

Profile of Flexible Fiberoptic Laryngoscopy Examination Before and During the COVID-19 Pandemic in the ORL-HNS Outpatient Unit of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia in 2018–2021

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ABSTRACT

Introduction: Flexible fiberoptic laryngoscopy (FOL) is indicated for various conditions in patients with abnormal upper airway anatomy. This study aimed to determine the profile of flexible FOL examinations at the Otorhinolaryngology-Head and Neck Surgery (ORL-HNS) outpatient unit of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from 2018 to 2021.

Methods: This retrospective study used secondary data from medical records of patients who underwent flexible FOL examinations at the ORL-HNS outpatient unit from 2018 to 2021. The inclusion criteria consisted of patients' medical records who had complete profiles, successful laryngoscopy, and diagnoses that met the specified variable criteria.

Results: A total of 723 patients underwent flexible FOL at the ORL-HNS outpatient clinic during the study period. Before and during the coronavirus disease (COVID-19) pandemic, most of these patients were males, between 20 and 59 years old, unemployed, and lived out of town. The most common procedure before and during the COVID-19 pandemic was FOL. Laryngomalacia was the common diagnosis before the COVID-19 pandemic. Malignancy in the larynx was the common diagnosis during the COVID-19 pandemic.

Conclusion: The variables age, sex, place of residence, occupation, and type of action remained consistent before and during the COVID-19 pandemic. However, the diagnosis variable had different results.

Highlights:

1. No differences were observed in any of the variables before and during the COVID-19 pandemic.
2. Only diagnosis variables differed between before and during the COVID-19 pandemic.

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Introduction

On 9 March 2020, the World Health Organization (WHO) officially declared coronavirus disease (COVID-19) a global pandemic.¹ The virus first entered Indonesia on 2 March 2020, and quickly became endemic in Jakarta, followed by West Java and Central Java.² By 9 April 2020, the pandemic had spread to all 34 provinces in the country.² From its entry into Indonesia until 12 June 2022, there had been approximately 6.06 million cases of COVID-19, resulting in 157,000 deaths and 5.9 million recoveries.^{1,3} The virus was primarily spread through respiratory droplets when an infected person coughs, sneezes, talks, or touches contaminated surfaces.^{1,3}

The COVID-19 pandemic has resulted in the loss of numerous lives, including medical and health workers.^{4,5} The first physician to succumb to the virus on 25 January 25 in Wuhan, China was an ear, nose, and throat (ENT) specialist. Health workers responsible for aerodigestive tract diseases (including ENT-head and neck/HN doctors) and ophthalmologists are particularly vulnerable due to the potential transmission through droplets. Procedures performed at the Otorhinolaryngology-Head and Neck Surgery (ORL-HNS) outpatient unit, including both preparation, diagnostics, and disease management, are likely to involve an aerosol-generating procedure (AGP), which can trigger the release of droplets. During emergencies, various methods may need to be reconsidered or avoided altogether because they can be potentially life-threatening to the patient. These procedures include flexible nasolaryngoscopy, endotracheal intubation, non-invasive ventilation, transnasal endoscopic surgery, and the use of high-speed handpieces or ultrasonic instruments.⁶

Examinations at the ORL-HNS outpatient unit during the COVID-19 pandemic prioritized patients who required immediate treatment, those over 60 years of age and/or with comorbidities, patients undergoing regular therapy according to standard operating procedures, and those with multiple diagnoses. Subjective evaluations were excluded unless marked as such. Diagnoses that require immediate attention include abscesses in the ORL-HNS field, upper airway obstruction, maxillofacial and nasal fractures, epistaxis, sudden deafness, laryngeal trauma, foreign bodies in the ENT, vertigo, acute otitis media, otitis externa, sinusitis with orbital abscess, chronic suppurative otitis media with suspected laryngitis, meningitis, and progressively growing malignancies.⁷

