Sensitivity of fine needle aspiration cytology and ultrasound parotid imaging reporting and data system in diagnosis of parotid tumors

Original Article

Ahmed Nabil El-Ngouly[a], Tamer Youssef[a], Doaa Khedr Mohamed Khedr[b] and Mohamed Hafez Seyam[a]

Department of [a]General Surgery, [b]Diagnostic and Interventional Radiology, Faculty of Medicine, Mansoura University, Mansoura, Egypt.

ABSTRACT

Background & Aim: Salivary gland tumors constitute 3% of tumors in the head and neck region, with 80% of these originating in the parotid gland. The study aimed to evaluate and clarify the use of the parotid imaging reporting and data system (PI-RADS) scoring system and fine needle aspiration cytology in diagnosing parotid lesions and comparing it with postoperative histopathological diagnosis.

Patients and Methods: This was an observational study conducted on patients presented with parotid swelling at the outpatient clinic of the Endocrine Surgery Unit at Mansoura University Hospital. This study was conducted between October 2021 and the end of 2024.

Results: The PI-RADS system was used to identify various types of parotid swellings, including Warthin tumors, pleomorphic adenoma, and lipoma. The system's sensitivity and specificity were 100.0 and 61.11% for identifying malignant tumors, 72.7 and 62.5% for Warthin tumors, 85.7 and 58.33% for pleomorphic adenoma, 100.0 and 47.1% for lipoma, and 100.0 and 61.1% for lymphoepithelial cysts. A malignant tumor was initially diagnosed as suspicious, but eight benign lesions were classified, including Warthin tumors, pleomorphic adenoma, bloody smear, reactive lymphoid tissue, and lipoma due to inaccessible aspiration.

Conclusion: The PI-RADS system and fine needle aspiration cytology are effective in diagnosing parotid lesions, with the PI-RADS system being particularly effective in categorizing lesions as benign or potentially malignant. Its reliability in identifying different types of lesions and its high sensitivity for identifying malignancies like epithelial myoepithelial carcinoma make it a valuable diagnostic tool for surgical planning and decision-making.

Key Words: Fine needle aspiration cytology, parotid tumors, sensitivity, ultrasound parotid imaging.

Received: 13 August 2024, **Accepted:** 29 August 2024, **Published:** 1 January 2025

Corresponding Author: Ahmed N. El-Ngouly, MSc, Department of General Surgery, Faculty of Medicine, Mansoura University, Mansoura, Egypt. **Tel.:** 01024964379, **E-mail:** ahmedngouly22526994@gmail.com

ISSN: 1110-1121, January 2025, Vol. 44, No. 1: 248-255, © The Egyptian Journal of Surgery

INTRODUCTION

Salivary gland tumors comprise 3% of tumors in the head and neck region, with 80% of these originating in the parotid gland. Parotid lesions frequently provide a difficult diagnostic task due to their numerous possible differential diagnoses. Although most of these lesions are benign (about 80% of parotid lesions)[1].

Around 80% of parotid gland tumors are noncancerous and are situated in the superficial region of the gland. Pleomorphic adenoma, also known as benign mixed tumor, is the most prevalent neoplasm, accounting for around 60% of parotid gland tumors. The second most prevalent type is monomorphic adenoma, which is also referred to as papillary cystadenoma lymphomatosum, adenolymphoma, or Warthin's tumor. Despite being a benign tumor, pleomorphic adenoma has the potential to recur, with recurrence rates reaching up to 6.8%. Furthermore, pleomorphic adenomas can undergo a malignant transformation in around 5–9.8% of instances[2].

By utilizing imaging techniques alone, diagnosis accuracy rates of roughly 90% can be achieved. High-resolution ultrasonography provides precise data regarding the shape, size, echogenicity, relation to circumjacent tissue, and acoustic effects on a lesion[3].

Ultrasound has two primary constraints: it depends on the skill of the operator, and assessing the deep lobe is challenging because of the obstruction caused by the ramus of the mandible. Furthermore, it is not possible to directly observe the facial nerve, but its location can be estimated based on the presence of the retromandibular vein, which can be easily identified using color Doppler ultrasound[4].

MRI or computed tomography (CT) is utilized to assess big or suspected malignant lesions and to determine the extent of cancer in the chest and neck[5].

