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Original Article

Inflammatory myofibroblastic tumor of the orbit: A clinico-pathological study of 25 cases

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Abstract

Background: Inflammatory myofibroblastic tumor (IMT) is a rare entity characterized by the presence of myofibroblasts and inflammatory cells within a fibrous stroma, which typically occurs in children or young adults. The IMT is considered generally a benign lesion, although about 20% of cases may experience recurrence, and most rarely develop metastasis. Herein, we present the largest series of primary orbital IMT ever reported.
Patients and methods: The clinical records of 25 patients, collected between the 1995 and 2015, with biopsy-proven diagnosis of orbital IMT were retrospectively reviewed to determine demographic, clinical, radiologic and pathological features, management, and outcome.
Results: The study included 13 females and 12 male patients, age ranged from 5 to 76 years. Disease onset was in all cases unilateral (25/25), with posterior location (10/25) or extending anterior to posterior (7/25). The most common signs and symptoms were: proptosis (19/25), ptosis (18/25), diplopia (10/25), periocular swelling (9/25), pain (8/25), redness (7/25). All patients underwent to incisional biopsy which included total or subtotal tumor resection avoiding arming of the adjacent structure, followed by systemic steroid therapy (22/25) or radiotherapy (3/25). The disease recurred in 6 (24%) patients who responded to the subsequent therapy. No one developed metastasis or died because of the disease.
Conclusion: IMT is a distinct entity which may occur in the orbit primarily. It should be considered in differential diagnosis in all orbital masses, particularly with onset of acute or subcronic inflammation. Surgical biopsy associated to a partial debulcking of the tumor, avoiding to damage adjacent vital structure may contribute to improve the outcome. Steroid therapy, seems to be the suitable as first line medical therapy, although, as reported in literature, not all cases respond to this treatment regimen. Radiotherapy, may be considered as an alternative therapy. Recurrences occurred in 24% of patients and may be treated with additional surgical resection and a new course of steroid or radiotherapy. No specific pathological features which may correlate with the prognosis have been found in this series.

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Introduction

Inflammatory myofibroblastic tumor (IMT) or inflammatory pseudotumor is a spindle cell proliferation of disputed nosology.[1] Although the lung is the best known and most common site, inflammatory myofibroblastic tumor occurs in diverse extra-pulmonary sites; the extra-pulmonary location concerns generally young patients between the first and the second life decades.[1–3] Although rare, there are case reports in the literature of IMT in the orbit.[4–11] Herein we report our series of 25 patients with the proven diagnosis of IMT collected in a

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20 years period. To the best of our knowledge this is the largest ever reported in literature on IMT involving solely the orbit.

Patients and methods

The clinical records of 25 patients, collected between 1995 and 2015 at the Orbital Unit of the University of Naples '' Federico II'', with the proven diagnosis of IMT of the orbit have been reviewed retrospectively to obtain patient information, including age, sex, signs and symptoms at the onset, radiologic features, location, clinical course, outcome and management. Clinical data were correlated with histopathologic and immunopathologic findings.

Results

Demographic data, characteristics of disease, management and outcome of each case are presented in Table 1.

Patients ranged in age from 5 to 76 years (mean, 50 years), there was no significant gender predilection. Distribution of the age has been plotted with the VI decade which, turned out to be the most frequent one (Fig. 1).

Disease affected the left eye in 14 patients, the right eye in 11 patients. The superior-lateral quadrants was the most frequent site involved. The mass was considered to be anterior in 6 patients, posterior in 10 patients, diffuse in 9 patients. Data are summarized in Table 2.

Symptoms developed between 20 days and 13 years before initial examination. Duration of the symptoms was longer than 1 month in 16 patients, and acute few days in 2 patients (Table 1).

Proptosis and ptosis were the most common symptoms. Signs and symptoms of inflammation such as periocular swelling, chemosis, redness and pain occurred in 32% up to 40% of cases (Table 2).

Images or detailed reports of examination by computed tomograhy (CT) or magnetic resonance imaging (MRI) were

Table 1. Patients' characteristics.

