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EVALUATING THE EFFICACY OF IMPRINT CYTOLOGY IN DIAGNOSING THYROID NEOPLASM

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ABSTRACT:

BACKGROUND:

Thyroid disorders are a common clinical problem seen in surgical practice, frequently presenting as thyroid nodules with estimated prevalence ranging from 4% by palpation to 67% by non-palpation. Since only malignant nodules or large symptomatic nodules need surgery, a systemic approach is necessary to avoid erroneous surgical intervention. Imprint cytology is cost effective, simple and rapid intraoperative diagnostic modality. The current study is designed to study the age, sex profile in the spectrum of various thyroid lesions and to assess the efficacy of imprint cytology by comparing it with frozen section and histopathological diagnosis.

MATERIALS AND METHODS:

This is a retrospective study of 42 cases Conducted at Department of Pathology, BGS Global Institute of Medical Sciences, Bengaluru from the period of April 2022 - Sept 2023. Thyroid lesions were categorized based on New 2022 WHO classification of thyroid tumours. The imprint cytology of cases were compared with paraffin section diagnosis.

RESULTS:

The overall diagnostic accuracy was 95.24%. Sensitivity, specificity, positive predictive value and negative predictive value was 75%, 100%, 100% and 94.44% respectively. Discordant rate in the present study was 4.8%.

CONCLUSION:

On reviewing literature, the overall accuracy of imprint cytology in our study was found similar to those of frozen section in several studies of thyroid lesions proving that imprint cytology could prove to be an valuable alternative for intraoperative diagnosis of thyroid lesions in centres which lack frozen section. It is also simple, reliable and cost-effective diagnostic technique which can be a useful guide in making intraoperative therapeutic decision quickly.

Key words: Imprint cytology, thyroid, Intraoperative diagnosis

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INTRODUCTION:

Thyroid disorders are a common clinical problem seen in surgical practice, frequently presenting as thyroid nodules with estimated prevalence ranging from 4% by palpation to 67% by ultrasonography. [(1)] Diagnosis of thyroid lesions is important involving both the pathologist and the operating surgeon. Since only malignant nodules or large symptomatic nodules need surgical intervention, systematic approach is necessary to avoid erroneous surgical treatment. To avoid unnecessary surgical resection intraoperative frozen section is usually performed, which require expensive equipment and technical expertise. [(2)]

Imprint cytology can be used as an alternative to frozen sections since imprint cytology is much more cost-effective, simple, rapid and easy diagnostic modality for quick intraoperative decision making. [(3)] It can be used as an alternative to frozen section in centres lacking trained technician and equipment needed for frozen section. The present study is designed to assess the efficacy of imprint cytology by comparing it with frozen section and histopathological diagnosis in thyroid neoplasms.

AIMS AND OBJECTIVES:

- To study the age, sex profile in the spectrum of various thyroid lesions.
- To assess the efficacy of imprint cytology by comparing it with frozen section and histopathological diagnosis.

MATERIALS AND METHODS:

The present study is a Retrospective study conducted in the department of pathology, BGS Global Institute of Medical sciences, Bengaluru for the duration of 18 months (April 2022-September 2023). The Approval was obtained from the Institutional Ethics Committee prior to the study, IEC number: BGSGIMS/IEC/App/Dec/2023/005. Study included all the patients undergoing thyroidectomy at BGS Global Institute of Medical Sciences, Bengaluru. After surgical removal, the fresh thyroidectomy specimens were thoroughly inspected, cleaned with wet gauze to remove blood and debris.

Impressions were obtained on a glass slide by pressing firmly but gently by a "touch and withdraw" movement. This was followed by fixation in 95% isopropyl alcohol followed by routine Haematology & eosin stain. The smears were carefully examined and a provisional cytodiagnosis was offered. The specimens were subsequently fixed in formalin and embedded in paraffin for conventional histopathological diagnosis. The intraoperative cytodiagnosis and histopathological diagnosis were correlated. In this study we have classified cases based on New 2022 WHO classification of thyroid tumours.

Inclusion Criteria: All thyroidectomy specimens received in Department of Pathology, BGS Global Institute of Medical Sciences.

