



COMPARING THE PREOPERATIVE VASCULARITY OF TONSILS BY NARROW BAND IMAGING WITH INTRAOPERATIVE BLEEDING RISK.

Haritha. S¹, *Shyam Sudhakar Sudarsan², Shravanthi Mantra Prithviraj³, Agasthiaram. S⁴

^{1,2,3,4} Department of Otorhinolaryngology, Head and Neck Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

*Correspondence Author

Dr. Shyam Sudhakar Sudharsan

Department of Otorhinolaryngology, Head and Neck Surgery, Saveetha Medical College and Hospital, Saveetha University, Chennai, Tamil Nadu, India

Email: drshyam.smch@gmail.com

Tel: +919941087697

Article History

Volume 6, Issue 10, 2024

Received: 16 May 2024

Accepted : 25 June 2024

Doi:

[10.48047/AFJBS.6.10.2024.7081-7091](https://doi.org/10.48047/AFJBS.6.10.2024.7081-7091)

ABSTRACT

Introduction

The palatine tonsils are lymphatic tissues located in the lateral oropharynx, with a rich blood supply from branches of the external carotid artery and venous drainage through the peritonsillar plexus. Narrow-band imaging (NBI) is a novel optical imaging technique using 415 nm and 540 nm wavelengths to enhance visualization of superficial and subepithelial vessels, respectively. This study aims to evaluate preoperative tonsillar vascularity using NBI and correlate it with intraoperative bleeding risk.

Aim

To assess the vascularity of the tonsil preoperatively using NBI and correlate it with the quantity of intraoperative bleeding.

Methodology

This prospective cohort study included 30 patients diagnosed with tonsillitis from January 30, 2022, to January 30, 2023, at a tertiary care center in South India. Inclusion criteria were patients aged 5-35 years with confirmed tonsillitis requiring surgical intervention. Patients underwent NBI under topical anesthesia and were graded according to the IPAB pattern classification. Intraoperative blood loss was assessed and correlated with preoperative NBI grades. Statistical analysis was performed using SPSS software.

Results

- Acute Tonsillitis:

- Pre-treatment: 70% of patients had a moderate IPCL pattern.
 - Post-treatment: Significant reduction in IPCL pattern ($p = 0.005$), with 60% showing improvement.
 - Chronic Tonsillitis:
 - 60% had minimal IPCL patterns.
 - Significant correlation between NBI grading and intraoperative bleeding ($p < 0.001$).
 - Intraoperative Blood Loss:
 - Higher NBI grades were associated with increased bleeding.

The duration of surgery was longer for acute tonsillitis (60-120 minutes) compared to chronic tonsillitis (30-60 minutes).

Discussion

NBI proved effective in assessing tonsillar vascularity and predicting intraoperative bleeding risk. Preoperative antibiotics reduced the NBI grade and subsequent bleeding in acute tonsillitis cases. The study supports the use of NBI in improving perioperative outcomes by minimizing blood loss during tonsillectomy.

Conclusion

NBI is a valuable tool for preoperative assessment of tonsillar vascularity, helping to predict and manage intraoperative bleeding risk. Its implementation can reduce morbidity and complications associated with tonsillectomy.

Keywords: Narrow-band imaging, tonsillitis, tonsillectomy, intraoperative bleeding, vascularity, IPCL pattern.

