# Role of fine needle aspiration in malignant parotid tumors at a single-center experience: A retrospective cohort study

Ashwag Alwagdani [a],[*], Mohammad Alhejaili [b], Abdulaziz Alanzi [c], Saif Alghamdi [a]

[a] Department of Otolaryngology–Head and Neck Surgery, King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia
[b] Department of Otolaryngology–Head and Neck Surgery, Prince Sultan Armed Forces Hospital, Madina, Saudi Arabia
[c] Department of Otolaryngology–Head and Neck Surgery, King Abdulaziz Medical City, Jeddah, Saudi Arabia

## ARTICLE INFO

## ABSTRACT

*Background:* Parotid gland tumors are mostly benign with good prognosis. On the other hand, malignant tumors of the parotid gland often have poor prognosis and metastasize. Mucoepidermoid carcinoma is the most common cancer in the parotid gland accounting for nearly 40–50% of the cases. Therefore, it is important to define the role of fine needle aspiration in differentiating between different types of parotid malignancies.
*Method:* This is a retrospective chart review study that was done on 49 consecutive patients who underwent parotid surgeries in King Fahad Armed Forces Hospital in Jeddah, Saudi Arabia, between Jan 2003 and Feb 2020. The records of 49 patients were obtained, fine needle aspiration and pathology reports were reviewed to define the role of fine needle aspiration in diagnosing malignant parotid tumors by calculating the sensitivity, specificity, positive predictive value, and negative predictive value.
*Results:* Retrospective analysis of 39 cases revealed that there was one case which was diagnosed for cancer was missed by fine needle aspiration. Meanwhile, six cases were diagnosed as malignant lesions using both fine needle aspiration and histopathology. Furthermore, 30 cases were determined benign based on fine needle aspiration and histopathology. The sensitivity of fine needle aspiration for detecting malignancy was 85.7%, specificity was 93.8%. positive predictive value of 75% and negative predictive value of 96.7%.
*Conclusion:* Fine needle aspiration is highly sensitive and specific for parotid tumors. We support the role of preoperative FNA for all parotid tumors as its accurate in differentiating between benign and malignant lesions.

## 1. Introduction

Parotid gland plays a major role in the secretion of saliva as it is the largest salivary gland in the human body. Tumors of salivary glands account for nearly 5% of all head and neck tumors with 75% arising from the parotid glands [1]. Moreover, 80% of parotid gland tumors are considered benign with the most common types being mixed tumors and warthin's tumors [1]. Parotid gland malignancy is considered rare and has a slow-growing rate with a tendency to having an aggressive nature if not detected early [2]. Furthermore, malignant tumors can originate from the parotid gland as primary malignant tumors or metastasize to surrounding structures. Meanwhile, mucoepidermoid carcinoma is the most common cancer in the parotid gland accounting for nearly 40–50% of the cases [2,3].

Parotid tumors has variable prognosis according to the histological type and stage of the malignancy and are treated using a combination of surgical and radiational therapy. However, mortality often occurs due to metastasis spread, especially to the lung, rather than from direct extension. Risk factors that have been associated with decreased survival include male gender, old age, tumor size ≥4 cm, extraparenchymal extension, lymph node involvement or distant metastasis [3]. Therefore, early evaluation and diagnosis improves chance of early proper management.

The initial diagnostic approach is taking a biopsy by Fine Needle Aspiration (FNA) and is considered safe, rapid and cost effective [4,5]. Meanwhile, the gold standard for diagnosing parotid tumors is the histopathology of the resected tumor to differentiate either it is a benign or a malignant form of tumors. However, FNA carries a challenge in diagnosing parotid tumors and the accuracy of the diagnosis is variable as it is operative dependent.

Due to the limitations of the local studies that assess FNA accuracy, we are aiming to evaluate the accuracy of FNA in detecting benign and

malignant parotid lesions subtypes in comparison to post-surgical tumor resection histopathology among patients in King Fahd Armed Forces Hospital, Jeddah, Saudi Arabia.

## 2. Methods

This is a retrospective chart review study which was carried out in King Fahad Armed Forces Hospital, Jeddah, between Jan 2003 and Feb 2020. The study was approved by the institutional board review (IRB) of King Fahad Armed Forces Hospital and registered in research registry with ID: researchregistry6565. All consecutive patients with benign and malignant parotid diseases undergoing superficial or total parotidectomy were included. A total of 49 patients were obtained initially. The patient records were reviewed, and data on age, gender, history of previous surgery, and details of FNA and postoperative pathology reports were recorded on data sheets. Afterwards, 10 patients were excluded due to missing FNA or non-conclusive reports. Only patients who underwent ultrasound guided FNA were included. FNA and final pathology reports were recorded for 39 patients and the role of FNA in diagnosing malignant parotid tumors was assessed by measuring sensitivity, specificity, positive predictive value, and negative predictive value. We used the Statistical Package for the Social Sciences (SPSS) software (version 25; IBM, Armonk, New York) to perform all the statistical analyses. The study has been reported with accordance to the strengthening the reporting of cohort studies in surgery (STROCSS 2019) guidelines [6].

