ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 01 | January - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"THE ROLE OF NARROW BAND IMAGING IN THE EARLY DIAGNOSIS OF ORAL, OROPHARYNGEAL AND LARYNGEAL PREMALIGNANT AND MALIGNANT LESIONS."

Otorhinolaryngology

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ABSTRACT

Introduction: Head and neck tumors are the sixth most common cancers globally, with significant impact on patients' functional and cosmetic outcomes. Early detection is crucial for treatment success. This study explores the diagnostic ability of Narrow Band Imaging (NBI) for detecting premalignant and malignant lesions in the head and neck, suggesting it as an optical adjunct to histopathology, the gold standard. **Methods:** A cross-sectional study was conducted on 50 patients with suspected head and neck premalignant and malignant tumors at a tertiary care center in central India between April 2017 and April 2018. NBI and conventional white light endoscopy were used to examine lesions, followed by histopathological confirmation. **Results:** Among 45 histopathologically confirmed malignant cases, NBI detected 44, while white light endoscopy detected only 36. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for white light were 80%, 100%, 100%, and 35.71%, respectively. For NBI, these values were 95.5%, 80%, 97.72%, and 66.66%, respectively. The P-value of 0.003 indicates NBI's significant role in early diagnosis.**Conclusion:** NBI is an effective optical confirmatory test for detecting premalignant and malignant lesions in the head and neck. Its ability to visualize intrapapillary capillary loops correlates well with histopathology, providing a faster and less invasive diagnostic tool.

KEYWORDS

Narrow band imaging (NBI), Optical confirmatory test, White light endoscopy, Pre malignant, Histopathology

INTRODUCTION

Head and neck tumors are the sixth most common cancer globally with annual incidence of over 3,00,000 cases of which 62% arise in developing countries [1]. In India it is the third most common preventable cancer with prevalence rate of 20 per 100,000 population. About 80% of oral, oropharyngeal and laryngeal cancers are due to tobacco and alcohol. The tobacco can be either in the form of smokeless tobacco like paan or betel nut or smoke tobacco in the form of bidi or cigarette. The other factors include Human papilloma virus infection or radiation exposure or rarely occupation exposure.

These head and neck tumors are well known for its synchronous or metachronous origin. The treatment of these tumors which could be either surgical for smaller lesions or oncological for larger lesions leading to significant mutilation of the affected individual. The result leads to cosmetic defect, and affects functionally like difficulty in articulation, chewing, swallowing, breathing and voice production. Thus, the early detection of these fatal tumors is the most important factors for treatment success.

Narrow Band Imaging (NBI) is a digital endoscopic technique that uses narrow bandwidth light, specifically 440-460nm (blue) and 540-560nm (green) [2], which are absorbed by hemoglobin. This enhances the visibility of blood vessels, allowing for better detection of lesions, including those in early stages that might be missed by white light endoscopy. This study aims to evaluate the role of NBI in diagnosing premalignant and malignant lesions in the head and neck, positioning it as an adjunct to histopathology.

MATERIALS AND METHODS

A cross-sectional study was performed on 50 patients with suspected premalignant and malignant head and neck tumors who came to the Department of Otorhinolaryngology, in the tertiary care center of central India from April 2017 to April 2018.

Inclusion Criteria:

- Age between 20-80 years.
- Patients with suspected oral, oropharyngeal and laryngeal premalignant and malignant lesions, presenting as ulcers, pain, difficulty swallowing, hoarseness, respiratory difficulty and neck swelling.

Exclusion Criteria

- Patients not giving consent.
- Biopsy proven cancer patients
- Patients with recurrent lesions

Each patient underwent clinical evaluation, including detailed history and examination, followed by endoscopic evaluation through **OLYMPUS VISERA ELITE OTV-S190 VIDEO SYSTEM** using conventional white light and NBI. The lesions were assessed for vascular patterns, focusing on intraepithelial papillary capillary loops (IPCLs). Lesions were categorized into four types based on these vascular patterns:
Type 1: Regularly distributed IPCL
Type2: Dilated and tortuous microvasculature
Type3: Elongated and twisted microvasculature
Type 4: Destruction of IPCLs

Biopsy was performed under NBI guidance, and histopathology was used for final diagnosis

RESULTS

The study included 50 patients, 34 male (68%) and 16 female (32%), aged between 20-80 years.

