Solitary Fibrous Tumor of the Orbit

Is it Rare? Report of a Case Series and Review of the Literature

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Purpose: The real incidence of solitary fibrous tumor (SFT) of the orbit is unknown, but it seems that since it was first described in 1994, orbital SFT has been increasingly recognized. We believe that the orbital SFT is a relatively common tumor and that it should be considered in the differential diagnosis of any orbital tumor.

Design: Interventional case series.

Participants: Four new cases of orbital SFT.

Methods: Four patients affected by solitary fibrous tumor of the orbit are described. One patient experienced a recurrent SFT shortly after initial surgical excision performed elsewhere. Thirty-eight cases have been reported in the literature in 7 years.

Results: The number of orbital SFTs reported has been increasing, reaching an average of more than five tumors reported per year. Since the first orbital SFT was described in 1994, 37 cases have been reported in the literature. We add four new cases in our series, including a recurrent tumor. A total of 42 cases have now been described, eight with recurrences. Malignant transformation occurred in one case.

Conclusions: We believe that before 1994, the diagnosis orbital SFT was confused with other benign orbital tumors, such as fibrous histiocytoma and hemangiopericytoma because of a lack of use of immunohistochemical techniques. This entity should now be considered relatively common and should be included in the differential diagnosis of orbital tumors in any age group. Local recurrences of SFT are possible and usually follow an incomplete initial excision. Recurrent tumors in the orbit have shown the tendency to infiltrate the surrounding tissues and the bone, rendering complete secondary excision more difficult. Recurrent orbital SFT also has the potential for malignant transformation. The treatment of choice of orbital SFT is complete surgical excision and careful follow-up. Considering the more aggressive course followed by recurrent tumor, correct diagnosis and management is essential. *Ophthalmology 2003;110:1442–1448 © 2003 by the American Academy of Ophthalmology.*

Solitary fibrous tumor (SFT) is considered a rare tumor of the pleura, pericardium, and mediastinum that tends to affect predominantly older patients between the fourth and seventh decade of life. Only recently has it been recognized in extraserosal locations such as lung, liver, nasal and paranasal sinuses, thyroid, parotid and salivary glands, spine, and orbit. Since Westra et al[1] described two cases of orbital SFT in 1994 along with the distinctive histologic and immunohistochemical characteristics that define this lesion, 38 cases, including our series, have appeared in the literature.[2–24] Recently, ophthalmologists, pathologists, neurosurgeons, and otolaryngologists have recognized this tumor and have reported its characteristics, increasing our understanding of its behavior. Seven cases of recurrent orbital SFT have been reported,[2–5,23] and the single most important factor in predicting recurrence is initial incomplete excision. Orbital solitary fibrous tumor can affect young patients, can be localized anywhere in the orbit, and tends to pursue an indolent course. We report four cases of orbital SFT, including a tumor that recurred shortly after incomplete surgical excision.

Patients and Methods

Four patients sought treatment for a unilateral orbital mass and were treated successfully with surgical excision by three of the authors (CDC, RCK, and FPB); one case was a recurrent tumor occurring after incomplete initial excision. Before surgery, a be-

Figure 1. Patient 1. **A,** Medial right lower eyelid mass. **B,** Anterior orbitotomy via infraciliary incision revealing the solid, well encapsulated, red tumor.

nign lesion was suspected in all four cases, but orbital solitary fibrous tumor was not included in the preoperative differential diagnosis. The final diagnosis relied on the distinctive histologic pattern and immunohistochemical staining.

