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ORIGINAL ARTICLE

Diagnostic Accuracy of Fine Needle Aspiration Cytology (FNAC) in Salivary Gland Lesions with Histopathological Examination (HPE) Correlation in a Tertiary Care Centre in Southern India

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Abstract This study aimed to determine the diagnostic yield of fine-needle aspiration cytology (FNAC) in salivary gland lesions compared to histopathological diagnosis. The present study was done on patients above 18 years of age, with a palpable swelling, who are clinically diagnosed as salivary gland lesions were evaluated. A total of 31 patients were evaluated in this study. The mean age of the patients was 41 years ± 16.08. The male to female ratio of patients evaluated in our study was 1: 1.066, with a marginal preponderance in the female population. There was a higher incidence of carcinoma in females than males. Parotid gland lesions comprised 83.9% of all the salivary gland lesions analyzed, while submandibular gland lesions comprised 16.1%. In our study, the distribution between non-neoplastic, neoplastic benign, and neoplastic malignant lesions was 9.6%, 83.8%, and 6.4%. The overall diagnostic accuracy for non-neoplastic and neoplastic lesions is 90.3%, with a sensitivity of 89% and a specificity of 100%. The segregation of the results into the positive and negative class of diagnostic outcomes shows 80.6% for true positive, 9.7% for true negative, 0% for false-positive, and 9.7% for false-negative reports. Diagnostic accuracy in differentiating non-neoplastic and neoplastic lesions is 90.3%, with a sensitivity and specificity of 89.0% and 100%, respectively. The diagnostic accuracy of FNAC in differentiating benign from malignant lesions in our study is 93.5% (29 out of 31), the sensitivity of FNAC in our study for diagnosing malignancy is poor, and the specificity is 100%. It can be concluded that FNAC is more accurate in diagnosing benign lesions and more specific than sensitive in diagnosing malignant lesions.

Keywords FNAC · Salivary gland · Non-neoplastic lesions · Neoplastic lesions · Diagnostic accuracy

Introduction

Salivary glands are a common source of benign pathology, whereas salivary gland carcinoma is uncommon. Salivary gland lesions comprise 2–6.5% of all head and neck neoplasms in adults [1]. Salivary gland infections and inflammations present themselves differently, depending on the etiologic agents involved and the intensity and duration of the infection. These might range from acute localized infections like bacterial sialadenitis to systemic diseases caused by viruses like paramyxovirus or the human immunodeficiency virus (HIV). Non- infectious inflammations such as Sjogren's syndrome may present as a chronic swelling of the salivary glands. The submandibular gland is most commonly affected, with most of the sialolithiasis developing in the Wharton's duct [2].

Neoplasms can occur in any salivary gland tissue. The likelihood of malignancy is most significant in the smallest glands. In parotid, the most common lesions are benign. Most of these benign lesions are pleomorphic adenomas [1, 3]. Fine needle aspiration cytology (FNAC) has an essential role in the diagnostic workup and planning of treatment of a salivary gland mass. For example, the extent of surgery can be planned according to the FNAC result. FNAC can be performed without imaging if the lesion is superficial and palpable. However, ultrasound-guided (USG) FNAC has been shown to increase

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the diagnostic accuracy compared to an FNAC without USG guidance. USG guidance is beneficial not only for assuring proper needle placement in deeper lesions but also for evaluating the overall character of the lesion. Vascular structures are identified and therefore avoided [1].

Salivary gland lesions commonly present as an enlarged mass. They are not generally subjected to incisional or needle biopsy techniques because of the risk of fistula formation, or in the case of neoplasm, risk of tumour implantation. There is no evidence that these complications occur with FNAC. FNAC plays a vital role in preoperative discrimination between benign lesions and malignant tumours of the diagnostic tools. In conjunction with clinical and radiological assessment, FNAC forms the best possible base for the selection of effective management. However, histological examination is still the gold standard for establishing salivary gland lesions' final diagnosis and staging [1].

