An Analysis of 2,480 Space-Occupying Lesions of the Orbit From 1976 to 2011

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Purpose: To evaluate the frequencies of orbital space-occupying lesions seen at single orbital unit in a period of 35 years.

Methods: In this retrospective case series, the authors reviewed the medical records of 2,480 consecutive patients referred to the authors' Orbital Unit for evaluation of an orbital mass between 1976 and 2011. The final diagnosis in each case was established by a combination of history, ocular findings, diagnostic imaging, and histopathologic analysis, when available. The number and percentage of benign and malignant tumors were determinated, also according to the age of the patients and the tumor location within the orbit. This study adhered to the principles of the Declaration of Helsinki.

Results: Of the 2,480 lesions, 1,697 (68%) were benign and 783 (32%) were malignant. The most frequent benign tumors were dermoid cyst (14%) and cavernous hemangioma (9%). The most common malignant tumors were non-Hodgkin lymphoma (12%), basal cell carcinoma (3%), and orbital metastases (3%). In patients younger than 60 years, benign tumors are more frequent, whereas in patients older than 60 years, the frequency of malignant tumors increased. Regarding the distribution in the orbit, the most common tumors were dermoid cyst (206 cases) in the upper-outer quadrant, mucocele (155 cases) in the upper-inner quadrant, basal cell epithelioma (35 cases) in the lower-inner quadrant, cavernous hemangioma (68 cases) in the lower-outer quadrant, and meningioma (90 cases) in central space. Most of the tumors were located in the upper-outer quadrant. In the lower-inner quadrant, malignant tumors were more frequent than benign tumors.

Conclusions: The authors' findings highlight the distinctive nature of the orbital oncology experience at an ocular oncology department.

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Different types of neoplastic and nonneoplastic lesions can affect the orbit causing ocular damage. There can be several effects related to masses in the orbit, such as cosmetic problems, severe ophthalmologic deficit with loss of vision, or eye movement deficit, eventually some orbital malignancy can be life-threatening. The reported frequencies of the different types of orbital lesions vary greatly in the literature.[1–7] This variation is most likely due to differences in the study populations. Some studies included only cases occurred among residents of certain geographic locations, or only lesions that occurred among people of specific ages.[8–11] The authors determined the frequencies of specific types of orbital tumors and tumor-simulating lesions evaluated at the Orbital Unit of the Department of Ophthalmology of the University of Naples "Federico II" over a 35-year period. The authors excluded from this report patients with thyroid orbitopathy, traumatic and malformative lesions, and specific and idiopathic orbital inflammations to study the frequency of the space-occupying lesion in a single institution experience. Lacrimal gland inflammation frequency was reported together with the tumor of the lacrimal gland fossa with the intent to enhance the distribution of the lesions involving this area of the orbit and to allow differential diagnosis.

METHODS

The clinical records of the Orbital Unit of the Department of Ophthalmology of the University Federico II of Naples were reviewed, and all cases coded with a diagnosis of an orbital tumor or simulating condition were selected for a more detailed analysis. Patients with nonneoplastic diseases (endocrine, traumatic, inflammatory diseases—except those involving the lacrimal fossa—and malformations), or with tumors limited to the eyelids, to the eyeball or not invading the orbit were excluded from this study. In all patients, the diagnosis of orbital tumor was postulated on the basis of clinical symptoms and radiologic preoperative assessment. The final diagnosis in each case was established by a combination of history; ocular and systemic findings; imaging studies, including CT and MRI scans; and histopathologic analysis, when available. To localize and characterize the lesion, preoperative radiologic evaluation with cranio-orbital CT and/or MRI scans were routinely requested. The location of the tumor within the orbit was obtained through the preoperative radiologic evaluation and the description of the surgery. When the lesion occupied 2 or more orbital quadrants, the authors assigned the position considering the orbital quadrant that was occupied by approximately two-thirds of the tumor (prevalent orbital quadrant).

Using a modification of a previously published classification of orbital tumors,[12,13] the primary diagnosis in each case was categorized in one of major groups of lesions (cystic, vascular, neurogenic, mesenchymal, lacrimal gland, lymphoproliferative and histiocytic, secondary, metastatic). The frequency of diagnosis of specific lesions among each major category was tabulated. The number and percentage of benign and malignant lesions were determined. This study adhered to the principles of the Declaration of Helsinki.