The majority of patients were in the 5th (32%) and 6th (26%) decades of life.

Oral cavity lesions were the most common (78%), followed by the oropharynx (14%) and larynx (8%). The buccal mucosa was the most frequently affected area (53.8%), followed by the tongue (21%).

In terms of vascular patterns under NBI, Type I IPCL was observed in 38.6% of cases, Type II in 36.3%, Type III in 22.7%, and Type IV in 2.2%.

Histopathologically, the most common diagnosis was well-differentiated squamous cell carcinoma (54%), followed by moderately differentiated carcinoma (20%).

Among 45 histopathologically confirmed malignant lesions, NBI detected 44, whereas white light endoscopy detected only 36. This highlights NBI's superior ability to identify lesions.

The sensitivity, specificity, PPV, and NPV of white light were 80%, 100%, 100%, and 35.71%, respectively, while sensitivity of 95.5%, specificity of 80%, PPV of 97.72%, and NPV of 66.66%.

The P-value of 0.003 indicates NBI's statistical significance in early lesion detection.

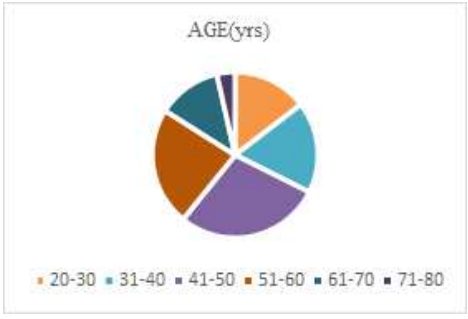

Chart No. 1: Age Distribution

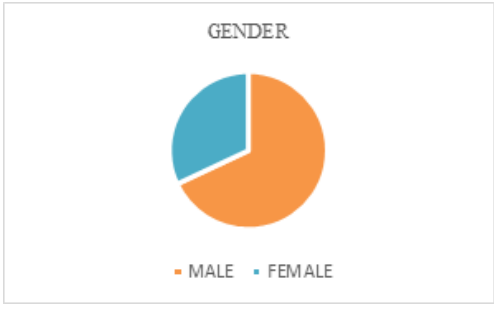

Chart No.2: Sex Distribution

Table 1: Topographical Distribution

TOPOGRAPHIC LOCATION	NUMBER OF CASES	PERCENTAGE (%)
(I) ORAL CAVITY	**39**	**78**
1) LIP	1	2.5
2) BUCCAL MUCOSA	21	53.63
3) TONGUE	9	23
4) FLOOR OF MOUTH	1	2.5
5)ALVEOLAR REGION	2	5
6) HARD PALATE	5	12.8
(II) OROPHARYNX	**7**	**14**
1) SOFT PALATE	4	57.1
2) TONSIL	3	42.8
(III) LARYNX	**4**	**8**
1)ARYTENOIDS/AEF	3	75
2) SUB GLOTTIS	1	25

Table 2: Distribution of IPCL

INTRAPAPILLARY LOOP	NUMBER OF CASES	PERCENTAGE (%)
TYPE I	17	38.6
TYPE II	16	36.3
TYPE III	10	22.7
TYPE IV	01	2.2

Table 3: Distribution of cases on the basis of histopathology

HISTOPATHOLOGICAL DIAGNOSIS	No. OF CASES	PERCENTAGE (%)
Hyperplasia/ dysplasia	5	10
Carcinoma in situ	4	08
Well differentiated carcinoma	27	54
Moderately differentiated carcinoma	10	20
Poorly differentiated carcinoma	03	06
Others (verrucous carcinoma)	01	02