The importance of FNAC in distinguishing malignant parotid mass lesions from benign ones has been investigated by several authors [4, 5]. Despite the simplicity of the method, the accuracy of FNAC varies depending on the precision and experience of pathologists [6]. Studies have shown that the experience of the pathologist is related to diagnostic accuracy [7]. Successful FNAC demands high specimen quality and experience on the part of both the aspirator and the pathologist [8]. It is well known that a definitive diagnosis can sometimes be difficult on a salivary gland FNAC and it is recommended to give a differential diagnosis when in doubt [9, 10]. It is also recommended that the cytological opinion be interpreted in the context of clinical and imaging findings [9]. In order to increase the diagnostic accuracy in benign salivary glandular lesions, triple assessment consisting of cytologic features, clinical information, and radiologic findings is essential. Recognition of aspiration sites and the correlation with radiologic findings are essential, and a detailed cytologic examination based on both typical and non-typical cytologic features will be needed [11].

Most clinical studies on this topic have been published by researchers from clinical pathology, general surgery or oral dentistry disciplines. There, however, appears to be a dearth of published literature on this topic by otorhinolaryngologists (ENT surgeons). Therefore, the study aimed to analyze the cyto-histopathological correlation of salivary gland lesions and to determine the diagnostic yield of FNAC in salivary gland lesions compared with histopathological diagnosis.

Methods

Study Setting

A prospective study was conducted in the ENT Outpatient Department of Apollo Hospitals, Chennai, India, from January to November 2018 on patients above 18 years of age, who consented to participate in the study and presented with palpable swelling, clinically diagnosed as salivary gland lesions. The study was carried out according to the ethical principles for medical research on humans established by the Helsinki protocol (version 17c, 2004). Ethical approval was sought from the institutional review board (ECR/37/Inst/Tn/2013/RR-16) before the study began.

Study Population

A total of 31 patients who fulfilled the selection criteria were enrolled in the study and evaluated. Patients (18 years and above) who underwent preoperative FNAC followed by surgical procedure, and histological examination were included in the study. Cases that had histopathological examination (HPE) correlation only were included in calculating the diagnostic accuracy. Patients who did not undergo surgical excision, those with a recurrent lesion(s), suspected masses of vascular origin, skin infection in the area of FNAC, and patients with bleeding diathesis were excluded from the study.

Sample Size and Technique

Since the primary objective of the study was to determine the diagnostic accuracy of FNAC in salivary gland lesions in par with the gold standard histopathological examination (HPE), for sample size calculation, the sensitivity of FNAC was considered to be 91% based on the study conducted by Kakoty and colleagues [12].

The sample size is derived by using the following formula:

$$n = \frac{Z^2 pq}{d^2}$$

wheren is the sample size, Z is the standard normal variate value = 1.96, p is the sensitivity of FNAC in salivary gland lesions = 91%, q = 1 − p = 9%, d = Clinical allowable error = 10%

Therefore, using the above formula, the minimum required sample size was n = 31.

Procedure

Written and informed consent was taken from all subjects who satisfied the inclusion criteria. In all cases, detailed clinical examinations followed by routine haematological and biochemical investigations were carried out. The clinical details of the patient included in the study were recorded.

Radiological investigations like Computer Tomography imaging (CT imaging) were done only in cases suspected

of calcification and/or inflammatory condition(s) of the salivary gland. Magnetic Resonant Imaging (MRI) was done in cases suspected of malignancy – to assess the extent of the tumour, perineural spread, intracranial extension or marrow invasion. FNAC was performed in all cases by using a 24-gauge needle attached to a 10 cc disposable syringe. Ultrasound-guided FNAC was done in cases where the lesion involves the deep lobe or where the CT image revealed a solid component in the cystic lesion. *May-Grunwald Giemsa* and *Papanicolaou* stains were used for staining the cytology smears. Histopathological confirmation was sought in all cases. Only cases that had histopathological correlation were included in calculating the diagnostic accuracy.