Exclusion Criteria: None

Statistical Analysis: All the data collected were entered and analysed using Microsoft excel. The qualitative variables were expressed in percentage and age with Mean ± SD. The diagnostic evaluation is done using Med Calc Software and expressed in % with 95% confidence interval.

RESULTS:

In the present study, age of the patient ranged from 20 to 69 years, with a mean age being 40.19 years (Figure 1).

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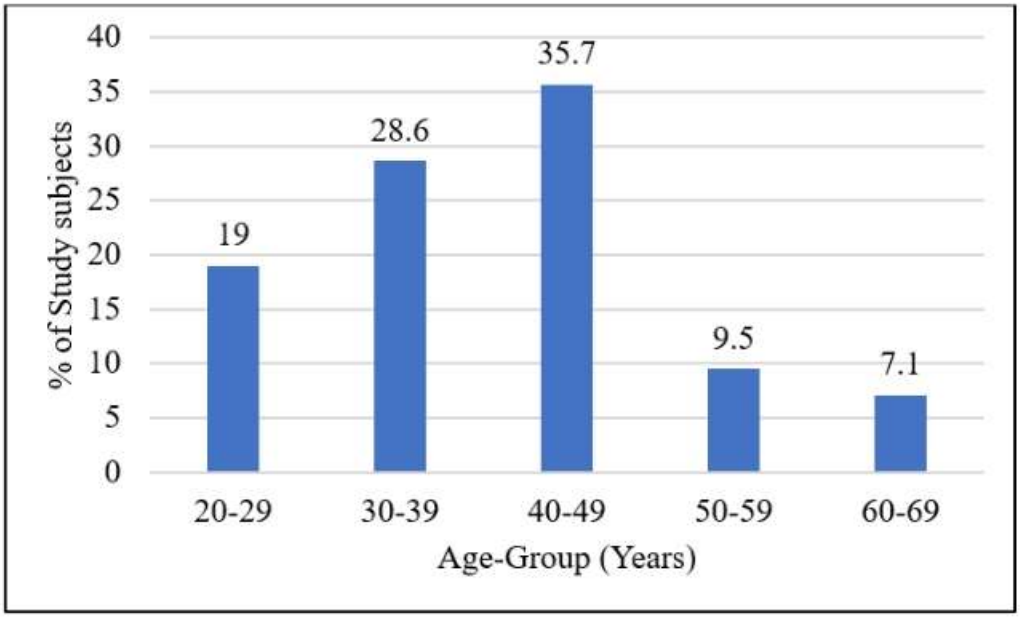

Figure 1: Distribution of Thyroid lesions in different age groups

Majority of patients were females (92.9%) with male to female ratio of 1:13.

