Parotid masses: The effectiveness of preoperative diagnostic methods on definitive diagnosis

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Abstract

Aim: 85% of neoplasms originating from the major salivary glands are seen in the parotid gland. The diagnosis of parotid masses can sometimes be made with a simple anamnesis and physical examination. However, despite all advanced examinations and biopsies, the preliminary diagnosis can be very different from the postoperative pathological diagnosis due to the unique embryological and anatomical features of the parotid gland. In our study, we aimed to evaluate the relationship between the accuracy of diagnostic tools and postoperative pathological diagnoses in patients who underwent parotidectomy.

Materials and Methods: The files of patients who underwent surgery between 2014 and 2019 due to a parotid mass were evaluated. Preoperative neck ultrasound, computed tomography, magnetic resonance imaging, and fine-needle aspiration biopsies were evaluated. Postoperative pathological diagnoses and preoperative examination findings, imaging methods, and preliminary diagnoses obtained according to fine-needle aspiration biopsy results were compared and sensitivity, specificity, and accuracy rates were determined.

Results: According to the postoperative pathologic diagnosis, 31 of the tumors were reported as benign (91.1%) and 3 as malignant (8.8%). Ultrasound defined 10 of 17 patients with benign pathology as benign (58.8%) and 7 as nondiagnostic (41.1%). Magnetic resonance imaging reported 11 of 15 benign cases as benign (73.3%), and defined 1 malignant case as nondiagnostic. It was observed that 20 of the patients who underwent fine-needle aspiration biopsy were reported as benign and 4 as nondiagnostic. Postoperative pathology results of 2 of 24 patients were reported as malignant, and 22 of them as benign.

Conclusion: Although magnetic resonance imaging gives the most accurate information among the imaging methods evaluated for preoperative parotid masses, it cannot always make a definitive diagnosis. Although fine-needle aspiration biopsy is useful in distinguishing between malignant and benign tumors, malignant tumors can be reported as benign.

Introduction

Three percent of head and neck cancers originate from major salivary glands. Among the major salivary glands, 85% of neoplasms occur in the parotid gland [1]. Although the diagnosis of parotid masses can sometimes be made with a simple history and physical examination; and sometimes, despite all advanced examinations and biopsies, the preliminary diagnosis can be very different from the postoperative pathological diagnosis, due to the unique embryological and anatomical features of the parotid gland and the parotid cells which has a wide histological spectrum. To reach the diagnosis, a detailed anamnesis should be taken and a physical examination should be performed. Ultrasound (USG), computed tomography (CT), and magnetic resonance imaging (MRI) are frequently used in diagnosis. The fact that USG is easy, gives quick results, and is a noninvasive method makes it very frequently used in salivary gland diseases. It is often the first imaging method used in parotid gland tumors, but technically, a part of the parotid gland cannot be visualized in a small area behind the mandible ramus.

On the other hand, CT mostly evaluates the bone structures in the foreground. Therefore, it is used to evaluate the possible presence of tumors in the mandible cortex, especially in malignant parotid gland tumors. Computed tomography gives information about the size and depth of the mass in salivary gland tumors, the detection of bone

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tissue invasion and destruction, the vascular status of the mass, its relationship with the surrounding tissues, and staging [2].

MRI is very valuable in the differentiation of inflammatory mass/tumor in the parotid gland, in determining the benign/malignant character of the tumor, and in determining the extent of tumors to the deep lobe [3]. In addition, MRI identifies the tumor-facial nerve relationship with an accuracy of over 90% [4].

In addition to the imaging methods mentioned, fine needle aspiration biopsy (FNAB) from the mass may often be required. Especially in cases where imaging methods are unstable, it reveals whether the lesion is inflammatory or neoplastic and can prevent unnecessary surgery. However, although it has been reported that the risk of recurrence is increased in tumors, especially if a biopsy is performed before surgery [5], no recurrence has been observed in the published series [6]. In addition to routine laboratory tests, immunological, serological, rheumatological tests and saliva analysis may be requested from the patients.

Whether the mass is inflammatory or tumoral, malignant or benign, and its relationship with the surrounding tissues will affect the treatment plan and postoperative management of the patients. For this reason, the high sensitivity of examination and imaging methods will increase the success of the surgery. Even if all these are taken into consideration, the preoperative diagnosis may be different from the postoperative diagnosis.

In our study, we aimed to determine the effectiveness of preoperative diagnostic methods by evaluating the relationship between pre-diagnoses and postoperative pathological definitive diagnoses in patients who underwent parotidectomy.

