Original Article

Evaluation of Pediatric Oral and Maxillofacial Biopsies from a Tertiary Hospital in Sub-Saharan Africa

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Abstract

Introduction: Despite the large number of published studies on indications for biopsy during investigation of adult oral and maxillofacial pathologies, there is a dearth of literature focusing on biopsies for pediatric orofacial pathologies (particularly in sub-Saharan Africa). **Objectives:** Hence, this study analysed data on maxillofacial pediatric lesions from the surgical pathology archives of the Oral Maxillofacial surgery/Oral pathology unit of Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria. **Method:** Data was collected over a ten year period (2007-2016). **Result:** From a total of 790 biopsies recorded within the study period, only 105 (13.3%) were found to be pediatric cases. Lesions such as ameloblastoma (24%), benign bone pathologies (25%), hyperplastic reactive lesions (22%) and primary oro-facial malignancies (6%), were found within the 105 pediatric cases. Lesions tended to occur more in the mixed dentition to permanent dentition, than primary dentition age groups. A female preponderance in frequency of lesions was also observed in our study. The commonest non-odontogenic tumor was found to be fi brous dysplasia, while pyogenic granuloma was the most prevalent hyperplastic reactive lesions. Lymphangioma and Heck's disease were the commonest soft tissue tumours, and mucous extravasation phenomenon was equally the most frequent salivary gland lesion. Malignancies were found to be rare in pediatric age groups. Overall, we compared our findings to previously published literature on pediatric biopsies. **Conclusion:** We are hopeful that the knowledge provided in this study, may assist general dental practitioners, oral pathologists, and pediatric dentists in sub-Saharan Africa in making precise diagnostic and management decisions.

Keywords: *Africa, biopsy, maxillofacial, pathology, pediatric*

Introduction

Scientific literature is replete with oral and maxillofacial biopsy reviews in adults, including detailed epidemiological information (prevalence, gender predilection, age, site and geographical variations). On the contrary however, such profound biopsy reviews and epidemiological studies have not been adequately reported in pediatric age groups. The few documented research on oral biopsy in pediatric groups has largely been those from the Americas, Europe, United Kingdom and Asia.[1] Such studies have emerged from Turkey,[2] Southern Taiwan,[3] Thailand,[4] as well as North America[5,6] and South America.[7,8] Most of these studies focused only on a particular type of pediatric dental lesion among specific populations. However, there are only a few notable pediatric biopsy studies emanating from sub-Saharan Africa, despite its high burden of diseases.[9] Hence, there is an urgent need to investigate the indications and epidemiology of oral biopsies in pediatric age groups among African populations.

Pediatric patients present diverse oral pathoses that are often variable from those of adults. This is generally attributed to the small size of children, as well as the age-group predilection of some lesions. There can be marked changes in histopathology, clinical behavior, and management of pediatric lesions even when the lesions are common to both adults and children.[10-13] Furthermore, it has been observed from documented studies that the prevalence of pediatric lesions vary as dictated by differences in racial profiles, environmental factors and lifestyle of each affected population. However, there is no consensus about the accepted age for the pediatric groups, as different authors have used different age cut-offs such as

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14-18 years,[8] 15 years,[14] and 16[1] in most regions. Older ages such as 18 years[15,16] and 19 years has even been used in the study of Skinner *et al*.[5]

This study therefore aims at evaluating the incidence of biopsied oral lesions amongst pediatric patients at Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria; and to compare the epidemiological data with those documented in previous studies.

Materials and Methods

This is a cross-sectional, institution-based, retrospective study, which evaluated biopsy records of all oral lesions from pediatric patients aged 0–16 years, in the record files, histopathology forms and the biopsy record book of the Oral Maxillofacial surgery/Oral pathology unit of OAUTHC Ile-Ife from 2007-2016. All cases were considered for analysis of socio-demographic characteristics and clinico-pathological features. Duplicate records were unified and inclusion criterion was: all biopsy reports of all patients between 0-16 years including soft tissue and bony pathologies. Dental pathologies of pulpal, periapical and periodontal causes such as pulpitis, apical periodontitis, dento-alveolar abscess, pericoronitis and gingivitis were excluded, because most of these cases are usually clinically diagnosed without the aid of biopsy. Normal tissues specimen were equally excluded.

