International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Diagnostic Contribution of Magnetic Resonance Imaging in Pleomorphic Adenoma of the Parotid Gland: A Six-Year Experience at Avicenne Military Hospital, Marrakech

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International Journal of Science and Research Archive, 2025, 17(02), 950-955

Publication history: Received 11 October 2025; revised on 19 November 2025; accepted on 21 November 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.17.2.3104

Abstract

Objective: This study aimed to assess the diagnostic accuracy and overall contribution of magnetic resonance imaging (MRI) in the preoperative characterization of pleomorphic adenoma (PA) of the parotid gland in a Moroccan tertiary military medical center.

Patients and Methods: A retrospective longitudinal study was conducted over six years (2015–2020), including patients who presented with a parotid mass, underwent MRI of the parotid region, subsequently underwent surgical excision, and were finally diagnosed with pleomorphic adenoma on histopathology.

Results: Thirty patients met the inclusion criteria. The mean age was 36.6 years (range: 14–72), with a slight female predominance (53.3%). The mean duration before consultation was 4 years. MRI localized the tumor to the superficial lobe in 76.7% of cases, the deep lobe in 13.3%, and both lobes in 10%. The mean MRI-measured tumor size was 30 mm. Superficial parotidectomy was performed in 76.7% of patients. MRI suggested pleomorphic adenoma in all 30 patients; histopathology confirmed the diagnosis in 83.3%. Discordant findings included four Warthin tumors (13.3%) and one oncocytoma (3.3%). Typical MRI features—T1 hyposignal, T2 hypersignal, lobulated margins, and strong post-contrast enhancement—showed variable sensitivity and specificity.

Conclusion: In our six-year experience, MRI demonstrated a high diagnostic yield in identifying pleomorphic adenoma of the parotid gland. However, atypical imaging presentations and overlap with other benign lesions, particularly Warthin tumors, account for false-positive cases. Combining conventional MRI sequences with functional imaging modalities improves diagnostic accuracy and helps guide surgical planning.

Keywords: Pleomorphic adenoma; Parotid gland; MRI; Salivary gland tumors; Diagnostic imaging

1. Introduction

Pleomorphic adenoma (PA), historically termed "mixed tumor," is the most frequent benign tumor of the parotid gland, accounting for approximately 60–70% of benign parotid neoplasms. It affects individuals across a wide age spectrum but most commonly presents between the third and sixth decades of life, with a recognized female predominance. Histologically, its hallmark lies in its biphasic epithelial and stromal components, which confer varied imaging appearances. (1)

Despite its benign nature, pleomorphic adenoma presents significant clinical challenges due to its intimate anatomical relationship with the facial nerve, its propensity for recurrence when incompletely excised, and its potential—although

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rare—for malignant transformation. Accurate preoperative diagnosis is therefore essential to guide surgical management and reduce morbidity. (2)

Magnetic resonance imaging (MRI) is considered the reference imaging modality for parotid gland tumors. Its superior soft-tissue resolution allows precise delineation of lesion margins, localization in relation to the facial nerve (via lobe identification), characterization of internal architecture, and assessment of deep-lobe or parapharyngeal extension. MRI also helps differentiate benign from malignant lesions, although overlaps in imaging features persist. (3)

In the context of the Moroccan healthcare setting and particularly within military medical institutions, data on the performance of MRI in diagnosing pleomorphic adenoma remain limited. This study aims to contribute robust evidence by analyzing a six-year institutional experience. (4,5)

The primary objective was to evaluate the diagnostic value and accuracy of MRI in identifying pleomorphic adenoma of the parotid gland in a Moroccan tertiary center, comparing imaging findings with postoperative histopathology.

2. Patients and methods

2.1. Study Design and Setting

A retrospective descriptive and analytical study was carried out in the Department of Otorhinolaryngology – Head and Neck Surgery at Avicenne Military Hospital, Marrakech, Morocco. Data were collected for the period from January 1, 2015, to December 31, 2020.

2.2. Inclusion Criteria

- Patients presenting with a unilateral parotid mass.
- Patients who underwent preoperative parotid MRI.
- MRI reports suggesting pleomorphic adenoma.
- Patients subsequently treated surgically with available histopathological confirmation.

2.3. Exclusion Criteria

- Recurrent parotid tumors.
- Patients with incomplete imaging or histopathological data.
- Malignant cases suspected clinically or radiologically.

2.4. Data Collection

Data were extracted from patient medical records, radiologic reports, operative reports, and histology results. The following variables were analyzed:

- Demographics: age, sex.
- Clinical features: tumor side, size, mobility, signs of malignancy (pain, facial palsy, lymphadenopathy).
- MRI characteristics: morphology, margins, location, T1/T2 signal, enhancement pattern, diffusion-weighted imaging (when available).
- Surgical approach: superficial or total parotidectomy.
- Histopathology: final diagnosis.

2.5. MRI Protocol

MRI studies were performed using standard head and neck protocols including:

- Axial and coronal T1-weighted sequences
- T2-weighted sequences with and without fat suppression
- Post-contrast T1-weighted sequences
- Diffusion-weighted imaging (DWI) and ADC maps when available

2.6. Statistical Analysis

Descriptive statistics were used to summarize clinical and imaging data. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for key MRI features.