Table 4: Correlation between IPCL type and histopathological diagnosis

HISTOPATHOLOGICAL DIAGNOSIS	IPCL TYPE I	IPCL TYPE II	IPCL TYPE III	IPCL TYPE IV
Hyperplasia/ dysplasia	1	-	-	-
Carcinoma in situ	3	-	-	-
Well differentiated carcinoma	13	14	-	-
Moderately differentiated carcinoma	-	2	8	-
Poorly differentiated carcinoma	-	-	2	1
Others(verrucous carcinoma)	1	-	-	-

Table 5: Diagnostic ability of white light endoscopy (WLE) and Narrow band imaging (NBI) with histopathology

	WLE ALONE	WLE+NBI	HISTOLOGY
BENIGN	14	06	05
MALIGNANT	36	44	45

Table 6: Statistical analysis between WLE and NBI

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	P-value
WLE	80	100	100	35.71	
NBI	95.5	80	97.72	66.66	0.003

DISCUSSION

The male predominance among the patients is due to the more prevalent habit of tobacco chewing and tobacco smoking among them. **Monika Aroquiadasse et al (2015) [6]** found that, among the 112 patients; 71% were males and 29% were females which is correlating to this study.

Prashant N. Keche et al (2014-2016) [7] found that lesions were common in males (70.2%) than females(29.8%) with M.F ratio of 2.3:1 which also correlated with this study.

The most common affected age group is in the 5th decade (between 41-50yrs) with 32% and the second most common is 6th decade (between 51-60yrs) with 26%.

Mohammad Shadab Alam et al (2011-2013) [5] found that maximum incidence of head and neck cancer was between 51-60 but in males it was almost equal both between 41-50 and 51-60 which correlated with this study.

Akilesh Krishna et al found most SCC in the age group 51-60 followed by 41- 50 which is also consistent with this study.

In this study, oral cavity was the most common affected region of 78% followed by oropharynx and then the larynx. Also, as any change in mucosa, ulcer or growth in the oral cavity is easily appreciated by the patient themselves it helps in early and prompt detection of the oral cavity lesions compared to pharyngeal or laryngeal lesions.

Kevin et al (2012) (8) found that, most commonly affected area was the oral cavity (202,000 cases) followed by oropharynx (100,500 cases), nasopharynx, hypopharynx and larynx in order.

As the tobacco is kept in the oral vestibular region for a longer duration, buccal mucosa followed by tongue proves the most commonly affected region. The soft palate and the tonsils are affected equally in the oropharyngeal region.

In the larynx, supraglottic contributes to the larger number of affected patients, with arytenoids and aryepiglottic fold to the largest number with 60% of cases.

Sandhya Kandath et al (2008) [3] found that buccal mucosa was the most affected site with 42.6% among oral squamous cell carcinoma patients as with this study.

In this study, lesions with Type 1 IPCL were the most common occupying 38.6% followed by Type II IPCL with 36.3%, Type III with 22.7% followed by Type IV with 2.2% of cases.

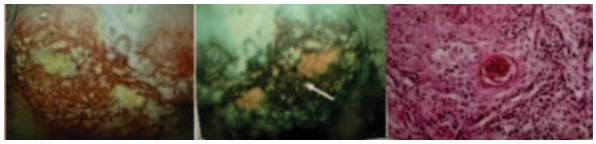

Fig. 1 Type I IPCL— showing significant brown dots with regularly distirbuted capillary loops

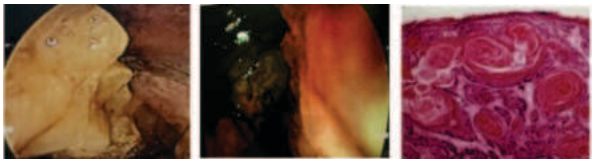

Fig. 2 Type II IPCL—showing dilated vessels

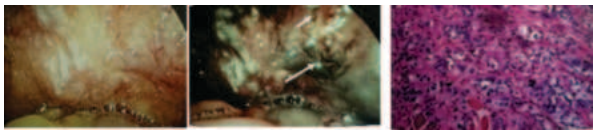

Fig. 3 Type III IPCL- showing elongated and branching vascular pattern

Fig. 4 Type IV-showing increased vascular proliferation and intraepithelial invasion

Shih Wei Yang et al (2009) in his study found that IPCL type II was the most common with 38 cases amounting to 62.8% followed by IPCL type II with 25 cases occupying 34.7% followed by type I and type IV.

