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HISTOMORPHOLOGICAL SPECTRUM OF PEDIATRIC SURGICAL LESIONS.

Pathology

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ABSTRACT

Objectives: To detect the histopathological features of the pediatric surgical lesions and then categorize them systematically to form a histomorphological spectrum. **Method:** The current cross-sectional study was conducted on 180 pediatric histopathological specimens received at the department of pathology, S.N medical college, Agra through proper processing, staining, examination and data analysis methods. **Results:** Out of total 180 samples received, 5 samples were inadequate for evaluation and no proper diagnosis could be made in 12 cases. So, among 163 diagnosed pediatric surgical lesions, 69 cases were males and 94 were females. Congenital & developmental cases were 17 and Acquired cases were 146. Non neoplastic lesions accounted for 116 cases. Among neoplastic lesions 26 were found to be benign and 4 cases were malignant. **Conclusion:** The studies related to pediatric surgical pathology have been relatively rare in India and Indian subcontinent as most of these studies are either confined to a particular system or about the burden of these cases in all age groups but not just pediatric. Extensive search of literature shows none of the studies done on this subject have attempted to estimate the Prevalence of these lesions.

KEYWORDS

Histomorphology, prevalence, pediatric, surgical lesions, Profiling.

INTRODUCTION

There is a large range of pediatric lesions that need surgical management. These include malignant and benign neoplasms, acute emergencies, developmental and congenital disorders, and various space occupying lesions. Both malignant and non-malignant neoplastic paediatric surgical lesions are quite prevalent. Less research has been done on the general profile of pediatric surgical specimens collected in histopathology laboratories; most previous investigations have focused on case reports or specific lesions.[1]

The newborn has the most unique and quickly altering physiological features of any pediatric patient. The newborn must adjust from placental support to the extrauterine environment, necessitating several modifications. Early organ adaptation and the physiological requirements of fast growth and development are other factors.[4]

Malnutrition among hospitalized pediatric patients especially those with a prolonged clinical course remains common globally and is linked to worse outcomes, despite advancements in the field of nutritional support. Moreover, it has been well established that preoperative malnutrition is associated with higher postoperative mortality.[4]

During the newborn period and infancy, the pediatric pathologist's attention in the past was largely focused on the outcomes of prematurity, such as pulmonary hyaline membrane disease and subependymal and intraventricular hemorrhage of the brain. These days, research and diagnostic pathology are primarily concerned with infectious diseases, metabolic diseases, pathologies of iatrogenic origin, and genetic diseases, including the issue of deformities. The pediatric pathologist and their laboratory colleagues have the responsibility to determine the final diagnosis, even though a preliminary diagnosis may be reached based on clinical considerations.[5]

Despite advancements in aseptic surgery, antimicrobial medication, and postoperative critical care, infection remains a major cause of death and morbidity in children. Widespread unchecked antibiotic use has led to the development of more resistant organisms, leading to a rather complex process of selecting the appropriate antibiotic, especially as newer antibiotics are continually developed.

Search in literature shows lack of good number of reports, particularly in Indian subcontinent, encompassing the profile of paediatric surgical specimen workload.

The prevalence of these lesions is arguably affected by factors like awareness about the problem geographical location, availability of health services, tropical climate and socio-economic conditions of the patients.

Early diagnosis and surgical management of these lesions is the need of the hour to averse the forthcoming complications and improve the quality of life of the affected children.

The present study focussed on profiling the spectrum of surgical lesions in pediatric age group, particularly the first 12 years of life through histopathological examination and processing the then obtained data in a tertiary care centre in Western Uttar Pradesh.

MATERIAL AND METHODS

Study Setting - The present study was a hospital based and conducted in the Department of Pathology, S. N. Medical College Agra in collaboration with the Department of Surgery S. N. Medical College, Agra.

Study Duration - The study was conducted over a period of 18 Months [From September 2022 to March 2024].

Study Design - Cross sectional study.
Sample Size - The study was carried out on paediatric surgical specimens received in the histopathology lab in the Department of Pathology, S. N. Medical College, Agra over a period of 18 months
A total 180 cases were studied.

Inclusion Criteria

- All paediatric surgical specimens till 12 years of age.
- Tissue should be adequate for processing.
- Clinical details should be available for correlation.