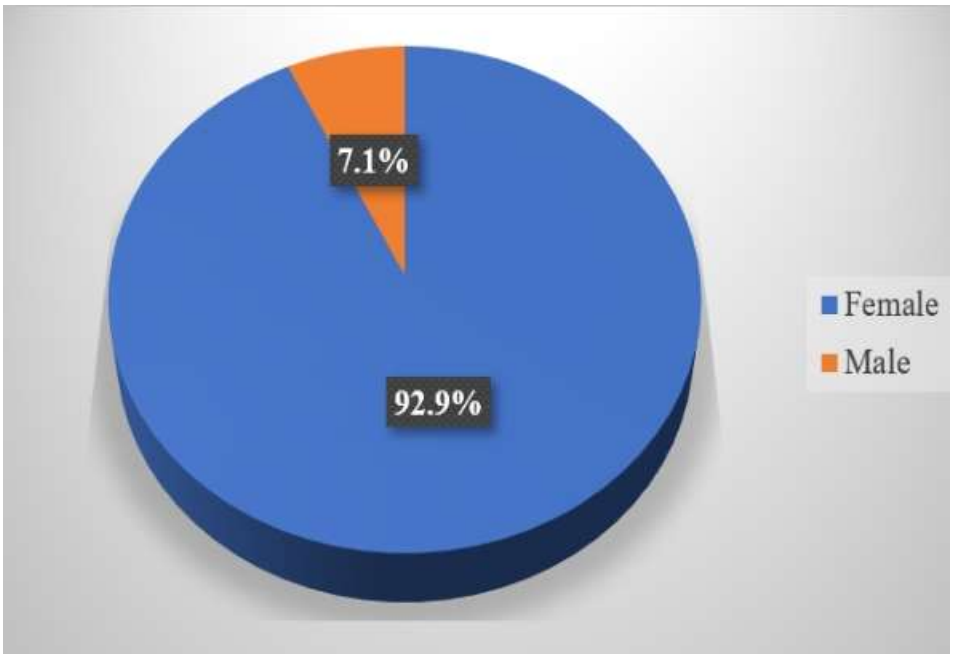

Figure 2: Distribution of Thyroid lesions in different sex.

The thyroid follicular neoplasms were classified according to new 2022 WHO Classification of thyroid tumours i.e., Benign tumours, Low risk neoplasms and Malignant neoplasms. [(4)] Out of 42 cases studied 34 (80.9%) cases were diagnosed as Benign tumours, 2 cases (4.8%) as low risk neoplasm and 6 cases (14.3%) as malignant tumours on imprint cytology. (Table 1)

Out of 34 cases of Benign tumours 30 were diagnosed as **Thyroid follicular nodular disease**, which includes colloid goitre, hyperplastic nodule, lymphocytic thyroiditis (Figure 3a-d),4 cases as follicular

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adenoma. Under low-risk neoplasms, 2 cases were diagnosed as **Non-Invasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP).** Among the malignant tumours 6 cases of papillary carcinoma were diagnosed on imprint cytology(Figure 4a-d)
Similar statistics were seen in frozen section examination.

On Histopathological Examination, 34 cases were diagnosed as Benign Tumours which included 30 cases of thyroid follicular nodular disease and 4 cases as follicular adenoma. 8 cases of papillary carcinoma were diagnosed under malignant tumours. 2 cases of low-risk neoplasm (NIFTP) turned out to be as papillary carcinoma on Histopathology. There were 2 cases (4.8%) of Discordant and 40 cases (90%) as Concordant. (Table 2)

Impression	Imprint Diagnosis	n	%
Malignant	Papillary Carcinoma	6	14.3
Low risk	Non-invasive follicular thyroid neoplasm with papillary like nuclear features	2	4.8
Benign	Thyroid follicular Nodular Disease	30	71.4
	Follicular Adenoma	4	9.5
	Frozen Section		
Malignant	Papillary Carcinoma	6	14.3
Low risk	Non-invasive follicular thyroid neoplasm with papillary like nuclear features	2	4.8
Benign	Thyroid follicular Nodular Disease	30	71.4
	Follicular Adenoma	4	9.5
	HPE Diagnosis		
Malignant	Papillary Carcinoma	8	19.0
Benign	Thyroid follicular Nodular Disease	30	71.4
	Follicular Adenoma	4	9.5

Table 1: Distribution of thyroid neoplasms on imprint cytology, frozen and on HPE diagnosis bases on new WHO 2022 classification of thyroid neoplasm.

Concordant Status	n	%
Yes	40	95.2
Discordant	2	4.8

Table 2: Number of Discordant and concordance cases

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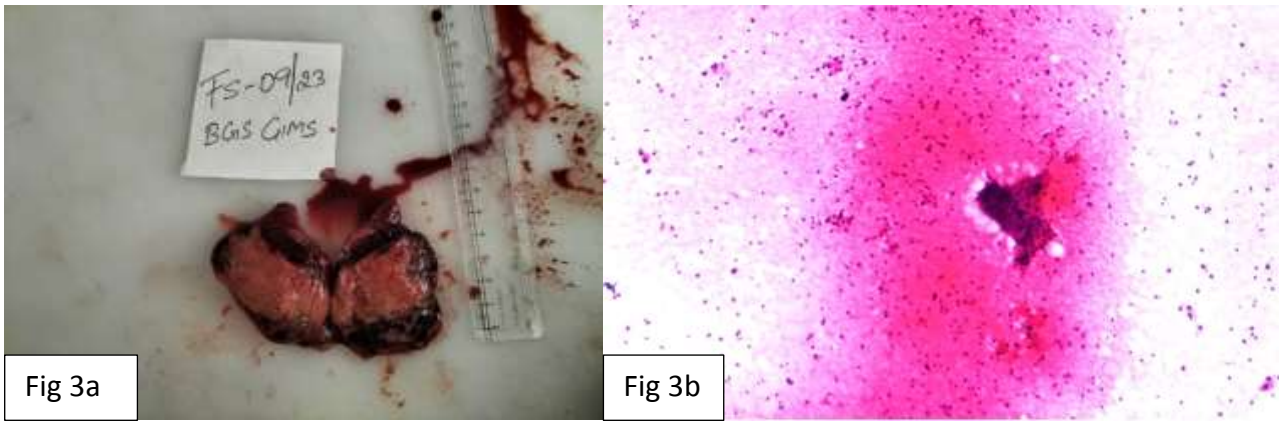