Patient No	Sex	Age at Onset (y)	Onset Time (month)	Onset Course	Side	Clinical Signs and Symptoms	Visual Acuity (10/10)
1	F	22	6	CHR	Left	Swelling of left superior eyelid, moderate ptosis, moderate proptosis	20/20
2	M	66	2	CHR	Right	Eyelid edema, pain, moderate ptosis moderate proptosis	20/20
3	F	43	2	CHR	Left	Mild proptosis, conjunctiva edema, pain	20/20
4	F	69	4	CHR	Left	Moderate proptosis, diplopia, periorbital edema, diplopia	20/20
5	M	65	5	SA	Left	Moderate proptosis, tearing, diplopia, superior rectus muscle restriction.	20/25
6	M	63	24	CHR	Right	Moderate proptosis	20/200
7	F	68	2/3	SA	Right	Pain, conjunctival redness, moderate proptosis	20/25
8	M	49	1	SA	Left	Moderate proptosis, Severe ptosis, conjunctival redness	20/30
9	F	76	5	AC	Left	Orbital trauma, moderate proptosis, mild ptosis, pain, diplopia, hypofunction of lateral rectus muscle	20/20
10	F	40	4	CHR	Right	Swelling, conjunctival redness, mild proptosis	20/20
11	F	33	2/3	SA	Right	Pain, eyelid edema, mild proptosis, mild ptosis, diplopia	20/20
12	F	58	4	CHR	Left	Mild proptosis, tearing, diplopia	20/20
13	M	34	3	CHR	Right	Edema, pain, mild proptosis, severe ptosis, tearing, diplopia	20/20
14	M	48	3	CHR	Right	Moderate proptosis, mild ptosis	20/20
15	F	73	2	CHR	Left	Swelling of the lacrimal gland, severe ptosis, edema, conjunctival chemosis	20/20
16	M	73	8	CHR	Left	Swelling, pain	20/20
17	M	23	1	SA	Right	Swelling	20/20
18	M	23	2	SA	Left	Mass effect, proptosis, edema, conjunctiva chemosis, diplopia	20/60
19	M	63	1	CHR	Left	Pain, severe ptosis, swelling of lachrymal gland, proptosis, diplopia, hypofunction of the superior rectus muscle	20/20
20	F	58	36	CHR	Right	Swelling, diplopia, mild ptosis, mild proptosis	20/20
21	M	5	1	AC	Right	Eyelid edema, swelling, severe ptosis	20/20
22	F	21	156	CHR	Right	Moderate proptosis, diplopia	20/50
23	M	76	2	SA	Left	Eye displacement, moderate degree ptosis	20/100
24	F	32	4	CHR	Left	Swelling of the lacrimal gland	20/20
25	F	69	2	CHR	Left	Swelling, conjunctival redness and chemosis, edema, severe ptosis	20/20

M: male; F: female; CHR: chronic; SA: subacute; AC: acute.

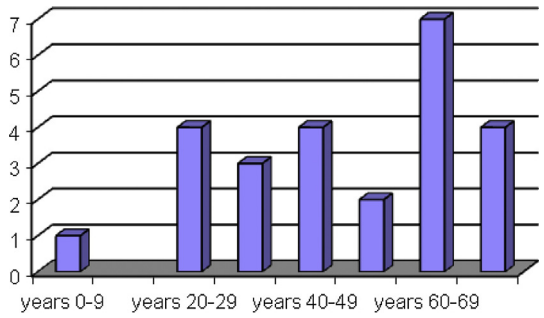

Fig. 1. Age distribution of our cases showing the peak in the sixth decade.

available for all patients: 20 patients underwent CT scan only while 5 had both CT scan and MRI. CT scan showed in all cases a circumscribed mass with or without defined margins, usually isointense with the extraocular muscles (Fig. 2). On MRI the most common feature was of either extraconal or intraconal orbital mass slightly displacing the adjacent structures with or without distinct borders, isointense in T1 and hyper intense in T2. Contrast enhancement with gadolinium was also observed.