INTRODUCTION

The palatine tonsils, commonly referred to as tonsils, are clusters of lymphatic tissue situated in the lateral oropharynx. They are located in the isthmus of the fauces, bordered anteriorly by the palatoglossal arch and posteriorly by the palatopharyngeal arch. The blood supply of the palatine tonsils originates from several major vessels, primarily tributaries of the external carotid artery. These include the dorsal lingual artery, ascending palatine artery, tonsillar branch of the facial artery, ascending pharyngeal artery, and lesser palatine artery. Venous drainage is managed by the peritonsillar plexus of veins, which drain into the pharyngeal and lingual veins, ultimately emptying into the internal jugular vein.(1) Narrow-band imaging (NBI) is a brand-new optical imaging system that uses different wavelengths of light. It is a modified version of the White Light endoscopy. Two different wavelengths of light are used, 415 nm and 540 nm mean. The shorter wavelength, 415 nm, is the peak absorbed spectrum of hemoglobin at the superficial mucosa and is seen as a brownish color. However, the longer wavelength, 540 nm, penetrates deeper and visualizes subepithelial vessels located at the deeper portion of the mucosa and is seen in blue in the background(2). Conventional WLE is not ideal in resolution and contrast, which may lead to misdiagnosis of superficial mucosal cancer and precancerous lesions. Therefore, it is critical to find a new optical imaging technology to distinguish benign from malignant lesions(3).Initially,a Pilot study for 30 patients was carried out to assess the procedure's feasibility. NBI was mainly used for finding pre-malignant and malignant lesions but there is no documented evidence of use on benign conditions of tonsil like tonsillitis.

Aim of the study: To assess the vascularity of the tonsil preoperatively using NBI and correlate with the quantity of intraoperative bleeding.

METHODOLOGY

This is a Prospective cohort study of all the patients diagnosed with Tonsillitis during the period 30thJanuary 2022 to 30th January 2023 conducted in a tertiary care centre located in south India. The study cohort comprised [30] patients who met the criteria were included in the study.

INCLUSION CRITERIA:

1. Age between 5-35 years.
2. Clinical diagnosis: Confirmed cases of Tonsillitis (Acute, Subacute, Chronic) necessitating surgical intervention.
3. Participants providing informed consent to be part of the study.

4. Surgical procedure: Patients scheduled for tonsillectomy or tonsillectomy-related procedures.

EXCLUSION CRITERIA:

1. Age range: Individuals outside this defined range.
2. Coexisting conditions: patients with significant comorbidities affecting vascularity or bleeding tendencies.
3. Pregnancy
4. Previous Tonsillectomy
5. Bleeding disorders /Anticoagulant therapy.
6. Refusal to participants.
7. Emergency Cases: Excluding cases requiring immediate unplanned surgery.

Ethical consideration: The study was initiated after approval by the Institutional Ethical Committee.

RESEARCH DESIGN:

- Participants were selected as per the inclusion and Exclusion criteria.
- Informed written consent was obtained from the participants and detailed history was taken. ENT examination was performed.
- Patients who are diagnosed with Acute Tonsillitis were allowed to undergo NBI and will be graded according to IPAB pattern classification (based on IPCL pattern classification, which was introduced by Inoue et al in 2001)(4) and were treated symptomatically and was reviewed after 2 weeks to repeat NBI to assess the NBI Grading of tonsils and followed by were planned for surgery after 6 weeks.
- Patients who are diagnosed with chronic tonsillitis were also allowed to undergo NBI which was graded according to IPAB pattern classification planned for surgery.
- All Confirmed cases of Tonsillitis (Acute, Subacute, Chronic) necessitating surgical intervention were allowed to undergo Narrow Band Imaging at their first visit and patients were shifted to Minor OT to undergo NBI, Patient were allowed to undergo this procedure under topical anesthesia (10% lignocaine spray). Initially with WL endoscopy followed by NBI.
- Patients' IPAB pattern was compared with intraoperative bleeding status using a novel grading system using intraoperative blood loss in tonsillectomy (5).
- All patients were operated on by the same surgeon with the Dissection and snare method of tonsillectomy (Cold steel technique). And were followed up accordingly.