Case Reports

Patient 1

A 27-year-old white man had a 1-year history of an expanding mass in the medial aspect of the right lower eyelid (Fig 1). On examination, pupils, Extraocular muscle (EOM) examination results, and visual acuity were normal. An anterior orbital mass was palpable through the medial one third of the right lower eyelid and was oval, well delineated, mobile, and separate from the surrounding orbital tissue. Retropulsion and Hertel exophthalmometry results were unremarkable, but the globe was slightly displaced upward (1–2 mm). Past medical history was otherwise unremarkable; complete blood count and chest radiograph were within normal limits. An anterior orbitotomy was performed via an infraciliary incision. At the time of surgery, the 2.2-cm mass was well encapsulated, solid, and red (Fig 1). The lesion was excised in an en bloc fashion. Histologically, the tumor was well demarcated and composed of spindle-shaped cells with uniform nuclei and finely dispersed chromatin without conspicuous nucleoli (Fig 2). Cellularity varied from area to area; some areas showed foci of myxoid matrix. The vascular component was prominent with dilated blood vessels. No necrosis or mitoses were present. Immunohistochemical staining revealed strong and diffuse positivity for CD34, vimentin, and BCL2, whereas actin, Epithelial membrane antigen (EMA), desmin, and K11 stains were negative (Fig 2). The findings were consistent with the diagnosis of orbital SFT. No recurrence was noted at 1-year follow-up.
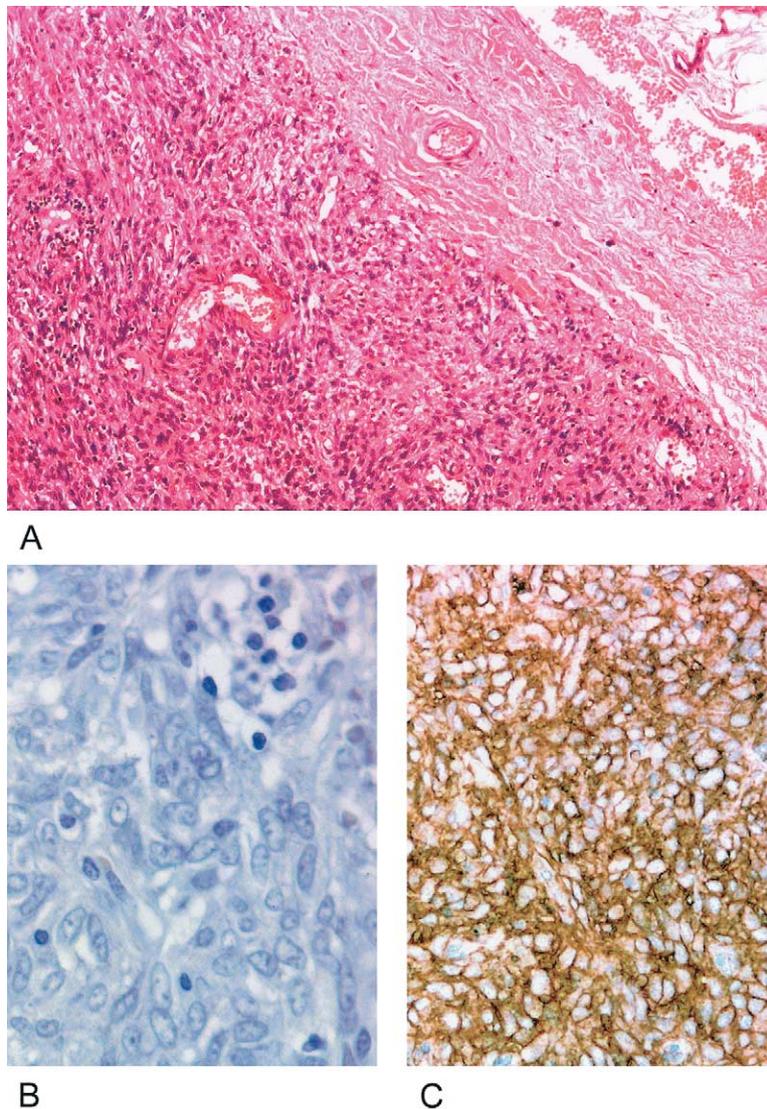
Patient 2

A 56-year-old woman had a history of fullness in the left upper eyelid and epiphora; a left orbital mass was discovered incidentally on computed tomography scanning that was performed as a routine follow-up because of her previous thyroid carcinoma: past medical history revealed that the patient had undergone total thyroidectomy 12 years previously for thyroid carcinoma. Since then she had been receiving thyroid replacement therapy and had been free of recurrence. A pulmonary biopsy performed 6 years before presentation disclosed an isolated pulmonary sarcoid nodule. The remainder of