Figure 3a: Gross specimen of Thyroid follicular Nodular Disease showing a well delineated nodule; **Figure 3b**:Imprint smear of lymphocytic thyroiditis showing aggregates of thyroid follicular cells in a background of lymphocytes.(H&E,100x)

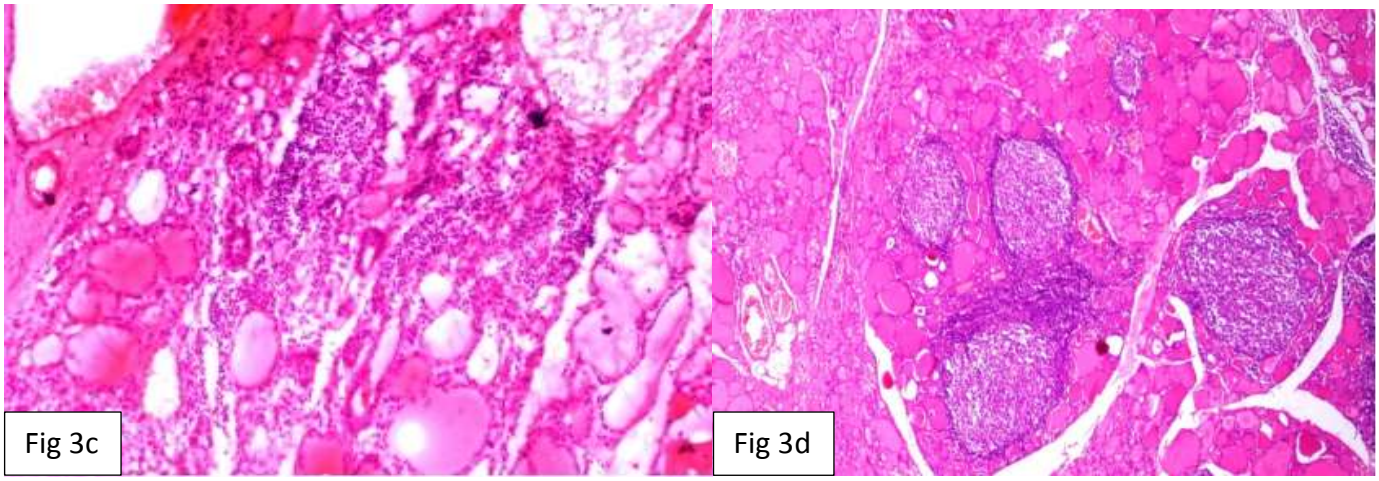

Figure 3c&3d: Frozen section and Histopathology of lymphocytic thyroiditis. (H&E,400x)

