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# Radio-Histological Correlation of Parotid Tumors

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**Abstract:** The Parotid tumors represent less than 3% of all cervical tumors. They are benign in 80% of cases. The objective of this study is to evaluate the contribution of 3 imaging methods: ultrasound, CT and MRI in the differentiation between malignant and benign tumor of the parotid. This is a retrospective study of 49 cases of parotid tumors collected over 3 years from 2014 to 2016. The parameters studied were age, sex, reason for consultation, data from clinical examination, imaging, surgery and histological data. Each of the radiological criteria used to determine the nature of the tumor was analyzed and correlated with the histology data. For the analytical study, the chi-two test was used and the p-value was calculated (significant if $p < 0.05$) and then the sensitivity, specificity and diagnostic efficiency were calculated for each modality. The average age of our patients was 44 years. The sex ratio is a 0.58 with a clear female predominance. The pattern of consultation was parotid swelling in all cases. The right side with 30 cases and the left with 19 cases, with cervical adenopathy in 4 cases. The average time for consultation was 59 months. The definitive histology was benign in 39 patients and malignant in 10 cases. On ultrasound, fuzzy boundaries and irregular contours predict malignancy. At CT, the criteria that lead to malignancy are: blurred boundary, area of necrosis, and extends to neighboring tissues. At MRI, irregular contours, capsular effraction, extension to neighboring tissues and presence of adenopathy are the criteria that lead to malignancy. Radiation-histological correlation showed a sensitivity of 66%, 42% and 88%, and a specificity of 90%, 82% and 82% for ultrasound, CT and MRI, respectively. Preoperative knowledge of the nature of the tumor guides the surgeon in his surgical decision. Therefore, imaging has become a real diagnostic tool for surgeons, and MRI represents the exam of choice, especially with the emergence of new dynamic techniques.
**Keywords**: Parotid, Ultrasound, CT, MRI, histology.

## INTRODUCTION

Salivary gland tumors are relatively rare, accounting for 3% of all tumors of the head and neck. Parotid localization is the most common and represents less than 3% of all cervical tumors [1, 2]. They are benign in the majority of cases predominated by the pleomorphic adenoma. Preoperatively, the clinical examination and the imaging data allow to specify the exact seat of the lesion, its extension to neighboring tissues. Ultrasonography, whether or not associated with needle aspiration, CT and MRI, is the routine examination used in the diagnosis of parotid tumors. However, their effectiveness in evaluating the benign or malignant nature of the tumor is not yet well codified. The objective of this work is to evaluate the contribution of the 3 imaging methods: ultrasound, CT and MRI in the differentiation between malignant and benign parotid tumors.

## MATERIALS AND METHODS

It is a retrospective study of 49 cases of parotid tumors collected over a period of 3 years, between March 2014 and March 2017, in the department of Ear-nose-throat and head-neck surgery of the specialty hospital in Rabat. The parameters studied were age, sex, reason for consultation, clinical examination data, imaging, surgery and histology data. We first studied the population as a whole, and then correlated the radiological criteria with ultrasound, CT and MRI (used to determine the nature of the tumor) with the histology data of the patient. For the analytical study, the chi-square test was used and the p-value (significant if $p < 0.05$) was calculated, after which the sensitivity and specificity for each modality were calculated.

## RESULTS

### Descriptive results

Epidemiologically, the average age of our patients was 44 years with extremes between 9 years and 80 years. There was a female predominance with 31 women and 18 men and a sex ratio of 0.58. The average consultation time was 59 months, with extremes between 2 months and 3 years. The affected side was right in 30 cases (61.2%) and left with 19 cases (38.7%).

Clinically (Table-1), the mass was painful in 11 cases (22.5%). The consistency was hard in 14 cases (28.5%), closed in 33 cases (67.3%) and mole in 2 cases (4%). The tumor was well limited in 36 patients (73.4%), poorly limited in 13 patients (26.5%), mobile in 27 patients (55%) and fixed in 11 patients (22.5%). Two patients (4%) had cutaneous infiltration by the tumor with facial palsy in 3 patients (6%). Adenopathy were present in 9 patients (18.3%).