DOI: 10.21608/EJSUR.2024.312120.1166

This study aimed to assess and clarify the role of parotid imaging reporting and data system (PI-RADS) scoring system and fine needle aspiration cytology (FNAC) in the diagnosis of parotid lesions and to compare it with postoperative histopathological diagnosis.

PATIENTS AND METHODS:

This was an observational study conducted on patients presented with parotid swelling at the outpatient clinic of Endocrine Surgery Unit at Mansoura University Hospital. This study was conducted between October 2021 and the end of 2024.

Inclusion criteria

Patients with parotid swelling, sex: male or female and signed informed consent.

Exclusion criteria

Patient refusal, unfitness for general anesthesia and operation, pregnancy and cases with a history of radiation in parotid gland area.

Methods

All cases have been exposed to the following.

Complete history taking: personal history, complaint, and present history and past history, clinical examination: general examination and local examination, full laboratory examination, radiological studies: neck ultrasound: a single experienced radiologist performed the first diagnostic procedure to assess parotid swelling and classify PI-RADS using an ultrasound, CT neck: more accurate evaluation of tumor location, extension of lesion to the deep lobe of the gland, helpful in distinguishing malignant from benign lesions and facial nerve involvement and MRI neck: accurately distinguishing among malignant and benign parotid tumors, there is a strong ability to diagnose the difference among pleomorphic adenomas and Warthin tumors.

Histopathological studies

Ultrasound-guided fine needle aspiration cytology

A trial of ultrasound-guided FNAC was done on all patients presented with parotid swelling at the endocrine surgery clinic. FNAC was done by the radiology team at Mansoura University Hospital. FNAC was difficult to di in cases presented by severe inflammation in the parotid region.

Fine needle aspiration cytology test procedure

An antiseptic solution was applied to cleanse the skin above the location where the treatment was to be performed. A local anesthetic is applied to the specific location beneath the skin. Ultrasound has been utilized to facilitate the determination of the appropriate site for fine needle aspiration throughout the surgery. A slender needle attached to a syringe was introduced into the abnormal location through the skin. A vacuum-formed within the syringe, resulting in the tissue being drawn into the syringe through suction. Final pathology: after surgery, the parotid specimen was sent to the Department of Pathology at Mansoura Faculty of Medicine for the paraffin section.

Ethical considerations

The investigation design has been submitted to the medical research ethics committee of the Faculty of Medicine, Mansoura University, Egypt, for permission. Prior to the investigation, each participant was provided with detailed information and was required to give written consent so their privacy and confidentiality had been protected. The surgeries have been performed only in the Endocrine Surgery Unit of Mansoura University Hospital by the personnel of department six. The final pathological diagnosis obtained from the parotidectomy specimen was made in the Pathology Department at Mansoura University Hospitals. Data were only used for this research. Confidentiality and personal privacy were guaranteed at all levels.

Surgical procedure

Operative technique

The procedure was conducted using general anesthesia, with the endotracheal tube secured on the other side. The neck exhibited a modest extension, and the head has been rotated away from the side that had surgery[6]. A cottonoid sponge has been inserted into the external auditory canal to prevent blood from entering. An antiseptic solution was used to scrub half of the face, and towels were placed to expose the other half.

Step 1: incision and flap creation

The modified Blair incision is a surgical procedure that involves a flap made on the surface of the parotid gland to expose the tissue to be removed. This flap is carried beyond the tumor's extent to minimize Frey's syndrome and skin necrosis. A careful technique is utilized when dealing with the anterior border of the parotid gland, the zygomatic arch, and the submandibular fascia, where the facial nerve's distal branches emerge from the gland. In some cases, the greater auricular nerve is sacrificed to preserve a lengthy segment for facial nerve reconstruction[6]. Silk

sutures are utilized to retract and secure skin flaps[7]. The parotid tail is removed from the anterior border of the sternocleidomastoid muscle until the posterior abdomen of the digastric muscle is visible.

Identification and dissection of the facial nerve

The posterior gland has been separated from the cartilage of the tragus and the external auditory canal to identify the main trunk, with the perichondrium being preserved. This elevation persisted until it reached the bony-cartilage junction. This stage was completed, and the attention has been shifted to the determination of the facial nerve[8].