Laryngoscopy is a medical procedure used to visualize the larynx, including the vocal cords and surrounding structures. There are two types of laryngoscopy: direct and indirect. Direct laryngoscopy can be further divided into rigid laryngoscopy, which involves inserting a rigid laryngoscope directly into the mouth and down to the larynx, and flexible laryngoscopy, which involves inserting a flexible fiberoptic cable through the nose and into the throat.⁸ Flexible fiberoptic laryngoscopy (FOL) is indicated for various conditions, including dysphagia, vocal polyps, vocal nodules, laryngeal granuloma, spasmodic dysphonia,

laryngeal cancer, laryngeal neoplasm, malignancy in the larynx, and acute and chronic infections.⁹

During the COVID-19 pandemic, individuals may feel unsafe visiting hospitals due to the risk of contracting the virus. A survey conducted by Soenarso (2020) revealed that before the pandemic, 31.8% of respondents visited hospitals at least once a year.¹⁰ During the pandemic, 71.8% of individuals avoided hospital or clinic visits, with 65.5% opting for telemedicine and 64.5% preferring to recuperate at home with rest and a healthy diet.¹⁰ To date, no publications have reported on the patient profiles of those who underwent flexible FOL during the COVID-19 pandemic at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Therefore, this study aimed to gather patient profile data, specifically from before and during the COVID-19 pandemic, at the ORL-HNS outpatient unit of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from 2018 to 2021. The necessary profile data include age, gender, education, occupation, address, complaints, diagnosis, and comorbidities. This study can help evaluate services for patients and improve the quality and accuracy of flexible FOL examinations.

Methods

This was a descriptive, original study employing a retrospective method with a total sampling technique. Descriptive research is a type of research that aims to describe people, events, or conditions as they are, without modifying variables.¹¹ Researchers describe samples and/or variables without altering them.¹¹ In retrospective studies, the outcome of interest has already occurred in each individual at the time of enrollment.¹² Data are obtained either from records or by asking participants to recall exposures.¹²

Data collection was conducted using the medical records of patients who underwent flexible FOL examinations at the ORL-HNS outpatient unit of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from 2018 to 2021. The inclusion criteria in this study were patients who successfully performed laryngoscopy and had complete medical record data. On the other hand, the exclusion criteria were patients with unavailable examination records. This study received ethical clearance from the Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia (No. 1306/LOE/301.4.2/V/2023).

The results are presented in a frequency distribution table, categorizing age, gender, occupation, domicile, and education. Additionally, this study also reported data regarding the type of action in the form of FOL and fiberoptic endoscopic evaluation of swallowing (FEES), as well as diagnoses such as dysphagia, vocal polyps, vocal nodules, laryngeal granuloma, dysphonia, laryngomalacia, laryngopharyngeal reflux (LPR), laryngeal papilloma, laryngeal cyst, malignancy in the larynx, laryngeal tumor, laryngeal paresis, as well as acute and chronic infections.

This study utilized data collected from September 2018 to December 2021. Data from January to August was not included due to difficulty in obtaining it. However, the

available data from September 2018 to December 2021 were deemed sufficient and did not impact the results of the study. It was not possible to obtain information on the education category from the medical records of the laryngopharyngeal and bronchoendoscopy divisions of the ORL-HNS outpatient unit and the Information Technology and Medical Records (ITKI) of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

Results

From September 2018 to December 2021, 1,493 patients underwent flexural fiber examination at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Of these, 770 patients were excluded due to incomplete data profiles or failure to meet the established diagnosis criteria. The remaining 723 patients had complete data and met the requirements, making them suitable research samples.

Patients' Profile Distribution

In 2018-2019, most flexural fiber examinations were performed on patients aged 20-59 years old (215 patients, 46.74%), followed by those aged ≥60 years old (102 patients, 22.17%), 0-2 years old (82 patients, 17.83%), 6-10 years old (30 patients, 6.52%), 3-5 years old (17 patients, 3.70%), and 11-19 years old (14 patients, 3.04%). In 2020-2021, the age group with the highest number of patients who underwent flexural fiber examination was 20-59 years old (122 patients, 46.39%), followed by those aged ≥60 years old (73 patients, 27.76%), 0-2 years old (36 patients, 13.69%), 6-10 years old (12 patients, 4.56%), 11-19 years old (12 patients, 4.56%), and 3-5 years old (8 patients, 3.04%).

