

Evaluation of the Efficacy of Exfoliative Oral Brush Cytology in Malignancies of Oral Cavity and Oropharynx

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Abstract:

Aim and objectives: To evaluate the usefulness of exfoliative cytology in diagnosing malignant lesions of the oral cavity and oropharynx.

Materials and Methods: This prospective study was conducted in the Department of ENT at a tertiary care center from October 2024 to October 2025. A total of 30 patients with clinically suspected malignant oral or oropharyngeal lesions were included. Exfoliative cytology samples were obtained using a brush or spatula, stained (Papanicolaou/Romanowsky), and analyzed. Results were compared with histopathological findings.

Results: Among 30 patients, 22 were males and 8 females. The tongue was the most frequently affected site. Cytology detected premalignant or malignant changes in 20 cases, with 10 false negatives and no false positives. The sensitivity and specificity were 66.67% and 100%, respectively. Positive predictive value was 100%, negative predictive value was 50%, and overall diagnostic accuracy was 75%.

Conclusion: Exfoliative cytology is a simple, cost-effective, and minimally invasive screening tool for early detection of oral malignancies. Histopathological examination may remain the gold standard for diagnosing oral cavity biopsies but cytology can be used as an adjunct for screening and follow-up.

Keywords: Oropharyngeal carcinoma, Exfoliative cytology, Screening

Introduction:

Oral cavity malignancies (excluding those of the lip) account for 14% of all head and neck cancers ^[1]. Around 300,000 patients are annually estimated to have oral cancer worldwide. It is responsible for 2 to 4 % malignancies in the west. In India, however, it accounts for almost 40 % of malignancies ^[2]. It is the third most common cancer overall and contributes to mortality in the country ^[3].

Tobacco and alcohol consumption are considered to be the most common preventable risk factors associated with the development of oral cavity SCC ^[4]. In addition, this relationship is synergistic, with alcohol serving as a promoter for the carcinogenic effects of tobacco ^[4]. Betel nut (including betel quid) is the fourth most abused substance and is chewed by 10% of the world's population. Environmental uv light exposure has been associated with the development of lip cancer.

Other entities that have a potential associated with development of squamous cell carcinoma include plummer Vinson syndrome, chronic infection with syphilis, long term immunosuppression and HIV infection ^[4].

The oral cavity has a pivotal role in articulation and deglutition hence oral cavity and oropharyngeal malignancies have a significant impact on a patient's quality of life, including their nutrition status. Earlier detection and management of malignancies could improve both the prognosis and the disability factor.

A detailed history followed by a thorough examination is critical in evaluation of all oropharyngeal cancers. This is to be followed up by biopsy which is the gold standard technique. Other adjuvants are radiological investigations and brush cytology (exfoliative cytology).

In 1954, George Papanicolaou demonstrated that exfoliative cytology could be applied to virtually any body site. At a fundamental level, carcinogenesis involves a disordered transformation of tissue, progressing from normal to dysplastic and ultimately malignant states [5].

Exfoliative cytology can be done in two methods (just like pap smear); the conventional method and the liquid-based cytology. The physician uses a brush to scrape of oral mucosa (where the suspected lesion is), this sample will include cells that have been shed from desquamated mucosa. The sample will then be tested for malignant cells.

Direct sampling techniques—such as the use of a wooden spatula, tongue blade, brush, or suction cytology—can be employed in accessible lesions. Among these, direct brushings of visible lesions generally yield the most reliable exfoliative cytology specimens.

Cytological techniques have several advantages over histological biopsy. They allow sampling of a wider surface area and are particularly useful in monitoring premalignant conditions. The procedure is minimally invasive, less traumatic, and carries a lower risk of complications such as perforation and significant bleeding. In addition, cytological processing is rapid, providing quicker results.

Although cytology may be diagnostically more sensitive in certain situations, the yield can be influenced by the pattern of tumor growth. Overall, cytology and histology are complementary methods, and the highest diagnostic accuracy is achieved when both are used together.

Aim: To evaluate the usefulness of exfoliative cytology for diagnosis of malignant lesions in suspected oral cavity and oropharynx carcinomas

Objectives:

Primary objective: To assess the reliability of oral brush cytology in detection of potentially malignant lesions of the oral cavity and oropharynx.

Secondary objective: To determine the sensitivity and specificity of oral brush cytology in comparison to histopathology

Materials and methods:

Study type: Prospective study

Study period: October 2024 to October 2025

Study settings: Department of ENT, tertiary care centre

Study population: All patients with suspected oral cavity and oropharynx lesions.