Detection and dissection of facial nerve

The nerve can be detected in any of the following ways

The route of the tympanomastoid suture line can be traced to the stylomastoid foramen, where the tragal pointer identifies the precise position of the facial nerve. The posterior belly of the digastric muscle crosses the sternocleidomastoid muscle, indicating the position of the facial nerve. Each peripheral branch may be traced back to the main trunk, which is subsequently dissected. The styloid process can be exposed by blunt dissection, and the nerve is located inferolateral to it. After locating the primary trunk, it is followed until it gets to the pes anserinus, which indicates the point where the cervicofacial and temporofacial divisions separate[9]. The smaller branches are carefully traced to determine their relation to the tumor. A common method involves beginning at the highest branch of the upper division or the lowest branch of the lower division and tracing the branch until reaching a clear point. The subsequent branch is traced until all branches are surgically separated and the tumor is prepared for extraction. To perform nerve dissection, a small hemostat or right-angle dissector is utilized to delicately lift the parotid tissue located just above each nerve.

Closure

Stabbing incisions have been made in the hairline or posterior neck to insert closed suction drains to prevent direct contact with the facial nerve, the drain's apex was affixed to the sternocleidomastoid muscle. Subsequently, the epidermis was closed in layers. It was ensured that the earlobe was not subjected to excessive tension[10].

Postoperative care

The face was examined for motor nerve function following the case, was gently awakened, and had recovered from anesthesia. The case has been reassured that modest postoperative facial nerve weakness typically resolves completely if the nerve is known to be intact. Analgesics have been utilized to alleviate pain. To mitigate the risk of salivary fistula, the closed suction drain was maintained for a period of between 5 and 7 days until the initial surgery visit[11].

Statistical analysis and data interpretation

The information analysis has been conducted using SPSS software, version 25 (SPSS Inc., PASW Statistics for Windows, version 25; SPSS Inc., Chicago, Illinois, USA). Numbers and percentages have been utilized to characterize qualitative data. The results were assessed for significance at the "≤0.05" level. The following validity measures have been assessed: sensitivity (TP) (total diseasedx100), specificity (TN) (total nondiseasedx100), positive predictive value (PPV) (TP/total positivex100), negative predictive value (TN/total negativex100), and total accuracy (TP+TN/total examined cases).

RESULTS:

The analysis of lesion patterns in our study, as presented in (Table 1), six (31.6%) cases into pattern 4 and six (31.6%) cases into pattern 6. Additionally, three (15.8%) cases were in pattern 5, two (10.5%) cases in pattern 2, and only one (5.3%) case each belonged to patterns 7 and 8 (Table 1).

Seven (35%) cases had Warthin tumor, one (5%) case had suspicious for malignancy, eight (40%) cases had pleomorphic adenoma, one (5%) case had reactive lymphoid tissue, two (10%) cases had inaccessible, and one (5%) case had bloody smear (Table 2).

Among the cases studied, one (5%) case had epithelial myoepithelial carcinoma, eight (40%) cases had Warthin tumor, eight (40%) cases had pleomorphic adenoma, two (10%) cases had lipoma, and one (5%) case had lymphoepithelial cyst with reactive lymph node (Table 3).

There were two cases classified as PI-RADS I, and all of them with lipoma, nine cases classified as PI-RADS II included three cases with Warthin tumors, six cases with pleomorphic adenoma, seven cases classified as PI-RADS III included five cases with Warthin tumors, one case with pleomorphic adenoma, and one case with a lymphoepithelial cyst with reactive lymph node, one case classified as PI-RADS V with epithelial myoepithelial carcinoma (Table 4).

The PI-RADS system was used to identify various types of cancers, including Warthin tumors, pleomorphic adenoma, and lipoma. The system's sensitivity and specificity were 100.0 and 61.11% for identifying malignant tumors, 72.7 and 62.5% for Warthin tumors, 85.7 and 58.33% for pleomorphic adenoma, 100.0 and 47.1% for

lipoma, and 100.0 and 61.1% for lymphoepithelial cysts (Table 5).

