

# DIAGNOSTIC EFFICACY OF FNAC IN THYROID LESIONS AND THEIR CYTO-HISTOPATHOLOGICAL CORRELATION AT TERTIARY CARE CENTER

Neha Gupta<sup>1</sup>, Shweta Agarwal<sup>2</sup>, Swapna Devi<sup>3</sup>, Vijeta Tomar<sup>4</sup>

<sup>1,2,3,4</sup>Assistant Professor, Department of Pathology, SMS Medical College, Jaipur, Rajasthan, India.

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Corresponding Author:

**Dr. Vijeta Tomar,**  
Email: dr.vijetatomar@gmail.com

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## Abstract

**Background:** Thyroid lesions are one of the common conditions encountered in clinical practice. FNAC examination has proved to be a simple, accurate, safe and cost-effective method for the preoperative diagnosis of benign and malignant thyroid nodules. The present study aims at diagnosing various thyroid diseases based upon cytomorphological features in FNAC and wherever possible with its histopathological correlation, which is the gold standard. **Materials & Methods:** A retrospective study comprised of 1000 cases who presented with the history of swelling in front midline of neck which were referred from the Departments of Surgery, Medicine & ENT for FNA procedure to the Department of Pathology at SMS Medical College, Jaipur, Rajasthan during two year period. The cytology and histopathology slides were collected. When the surgery was done, the received specimens were fixed with 10% formalin and detailed gross examination was done and sections were taken from the representative areas for paraffin sections and stained by H & E. The sections were studied under light microscopy. Cytological diagnosis was correlated with histopathology whenever thyroidectomies were available. **Results:** According to FNAC diagnostic criteria, there were 66% benign cases, 69 (6.9%) malignant cases, 175 (17.5%) suspicious and 96 (9.6%) unsatisfactory or non-diagnosis. We correlated FNA diagnosis with histopathological confirmatory diagnosis. These conventionally diagnosed thyroid lesions were then classified according to the Bethesda system. The value of Kappa was 0.786, which signifies good agreement between FNAC and histopathological diagnosis which is the gold standard. **Conclusion:** We concluded that FNAC gives good positive correlation with histopathology with high sensitivity and specificity. Hence FNAC is a well-established first line diagnostic test and effective screening tool and along with Bethesda System for Reporting Thyroid Cytopathology aids in the diagnosis and management of patients with thyroid lesions effectively.

## INTRODUCTION

Thyroid lesions are one of the common conditions encountered in clinical practice. The diseases of thyroid are of great importance because most of them are amenable to medical or surgical treatment.<sup>[1]</sup> Cytological diagnosis of thyroid nodules by fine-needle aspiration has become the standard of care. Within the general population, palpable thyroid nodules are present in 4% to 7% of adults and subclinical (nonpalpable) nodules are present in up to 70% of individuals. Of these thyroid nodules, 90% to 95% are benign.<sup>[2]</sup> Fine-needle aspiration cytology of the thyroid was described by N. Soderstrom in 1952 and has been generally available since the 1970s. Number 13 From then on, FNA enjoyed an increasing popularity in many countries, as the technique proved to be a highly accurate and cost-effective procedure with

low morbidity. During the 1960s FNA became a standard procedure in Sweden not only for the thyroid but for all palpable lumps in the body.<sup>[3]</sup> As all palpable lesions can be assessed by FNAC technique, early diagnosis is often possible.<sup>[4]</sup> FNAC is a diagnostic tool in which cells are aspirated from a palpable swelling using syringe and fine needle. It is a simple, minimally traumatic and an ideal first line diagnostic test. It is also a speedy and an accurate technique being used worldwide.<sup>[4]</sup> The number of noninvasive diagnostic tests and surgical lobectomies done to establish or exclude thyroid cancer, makes it a disease of economic importance. Living in a society concerned with containment of medical costs, we should carefully select the most cost-effective diagnostic tests and hence FNAC is being increasingly used for evaluation of thyroid swellings.<sup>[5]</sup> FNAC examination has proved to be a simple, accurate, safe and cost-effective method for

the preoperative diagnosis of benign and malignant thyroid nodules.<sup>[6]</sup> Its use has decreased the number of thyroid surgeries performed and increased the ratio of malignant to benign lesions resected. As a result, many thyroid surgeries for benign diseases have been avoided.<sup>[7]</sup> The clinical value of thyroid FNAC is useful in the diagnosis of inflammatory, infective and neoplastic conditions.<sup>[1]</sup> Different imaging techniques are now used for preoperative diagnosis of thyroid nodules like radionuclide scanning, high-resolution ultrasonography (USG). However, FNAC is still regarded as the single most accurate and cost-effective procedure particularly if ultrasound is used as a guide for better sample collection, especially for cystic lesions.<sup>[8]</sup>