In 2018-2019, 273 male patients (59.35%) and 187 female patients (40.65%) underwent fiber bending examinations. In 2020-2021, 168 male patients (63.88%) and 95 female patients (36.12%) were examined. In 2018-2019, 304 (66.99%) patients who underwent fiber bending examinations were from out of town, while 156 (33.91%) were from in-town areas. Similarly, in 2020-2021, 163 (61.98%) patients who underwent the most flexible fiber examination were from out of town, and 100 (38.02%) were from in-town areas.

In 2018-2019, the majority of patients who underwent flexural fiber examination were unemployed (40.00%), followed by private employees (20.22%), individuals with

unspecified occupations (10.00%), students (7.83%), farmers (7.17%), and self-employed individuals (6.00%).

Table 1. Distribution of patients undergoing flexural fiber examination profile at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from September 2018 to December 2021

	2018-2019	Percentage (%)	2020-2021	Percentage (%)
Age (Years Old)				
0-2	82	17.83	36	13.69
3-5	17	3.70	8	3.04
6-10	30	6.62	12	4.56
11-19	14	3.04	12	4.56
20-59	215	46.74	122	46.38
≥60	102	22.1	73	27.76
Total	460	100	263	100
Gender				
Male	273	59.35	168	63.88
Female	187	40.65	95	36.12
Total	460	100	263	100
Domicile				
In town	156	33.91	100	38.02
Out of town	304	66.09	163	61.98
Total	460	100	263	100
Occupation				
Students	36	7.83	23	8.75
Lectures	2	0.43	0	0.00
Teachers	9	1.96	4	1.52
Traders	6	1.30	3	1.14
Civil servants	21	4.57	8	3.04
Private employees	93	20.22	62	23.57
Farmers	33	7.17	25	9.51
Tourists	29	6.30	20	7.60
Police	1	0.22	0	0.00
Others	46	10.00	21	7.98
Unemployed	184	40.00	97	36.88
Total	460	100	263	100

Source: Research data, processed

Among the employed patients, the highest number of cases were from civil servants, accounting for 4.57% of the total patients, followed by teachers (1.96%), traders (1.30%), lecturers (0.43%), and police (0.22%), with only one patient. In the study, the majority of patients who underwent flexural fiber examination between 2019 and 2020 were unemployed, accounting for 62.61% of the total patients. Similarly, in 2020-2021, the majority of patients who underwent flexural fiber examination were also unemployed, accounting for 36.88% of the total patients. Sixty-two (23.57%) patients were private employees, 25 (9.51%) were farmers, 23 (8.75%) were students, 21 (7.98%) were classified as 'others', 20 (7.60%) were self-employed, 8 (3.04%) were civil servants, 4 (1.52%) were teachers, 3 (1.14%) were traders, and 0 (0.00%) were either lecturers or police.

Table 2. Distribution of type of flexural fiber examination at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from September 2018 to December 2021

Type of Action	2018-2019	Percentage (%)	2020-2021	Percentage (%)
FOL	392	85.22	237	90.11
FEES	68	14.78	26	9.89
Total	460	100	263	100

FOL: fiberoptic laryngoscopy; FEES: fiberoptic endoscopic evaluation of swallowing

Source: Research data, processed

In 2018-2019, 392 patients (85.22%) underwent the most flexural fiber examination with FOL, whilst 68 patients (14.78%) underwent FEES. In 2020-2021, 237 patients (90.11%) underwent the flexible fiber examination with FOL, while 26 patients (9.89%) underwent FEES.

Diagnoses of Patients Undergoing Flexural Fiber Examination Distribution

In 2018-2019, flexural fiber examination was primarily performed on patients diagnosed with laryngomalacia (82 patients, 17.83%), followed by dysphagia (69 patients, 15.00%), dysphonia (64 patients, 13.91%), laryngeal papilloma (60 patients, 13.04%), and laryngeal malignancy (51 patients, 11%). Out of 460 patients, the most common diagnoses were gastroesophageal reflux disease (GERD) in 98 (21.30%) patients, followed by Reinke's edema in 47 (10.22%) patients, sulcus vocalis in 38 (8.26%) patients, and laryngeal tumors in 34 (7.39%) patients.