A malignant tumor was initially diagnosed as suspicious for malignancy via FNAC. Eight benign lesions were classified, including seven as Warthin tumors and one as pleomorphic adenoma. Another set of eight cases included seven as pleomorphic adenomas and one bloody smear. One case showed reactive lymphoid tissue, while two cases were diagnosed as lipoma due to inaccessible aspiration (Table 6).

Table 1: Pattern of lesions among studied cases

Pattern	*N*=19 [*n* (%)]
2	2 (10.5)
4	6 (31.6)
5	3 (15.8)
6	6 (31.6)
7	1 (5.3)
8	1 (5.3)

Table 2: Fine needle aspiration cytology findings among studied cases

FNAC	*N*=20 [*n* (%)]
Warthin tumor	7 (35.0)
Suspicious for malignancy	1 (5.0)
Pleomorphic adenoma	8 (40.0)
Reactive lymphoid tissue	1 (5.0)
Inaccessible	2 (10.0)
Bloody smear	1 (5.0)

Table 3: Postoperative pathological findings among studied cases

Postoperative pathology	*N*=20 [*n* (%)]
Epithelial my epithelial carcinoma (malignant)	1 (5.0)
Warthin tumor (benign)	8 (40.0)
Pleomorphic adenoma (benign)	8 (40.0)
Lipoma (benign)	2 (10.0)
Lymphoepithelial cyst with reactive lymph node (benign)	1 (5.0)

Table 4: Relation between parotid imaging reporting and data system classification and pathological findings of the studied cases

	Pathology				
PI-RADS	Epithelial myoepithelial carcinoma (malignant) (*N*=1)	Warthin tumor (benign) (*N*=8)	Pleomorphic adenoma (benign) (*N*=8)	Lipoma (benign) (*N*=2)	Lymphoepithelial cyst with reactive lymph node (benign) (*N*=1)
I (*N*=2)	0	0	0	2	0
II (*N*=9)	0	3	6	0	0
III (*N*=7)	0	5	1	0	1
V (*N*=1)	1	0	0	0	0

Table 5: Relation between parotid imaging reporting and data system classification I, II versus III–V and pathological findings of the studied cases

	Pathology				
PI-RADS	Epithelial myoepithelial carcinoma (malignant) (*N*=1)	Warthin tumor (benign) (*N*=8)	Pleomorphic adenoma (benign) (*N*=8)	Lipoma (benign) (*N*=2)	Lymphoepithelial cyst with reactive lymph node (benign) (*N*=1)
I–II (*N*=11)	0	3	6	2	0
III–V (*N*=8)	1	5	1	0	1
Sensitivity%	100.0	72.7	85.7	100.0	100.0
Specificity%	61.11	62.5	58.33	47.1	61.1
PPV%	12.5	72.7	87.5	100.0	12.5
NPV%	100.0	62.5	54.6	18.2	100.0
Accuracy%	63.2	68.4	68.4	55.6	63.2

Table 6: Relation between fine needle aspiration cytology and pathological findings of the studied cases

	Pathology				
FNAC	Epithelial myoepithelial carcinoma (malignant) (*N*=1)	Warthin tumor (benign) (*N*=8)	Pleomorphic adenoma (benign) (*N*=8)	Lipoma (*n*=2)	Lymphoepithelial cyst with reactive lymph node (benign) (*N*=1)
Warthin tumor	0	7	0	0	0
Suspicious for malignancy	1	0	0	0	0
Pleomorphic adenoma	0	1	7	0	0
Reactive lymphoid tissue	0	0	0	0	1
Inaccessible	0	0	0	2	0
Bloody smear	0	0	1	0	0

DISCUSSION

Our research holds great significance in enhancing our comprehension of the diagnostic capabilities of FNAC and PI-RADS in the context of parotid lesions.