Exclusion Criteria

- Inadequate and autolysed tissue.
- Insufficient history for evaluation.
- Specimens not yielding diagnosis.

Methodology

A total 180 cases of paediatric post-surgical resected specimens including biopsies were included in the present study. After receiving the sample gross inspection was done and the size and appearance of the specimen were documented. The specimens were fixed in 10% formal saline for 12 to 24 hours. Then the tissue sections from the representative areas were submitted for further processing and paraffin

wax blocks were made. A 3-4 micrometres section were made from the paraffin wax blocks and stained by routine Haematoxylin and Eosin (H&E) and examined under light microscope. A histological diagnosis was made through light microscopic examination. Special stains and immunohistochemical markers were applied wherever necessary.

The patient's case papers provided the clinical, radiological, and treatment data. Three age groups; less than or equal to five years (< 5 y), six to ten years (6-10 y), and more than ten years (>10 y), were used to group the cases based on age. Following the classification of the lesions' histopathological diagnosis into two groups—"congenital & developmental" and "acquired" conditions—the lesions were further separated into "non-neoplastic" and "neoplastic" subtypes.

Ethical Consideration

The study involves pediatric human subjects suffering from a variety of surgically resectable lesions. Ethical standards followed and the approval of institutional ethical committee obtained (IEC/2024/297).

RESULTS

The study included a total of 180 cases received in the histopathology lab of a tertiary care centre in western Uttar Pradesh, India. Out of 180 total cases, 05 cases had sample proved to be inadequate for evaluation and proper histopathological diagnosis couldn't be made in 12 cases hence were excluded from the study as per the exclusion criteria. So, the actual number of cases under the study was 163.

Out of 163 diagnosed pediatric cases, 69(42.3%) cases were males and 94(57.7%) were females with male to female ratio of 1: 1.4 and female preponderance. The surgical lesions were classified into congenital & developmental and acquired lesions. Acquired lesions were again reclassified into non neoplastic and neoplastic lesions. Females were affected more than males in both congenital & developmental and acquired lesions.

Table.1: Overall Distribution Of Pediatric Surgical Lesions

S. No	SURGICAL LESIONS	TOTAL	MALES	FEMALES	0-5 Y	6-10 Y	>10 Y
01	Congenital & developmental lesions	17	07	10	07	03	07
02	Non neoplastic lesions	116	52	64	15	57	44
03	Neoplastic benign lesions	26	09	17	03	10	13
04	Neoplastic malignant lesions	04	01	03	02	01	01
	TOTAL	**163**	**69**	**94**	**28**	**71**	**64**

Among 17 congenital and developmental lesions 7 belonged to males and 10 belonged to females with 41% and 59% respectively. Among 146 acquired pediatric surgical lesions 62 cases were males and 84 were females with 42.5% and 57.5% respectively.

The study included cases from 1 day old to 12 years of age. The cases were further subdivided into lesions belonging to 0-5 years, 6-10 years and >10 years of age with71(43.5), 64(39.3) and 28(17.2) cases respectively.

Among 146 acquired surgical lesions majority of the cases belonging to 6-10 years age group followed by >10 years and 0-5 years of age with 68(46.6%), 57(39%) and 21(14.4%) cases respectively. Out of 17 congenital and developmental lesions majority of cases (7, 41.2%) belonged to 0-5 years age group followed by >10yrs (7, 41.2%) and 6-10 years (3, 17.6%).

Table 2: Congenital and developmental pediatric surgical lesions

S. No	Diagnosis	Total	Male	Female	0-5y	6-10y	>10y
1	Hirschsprung's disease	03	02	01	02	01	00
2	Preauricular sinus	02	00	02	00	00	02
3	Vitello intestinal duct	01	00	01	01	00	00
4	Neural tube defects	04	03	01	03	00	01
5	Branchial cyst	01	01	00	01	00	00
6	Cystic hygroma	01	00	01	00	01	00
7	Sacro coccygeal teratoma	01	00	01	00	01	00
8	Choledochal cyst	01	00	01	00	00	01
9	PUJ obstruction	01	00	01	00	00	01
10	Lymphovascular malformation	01	01	00	00	00	01
11	Meckel's diverticulum	01	00	01	00	00	01
	Total	**17**	**07**	**10**	**07**	**03**	**07**