RESULTS

During a 35-year period from 1975 through July 2011, there were 2,480 patients with the diagnosis of suspected orbital tumor. The general demographics are depicted in Table 1. The

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TABLE 1. General demographics of 2,480 consecutive patients with orbital lesions

Category	No. patients (%)*
Females	1,329 (53.6)
Males	1,151 (46.4)
Mean age of female patients	43.4
Mean age of male patients	41.7
Total	2,480 patients

*Percents are rounded.

number and percentage of lesions in each major category are shown in Table 2. The specific diagnoses in each category are depicted in Tables 3 to 10. In Table 11, stratification of benign versus malignant tumors per age group is shown. Of the 2,480 lesions, 1,697 (68%) were benign and 783 (32%) were malignant. Biopsy and histopathologic confirmation of the diagnosis were obtained in 90% of the benign conditions and in 83% of the malignant lesions.

The most frequent lesion in the orbital tumor group was dermoid cyst, which accounted for 339 of the 2,480 cases of orbital tumors (14%) and represents the 20% of the 1,697 cases

TABLE 2. Classification of 2,480 consecutive patients with orbital lesions

Category	No. patients (%)*	No. biopsy proven (%)*	% Total biopsy proven*	Mean age in years (median, range)
Vasculogenic lesions	609 (24)	327 (54)	13	39 (1–83)
Cystic lesions	529 (21)	346 (65)	14	29 (1–84)
Neurogenic lesions	300 (12)	213 (71)	8	36 (1–92)
Mesenchymal lesions	177 (7)	134 (76)	5	29 (1–82)
Lacrimal gland lesions	241 (10)	134 (56)	5	46 (3–92)
Lymphoproliferative and histiocytic lesions	317 (13)	304 (96)	12	61 (5–85)
Secondary orbital tumors total	220 (9)	213 (97)	8	69 (42–95)
Basal cell epithelioma	87	87 (100)	3	71 (42–95)
Squamous cell carcinoma	56	56 (100)	2	71 (45–87)
Melanoma	36	36 (100)	1	64 (30–83)
Paranasal sinus origin	22	15 (68)	<1	59 (20–76)
Secondary orbital carcinoma	8	8 (100)	<1	72 (63–82)
Retinoblastoma	3	3 (100)	<1	16 (1–26)
Basal cell carcinoma	2	2 (100)	<1	71 (69–73)
Histiocytoid eccrine carcinoma	2	2 (100)	<1	53 (51–55)
Esthesioneuroblastoma	2	2 (100)	<1	52 (50–54)
Sebaceous carcinoma	1	1 (100)	<1	72
Lacrimal sac origin	1	1 (100)	<1	65
Metastatic tumors to the orbit	87 (3)	40 (46)	2	60 (1–88)
Total orbital lesions	2,480	1,711 (69)	69	43 (1–95)

*Percents are rounded.

TABLE 3. Subclassification of 609 patients with vascular lesions among 2,480 patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Lesion that expand by cellular proliferation	318 (52)	13	213 (67)	41 (1–78)
Cavernous hemangioma	218 (36)	9	174 (80)	48 (9–78)
Capillary hemangioma	80 (13)	3	21 (26)	5 (1–16)
Hemangiopericytoma	13 (2)	<1	13 (100)	39 (64–18)
Hemangioendothelioma	4 (<1)	<1	4 (100)	21 (1–53)
Intravascular papillary endothelial hyperplasia	3 (<1)	<1	1 (33)	56 (45–62)
No flow malformation	104 (17)	4	30 (29)	17 (1–73)
Venous lymphatic malformation (lymphangioma)	104 (17)	4	30 (29)	17 (1–73)
Venous flow lesions	104 (17)	4	46 (44)	52 (1–76)
Varix	89 (15)	3	43 (48)	40 (15–76)
Combined lymphangioma-varix	10 (2)	<1	2 (20)	19 (1–76)
Malformation	5 (<1)	<1	1 (20)	33 (1–62)
Arterial flow lesions	83 (14)	3	38 (46)	54 (1–83)
Shunt/fistula	70 (11)	3	29 (41)	56 (3–83)
Carotid cavernous fistula	9 (1)	<1	9 (100)	56 (35–72)
Arterial malformation	4 (<1)	<1	0 (0)	31 (1–59)
Total vasculogenic lesions	609	24	327 (54)	39 (1–83)

*Percents are rounded.