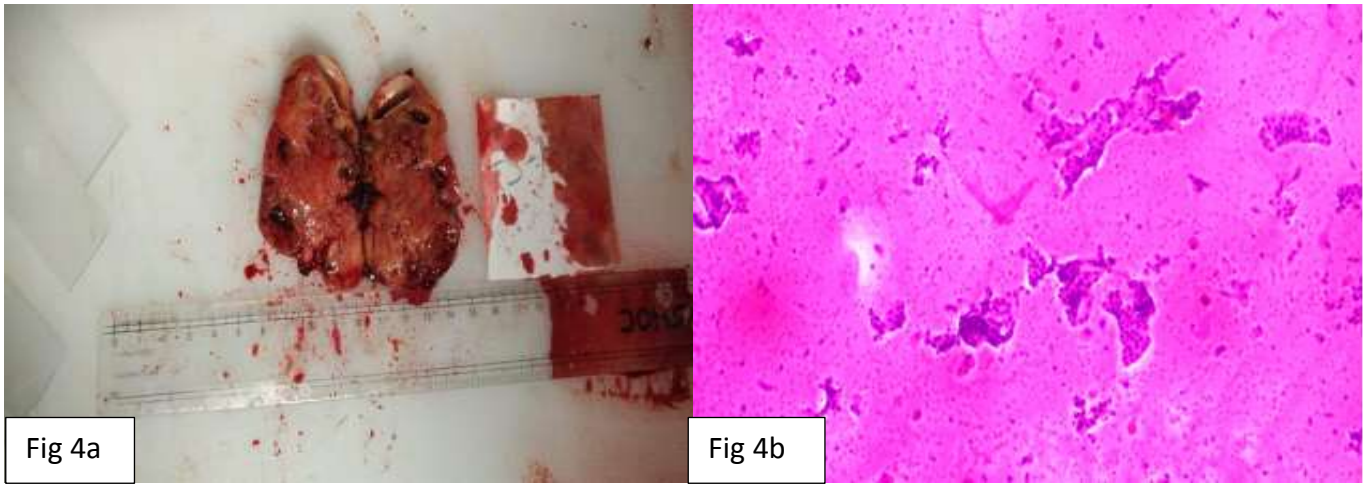

Figure 4a:Gross specimen of Papillary Carcinoma of thyroid showing cystic mass with papillary excrescences.; **Figure 4b**:Imprint smear of Papillary Carcinoma of thyroid showing follicular cells arranged in papillaroid pattern(**H&E,100x**)

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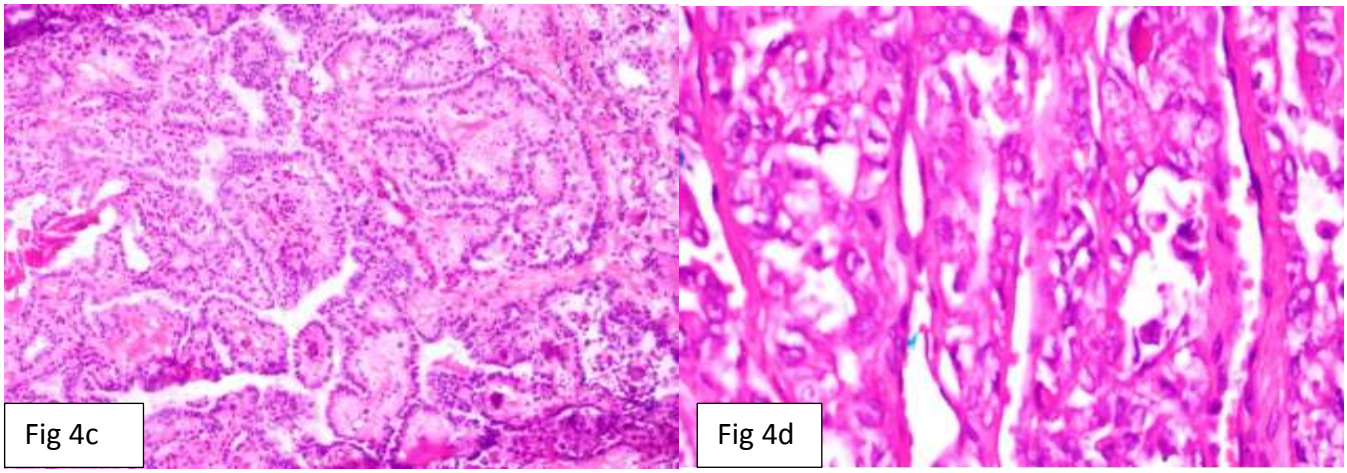

Figure 4c & 4d: Frozen section and Histopathology of Papillary carcinoma thyroid showing follicular cells arranged in papillary architecture and follicular cells displaying nuclear features(**H&E,400x)**