Radiologically (Table-2), 26 patients (53%) underwent cervical ultrasound, 36 patients (73, 4%) underwent cervical CT and MRI was performed in 19 patients (38), but 7% on ultrasound .The conclusion was in favor of a benign tumor in 20 cases (76.9%) and malignancy in 6 cases (23%). The boundaries were fuzzy in 5 cases (19.2%) and sharp in 21 cases (80.7%). The outlines were regular in 14 cases (53.8%) and irregular in 12 cases (46.1%). The appearance was heterogeneous in 22 cases (84.6%) and homogeneous in 4 cases (15.4%). The tumor was hyperechoic in 9 cases (34.6%) and hypoechoic in 17 cases (65.4%). Areas of necrosis were observed in 9 cases (34.6%) and ADPs were present in 6 cases (23%). In CT, the benign aspect was evoked in 29 cases (80.5%) and malignant in 7 cases (19.5%). The limits were clear in 27 cases (75%) and fuzzy in 9 cases (25%). The outlines were regular in 26 cases (72.2%) and irregular in 10 cases (27.7%). Contrast uptake was observed in 29 cases (80.5%), calcifications in 3 cases (8.3%), necrotic zones in 12 cases (33.3%) and extends to neighboring tissues. was noted in 3 cases (8.3%). On MRI, the diagnosis of a benign tumor was retained in 10 cases (52.6%) and malignancy in 9 cases (47.4%). Contours were regular in 7 cases (36.8%), irregular in 6 cases (31.5%) and lobulated in 6 cases (31.5%). The matter was tissue in 10 cases (52.6%), cystic in 1 case (5.2%) and mixed in 8 cases (42%). Capsular break-in was noted in 6 cases (31.5%), extension to surrounding tissues in 5 cases (26.3%), areas of necrotic in 12 cases (63%) and perineural infiltration. in 1 case (5.2%). At T1 signal the tumor was hypo-signal in 17 cases (89.5%) and ISO-signal in 2 cases (10.5%). At signal T2 the tumor was hypo-signal in 7 cases (36.8), hyper-signal in 11 cases (57.9%) and ISO-signal in 1 case (5.2%). ADPs were revealed by MRI in 7 cases (36.8%).

Histologically (Table-4), the histological type was benign in 39 cases and malignant in 10 dominated by pleomorphic adenoma in 29 patients, is 59% of cases.

**Table-1: Clinical Data**

| Data | | Number of cases (%) |
|---|---|---|
| Pain | | **11(22,5)** |
| Consistency | **Lasts** | **14(28,5)** |
| | **Farm** | **33(67,3)** |
| | **Molle** | **2(4)** |
| Limits | **Limited** | **36(73,4)** |
| | **irregular** | **13(26,5)** |
| Mobility | **Mobile** | **27(55)** |
| | **Fixed** | **11(22,5)** |
| Skin infiltration | | **2(4)** |
| Facial paralysis | | **3(6)** |
| ADPs | | **9(18,3)** |