TABLE 4. Subclassification of 529 patients with cystic lesions among 2,480 consecutive patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Congenital lesions	371 (70)	15	249 (67)	54 (1–83)
Dermoid and epidermoid cyst	339 (64)	14	220 (65)	17 (1–83)
Dermolipoma	19 (3)	<1	16 (84)	27 (1–66)
Sweat gland cyst	7 (1)	<1	7 (100)	40 (12–66)
Hematic pseudocyst	2 (<1)	<1	2 (100)	56 (69–43)
Arachnoid cyst	2 (<1)	<1	2 (100)	72 (63–82)
Microphthalmos with cyst	1 (<1)	<1	1 (100)	52
Muscle cyst	1 (<1)	<1	1 (100)	45
Acquired lesions	158 (30)	6	97 (61)	52 (1–84)
Mucocele	155 (29)	6	94 (61)	55 (10–84)
Encephalocele	1 (<1)	<1	1 (100)	1
Lacrimal sac mucocele	1 (<1)	<1	1 (100)	3
Implantation	1 (<1)	<1	1 (100)	8
Total cystic lesions	529	21	346 (65)	29 (1–84)

*Percents are rounded.

of benign orbital tumors. The second most frequent lesion was non-Hodgkin lymphoma, which accounted for 291 of the 2,480 cases of orbital tumors (12%) and of the 783 cases of malignant orbital tumors (37%), and the next most frequent lesion was cavernous hemangioma, which accounted for 218 of the 2,480 cases of orbital tumors (9%) and of the 1,697 cases of benign orbital tumors (13%). Top 8 most frequent orbital tumors are shown in Table 12. The most frequent lesion in the benign orbital tumor group was dermoid cyst, followed by cavernous hemangioma.

Malignant lesions of the orbit can be classified in primary malignant lesions, which are tumors that arise from the orbital tissues, and secondary malignant lesions, which originate from several close structures, such as paranasal sinuses, nasal cavity and nasopharynx, eyelid skin and face, eyeball, conjunctiva, lacrimal sac, and intracranial cavity, eventually they can originate from a distant area creating orbital metastases. In the present series, primary malignant lesions were 476 (61% of orbital malignant lesions), secondary malignant lesions were 220 (28% of orbital malignant lesions), and orbital metastases were 87 (11% of orbital malignant lesions).

The most frequent lesion in the malignant orbital tumor group was non-Hodgkin lymphoma, which accounted for 291 of the 783 cases of malignant orbital tumors (37%), followed by basal cell epithelioma and orbital metastases, which accounted, respectively, for 89 and 87 of the 783 cases of malignant orbital tumors (11%). However, taken together the nonmelanoma skin malignancies of the eyelid and the periocular skin represent the second most frequent orbital malignancy with 143 cases registered.

Among the 476 lesions diagnosed as primary malignant lesions, the most frequent was non-Hodgkin lymphoma, which accounted for 291 of the 783 cases of malignant orbital tumors (37%). Among the 220 lesions diagnosed as secondary tumors (Table 9), the most frequent was clinically detectable orbital extension of basal cell epithelioma, which was diagnosed in 89 cases (40%). The next most common secondary tumor was orbital extension of squamous cell carcinoma, which accounted for 56 cases (25%). The other secondary tumors are listed in Table 9.

Among the 87 lesions diagnosed as orbital metastases (Table 10), the most frequent was orbital metastasis of breast carcinoma, which was diagnosed in 34 cases (39%), followed by metastasis from undetermined primary site (15 cases—17%), metastasis originated from kidney (10 cases—11%), and from lung cancer (7 cases—8%) (Table 10).