Table 3: Non neoplastic surgical lesions

S. No	Diagnosis	Total	Male	Female	0-5y	6-10y	>10y
01	Acute appendicitis	12	06	06	00	06	06
02	Healing appendicitis	03	01	02	00	02	01
03	Chronic appendicitis	02	01	01	00	01	01
04	Recurrent appendicitis	01	01	00	00	01	00
05	Antrochoanal polyp	10	07	03	01	06	03
06	Cholesteatoma	10	03	07	00	07	03
07	Phimosis	01	01	00	01	00	00
08	Ileal stricture	01	00	01	00	00	01
09	Gynaecomastia	01	01	00	00	00	01
10	Chronic granulomatous lesions	03	01	02	00	01	02
11	Juvenile polyp	03	01	02	02	01	00
12	TB lymphadenitis	02	00	02	00	01	01
13	Chronic tonsillitis	01	00	01	00	00	01
14	Foreign body granuloma	01	00	01	00	01	00
15	Chronic rhinitis	01	00	01	00	01	00
16	Keratosis obturans	01	00	01	00	01	00
17	Chronic enteritis	02	01	01	00	01	01
18	Olecranon bursitis	02	01	01	00	01	01
19	Mastoiditis	02	01	01	00	02	00
20	Gangrenous bowel	01	01	00	01	01	00
21	Pemphigus foliaceous	01	00	01	00	01	00
22	Chronic orchitis	01	01	00	01	00	00
23	Synovitis	02	00	02	00	00	02
24	Chronic blepharitis	01	00	01	00	00	01
25	Gangrene of right hand	01	01	00	01	00	00
26	Perineal fistula	01	00	01	00	01	00
27	Aural polyp	01	00	01	00	00	01
28	Acute calculous cholecystitis	01	01	00	00	00	01
29	Verruca palmaris	01	01	00	00	00	01
30	Florid lymphoid hyperplasia	04	02	02	01	02	01
31	Nonspecific lymphadenitis	02	01	01	00	01	01
32	Chronic cholecystitis	06	03	03	01	01	04
33	Hydatid cyst	01	00	01	00	00	01
34	Tuberculoid leprosy	01	01	00	00	00	01
35	Pleuro-cutaneous fistula	01	00	01	00	01	00
36	Sinus tract	01	01	00	00	01	00
37	Ranula	06	03	03	00	05	01
38	Hepatic cyst	01	01	00	01	00	00
39	Dermoid cyst	02	01	01	01	02	00
40	Epidermal inclusion cyst	10	02	08	02	04	04
41	Conjunctival cyst	01	00	01	00	00	01
42	Chronic colitis	01	01	00	01	00	00
43	Necrotizing granulomatous lymphadenitis	01	00	01	00	01	00
44	Calcinosis cutis	01	01	00	00	00	01
45	Inflammatory nasal polyp	01	00	01	01	00	00
46	Hypertrophic scar	01	01	00	00	01	00
47	Chronic otitis media	02	01	01	00	02	00
48	Ganglion cyst	02	01	01	00	01	01
49	Chronic pyelonephritis	01	01	00	00	00	01
	Total	**116**	**52**	**64**	**15**	**57**	**44**

Table 4: Neoplastic surgical lesions

S. No	Diagnosis	Total	Male	Female	0-5y	6-10y	>10y
01	Schwannoma	02	00	02	00	00	02
02	Pleomorphic adenoma	02	00	02	00	01	01
03	Pilocytic astrocytoma	01	00	01	01	00	00

04	Chondroblastoma	02	01	01	00	00	02
05	Osteochondroma	01	01	00	00	00	01
06	Exostosis	01	00	01	00	00	01
07	Odontogenic myxoma	01	00	01	00	01	00
08	Lymphangioma	01	00	01	00	01	00
09	Pilomatricoma	01	01	00	00	00	01
10	Infarcted fibroadenoma	01	00	01	00	00	01
11	Dermal nevus	01	00	01	00	01	00
12	Nodular fasciitis	01	00	01	00	00	01
13	Neurofibroma	02	01	01	00	00	02
14	Haemangioma	04	03	01	02	01	01
15	Lipoma	03	01	02	00	03	00
16	Nasopharyngeal angiofibroma	01	01	00	00	01	00
17	Osteofibrous dysplasia	01	00	01	00	01	00
18	Wilm's tumor	01	00	01	01	00	00
19	Osteosarcoma	01	01	00	00	00	01
20	Ependymoma	01	00	01	01	00	00
21	Malignant round cell tumor	01	00	01	00	01	00
	Total	**30**	**10**	**20**	**05**	**11**	**14**