A uniform reporting system for thyroid FNA will facilitate effective communication among cytopathologists, endocrinologists, surgeons, radiologists, and other health care providers. Also it will facilitate cytologic-histologic correlation for thyroid diseases, facilitate research into the epidemiology, molecular biology, pathology and diagnosis of thyroid diseases, particularly neoplasia and allow easy and reliable sharing of data from different laboratories for national and international collaborative studies.<sup>[9]</sup> The present study aims at diagnosing various thyroid diseases based upon cytomorphological features in FNAC and wherever possible with its histopathological correlation, which is the gold standard.

## MATERIALS AND METHODS

A retrospective study comprised of 1000 cases who presented with the history of swelling in midline of neck which were referred from the Departments of Surgery, Medicine & ENT for FNA procedure to the Department of Pathology at SMS Medical College, Jaipur, Rajasthan during two-year period. Patients who have had surgery at this Institute, but FNAC was not performed preoperatively for thyroid swelling were excluded. The cytology and histopathology slides were collected. Patient's clinical data was collected from the medical records.

1. Mental preparation: Proper mental preparation is the first step in the performance of FNAC. Most of the pain experienced by patients is minor discomfort magnified by anxiety. In the present study, all the patients were reassured as to the simplicity and painlessness of the procedure and the patient was asked not to swallow while the needle is in the nodule.
2. Physical examination: Patient was asked to rest in supine position with the head and neck extended over a pillow. The degree of extension should not produce skin tension that interferes with nodule palpation or partially obstructs vertebral artery blood flow in the elderly. The site of the needle puncture was cleaned by firm application of an alcohol swab.

## Method

A 10 or 5mL syringe was used for obtaining cytologic specimens. 23 gauge needle were used. For nodules 1.5 cm or smaller, to and fro movements of the needle into the nodule were done. With larger nodules, peripheral subcapsular parts of the nodule were sampled rather than the center. Minimum of three passes were done in the present study. Whenever fluid was obtained all the contents were aspirated and centrifuged.

After aspiration, the needle is removed and the plunger is withdrawn. The needle is reattached, and the specimen is expressed onto the slide and then smeared with the edge of another slide. If particulate matter is visibly present then the material is compressed between two slides and smeared. In case of completely evacuated cystic nodule, smears were prepared from the sediment. The clean slides are then labelled and studied under light microscopy.

For Haematoxylin and eosin (H&E) and Papanicolaou (Pap) stain: 95% ethyl alcohol was used for fixation. For Leishman stain slides were air dried.

When the surgery was done, the received specimens were fixed with 10% formalin and detailed gross examination was done and sections were taken from the representative areas for paraffin sections and stained by H & E. The sections were studied under light microscopy. Cytological diagnosis was correlated with histopathology whenever thyroidectomies were available.

## RESULTS

In the present study, cytomorphological features of thyroid lesions by fine needle aspiration were studied. Histopathological correlation was done wherever thyroidectomies were available. Cytologically diagnosed lesions were later classified according to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC). The various parameters which included age, sex, clinical presentation along with ultrasound imaging features of patients. We then studied cytomorphological features and classified the thyroid lesions according to conventional method. In 114 cases, thyroidectomies were available for histopathological correlation. We correlated FNA diagnosis with histopathological confirmatory diagnosis. These conventionally diagnosed thyroid lesions were then classified according to the Bethesda system.

According to FNAC diagnostic criteria, there were 66% benign cases, 69 (6.9%) malignant cases, 175 (17.5%) suspicious and 96 (9.6%) unsatisfactory or non-diagnosis.