Table 1 Grading of intraoperative blood loss in tonsillectomy*

Grade	Number of Ray-tech® swabs used [†]	Volume of blood in suction canister (mL)	Rescue measures
Grade 1: minimal			
1a	<50% of 1 swab	0	None
1b	Up to 1	<5	None
Grade 2: mild	1-2	<50	None
Grade 3: moderate	2-5	<100	None
Grade 4: moderately severe	5-7	<200	None
Grade 5: severe	7 or more	>200	Intra- or postoperative blood transfusion, and/or ligation of the external carotid artery

*, based on the experimental observation that each 10 cm × 10 cm Ray-tech® swab absorbed approximately 10 mL of 10% povidone-iodine solution; [†], nearest whole number of saturated swabs. Approximated corresponding volumes of blood loss for each grade are as follows: grade 1a = 0-5 mL, grade 1b = 6-15 mL, grade 2 = 16-70 mL, grade 3 = 71-150 mL, grade 4 = 151-270 mL, grade 5 = >270 mL.

(5)

Commonest Classification Based on IPCL (Intrapapillary Capillary loop) for premalignant lesion we are predicting the intraoperative bleeding risk based on this classification - More dilated and higher calibre more is the anticipated bleeding.

We classify as IPCL Pattern analysis in (BENIGN) (IPAB)

Grade 1 – Normal.

Grade 2- Minimal IPCL Pattern which is similar calibre to vessels away from Tonsils.

Grade 3- Moderate IPCL Pattern More Dilated in comparison to vessel away from Tonsil.

Grade 4- Increased IPCL patterns throughout the Oropharyngeal area. (Dilated calibre Pattern)

RESULTS:

In this study, we have assessed and predicted preoperatively the intraoperative bleeding risk using NBI in conditions like chronic tonsillitis (a benign condition).

TABLE 1: NBI GRADING IN ACUTE TONSILLITIS.

	NBI GRADING IN ACUTE TONSILLITIS								FOLLOW UP NBI IN 2WEEKS							
	1		2		3		4		1		2		3		4	
NUMBER OF PATIENT	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
10	0	0	1	10	7	70	2	20	1	10	6	60	2	20	1	10

TABLE 2: NBI GRADING IN CHRONIC TONSILLITIS

Chronic Tonsillitis	NBI Grading in Chronic Tonsillitis							
	1		2		3		4	
	N	%	N	%	N	%	N	%
20	3	15	12	60	5	25	0	

TABLE 3: CASE DISTRIBUTION COMPARING INTRAOPERATIVE BLOOD LOSS USING INTRAOPERATIVE BLEEDING SCORE WITH RESPECT TO NBI GRADING IN PATIENTS WITH ACUTE TONSILLITIS.

NBI GRADING	INTRAOPERATIVE BLEEDING SCORE					
	1A	1B	2	3	4	5
1	0	1	0	0	0	0
2	0	0	5	1	0	0
3	0	0	0	2	0	0
4	0	0	0	0	1	0

TABLE 4: CASE DISTRIBUTION COMPARING INTRAOPERATIVE BLOOD LOSS USING INTRAOPERATIVE BLEEDING SCORE WITH RESPECT TO NBI GRADING IN PATIENTS WITH CHRONIC TONSILLITIS.

NBI GRADING	INTRAOPERATIVE BLEEDING SCORE					
	1A	1B	2	3	4	5
1	2	1	0	0	0	0
2	0	10	2	0	0	0
3	0	0	3	2	0	0
4	0	0	0	0	0	0

TABLE 5: DURATION OF SURGERY IN ACUTE TONSILLITIS

DURATION(MINUTES)	FREQUENCY	PERCENTAGE (%)
60-90	7	70
90-120	3	30

TABLE 6: DURATION OF SURGERY IN CHRONIC TONSILLITIS

DURATION(MINUTES)	FREQUENCY	PERCENTAGE (%)
30-40	5	25
40-50	8	40
50-60	7	35

TABLE 7: DISTRIBUTION OF PATIENTS FOR AGE.

	Acute tonsillitis (n=10) Mean ± SD	Chronic tonsillitis (n=20) Mean ± SD	p value
Age	14.2± 7.714	11.80± 5.54	0.335

TABLE 8: GENDER DISTRIBUTION

GENDER	ACUTE TONSILLITIS N (%)	CHRONIC TONSILLITIS N (%)
Male	4(40%)	12(60%)
Female	6(60%)	8(40%)

TABLE 9: COMPARISON OF NBI GRADING FROM PRETREATMENT TO POST-TREATMENT AFTER 2 WEEKS FOR ACUTE TONSILLITIS PATIENTS.