Table 5: System wise distribution of pediatric surgical lesions

S No	System	Total	Males	Females	0-5y	6-10y	>10yrs
1	Gastrointestinal tract	38	20	18	08	18	12
2	Head and neck region	24	09	15	02	13	09
3	Musculoskeletal system & joints	12	04	08	00	04	08
4	Lymph node	09	03	06	01	05	03
5	Renal	02	01	01	01	00	01
6	Respiratory system	13	06	07	02	07	04
7	Nervous system	11	05	06	04	02	05
8	Liver and biliary system	10	04	06	02	02	06
9	Urogenital system	03	02	01	02	00	01
10	Skin and soft tissue	33	12	21	03	18	12
11	Vascular system	06	02	04	02	02	02
12	Breast	02	01	01	01	00	01
	Total	**163**	**69**	**94**	**28**	**71**	**64**

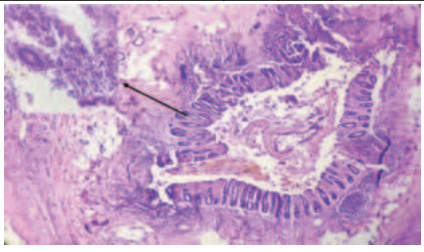

Figure - 1: Acute appendicitis, 40X. Infiltration of neutrophils and eosinophils in the mucosa and submucosa (inset 400X). H&E stain.

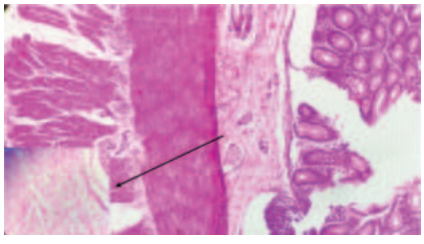

Figure - 2: Hirschprung's disease, (40X, H&E). Shows absence of ganglion cells in the submucosal layer of rectum.

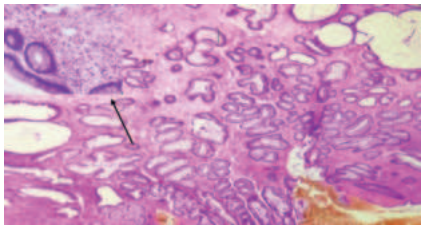

Figure - 3: Juvenile polyp 40X. showing colonic glands with edematous stroma and inflammation (inset, 400X). H&E stain.

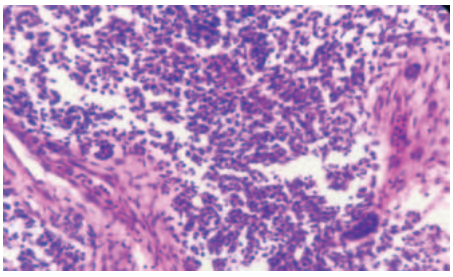

Figure – 4: Nephroblastoma, (400X, H&E). Shows predominantly blastemal component along with epithelial and stromal components. Blastemal component consisting of sheets of randomly arranged & densely packed small cells with darkly staining nuclei. Epithelial component consists of tubules and stroma is myxoid.

DISCUSSION

The present cross-sectional study analysed 163 diagnosed pediatric histopathological cases at the department of Pathology, Sarojini Naidu medical college and hospital at Agra in Western Uttar Pradesh over a period of 18 months from September 2022 to March 2024.

The surgical pathology specimens pose several challenges for pathologists as they differ from adults in variety of factors such as their natural history and management. Numerous elements, including topography, tropical climate, and socioeconomic status, are known to have an impact on them. They include both benign and malignant neoplasms, acquired disorders, and developmental and congenital abnormalities.[1]

In our study, out of 163 histopathologically diagnosed cases, 69 cases were males and 94 cases were females with female predominance. No study was found concordant with our study as those conducted by Seema Bijjaragi et al[1], Shah et al[2], Kaur et al[9] and others reported male predominance.

