

## HISTOPATHOLOGICAL SPECTRUM OF INFLAMMATORY AND NEOPLASTIC COLORECTAL LESIONS: A CROSS-SECTIONAL STUDY OF COLONOSCOPIC BIOPSIES

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### ABSTRACT

**Background:** Colorectal diseases include a wide range of non-neoplastic as well as neoplastic conditions. These pathologies are known to significantly impact global health. Colonoscopy-guided biopsies followed by histopathological examination remains the cornerstone for early and accurate diagnosis of these conditions. This is important in differentiating inflammatory lesions from premalignant and malignant neoplasms. **Materials and Methods:** This hospital-based cross-sectional study was conducted over 6 months in the Departments of Pathology at a tertiary care center. A total of 80 colonoscopic biopsies from patients presenting with lower gastrointestinal symptoms were analyzed. Biopsies were processed for routine H&E staining with special stains and immunohistochemistry when indicated. Lesions were classified as non-neoplastic, benign neoplastic or malignant neoplastic. Data was stratified by age, sex, lesion type and anatomical site. Statistical analysis was performed using SPSS version 23.0. For statistical purposes p-value less than 0.05 was considered significant. **Result:** Of the 80 cases, 48 (60%) were male and 32 (40%) females, with a mean age of 56.2 years in males and 51.7 years in females. The most affected age group was 61–80 years. The rectum and sigmoid colon were the most common anatomical sites. Inflammatory lesions accounted for 32 cases (40%), predominantly chronic non-specific colitis (18.75%), ulcerative colitis (15.63%), and SRUS (6.25%). Benign neoplastic lesions were found in 17 cases (21.25%), mostly tubular and tubulovillous adenomas. Malignant neoplasms comprised 31 cases (38.75%), with conventional adenocarcinoma being the most frequent. Malignant lesions were most common in the 61–80 age group. Malignant lesions were more frequent with increasing age (p=0.012). **Conclusion:** This study showed a near-equal burden of inflammatory and malignant colorectal lesions in studied cases. Histopathology played a significant role in the diagnosis as well as risk stratification of cases presenting with colorectal pathologies. The predominance of malignant lesions in elderly individuals underlines the need for surveillance protocols in these cases.

## INTRODUCTION

Colorectal diseases are significant global health problems and consist of a wide spectrum of lesions that may range from benign inflammatory conditions to malignant neoplasms. Colorectal cancer (CRC) ranks among the common causes of cancer-related morbidity and mortality worldwide. They are also the third most commonly diagnosed cancers and the second leading cause of cancer-related mortality

worldwide. This prevalence is projected to increase substantially over coming decades due to aging populations and the adoption of Westernized lifestyles, particularly in developing countries including India. Alongside malignant lesions a considerable proportion of the population also suffers from chronic non-neoplastic diseases such as inflammatory bowel diseases (Ulcerative colitis (UC) and Crohn's disease (CD)) which not only contribute significantly to morbidity but also carry a recognized

risk of malignant transformation. Early and accurate diagnosis of these conditions is important as it plays an important role in guiding treatment, preventing complications, and improving overall outcomes.<sup>[1]</sup>

In routine clinical practice, the lower gastrointestinal tract is frequently subjected to diagnostic evaluation for symptoms such as bleeding per rectum, altered bowel habits, chronic diarrhoea, weight loss or recurrent abdominal pain. Colonoscopy, with the ability to directly visualize mucosal abnormalities and obtain targeted biopsies has become the gold standard in the assessment of these cases. Histopathological examination of these biopsies provide diagnosis as well as helps in classification of lesions into non-neoplastic, benign neoplastic and malignant categories. Inflammatory lesions such as CD and tuberculosis often demonstrate overlapping clinical and endoscopic features hence histological confirmation remains indispensable. Similarly, non neoplastic polyps such as hyperplastic polyps and juvenile polyps must be distinguished from adenomatous polyps due to differences in their future malignant potential.<sup>[2]</sup>