NBI	Median(IQR)	p-value
Pre NBI grading	3(3, 3.25)	0.005
Post NBI grading	2(2, 3)	

TABLE 10: COMPARISON OF BLEEDING WITH RESPECT TO NBI GRADING AMONG CHRONIC TONSILLITIS PATIENTS.

NBI Grade	Bleeding (mean±sd)	p value
Grade 1(n=3)	1.33± 2.31	<0.001
Grade 2(n=12)	9.25±13.59	
Grade 3(n=5)	20.25±26.48	

FIGURE 1: DISTRIBUTION OF AGE

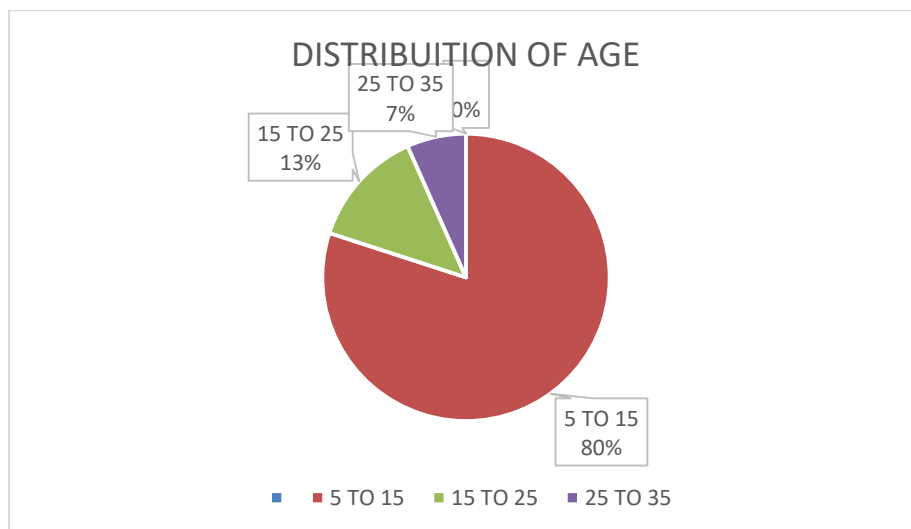


FIGURE 2: GENDER DISTRIBUTION

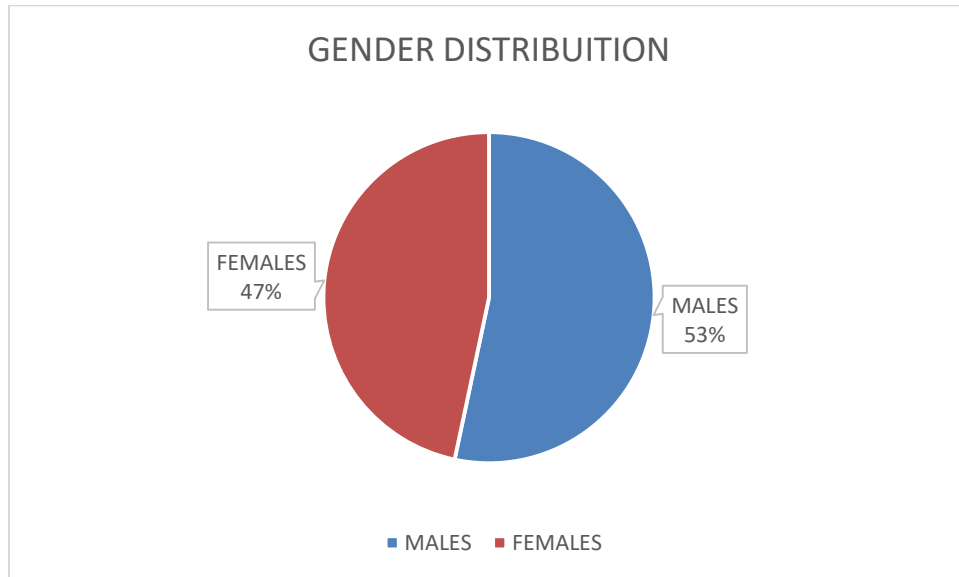


FIGURE 3: DISTRIBUTION OF PATIENTS IN ACUTE AND CHRONIC TONSILLITIS

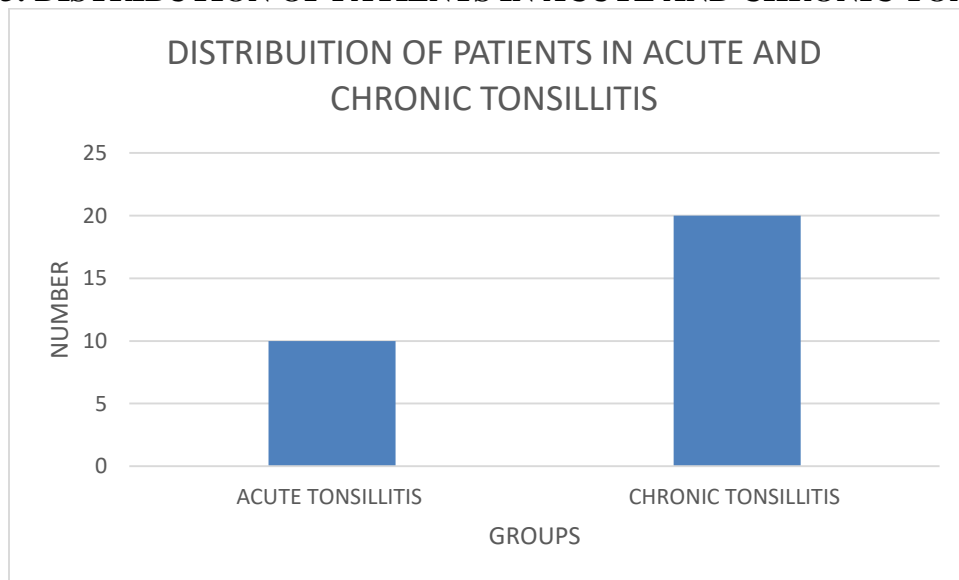


FIGURE 4: DURATION OF SURGERY IN ACUTE TONSILLITIS (MINUTES)