Table 1 Age distribution of participants

Age groups	Frequency	Percentage
< = 20 yrs	4	12.9
21–30 yrs	5	16.1
31–40 yrs	8	25.8
41–50 yrs	2	6.5
> 50 yrs	12	38.7
Total	31	100.0

Table 2 Sex distribution of participants

Gender	Frequency	Percent
Male	15	48.4
Female	16	51.6
Total	31	100.0

FNAC in Diagnosing Salivary Gland Lesions

Procedure

A thin needle (22–25 gauge) attached to a syringe is inserted into the lump, and the plunger is pulled to create a negative pressure in the syringe. Keeping the plunger pulled, the needle is moved in and out in different directions. Care should be taken to ensure that the needle remains in the lump and the plunger remains pulled all through this procedure. The plunger is then released, and the aspirated material is smeared onto the slide, stained, and examined [5].

In 2015, an international group of cytopathologists initiated the development of a reporting system for salivary gland FNAC specimens using a framework consisting of 6 diagnostic categories. The reporting system is named the "Milan System for Reporting Salivary Gland Cytopathology (MSRSGC)," reflecting the first meeting of the core group during the 2015 annual meeting of the European Cytology Congress in Milan, Italy. The MSRSGC is an evidence-based system that aims to correlate each diagnostic category with a risk of malignancy and clinical management strategies [13]. However, MSRSGC is not widely used currently.

Histopathology

The specimen for histopathological analysis was sent/received in 10% formalin, and following tissue processing, haematoxylin and eosin staining were done. The parameters of diagnostic validity of FNAC in terms of sensitivity, specificity, and diagnostic accuracy were evaluated. In this study, non-neoplastic lesions are considered negatives, and neoplastic lesions, both benign and malignant, are considered positives for calculating the diagnostic accuracy. Considering benign as negative and malignant as positive, diagnostic accuracy is calculated separately.

Statistical Analysis

All continuous variables are expressed as mean ± standard deviation (SD). All categorical valuables are expressed as percentages. Comparison of continuous variables was done by independent sample '*t*-test. Comparison of categorical variables was made by either the Chi-Square test or Fisher's exact test. Sensitivity, specificity, and accuracy have been computed. Data analysis was carried out by SPSS software for Windows, Version 25.0. (SPSS Inc., Chicago, IL, USA).

Results

All the patients included in the study completed it (n = 31). The mean age of the patients enrolled in the study was 41.55 ± 16.08 years, and the mean duration of the swelling was 36.05 ± 67.95 months. The mean size of the swelling in the patients enrolled was 3.35 ± 2.12 cm. Among the 31 cases, most patients were above 50 years (38.7%, n = 12). 25.8% (n = 8) of the patients were between 31 and 40 years. The youngest age group in this study were below 20 years of age (12.9%, n = 4) (Table 1). 48.4% were males in our study, and 51.6% were females (Table 2). 83.9% of the lesions originated from the parotid gland, and the remaining 16.1% was from the submandibular gland. 22.6% of patients had pain, while 77.4% did not experience any pain at the lesion site. The distribution of pathology based on FNAC and HPE showed Pleomorphic adenoma to be the most common pathology detected (FNAC: 54.8% and HPE: 45.2%) (Table 3). Another finding was that Pleomorphic adenoma was found to be more common in females (n = 11, 68.8%), whereas Warthin's tumour was found to be more common in males (n = 6, 40%). This difference was statistically significant ($p = 0.038$) (Table 4).

Table 3 Distribution of pathology based on FNAC and HPE

Pathology	FNAC		HPE	
	Frequency	Percent	Frequency	Percent
Pleomorphic adenoma	17	54.8	14	45.2
Warthin's	4	12.9	7	22.6
Basal cell adenoma	1	3.2	2	6.5
Benign miscellaneous*	8	25.8	6	19.4
Inconclusive	1	3.2	2	6.5
Total	31	100.0	31	100.0

*Benign adenoma, Infarcted Tumour, Trichellemmal cyst, Mixed Spindle Cell Tumour, Adipose Tissue Replacement, Nodular Fascitis