Neoplastic colorectal lesions (benign as well as malignant) constitute a major area of concern in gastrointestinal pathology. Adenomatous polyps especially those exhibiting villous architecture or high-grade dysplasia are considered precancerous and warrant close surveillance or excision. Malignant lesions account for the vast majority of colonic lesions. These are categorized into conventional adenocarcinomas, mucinous carcinomas, signet ring cell carcinomas, lymphomas and neuroendocrine tumors. Each of these histologic variant carries distinct prognostic and therapeutic implications. Therefore, there is critical role of histopathological characterization in patient management. The incidence of these lesions varies with age, gender and anatomical site with studies consistently reporting a higher prevalence in males and increased frequency with advancing age particularly beyond the fifth decade.<sup>[3]</sup>

Previous studies have reported that non-neoplastic lesions such as non-specific colitis and ulcerative colitis are common findings in cases undergoing colorectal biopsies. These conditions are particularly important due to their potential to mimic or mask early neoplastic changes. For example, ulcerative colitis is a well-established risk factor for CRC with risk increasing in relation to disease duration, extent and presence of dysplasia. Surveillance colonoscopy with targeted biopsies therefore becomes a cornerstone in the management of long-standing UC. These biopsies allow early detection of dysplasia or carcinoma. Similarly, tuberculosis and other infectious colitis may clinically mimic inflammatory bowel disease thereby necessitating histological as well as microbiological evaluation.<sup>[4]</sup>

Furthermore, population-based studies have also underscored the importance of analyzing distribution of lesions on the basis of site and demographic profiles of colorectal lesions to decide screening and

diagnostic approaches effectively. Additionally, benign neoplastic polyps such as tubular and villous adenomas often display a predilection for the left colon, similar to malignant neoplasms which show a wider distribution with a similar left-sided predominance in many populations.<sup>[5]</sup>

This is a cross-sectional histopathological analysis of inflammatory as well as neoplastic colorectal lesions identified through colonoscopic biopsies. By encompassing a wide age range and analysing data based on lesion type, age, sex and site of lesion this study aims to provide a comprehensive overview of the disease spectrum.

## MATERIALS AND METHODS

This was a hospital-based cross-sectional study conducted over a period of six months in the Department of Pathology of NRI Institute of Medical Sciences, Visakhapatnam. The study population included all patients above 18 years undergoing colonoscopy for lower gastrointestinal symptoms such as rectal bleeding, altered bowel habits, unexplained weight loss, chronic diarrhoea and/or abdominal pain. Colonoscopic biopsies from the colon and rectum were included in the analysis. The sample size was determined based on findings from prior pilot studies conducted on similar colorectal biopsy-based research topics, which provided an estimated prevalence around 50%. Using this preliminary evidence to guide variability and precision requirements, the final calculated sample size for the present study was approximately 67 participants. However, all consecutive patients meeting inclusion criteria during the study period were included to maximize statistical power. A total of 80 colonoscopic biopsies were evaluated.

Colonic biopsies were obtained during colonoscopy using standard forceps and placed in 10% neutral buffered formalin. Each specimen was processed as per standard protocol. Sections of 4–5 µm were stained with haematoxylin and eosin (H&E). Special stains such as Periodic Acid-Schiff (PAS) and Ziehl-Neelsen (ZN) were employed when indicated particularly in cases suspected to be of infectious etiology. Immunohistochemistry (IHC) was performed for confirmation of diagnosis in selected cases. IHC panel consisted of Pan CK (for epithelial tumors), CD3, CD20 (for lymphomas) and chromogranin/synaptophysin (for neuroendocrine tumors). Evaluation and analysis of histopathological specimens was done by two independent pathologists to reduce inter-observer variability. Lesions were categorized into non-neoplastic (e.g. SRUS, tuberculosis, IBD), benign neoplastic (e.g., adenomatous polyps), and malignant neoplastic lesions (e.g., adenocarcinomas, lymphomas) based on WHO classification criteria.

Demographic data, clinical presentation, colonoscopic findings and histopathological diagnoses were recorded and compiled. Anatomical

site of lesion involvement was noted (caecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum) based on colonoscopy documentation. Lesions were also stratified by age and sex. Cases of inflammatory bowel disease were further subclassified into ulcerative colitis or Crohn's disease based on established histological criteria including distribution, crypt distortion, mucosal ulceration and presence of granulomas. Presence of dysplasia, when noted in inflammatory lesions or adenomas were documented and graded as low-grade or high-grade according to accepted morphological features.