Data collected included age, sex, site and histopathological diagnosis for each case. The patients were divided into four age groups *viz*; group 1 (0-4 years), group 2 (5-8 years), group 3 (9-12 years) and group 4 (13-16 years). The study population was also categorized into three age groups according to their dentition period *viz*; primary dentition period (0-6 years old), mixed dentition period (>6-12 years old) and, permanent dentition period (>12-16 years old). Based on these classification system, we analyzed the frequency of biopsy distribution relative to the developmental stage of the dentition. Final diagnoses were recorded after association of the clinical, radiographic and histopathological features. Diagnoses were entered using an alphanumeric code based on modification of diagnostic categories and subgroups as determined by Jones and Franklin into 12 categories for comparison.[17] All data were retrieved and tabulated in a Microsoft Excel (2016) file for epidemiological description.

Data analysis

The data were analyzed using Stata 13 (Statacorp College Station, Texas, USA). Descriptive statistical analyses carried out were for socio-demographic variables such as age, gender, location of tumour and incidences of the lesions. The absolute and relative frequencies were expressed as percentages. Means and standard deviations were used for continuous variables while proportions and tables were used for categorical variables, analysis of each diagnosis entailed: the number of samples, male:female ratio, age range, mean age and standard deviation.

Results

Percentage of children with tumour compared with other age groups

From a total of 790 biopsies recorded within the study period (2007-2016), only 105 (13.3%) were pediatric cases (16 years or below). Of the 105 cases, common categories of lesions seen in both pediatric populations and adult groups as found in this study were ameloblastoma (24%), benign bone pathologies (25%), hyperplastic reactive lesions (22%) and primary oro-facial malignancies (6%). A comprehensive overall distribution of lesions by gender can be found in Table 1.

Age distribution

Patients' age range was between 2 days to 16 years, the mean age being 11.74 years (± standard deviation of 4.2 years). Lesions occurred mostly within the 13-16 years category (n = 58 (55.24%)) involving the early permanent dentition [Table 2]. The occurrence of lesions in the permanent dentition is more than the combined occurrence in both the primary dentition (n = 15) and the mixed dentition (n = 31) [Figure 1a]. Six(6) occurred at the age group of 0-4 years and the most common were benign neoplasm of soft tissue, specifically hemangioma and focal epithelial hyperplasia (heck's disease). Benign odontogenic tumors (BOT) and benign bone pathologies (BBT) were the most common lesions between the age group 5-8 years. This trend also was reflected in the third and fourth group respectively with most prevalence in BOT (n = 8 (total of 27) and (n = 18 (total of 58)) respectively followed by BBT [Table 3].

Gender

This study observed a higher female occurrence (n = 64, 60.95%) as against male gender n = 41 (39.05%) with a male to female ratio of 1:1.6 and this is similarly observed in all the age groups most especially in group 1 where 4 of the 6 pediatric patients in this subgroup are females [Figure 1b]. The mean ages for females and males are 10.93 years (±4.40 years) and 12.99 years (±3.56 years), respectively. BOT were the most common lesion, with a frequency of 26.8% (n = 11) in males and 29.7% (n = 19) in females, other common lesions however differ in males and females. Reactive/inflammatory lesions is observed as the next most common in males with 19.5%, while BBT category is the next common in females with a frequency of 21.9%.

Categories of lesions

Out of 105 biopsied lesions, five (4.76%) were malignant, other were benign lesions. The benign tumours included