**Table-2: Radiological Data**

| Data | | Number of cases (%) |
|---|---|---|
| Ultrasound | | |
| Benin | | 20(76,9) |
| Malin | | 6(23) |
| Limits | Net | 21(80,7) |
| | **Fuzzy** | 5(19,2) |
| Contours | Régular | 14(53,8) |
| | **Irrégular** | 12(46,1) |
| Aspect | homogeneous | 4(15,4) |
| | **Heterogeneous** | 22(84,6) |
| Echogenicity | Hypoéchoic | 17(65,4) |
| | **Hyperéchoic** | 9(34,6) |
| Central necrosis | | 9(34,6) |
| ADPs | | 6(23) |
| CT | | |
| Benin | | 28(77,7) |
| Malin | | 8(22,2) |
| Limits | Net | 27(75) |
| | Fuzzy | 9(25) |
| Contours | Régular | 26(72,2) |
| | Irrégular | 10(27 ;7) |
| Contrast | | 29(80,5) |
| Calcifications | | 3(8,3) |
| Nécrose | | 12(33,3) |
| Extensions | | 3(8,3) |
| MRI | | |
| Benin | | 10(52,6) |
| Malin | | 9(47,4) |
| Contours | **Régular** | 7(36,8) |
| | **Irrégulars** | 6(31,5) |
| | **Lobulated** | 6(31,5) |
| Nature | **Tissue** | 10(52,6) |
| | **Cystic** | 1(5,2) |
| | **Mixted** | 8(42) |
| Signal T1 | **Iso** | 2(10,2) |
| | **Hypo** | 17(89,5) |
| | **Hyper** | 0(0) |
| Signal T2 | **Iso** | 1(5,2) |
| | **Hypo** | 7(36,8) |
| | **hyper** | 11(57,9) |
| Capillary effraction | | 6(31,5) |
| Extension | | 5(26,3) |
| Nécrose | | 12(63) |
| Perineural Infiltration | | 1(5,2) |
| ADPs | | 7(36,8) |

**Table-3: Histological Data**

| Histological type | Number of cases (%) |
|---|---|
| Benign tumors | **39** |
| Pleomorphic adenoma | 29 |
| Epidermoid cyst | 2 |
| Intraparotid ADP | 2 |
| Chronic non-specific inflammation | 2 |
| Tuberculosis | 1 |
| Cystadénolymphome | 1 |
| Wharton tumor | 1 |
| Mucocele | 1 |
| Malignant neoplasms | **10** |
| Squamous cell carcinoma | 3 |
| Muco-epidermoid carcinoma | 2 |
| Cystic adenocarcinoma | 2 |
| Myo-epidermoid carcinoma | 1 |
| Ductal carcinoma | 1 |
| Adenocarcinoma | 1 |

**Analytical results**

Then, the results of the different radiological criteria (ultrasound, CT and MRI) were correlated with the definitive histology results in terms of detection of the nature of the tumor (malignant / benign). The correlation was made via SPSS 20.0 software and the chi-square test was used and the p-value (significant if p <0.05) was calculated (Table 4), then the sensitivity, the specificity for each category (Table 5, 6 and 7).

On ultrasound, the parameters of which the correlation was significant are the limits (P = 0.05) and the contours (0.05). Among the 6 diagnoses suspected on ultrasound 4 diagnoses were histologically malignant, 66.6% sensitivity and 90% specificity.

At CT, the limits (0.05), the presence of necrosis zones (0.029) and the extension to neighborhood tissues (0.005) are criteria that point to malignancy. Of the 8 diagnoses suspected to have CT, 3 diagnoses were histologically malignant, with a summer sensitivity of 42.8% and a specificity of 82.75%.

On the MRI, the elements with a significant P-value are the contours (0.05), the capsular intrusion (<0.001) and the extension to the surrounding tissues (0.005). Of the 9 MRI-suspected diagnoses, 7 diagnoses were histologically malignant with 87.5% sensitivity and 81.8% specificity.