Sample size: 30

Inclusion criteria: All patients attending ENT department with suspected malignant lesions

Exclusion criteria:

- Patients not willing to participate in the study
- Lesions with a duration of less than 8 weeks.
- Smooth-surfaced benign swellings were not included in this study.

- Patients belonging to the pediatric age group.

Methodology:

After obtaining ethics committee approval, 30 patients who are suspected to have malignant lesions that come to ENT out patient department will be selected according to history and examination.

The procedure was explained to the patient in their native language, along with the significance of the study. In cases of lesions involving the oral cavity, face, or neck, the lesion was gently scraped from all margins using a wooden spatula under headlight illumination. The procedure is generally not very painful; however, if the lesion is tender, a brush may be used to obtain the sample with minimal pressure. The collected material was smeared immediately.

For slide preparation, the brush was rolled—rather than rubbed or scrubbed—over an area approximately the size of a coin on clean, untreated glass slides. The slides were then immediately fixed in 95% ethanol for Papanicolaou staining or rapidly air-dried for Romanowsky staining and sent for histopathological analysis.

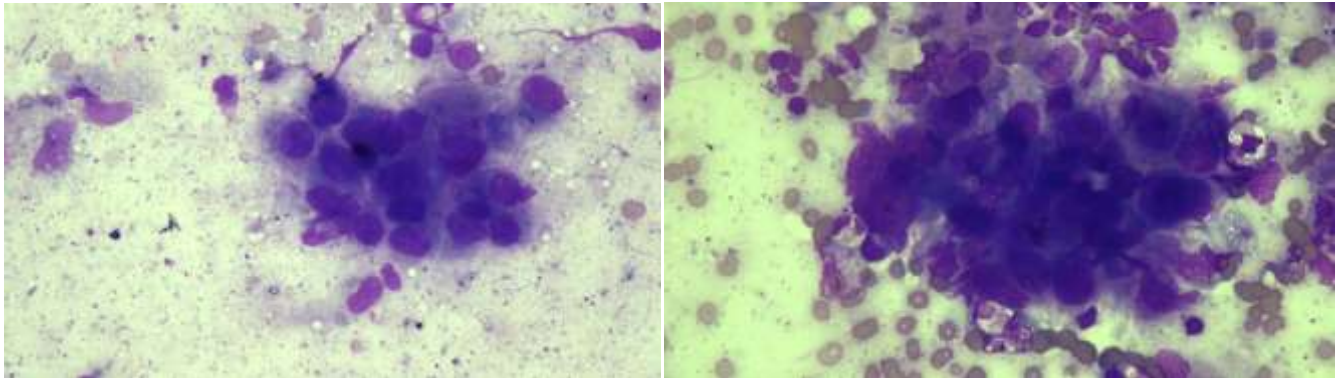


Image 1: FNAC smear shows atypical cells arranged in clusters. Cells show pleomorphic nuclei, dispersed chromatin and prominent nucleoli.

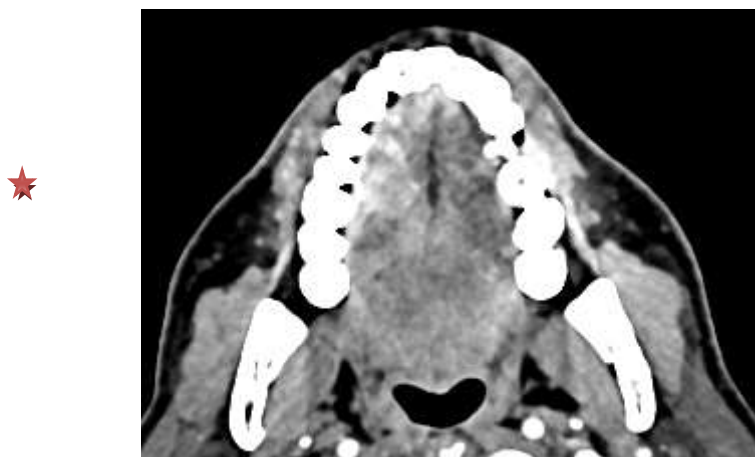


Image 2: This is a contrast enhanced CT image; the red star shows a contrast enhancing lesion approximately 16x10 with irregular margins seen in the right side of anterior tongue.

Results

A total of 30 patients with chronic ulcerative lesions in the head and neck region were included in the stu

dy. Of these, 22 were males and 8 were females. The age range was 20–70 years in males and 20–65 years in females. The most common presenting complaint was a non-healing oral ulcer.