## 3. Results

In our study, 39 consecutive patients were included with a mean age of 51 ± 14.7 with the youngest included patient aged 23 and oldest of 80 years while the majority of patients were males 22 (56.4%). Regarding FNA diagnosis, there was one case of cancer that was missed by FNA, two cases were misdiagnosed as benign by FNA, six cases were diagnosed as malignant lesions using both FNA and histopathology and 30 cases were determined benign based on FNA and histopathology (Table 1). The accuracy of FNA for detecting malignancy was 85.7% sensitivity, 93.8% specificity, 75% positive predictive value, and 96.7%. negative predictive value (Table 2).

## 4. Discussion

FNA is a consistent investigation technique that offers valuable evidence for the preoperative diagnostic work-up [7]. As the complication rate rationally upsurges with the grade of invasiveness of the surgery, it is vital to be capable to distinguish the tumor preoperatively to properly notify the patient about the type of operation that will be done, the need for lymph node dissection and the chances of nerve sacrifice or injury [8]. Because FNA is a cheap, fast and easy technique for preoperative diagnosis and has a low complication rate and morbidity, it is the initial choice of investigation in parotid tumors [9].

In 2011, Ali et al. studied a total of 114 salivary gland and reported

**Table 1**
Demographics and lesion characteristics.

| Variable | N (%) |
|---|---|
| Age range **(Mean ± SD)** | 23-80 (51 ± 14.7) |
| Gender | |
| **Male** | 22 (56.4%) |
| **Female** | 17 (43.6%) |
| Diagnosis based on FNA | |
| **Benign** | 31 (79.5%) |
| **Malignant** | 8 (20.5%) |
| Diagnosis based on final histopathology | |
| **Benign** | 32 (82%) |
| **Malignant** | 7 (18%) |

**Table 2**
Analysis of FNA results in relation to the histological findings (N = 39).

| Parameter | Histological results | | | |
|---|---|---|---|---|
| | Positive | Negative | Total | |
| FNA results | • Positive | 6 | 2 | 8 |
| | • Negative | 1 | 30 | 31 |
| | • Total | 7 | 32 | 39 |
| **Sensitivity** | **Specificity** | **Positive predictive value** | **Negative predictive value** | |
| 85.7% | 93.7% | 75% | 96.7% | |

the FNA that were undertaken. From those 114, 75 patients were correctly diagnosed by FNA with neoplasms [10]. Another study reported that (78.4%) of the patients, tumor was reported as benign and in (21.6%) patients FNAB diagnosis was suspicious for malignancy, malignant or non-diagnostic. In final histopathologic diagnosis, 42 of the tumors were benign and 9 were malignant [11].

According to our results, the sensitivity of FNA for detecting malignancy was 85.7% and specificity was 93.8% with positive predictive value of 75% and negative predictive value of 96.7%. In comparison to a study conducted on 114 patients in 2016 at King Abdulaziz University Hospital, Jeddah, KSA, they reported a sensitivity of 50%, specificity of 100%, positive predictive value of 100% and negative predictive value of 91.4% [12]. Furthermore, Altin et al. studied 217 cases of FNA in Brazil found that sensitivity, specificity, positive predictive value and negative predictive value were 76.9%, 95.4%, 75% and 95.9%, respectively [13]. In a review of the literature of the last decade, the sensitivity was reported to range between 60% and 92% and the specificity was reported to range between 87.7% and 100% [14]. Another survey showed sensitivity of 88.9%, specificity of 97.9%, positive predictive value of 93%, and negative predictive value of 96.7% and diagnostic accuracy of 95.8% [15]. Other previous studies reported sensitivity 68.96%, specificity 89.63%, positive predictive value 54.05% and negative predictive value 94.23% [16]. Other studies reported that FNA sensitivity and specificity values can be variable in relation to different populations [17,18] where sensitivity varied between 38% [19] and 97% [16] and specificity varied between 81%13 and 100% [20].Furthermore, Dhanani R et al. conducted fine needle aspiration cytology preoperatively and the results were compared with the final histopathology, which showed a sensitivity of 88.9%, specificity of 97.9%, positive predictive value of 93%, and negative predictive value of 96.7% [15].