Variation in HPE findings based on site show no significant difference ($p = 0.457$; Fisher's exact test), as seen in Table 5. In the parotid lesions, 11 out of 26 cases (42.3%) was Pleomorphic adenoma, 7 out of 26 (26.9%) was Warthin's tumour, 2 out of 26 (7%) were basal cell adenoma, 5 out of 26 (19%) were benign miscellaneous and 1 out of 26 (3%) was carcinoma. Similarly, amongst the submandibular gland lesions, 3 out of 5 (60%) cases were Pleomorphic adenoma, 1 out of the 5 (20%) was a benign miscellaneous lesion (gland replaced by adipose tissue) and another 1 out of 5 (20%) was an undifferentiated carcinoma of metastatic origin. Cytohistopathological correlation shows that 14 out of 14 cases (100%) of Pleomorphic adenoma were correlated with FNAC. 4 out of 7 (57.1%) of Warthin's tumour correlated with FNAC whereas, 2 out of 7 (28.6%) were misdiagnosed as Pleomorphic adenoma and 1 out of 7 (14.3%) was reported as a cystic lesion. 1 out of 2 (50%) of basal cell adenoma correlated with FNAC, the remaining one case (50%) was misdiagnosed as Pleomorphic adenoma. Among the other 6 benign lesions, which were grouped as benign miscellaneous, 3 benign tumours and 3 non-neoplastic lesions were picked up by FNAC. Hence 100% of benign miscellaneous lesions correlated with FNAC. Both of the malignant cases were not picked up by FNAC, one was reported as a benign suppurative lesion, and one was reported as inconclusive (Table 6).

FNAC cross-tabulation with HPE showed that 29 out of 29 benign cases (100%) were diagnosed by FNAC, whereas malignancy was not picked up (Table 7). Considering malignancy as positive and benign as negative, diagnostic accuracy was 93.5%, with a sensitivity and specificity of 0% and 100%, respectively. (True positives (TP) = 0; True negatives (TN) = 29; False positive (FP) = 0; False negative (FN) = 2) (Table 8). Considering neoplasms (benign and malignant lesions) as positive and non-neoplastic as negative, the diagnostic accuracy was 90.3% with a sensitivity and specificity

Table 4 Variation in HPE findings based on gender

			HPE				
			Pleomorphic adenoma	Warthin's	Basal cell adenoma	Benign miscellaneous	Carcinoma
Sex	Male	Count	3	6	1	3	2
		% within SEX	20.0%	40.0%	6.7%	20.0%	13.3%
		% within HPE	21.4%	85.7%	50.0%	50.0%	100.0%
	Female	Count	11	1	1	3	0
		% within SEX	68.8%	6.3%	6.3%	18.8%	0.0%
		% within HPE	78.6%	14.3%	50.0%	50.0%	0.0%
Total		Count	14	7	2	6	2
		% within SEX	45.2%	22.6%	6.5%	19.4%	6.5%
		% within HPE	100.0%	100.0%	100.0%	100.0%	100.0%
p value		$p = 0.038$*					

*Significant ($p < 0.05$)

Table 5 Variation in HPE findings based on site

	Pleomorphic adenoma	Warthin's	Basal cell adenoma	Benign miscellaneous	Carcinoma	Total
Parotid	11 42.2%	7 26.9%	2 7.7%	5 19.2%	1 3.8%	26
Submandibular	3 60%	0	0	1 20%	1 20%	5
N = 31	14	7	2	6	2	

PA Pleomorphic adenoma, *Ca* Carcinoma p = 0.457(Fisher's exact test), not significant

Table 6 Cytohistopathological correlation

	Histopathology										
				Benign Miscellaneous							
	PA	W	BCA	Aden	Inf. T	T. Cy	Mx	Adip	N.F	CA	T = 31
FNAC											
PA	14	2	1								17
W		4									4
BCA			1								1
BM-C		1		1	1	1	1	1	1	1	8
CA											0
Inc										1	1
T = 31	14	7	2	1	1	1	1	1	1	2	

PA Pleomorphic Adenoma, W Warthin's Tumour, BCA Basal Cell Adenoma, BM-C Benign Miscellaneous – Cystic, CA Carcinoma, Inc Inconclusive Aden Adenoma (Cellular pleomorphic adenoma / Basal cell adenoma), Inf.T Infarcted Tumour, T.CyTrichellemmal cyst, Mx Mixed Spindle Cell Tumour, Adip Adipose Tissue Replacement, NF Nodular Fascitis Carcinoma – Poorly differentiated adenocarcinoma, Undifferentiated carcinoma – metastatic