The distribution of lesion sites was as follows: tongue (12 cases), buccal mucosa (5 cases) tonsillar fossa (5), soft palate (4 cases), floor of mouth (2 cases) and posterior pharyngeal wall (2 cases). All cases presented with chronic ulcerative lesions.

Multiple smears were obtained from each lesion; the first smear yielded a diagnosis in approximately 50–75% of cases (15 cases), the second smear in 15–20% (4 cases), and the third smear in 10% (3 cases).

Cytological evaluation revealed 20 cases positive for premalignant or malignant cells, with 10 false-negative cases. No false-positive cases were observed.

On cytological examination, 10 cases showed normal squamous cells, 12 showed metaplastic changes, 3 demonstrated anaplastic features, and 5 showed malignant squamous cells.

Normal squamous cells	Metaplastic cells	Anaplastic cells	Malignant Squamous cells
10	3	12	5

These results were then compared with that of histopathological analysis, following which sensitivity and specificity was calculated.

Present	n	Absent	n	Total	
Positive	True Positive	a= 20	False Positive	c= 0	a + c = 20
Negative	False Negative	b= 10	True Negative	d= 10	b + d = 20
Total		a + b = 30		c + d = 10	

The diagnostic performance of exfoliative cytology showed a sensitivity of 66.67% (95% CI: 47.19%–82.71%) and a specificity of 100% (95% CI: 69.15%–100%). The positive predictive value was 100%, while the negative predictive value was 50%. The overall diagnostic accuracy was 75%. The negative likelihood ratio was 0.33 (95% CI: 0.20–0.55).

Statistic	Value	95% CI
Sensitivity	66.67%	47.19% to 82.71%
Specificity	100.00%	69.15% to 100.00%
Positive Likelihood Ratio		
Negative Likelihood Ratio	0.33	0.20 to 0.55
Disease prevalence (*)	75.00%	58.80% to 87.31%

Positive Predictive Value (*)	100.00%	83.16% to 100.00%
Negative Predictive Value (*)	50.00%	37.61% to 62.39%
Accuracy (*)	75.00%	58.80% to 87.31%

Discussion:

In our study it was found that there was an increased preponderance for male gender, compared to that of females, this is comparable with current literature [1]. The most commonly involved sites are the tongue (40%) followed by buccal mucosa (17%). These may be attributed to tobacco chewing which is common in India [15].

The diagnostic yield increases with multiple smears, as demonstrated in this study. Larger lesions tend to exfoliate more diagnostic cells, whereas smaller lesions (<2 cm) may yield insufficient cellular material. The optimal lesion size for cytological diagnosis is typically between 3–6 cm.

Cytology is particularly useful in identifying cellular atypia, including increased nuclear-cytoplasmic ratio, nuclear pleomorphism, hyperchromasia, and chromatin clumping. Premalignant lesions often show immature or keratinized cells with dysplastic features. However, distinguishing severe dysplasia from well-differentiated squamous cell carcinoma remains challenging on cytology alone.

On comparing the histopathology and cytology reports, out of 30 histopathologically proven malignancies, 20 cytology smears were suggestive of malignant cells in the specimen. The reason for the higher number of false negatives could be due to the sample being taken from normal cells rather than abnormal cells or inadequate slide preparation.

In our study, the sensitivity of detecting oral cavity and oropharyngeal carcinomas is 66.67. The absence of false-positive cases in this study highlights the high specificity of exfoliative cytology. However, negative cytology does not exclude malignancy.

Inflammatory and reactive atypia, as well as atypical parakeratosis, may mimic dysplastic changes, necessitating histopathological confirmation. Therefore, biopsy remains the gold standard for definitive diagnosis and treatment.

Human papillomavirus (HPV) has been implicated in the pathogenesis of certain oral and oropharyngeal cancers, and the combination of exfoliative cytology with HPV testing may serve as a useful screening modality.

However, its limitations—particularly sampling errors and difficulty in grading dysplasia—must be recognized. The highest diagnostic accuracy is achieved when cytology is used in conjunction with histopathological examination.

Conclusion:

Exfoliative cytology serves as a simple, cost-effective, and minimally invasive diagnostic tool for the early detection of oral premalignant and malignant lesions. It allows direct sampling of lesions without the need for anesthesia and is well tolerated by patients, facilitating repeated examinations when required. The gold standard for diagnosing malignancy may be histopathological analysis, however, brush cytology can be used as a screening tool for early detection of malignancies.

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