Statistical analysis was done using SPSS version 23.0. Categorical variables were expressed as frequencies and percentages. Chi-square test or Fisher's exact test was used to compare proportions between groups. Continuous variables such as age was expressed as mean and standard deviation. Comparative subgroups were analysed between non-neoplastic and neoplastic lesions to evaluate associations with factors such as age, sex, and anatomical distribution of the lesions. A p-value of less than 0.05 was considered as statistically significant.

#### Inclusion Criteria

- All colonoscopic biopsies obtained from the colon and rectum during the study period.
- Patients above 18 years of age.
- Adequately fixed specimens with preserved mucosal architecture.

#### Exclusion Criteria

- Poorly preserved or autolyzed specimens.
- Biopsies limited to the anal canal or small intestine.
- Inadequate biopsies (e.g., only fibrocollagenous tissue without mucosal glands).

## RESULTS

The analysis of the gender distribution of the studied cases showed that males constituted the majority, accounting for 48 cases (60%), while females made up 32 cases (40%). There was a male predominance with a M:F ratio of 1:0.66 [Figure 1].

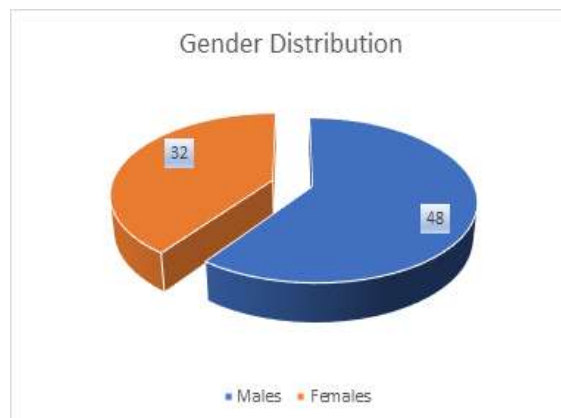


Figure 1: Gender distribution of studied cases.

The analysis of the age group distribution of the studied cases showed that the most frequently affected age group in both genders was 61–80 years comprising of 18 males (22.5%) and 15 females (18.75%). This was followed by the 41–60 years group which included 17 males (21.25%) and 11 females (13.75%). The 18–40 years age group had the least number of cases with 13 males (16.25%) and 6 females (7.5%). The mean age was higher among males ( $56.2 \pm 13.4$  years) as compared to females ( $51.7 \pm 14.1$  years). The mean age of male and female patients was found to be comparable with no statistically significant difference ( $P=0.15$ ) [Table 1].

Table 1: Gender Distribution of studied cases.

Age Group	Male (n=48)	Female (n=32)	P=0.15
18–40	13 (16.25%)	6 (7.50%)	
41–60	17 (21.25%)	11 (13.75%)	
61–80	18 (22.50%)	15 (18.75%)	
Total	48 (60.00%)	32 (40.00%)	
Mean age $\pm$ SD	56.2 $\pm$ 13.4	51.7 $\pm$ 14.1	

The analysis of the anatomical distribution of colorectal lesions based on biopsy site showed that the rectum was the most commonly involved region (27 cases) followed by the sigmoid colon (24 cases). The descending colon was affected in 9 cases, while the ascending colon had 7 cases. Caecum and transverse colon lesions were seen in with 8 and 5 cases respectively [Figure 2].

The analysis of the lesion types identified through colonoscopic biopsies revealed that inflammatory lesions were slightly more common, accounting for 32 cases (40%). Malignant neoplastic lesions were close in frequency, with 31 cases (38.75%). Benign neoplastic lesions were the least common comprising of 17 cases (21.25%) [Table 2].

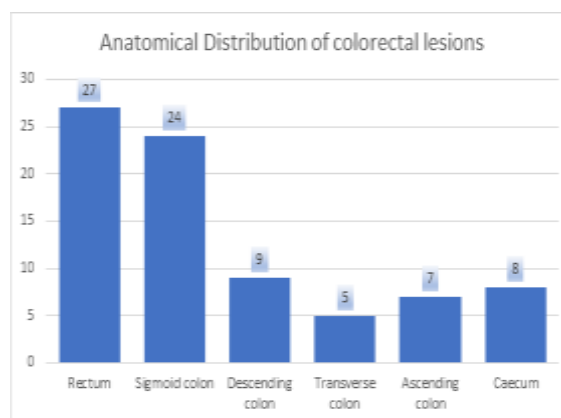


Figure 2: Distribution of cases on the basis of site of lesion.