Table 7 FNAC cross tabulation with HPE

			HPE(Benign/Malignant)		
			Benign	Malignant	Total
FNAC (Benign/Malignant)	Benign	Count	29	2	31
		% within FNAC (Benign/Malignant)	93.5%	6.5%	100.0%
		% within HPE (Benign/Malignant)	100.0%	0%	100.0%
Total		Count	29	2	31
		% within FNAC (Benign/Malignant)	93.5%	6.5%	100.0%
		% within HPE (Benign/Malignant)	100.0%	0%	100.0%

Table 8 Accuracy of FNAC—Benign vs. Malignant

FNAC/USG guided FNAC	HPE diagnosis	
	Malignant	Benign
Malignant	0(TP)	0(FP)
Benign	2(FN)	29(TN)
Total	2	29

Table 9 Accuracy of FNAC – Neoplastic vs. Non neoplastic

FNAC/USG guided FNAC	HPE diagnosis	
	Neoplastic	Non-neoplastic
Neoplastic	25(TP)	0(FP)
Non-neoplastic	3(FN)	3(TN)
Total	28	3

Sensitivity = 89.2%, Specificity = 100%, Accuracy = 90.3%

of 89.2% and 100%, respectively. When neoplastic versus non-neoplastic lesions were considered, the FNAC showed a sensitivity of 89.2%, specificity of 100%, and accuracy of 90.3% (Table 9).

Discussion

FNAC is a quick, relatively cheaper, and more reliable diagnostic method without significant complications in assessing salivary gland lesions. The methodology in our study employed the use of a 24-gauge needle for FNAC, which ensured an adequate collection of materials and ensured fewer complications and an easily executable outpatient procedure. The results of our study are comparable with some studies which have documented the use of 22- and 23-gauge needles for FNAC [12, 14, 15].

In our study, the mean age of the patient's enrolled and evaluated was 41 years ± 16.083, with the age range between 16 and 41 years. This is similar to the age groups of patients evaluated in other studies [16–18]. The male to female patients evaluated in our study was 1:1.066, with a slightly more preponderance in the female population. This was a similar pattern of the gender ratio of patients evaluated in other studies as well [16, 18]. In our study, parotid gland lesions comprised 83.9% of all the salivary gland lesions, while submandibular gland lesions comprised 16.1%. This

was in line with the findings of Singh et al. [18], where the percentage of salivary gland lesion distribution between the parotid gland and submandibular gland was 79% and 18.7%, respectively. This was also seen from other similar published literature [19–22].

Distribution and Prevalence of Lesions

The distribution between non-neoplastic, benign, and malignant lesions is similar to the distribution reported in a study by Arul et al. [23]. In our study, inflammations (inflammatory and cystic lesions) were not common lesions in salivary glands (9.6%), and these findings are not consistent with previous studies, which showed that inflammations constitute the most common pathology (53.76%) in the salivary gland [23, 24]. The possible reason might be excluding the sialadenitis cases that did not undergo FNAC, as the reported sialadenitis cases had presented with sialolithiasis, which is well diagnosed by imaging modality.

In the present study, the majority of lesions in the parotid gland were benign tumours (88.4% of all lesions: 50%-pleomorphic adenomas; 26.9%-Warthin's tumour; 11.5%-other benign tumours such as mixed spindle cell tumour, etc.). Malignancy in parotid was 3.8%, and non-neoplastic lesions comprised of 7.6%. Similarly, the submandibular gland pathology distribution in our study showed 60% of the submandibular lesions to be benign neoplasms (all of them were pleomorphic adenomas). 20% of the lesions were malignant neoplasms, and 20% were non-neoplastic lesions in the submandibular gland. These findings are similar to the findings reported by Ameli et al., where the Pleomorphic adenoma distribution in the parotid gland was 79.1% [15]. Pleomorphic adenoma was the most common benign lesion seen in our study (54.8%). Warthin's tumour is the second most common benign salivary gland tumour. This finding is supported by many previous studies [25, 26]. The diagnosis of Pleomorphic adenoma is usually reasonably straightforward due to an adequate mixture of components like the presence of ductal cells, myoepithelial cells and chondromyxoid materials.