The imprint cytology in our study showed sensitivity and specificity of 75% and 100% respectively. The positive predictive value, negative predictive value and diagnostic accuracy was 100%, 94.44% and 95.24% respectively. (Table 3)

Indices of screening test	Value	95% CI
Sensitivity	75%	(34.91-96.81) %
Specificity	100%	(89.72-100) %
Positive predictive value	100%	(54.07-100) %
Negative predictive value	94.44%	(83.66-98.26) %
Accuracy	95.24%	(83.84-99.42) %

Table 3: Accuracy of Imprint cytology in diagnosis of thyroid neoplasms (Histopathological examination taken as gold standard)

DISCUSSION:

Thyroid disorders frequently present as thyroid nodules, and several methods are used to evaluate the thyroid nodule. Preoperatively FNAC (fine needle aspiration cytology) is frequently performed diagnostic modality for evaluation. Intraoperatively Imprint cytology, crush preparation and frozen section are the various methods used. Imprint cytodiagnosis is recognised as simple, rapid, reliable and inexpensive technique. Imprint cytology technique was introduced as early as 1927by Dudgeon and Patrick . [(5)] After their pioneering work, this technique remained unrevealed for many years. Later on intraoperative imprint cytodiagnosis was recognized and came into an existence in various diagnosis. Imprint cytology has been applied in the study of various tissues like lymph node, breast, thyroid .[(6)] Imprint cytology can also be used in centres where frozen section facilities are not available.[(2)] Only limitations being capsular/vascular invasion cannot be assessed in imprint cytology.

In our study, age of the patients ranged from 20-60yrs with mean age of 40.19 years. It was comparable with studies done by Anjali P V.et al [(7)] and Mojtaba A et al. [(8)]Male to female ratio was 1:13, comparable with Anjali P V.etal[(7)] and Pustaka IGN et al[(9).] The percentage of Benign lesions and malignant lesions was comparable with Anjali P V.et al[(7)] al and Mojtaba A et al. [(8)]In our study we have categorise the thyroid

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lesions according to new WHO 2022 classification, into Benign lesions, low risk neoplasms and malignant neoplasms.

Out of total 42 cases studied, 34 cases (80.9%) cases were benign neoplasm, thyroid follicular nodular disease and follicular adenoma which was diagnosed was confirmed by frozen section and by Histopathology. There were 2 cases of NIFTP (non-invasive follicular tumour with papillary like nuclear features) on imprint cytology and frozen section,which was diagnosed as papillary carcinoma on histopathology. Totally 8 cases of papillary carcinoma were diagnosed on Histopathology, so there was 2cases of discordant (4.8%) and 40 cases (95.2%) of concordance. The reason for discordant can be due to insufficient sampling, improper technique and artificial mimicker for nuclear crowding.

The imprint cytology in our study showed sensitivity and specificity of 75% and 100% respectively , which was similar to study done by Anjali P V.et al[7] , Haeri et al[10] and K R Anila et al[2].The positive predictive value, negative predictive value and was 100%, 94.44% and respectively, Diagnostic accuracy in our study was 95.24% which was comparable with KR Anila et al[2].(Table 4)

STUDY	Sensitivity	Specificity	Diagnostic Accuracy
Anjali P V.et al[7]	87.5%	100%	98.1%
Haeri [10]	92.4%	100%	95.4%
Bolkainy T[11]	100%	100%	100%
Taneri et al[12]	83.3	97.7	96
Present study	75%	100%	95.24%

Table 4: Comparative table showing sensitivity, specificity, and Diagnostic Accuracy of Imprint cytology with other studies.

Considering High Diagnostic Accuracy and high specificity of Imprint Cytology, it can be used as a good tool for diagnosing Thyroid lesions.

CONCLUSION:

Imprint cytology is a simple, reliable, and cost-effective procedure for rapid intraoperative diagnosis. Imprint cytology has high accuracy rate in diagnosing thyroid lesions. It provides excellent cellular details without any expensive instrument. It can be a useful guide in making intraoperative therapeutic decision quickly and an valuable alternative for intraoperative diagnosis of thyroid lesions in centres which lack frozen section.

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