Regarding the distribution in quadrants of orbital tumors, the most common tumor of the upper-outer quadrant of the orbit

TABLE 5. Subclassification of 300 patients with neurogenic lesions among 2,480 consecutive patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Sphenoid wing meningioma	101 (34)	4	101 (100)	54 (29–80)
Optic nerve sheath meningioma	90 (30)	4	34 (38)	45 (9–79)
Neurilemmoma	33 (11)	1	32 (97)	41 (7–83)
Neurofibromatosis	29 (10)	1	20 (69)	24 (3–78)
Optic nerve glioma	18 (6)	<1	0 (0)	15 (2–75)
Neurofibroma	17 (6)	<1	14 (82)	43 (10–70)
Alveolar soft part sarcoma	5 (2)	<1	5 (100)	65 (41–92)
Neurinoma	3 (1)	<1	3 (100)	62 (45–77)
Neural-glial hamartoma	2 (<1)	<1	2 (100)	14 (1–28)
Neuroblastoma	2 (<1)	<1	2 (100)	2 (1–4)
Total neurogenic lesions	300	12	213 (71)	55 (1–92)

*Percents are rounded.

TABLE 6. Subclassification of 177 patients with mesenchymal lesions among 2,480 consecutive patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Fibrocystic lesions	33 (19)	1	30 (91)	42 (14–70)
Benign fibrous histiocytoma/solitary fibrous tumor	19 (11)	<1	17 (89)	42 (10–74)
Fibroma	9 (5)	<1	8 (89)	45 (14–68)
Fibrosarcoma	4 (2)	<1	4 (100)	58 (41–69)
Angiofibroma	1 (<1)	<1	1 (100)	43
Benign fibro-osseous lesions	64 (36)	2	37 (58)	41 (7–65)
Osteoma	44 (25)	2	29 (66)	32 (14–65)
Fibrous dysplasia	18 (10)	<1	6 (33)	29 (7–56)
Ossifying fibroma	2 (1)	<1	2 (100)	53 (51–55)
Malignant bone lesions	7 (4)	<1	7 (100)	23 (2–36)
Ewing sarcoma	3 (2)	<1	3 (100)	10 (2–22)
Osteosarcoma	2 (1)	<1	2 (100)	34 (32–36)
Chondrosarcoma	2 (1)	<1	2 (100)	21 (19–23)
Reactive bone tumors	6 (3)	<1	6 (100)	24 (5–71)
Giant cell granuloma	3 (2)	<1	3 (100)	33 (5–71)
Aneurysmal bone cyst	3 (2)	<1	3 (100)	14 (10–18)
Myogenic lesions	55 (31)	2	45 (82)	10 (1–34)
Rhabdomyosarcoma	54 (30)	2	44 (81)	10 (1–34)
Rhabdoid tumor	1 (<1)	<1	1 (100)	24
Lipocytic or myxoid lesions	12 (7)	<1	9 (75)	31 (1–82)
Lipoma	7 (4)	<1	5 (71)	36 (1–82)
Liposarcoma	3 (2)	<1	3 (100)	26 (19–38)
Dermolipoma	1 (<1)	<1	1 (100)	2
Epithelioid sarcoma	1 (<1)	<1	1 (100)	16
Total mesenchymal lesions	177	7	134 (76)	29 (1–82)

*Percents are rounded.