Table 1: Distribution of pediatric lesions by gender

Pediatric pathology requiring bopsy	Gender		Total (%)
	Male	Female	
Adenocystic carcinoma	0	2	2 (1.9)
Ameloblastic fibroma	1	0	1 (0.95)
Adenomatoid odontogenic tumour	2	5	7 (6.65)
Central giant cell granuloma	2	3	5 (4.67)
Cyst of the antrum	0	1	1 (0.95)
Dentigerous cyst	3	2	5 (4.67)
Epidermoid cyst	1	1	2 (1.9)
Fibrous dyslpasia	4	6	10 (9.52)
Focal epithelial hyperplasia	2	0	2 (1.9)
Giant cell epulis	0	1	1 (0.95)
Granuloma	1	0	1 (0.95)
Haemangioma	0	2	2 (1.9)
Hodgkins lymphoma	0	1	1 (0.95)
Inconclusive	1	0	1 (0.95)
Lipoma	0	1	1 (0.95)
Lymphangioma	1	2	3 (2.85)
Melanotic nodule	0	1	1 (0.95)
Multifocal papillomavirus epithelial hyperplasia	0	3	3 (2.85)
Mucocele	3	2	5 (4.67)
Neurofibroma	1	0	1 (0.95)
Odontoma	1	0	1 (0.95)
Ossifying fibroma	1	2	3 (2.85)
Odontogenic keratocyst	0	1	1 (0.95)
Odontogenic myxoma	0	2	2 (1.9)
Osteoma	0	3	3 (2.85)
Osteomyelitis	1	0	1 (0.95)
Osteosarcoma	1	0	1 (0.95)
Papilloma	1	0	1 (0.95)
Peripheral fibroma	3	0	3 (2.85)
Peripheral giant cell granuloma	1	0	1 (0.95)
Pleomorphic adenoma	0	1	1 (0.95)
Peripheral ossifying fibroma	0	2	2 (1.9)
Pyogenic granuloma	2	5	7 (6.65)
Rhabdomyoma	0	1	1 (0.95)
Sialadenitis	1	0	1 (0.95)
Submandibular abcess	4	7	11 (10.47)
Squamous cell carcinoma	1	0	1 (0.95)
Unicystic ameloblastoma	2	5	7 (6.65)
White sponge naevus	0	2	2 (1.95)
Total	41	64	105 (100)

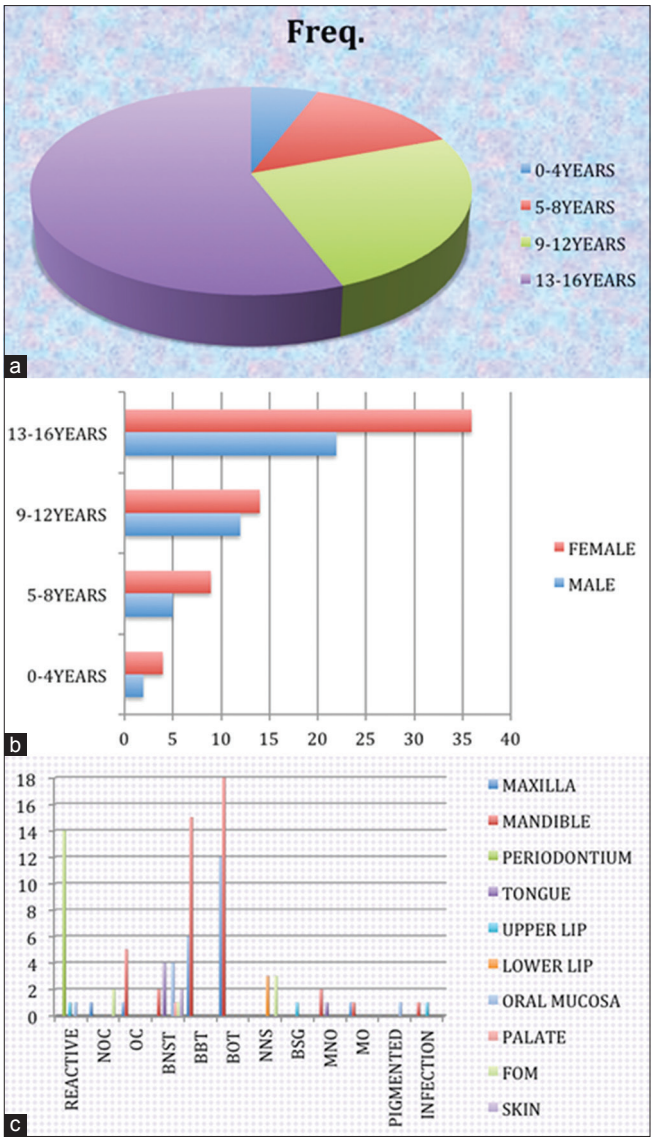

Figure 1: Distribution of pediatric lesions by age group, gender and site of lesion. The frequency of occurrence of maxillofacial lesions in the 13–16 age group is greater than all other pediatric age groups combined (a). Maxillofacial lesions were commoner in females across all pediatric age groups (b). Benign bone tumors and benign odontogenic tumors were some the most frequent indications for biopsy in pediatric age groups in our study (c)

40 soft tissue lesions and 60 lesions of the jaw. The commonest of these benign lesions are odontogenic tumors (n = 30, 28.57%), followed by benign bone pathologies (n = 21, 20%) and the hyperplastic reactive lesions (n = 16, 15.24%). The least common category is the benign salivary gland lesions and oral pigmented lesions with both presenting one case each.