The most common histopathological grading among the SCC of head and neck tumors was the well differentiated carcinoma (Grade l) with 52% of cases followed by moderately differentiated carcinoma (Grade II) with 20% of cases followed by hyperplastic/dysplastic and carcinoma in situ lesions.

Krishna et al (2012) [9] found that well differentiated squamous cell carcinoma of 39.9% was more common.

Ravi Mehrotra et al (2000) (10), in his study found that Grade II was the most prevalent type among the oral squamous cell carcinoma.

In this study most of the patients presented with ulcerative or proliferative growth. Though the patients presented with frank growth, the NBI IPCL types gave us an idea about the histopathological grading of the lesions which helped in further treatment. The IPCL types correlated with the histopathological results. Among the 17 cases of Type I IPCL, 13 cases were well differentiated squamous cell carcinoma, 3 cases were carcinoma in situ lesions, 1 case of dysplasia lesion and 1 case of verrucous carcinoma. Among the type II IPCL of 16 cases, 14 cases were well differentiated squamous cell carcinoma and 2 cases were moderately differentiated carcinoma. Among the 10 cases of Type II IPCL, 8 cases were moderately differentiated squamous cell carcinoma and 2 cases were poorly differentiated carcinoma. One case of Type IV IPCL type was a poorly differentiated squamous cell carcinoma. Thus, both the Type I and II IPCL correlated with well differentiated carcinoma, Type III correlated with moderately differentiated squamous carcinoma and Type IV type correlated with poorly differentiated cases, though few exceptions were present.

Shih Wei Yang et al (2009) [4] found that type IV type correlated with invasive carcinoma. Among the 25 cases of Type III IPCL, 14 cases (56%) were HGD/carcinoma in situ and among the 44 cases of Type I and II only 9 cases were of HGD/ carcinoma in situ lesion others were low or moderate dysplastic lesions.

In this study the sensitivity and specificity of White light endoscopy is found to be 80% and 100% respectively and of Narrow band imaging is found to be 95.5% and 80% respectively and PPV and NPV of white light is found to be 100% and 35.71% respectively and that of NBI is about 97.72% and 66.66% respectively and the P-value is 0.003..

In Vu en et al in 2014 study the sensitivity, specificity, PPV, NPV and accuracy for WLE ranged between 56-96%, 60-100%, 33-100%, 87-99% and 66-89% respectively, whereas it was 87-96%, 94-98%, 73-96%, 97-98% and 92-97% respectively for NBI. Thus they proved that NBI is much more efficacious than standard endoscopy.

CONCLUSION

The visualization of vascular loops, known as IPCL, using NBI provides results comparable to histopathology, which remains the gold standard but involves a waiting period for results. This makes NBI an effective optical tool for detecting lesions in both premalignant and malignant stages. In this study, although many patients presented with obvious tumor growth, the identification of vascular loops showed a strong positive correlation with histopathological findings. This allowed for better, faster treatment planning. In certain cases, such as leukoplakic lesions, NBI helped in clearly defining lesion margins against a vivid background, enabling wider local excision with negative margins, later confirmed by histopathology.

Regular use of NBI could help detect more premalignant lesions at earlier stages, allowing timely intervention and preventing disease progression, thereby reducing the risk of structural and functional deformities in patients.

It is important to emphasize that while NBI is a valuable tool, histopathology remains the gold standard for diagnosing and staging both malignant and premalignant lesions. NBI should be viewed as a complementary technique, not a replacement for histopathological examination.

Compliance With Ethical Standards:
Competing Interests: The author(s) declare none".
Financial Supports: This research received no specific grant from any funding agency, commercial or not-for-profit sectors.
Ethical Standards: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guidelines on human experimentation (please name) and with the Helsinki Declaration of 1975, as revised in 2008.
Informed consent is taken wherever necessary.

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