TABLE 7. Subclassification of 241 patients with lacrimal gland lesions among 2,480 consecutive patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Benign lesions	154 (64)	6	99 (64)	49 (20–92)
Neoplastic	85 (35)	3	73 (86)	57 (20–92)
Pleomorphic adenoma	78 (32)	3	68 (87)	45 (20–92)
Monomorphic adenoma	5 (2)	<1	3 (60)	68 (52–78)
Warthin tumor	1 (<1)	<1	1 (100)	62
Oncocytoma	1 (<1)	<1	1 (100)	74
Nonneoplastic	69 (29)	3	26 (38)	53 (12–75)
Nonspecific inflammation	54 (22)	2	15 (28)	57 (48–74)
Atypical lymphoid hyperplasia	11 (4)	<1	11 (100)	63 (54–75)
Lacrimal cyst	4 (2)	<1	0 (0)	37 (12–70)
Malignant lesions	87 (36)	3	87 (100)	57 (11–83)
Adenoid cystic carcinoma	44 (18)	2	44 (100)	44 (11–80)
Non-Hodgkin lymphoma	18 (7)	<1	18 (100)	60 (33–83)
Carcinoma ex-pleomorphic adenoma	7 (3)	<1	7 (100)	56 (37–68)
Adenocarcinoma	8 (3)	<1	8 (100)	48 (27–69)
Mucoepidermoid carcinoma	5 (2)	<1	5 (100)	64 (55–74)
Squamous cells carcinoma	1 (<1)	<1	1 (100)	73
Ductal cell carcinoma	1 (<1)	<1	1 (100)	76
Acinic cell carcinoma	1 (<1)	<1	1 (100)	64
Unclassified carcinoma	2 (<1)	<1	2 (100)	73 (68–78)
Total lacrimal gland fossa lesions	241	10	186 (77)	58 (11–92)

*Percents are rounded.

TABLE 8. Subclassification of 317 lymphoproliferative and histiocytic lesions among 2,480 consecutive patients with orbital lesions

Subcategory	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Diffuse lymphoma	69 (22)	3	69 (100)	63 (52–85)
MALT-type lymphoma	64 (20)	2	64 (100)	46 (36–55)
Marginal zone lymphoma	60 (19)	2	60 (100)	62 (48–71)
Small lymphocytic lymphoma	57 (18)	2	57 (100)	64 (51–75)
Follicular lymphoma	19 (6)	<1	19 (100)	67 (55–73)
Mantle cell lymphoma	13 (4)	<1	13 (100)	64 (58–70)
Plasmacytoma	8 (3)	<1	8 (100)	65 (45–76)
Atypical lymphoid hyperplasia	7 (2)	<1	7 (100)	51 (15–76)
Xanthogranuloma	4 (1)	<1	4 (100)	53 (40–60)
Eosinophilic granuloma	1 (<1)	<1	1 (100)	5
Histiocytic lymphoma	1 (<1)	<1	1 (100)	53
Burkitt lymphoma	1 (<1)	<1	1 (100)	56
Unknown histology lymphoma	13 (4)	<1	0 (0)	54 (45–72)
Total lymphoproliferative and histiocytic lesions	317	13	304 (96)	61 (5–85)

*Percents are rounded.

TABLE 9. Subclassification of 220 secondary malignant tumors arising from adjacent structures among 2,480 consecutive patients with orbital lesions

Primary site	No. patients (%)*	% of total or bital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Basal cell carcinoma	89 (40)	3	89 (100)	71 (42–95)
Squamous cell carcinoma	56 (25)	2	56 (100)	71 (45–87)
Melanoma	36 (16)	1	36 (100)	64 (30–83)
Carcinoma of the paranasal sinuses and nasopharyngeal	22 (10)	<1	15 (68)	59 (20–76)
Unspecified origin carcinoma	8 (4)	<1	8 (100)	67 (60–83)
Retinoblastoma	3 (1)	<1	3 (100)	16 (1–26)
Eccrine histiocytoid carcinoma	2 (<1)	<1	2 (100)	53 (51–55)
Esthesioneuroblastoma	2 (<1)	<1	2 (100)	52 (50–54)
Sebaceous carcinoma	1 (<1)	<1	1 (100)	72
Lacrimal sac origin carcinoma	1 (<1)	<1	1 (100)	65
Total secondary tumors	220	9	213 (97)	67 (1–95)

*Percents are rounded.

TABLE 10. Subclassification of 87 patients with metastatic tumors among 2,480 consecutive patients with orbital lesions