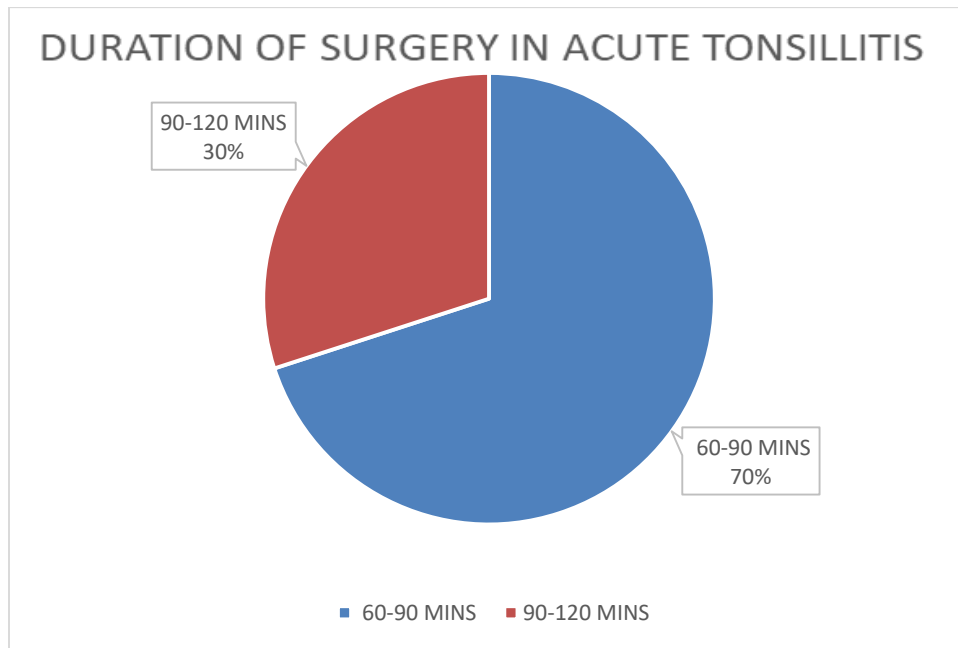
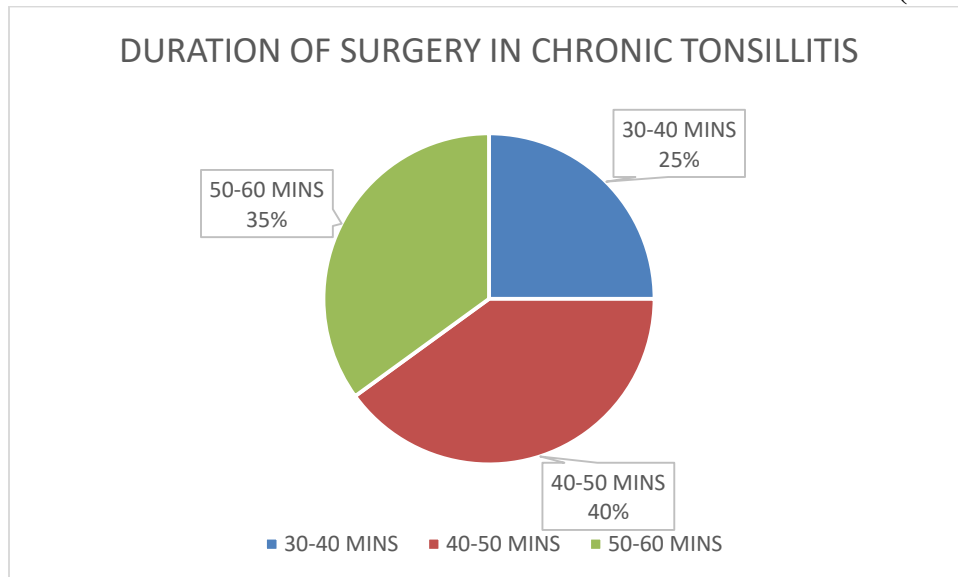


FIGURE 5: DURATION OF SURGERY IN CHRONIC TONSILLITIS (MINUTES)



Data analysis

The statistical analysis was carried out using SPSS software version 19. Frequencies and percentages were used to describe categorical variables. Mean and standard deviations/Median (Inter quartile range) were used to describe quantitative variables. To check the normality of the quantitative data, the Shapiro Wilk test was administered. For the normally distributed data, the independent test was used to compare between two groups, and the Whitney U test for not normally distributed data. Kruskal Wallis test was done for more than 2 groups. To compare pre and post-values Wilcoxon signed rank test was applied. For categorical variables, chi square test was used. The significance level was set at 5%.

DISCUSSION

In the last decade, the classic white light endoscopy has been complemented by endoscopy with NBI (Narrow Band Imaging), a system based on narrow band filters, with a light consisting of only two specific wavelengths absorbed by haemoglobin. The NBI allows to study the superficial capillary and vascular network of the mucous membrane and it is widely used for oncological diagnosis. But, as it is well known, neo angiogenesis and hypervascularization are a characteristic process of other physiological and non-physiological phenomena, such as acute and chronic inflammation (6).

New optical devices, such as narrow-band imaging (NBI), have enabled non-invasive visualization of microscopic morphological changes of the intraepithelial papillary capillary loop, including those suggestive of intraepithelial neoplasia or squamous cell carcinoma of the head and neck. Thus, using a flexible rhino laryngoscope with NBI, we can detect early cancers in the pharyngo-larynx that cannot be visualized upon macroscopic or white light examination (6).