**Table 2: Type of lesions in studied cases.**

Lesion Type	Number of Cases (Percentage %)
Non neoplastic	32 (40.00%)
Benign neoplastic	17 (21.25%)
Malignant neoplastic	31 (38.75%)
Total	80 (100.00%)

The analysis of the histological diagnosis among non-neoplastic colorectal lesions showed that chronic non-specific colitis was the most commonly observed condition, present in 6 cases (18.75%), followed by both ulcerative colitis and solitary rectal ulcer syndrome [Figure 3] each accounting for 5 cases

(15.63%). Acute colitis, inflammatory polyp, and hyperplastic polyp were each seen in 3 cases (9.38%). Other frequent findings included juvenile polyp, and Crohn's disease with 3 cases each (9.38%). Granulomatous colitis [Figure 4] was seen in 2 cases (6.25%) [Table 3].

**Table 3: Histological diagnosis among non-neoplastic colorectal lesions**

Histological Diagnosis	Number of Cases (Percentage %)
Chronic non-specific colitis	6 (18.75%)
Solitary rectal ulcer syndrome	5 (15.63%)
Ulcerative colitis	5 (15.63%)
Acute non-specific colitis	3 (9.38%)
Inflammatory polyp	3 (9.38%)
Hyperplastic polyp	3 (9.38%)
Juvenile polyp	3 (9.38%)
Crohn's disease	3 (9.38%)
Granulomatous colitis	2 (6.25%)
Total	32 (100.00%)

The analysis of the histological diagnosis among benign neoplastic colorectal lesions showed that tubular adenoma was the most frequently encountered type (47.06%) with low grade dysplasia

[Figure 5] on the top. This was followed by tubulovillous adenoma (35.29%) and villous adenoma (17.65%). [Table 4].

**Table 4: Histological diagnosis among benign neoplastic colorectal lesions.**

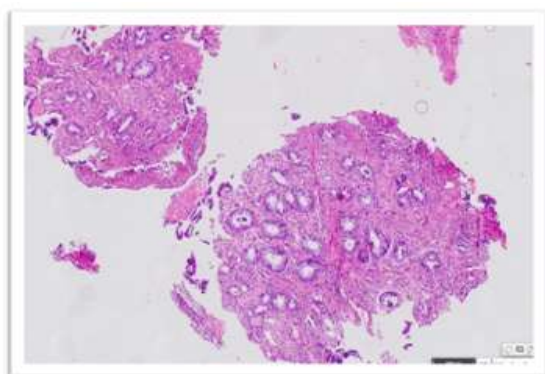
Histological Diagnosis	Number of Cases (Percentage %)
Tubular adenoma with low grade dysplasia	8 (47.06%)
Tubulo-villous adenoma with low grade dysplasia	6 (35.29%)
Villous adenoma with high grade dysplasia	3 (17.65%)
Total	17 (100.00%)

Amongst malignant colorectal lesions classical adenocarcinoma (well and moderately differentiated) was the most common type (70.97%) (Fig 6). Poorly differentiated adenocarcinoma and mucinous

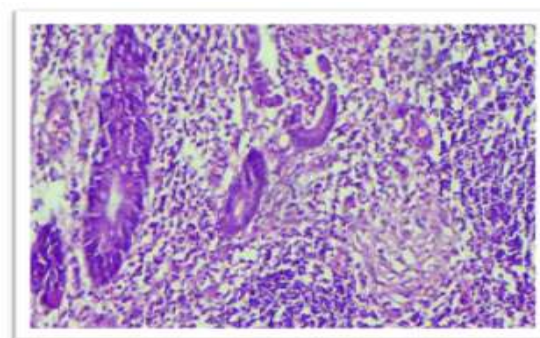
adenocarcinoma were each observed in 3 cases (9.68%), while signet ring cell carcinoma was found in 2 cases (6.45%). A single case (3.23%) was diagnosed as non-Hodgkin lymphoma [Table 5].