Primary site or type	No. patients (%)*	% of total orbital lesions*	No. biopsy proven (%)*	Mean age in years (median, range)
Breast carcinoma	34 (39)	1	2 (6)	65 (40–84)
Undetermined primary site	15 (17)	<1	15 (100)	62 (39–85)
Renal cell carcinoma	10 (11)	<1	7 (70)	56 (36–67)
Lung carcinoma	7 (8)	<1	3 (43)	60 (49–84)
Nasopharyngeal carcinoma	4 (4)	<1	2 (50)	75 (69–80)
Melanoma	3 (3)	<1	2 (66)	57 (48–70)
Parotid gland carcinoma	3 (3)	<1	0 (0)	41 (29–54)
Squamous cell carcinoma	3 (3)	<1	3 (100)	69 (56–85)
Neuroendocrine carcinoma	2 (2)	<1	2 (100)	63 (59–67)
Prostate carcinoma	1 (1)	<1	0 (0)	69
Bladder carcinoma	1 (1)	<1	1 (100)	73
Gastric carcinoma	1 (1)	<1	1 (100)	73
Hepatocarcinoma	1 (1)	<1	1 (100)	82
Adrenal neuroblastoma	1 (1)	<1	0 (0)	1
Carcinoma of the penis	1 (1)	<1	1 (100)	75
Total metastatic tumors	87	3	40 (46)	60 (1–85)

*Percents are rounded.

TABLE 11. Age stratification and frequency of malignancy orbital lesions among 2,480 consecutive patients with orbital lesions

Category*	0–18 years of age	19–59 years of age	60–92 years of age	All ages
Number benign (% of age group)	414 (83)	901 (76)	382 (48)	1,697 (68)
Number biopsy proven (% of benign)	386 (93)	797 (88)	344 (90)	1,527 (90)
Number malignant (% of age group)	87 (17)	281 (24)	415 (52)	783 (32)
Number biopsy proven (% of malignant)	66 (76)	247 (88)	336 (81)	649 (83)
Total number of patients (% of total)	501 (100)	1,182 (100)	797 (100)	2,480 (100)
Total number biopsy proven (% of age group)	452 (90)	1044 (88)	680 (85)	2176 (88)

*Percents are rounded.

was dermoid cyst, which accounted for 206 of the 833 cases of orbital tumors of the upper-outer quadrant of the orbit (25%). The second most common tumors of this quadrant were non-Hodgkin lymphoma, which accounted for 88 cases (10%), and pleomorphic adenoma of the lacrimal gland, which accounted for 78 cases (9%). The most frequent 8 tumors of the upper-outer quadrant of the orbit are shown in Table 13.

The most common tumor of the upper-inner quadrant of the orbit was mucocele, which accounted for 155 of the 664 cases of orbital tumors of the upper-inner quadrant of the orbit (23%). The second most common tumors of this quadrant were dermoid cyst, which accounted for 133 cases (20%), and non-Hodgkin lymphoma, which accounted for 126 cases of orbital tumors (19%). The most frequent 8 tumors of the upper-inner quadrant of the orbit are shown in Table 14.

The lower-inner quadrant was the quadrant with the higher percentage of malignant tumors (223 cases—57% the tumors of this quadrant). The most common tumor of the lower-inner quadrant was basal cell epithelioma, which accounted for 35 of the 394 cases of orbital tumors of this space (9%). The second most common tumors of this quadrant were non-Hodgkin lymphoma, which accounted for 31 cases (8%), followed by cavernous hemangioma, which accounted for 20 cases (5%). The most frequent 8 tumors of the lower-inner quadrant of the orbit are shown in Table 15.

The lower-outer quadrant was the quadrant with fewer tumors and with less orbital metastases. The most common tumor of the lower-outer quadrant of the orbit was cavernous hemangioma, which accounted for 68 of the 316 cases of orbital tumors of this quadrant (21%). The other most common tumors of this quadrant were varix, which accounted for 22 cases (7%), and non-Hodgkin lymphoma, which accounted for 20 (6%). The most frequent 5 tumors of the lower-outer quadrant of the orbit are shown in Table 16.

The most common central tumor of the orbit was optic nerve meningioma, which accounted for 90 of the 273 cases of orbital tumors of this quadrant (33%), cavernous hemangioma, which accounted for 27 cases (10%), and non-Hodgkin

TABLE 12. The 8 most frequent orbital tumors

Orbital tumors	No. cases (% of total orbital lesions*)
Dermoid cyst	339 (14)
Non-Hodgkin lymphoma	291 (12)
Cavernous hemangioma	218 (9)
Mucocele	155 (6)
Lymphangioma	104 (4)
Sphenoid wing meningioma	101 (4)
Optic nerve meningioma	90 (4)
Basal cell epithelioma	89 (3)

*Percents are rounded.