All patients underwent to orbitotomy in order to perform and incisional biopsy plus partial or complete (2 cases) debulking of the lesion. Management included administration of systemic steroids in 23 patients plus radiotherapy in 1 patient. Two patients received RT only. Surgical intervention consisted in 14 patients through an anterior orbitotomy, in 9 through lateral orbitotomy and in 2 using a coronal approach. Administration of systemic steroids was the initial treatment in 23 patients, with the initial dose of 1 mg/kg body weight tapered in 6 up to 8 weeks depending upon clinical response. The initial treatment was a low-dose radiotherapy (20c-Gy), for 2 patients, in whom steroid were contraindicated for liver problems. One patient had systemic steroid treatment plus anti-inflammatory radiotherapy after surgical incisional biopsy, because of the lack of response to steroid treatment.

Six patients (24%) had recurrences. All underwent to a surgical intervention aimed to resect as much as possible the lesion avoiding damaging adjacent structure. Four cases received a second course of systemic steroid treatment, one patient received radiotherapy after systemic steroid, one patient after a second course of systemic steroid.

Thirteen patients (52%) had functional sequela. Upper eyelid ptosis occurred in 7 cases (28%), which was successfully surgically repaired in all cases. One patient had lagophthalmos, temporary treated with tarsorrhaphy; one case suffered of diplopia and required surgical intervention; one case experienced recurrent periocular swelling resolved by itself in the long-term follow-up; one case developed a mild enophthalmos (2 mm) probably due to cicatricial tissue, One case had concomitant inflammation of adjacent paranasal sinus without evidence of invasion or secondary mass.

The tumors varied in size between 1 and 2.5 cm and in the larger lesions foci of fibrosis and haemorrhage were observed.

Table 2. Management and prognosis of our cases in relation to the location and extent of the lesions.

Case #	Location	Quadrant	Management	Recurrence	Management of recurrence	F/U	Outcome
1	Anterior/Posterior	Supero-lateral	SA, SS	Yes	SA	5	Moderate ptosis
2	Anterior/Posterior	Supero-lateral.	SL, SS	No		3	Mild Ptosis
3	Anterior/Posterior	Supero-lateral.	SL, RT	No		1	
4	Posterior	Supero-lateral	SL, SS	No		1	
5	Posterior	Supero-medial	SA, SS	No		1	
6	Middle/Posterior	Supero-lateral	SL, SS	Yes	SS, RT		Residual proptosis,
7	Posterior	Supero-medial.	SA, SS				Lagophthalmos:
8	Posterior	Superior	SA, SS			1	
9	Middle/Posterior	Supero-lateral	SL, SS	Yes	SS	1	
10	Posterior	Infero-medial	SA, SS	Yes	SS, SA	23	
11	Posterior	Supero-lateral	SA, SS			1	
12	Anterior/Posterior	Infero-medial	SA, SS			2	Slight limitation of the eye gaze
13	Posterior	Supero-lateral	SL, SS			15	Mild Ptosis
14	Anterior/Posterior	Supero-lateral	SL, SS			3	Mild Ptosis
15	Anterior/Posterior	Supero-lateral	SC, SS	Yes	SS.	2	Moderate Ptosis
16	Anterior	Superior	SA, SS				Inflammation paranasal sinus
17	Anterior	Infero-medial	SA, SS			4	Recurrent periocular swelling resolved by itself with time
18	Posterior	Superior	SA, SS			1	
19	Anterior/Posterior	Supero-lateral	SA, SS			1	
20	Posterior	Supero-lateral	SC, RT	Yes	SS, SA	19	After 13 years recurrence located in the lacrimal gland: severe ptosis
21	Anterior	Supero-medial.	SA, SS			2	Dacryops
22	Posterior	Supero-lateral	SL, SS				Diplopia, moderate ptosis
23	Anterior	Superior	SA, RT			1	
24	Anterior	Supero-lateral	SL.SS			1	
25	Anterior	Supero-lateral	SA.SS			1	

SL: surgical lateral orbitotomy; SA: surgical anterior orbitotomy; SC: surgical coronal approach; SS: systemic steroid; RT: radiotherapy.