However, fine-needle aspiration biopsy may have some disadvantages including bleeding, squamous metaplasia, fibrosis, and necrosis in the final histopathological examination. Nevertheless, it is generally accepted that these complications, if they do exist, do not interfere with the definitive diagnosis [21]. Rarely, complications such as bleeding, facial nerve injury, fibrosis, and tumor erosion have been reported.

## 5. Conclusion

FNA is highly sensitive and specific for parotid tumors. More support for the role of pre-operative FNA should be established for all parotid tumors as its accuracy in differentiating between benign and malignant lesions can be high.

## Funding

## Annals of Medicine and Surgery

The following information is required for submission. Please note that failure to respond to these questions/statements will mean your

submission will be returned. If you have nothing to declare in any of these categories then this should be stated.

## Please state any conflicts of interest

All authors must disclose any financial and personal relationships with other people or organisations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding.

## Please state any sources of funding for your research

All sources of funding should be declared as an acknowledgement at the end of the text. Authors should declare the role of study sponsors, if any, in the collection, analysis and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication. If the study sponsors had no such involvement, the authors should so state.

## Ethical Approval

Research studies involving patients require ethical approval. Please state whether approval has been given, name the relevant ethics committee and the state the reference number for their judgement.

IRB Approval was obtained by King Fahad Armed Forces Hospital in Jeddah, KSA

## Consent

Studies on patients or volunteers require ethics committee approval and fully informed written consent which should be documented in the paper.

Authors must obtain written and signed consent to publish a case report from the patient (or, where applicable, the patient's guardian or next of kin) prior to submission. We ask Authors to confirm as part of the submission process that such consent has been obtained, and the manuscript must include a statement to this effect in a consent section at the end of the manuscript, as follows: "Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request".

Patients have a right to privacy. Patients' and volunteers' names, initials, or hospital numbers should not be used. Images of patients or volunteers should not be used unless the information is essential for scientific purposes and explicit permission has been given as part of the consent. If such consent is made subject to any conditions, the Editor in Chief must be made aware of all such conditions.

Even where consent has been given, identifying details should be omitted if they are not essential. If identifying characteristics are altered to protect anonymity, such as in genetic pedigrees, authors should provide assurance that alterations do not distort scientific meaning and editors should so note.

All patients were informed over the phone by the IRB that they will be included in the study with their data being private and protected.

## Author contribution

Please specify the contribution of each author to the paper, e.g. study concept or design, data collection, data analysis or interpretation, writing the paper, others, who have contributed in other ways should be listed as contributors.

All authors contributed evenly in drafting, collecting data, analysis, writing and proofreading of the paper.

## Registration of Research Studies

In accordance with the Declaration of Helsinki 2013, all research involving human participants has to be registered in a publicly accessible database. Please enter the name of the registry and the unique identifying number (UIN) of your study.

You can register any type of research at http://www.researchregistry.com to obtain your UIN if you have not already registered. This is mandatory for human studies only. Trials and certain observational research can also be registered elsewhere such as: ClinicalTrials.gov or ISRCTN or numerous other registries.

1 Name of the registry: Research Registry
2 Unique Identifying number or registration ID: researchregistry6565
3 Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.researchregistry.com/browse-the-registry#user-researchregistry/registerresearchdetails/60267f4d175c2b001b5384fc/

## Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish

## Declaration of competing interest

Authors declare that they have no funding and conflicts of interest to disclose.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102229.

## References

[1] K. Ho, H. Lin, D.K. Ann, P.G. Chu, Y. Yen, An overview of the rare parotid gland cancer, Head Neck Oncol. 3 (2011), https://doi.org/10.1186/1758-3284-3-40, 40-40.

[2] F.M. Makki, A.I. Mendez, S.M. Taylor, J. Trites, M. Bullock, G. Flowerdew, R.D. Hart, Prognostic factors for metastatic cutaneous squamous cell carcinoma of the parotid, J Otolaryngol Head Neck Surg 42 (2013), https://doi.org/10.1186/1916-0216-42-14, 14-14.

[3] T.M. Davidson, J. Husseman, Clinical Manual of Otolaryngology, JP Medical Ltd, 2012.

[4] U. Engzell, P.L. Esposti, C. Rubio, A. Sigurdson, J. Zajicek, Investigation on tumour spread in connection with aspiration biopsy, Acta Radiol. Ther. Phys. Biol. 10 (1971) 385–398, https://doi.org/10.3109/02841867109130784.

[5] A.J. Mighell, A.S. High, Histological identification of carcinoma in 21 gauge needle tracks after fine needle aspiration biopsy of head and neck carcinoma, J. Clin. Pathol. 51 (1998) 241–243, https://doi.org/10.1136/jcp.51.3.241.