Solid/multicystic ameloblastoma was found to be the most common odontogenic tumor (n = 11, 36.67%) followed by both the unicystic ameloblastoma and adenomatoid odontogenic tumors, each having a frequency of 7 (23.33%). Odontoma and Ameloblastic fibroma had the least occurrence of one case each. The commonest non-odontogenic tumor was fibrous dysplasia (n = 10, 47.62%) followed by the central giant cell granuloma (n = 5, 23.81), osteoma (n = 3, 14.29%) and ossifying fibroma (n = 3, 14.29%).

Pyogenic granuloma was the most prevalent hyperplastic reactive lesions while lymphangioma and Heck's disease were the commonest soft tissue tumours. Mucous extravasation phenomenon was equally the most frequent salivary gland lesion (n = 5). Of the malignant lesions, 2 cases were ameloblastic carcinoma and a peculiar case of a squamous cell carcinoma of the tongue.

Table 2: Summary of age and gender distribution of pediatric patients with oral lesions

Age (years)	Frequency (%)	Sex distribution (male:female)
0	1 (0.95)	
0-4	6 (5.71)	2:4
5-8	14 (13.33)	5:9
9-12	26 (24.76)	12:14
13-16	58 (55.24)	22:36
Total	105 (100.00)	41:63

Table 3: Distribution of pediatric patients by oral disease categories

Categories	Frequency (%)	Sex distribution (male:female)
Reactive	16 (15.24)	8:8
NOC	3 (2.86)	1:2
OC	6 (5.71)	3:3
BNST	14 (13.33)	3:11
BBT	21 (20.00)	7:14
BOT	30 (28.57)	11:19
NNS	6 (5.71)	4:2
BSGT	1 (0.95)	0:1
MNO	3 (2.86)	2:1
MO	2 (1.90)	0:2
Pigmented	1 (0.95)	0:1
Infections	2 (1.90)	2:0
Total	105 (100.00)	

NOC: Nonodontogenic cysts, OC: Odontogenic cysts, BNST: Benign neoplasm of soft tissue, BBT: Benign bone tumor, BOT: Benign odontogenic tumor, NNS: Nonneoplastic salivary gland lesions, BSGT: Benign salivary gland tumor , MNO: Malignant nonodontogenic tumor, MO: Malignant odontogenic tumor

Site

Mandible was the most common location and also the commonest site for jaw tumours whilst the soft tissue lesions occur more on the periodontium and tongue [Figure 1c].

Discussion

This study has provided a much needed audit for the use of diagnostic biopsy services for oral and maxillofacial lesions among patients of pediatric age group in sub-Saharan Africa. Previous oral biopsy studies (mostly coming from outside Africa), have focused on adult populations. The frequency of pediatric oral lesions in all oral biopsies in the present study is 13.29%, which is in agreement with previously documented studies ranging from 12% to 17%.[5,6] In an Iranian population, Abdullah *et al*., observed an incidence of 13.9%;[18] while in a study in Thailand, Saravani *et al*., observed an incidence of 15%,[15] which is slightly lower compared to the incidence of 17% reported by Dhanuthai *et al*. and Ha *et al*., from Australia.[4] The observed frequency in our study is however higher than the range of 5%–8% reported in studies from South America, China, Turkey, Taiwan and the United Kingdom.[2,3,8,17] It is also considerably lower than the 25% incidence reported in the previous African study by Lawoyin.[19] The reason probably accrued to the observed inter-regional variability in incidences of pediatric oral lesions may be due to the lack of a standardized cut off point for pediatric age group (ranging between 12-20) as used by different authors even from the same region. Environmental factor and lifestyle could also be responsible for the variance in frequency of occurrence. Environmental factors such as weather, infection, as well as political climate can affect these variations. While lifestyle factors such as unhealthy living conditions, poverty, lack of education and type of diet may be contributory to these discrepancies as well. In addition, variation in incidence might not be unconnected with the fact that periapical and dental pathologies are not routinely biopsied in resource limited centers but typically included in resource-oriented centers. Furthermore, discrepancies in the methodology pertaining to time frame of the study, age range and disease categorization, geographical region and genetic background of the population have also been mentioned as a contributing factor.[4,20]