Diagnostic problems can arise when there is a significant overgrowth of one of the components [27, 28]. In our study, the probable reason for one of the Warthin's tumour to have been misreported as a cystic lesion may be an inadequate sampling of the lesion due to the absence of cellular material. Misinterpretations of BCA as Pleomorphic adenoma by FNAC can occur due to small round basal cells with scanty stroma simulating cellular Pleomorphic adenoma [29]. However, among the benign lesions in the present study, none of the benign neoplastic and non-neoplastic lesions were reported as malignant. In the present study, the sensitivity, specificity, and accuracy of FNAC for non-neoplastic lesions, i.e., inflammatory lesions and inclusion cysts, are 100% when compared with biopsy. This is comparable with results from previous studies [25, 30].

In our study, there were 2 malignant lesions noted. One was a poorly differentiated carcinoma with adenosquamous features of the parotid, and the other was a metastatic undifferentiated carcinoma of the submandibular gland, origin probably from aero-digestive tract. This is contrary to the commonly reported malignancies in other studies where mucoepidermoid carcinoma, adenoid cystic carcinoma, and acinic cell carcinoma are the most commonly reported malignancies in decreasing order of frequency [12, 17, 23].

In our study, the poorly differentiated carcinoma with adenosquamous features of parotid was misreported as a suppurative lesion by FNAC. The metastatic undifferentiated carcinoma of the submandibular gland was misreported as inconclusive by FNAC.

Metastatic squamous cell carcinoma may also show cystic degeneration, and while performing FNAC, drops of turbid fluid might be aspirated. This may be a source of false-negative diagnosis unless a careful cytological observation is made to locate malignant squamous cells. The cyst should always be re-aspirated, particularly from the solid area [7].

In our study, the diagnostic accuracy is 90.3%, when neoplasm (benign and malignant together) is considered positive and non-neoplastic lesions (cystic lesions, adipose tissue, etc.) are considered negative. The sensitivity and specificity were 89% and 100%, respectively. This finding in our study is similar to the findings in a meta-analysis where the sensitivity and specificity to differentiate neoplastic from non-neoplastic lesions are 79 to 100% and 71 to 100%, respectively [31]. In the present study, when considering malignancy as positive and non-malignant (non-neoplastic and benign neoplastic) as negative, diagnostic accuracy becomes 93.5% with a sensitivity of 0% and specificity of 100%. This is comparable with reports from other studies [17, 23, 31].

The sensitivity, specificity, and accuracy of FNAC for benign and malignant neoplasia were not 100%. These values are comparable with previous studies [28, 32]. The sensitivity for diagnosing malignant lesions is very poor (0%) in this study as there were no true positives and is explained as follows: (a) The overall sample size (n = 31) is very small. (b)The total number of malignant cases was just 2 out of 31, and those too were uncommon malignancies. According to the published literature, the false-negative prediction range falls between 0 and 37% [33, 34]. The chances of the two reported malignant cases in this study falling in this wide range of false-negative are practically possible.

In this study, considering the radiological investigations, 14 out of 31 cases had a USG neck done, 11 out of 31 cases had a CT NECK done, 2 out of 31 cases had an MRI, 3 cases had both USG and CT NECK, and one case had both a USG neck and an MRI done. Considering the

radiological features of malignancy in salivary glands, as described previously, 29 out of 31 cases were picked up as benign, and two were suspected as malignant, which had a 100% correlation with HPE. It also needs to be understood that since the study was done in a tertiary hospital, many of the patients already had radiological imaging done prior to presenting here, and in such cases, those imaging reports were taken into consideration for evaluation.