TABLE 13. The most frequent 8 tumors of the upper-outer quadrant of the orbit

Tumors of the upper-outer quadrant of the orbit	No. cases (% of total orbital lesions*)
Dermoid cyst	206 (8)
Non-Hodgkin lymphoma	88 (3)
Pleomorphic adenoma of the lacrimal gland	78 (3)
Cavernous hemangioma	44 (2)
Adenoid cystic carcinoma of the lacrimal gland	44 (2)
Metastases	37 (1)
Varix	36 (1)
Lymphoma of the lacrimal gland	18 (<1)

*Percents are rounded.

TABLE 14. The most frequent 8 tumors of the upper-inner quadrant of the orbit

Tumors of the upper-inner quadrant of the orbit	No. cases (% of total orbital lesions*)
Mucocele	155 (6)
Dermoid cyst	133 (5)
Non-Hodgkin lymphoma	126 (5)
Cavernous hemangioma	59 (2)
Capillary hemangioma	33 (1)
Osteoma	29 (1)
Varix	26 (1)
Lymphangioma	24 (<1)

*Percents are rounded.

TABLE 15. The most frequent 8 tumors of the lower-inner quadrant of the orbit

Tumors of the lower-inner quadrant of the orbit	No. cases (% of total orbital lesions*)
Basal cell epithelioma	35 (1)
Non-Hodgkin lymphoma	31 (1)
Cavernous hemangioma	20 (<1)
Carcinoma of the maxillary sinus	14 (<1)
Squamous cell carcinoma	13 (<1)
Melanoma	13 (<1)
Lymphangioma	11 (<1)
Neurilemmoma	9 (<1)

*Percents are rounded.

TABLE 16. The most frequent 5 tumors of the lower-outer quadrant of the orbit

Tumors of the lower-outer quadrant of the orbit	No. cases (% of total orbital lesions*)
Cavernous hemangioma	68 (3)
Varix	22 (<1)
Non-Hodgkin lymphoma	20 (<1)
Basal cell epithelioma	12 (<1)
Schwannoma	3 (<1)

*Percents are rounded.

lymphoma, which accounted for 26 cases (9%). The most frequent tumors of the intraconal space of the orbit are shown in Table 17.

DISCUSSION

The authors included all consecutive patients treated over the course of 35 years and studied the distribution according to patient age and tumors position within the orbit. In the authors' series, 2,173 (88%) were primary orbital tumors, 220 (9%) were secondary orbital tumors originating in close areas, and 87 (3%) were metastatic tumors. Dermoid cyst was the most frequently encountered orbital tumor in the authors' series, accounting for 14% of all cases. Shields et al.[14] and Rootman[15] found similar data in their surveys, whereas dermoid cyst was the thirteenth most encountered orbital tumor and the seventh most frequent benign orbital lesion (2%) in the series of Henderson et al.[16] Cavernous hemangioma was the second most common orbital space-occupying lesions. It occurred in 218 cases, 9% of all cases. This evidence did not differ from most other studies,[1–4,14,15,17,18] whereas cavernous hemangioma was the sixth most encountered orbital tumor (4% of all cases) in the series of Henderson et al.[16] The most common malignant orbital tumor in this study was non-Hodgkin lymphoma, which accounted for 291 cases, 12% of all cases. This evidence was similar to other series (8–12%).[15,16] In addition, in recent years, it has been highlighted an increase in the incidence of non-Hodgkin lymphoma over the years[19,20] and that infectious agents may play a role in the etiology of orbital lymphoma.[21,22]

Regarding orbital tumors of childhood, dermoid cyst with 118 cases registered in the first decade of life was the most common orbital lesion, followed by capillary hemangioma (46 cases), in agreement with data reported by Rootman.[15] Rhabdomyosarcoma was found in 54 patients, 2% among all cases. In the authors' series, rhabdomyosarcoma was the most prevalent extraocular orbital malignancy in children, and for this reason has received considerable attention in the literature.[20,23–25] Historically, children died from this neoplasia, but recent advances in diagnosis and treatment have led to marked improvement in prognosis.[23] Chondrosarcoma and liposarcoma

