often been contradictory.

Adjuvant chemotherapy with anthracyclines as a first-line treatment offers an objective response rate of 0–20%, with disease stability achieved in 26–65% of cases (6).

SFTPs, being highly vascularized, exhibit strong expressions of the proteins involved in angiogenic pathways such as PDGFR and VEGFR. Anti-angiogenic agents such as Sunitinib, Sorafenib and Pazopanib have shown prolonged disease control in case studies, leading to their use to be recommended following chemotherapy failure (14).

Immunotherapy for the treatment of high-grade solitary fibrous tumors of the pleura (SFTPs) has shown promise, with several cases of partial responses reported following anti-PD1 or PD-L1 treatments. A phase III trial is currently underway comparing Nivolumab/Ipilimumab with Pazopanib in patients with advanced sarcomas, including SFTPs.

Surgical resection remains the primary treatment modality, often combined with postoperative radiotherapy, as the only validated treatment, confirming the prognostic benefit of R0 resection.

In cases in which resection is not feasible, treatments such as radiotherapy, chemotherapy, targeted therapy and immunotherapy may be considered on a case-by-case basis, although these alternatives should be considered only after surgical resection has been ruled out. This approach reflects the complexity of managing SFTs and underscores the importance of tailoring the treatment to the individual patient characteristics.

The prognosis for benign SFTs is generally favorable, with a 5-year overall survival rate of 100% among patients with benign tumors (13). It should be noted, however, that local recurrences and malignant transformations can occur with a 10-year recurrence rate of between 10% and 25% that can generally be attributed to incomplete resection (14). For MSFTs, the survival rate is significantly lower, with disease-free survival and overall survival rates at 5 years of 58.3% and 66.7% reported, respectively. The surgical approach also affects outcomes, with VATS yielding a 10-year overall survival rate of 96.3% compared to 78.4% for thoracotomy. Tumors of the visceral pleura typically have better survival rates than those of the parietal pleura (15).

SFTPs are generally localized masses, and are often benign, however, a subset (10% to 30%) exhibits aggressive behavior, with local or systemic recurrences.

The risk of recurrence in solitary fibrous tumors of the pleura (SFTPs) is associated with several factors:

• Histological Factors: Hypercellularity, high mitotic figures, nuclear pleomorphism, as well as hemorrhage or tumor necrosis increase the risk of recurrence.

• Macroscopic Characteristics: Tumors with a sessile morphology, size greater than 10 cm, and a parietal pleural origin are also implicated.
• Clinical Factors: Symptomatic presentation, the presence of pleural effusion, incomplete resection and advanced age are among the aggravating factors.
• Immunohistochemical Criteria: High Ki67 proliferation index and overexpression of p53 contribute to assessments.
• Genetic Factors: Specific NAB2-STAT6 fusions are relevant when evaluating recurrence risk (6).

Follow-up for the identification of solitary fibrous tumors of the pleura (SFTPs) is crucial, especially for malignant forms, which have a recurrence rate of up to 54%. Recurrences primarily occur within the first 2 years, although such cases have been reported 17 years after surgery. Metastases mainly affect the liver, central nervous system and other organs (16).

There are currently no specific treatment recommendations, however, the National Comprehensive Cancer Network (NCCN) advises the strict follow-up of cases of malignant SFTP. Rigorous follow-up is essential for the adaptation of treatments and the improvement of clinical outcomes (17). Unfortunately, three of the five cases presented here were lost to follow-up, while of the remaining cases that were added to a follow up program, one died due to a pulmonary infection.

CONCLUSION

Our findings reinforce the importance of long-term surveillance, as recurrence can occur even years after the initial resection, particularly in aggressive cases. Among the five presented cases, three were lost to follow-up limiting our ability to assess their long-term outcomes. However, the aggressive nature of some cases, particularly Case 5, aligns with previous studies reporting a 10–25% recurrence rate, despite complete resection, underlining the need for clinicians to remain vigilant and proactive post-treatment.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - R.A., K.A.S., M.K.A., L.S., M.S., E.M., B.A., S.M., M.C.B., B.A.; Planning and Design - R.A., K.A.S., M.K.A., L.S., M.S., E.M., B.A., S.M., M.C.B., B.A.; Supervision - R.A., K.A.S., M.K.A., L.S., M.S., E.M., B.A., S.M., M.C.B., B.A.; Funding - R.A., B.A.; Materials - R.A., B.A.; Data Collection and/or Processing - R.A.; Analysis and/or Interpretation - R.A., B.A.; Literature Review - R.A.; Writing - R.A.; Critical Review - R.A., L.S., M.K.A, M.S., E.M., B.A., S.M., B.A.

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