3. Results

3.1. Demographic and Clinical Characteristics

Thirty patients fulfilled the inclusion criteria. The mean age was 36.6 years (range 14–72), and the sex ratio was 0.87 (female predominance: 53.3%). The average delay before consultation was 4 years, ranging from 1 to 10 years.

All patients presented with a unilateral parotid swelling—right-sided in 50% and left-sided in 50%. No patient exhibited facial nerve palsy or palpable cervical lymphadenopathy. Oral cavity examination findings were normal.

Tumor size on clinical examination ranged from 2 to 8 cm (mean 3.8 cm). All masses were mobile relative to the superficial plane; deep mobilization was possible in 29 of 30 cases.

3.2. MRI Findings

Table 1 Distribution of patients in our series according to the signaling and functional results of the MRI

MRI Feature	Frequency	Percentage
Oval shape	17 cases	56.7%
Nodular shape	13 cases	43.3%
Superficial lobe	23 cases	76.7%
Deep lobe	4 cases	13.3%
Both lobes	3 cases	10%

Margins were lobulated in 73.3% and smooth in 26.7%. All lesions were well circumscribed, and no local invasion was noted.

3.3. Signal Characteristics:

- T1 hyposignal: 70%
- T2 hypersignal: 83.3%
- Intense contrast enhancement: 93.3%

Functional imaging (DWI/ADC) was available for six patients; ADC values ranged from 1.6 to 1.8 × 10^{-3} mm^2/s.

3.4. Diagnostic Performance of MRI

- Correct MRI diagnosis: 25/30 cases (83.3%)
- Discordant cases: 5 (16.7%)
    - Warthin tumor: 4 cases
    - Oncocytoma: 1 case

3.5. Surgical Treatment

- Superficial parotidectomy: 23 patients (76.7%)
- Total parotidectomy: 7 patients (23.3%)

3.6. Key MRI Feature Performance

Table 2 MRI morphological, signaling and functional characteristics according to the histological type found

Feature	Sensitivity	Specificity	PPV	NPV
T1 hyposignal	76%	60%	90%	33%
T2 hypersignal	88%	40%	88%	40%
Lobulated margins	95%	50%	84%	80%
Strong enhancement	96%	25%	88%	50%

4. Discussion

Pleomorphic adenoma is the most prevalent benign salivary gland tumor and predominantly affects women, suggesting a hormonal influence, as proposed by Wong et al. The mean age in our population aligns with international reports. (6)

4.1. Clinical Presentation

Consistent with the literature, the primary symptom was a slow-growing, painless parotid mass. (7,8) The absence of facial palsy or lymphadenopathy strongly favors a benign condition since such signs raise suspicion for malignant transformation. (9,10)

4.2. MRI as a Diagnostic Tool

MRI remains the gold standard for evaluating parotid masses due to its exquisite soft-tissue contrast and ability to localize lesions in relation to the facial nerve. Pleomorphic adenoma classically shows: (11,12,13)

- well-defined margins
- lobulated contours
- T1 hypointensity
- T2 hyperintensity
- homogeneous post-contrast enhancement

These typical features were present in 66.6% of our cases, consistent with findings by Prades, Lechner, and others. (14,15,16)

However, atypical appearances are not rare. Ikeda et al. noted that T2 heterogeneity is common and may complicate the diagnosis. In our series, 10 cases showed atypical patterns; 7 were still confirmed as PA, while the remaining 3 were Warthin tumors. (17,18)

4.3. Differentiation from Other Benign Tumors

Warthin tumors can mimic PA on MRI. Their cystic components and frequent bilateral occurrence can help distinguish them, but overlap is common. In our study, four Warthin tumors were misdiagnosed as PA. (19)

Oncocytomas are even rarer and their MRI signal characteristics may resemble PA, contributing to one misdiagnosis.

4.4. Functional MRI Sequences

Advanced MRI sequences—diffusion-weighted imaging (DWI) and dynamic contrast-enhanced MRI (DCE)—have significantly improved diagnostic specificity. (19,20)

- Pleomorphic adenoma typically shows **high ADC values**, reflecting its myxoid extracellular matrix.
- Malignant tumors tend to have lower ADC values.
- DCE patterns can also distinguish benign from malignant lesions.

In our study, limited availability of these functional sequences explains part of the false-positive rate.

4.5. Histopathology: The Gold Standard

Histological examination remains the definitive diagnostic method. Cellular variants of PA may complicate diagnosis and demonstrate atypical imaging features. (20,21)

4.6. Strengths and Limitations

4.6.1. Strengths

- Six-year institutional experience
- MRI–histopathology correlation
- Complete surgical and imaging data

4.6.2. Limitations

- Retrospective design
- Limited use of DWI and DCE
- Small sample size (single-center study)

5. Conclusion

Our six-year experience confirms that MRI provides high diagnostic accuracy in identifying pleomorphic adenoma of the parotid gland and remains the cornerstone of preoperative assessment. Typical MRI features strongly favor PA; however, overlap with Warthin tumors and other benign lesions explains the false-positive findings. Incorporating functional imaging, such as diffusion-weighted and dynamic contrast-enhanced MRI, significantly enhances diagnostic performance.

Future prospective studies with larger cohorts and comprehensive MRI protocols are needed to refine imaging criteria and establish more precise diagnostic algorithms.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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