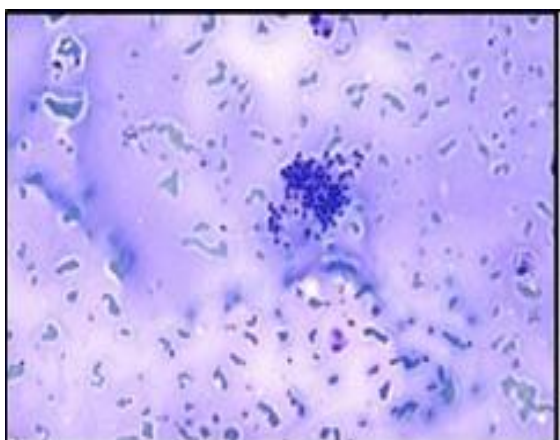
Benign lesions included (94.54%) cases of multinodular goiter, 34 (5.15%) cases of Hashimoto's and Chronic non-specific lymphocytic thyroiditis, 1 (0.15%) cases of Dequervain's subacute thyroiditis, and one (0.15%) case of Riedel's thyroiditis [table 1].

Sixty (60) cases of benign category underwent surgery due to massive enlargement of thyroid and histopathologic examination was performed. The FNAC reports were confirmed in 57 (95%) cases by histopathologic examination, in remaining 3 patients FNAC reports were not confirmed, 2 cases had papillary carcinoma, and one of them had follicular carcinoma in histopathologic examination. Therefore, in benign category, we had 57 true negative and 3 false negative results [table 2 & 3].

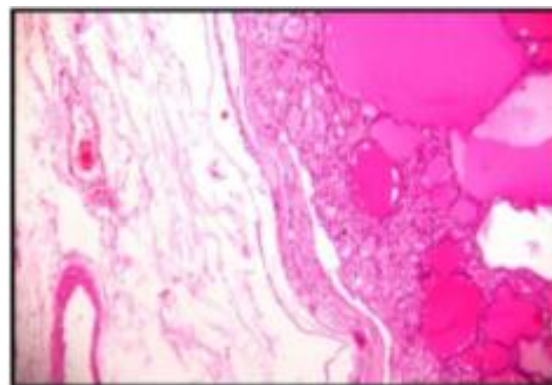
From 69 malignant lesions, papillary carcinoma was diagnosed in 46 (66.66%) cases, follicular carcinoma in 7 (10.14%), medullary carcinoma in 7 (10.14%) and other malignancy present in 9 cases (13.04%). Twenty four (24) cases of patients of this category underwent surgery in our center, and the rest of patients did not accept surgery or treated in other centers and some of them had medical contraindications for surgery. On histologic examination, 17 cases were diagnosed papillary carcinoma, 3 cases had follicular carcinoma, 3 cases had medullary carcinoma and one of them was diagnosed as NHL. The cytopathologic diagnoses were confirmed by histopathologic examination in all of 24 cases which underwent surgery. Therefore, we had 24 true positive and 0 false positive in malignant group [table 2 & 3].

Of the 175 cases with suspicious results, six cases were suspected to have hürthle cell neoplasm, two cases suspected to have cystic papillary carcinoma, and the remainder were follicular neoplasms that could not be differentiated from nodular hyperplasia. From this category, 30 patients underwent surgery in our center. For 13 cases, the suspicious were ruled out. The remaining 17 cases included as 14 cases of follicular adenoma, 2 cases of follicular carcinoma, and 1 case of papillary carcinoma. This group was not included in determining of FNAC accuracy [table 2 & 3].

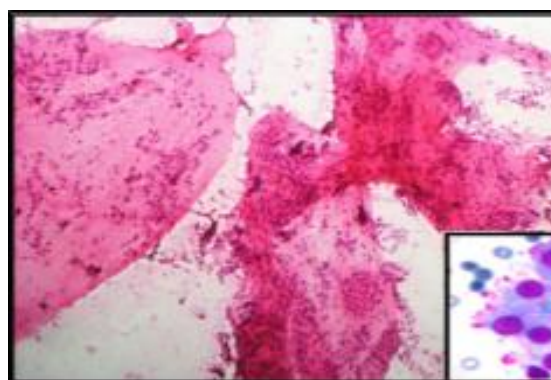
In the present study, value of Kappa was 0.786, which signifies good agreement between FNAC and histopathological diagnosis which is the gold standard.