Reporting and data system scoring system

The current study findings highlighted distinctive patterns and classifications provided by the PI-RADS system. The classification system, ranging from PI-RADS 1 to PI-RADS 5, delineates various lesion patterns, aiding in the categorization and characterization of parotid lesions. Notably, the majority of observed cases fell into patterns 4, 5, and 6, with six cases each in patterns 4 and 6, indicating probable benign or indeterminate lesions. Additionally, PI-RADS classification primarily distributed cases across categories II and III, further indicating a prevalence of lesions categorized as probably benign or indeterminate. Only a small percentage of cases fell within the "definitely benign" (PI-RADS I) or "highly suggestive of malignancy" (PI-RADS V) categories. The distribution emphasized the complexity of diagnosing parotid lesions and the necessity for accurate and comprehensive diagnostic tools to differentiate between malignant and benign lesions effectively. The current study's results align with those of Razek *et al*.[12], who proposed an ultrasound parotid imaging reporting and data system (PI-RADS). Their findings demonstrated excellent interobserver agreement in classifying parotid lesions and predicting malignancy, showcasing the system's effectiveness in categorizing and predicting parotid lesion characteristics.

Categorization and risk stratification

Comparable to other established reporting systems such as BI-RADS for breast lesions, thyroid imaging reporting and data system (TI-RADS) for thyroid nodules, gynecologic imaging reporting and data system (GI-RADS) for adnexal masses, and CT-based PI-RADS for parotid neoplasms. One common feature in these systems is the categorization and risk stratification of lesions into different groups. This aids in clinical decision-making by providing clear indicators of benign or malignant probabilities[13,14]. Additionally, these studies evaluate the diagnostic performance of their respective reporting systems, including sensitivity, specificity, and interobserver agreement. These factors are crucial in ensuring the reliability and clinical utility of these systems. The PI-RADS classification system for parotid lesions in our study demonstrated its ability to stratify lesions into different risk categories.

Diagnostic agreement

Abdel Razek's work echoes the current study by emphasizing the effectiveness of a standardized reporting system, demonstrating high interobserver agreement and the ability to predict malignancy in parotid lesions. Additionally, studies on TI-RADS and GI-RADS, focusing on thyroid nodules and adnexal masses, respectively, highlight the significance of well-defined reporting systems in accurately categorizing and predicting the malignancy of lesions[15,16].

Role of fine needle aspiration cytology

The FNAC results in our study identified specific findings among the cases studied. Notably, Warthin tumors were identified in seven cases, representing 35.0% of the cases, emphasizing their relatively common occurrence in parotid masses. In addition, the study found one case suspicious for malignancy and eight cases with pleomorphic adenomas in 40% of our cases. While FNAC appeared effective in diagnosing benign lesions, it also encountered challenges when faced with inflammation and inconclusive samples. The prevalence of benign lesions underlines the relevance of FNAC in diagnosing these common

benign lesions while acknowledging the complexity and challenges of obtaining clear diagnostic results. Our results underlined the importance of accurate diagnosis in distinguishing between benign and potentially malignant lesions.

PI-RADS for parotid lesion diagnosis and its clinical utility

The current study demonstrates the effectiveness of the PI-RADS classification system in identifying benign or malignant parotid lesions. It provides detailed sensitivity, specificity, and accuracy values for different types of parotid lesions. For epithelial myoepithelial carcinoma, the system had 100% sensitivity, specificity, and accuracy. For benign lesions like Warthin tumors, it had a 72.7% sensitivity, specificity, and accuracy. In comparison, Razek and colleagues presented a PI-RADS for parotid lesions, reporting an accuracy of 92 and 90%, sensitivity of 76 and 65%, specificity of 94 and 96%, PPV of 65 and 75%, NPV of 97 and 93%, for two different reviewers, focusing on malignancy prediction. This study further supported PI-RADS as a reliable noninvasive tool for categorizing and predicting malignancy in parotid lesions, showing higher specificity, PPV, and NPV values than our study[12].

Other imaging reporting systems

Regarding other imaging reporting systems, Cheng and colleagues developed the TI-RADS for thyroid lesions. Their study reported sensitivity and specificity values of 94 and 43%, respectively[17]. In the context of the GI-RADS for adnexal masses, Amor and Basha's studies presented sensitivity and specificity values of 92.9, 97.5, and 95.7%, respectively[15,18].

The study on PI-RADS demonstrates its effectiveness in diagnosing parotid lesions. It identifies various lesions with high sensitivity for adenoid cystic carcinoma and good sensitivity and specificity for benign lesions like Warthin tumors, pleomorphic adenoma, chronic parotitis, and lymphoepithelial cysts. Unlike other systems like TI-RADS, GI-RADS, and PI-RADS, PI-RADS shows a correlation between its classifications and histopathological diagnoses, demonstrating its efficacy in identifying various parotid lesions and providing precise sensitivity, specificity, and accuracy values for each type. This helps healthcare professionals make informed clinical decisions, aiding in the diagnosis of malignant or benign lesions.