her review of systems was unremarkable. Complete blood count and chest radiograph results were within normal limits. Ophthalmic examination revealed mild proptosis of the left eye, increased resistance to retropulsion, but no palpable mass (Fig 3). Dye disappearance testing showed delay in the passage of 2% fluorescein from the left lacrimal system. Irrigation resulted in reflux on the left side, suggesting that the mass had caused compression of the left lacrimal outflow system (Fig 3). A magnetic resonance imaging scan showed a well-encapsulated mass between the lacrimal sac and the medial rectus muscle on the left side, extending behind the equator of the globe (Fig 4). Computed tomography scans revealed no signs of bony erosion or globe indentation. Before surgery, a cavernous hemangioma of the orbit was suspected and an anterior orbitotomy via a transcaruncular approach was planned. During surgery, the mass appeared well delineated from the surrounding tissue, and although fairly posterior, it was possible to dissect it free and excise it entirely. Histopathologic examination established an initial diagnosis of hemangiopericytoma based on light microscopic findings (Fig 5). Subsequent immunohistochemical studies of the tumor revealed positive CD34 and BCL2 staining and negative actin and collagen type IV reactivity, consistent with a diagnosis of orbital SFT (Fig 5). The patient was free of recurrence at the 5-month follow-up.

Patient 3

A 37-year-old man had a 6-month history of proptosis of the left eye. Ophthalmic evaluation revealed normal visual acuity and normal pupil examination; extraocular motility examination showed limited up-gaze in the left eye, but the patient did not report double vision. Hertel exophthalmometry showed 5 mm of proptosis in the left eye. A slightly increased resistance to retropulsion was identified by palpation, but no mass was palpated. No choroidal folds were noted by indirect funduscopic ophthalmoscopy. The patient's past medical history was otherwise unremarkable; complete blood count and chest radiograph results were within normal limits. Computed tomography scans revealed a well-delineated extraconal mass affecting the superolateral aspect of the orbit. The lesion appeared to be medial to the lacrimal gland but separate from it. No signs of bony erosion or globe indentation were visible. An anterior orbitotomy via an upper eyelid crease approach was performed and a round, encapsulated 2.2-cm mass was completely excised. Immunohistochemical staining revealed an intense and diffuse positive reaction to CD34 and vimentin, but a negative reaction to CD31, EMA, and KP-1. The diagnosis was consistent with solitary fibrous tumor with a hemangiopericytoma-

Figure 2. Patient 1. Microscopic features of the tumor. **A,** Spindle to ovoid-shaped cells interspersed with irregular vascular channels (stain, hematoxylin–eosin; original magnification, ×50). **B,** Immunohistochemical staining, Desmin negativity (original magnification, ×200). **C,** Immunohistochemical staining, BCL2 positivity (original magnification, ×200).

like pattern. The patient was free of recurrence when examined 3 months after surgery.

Patient 4

A 61-year-old white man was referred for a recurrent mass in the right superior orbit, causing blepharoptosis. An orbital tumor had been removed 2 years earlier at another institution but recurred shortly thereafter with progressive enlargement. Histopathologic examination of the tumor was consistent with a fibrous tumor, with positive immunohistochemical reactivity to CD34, but the diagnosis of SFT was not made. On referral, external examination revealed an indurated mass in the medial aspect of the superior orbit, causing 2 mm of right upper eyelid ptosis. Pupil examination, visual acuity, EOM, and Hertel exophthalmometry results were unremarkable. The mass was palpable through the right upper eyelid and seemed to be adherent to the periostium of the superior orbital rim. The patient's past medical history was otherwise

Figure 3. Patient 2. Mild proptosis of the left eye. Dye disappearance test delayed on the left side.
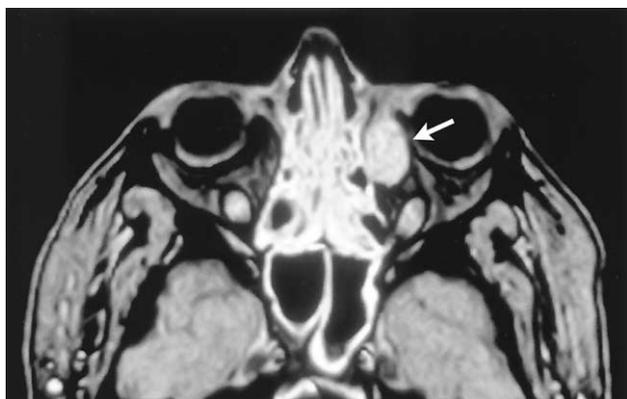
Figure 4. Patient 2. Magnetic resonance imaging scan showing a well-encapsulated mass (arrow) between the lacrimal sac and medial rectus muscle.

unremarkable; systemic work-up, which included complete blood count and differential and chest radiograph, was within normal limits. Computed tomography scans revealed an orbital mass in the region of the trochlea, ill-defined and adherent to the bone of the orbital rim but not eroding it.