Table 3. Distribution of diagnoses of patients undergoing flexural fiber examination at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from September 2018 to December 2021

Diagnosis	2018-2019	Percentage (%)	2020-2021	Percentage (%)
Dysphagia	69	15.00	27	10.27
Vocal polyps	0	0.00	0	0.00
Vocal nodules	32	6.69	11	4.18
Laryngeal granuloma	4	0.87	0	0.00
Dysphonia	64	13.91	40	15.21
Laryngeal papilloma	60	13.04	35	13.31
Laryngeal cyst	1	0.22	6	2.28
Acute infection	5	1.09	2	0.76
Chronic infection	10	2.17	10	3.80
Laryngeal neoplasm	51	11.09	54	20.53
Laryngeal tumor	34	7.39	20	7.60
Laryngopharyngeal reflux	31	6.74	15	5.70
Laryngomalacia	82	17.83	40	15.21
Laryngeal paresis	17	3.70	3	1.14
Total	460	100	263	100

Source: Research data, processed

Vocal nodules were diagnosed in 32 (6.96%) patients, while 31 (6.74%) patients were diagnosed with LPR. Laryngeal paresis was diagnosed in 17 (3.70%) patients, chronic infections in 10 (2.17%) patients, acute infections in 5 (1.09%) patients, laryngeal granuloma in 4 (0.87%) patients, and laryngeal cysts in 1 (0.21%) patient. No patients were diagnosed with vocal polyps. In 2020-2021,

flexural fiber examination revealed that 54 patients (20.53%) had a diagnosis of malignancy in the larynx, followed by 40 patients (15.21%) with laryngomalacia, 40 patients (15.21%) with dysphonia, and a further 27 patients (10.27%) with dysphagia. Additionally, 13.31% of patients were diagnosed with laryngeal papilloma. The study found that the most common diagnoses among patients were GERD in 35 (13.31%) patients, followed by Reinke's edema in 30 (11.42%) patients, and laryngeal tumors in 20 (7.60%) patients. Vocal nodules were diagnosed in 11 (4.18%) patients, chronic infection in 10 (3.80%) patients, laryngeal cyst in 6 (2.28%) patients, and laryngeal paresis in 3 (1.14%) patients. Acute infection was diagnosed in 2 (0.76%) patients, while laryngeal granuloma and vocal polyps were not diagnosed in any patients.

Discussion

The study conducted in 2018-2019 found that the majority of patients who underwent flexural fiber examination were aged between 20 and 59 years old, with 215 (46.74%) patients, followed by those aged 60 years old or older, with 102 (22.17%) patients. Similarly, in 2020-2021, the majority of patients who underwent flexural fiber examination were aged between 20 and 59 years old, with 122 (46.39%) patients, followed by those aged 60 years old or older, with 73 (27.76%) patients. Kamal, *et al.* (2022) found that the most significant proportion of flexible fibreoptic nasopharyngolaryngoscopic patients were aged between 21 and 30 years old, accounting for 26 (30.5%) out of 85 adults.¹³ This was followed by the 36-45 years old age group, comprising 32 (23%) individuals.¹³ Omokanye, *et al.* (2021) examined 360 patients who underwent flexible FOL and found that the largest age groups were 35-44 years old and 45-54 years old, with 87 people (24.2%) in each group.¹⁴

The age group was divided into five categories: infants and toddlers (0-5 years old), children (6-10 years old), adolescents (11-19 years old), adults (20-59 years old), and the elderly (≥ 60 years old).¹⁵ The highest age group in 2018-2019, 20-59 years old, had the same results as in 2020-2021, but the number of cases decreased in the latter period. Laryngomalacia was the most common diagnosis in 2018-2019, followed by dysphagia and dysphonia. The most frequently identified endoscopic cause of noisy breathing in infants is laryngomalacia. When a newborn presents with loud breathing, awake flexible endoscopy is a valuable diagnostic tool for locating upper airway obstruction.¹⁶