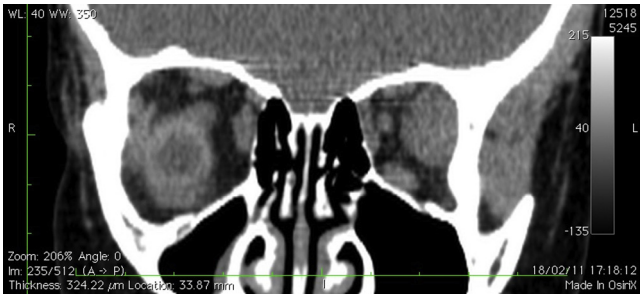

Fig. 2. Coronal CT scan showing circumscribed mass with defined margin located in the supero-temporal quadrant of the left orbit.

Microscopically all the lesions showed fibroblasts and myofibroblasts which made up the spindle cell component, in a fibrous tissue mixed with inflammatory cells, but the relative degree of these components varied considerably.

Plasma cells were usually prominent, but lymphocytes, neutrophils, and macrophages were also often present. The predominant lymphocyte type was the T-cell, and the plasma cells were polyclonal. The spindle cells had a fascicular arrangement or a storiform pattern. The fibroblasts/myofibroblasts showed mild to moderate variation in nuclear size but there was no significant nuclear hyperchromasia or pleomorphism.

Mitotic activity was present but the mitoses had typical forms, and abnormal forms were not present. The nuclei were elongated with modest blunting of the tip. Areas of necrosis and haemorrhage were not observed in all cases No microorganisms were identified using special stains. Immunohistochemical (IHC) stains for lymphoid markers (CD3, CD20) showed the lymphocytes to be a mixture of T and B cells. The plasma cells were polyclonal (κ, λ). The spindle cells were strongly and uniformly positive for vimentin, smooth muscle actin, muscle-specific actin.

Five cases in the present series were characterized by a compact spindle cell proliferation with foci ofluent cellular areas and irregular foci of dense collagen deposition.

Plasma cells were the predominant inflammatory cell type as small aggregates among the spindle cells or more uniformly dispersed in the background (Fig. 3a and b). Most of the spindle cells had the characteristic of myofibroblasts, with the IHC profile of reactivity with vimentin (Fig. 4), smooth muscle actin (SMA) (Fig. 5), and desmin (Fig. 6) and cytokeratin (Fig. 7) in few cases.

Discussion

Inflammatory myofibroblastic tumor is a rare[13] lesion characterized by the proliferation of spindle cells whose etiology and pathogenesis have been highly debated. This lesion has been called inflammatory pseudotumor or plasma cell granuloma, in the past. There was controversy as to whether this tumor is inflammatory or neoplastic, benign or of uncertain behaviour, an independent of or closely related to low-grade inflammatory fibrosarcoma.[14]

IMT has been described for the first time in the lung[1] was subsequently reported in almost all the organs, most commonly occurring in the abdominal cavity, the retroperitoneum, the mediastinum, and less frequently the head and the neck region, including the orbit.[2–10] The majority of cases present in young adulthood and childhood, but there is no clear age predilection. The prior case report of primary orbital IMT describes a subconjunctival mass found in a 10-year-old boy who presented with diplopia and limited ocular motility.[4] Although still more common in children, case reports range in age from 10 to one case in a 78-year-old presenting with both lung and orbital involvement.[3–10] Our series ranged from 5 to 76 years old. The uncommon feature we found in our series is that there is a slightly prevalence in the 6th and 7th decades, differently to the age distribution reported for large series involving other organs.[1–3]

Presentation reported in literature for orbital IMT included proptosis, diplopia, and painless loss of vision.[3–10] The most frequent sign in our series was the proptosis followed by the ptosis. This high incidence of the latter sign is explained by the high incidence of IMT located in the superior quadrants of the orbits, which occurred in 17 of 25 cases. However, is remarkable that the inflammatory signs such as the chemosis, eyelid edema, eyelid redness, pain at rest, occurred from 20% up to 50% of cases indicating the inflammatory nature of the lesions.

