

Application of Rose and Wright's algorithm in the diagnosis of lacrimal gland masses: a study of 93 cases

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ABSTRACT •

Objective: To investigate the application of Rose and Wright's algorithm in diagnosing lacrimal gland masses.

Design: Retrospective observational cases series.

Participants: A total of 93 consecutive patients with primary masses within the orbital lobe of the lacrimal gland were reviewed.

Methods: Before treatment, patients' detailed history was collected verbally and all patients underwent image examination (computed tomography and magnetic resonance imaging). The clinical and radiological features of every patient were evaluated by experienced orbital surgeons. Based on Rose and Wright's criteria, patients were scored and then treated using surgery with radiotherapy and/or chemotherapy. The final diagnoses were based on the histopathologic results. Based on the histopathologic diagnosis, the data from Rose and Wright's algorithm were evaluated.

Results: The accuracy of Rose and Wright's algorithm for benign and malignant tumour diagnoses was 75% and 50%, respectively. The diagnostic sensitivity, specificity, and accuracy of Rose and Wright's algorithm were 64%, 93%, and 86%, respectively. The algorithm demonstrated significant accuracy in the clinicoradiological criterion in differentiating between benign tumours and malignant tumours ($p < 0.05$).

Conclusions: Rose and Wright's algorithm has great advantages in distinguishing benign from malignant tumours within the orbital lobe of the lacrimal gland. However, the algorithm should be used with great caution because of its low diagnostic sensitivity for malignant tumours.

Lacrimal gland masses account for 10% of all orbital lesions.¹ This tumour is rare and occurs in less than 1 in 1 million people annually.² Lacrimal gland masses can be divided into benign and malignant tumours. The most common benign tumour type is pleomorphic adenoma (PA), and the most common malignant tumour type is adenoid cystic carcinoma (ACC).³ PAs generally demonstrate a long duration of acute symptoms (>10 months) without persistent pain or clinical sensory loss. Radiologic assessment generally reveals a well-defined round or oval mass without tumour calcification or bone invasion. ACCs often have a short duration of acute symptoms (<10 months) with persistent pain and clinical sensory loss. By radiologic assessment, mass moulding to the globe or along the lateral orbital wall and with tumour calcification or bone invasion is observed.⁴⁻⁷ PAs are usually treated with complete excision without prior biopsy.^{8,9} If tumour cells are dispersed into the adjacent tissues during excision or biopsy, PAs will have a high rate of recurrence, and the recurrence is often malignant.^{10,11} Therefore, it is of great importance to develop an easy and efficient method for diagnosing the tumour based on radiologic and clinical evidence without requiring a biopsy.

Rose and Wright's algorithm includes clinical and radiologic characteristics and was introduced in 1992. This approach helps determine a management plan for masses

within the orbital lobe of the lacrimal gland.¹¹ This algorithm was modified from a previous algorithm according to substantial clinical experience and improved radiologic imaging.^{8,11,12} It has been demonstrated to be a useful management approach for evaluating lacrimal gland masses based on the clinical and radiologic features of the tumour. Because epithelial neoplasms of the lacrimal gland are rare, Rose and Wright's algorithm has not been widely reported in diagnosing lacrimal gland masses. Therefore, we designed and performed a study of 93 consecutive patients to evaluate Rose and Wright's algorithm in diagnosing lacrimal gland masses and further studied the clinicoradiologic features of lacrimal gland masses.

METHODS

This is a prospective study and was performed between December 2009 and September 2014. Ninety-three consecutive patients attended the orbital clinic at Eye & ENT Hospital of Fudan University with primary masses within the orbital lobe of the lacrimal gland. They underwent a series of clinical examinations, including refractometry; assessment of eye motility; sonographic examination; and computed tomography (CT), magnetic resonance imaging (MRI), or both to diagnose the mass as a lacrimal gland lesion. Patients with typical inflammatory lesions were not included in our study.

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Informed consent was obtained from the study subjects. Institutional review board approval was given to this study by the Eye & ENT Hospital of Fudan University. This study adhered to the tenets of the Declaration of Helsinki.

Before treatment, patients' history was collected verbally; the history included questions about the duration of acute symptoms and the presence of persistent pain and sensory loss. Then the clinicoradiologic features of every patient were evaluated by experienced orbital surgeons (3 different orbital surgeons). Based on Rose and Wright's criteria, the cases were scored from -8 to $+8$. Patients were scored -1 for each of the following: <10 -month duration of acute symptoms, persistent pain, sensory loss, no well-defined round/oval mass, moulding of the mass to the globe or along the lateral orbital wall, tumour calcification, bone invasion, large tumour, and short symptoms in the duration of symptoms in relation to the tumour size. They were scored $+1$ for each criterion that was not met.