When considering the image-guided FNAC, four cases underwent USG guided FNAC, out of which 3 cases had a cyto-histological correlation, whereas one from the left submandibular gland was reported as inconclusive by FNAC. This inconclusive report in FNAC has been reported as an undifferentiated carcinoma of metastatic origin by HPE. Bartels et al. found no advantages in combining FNAC with USG in terms of sensitivity, specificity, or accuracy [35]. Schmidt et al. in a meta-analytic study noted that the diagnostic variation of different studies is mainly due to: (1) Performer's capability: Pathologists do better FNAC than surgeons, (2) Additional help of imaging, (3) Variation of the diagnostic threshold of neoplasm, (4) Verification bias of FNAC: the subset of non-neoplastic disease undergoes less histopathological verification, (5) Bias due to non-inclusion of indeterminate or inadequate lesion: in many studies, there is no clear mention about the inclusion or exclusion of inadequate or indeterminate reports [31].In addition as per a study by Lanisnik et al., in parotid lesions, the non-diagnostic rate of USG guided FNAC is 3.1%, which is lesser when compared to 7.2% of non-diagnostic rate by blind FNAC. Hence, the percentage of representative sample by USG guided FNAC is 96.9%, which is higher than 92.8% by blind FNAC [36]. Another study reported sensitivity and specificity of the USG guided FNAC (in parotid lesions) for diagnosis of Warthin's tumor as 96.63% and 96% respectively. The accuracy of this method was found to be 96.36% (CI: 94.54–97.70) [37, 38]

As per published literature, the incidence of minor salivary gland tumors are less common. The present study found no minor salivary gland tumors – as a result of which the role of FNAC in minor salivary gland lesions was not reported in this study. Accuracy of FNAC in minor salivary gland tumors is still controversial because of diversity of minor salivary gland lesions, difficulty of aspiration in intraoral lesions, and relative rarity of these tumors. As accuracy of FNAC in any external swelling varies according to the technique applied and the procedural expertise, which is one of the fact which demands USG guided FNAC for a better yield; FNAC of an intraoral lesion is therefore bound to be inaccurate. As per Kurasawa et al., the sensitivity and specificity of FNAC in minor salivary gland lesions is 66.7% and 91% respectively with an accuracy of 69.6% [39].

Limitations

Accuracy of FNAC in most common non-neoplastic lesions like sialadenitis with sialolithiasis or in cases of tuberculous aetiology could not be assessed in this study, as cytology is not needed in sialolithiasis, which is best diagnosed by radiology. Similarly, histology will not be available for lesions confirmed as tuberculosis by cytology, which is managed by conservative management. The study period is short & the sample size is small to assess the accuracy of FNAC in diagnosing malignant lesions, as true positive cases could not be obtained due to the low incidence of malignancy in salivary glands. Uniformity of FNAC technique cannot be assessed with, as the study was performed at a large academic centre where different skill levels were involved in performing FNAC.

It is recommended that larger randomized multi-centric trials be needed to assess the cyto histological correlation. Opting for a USG guided FNAC over FNAC without guidance whenever there is a suspicion of malignancy will improve the accuracy helping in obtaining a representative sample avoiding sampling errors. Furthermore, if the FNAC is negative or inconclusive in suspected cases of malignancy, it is recommended that surgery should be planned with a frozen section.

Conclusion

The majority of salivary gland lesions occur in the parotid gland. The majority of salivary neoplasms are benign. The most common salivary neoplasm identified is pleomorphic adenoma. There is a slight female preponderance in the occurrence of salivary lesions except for Warthin's tumour, which is more common in males. FNAC is a simple, cost-effective, reliable diagnostic tool in diagnosing salivary gland lesions. It is more accurate in diagnosing benign lesions and more specific than sensitive in diagnosing malignant lesions. Preoperative FNAC results provide otorhinolaryngologists with valuable diagnostic information that may influence the surgical management of salivary gland tumours.

The malignant cases cited in this study are possible sources of erroneous diagnosis. These pitfalls should be kept in mind when faced with different or challenging cases of FNAC results. Hence, the approach to each case should be individualized, correlating all the clinical, radiological & cytological information available.

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Declarations

Conflict of interest The authors declare that they have a conflict of interest.

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