Non-invasive visualization of microscopic morphological changes of the intraepithelial papillary capillary loop, including those suggestive of intraepithelial neoplasia or squamous cell carcinoma of the head and neck. (7) NBI could successfully detect unknown primary sites in the head and neck. For patients with metastatic cervical lymph nodes, identifying the primary site is essential for the appropriate treatment (7).

It has been widely used for Mucosal pathology in the aerodigestive tract (esophageal CA, Barrett's esophagus).

Laryngeal and hypopharyngeal lesions (microvascular patterns). NBI increases the sensitivity, specificity, PPV, and NPV in the diagnosis of vocal cysts, nodules, and sulcus vocalis. Therefore, NBI is a promising approach to identifying benign laryngeal lesions. (2)

It has been widely used for Early identification of lesion, targeted biopsy and for surveillance and follow up. (8) Intraoperative blood loss (IBL) in surgery is an important predictor of perioperative outcome (5). Where in this study it was used to assess intraoperative blood loss concerning NBI grading as NBI allows us to assess its vascularity by its grading and high grades were treated symptomatically. And followed up with NBI to assess its grading after treatment and allowed to undergo surgery.

NBI endoscopy uses narrow-bandwidth filters in a sequential red-green-blue illumination system and may detect superficial vascularization of the pharynx-laryngeal mucosal lesions. On the inflamed mucosa, adopting NBI endoscopy, it is possible to observe typical inflammatory

signs like dilation or proliferation of microvessels, and quantify, with the grading system, the severity of epithelial inflammation.(8)Similarly, it was followed in this study. Endoscopic examination with NBI associated with WLI showed good diagnostic performance (9).

A total of 30 patients with tonsillitis were recruited in this study, of which 10(33.3%) patients were diagnosed with Acute tonsillitis and 20 patients(66.6%) had Chronic tonsillitis(Figure 3).

In this study, among 30 patients, the Age group between 5-15 years was 80%, between 15-25 years was 13%, and between 25-35 years was 7% (Figure 1). These findings correlate according to Prasad et al., the older the patients, and greater the blood loss as one of the reasons for intraoperative blood loss during surgery.(10)

According to prasad et al., Bleeding was more in males compared to females reason could be attributed to males being usually heavier(10). Whereas in this study With respect to gender, Males (53%) and females (47%) (Figure 2), it was found that bleeding was more in males compared to females.

Cases of Acute Tonsillitis patients(70%)(Table 1),The Majority had a Moderate IPCL pattern initially, which was reduced to (30%) after 2 weeks following the treatment with oral antibiotics and symptomatic management. And followed up with surgery after 6 weeks. There was statistical significance in patients with acute tonsillitis with respect to NBI grading in pre-treatment and post-treatment with P-value of 0.005as the pattern reduced intraoperative bleeding also decreased. NBI picked up cases of acute tonsillitis missed in WL Endoscopy. Similarly in a study preoperative treatment with antibiotics significantly decreased bleeding (10).

In cases of chronic Tonsillitis (Table 2),the majority 60% had minimal IPCL pattern on NBI.Assessed intraoperatively blood loss respectively. There was statistical significance in the comparison of bleeding with respect to NBI grading among Chronic Tonsillitis patients with a p-value of <0.001.

Duration of surgery in Acute tonsillitis ranged from 60-120 minutes and among chronic tonsillitis patients it ranged from 30-60 minutes. (Table- 5,6). There was no statistical significance between both the groups because the NBI grading was reduced with medical treatment in Acute tonsillitis patient. There are various causes of intraoperative bleeding in tonsillitis apart from acute tonsillitis. This study requires further research as samples were limited.

This study would be concluded with evidence suggestive that as the NBI grades increased, proportionally intraoperative bleeding also increased and there was a statistical significance of <0.001.(Table- 9,10)This way we can reduce the intraoperative blood loss in patients. And prevent morbidity and complications associated with it.

This study has not been reported in any literature so far.NBI could be considered as one of the investigations of choice before tonsillectomy for an improved perioperative outcome.