**Table-4: Univariate Analytical Comparison**

| Nature | | Bénin | Malin | Value P |
|---|---|---|---|---|
| Ultrasound | | 20 | 6 | |
| Limits | Net | 19 | 2 | **0,05** |
| | Fuzzy | 1 | 4 | |
| Contours | Régular | 13 | 1 | **0,005** |
| | Irrégular | 7 | 5 | |
| Aspect | homogeneous | 7 | 5 | 0,324 |
| | Heterogeneous | 4 | 0 | |
| Echogeneicité | Iso | 0 | 0 | 0,296 |
| | Hypo | 12 | 5 | |
| | Hyper | 8 | 1 | |
| Nécrose | | 5 | 4 | 0,08 |
| ADPs | | 4 | 2 | 0,428 |
| TDM | | 29 | 7 | |
| Limits | Net | 24 | 3 | **0,05** |
| | Fuzzy | 5 | 4 | |
| Contours | Régular | 23 | 3 | 0,07 |
| | Irrégular | 6 | 4 | |
| Contraste | | 22 | 7 | 0,232 |
| Calcifications | | 2 | 1 | 0,48 |
| Nécrose | | 7 | 5 | **0,029** |
| Extensions | | 0 | 3 | **0,005** |
| MRI | | | | |
| Contours | Régular | 7 | 0 | **0,001** |
| | Irrégular | 0 | 6 | |
| | Lobulated | 4 | 2 | |
| Nature | Tissue | 6 | 4 | 0,622 |
| | Cystic | 1 | 0 | |
| | Mixted | 4 | 4 | |
| Signal T1 | Iso | 2 | 0 | 0 ,3 |
| | Hypo | 9 | 8 | |
| | Hyper | 0 | 0 | |
| Signal T2 | Iso | 0 | 1 | 0,2 |
| | Hypo | 3 | 4 | |
| | Hyper | 8 | 3 | |
| Capsulary Effraction | | 0 | 6 | **<0,001** |
| Extension | | 0 | 5 | **0,005** |
| Nécrose | | 5 | 7 | 0,08 |
| périneural Infiltration | | 0 | 1 | 0,4 |
| ADPs | | 1 | 6 | 0,06 |

**Table-5: Sensitivity and specificity on ultrasound**

| | | Histology | |
|---|---|---|---|
| | | Malin = 6 | Benin = 20 |
| Ultrasound | Suspect = 6 | TP = 4 / sensibility = 66,6% | FP = 2 |
| | Benin = 20 | FN = 2 | TN = 18 / Spécificity = 90% |

**Table-6: Sensitivity and specificity at CT**

| | | Histology | |
|---|---|---|---|
| | | Malin = 7 | Benin = 29 |
| CT | Suspect = 8 | TP = 3 / sensibility = 42,8% | FP = 5 |
| | Benin = 28 | FN = 4 | TN = 24 / Spécificity = 82,8% |

**Table-7: MRI sensitivity and specificity**

| | Histologie | |
|---|---|---|
| | Malin = 8 | Benin = 11 |

| | | | |
|---|---|---|---|
| MRI | Suspect = 9 | TP = 7 / sensibility = 87,5% | FP = 2 |
| | Benin = 10 | FN = 1 | TN = 9 / Spécificity = 81,8% |