Materials and Methods

Before the study, consent was obtained from Adıyaman University Non-Invasive Clinical Research Ethics Committee (number: 2019/8-21). The files of the patients who applied to us for a parotid mass and were operated on in the Ear Nose Throat Department of our hospital between January 2014 and January 2019 were evaluated retrospectively through the hospital automation system. At the end of the retrospective scan, the number of patient files that met the criteria was taken as the number of files in which the study would be conducted. Detailed anamnesis, physical examination, preoperative imaging methods, USG, CT, MRI, and FNAB results of the patients were examined.

Statistical analysis

We did not test hypotheses in the study, we only calculated the sensitivity, specificity, and accuracy of the diagnostic methods. Sensitivity was defined as the ratio of preoperatively detected malignant lesions to actual malignant lesions and was expressed as a percentage. Specificity was defined as the ratio of preoperatively detected benign lesions to actual benign lesions and was expressed as a percentage. Accuracy was defined as the ratio of detected true benign and true malignant lesions to the total lesions and was expressed as a percentage. Microsoft Excel was used (Microsoft Corporation 2018, Microsoft 365, Excel)

for calculation.

The sensitivity, specificity, and accuracy of the preoperative diagnoses obtained according to the postoperative pathological diagnoses and preoperative examination findings, imaging methods, and FNAB results were compared.

Results

The ages of 34 patients included in the study ranged from 8 to 66 (mean: 44.7). Superficial parotidectomy was performed in 25 (73.5%) patients, total parotidectomy in 8 patients (23.5%) and enucleation in 1 (2%). According to the postoperative pathology results, 31 of the tumors were reported as benign (91.1%) and 3 as malignant (8.8%). In physical examination; The mass was mobile in all of the patients with a benign mass, but its consistency varied in some. Of the 3 patients with malignant masses, 3 had a fixed solid consistency, and 1 patient had facial paresis. According to the examination findings and imaging methods, 26 (76.4%) of the tumors were located in the superficial lobe, and in 8 cases (23.6%) the tumor was found to have deep lobe extension. Pleomorphic adenoma was the most common type of neoplasia (15 cases, 44.1%). The second most common neoplasia was the Warthin tumor (9 cases, 26.4%). Other benign masses are; It was reported as 3 lipomas, 2 myoepitheliomas, 1 retention cyst, and 1 sialoadenitis. Types reported as malignant were Epithelial Myoepithelial Carcinoma (1 case), Polymorphous Low-Grade Adenocarcinoma (1 case), and B-Cell Non-Hodgkin Lymphoma (1 case).

In the postoperative pathology results of 20 patients who underwent ultrasound, 17 were reported as benign and 3 as malignant. Ultrasound defined 10 of 17 patients with benign pathology as benign (58.8%) and 7 as nondiagnostic (41.1%). USG defined 1 of 3 patients with malignant pathology as benign, 1 as malignant, and 1 as nondiagnostic. 10 patients were benign and 1 was malignant of 11 patients reported as benign by ultrasound. The pathology result of 1 patient who was defined as malignant by ultrasound was malignant. 7 patients were benign and 1 was malignant of the 8 patients USG was defined as nondiagnostic. In 2 cases, the ultrasound results and the pathology results did not match; 1 was benign (5%), and 1 was malignant (5%). In a total of 9 cases, ultrasound made the correct specific pathological diagnosis (45%). All of these 9 cases were benign (Table 1). The sensitivity of USG was 1/3 (33.3%), specificity was 10/17 (58.8%), and accuracy was 11/20 (55%) (Table 2).

MRI was performed on 16 patients. Postoperative pathology results of these 16 patients were reported as 15 benign and 1 malignant. MRI reported 11 of 15 benign cases as benign (73.3%). MRI defined 1 malignant case as nondiagnostic. Postoperative pathology results of all 11 patients who were reported as benign in MRI were benign. MRI could not differentiate benign from malignant in 5 patients (Table 1). sensitivity of MRI; -, specificity;11/15 (73%) and accuracy; It was found to be 11/16 (68%) (Table 2).

CT was performed on 4 patients. In the postoperative pathology results of these 4 patients, 4 were benign. CT reported only 1 patient as benign (25%). In 3 patients, it could not distinguish between benign and malignant (Table 1). The sensitivity of CT; -, specificity; was 1/4 (25%)

Table 1. Comparison of preoperative imaging and FNAB prediagnoses and postoperative pathology diagnoses.