The age group considered under the study ranged from 0 to 12 years with youngest patient under the study being 6 months old and oldest patient is 12 years. The pediatric cases were again sub grouped into three age groups 0-5 years, 6-10 years and >10 years (>10 years to <12 years). The most common age group under the study affected is 6-10 years followed by >10 years and 0-5 years. This was in concordance with the study by Kaur et al[9] who reported the most commonly affected age group to be 4-13 years and in discordance with the study by Shah et al[2] and Seema Bijjragi et al[1] as they reported it to be 1 month to 1 year and 0-5 years age group respectively.

Our study distributed the total lesions into Congenital & Developmental and Acquired lesions. Acquired lesions were again divided into non neoplastic and neoplastic lesions; neoplastic were then into benign and malignant lesions.

Determining the histological type of congenital and developmental lesions, which make up a sizable number of pediatric surgical pathology specimens, would help in understanding their genesis and evolution because their management and outcome are entirely different from those of adults.[11] Birth defects registry of India revealed the most common congenital anomaly in children to be Neural tube defects (NTD's).[7] Our study is in concordance with the birth defects registry of India as we had 4 cases (highest) of meningocele; 1 cranial, 2 lumbar and 1 in sacral region. Cases were mostly in males of 0-5 years age group.

Gastrointestinal tract lesions were the most common among all the cases in our study with acute appendicitis being the most common GIT lesion followed by skin and subcutaneous tissue, head and neck lesions etc. This is in concordance with Shah et al[2] and Seema Bijjaragi et al[1].

The most frequent clinical ailment in children requiring emergency abdominal surgery is appendicitis.[11] **(Fig. 1)** In our study, the majority of cases were found to be between the ages of 6 and 10, with older cases following, with males experiencing higher rates of infection than females. Prasaad PR et al[11], Seema Bijjaragi et al[1], and Shah et al[2] all made similar observations. The mortality rate for children with acute

appendicitis has significantly decreased recently due to aggressive fluid resuscitation, improvements in anaesthetic technique, and antibiotic therapy.[8]

Hirschprung's disease **(Fig. 2)** is an enteric nervous system developmental abnormality typified by the lack of ganglion cells in the distal intestine's myenteric and submucosal plexuses. Hirschsprung's illness is diagnosed in around half of the patients within the first three months of birth, and in 20% of cases within the first year of life. As late as age five, up to 15% of individuals may not receive a diagnosis.[12] In our study Hirschprung's disease is the most common congenital disease of gastrointestinal system with 3 cases, mostly in males of 0-5 years. Our study was in concordance with the results of study conducted by Nilesh shah et al[2] and Seema Bijjaragi et al[1] in Western India and Southern India respectively.

The most prevalent congenital digestive system abnormality is Meckel's diverticulum, which most research indicate occurs between 0.6% and 4% of the population. The proximal portion of the congenital vitello-intestinal duct's persistence is to blame for this. It is a real diverticulum that is usually found on the antimesenteric border. It has a separate blood supply from the vitelline artery and contains all the layers of the intestinal wall.[6] However, in our study we had a single case of Meckel's diverticulum diagnosed in a female of age 10 years.

Juvenile polyps **(Fig. 3)**: According to histological definitions, 90% of colonic polyps in children are "juvenile". Polyps can affect up to 1% of children. Most people believe that juvenile polyps are hamartomatous lesions with low potential for malignancy. Conversely, "juvenile polyposis coli" is an uncommon disorder that may lead to cancer.[15] Three cases of juvenile polyps were included in our investigation; it was discovered that females were more commonly affected than males, and that the most common age group affected was 0–5 years. The diagnosis was made based on both the physical appearance and the histological findings**.**

Skin and subcutaneous lesions were the second most common diagnosed lesions and Epidermal inclusion cyst was the most commonly operated pediatric skin lesion with 10 cases mostly in females.[8], most commonly affected age groups were 6-10 years and >10 years. This was not in concordance with any of the studies referred.

Head and neck lesions were among the most common lesions diagnosed in our study and cholesteatoma was the most common resectable lesion in this region. Females were affected more than males and the most commonly affected age groups were 6-10 years and >10 years. Our study is not in concordance with any other study referred in this category.