The age groups with the highest diagnosis of dysphagia and dysphonia were 20-59 years old and over 60 years old. In 2020-2021, the highest incidence of laryngeal malignancy was observed in individuals aged 20-59 years old and those over 60 years old. Additionally, there was a decrease in patient visits during this period due to the pandemic. This decrease in visits was particularly pronounced among vulnerable populations such as pediatric and elderly patients, who may be at higher risk of contracting COVID-19. Parents expressed concerns about bringing their children to the hospital during the COVID-19

pandemic, resulting in fewer patients in the 0-2 years old and 3-5 years old age groups. Despite a decrease in numbers, the age group of 20-59 years old still had the highest number of patients, mainly due to the prevalence of larynx malignancies in patients over 60 years old and those aged 20-59 years old. It is essential to note that this information pertains specifically to the COVID-19 pandemic period. The study found that male patients were the most prevalent gender undergoing flexural fiber examination. In 2018-2019, 273 (59.35%) patients were males, and in 2020-2021, 168 (63.88%) patients were males. In a study conducted by Monintja, *et al.* (2019) at Prof. Dr. Roembajan Deil Kandou General Hospital, Manado, for the period 2014-2017, similar results were obtained.¹⁷ The majority of participants were males, accounting for nine patients (60%), while females accounted for only six patients (40%).¹⁷

Irace, *et al.* (2019) conducted a study on infants with laryngomalacia in 2015, which found that the condition was more prevalent in male babies (64.8%) than female babies (35.2%).¹⁸ This is in line with the most common diagnosis in 2018-2019, which was laryngomalacia. In 2020-2021, however, the most common diagnosis was malignancy of the larynx. The predominant gender of patients with malignant tumors of the larynx was male. With the two most common diagnoses, it is notable that males are more commonly affected in flexible FOL. In 2018-2019, 304 patients (66.99%) who underwent flexural fiber testing were from out of town. This was followed by 163 patients (61.98%) in the 2020-2021 period. Despite a decrease in the number of out-of-town patients during the COVID-19 pandemic, they still constituted the largest category. This may be due to Dr. Soetomo General Academic Hospital, Surabaya, being a referral hospital, which results in a higher number of out-of-town patients compared to in-town patients. The decrease in in-town patients during 2020-2021 might be attributed to the COVID-19 pandemic, as patients became more apprehensive about seeking medical care in hospitals. The COVID-19 pandemic has resulted in a 16% decrease in hospital admissions in the United States (US).¹⁹ Hospitals have intentionally limited in-hospital activities and non-medical services.¹⁹ Additionally, the government has implemented a lockdown policy to reduce social activities and prevent the spread of COVID-19.²⁰

The study conducted in 2018-2019 found that 40.00% of patients who underwent flexural fiber examination were unemployed, with 184 patients, followed by 20.22% of private employees with 93 patients. Similarly, in 2020-2021, the majority of patients who underwent flexural fiber examination were unemployed, with 36.88% (97 patients), followed by 23.57% (62 patients) who were private employees. The non-working category can include infants, children, housewives, pensioners, and individuals who are not employed. According to Adamu, *et al.* (2022), out of 90 patients with laryngeal disorders, 73.3% did not work as teachers.²¹ Other professions that require the use of the voice, such as singers, news anchors, and journalists, are likely to fall into the category of private workers.²²

Laryngitis presents with symptoms such as dysphonia and dysphagia. Viral, bacterial, or fungal infections, excessive inflammation, excessive coughing, smoking, alcohol consumption, and allergies can all contribute to it. These causes are often related to various activities, such as excessive vocal use, frequent exposure to dust, chemicals, smoke, and other pollutants.²³