An anterior orbitotomy was performed via an upper eyelid crease approach. The mass was promptly visualized, and it appeared to be anterior to the trochlea and adherent to the superior orbital rim medially. An en bloc (as in Case 1) excision of the tumor was performed and a gray-red mass, approximately 1.3 cm in diameter, was excised. The underlying bone of the superior orbital rim was remodeled, but not infiltrated, by the tumor. Histopathologic examination of the tumor along with positive immunohistochemical reactivity to CD34 was consistent with a diagnosis of an orbital SFT (Fig 6). The patient is free of recurrence 1 year after surgery.

Discussion

Solitary fibrous tumor is a spindle-shaped cell neoplasm, that has been described on the mesothelial surfaces of pleura and mediastinum. Originally, this entity was thought to be of mesothelial origin and was referred to as a "localized mesothelioma." More recently, this tumor has been described in many extraserosal sites, such as lung, liver, paranasal sinuses, and orbit, where no mesothelial lining exists, thus supporting a fibroblastic origin. Solitary fibrous tumor should be differentiated from other spindle-shaped cell tumors occurring in the orbit, such as fibrous histiocytoma, hemangiopericytoma, meningioma, and schwannoma, all of which present in a similar fashion. Westra et al[1] differentiated SFT from other spindle-shaped cell tumors arising in the orbit on the basis of the typical light microscopic appearance and the strong CD34 immunohistochemical reactivity of these tumors. According to Westra's observations, the classic histopathologic features of SFT are thick bands of collagen, alternating hypercellular and hypocellular areas, and a hemangiopericytoma-like pattern of vascularity.[1] The use of immunohistochemical markers and patterns of reactivity can be a very useful tool in diagnosing solitary fibrous tumor. Although the light microscopic appearance of the tumor is key to differentiating SFT from other orbital

neoplasms, both positive and negative reactivity of various immunohistochemical markers can solidify a diagnosis.[25–29] Solitary fibrous tumor shows strong and diffuse positivity with vimentin, BCL2, and CD34 and negativity with keratin, cytokeratin, epithelial membrane antigen, S100, smooth muscle actin, and desmin.[25] Smooth muscle tumors such as leiomyoma and leiomyosarcomas show strong positivity for smooth muscle actin and desmin and negativity for S100, BCL2, and CD34,[25,26] Neural tumors such as schwannoma and neurofibroma can show focal positivity for BCL2 and CD34. They show strong positivity for S100 protein.[25,27] Reactive conditions such as nodular fasciitis also are negative for BCL2 and CD34.[25] Solitary fibrous tumor, fibrous histiocytoma, and hemangiopericytoma all show positive reactivity with vimentin, BCL2, and CD34, although to varying degrees.[25,28,29] Fibrous histiocytoma shows focal positivity for BCL2 or CD34. In addition, it also shows intense staining with various keratins and alpha-1-antichymotrypsin, properties not shared by SFT.[25,28] It is the strong and generalized CD34 immunoreactivity of SFT that differentiates this tumor from hemangiopericytoma, which has a similar histologic pattern but has weak and patchy CD34 immunohistochemical positivity.[1]