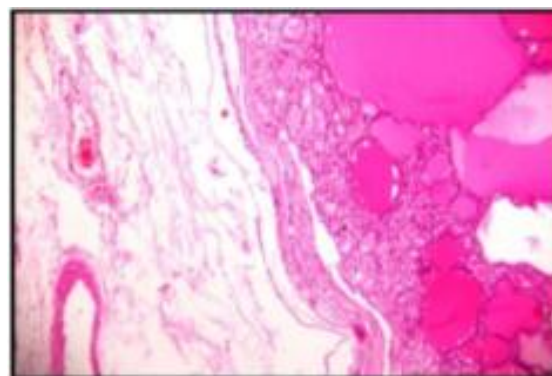
**Figure 1: Colloid cyst showing few benign follicular cells & numerous cyst macrophage in colloid background**



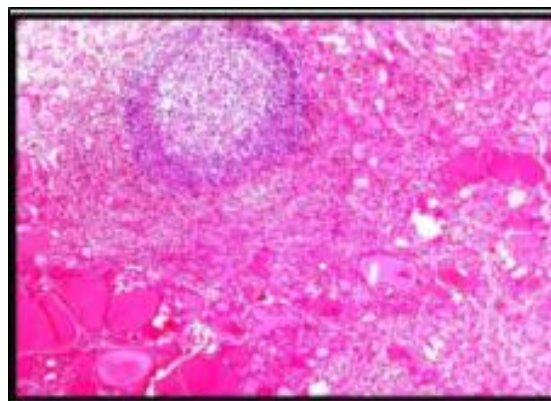
**Figure 2: Nodular goitre showing multiple colloid field areas**



**Figure 3: Adenomatoid goitre showing hypercellular smear**



**Figure 4: Hyperplastic nodule with hyperplastic areas**



**Figure 5: Hashimoto's thyroiditis showing lymphoid follicle with thyroid tissue**



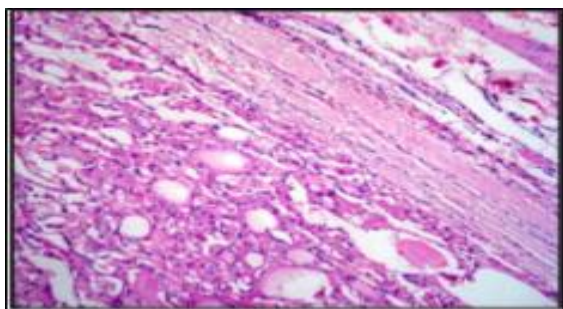


Figure 6: Follicular adenoma showing intact capsule and relative microfollicles

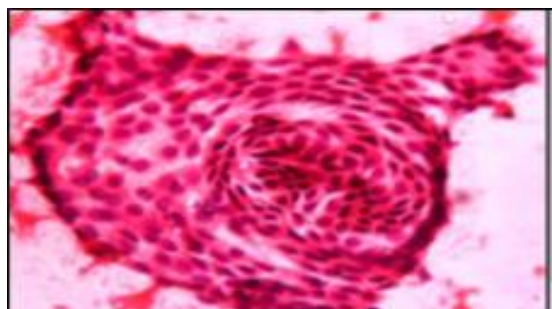


Figure 8: Papillary carcinoma with anatomical border and swirling

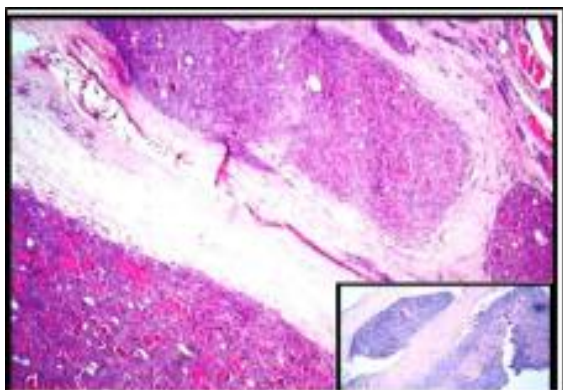


Figure 7: Follicular carcinoma showing capsular invasion

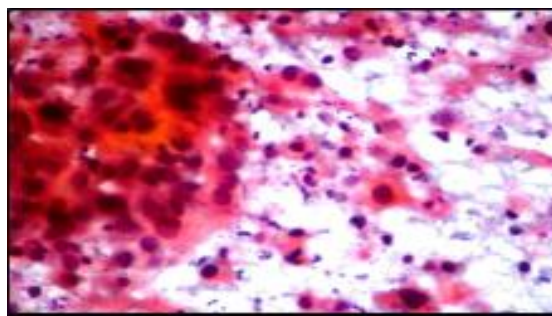


Figure 9: Anaplastic carcinoma showing highly pleomorphic cells in necrotic background