[6] R. Agha, A. Abdall-Razak, E. Crossley, N. Dowlut, C. Iosifidis, G. Mathew, M. Bashashati, F.H. Millham, D.P. Orgill, A. Noureldin, STROCSS 2019 Guideline: strengthening the reporting of cohort studies in surgery, Int. J. Surg. 72 (2019) 156–165.

[7] N. Fakhry, F. Antonini, J. Michel, M. Penicaud, J. Mancini, A. Lagier, L. Santini, F. Turner, M.A. Chrestian, M. Zanaret, P. Dessi, A. Giovanni, Fine-needle aspiration cytology in the management of parotid masses: evaluation of 249 patients, European annals of otorhinolaryngology, head and neck diseases 129 (2012) 131–135, https://doi.org/10.1016/j.anorl.2011.10.008.

[8] R. Jain, R. Gupta, M. Kudesia, S. Singh, Fine needle aspiration cytology in diagnosis of salivary gland lesions: a study with histologic comparison, CytoJournal 10 (2013), https://doi.org/10.4103/1742-6413.109547, 5-5.

[9] N.A. Ansari, N.W. Derias, Fine needle aspiration cytology, J. Clin. Pathol. 50 (1997) 541.

[10] A. Shetty, V. Geethamani, Role of fine-needle aspiration cytology in the diagnosis of major salivary gland tumors: a study with histological and clinical correlation, J. Oral Maxillofac. Pathol.: JOMFP. 20 (2016) 224.

[11] N. Seyhun, U. Doğan, Z.A.B. Çalış, M.F. Kaya, S.Ö. Hasçiçek, S. Turgut, The role of fine needle aspiration biopsy in deep lobe parotid tumors: comparison of preoperative cytology and postoperative histopathologic results, Am. J. Otolaryngol. 42 (2021), 102590, https://doi.org/10.1016/j.amjoto.2020.102590.

[12] H.Z. Marzouki, M.A. Altabsh, M.O. Albakrei, T.A. Al-Khatib, M.A. Merdad, N.J. Farsi, Accuracy of preoperative fine needle aspiration in diagnosis of malignant

parotid tumors, Saudi Med. J. 38 (2017) 1000–1006, https://doi.org/10.15537/smj.2017.10.20988.

[13] F. Altin, Y. Alimoglu, R.M. Acikalin, H. Yasar, Is fine needle aspiration biopsy reliable in the diagnosis of parotid tumors? Comparison of preoperative and postoperative results and the factors affecting accuracy, Brazilian Journal of Otorhinolaryngology 85 (2019) 275–281, https://doi.org/10.1016/j.bjorl.2018.04.015.

[14] J.M. Viguer, J.A. Jiménez-Heffernan, B. Vicandi, P. López-Ferrer, M. Navarro, Cytologic diagnostic accuracy in pleomorphic adenoma of the salivary glands during 2 periods, Acta Cytol. 51 (2007) 16–20, https://doi.org/10.1159/000325676.

[15] R. Dhanani, H. Iftikhar, M.S. Awan, N. Zahid, S.N.A. Momin, Role of fine needle aspiration cytology in the diagnosis of parotid gland tumors: analysis of 193 cases, Int. Arch. Otorhinolaryngol. 24 (2020) 508–512.

[16] P. Zbären, C. Schär, M.A. Hotz, H. Loosli, Value of fine-needle aspiration cytology of parotid gland masses, Laryngoscope 111 (2001) 1989–1992, https://doi.org/10.1097/00005537-200111000-00023.

[17] S. Naz, A.A. Hashmi, A. Khurshid, N. Faridi, M.M. Edhi, A. Kamal, M. Khan, Diagnostic role of fine needle aspiration cytology (FNAC) in the evaluation of salivary gland swelling: an institutional experience, BMC Res. Notes 8 (2015) 101, https://doi.org/10.1186/s13104-015-1048-5.

[18] A. Singh, A. Haritwal, B. Murali, Correlation between cytology and histopathology of the salivary glam, Australas. Med. J. 4 (2011) 66–71, https://doi.org/10.4066/AMJ.2011.518.

[19] N. Stow, D. Veivers, A. Poole, Fine-needle aspiration cytology in the management of salivary gland tumors: an Australian experience, Ear Nose Throat J. 83 (2004) 128–131.

[20] M. Longuet, E. Nallet, C. Guedon, J. Depondt, P. Gehanno, B. Barry, [Diagnostic value of needle biopsy and frozen section histological examination in the surgery of primary parotid tumors], Rev. Laryngol. Otol. Rhinol. 122 (2001) 51–55.

[21] S. Aversa, C. Ondolo, E. Bollito, G. Fadda, S. Conticello, Preoperative cytology in the management of parotid neoplasms, Am. J. Otolaryngol. 27 (2006) 96–100, https://doi.org/10.1016/j.amjoto.2005.07.015.