According to the management plan of Rose and Wright's algorithm, patients with probable carcinoma underwent incisional biopsies (score -8 to $+2$). Patients without prior biopsy and probable PA underwent excision (score $+3$ to $+8$). Final diagnoses were based on the histopathologic results. Based on the histopathologic diagnosis, the data from Rose and Wright's algorithm were evaluated, and further treatments (surgery with radiotherapy and/or chemotherapy) were explored. The diagnostic sensitivity, specificity, and accuracy of Rose and Wright's algorithm were also calculated: sensitivity = (number of true positive assessments) / (number of all positive assessments); specificity = (number of true negative assessments) / (number of all negative assessments); accuracy = (number of correct assessments) / (number of all assessments).

Lacrimal masses with total scores from $+3$ to $+8$ were defined as benign tumours, and masses with scores from -8 to $+2$ were defined as malignant tumours. The accuracy of Rose and Wright's algorithm then was determined. The accuracies of the clinicoradiologic criteria for benign and malignant tumours were compared. Statistical analyses were performed using the χ^2 test, Fish test, or Fisher's exact test where appropriate. Differences were considered statistically significant when $p < 0.05$.

RESULTS

Our study included 93 patients (42 male and 51 female patients) with a mean age of 52 years (range 22–99 years). According to Rose and Wright's criteria, 73 patients scored from $+3$ to $+8$, 19 patients from -6 to $+2$, and 1 patient from -8 to -6 . The clinicoradiological symptoms of Rose and Wright's algorithm are shown in Table 1. On the basis of the histopathologic diagnosis, there were 59 PA cases, 5 malignant mixed tumour cases, 5 carcinoma cases, and 8 ACC cases. Additionally, there were 16 cases with nonepithelial lesions, including the following: 9 inflammatory lesions,

Table 1—Clinicoradiological symptoms of Rose and Wright's algorithm in 93 cases with lacrimal gland masses

Cases	Score		
	+3 to +8	-6 to +2	-8 to +2
Clinical Characteristic Features			
Duration of acute symptoms >10 months	42	5	0
Persistent pain	15	13	1
Sensory loss	9	9	1
Radiological Characteristic Features			
Well-defined round or oval mass	73	9	0
Moulding of mass to globe or along the lateral orbital wall	73	9	0
Tumour calcification	0	6	0
Invasion of bone	4	8	1
Duration of symptoms in relation to the tumour size (large tumour; short symptoms)	0	7	1

2 lymphoid proliferation diseases, 4 lymphoma cases, and 1 meningioma case.

In the 73 cases scoring from $+3$ to $+8$ (probable PA), 55 cases (75.34%) had a histopathologic diagnosis of PA; the accuracy of Rose and Wright's algorithm for the PA diagnosis was 75.3%. In the 20 cases that scored from -8 to $+2$ (probable carcinoma), only 10 cases (50%) were confirmed with a histopathologic diagnosis; the accuracy of Rose and Wright's algorithm for a malignant tumour diagnosis was 50%. The diagnostic sensitivity, specificity, and accuracy of Rose and Wright's algorithm were 64%, 93%, and 86%, respectively (Table 2). The ratio of the clinicoradiologic criteria in the benign and malignant tumours is given in Table 3. The differences were also calculated. The clinicoradiologic symptoms in malignant tumours were more common than those in benign tumours ($p < 0.05$).

DISCUSSION

Lacrimal gland masses are usually present with a mass within the orbital lobe of the lacrimal gland, and there is a displacement of the eyeball with reduced eye motility.^{4,11,13} The mean duration of acute symptoms for patients with PA is approximately 10 months.^{11,13} In our study, the mean duration was 26.78 months. One of the patients had symptoms of slow-growing PA for 12 years. Rose and Wright¹¹ reported a PA patient with persistent symptoms for 20 years. However, patients with malignant tumour typically have a shorter duration of symptoms.^{14,15} Patients with malignant tumours often have symptoms of reduced eye motility, pain, and diplopia, compelling them to seek an earlier consultation. The duration of symptoms before the first ophthalmic

Table 2—Diagnostic accuracy of Rose and Wright's algorithm in 93 cases with lacrimal gland masses

Histopathologic Diagnosis	The Rose and Wright's Algorithm Diagnosis	
	Malignant Tumours	Benign Tumours
Malignant tumours	14	8
Benign tumours	5	66

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