Solitary fibrous tumor of the pleura and mediastinum can exhibit aggressive behavior, with invasion of the surrounding tissue, local recurrences, and distant metastases. In the orbit, SFT usually follows a more indolent course and is cured by complete excision. Incomplete excision, however, results in a higher recurrence rate and carries a potential for malignant transformation. Recurrent orbital tumors have the tendency to spread locally and to invade the surrounding tissues, including orbital bone, rendering complete reexcision more difficult. We report one patient (patient 4) affected by orbital SFT that recurred shortly after surgical excision performed elsewhere. Despite the fibrous nature of the tumor and its characteristic CD34 positivity, the diagnosis of SFT was not made initially. We suspect that the recurrence in this case was the result of an incomplete surgical excision. This is based on the short time course to recurrence and the fact that the patient felt the persistence of an indurated mass immediately after the first surgery. At the time of repeat surgery performed by one of the authors (CDC) 2 years later, the tumor was believed to be completely excised, despite the adherence of the tumor to the surrounding tissues induced by the cicatricial reaction after the original surgery. This finding was confirmed by a repeat computed tomography scan 2 weeks after surgery that showed the mass to be completely excised. At the 6-month follow-up visit after the second surgery, the patient showed no signs or symptoms of recurrence. Patients 1 and 3 were treated primarily with complete excision, and both patients remain recurrence-free after surgery. Patient 2 was managed with complete excision and, 1 month after surgery, was free of recurrences. It is interesting to note that the appropriate diagnosis would not have been made if the specimen had not been submitted for immunohistochemical staining.