It has been reported that bony erosion can be seen with orbital and sino-orbital IMT on CT scan. In our series CT scan generally showed circumscribed, knobby mass with well or not well-defined margins, isodense with the extraocular muscle (Fig. 1). Bony erosion was not noted in our series. MRI appearance for nodular IMT located in the brain has been reported as a nodular dural mass with low SI on T2-weighted MR image, showing homogeneous enhancement with contrast on T1-weighted MR image. In our series MRI generally showed a nodular orbital mass, displacing the adjacent structures with or without distinct margins, isointense in T1 and slightly hyper intense in T2, with gadholinium contrast enhancement.

Overall treatment reported in literature for orbital IMT[3–10] ranged from complete resection, subtotal resection with adjuvant therapy to steroids alone. Cramer et al.[10] reported one patient who underwent partial resection, followed by cryotherapy after a local recurrence. The patient has been followed with repeated MRIs of the orbits every 3 months for 10 months with no further recurrence.

Habib reported a case of orbital manifestation of inflammatory myofibroblastic tumor followed for 12 years who revealed unanticipated behaviour as it incompletely responded to corticosteroid therapy, was initially stable for over a decade, then showed MRI evidence of spontaneous regression.[11] This is the only reported case of regression of IMT found in the orbit. Previous reports suggested that regression may be related to location and to the age/sex of patient, being more common in older and male population, and eventually linked to ALK positivity.[12] The author concluded that conservative management for orbital IMT may be appropriate in selected cases.

In our series the initial orbitotomy aimed primarily to obtain an incisional biopsy suitable for pathological analysis and it was always accompanied by the attempt to resect as much tissue as possible, avoiding damaging the adjacent and vital structures. Complete resection was obtained only in 2 cases, being the remaining incompletely resected. All patients received a course of systemic steroid, but 3 because contraindicated due to a liver failure, received RT at 20 Gy dose.

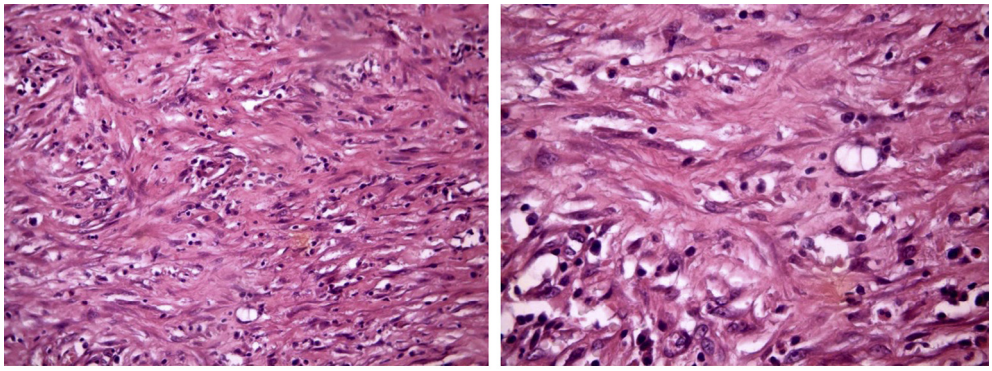

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Fig. 3. (a) The spindle cells with fascicular arrangement. Mitotic activity was present. The nuclei were elongated with modest blunting of the tip. Plasma cells were the predominant inflammatory cell type as small aggregates among the spindle cells or more uniformly dispersed in the background (Original magnification X100. Hematoxylin and Eosin). (b) The histopathological appearance in the same case with higher magnification of the cells (Original magnification X400. Hematoxylin and Eosin).