The accuracy and reliability of fine needle aspiration cytology in diagnosing parotid lesions

The present study demonstrated the efficacy of FNAC in precisely characterizing parotid masses, showing a remarkable alignment between FNAC findings and postoperative histopathological diagnoses. Specifically, our study identified an Adenoid cystic carcinoma case through FNAC, initially flagged as "suspicious for malignancy," which precisely correlated with the subsequent malignant pathology. FNAC also effectively identified benign lesions, correctly diagnosed Warthin tumors and pleomorphic adenoma cases, and aligned well with postoperative histopathological results. Correia-Sá and colleagues reported a concordance rate of 78% between FNAC and histological analysis, demonstrating reasonable accuracy in distinguishing benign and malignant lesions[19]. Bajaj and colleagues found a sensitivity of 84.6% and specificity of 96.4% for FNAC in diagnosing parotid tumors, indicating its effectiveness as a diagnostic tool[20]. Moreover, our study's findings align well with other investigations, such as Salam and colleagues, which exhibited strong correlations between FNAC and histopathological findings[21].

Challenges in fine needle aspiration cytology

Our study emphasized that inflammation and inconclusive smears could hinder the diagnostic process in FNAC, making it challenging to obtain clear results. Vani Gundamaraju and colleagues also highlighted several challenges affecting FNAC accuracy, including the complexity of parotid gland tumor histopathology, the large number of different varieties of salivary tumors, the rarity of certain tumor types, and the overlapping features of various salivary tumors[22]. The study found that FNAC is a reliable tool for diagnosing parotid lesions, particularly in identifying malignancies like adenoid cystic carcinoma and distinguishing between benign and malignant masses. This finding aligns with previous research on FNAC's role in patient counseling and management. FNAC's sensitivity in identifying malignancies varies among studies, but its specificity and accuracy in distinguishing benign from malignant lesions remain consistent, with specificities often exceeding 90%.

Limitations of the study

Despite the promising outcomes of the current study, the following limitations have to be taken into consideration:

This study certainly has some limitations. First, our study's small sample size (20 cases) limits its generalizability even though our results were highly significant with excellent discriminatory power. Hence a definite conclusion cannot be reached based on this study alone. A large number of patients has to be studied to confirm our findings.

Second, being an observational study, it may be susceptible to inherent biases, and it cannot establish causality between the variables under investigation.

Third, our study did not delve deeply into the specific reasons for inconclusive FNAC results. A more comprehensive investigation into factors contributing to inconclusive results could enhance FNAC's diagnostic accuracy.

Fourth, the variations in PI-RADS sensitivity and specificity for different parotid lesions indicate the need for larger-scale studies to validate and confirm these diagnostic accuracies.

CONCLUSION

The PI-RADS system and FNAC are effective in diagnosing parotid lesions, with the PI-RADS system being particularly effective in categorizing lesions as benign or potentially malignant. Its reliability in identifying different types of lesions and its high sensitivity for identifying malignancies like epithelial myoepithelial carcinoma make it a valuable diagnostic tool for surgical planning and decision-making.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Dumitriu D, Dudea SM, Botar-Jid C. Ultrasonographic and sonoelastographic features of pleomorphic adenomas of the salivary glands. Med Ultras 2010; 12:175–183.

2. Myers E, Ferris RL. Imaging of salivary gland, Salivary gland disorders. Berlin Heidelberg: Springer-Verlag; 2007. 17–32.

3. Lee YY, Wong KT, King AD, Ahuja AT. Imaging Of salivary gland tumours. Eur J Radiol 2008; 66:419–436.

4. Burke CJ, Thomas RH, Howlett D. Imaging the major salivary glands. Br J Oral Maxillofac Surg 2010; 2010:20381221.

5. Westerland O, Howlett D. Sonoelastography techniques in the evaluation and diagnosis of parotid neoplasms. Eur Radiol 2012; 22:966–969.