One of the most prevalent benign tumors in infancy is Hemangioma. While the majority (80%) occur during the first month of life, they are unlikely to be present at birth. Thus, a fully developed vascular lesion on a baby is a vascular malformation, while a Hemangioma is one that appears during the neonatal stage.[10] Four cases of haemangiomas, including one each of capillary and cavernous haemangiomas, and one case of Lymphovascular malformation were included in our study. Most cases were diagnosed in males, and children aged 0 to 5 were the most frequently affected age group. The only documented congenital vascular lesion in the vascular system was Lymphovascular malformation. This aligns with the findings of Seema Bijjaragi et al[1].

Our study had 12 cases of surgical pathology lesions involving bones and joints with female preponderance. Chondroblastoma & osteochondroma were the most common benign tumors and Osteosarcoma in a 11year male & Malignant round cell tumor of humerus in a 7year female were the malignant bone tumors diagnosed in this category. These findings were in concordance with Deoghare SB et al[13].

Nervous system was affected with surgical lesions in 11 cases in our study. Males and females were almost equally affected with schwannoma and astrocytoma being the most common benign lesions and Ependymoma in a 3year female was the most common malignant lesion. The most common age groups affected were >10 years and 0-5 years. Our study is in concordance with Joshi H et al[16] and in discordance with Vijaya Lakshmi Muram Reddy et al[6] who reported Astrocytoma & meningioma to be the most common benign tumors and metastatic brain tumor to be the most common malignant tumor of nervous system.

Antrochoanal polyp followed by inflammatory nasal polyp were the most common surgical lesions found in th respiratory tract with 10 cases and 02 cases in our study. Males were affected more than females in Antrochoanal polyp with male:female ratio of 7:3. Most commonly affected age groups were 6-10 and >10 years. These findings are in concordance with Seema Bijjaragi et al[1].

Wilm's tumor (Nephroblastoma) **(Fig 4)** is the commonest paediatric renal tumor found in children below five years age.[14] Histologically, it is a triphasic tumour with three elements blastemal, stromal and epithelial in varying proportions. This tumour responds well to chemotherapy.[13] In our study, we have a single case of Wilm's tumor diagnosed in a 3 years female presented with abdominal mass. Our study is in concordance with Anu Gupta et al[14] and Seema Bijjaragi et al[1].

CONCLUSION

We concluded that, the current study provides a deep look into the profile of 163 diagnosed pediatric surgical pathology cases in Western Uttar Pradesh in the form of 2 categories (Congenital & Developmental and Acquired lesions) in 3 age groups of pediatric population (till 12 years) i.e., 0-5 years, 6-10 years and >10 years (10-12 years).

Females were affected more than males with 94 and 69 cases respectively. Male:female ratio was 1: 1.4. Among all the age groups under the study, 6-10 years age group was the most affected in both Congenital & Developmental and Acquired lesions.

Pediatric surgical pathology specimens constitute a significant portion of the overall burden of resectable surgical pathology lesions. Understanding about the histological type, progression and outcome of these lesions has a major role in diagnosis and overall management of the disease. The incidence of congenital and developmental lesions and the mortality due to them has been reduced ever since the introduction of novel antenatal and postnatal histopathologic and radiologic diagnostic techniques and preventive measures such as folic acid supplementation in pregnant woman drastically reduced the incidence of various kinds of Neural tube defects (NTD'S).

The studies related to pediatric surgical pathology have been relatively rare in India and Indian subcontinent as most of these studies are either confined to a particular system or about the burden of these cases in all age groups but not just pediatric. Extensive search of literature shows none of the studies done on this subject have attempted to estimate the Prevalence of these lesions.

Limitations

- Lack of good infrastructure and facilities reduce the opportunity to get a spectrum with diverse variety of cases limiting the profile to be of a large number of similar looking cases.
- The current study was a single institution-based study, the results obtained may not really represent the burden throughout the country and prevalence of the disease also cannot be calculated.
- The retrospective nature of this study may seldom help in understanding actual cause of the disease.

We recommend that, bigger community-based studies on this aspect will help in understanding the burden of the disease better and also help in estimating the prevalence of the disease in the country.

Conflict Of Interest: None.
Funding: None.
Institutional Ethical Committee Approval: Obtained (IEC/2024/297).

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