Table 1: FNAC results

Benign	Number	Malignant	Number	suspicious	Number
Multi nodular goiter	624	Papillary ca.	46	Hurtle cell neoplasm	6
Hashimoto and NSLT	34	Follicular ca.	7	Cystic papillary ca.	2
De quervain thyroiditis	1	Medullary ca.	7	Follicular neoplasm	167
Reidel thyroiditis	1	Other malignancies	9		
Total	660		69		175

Table 2: FNAC and histopathologic results

FNAC diagnosis	Number of specimen	No. of patients with histological diagnosis	Histopathological		
			Benign	Malignant	Adenoma
Benign	660	60	57 (TN)	3 (FN)	0
Suspicious	175	30	14	3	13
Malignant	69	24	0 (FP)	24 (TP)	0
Inadequate	96	-	-	-	-
Total	1000	114			

Table 3: Distribution of malignant cases among four FNAC categories

Cytologic diagnosis	Histologic typing				Total
	Papillary Ca.	Follicular Ca.	Medullary Ca.	Other malignancy	
Benign	2	1	-	-	3
Suspicious	1	2	-	-	3
Malignant	17	3	3	1	24
Inadequate	-	-	-	-	-
Total	20	6	3	1	30

## DISCUSSION

Thyroid disorders are the commonest endocrine disorders worldwide, including India. According to a project from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid disease. Thyroid diseases are different from other diseases in terms of their ease of diagnosis, accessibility of medical treatment and the

relative visibility that even a small swelling of the thyroid offers to treat physician. Early diagnosis and management remains the cornerstone of management.<sup>[10]</sup>

For early diagnosis and management of all thyroid swellings, the protocol to be followed in presence of a thyroid nodule is clinical evaluation, clinical laboratory investigations which include T3,T4 and TSH levels, thyroid scintigram, thyroid

echosonogram, FNAC and excision biopsy. Amongst all FNAC will be cheaper, cost effective and shows reproducible results.<sup>[11]</sup>

In the present study, 1000 patients who underwent FNA for thyroid lesions were included, out of which 114 cases underwent thyroidectomies and were subjected to histopathological study. A comparison of various parameters in our present study was done with the other studies. The maximum number of cases were seen in the age group of 31- 40 years – 280 cases (28%). Similar observations were seen by Manoj *et al*<sup>[12]</sup> and Yassa *et al*<sup>[13]</sup> observed maximum number of cases between age group of 41-50 years.

In the present study, maximum thyroid swellings were seen in female patients, with M:F ratio being 1:5. Similar observations were made by Silverman *et al*<sup>[14]</sup> found ratio was 1:6, Yassa *et al*<sup>[13]</sup> found was 1:7 and Rangaswamy *et al*<sup>[15]</sup> found was 1:3.

In the present study, maximum number of cases were seen in goitre group 624 cases (94.54%). Similar observations were seen by Manoj *et al*<sup>[12]</sup> (60%), Ray *et al*<sup>[16]</sup> (50%), Silverman *et al*<sup>[14]</sup> (56.5%) and GG Swamy *et al*<sup>[17]</sup> (50%). However according to Rangaswamy *et al*<sup>[15]</sup> maximum cases came under follicular neoplasm 21 cases (44.68%).