USG	Postop Benign	Postop Malign	Total	CT	Postop Benign	Postop Malign	Total
Preop Benign	10	1	11	Preop Benign	1	-	1
Preop Malign	-	1	1	Preop Malign	-	-	-
Preop Nondiagnostic	7	1	8	Preop Nondiagnostic	3	-	3
Total	17	3	20	Total	4	-	4
MRI				FNAB			
Preop Benign	11	-	11	Preop Benign	19	1	20
Preop Malign	-	-	-	Preop Malign	-	-	-
Preop Nondiagnostic	4	1	5	Preop Nondiagnostic	3	1	4
Total	15	1	16	Total	22	2	24

Preop: Preoperative, Postop: Postoperative, USG: Ultrasound, CT: computed tomography, MRI: Magnetic resonance imaging, FNAB: Fine needle aspiration biopsy.

Table 2. Specificity, sensitivity, and accuracy rates according to postoperative pathology results.

	Sensitivity (%)	Specificity (%)	Accuracy (%)
USG	33.3	58.8	55
CT	-	25	25
MRI	-	73	68
FNAB	-	86	79

USG: Ultrasound, CT: computed tomography, MRI: Magnetic resonance imaging, FNAB: Fine needle aspiration biopsy.

and accuracy was 1/4 (25%). (Table 2).

Ultrasound-guided fine-needle aspiration biopsy was performed in 24 patients (70.5%). According to FNAB, 20 patients were reported as benign and 4 patients as nondiagnostic. The postoperative pathology result of 2 of these 24 patients was malignant and the result of 22 of them was benign. FNAB was able to detect 19 of 22 benign patients (86.6%) and could not detect 2 malignant cases. 1 malignant case was reported as benign in FNAB. FNAB results and pathology results did not match in 3 cases, 2 were benign (8.3%), and 1 was malignant (4.1%) of them. FNAB established the specific correct pathological diagnosis in 12 cases (50%) (Table 1). sensitivity of FNAB; -, specificity, 19/22 (86%), and accuracy was 19/24 (79%) (Table 2).

Discussion

In our study, we retrospectively compared the preoperative examinations and the pathology results in patients who were operated on for parotid tumors and determined the sensitivity, specificity, and accuracy rates of the preoperative examinations. In our study, we found that the imaging method with the highest sensitivity was USG, and the examination with the highest specificity and accuracy was FNAB. We found that MRI was the second test with the highest specificity and accuracy. These findings showed us that USG would be useful in identifying parotid gland masses, but MRI and especially FNAB were more important in determining the nature of the mass.

The most common complaint in parotid diseases is swelling in the parotid region. Sudden onset of pain and swelling usually suggest inflammatory pathologies. A rapid increase in the size of a long-standing swelling may indicate malignant degeneration of a benign mass. Facial nerve paresis or paralysis with pain supports the fixation of the mass, malignancy, and infiltration of the trismus mass into the surrounding tissues. It has been reported in the literature that the first finding of 75% of malignant salivary gland tumors is a painless mass. The pain was found to be the first symptom at a rate of 6-29%, and facial paralysis was found at a rate of 6-13% [1,7,8]. Anamnesis and physical examination are important in the diagnosis of these diseases, but their definitive diagnostic value is limited [9]. The most important thing is to diagnose the masses before the operation and to plan the treatment. In this way, the comorbidity and mortality of unnecessary surgery will be avoided by deciding what kind of surgery will be performed. For this purpose, patients may require preoperative imaging and FNAB.

The most commonly accepted imaging method in patients presenting with a parotid mass is high-resolution USG. [10-12] The advantages of USG compared to other imaging methods such as CT and MRI are that it is easier to apply and it does not require contrast material, as well as its cost, is much lower. Brennan et al. stated that USG alone would provide sufficient information in the diagnosis of superficial lobe tumors of the parotid [13]. In addition, another advantage is that a biopsy can be taken during the USG. [14,15] In our study, the sensitivity of USG was; 33.3% specificity;58.8% accuracy was 55%. In addition, it was the most sensitive imaging method among the preoperative examinations performed in our study.

Computed tomography is useful in determining the size and depth of the mass in salivary gland tumors, detecting bone tissue invasion, and destruction, and giving information about the vascular status of the mass, relationship with surrounding tissues, staging, and postoperative follow-up [2]. In our study, CT was requested from only 4 patients; The specificity and accuracy rates were also the lowest preoperative imaging method. This was due to the low number of CTs requested. The specificity of CT in our study; 25% accuracy was 25%.

Another imaging method frequently used in the diagnosis of parotid masses is MRI. MRI shows the relationship between the surrounding tissue better than CT [14,16]. MRI is the most sensitive and specific imaging method in showing the tumor size, localization, type, invasion, and

relationship to the surrounding tissue in the parotid [17] MRI is very valuable in the differentiation of inflammatory mass/tumor in the parotid gland, in determining the benign/malignant character of the tumor, and in determining the extent of tumors to the deep lobe. [3] In addition, MRI identifies the tumor-facial nerve relationship with an accuracy of over 90%. [4] In our study, MRI was requested for 16 patients and the specificity of MRI was 73% and its accuracy was 68%. Among the preoperative imaging methods, the specificity and accuracy rates were the highest.