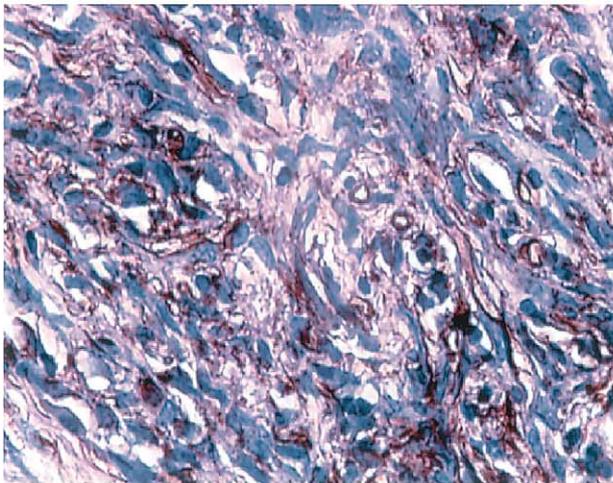
Since Westra et al's[1] definition in 1994, it appears that pathologists are more familiar with the diagnosis of SFT. It should be kept in mind that these lesions can affect any orbital space, including the lacrimal gland fossa and intra-
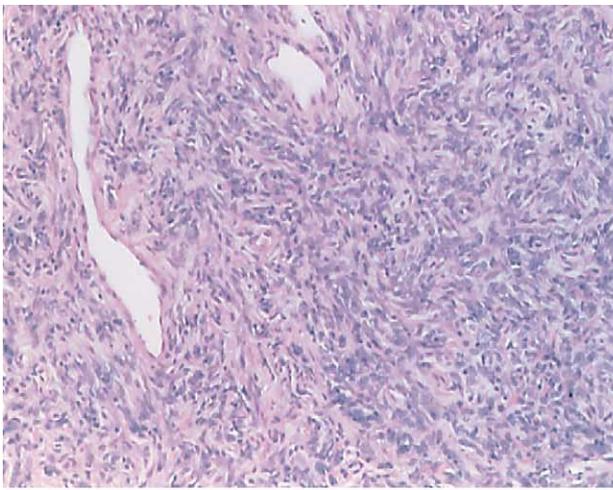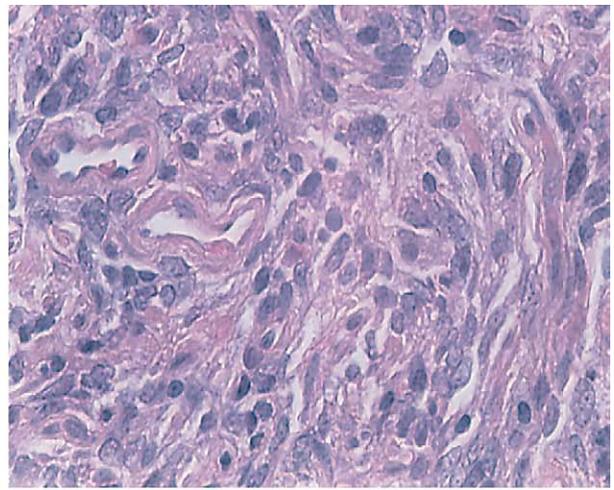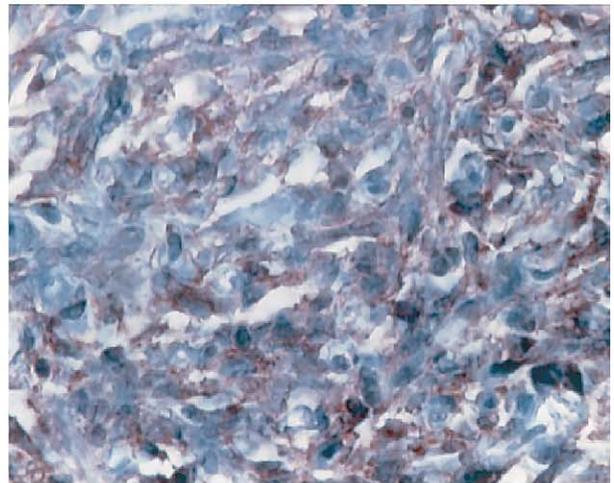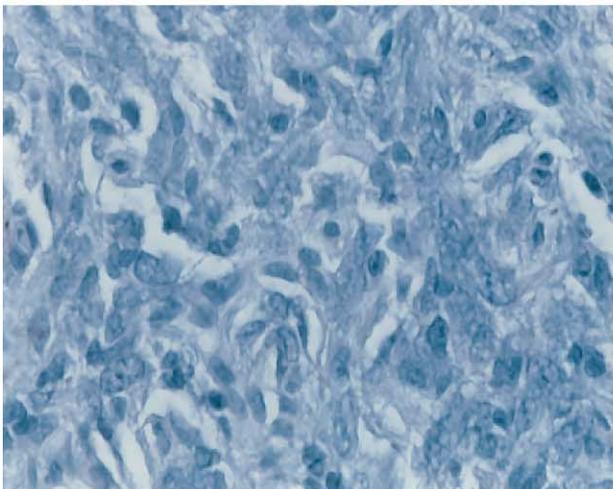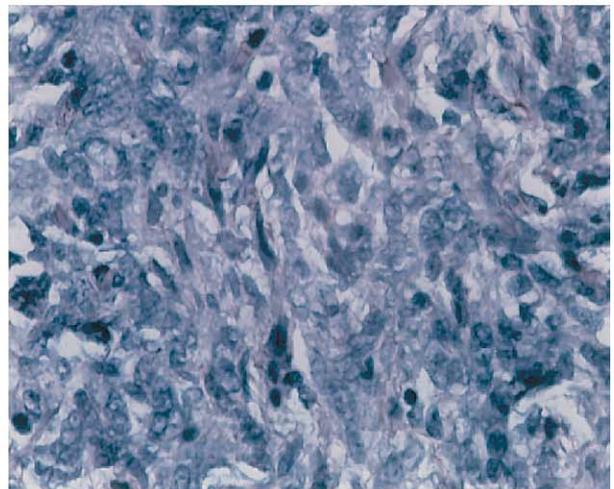
Figure 5. Patient 2. Microscopic features of the tumor. **A, B,** Spindle to ovoid-shaped cells with uniform nuclei and ill-defined cytoplasm. Some irregular vascular channels are present. No mitoses are present (stain, hematoxylin-eosin; original magnification, ×50 for A, original magnification, ×200 for B. *A = ×50; *B, C, D, E, F = ×200). **C,** Immunohistochemical staining, CD34 positivity (original magnification, ×200). **D,** Immunohistochemical staining, BCL2 positivity (original magnification, ×200). **E,** Immunohistochemical staining, actin negativity; (original magnification, ×200). **F,** Immunohistochemical staining, collagen type IV negativity; (original magnification, ×200).
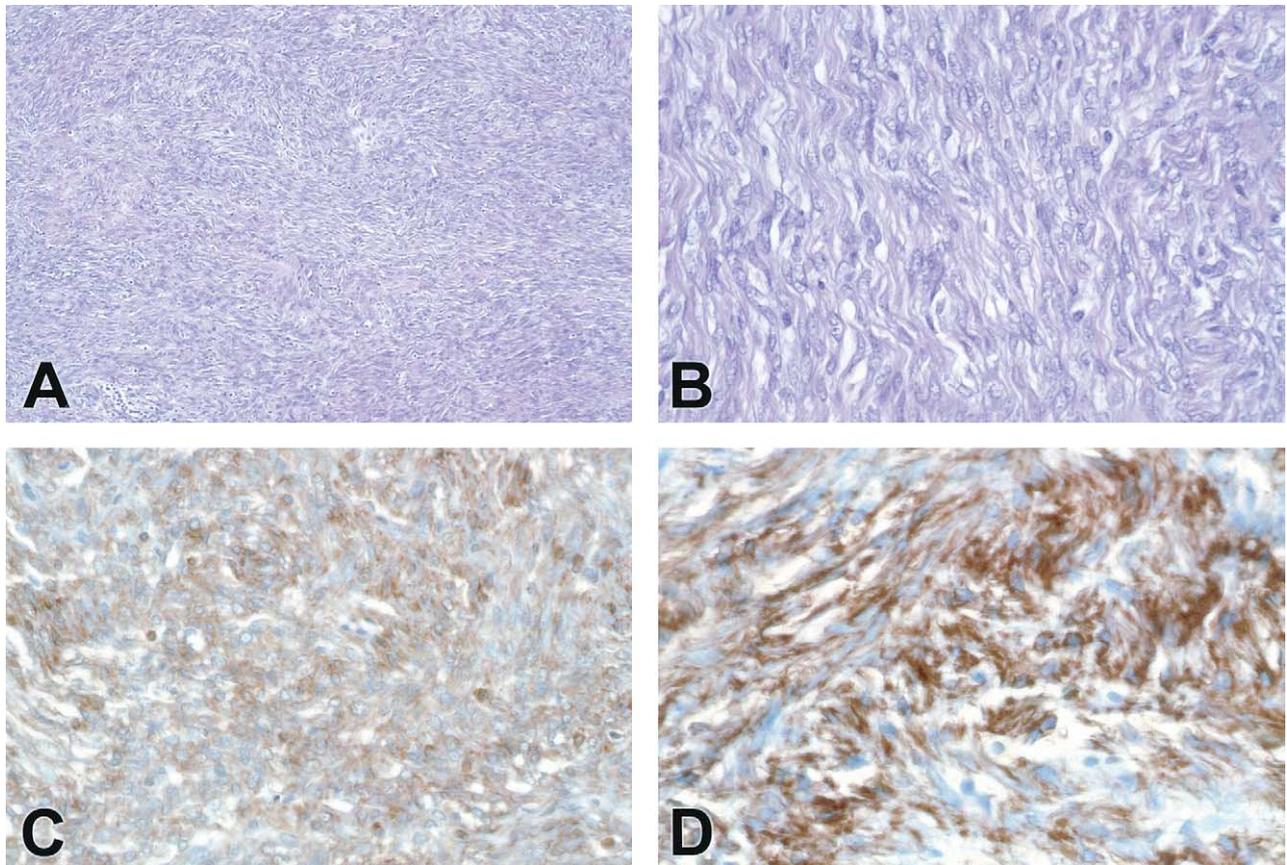
Figure 6. Patient 4. Microscopic features of the tumor. **A, B,** Spindle to ovoid-shaped cells with uniform nuclei and ill-defined cytoplasm. No mitoses are present (stain, hematoxylin–eosin, **A,** original magnification, ×25; **B,** original magnification, ×100). **C,** Immunohistochemical staining, CD34 positivity (original magnification, ×100). **D,** Immunohistochemical staining, BCL2 positivity (original magnification, ×100).