## DISCUSSION

Salivary gland tumors constitute less than 3% of all tumors of the head and neck, 80% of these tumors affect the parotid [1]. They are common, especially in adults and the elderly [2]. Clinically, several symptoms point to malignancy. Pain, facial paralysis, ganglionic involvement must attract the attention of the clinician. According to Jouzdani [3], some clinical signs were associated with malignancy: hard mass (48%), facial palsy (21%), adenomegaly (11.5%), and skin invasion (5.5%). For Ahuja [4], pain is found in 5.1% of patients with a benign tumor, and 6.5% of patients followed for malignant tumors, therefore, pain cannot be a good indicator for suspecting malignancy. The rapid evolution of the tumor is directed towards lymphomas, squamous cell carcinomas and undifferentiated tumors. On the other hand, their diagnostic value is not absolute [5]. In our series the maximum time of appearance of the parotid mass was 3 years. On the preclinical level, the ultrasound allows to move towards the malignancy in 80% of the cases showing an inhomogeneous aspect with fuzzy and irregular limits [5], in our series it is the fuzzy limits and the irregular contours that are in favors of malignity. For Burke [6], it is the undefined, hypoechoic and heterogeneous nature of the mass, with posterior reinforcement, that suggests malignancy. As for Bradley [7], the malignant tumor appears poorly defined, heterogeneous architecture, with internal necrosis and cystic degeneration. The sensitivity of ultrasound in detecting tumors of the superficial lobe of the parotid is close to 100% [5]. According to Fontanel [8] the distinction between glandular and extra-glandular lesion on ultrasound is 95%. In the Suzuki series (9), the sensitivity and specificity of ultrasound are respectively 62 and 91%. In our series sensitivity and specificity were 66.6 and 90%. On the other hand, CT can be used to evaluate tumor volume, deep lobe exploration, good bone structure analysis, and locoregional extension assessment. Its diagnostic value of the benign or malignant nature of the tumor is diminished compared to the MRI which is the examination of choice for parotid exploration. For some authors [10] the ultrasound is superior to CT with sensitivity values at 75% against 71.5% against CT but without significant difference. In our series the sensitivity and specificity of CT were 42.8% and 82.8%. For Rudack [11], the ultrasound was comparable to both CT and MRI in distinguishing tumor nature, and the difference was statistically insignificant between the sensitivity and specificity of each of the diagnostic modalities. In our series the criteria for malignancy were the fuzzy boundaries, the presence of necrotic zones and the extension to neighboring tissues. In Fassih's study [10] it is the fuzzy boundaries, irregular contours and extension to neighboring tissues that point to malignancy. For Akkari [12], the heterogeneous appearance, the fuzzy limits, the enhancement after contrast injection and the presence of lymphadenopathy favored the malignant nature. MRI allows a better anatomical resolution. It makes it possible to specify the tumor nature reliably and to distinguish between cystic tissue lesions. The diagnostic values of sensitivity and specificity of the MRI were calculated by Bartels [13] in 2000 and compared to the values of the CT scan: the sensitivity of the MRI is 100% against 88% for the CT, but it appears lower in specificity. According to Prades [14], the MRI sensitivity of detection of a malignant tumor reaches 75%. In our series, the sensitivity and specificity of MRI are 87.5% and 81.8% compared to 42.8% and 82.8% for CT. For Devos [16], the diagnostic performance of MRI compared to histology was 79% for sensitivity and 100% for specificity. These studies show the superiority of MRI in distinguishing the benign or malignant nature of the tumor compared to CT and ultrasound. On the other hand, Kim [17] showed that CT was comparable to MRI in the evaluation of tumor nature, sensitivity and specificity were respectively 93% and 61% for CT, and 83% and 63%, respectively, for MRI. Several MRI characteristics are related to malignancy, namely cervical ADPs, the presence of a poorly limited and irregular glandular capsule, T1 and T2 hyposignal images, and extension to neighboring tissues [15]. According to Koyuncu [18], the radiological signs in favor of malignancy are almost the same for CT and MRI: the fuzzy boundaries, the irregular contours and the extension to neighboring issues.

For some authors, high-grade carcinomas appear as hyposignal and intermediate signal, whereas low-grade carcinomas appear as hypersignals T2 simulating a benign tumor [18]. In our series the malignancy-orienting elements are the irregular contours extension to neighboring tissues and capsular intrusion. The diagnostic value of the tumor nature of fine needle aspiration is similar to or better than MRI and is lower in cost and should be performed after the imaging assessment [13]. In our series, 6 patients (12%) benefited from a needle aspiration, four of which were malignant.

## CONCLUSION

Preoperative knowledge of the nature of the tumor guides the surgeon in his surgical decision. As a result, imaging has become a real diagnostic tool for surgeons. Ultrasound is the first-line examination for many authors, but MRI is the exam of choice, especially with the emergence of new dynamic techniques.

## CONFLICTS OF INTEREST

The authors do not declare any conflict of interest.

## CONTRIBUTIONS OF THE AUTHORS

All the authors contributed to the realization of this work.

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