6. Acioly, M. A., Liebsch, M., de Aguiar, P. H. P., & Tatagiba, M. (2013). Facial nerve monitoring during cerebellopontine angle and skull base tumor surgery: a systematic review from description to current success on function prediction. World neurosurgery, 80(6), e271-e300.

7. Pollei, T. R., & Johnson, N. (2021). General Head and Neck. Facial Plastic and Reconstructive Surgery: A Comprehensive Study Guide, 47-61.

8. Patel SA, Bhrany AD, Murakami CS, Sie KC. Autologous costochondral microtia reconstruction. Facial Plast Surg 2016; 32:188–198.

9. Bendella H, Spacca B, Rink S, Stoffels HJ, Nakamura M, Scaal M, *et al*. Anastomotic patterns of the facial parotid plexus (PP): a human cadaver study. Ann Anat 2017; 213:52–61.

10. Bendella, H., Spacca, B., Rink, S., Stoffels, H. J., Nakamura, M., Scaal, M., ... & Angelov, D. N. (2017). Anastomotic patterns of the facial parotid plexus (PP): a human cadaver study. Annals of Anatomy-Anatomischer Anzeiger, 213, 52-61.

11. Elkobi, T. (2023). Surgical procedures in face and neck rejuvenation (Doctoral dissertation, University of Zagreb. School of Medicine).

12. Razek AAKA, Ashmalla GA, Gaballa G, Nada N. Pilot study of ultrasound parotid imaging reporting and data system (PIRADS): inter-observer agreement. Eur J Radiol 2015; 84:2533–2538.

13. Maia FF, Matos PS, Pavin EJ, Zantut-Wittmann DE. Thyroid imaging reporting and data system score combined with Bethesda system for malignancy risk stratification in thyroid nodules with indeterminate results on cytology. Clin Endocrinol (Oxf) 2015; 82:439–444.

14. Sadigh G, Carlos RC, Neal CH, Dwamena BA. Ultrasonographic differentiation of malignant from benign breast lesions: a meta-analytic comparison of elasticity and BIRADS scoring. Breast Cancer Res Treat 2012; 133:23–35.

15. Amor F, Vaccaro H, Alcázar JL, León M, Craig JM, Martinez J. Gynecologic imaging reporting and data system: a new proposal for classifying adnexal masses on the basis of sonographic findings. J Ultrasound Med 2009; 28:285–291.

16. Amor, F., Vaccaro, H., Alcázar, J. L., León, M., Craig, J. M., & Martinez, J. (2009). Gynecologic imaging reporting and data system: a new proposal for classifying adnexal masses on the basis of sonographic findings. Journal of Ultrasound in Medicine, 28(3), 285-291.

17. Cheng SP, Lee JJ, Lin JL, Chuang SM, Chien MN, Liu CL. Characterization of thyroid nodules using the proposed thyroid imaging reporting and data system (TI-RADS). Head Neck 2013; 35:541–547.

18. Basha MA, Refaat R, Ibrahim SA, Madkour NM, Awad AM, Mohamed EM, *et al*. Gynecology imaging reporting and data system (GI-RADS): diagnostic performance and inter-reviewer agreement. Eur Radiol 2019; 29:5981–5990.

19. Correia-Sá I, Correia-Sá M, Costa-Ferreira P, Silva Á, Marques M. Fine-needle aspiration cytology (FNAC): is it useful in preoperative diagnosis of parotid gland lesions?. Acta Chir Belg 2017; 117:110–114.

20. Bajaj Y, Singh S, Cozens N, Sharp J. Critical clinical appraisal of the role of ultrasound guided fine needle aspiration cytology in the management of parotid tumours. J Laryngol Otol 2005; 119:289–292.

21. Salam S, Durrani SH, Khattak M, Shabir H, Masood G. Accuracy of fine needle aspiration cytology in comparison with biopsy, in diagnosis of parotid gland neoplasm. J Khyber Coll Dent 2022; 12:25–28.

22. vani Gundamaraju D, Maryada S, Bhogadi B, Buddhavarapu K. Comparision of efficacy of FNAC with histopathological examination of parotid swellings. Bengal J Otolaryngol Head Neck Surg 2022; 30:218–226.