The study conducted between 2018 and 2019 found that 392 (85.22%) patients underwent the most flexible fiber examination with FOL. In 2020-2021, this number increased to 237 (90.11%) patients. Flexible laryngoscopy can help diagnose conditions of the larynx, such as laryngomalacia, as well as rule out other differential diagnoses, including laryngeal cysts, neoplasms, subglottic hemangiomas, paradoxical vocal cord movements, stenosis and web glottis, vocal cord paralysis, and vascular malformations.²⁴ Therefore, flexible laryngoscopy remains the most widely performed procedure, both before and during the COVID-19 pandemic. The study conducted in 2018-2019 found that flexural fiber examination was primarily performed on patients diagnosed with laryngomalacia (82 patients, 17.83%), followed by those with dysphagia (69 patients, 15.00%) and dysphonia (64 patients, 13.91%). However, in 2020-2021, it was discovered that the most flexible fiber examination was performed on patients diagnosed with malignancy in the larynx (54 patients, 20.53%), followed by patients with laryngomalacia (40 patients, 15.21%) and dysphonia (40 patients, 15.21%). In a study conducted by Monintja, *et al.* (2019) at Prof. Dr. Roembajan Deil Kandou General Hospital, Manado, for the period 2014-2017, it was found that the most common FOLs were performed on patients with a primary diagnosis of dysphonia (60%), followed by laryngeal cancer (20%).¹⁷

Congenital laryngomalacia is the most common cause of stridor in infants (65-75%). Typically, it presents in newborns or within the first few weeks of life. According to Tesmer, *et al.* (2020), the diagnosis of laryngomalacia is primarily made through flexible laryngoscopy, which is highly recommended even for neonates.²⁵ It is not uncommon for some children to experience persistent obstruction after surgery. According to Bakhtiar, *et al.* (2022), bedside FOL can differentiate between laryngeal edema and persistent laryngomalacia.²⁶ In 2022, Neighbors, *et al.* stated that dysphonia can be caused by various factors such as obstruction, laryngeal muscle paralysis, inflammation, tumors, and laryngeal abnormalities, including cicatrix due to surgery and fixation in the cricoarytenoid joint.²⁷ A study conducted by Zang, *et al.* in 2021 concluded that the FEES procedure is highly feasible in children, and 69 (53.9%) patients were diagnosed with dysphagia.²⁸ The study results differ because this study considered variables of patients with FOL and FEES, unlike the previous study, which only considered one variable. Additionally, the previous study focused on the children's age group, whereas this study did not solely rely on this variable.²⁸

The study results indicate that the second most common diagnoses in 2018-2019 and 2020-2021 were laryngomalacia and laryngeal malignancy, respectively. It

can be inferred that the incidence of laryngomalacia in patients aged 0-2 years old decreased during the COVID-19 pandemic, while the incidence of malignancy in the larynx increased. This may be due to parents' concerns about taking their children to the hospital during the pandemic. However, patients with laryngeal malignancies that require urgent treatment still accounted for the second highest number of cases of laryngomalacia. This is in contrast to the findings of the study by Monintja, *et al.* in 2019 at Prof. Dr. Roembajan Deil Kandou Hospital, which identified dysphonia as the most common diagnosis for the period 2014-2017.¹⁷ In this study, dysphonia ranked third in 2018-2019, while laryngomalacia and laryngeal malignancies were tied for second place in 2020-2021. Dysphonia can be an early symptom of various conditions, including suspected laryngeal malignancy and laryngeal paresis. The number of cases of larynx malignancy has remained stable, with 51 patients reported before and during the COVID-19 pandemic. Immediate treatment is necessary for patients with this diagnosis to prevent the pandemic from affecting them.¹⁷

Strengths and Limitations

This study is beneficial because it collected research data between 2018 and 2021, allowing for an examination of the variables that explain the differences in patient conditions undergoing flexible FOL examinations before and after the COVID-19 pandemic. The exclusion of data from January to August 2018 in the analysis was a limitation because it was discrete and difficult to locate.

Conclusion

The majority of patients who underwent flexible FOL at Dr. Soetomo General Academic Hospital, Surabaya, before and during COVID-19 were male adults. More FOL procedures than FEES procedures were performed, with laryngomalacia and laryngeal cancer being the most common diagnoses.

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Conflict of Interest

The authors declared there is no conflict of interest.

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Ethical Clearance

This study had received ethical clearance from the Ethics Committee of Dr. Soetomo General Academic

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Authors' Contributions

Designed the study and drafted the manuscript: ANS and RFP. Collected data and performed background literature review: ANS. Performed statistical analysis: ANS. Supervised results and discussion: ANS, RFP, AA, and NP. All authors reviewed and approved the final version of the manuscript.

Data Availability

N/A.

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