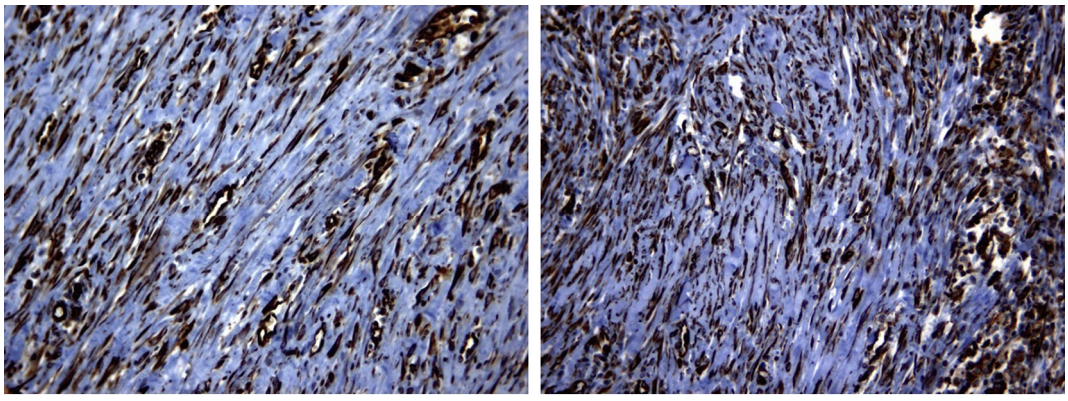

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Fig. 4. a and b Immunohistochemistry of paraffin-embedded IMT tissue using Vimentin Antibody at dilution of 1:1000 – from two different cases with strong expression of vimentin by the proliferating cells (Original magnification × 400 Vimentin).

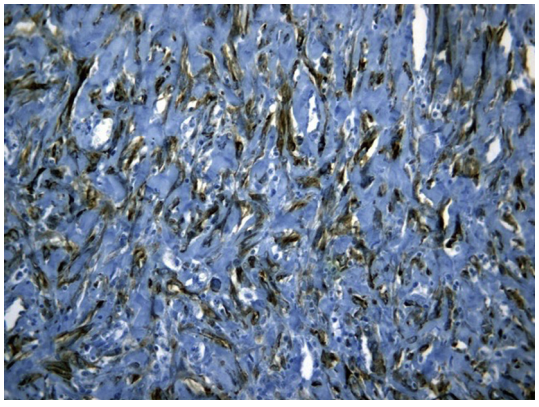

Fig. 5. Immunohistochemical staining of paraffin-embedded IMT tissue using muscle actin antibody- dilution of 1:500. with intense staining for α-smooth muscle actin in all of the cases, thereby indicating that the majority of the cells of the IMT are myofibroblasts (Original magnification × 400 SMA).

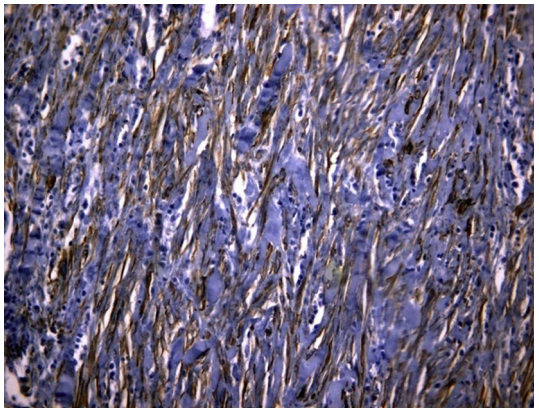

Fig. 6. Immunohistochemistry of the spindle tumor cells showing expression to Desmin, thus supporting our diagnosis (Original magnification × 400Desmin).

Recurrences has been reported up to 37%, particularly in the abdominal cavity.[1–3] In rare cases secondary lesions have occurred in sites generally regarded as metastases (e.g., bone, lung, and brain). In the present series, 6 patients experienced disease recurrence, 4 cases after less than 1 year, 1 after 2 years, 1 after 13 years. Five patients were initially treated with steroids (5/22–22%) and one with radiotherapy (1/3–33%), hence it seems that there is not an actual advantage using one treatment vs another. All patients

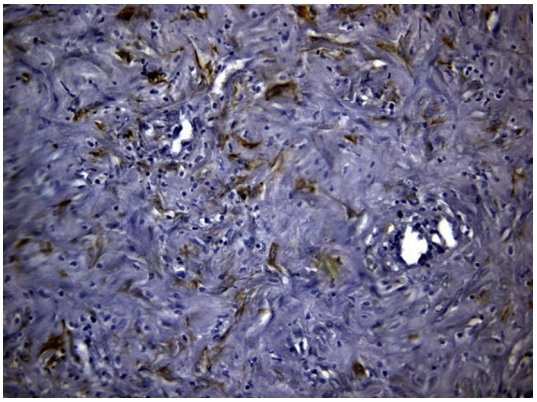

Fig. 7. Focal weaker expression of the spindle tumor cells to cytokeratin (Original magnification × 40 CytoK).