CONCLUSION

NBI which is an emerging endoscopic imaging technique that is widely used nowadays for various purposes was the most important tool in our study to assess the vascularity of tonsils

preoperatively with respect to intraoperative blood loss was studied which helped us to prevent or reduce morbidity or complication related to tonsillectomy mainly hemorrhage during tonsillectomy.

REFERENCES

1. Meegalla N, Downs BW. Anatomy, Head and Neck, Palatine Tonsil (Faucial Tonsils) [Updated 2023 Jun 5]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.
2. Yılmaz, Y. Z., Uğurlar, M., Yılmaz, B. B., Gülmez, Z. D., Özdoğan, H. A., Ataş, A., & Batioğlu-Karaaltın, A. (2023). The Comparison of Narrow Band Imaging, White Light Laryngoscopy and Videolaryngostroboscopy in the Evaluation of Benign Vocal Fold Lesions. *Journal of voice : official journal of the Voice Foundation*, 37(2), 275–281. <https://doi.org/10.1016/j.jvoice.2020.12.030>
3. Huang, F., Yu, J., Zhang, F., He, C., Li, S., & Shao, J. (2017). The usefulness of narrow-band imaging for the diagnosis and treatment of vocal fold leukoplakia. *Acta otolaryngologica*, 137(9), 1002–1006. <https://doi.org/10.1080/00016489.2017.1324216>
4. Inoue, Haruhiro & Kaga, Makoto & Ikeda, Haruo & Sato, Chiaki & Sato, Hiroki & Minami, Hitomi & Santi, Esperanza & Hayee, Bu'hussain & Eleftheriadis, Nikolas. (2015). Magnification endoscopy in esophageal squamous cell carcinoma: A review of the intrapapillary capillary loop classification. *Annals of gastroenterology : quarterly publication of the Hellenic Society of Gastroenterology*. 28. 41-48.
5. Zhen, E., Misso, D., & Shaw, C. (2020). An evaluation of factors associated with intraoperative blood loss in tonsillectomy using a novel grading system. *Australian Journal Of Otolaryngology*,
6. Galli, J., Meucci, D., Salonna, G., Anzivino, R., Giorgio, V., Trozzi, M., Settini, S., Tropiano, M. L., Paludetti, G., & Bottero, S. (2020). Use OF NBI for the assessment of clinical signs of rhino-pharyngo-laryngeal reflux in pediatric age: Preliminary results. *International journal of pediatric otorhinolaryngology*, 128, 109733.
7. Ebisumoto, K., Okami, K., Sakai, A., Sugimoto, R., & Iida, M. (2016). Successful detection of a minute tonsillar cancer lesion on transoral examination with narrow band imaging: A report of 2 cases. *Head & neck*, 38(S1), E2421–E2424.
8. Galli, J., Settini, S., Salonna, G., Mele, D. A., De Corso, E., & Paludetti, G. (2020). Narrow Band Imaging for lingual tonsil hypertrophy and inflammation, in laryngo-pharyngeal reflux disease. *European archives of oto-rhino-laryngology : official journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS) : affiliated with the German Society for Oto-Rhino-Laryngology - Head and Neck Surgery*, 277(3), 819–825.
9. Chabrillac, E., Dupret-Bories, A., Vairel, B., Woisard, V., De Bonnecaze, G., & Vergez, S. (2021). Narrow-Band Imaging in oncologic otorhinolaryngology: State of the art. *European annals of otorhinolaryngology, head and neck diseases*, 138(6), 451–458. <https://doi.org/10.1016/j.anorl.2021.03.004>.
10. Prasad, K. C., & Prasad, S. C. (2011). Assessment of Operative Blood Loss and the Factors Affecting it in Tonsillectomy and Adenotonsillectomy. *Indian journal of otolaryngology and head and neck surgery: official publication of the Association of Otolaryngologists of India*, 63(4), 343–348. <https://doi.org/10.1007/s12070-011-0268-9>