TABLE 17. The 4 most frequent central tumors of the orbit

Tumors of the intraconal space of the orbit	No. cases (% of total orbital lesions*)
Meningiomas	90 (4)
Cavernous hemangioma	27 (<1)
Non-Hodgkin lymphoma	26 (1)
Optic nerve glioma	18 (<1)

*Percents are rounded.

may occur in every age although they are more frequent in young age.[26,27]

Eighty-seven patients with metastatic cancer sought care at our center. Cancer metastatic to the orbit represented 3.5% of all cases. Among the 87 patients, the most prevalent primary tumor site was breast in 34 cases (39%), in agreement with literature,[14–16,28] while cancer of unknown origin appear to be the second for frequency by counting 15 cases (17%); kidney origin resulted the third origin with 10 cases (11%), and lung carcinoma was the origin in 7 cases (8%). These data were not so different from those reported in literature,[10,14,28,29] although the authors had only 1 case of metastasis of prostate gland tumor and 1 case of gastrointestinal tract tumors differently from the literature where they are reported with a frequency that varied from 9% to 12% and 3% to 6%, respectively.[15,16] Interestingly, the authors had 1 case of orbital metastasis of cancer of the penis, never reported in literature. Basal cell epithelioma was the most frequent secondary orbital tumor in the authors' study, leading to significant morbidity in the orbit which resulted in a high need of orbital exenteration[30] (Table 9). Squamous cell carcinoma was reported as the most frequent secondary orbital malignancy.[16]

In the authors' study, the pathologic profiles of orbital tumors were characterized according to patient's age and to the location of the tumor in the orbit. Table 11 shows the age distribution of the 2,480 patients at diagnosis. In patients younger than 59 years, the most common space-occupying lesions were benign tumors, while when patients aged 60 to 92 years, frequency of malignant tumors increased. Regarding the position in the orbit, the most frequent site involved was the upper-outer quadrant. Dermoid cyst (206 cases), non-Hodgkin lymphoma (88 cases), and cavernous hemangioma (78 cases) were the most common orbital tumors in the upper-outer quadrant (Table 13). Mucocele (155 cases), dermoid cyst (133 cases), and non-Hodgkin lymphoma (126 cases) were the most common tumors in the upper-inner quadrant (Table 14). Basal cell carcinoma (35 cases), non-Hodgkin lymphoma (31 cases), and cavernous hemangioma (20 cases) were the most common tumors in the lower-inner quadrant (Table 15). The authors found that in this quadrant, unlike other orbital regions, malignant tumors were most frequent than benign tumors (Table 15). Cavernous hemangioma (68 cases), varix (22 cases), and non-Hodgkin lymphoma (20 cases) were the most common tumors in the lower-outer quadrant (Table 16). Optic nerve meningioma (90 cases), cavernous hemangioma (27 cases), and non-Hodgkin lymphoma (26 cases) were the most frequently encountered tumors in the central intraconal space (Table 17). Optic nerve sheath meningioma represent approximately 3% of all orbital tumor, a percentage similar to the one already reported in literature.[14,31–33]

Ohtsuka et al.[34] studied relationships between pathologic profiles and the tumor location in the orbit. In this review, the authors described 244 cases of orbital tumors. Regarding the location in the orbit, 122 tumors (50%) were extraconal, 36 (15%) were intraconal, and 86 (35%) were in the lacrimal gland area. The authors encountered 241 lesions involving the lacrimal gland fossa that represent the 10% of the total. The most frequent benign epithelial tumor of the lacrimal gland was pleomorphic adenoma, the most frequent malignant was adenoid cystic carcinoma. However, several subtypes can be found and evaluation of the prognostic factor should be carefully evaluated.[13,35]

In summary, this study was undertaken to determine the number and percentage of various lesions referred to an ocular oncology center because of a suspected neoplasm. The incidence of the different subtypes resulted quite similar to those

previously reported in literature. Therefore, this knowledge may assist the clinician in formulating a differential diagnosis in a patient with proptosis or other orbit-related symptoms and signs, also considering mass position on diagnostic imaging.

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