On reviewing the histology slides, there were seen focal areas of dilated papillae filled with colloid and probably the aspiration needle has not hit that site. This can be avoided by aspirating from multiple sites of glands. Our case even on respiration only colloid material was seen. Since most of the papillary carcinomas undergo cystic degeneration and cystic papillary carcinomas yield fluid aspirate with scant follicular cells, which masks the diagnosis of papillary carcinoma giving a false negative result.<sup>[18]</sup> Braga M *et al* (2001) found that cystic thyroid nodules are considered to be one of the major causes of non diagnostic and false negative results on conventional fine needle aspiration, thus limiting the potential of this method for the evaluation of complex thyroid nodules. Ultrasound guided fine needle aspiration cytology is suggested as an excellent modality for the evaluation of the complex nodules and also for the re-evaluation of those nodules with non-diagnostic result on the conventional fine needle aspiration.<sup>[19]</sup> Goellner JR in his study commented that cyst fluid showing no pathologic change and containing only degenerative foam cells should be interpreted as “non-diagnostic” rather than “negative”.<sup>[20]</sup>

In the present study, 624 cases of nodular goitre were diagnosed by fine needle aspiration cytology out of which 57 cases histopathologically proved to be nodular goitre. Out of remaining three cases turn out to malignancy.

Silverman JF *et al*<sup>[14]</sup> in their study of 36 cases of Follicular neoplasm on FNAC, 27 cases were confirmed on histopathology with a diagnostic accuracy of 75%. Another study done by Hall TL *et al*<sup>[21]</sup> in their study of 17 cases of Follicular neoplasm on FNAC, 10 cases were confirmed on histopathology with a diagnostic accuracy of 58.8%.

This less diagnostic accuracy is explained by the fact that, there always exist confusion between hyperplastic nodular goitre and follicular adenoma. This error is generally accepted as unavoidable because of cytomorphologic similarity and the need to maintain a high degree of sensitivity to the presence of a neoplastic process requiring surgical biopsy.

The false-negative FNAC results may occur because of sampling error or misinterpretation of cytology. However, it is difficult to estimate the true frequency of false-negative results because only small percentages (about 10%) of patients with benign cytological findings undergo surgery.<sup>[22]</sup> Because the false-negative rate for cytologically benign thyroid nodules is as high as 7%, in order to prevent potential miss of malignant lesions, careful clinical follow-up of these nodules is required. Nodules with benign FNA results can be followed by physical examination and ultrasound.<sup>[23,24]</sup>

In the present study, 17 out of 20 cases were correctly diagnosed papillary carcinoma on FNAC with a diagnostic accuracy of 85%. Papillary thyroid carcinoma is the most common malignant tumor of the thyroid. Its pathological diagnosis is based on classic nuclear features. Although majority of papillary cancers can be diagnosed and classified on the basis of set pathological criteria, there exists a group of cases in which benign thyroid tissue or lesions can mimic nuclear cytologic features or the architecture and growth pattern of papillary thyroid cancers, posing a diagnostic problem. Hall TL *et al*<sup>[21]</sup> found diagnostic accuracy of 89.6%, Gagnetten CB *et al*<sup>[25]</sup> found 80% and Gupta M *et al*<sup>[12]</sup> found 75% diagnostic accuracy of papillary carcinoma on FNAC.

Papillary formations can occur as a focal change or in the form of a dominant nodule in multinodular goitre, Hashimoto's thyroiditis and Graves disease. These papillary patterned lesions can be partly or totally composed of oncocytic cells and show complex papillae with well-formed vascular cores or stroma poor edematous papillae with subfollicles. Fine needle aspirations of cytology specimens of solitary papillary hyperplastic nodules demonstrate cellular smears, transgressing vessels, papillary clusters, nuclear atypia, and pleomorphism, the presence of Intranuclear grooves, multinucleated giant cells and cells with vacuolated cytoplasm. In view of these features, such cases could be misclassified as “suspicious of” or consistent with papillary carcinoma. However in our case cytological features which mimicked papillary carcinoma features were having high cellularity, papillary clusters with anatomical borders, presence of Intranuclear inclusions and multinucleated giant cells.

## CONCLUSION

We concluded that FNAC gives good positive correlation with histopathology with high sensitivity

and specificity. The use of FNAC helps in early detection and proper managements of thyroid neoplasm. False negative and false positivity can be reduced by repeat aspiration, correct sampling from the lesions with meticulous examination and reporting. Hence FNAC is a well established first line diagnostic test and effective screening tool and along with Bethesda System for Reporting Thyroid Cytopathology aids in the diagnosis and management of patients with thyroid lesions effectively.

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