An increase in occurrence of lesions was observed with increasing age group. Most pediatric lesions were seen in the oldest age group (from 5.71% in the 0-4 years group to 55.24% in the 13-16 years age groups). Similar trends have been previously reported.[7,8,17] Despite differences in composition of age groups, most studies in the literature revealed a sharp increase in incidence after 6 years of age and a slight increase after 11 years, with many reporting as high as over 70% of occurrence after 9 years of age.[7,15,17] In our present study, about 80% of the lesions occurred after 9 years of age which is consistent with previous reports. Majority of the pediatric lesions in this age group are reactive and benign in nature hence often subjected to delay in biopsied and or surgery.[21] For instance, management of fibrous dysplasia is often delayed till after cessation of puberty due to its inherent nature to stabilize post-puberty. We also found female gender predilection for biopsied oral lesions in our study and this was observed in all the age groups with an overall male to female ratio of 1:1.5 consistent with previous studies.[16,21] However, some studies did not report a gender predominance;[4,7,8,17,20] while others observed a male gender predominance, with male to female ratio in the region of 1.4:1.[13,22] Our study found higher females proportion in the benign neoplasms of soft tissues and reactive inflammatory lesions which concurs with studies from Elarbi *et al.* and Dhanuthai *et al*.[4,23] This may allude to the potential role of hormonal influence in female patients. Regardless of the age groups, benign odontogenic tumours (28.57%), benign bone pathologies (20%), reactive lesions (15.24%) and benign neoplasm of soft tissues (13.33%) were the commonest lesions encountered respectively with all accounting for a total of 77.14% of the total biopsied

in pediatric oral lesions. The 5 commonest lesions overall were ameloblastoma, fibrous dysplasia, pyogenic granuloma, adenomatoid odontogenic tumour and unicystic ameloblastoma. The frequency of odontogenic tumors found in this study is much higher than the frequency of odontogenic tumours reported in other studies, with an average frequency between 2-15%.[8,12,16] The basis for such disparity between African and non-African studies warrants further research. Other studies have reported odontoma as the most common pediatric odontogenic tumors,[8,12] but we found ameloblastoma to have the highest frequency in this study. Similar trend have also been reported for odontogenic tumors in the adult age group in Africa.[19,22] Fibrous dysplasia (n = 10, 47.62%) was the most frequently encountered benign bone pathology in this category followed by central giant cell granuloma (n = 5, 23.81%). Studies reporting fewer benign bone pathologies (BBP) compared to BOTs exist. For example, Lawoyin reported a BBP to BOT ratio of 1:1.44,[19] which is similar to the ratio of 1:1.43 recorded in our study.

In most reported series, the reactive/inflammatory lesions were the most commonly diagnosed. Usually in the range of 15.7% to 66.1%.[5,6,12,15] The reasons we attribute to this high preponderance of reactive/inflammatory lesions may be inappropriate classification/grouping. For instance, many studies have grouped mucocele and central giant cell granuloma (CGCG) as reactive/inflammatory lesions.[5,6,12,15,16] In addition, the symptomatology of reactive/inflammatory lesions necessitates early clinical presentation as compared to other asymptomatic lesions that are diagnosed accidentally.[24] In our study however, the reactive/inflammatory lesion was the third commonest being 15.24% (16 cases) of all biopsies. Pyogenic granuloma was the most prevalent reactive lesion diagnosed, and this is in agreement with other studies.[8,18,25,26] However, other studies have documented fibro-epithelial hyperplasia as the commonest pediatric lesion.[7,20,27] Unlike other categories of lesion, pyogenic granuloma presents a slightly higher occurrence in the "9-12 age group" (mixed dentition) in our study, similar to other reports.[2,4,12] High prevalence of pyogenic granuloma may be adduced to poor oral hygiene and calculus accumulation in mixed dentition.[2,18]