who had recurrence were older than 40 years indicating that younger age might curry better prognosis, although this conclusion should be taken with caution having IMT located in other sites better prognosis in elderly patient rather than the young ones. Interestingly, we have registered one recurrence after 19 years which is the opposite to what was reported for one case of IMT followed for long time that had complete regression after 12 years.[11] The case with regression reported in literature was 7 years at the first presentation, and the case we reported with late recurrence was 40 year old at the onset. Both had partial resection followed by steroid course, our case had also a course of 20 Gy of radiotherapy.

Treatment of the recurrence was in 5 cases of new surgical intervention in the attempt to gain the maximum debulking was possible, followed by a course of systemic steroid. One case instead of the steroid received 20 Gy dose of radiotherapy. No patient had a further recurrence in the follow-up period.

Microscopic evaluation of IMT may show several histologic patterns: a myxoid vascular pattern, with loosely arranged spindle or stellate-shaped cells in myxoid edematous matrix; a compact pattern, with cellular fascicles or storiform bundles; and a hypocellular fibrous pattern, with dense collagen. In our series pathological analysis was able to report the subtype pattern in 10 cases which resulted 5 myxoid and 5 as fibrous pattern. However, regardless of the pattern, the predominant description reported a relatively bland of spindle cell, with scattered lymphocytes, plasma cells, or eosinophils. The spindle cells were generally positive for vimentin, muscle-specific actin, muscle-smooth actin, desmin and in some cases for cytokeratin. There is as yet no valid method to identify the case that may metastasise from those that may not, although any significant degree of atypia should suggest a low-grade sarcoma.[1–3] Actually, in none of the cases of the present series presented any degree of atypia, this result paired with the favourable outcome we registered as well as it was found in the other cases reported in literature of orbital IMT. This may suggest that when this tumor involve this site might have a benign course.

Among the proposed causes are infections (Epstain-Barr virus), trauma, surgical manipulations and radiation therapy.[1–3,14]

The anomalies of Anaplastic Lymphoma Kinase gene (ALK), of p80 gene and translocations involving chromosome band 2p23 are showed in some cases of IMT. This finding may reveal the neoplastic nature of the lesion and it is thought to be associated with a more aggressive behaviour.[15] We were not able to retrieve data on this feature in our series.

In a case report by Mudhar et al., IgG4 was found to be strongly positive in the case of orbital IMT in a 14-year-old male indicating that IgG4 is positive in cases of inflammation apart from IgG4 disease.[16]

The differential diagnosis of IMTs in the orbit includes lesions composed of myofibroblasts and fibroblasts, such as nodular fasciitis; cellular spindle cell lesion follicular dendritic tumor; fibrous lesions, desmoid fibromatosis, and fibrosclerotic lesions which may pose considerable challenges because of their morphological overlap with IMT. When myofibroblasts are set in a loose or myxoid stroma, the histological pattern may be indistinguishable from nodular fasciitis. However, IMT are generally larger than nodular fasciitis, tend to occur in younger age groups, and are composed of longer fascicles of spindle cells in an inflammatory background rich in plasma cells. In contrast, nodular fasciitis usually lacks the striking inflammatory infiltrate characteristically present in IMT. Fibromatosis of the orbit is characterized by broad interlacing fascicles of mature fibroblasts, with a variable degree of collagenisation, and by the absence of an inflammatory component. When IMT contains enlarged histiocyte-like cells, inflammatory malignant fibrous histiocytoma has to be taken into consideration. Compact cellularity, a fascicular pattern, and nuclear atypia should also raise the suspicion of other neoplasms with a spindle cell appearance, such as sarcomatoid carcinoma, high grade angiosarcoma with spindle cell areas, leiomyosarcoma, and fibrosarcoma.