In recent years, the effect of sensitivity-weighted imaging (DWI) on the differentiation of benign and malignant and subgroup diagnoses according to conventional MRI has been investigated. DWI, which is a functional technique and complements MRI, increases its value because it does not require contrast material and can provide a qualitative and quantitative evaluation. In a study conducted on 207 patients with parotid tumors, the effectiveness of conventional MRI, dynamic contrast MRI and DWI in the differentiation of benign and malignant findings were compared. It has been reported that contrast-enhanced imaging added to conventional MRI does not increase the diagnosis, while DWI is more effective [18]. Fassnacht et al. In a study of 178 patients; Sensitivity, specificity, and positive predictive value (PPD) in the diagnosis of malignant tumor were 45%, 89%, 84% for FNAB alone, 40%, 88%, 81% for conventional MRI, 50%, 85%, 85% in combination with FNAB and MRI, respectively. 80, it has been reported as 70%, 93%, and 91% in combination with MRI and DWI [19].

In particular, benign and malignant masses in the major salivary glands present with similar clinical features. The character of the mass may not be determined until the postoperative pathological evaluation is concluded [20]. Therefore, morphological diagnosis is often necessary for the appropriate treatment of masses. FNAB is a simple, inexpensive, and easily performed atraumatic procedure that requires minimal equipment in the evaluation of tumors, lymph nodes, and other lesions in the head and neck region. The risk of cancer cell implantation is very low. [21] Although it has been reported that the risk of recurrence is increased in tumors, especially if a biopsy is performed before surgery [5], no recurrence has been observed in the published series. [6] However, especially high false negatives have led many authors in the USA to think that FNAB has a limited application area in the diagnosis of salivary gland tumors. In 1987 Layfield et al. [22] after reviewing 36 publications, its application has increased and it has now become widely used in the primary diagnosis of salivary gland masses. In the literature review, it was stated that the sensitivity of FNAB in salivary gland tumors is between 54-92% and the specificity is between 86-100%. It has been reported that this rate is lower in parotid gland tumors [23]. In one study, the usefulness rate was found to be 88.4% [24]. Despite numerous studies on large series with a sensitivity, specificity, and accuracy of 90%, the importance of FNAB in the diagnosis of salivary gland tumors is still not accepted by everyone. Despite the simplicity of the method, the accuracy of FNAB depends on the sensitivity and experience of the pathologist

[25]. In some cases, malignant tumors can be reported as benign [26]. Therefore, although FNAB helps in preoperative planning, it cannot exceed this surgeon's clinical experience and intraoperative findings [27]. In our study, the specificity was 86% and the accuracy of FNAB was 79%. In addition, it was the test with the highest specificity and accuracy among the preoperative diagnostic method.

Evaluation of FNAB results together with imaging methods may be useful when making the diagnosis. In a study in which preoperative FNAB and MRI were evaluated in 81 patients (60 benign and 21 malignant) with parotid masses, the sensitivity, specificity, and accuracy rates were found to be 90%, 95%, 94% for FNAB, and 81%, 92%, 89% for MRI [14,28]. Atay et al. [29] reported that FNAB and MRI results were similar in the differentiation of benign-malignant parotid masses and that diffusion-weighted MRI and FNAB results were close to each other in determining the tumor subtype. However, it has been observed that the information provided by MRI in addition to FNAB contributes to the planning of surgery, and FNAB results do not change the approach to parotid mass [30]. In a different study, it was not found that the combined evaluation of MRI and FNAB was superior to the evaluation individually [31]. When the masses are evaluated according to their size; The sensitivity of FNAB in tumors smaller than 2 cm was found to be 54.5% and 77.7% in larger tumors. In addition, this rate was found to be 80% in tumors extending to the deep lobe. The accepted FNAB result and the final diagnosis are associated with tumor diameter [3].

In the preoperative diagnosis of parotid masses, MRI does not always provide a definitive diagnosis when compared to USG and CT. In our study, we found that the imaging method with the highest sensitivity was USG, and the examination with the highest specificity and accuracy was FNAB. We found that MRI was the second test with the highest specificity and accuracy. Although FNAB is useful in distinguishing between malignant and benign tumors, malignant tumors can be reported as benign. Although all these methods help make the diagnosis, they will not exceed the surgeon's clinical experience and intraoperative findings. Large series of studies are needed to reach more accurate results regarding preoperative examinations in parotid gland tumors.

Ethics approval

Before the study, consent was obtained from Adıyaman University, Non-Invasive Clinical Research Ethics Committee (number: 2019/8-21).

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