**Table 5: Histological diagnosis among malignant neoplastic colorectal lesions.**

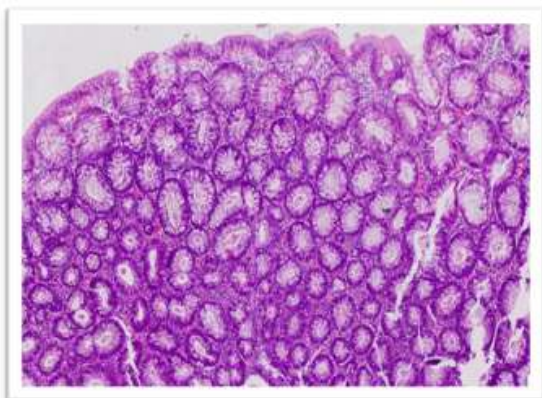
Histological Diagnosis	Number of Cases (Percentage %)
Classical Adenocarcinoma (Well and moderately differentiated)	22 (70.97%)
Adenocarcinoma (Poorly differentiated)	3 (9.68%)
Mucinous adenocarcinoma	3 (9.68%)
Signet ring cell carcinoma	2 (6.45%)
Non-Hodgkin lymphoma	1 (3.23%)
Carcinoid tumor	0 (0.00%)
Total	31 (100.00%)



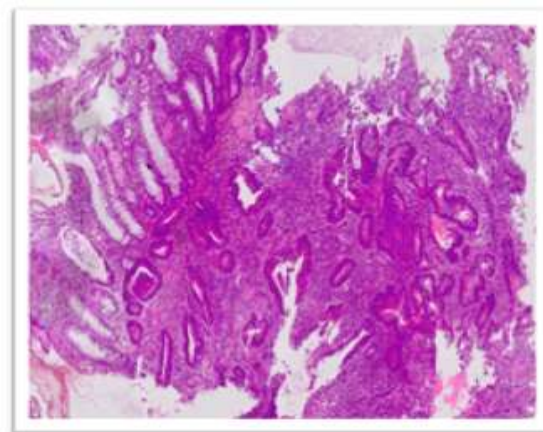
**Figure 3:** Distorted crypts with thickened lamina propria. Surface epithelial erosion and reactive atypia are noted—features characteristic of SRUS.



**Figure 4:** Colonic mucosa shows non caseating granulomas with surrounding lymphoplasmacytic inflammation and surface ulceration consistent with granulomatous colitis.



**Figure 5:** Colorectal mucosa shows closely packed tubular glands lined by dysplastic epithelium with nuclear stratification, elongation, and mild atypia—consistent with tubular adenoma with low grade dysplasia.



**Figure 6:** Irregular, infiltrative glands with nuclear atypia in a desmoplastic stroma and loss of normal mucosal architecture—features consistent with Adenocarcinoma.

**Table 6: Correlation between age and pathology of the colorectal lesion.**

Age Group	Non-neoplastic (n=32)		Benign Neoplastic (n=17)		Malignant Neoplastic (n=31)		P Value
	N	%	N	%	N	%	
18–40	10	12.50%	4	5.00%	5	6.25%	0.012*
41–60	12	15.00%	6	7.50%	10	12.50%	
61–80	4	5.00%	7	8.75%	22	27.50%	
Total	32	40.00%	17	21.25%	31	38.75%	

The analysis of the age-wise distribution of colorectal lesions showed that malignant neoplastic lesions were most common in the 61–80-year age group (27.5%), followed by 10 cases (12.5%) in the 41–60-year group and 5 cases (6.25%) in the 18–40-year group. Non-neoplastic lesions were predominantly observed in the 41–60 age group with 12 cases (15%), followed by 10 cases (12.5%) in the 18–40 group and 4 cases (5%) in those aged 61–80 years. Benign neoplastic lesions were most frequently seen in the 61–80 age group with 7 cases (8.75%), followed by 6 cases (7.5%) in the 41–60 group and 4 cases (5%) in the 18–40 group. Statistically significant higher number of malignant cases were observed in older individuals (P=0.012) [Table 6].