Lymphangioma and multifocal viral epithelial hyperplasia (Heck's disease) were the most frequently observed benign soft tissue neoplasms in our study (n = 3 each, 21.43% each). Although there are contradictory reports in the literature pertaining the prevalence various benign soft tissue tumors, no other series have demonstrated Heck's disease as the commonest among pediatric patients, even in previous African studies. To determine an African or a Nigerian burden of Heck's disease may require further collaborative, multicentre study.[28] Even though highly prevalent in previous studies,[7,8,15,19,26] cystic lesions and salivary gland lesions were found to have frequencies of 8.57% and 6.66%, respectively, in our study. Mucocele, which comprised the majority of salivary gland lesions from Western and Asian countries[5,8,12] was found to be 4.76% of the overall biopsied pediatric lesions in our study.

Of all the 105 cases included in the study, only 5 cases (4.76%) were malignant; implying a low rate of malignancy in children. The mean age for malignant lesions in this study was 10.62 years. However, this frequency is markedly higher than the 0.4-1.28% reported in most studies in the scientific literature.[1,8,12,21] Our report is however in tandem with other studies which have reported a frequency of between 4.5% and 5.5%.[15,18] Our finding is also observed to be lower than other studies that have reported frequencies between 8.9 and 34%.[19,20,29] Most of the higher malignancies were found in studies carried out in low and middle income countries (LMICs); and may be related to late presentation due to financial constraints or knowledge gaps.[30] 60% of the malignant cases in our study occurred in the 13-16 age group in agreement with some African studies that reveal the distribution of malignant tumours to be greater in the second decade of life.[19,31] Malignant lesions in pediatric age groups are considerably rarer, compared with adult biopsies; except in an African study where prevalence was as high as 38%.[29] The reason could be probably due to the endemic nature of Burkitt's lymphoma, which accounts for 75%-89% of all pediatric malignancies in this regions.[19,29,31] Burkitt's lymphoma cases at our centre, are routinely referred to pediatric oncology unit for further management; hence, it is beyond our purview in this study. The two commonest malignant lesions in this study were squamous cell carcinoma and osteosarcoma, which in previous African studies were next commonly encountered lesions after Burkitt's lymphomas.[19,29]

Conclusion

Despite overwhelming literature on indications for adult maxillofacial biopsies, records are critically lacking in pediatric age groups particularly in sub-Saharan Africa. We have presented herein a snapshot of various indications for biopsy in children at a tertiary dental hospital in sub-Saharan Africa. In addition, most literature available on oral and maxillofacial biopsy are of non-African origin. Hence there is a pressing need to establish data on the distribution of the oral and maxillofacial pathologies in pediatric age groups that warrant biopsy in our setting. We have provided information on dental pathologies arising solely from a pediatric subgroups at our hospital; which represented a considerable prevalence in most previously reported series. Moreover, our study setting may also influence the results obtained here, as hospital-based studies are more likely to provide higher frequencies of benign and malignant tumors than dental school-based studies.[21] Notably, data retrieved in the present study do not reproduce the prevalence of oral

and maxillofacial lesions diagnosed by pediatric dentists in clinical practice, since some pathologies, such as herpes simplex and aphthous ulcerations are diagnosed on the basis of clinical features; while the present study was based exclusively on biopsied lesions and hospital records which are often deficient in clinical details. For adequate clinical approach, it is essential to establish consistent differential diagnoses with the dentist recognizing the clinical features and likelihood of the different lesions occurring in pediatric age groups. Although the deficit in pediatric maxillofacial biopsy knowledge persists, the knowledge provided in this study may assist pediatric dentists in sub-Saharan Africa in making precise diagnosis of oral diseases. Dental professionals should carefully document clinical and/or radiographic information of lesions sent for histopathological exam, since they are essential for the establishment of the definitive diagnosis. Not least, the knowledge generated here, may also contribute to the effective planning of educational programs for dental students, primary care dentists and other specialists in the head and neck field.

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Conflicts of interest

There are no conflicts of interest.

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