Currently, IMT can be considered as distinct entity with a characteristic morphological pattern having generally favourable course, particularly when involving the orbit. Those cases, in whom the lesions were histologically and immunophenotypically similar to the IMT pattern, which developed aggressive relapses and/or metastases, have been described in the literature and identified as fibrosarcomas by the World Health Organization. It is not clear, however, if the different localizations represent distant metastases or synchronous manifestations of the disease.

References

1. Meis JM, Enzinger FM. Inflammatory fibrosarcoma of the mesentery and retroperitoneum. A tumor closely simulating inflammatory pseudotumor. *Am J Surg Pathol* 1991 Dec;**15**(12):1146–56.
2. Coffin CM, Watterson J, Priest JR, Dehner JR. Extrapulmonary inflammatory myofibroblastic tumor (inflammatory pseudotumor). *Am. J Surg Paethol* 1995;**19**(8):859–72.
3. Kazantseva IA, Gureuich LE, Stefinova EV. Extrapulmonary inflammatory myofibroblastic tumor. *Arkh Patol* 2001;**63**(6):35–9.
4. Ahmad SM, Tsirbas A, Kazim M. Inflammatory myofibroblastic tumour of the orbit in a 7-year-old child. *Clin Experiment Ophthalmol* 2007;**35**(2):160–2.
5. Gleason BC, Hornick JL. Inflammatory myofibroblastic tumours: where are we now? *J Clin Pathol* 2008;**61**(4):428–37.
6. Polito E, Pichierri P, Loffredo A, Moramarco A, Occhini R. Inflammatory myofibroblastic tumor of the orbit. *Ophthalmologica* 2007;**221**(5):353–5.
7. Dutta V, Manoj MG, Malik A, Kumar P. ALK negative inflammatory myofibroblastic tumor of the orbit: a masquerading entity. *Ind J Ophthalmol* 2014;**62**(5):627–9.
8. Lauwers N, De groot V, Kenis C, Dhubhghaill SN, Claes J, De keizer RJ. Atypical sino-orbital inflammatory myofibroblastic tumor with bone and cerebral invasion extending to the orbit. *Eur J Ophthalmol* 2014;**24**(4):608–10.

9. Tawfik HA, Raslan AO. Infantile inflammatory myofibroblastic tumor of the orbit with apical bone involvement. *Ophthal Plast Reconstr Surg* 2013;**29**(2):e44–6.
10. Cramer SK, Skalet A, Mansoor A, Wilson DJ, Ng JD. Inflammatory myofibroblastic tumor of the orbit: a case report. *Ophthal Plast Reconstr Surg* 2015;**31**(1):e22–3.
11. Habib Larissa, Son Jung Hoon, Petris Carisa, Kazim Michael. Spontaneous regression of inflammatory myofibroblastic tumor of the orbit: a case report and review of literature. *Orbit* 2017;**36**(3):178–82.
12. Dehner LP. The enigmatic inflammatory pseudotumor: the current state of our understanding, or misunderstanding. *J Pathol* 2000;**192**(3):277–9.
13. Bonavolontà G, Strianese D, Grassi P, Comune C, Tranfa F, Uccello G, Iuliano A. An analysis of 2480 space-occupying lesions of the orbit from 1976 to 2011. *Ophthal Plast Reconstr Surg.* 2013;**29**(2):79–86. https://doi.org/10.1097/IOP.0b013e31827a7622.
14. Nevhauser TS, Ddrringer GA, Thomson LD, Fanburg-smith JC, Aguillera NS, Andriko J, et al. Splenic inflammatory miofibroblastic tumor (Inflammatory Pseudotumor): a clinicalpathologig and immunophenotypic study of 12 cases. *Arch Pathol Lab Med* 2001;**125**(3):379–85.
15. Coffin CM, Patel A, Perkins S, Elenitoba-Johnson KS, Perlman E, Griffid CA. ALK1 and p80 expression and chromosomal rearrangements involving 2p23 in inflammatory myofibroblastic tumor. *Mod Pathol* 2001;**14**(6):569–76.
16. Mudhar HS, Nuruddin M. ALK-1 positive orbital inflammatory myofibroblastic tumour (IMT) associated with prominent numbers of IgG4 plasma cells—a case report. *Orbit* 2013;**32**(5):321–3.