conal or extraconal space. In the vast majority of reports, SFT has had a benign and indolent course, with no tendency for distant metastases. The treatment of choice is enbloc excision of the tumor and careful follow-up. Six cases of orbital solitary fibrous tumor have been reported to recur, including our patient 4. In four cases, the recurrence was believed to be secondary to incomplete excision at the time of the initial surgery. One case of SFT recurred three times after excision and underwent malignant transformation. The histopathologic examination of the specimen from the second recurrence showed a higher mitotic count, but it is not possible to know if it was excised completely the first two times.

In conclusion, SFT should be included in the differential diagnosis of benign orbital tumors. We believe that this tumor is more common than previously suspected and that before Westra et al's[1] landmark article, many orbital solitary fibrous tumors were probably misdiagnosed. Orbital SFT can be identified and differentiated from other spindle-cell tumors that can arise in the orbit on the basis of the combination of the typical histologic pattern and the strong and generalized CD34 positivity. It can grow anywhere in the orbit, and although it is more commonly seen in middle-aged patients, it can also affect young children.[24] Local recurrences and malignant transformation are possible and relate to incomplete initial excision or an aggressive histologic pattern of the tumor. The vast majority of recurrent orbital tumors reported have shown the tendency to spread into the surrounding tissues and orbital bone, rendering complete secondary excision more difficult if another surgical procedure is required.

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