## DISCUSSION

The present cross-sectional analysis of colorectal lesions highlights the histological spectrum and demographic trends of both inflammatory and neoplastic conditions. A key finding of this study is the almost similar distribution between non-neoplastic (40%) and malignant neoplastic lesions (38.75%). This reflects the growing burden of malignancies and also the importance of histopathological surveillance in patients presenting with lower gastrointestinal symptoms. Similar findings have been documented in a study by Shidham et al who reported a higher proportion of malignant lesions in elderly patients undergoing colonoscopic evaluation in a hospital-based cohort. Shift toward increasing neoplastic pathology with increasing age reported by Shidham et al was similar

to our study.<sup>[6]</sup> Similarly Tahiliani HT in their retrospective histopathological review of colorectal biopsies reported that adenocarcinomas formed the bulk of malignancies and showed a left-sided predominance. These findings also correspond with the site distribution observed in this study.<sup>[7]</sup>

Our data show that inflammatory lesions such as chronic and acute non-specific colitis, ulcerative colitis and SRUS form a significant component of non-neoplastic findings. Amongst these inflammatory lesions chronic non-specific colitis was the most common. This is similar to the observations made by Lee J et al who reported non-specific colitis as the most prevalent inflammatory lesion in colonoscopic biopsies in their cross-sectional study from Eastern India.<sup>[8]</sup> Furthermore, ulcerative colitis was more common than Crohn's disease in our cohort reflecting the general pattern observed in South Asian populations. A similar pattern was described by Kedia et al who studied inflammatory bowel disease in Indian patients and noted that ulcerative colitis outnumbered Crohn's disease.<sup>[9]</sup> This supports the notion that regional and genetic differences influence disease prevalence and phenotype.

In this study among benign neoplastic lesions tubular adenomas with low grade dysplasia is the most frequently encountered histological subtype. These lesions were over 75% of all benign neoplasms in our series. This finding is similar to the work of Fenoglio-Preiser and colleagues who emphasized the adenoma–carcinoma sequence. These findings highlights that villous and tubulovillous architecture significantly increase the risk of progression to carcinoma.<sup>[10]</sup> In a similar study by Jabeen A et al a

similar histological profile was observed with tubular and tubulovillous adenomas being the predominant benign neoplastic lesions.<sup>[11]</sup> The identification of dysplasia, even in a small proportion of adenomas underscores the importance of histopathological evaluation and endoscopic surveillance for early detection of high-risk lesions.

Adenocarcinoma (well and moderately differentiated adenocarcinoma) (70.97%) were common malignant neoplastic lesions seen in this study. Mucinous adenocarcinoma and signet ring cell carcinoma were also identified and are known to carry a poorer prognosis. Our findings align closely with those of Fleming M et al who reported similar histopathological distributions in colorectal carcinomas and emphasized the prognostic significance of histological subtypes.<sup>[12]</sup> In a recent multicenter study from India Bamanikar S et al also reported that adenocarcinoma remains the predominant colorectal cancer type and noted a substantial proportion of moderately differentiated tumors presenting in the sixth and seventh decades of life. These findings were consistent with our age-distribution data.<sup>[13]</sup>

The demographic analysis in our study showed a male predominance (60%) and an increasing frequency of malignant lesions with advancing age particularly in the 61–80-year age group. This gender trend is supported by the findings of Jemal et al who documented higher age-standardized incidence rates of colorectal cancer in men across most populations.<sup>[14]</sup> Furthermore, the age-specific pattern observed in our cohort echoes the study by Karve SH et al who reported that the incidence of colorectal malignancies was significantly higher in individuals aged above 60.<sup>[15]</sup> Anatomically, the rectum and sigmoid colon were the most frequently involved sites in our study. This pattern is consistent with multiple regional studies including those by Rasool M al who reported a left-sided predominance in colorectal lesions diagnosed through colonoscopic biopsies in Kashmiri patients.<sup>[16]</sup>

Our study underscores the histological diversity of colorectal lesions in symptomatic patients undergoing colonoscopy. Future studies with larger populations and prospective designs are needed to further clarify the relationship between inflammatory bowel disease, adenoma–carcinoma progression and demographic risk factors.

## CONCLUSION

The histopathological evaluation of colonoscopic biopsies revealed a broad spectrum of inflammatory, benign as well as malignant colorectal lesions. Histopathology proved essential for definitive diagnosis and helped in distinction of premalignant changes and identification of high-risk neoplasms.

Histopathological examination was found to have a critical role in guiding timely clinical decisions. Early biopsy and histopathological assessment is crucial to improve therapeutic planning and patient outcomes.

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