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RESEARCH ARTICLE

Clinical and epidemiological characteristics of pilomatricomas in a Mexican pediatric population

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Abstract

Background: *Pilomatricoma is a common benign adnexal neoplasm in children. There are few epidemiological studies on this subject, with most relying solely on descriptive statistics.* **Methods:** *A cross-sectional study conducted in two tertiary hospitals in Mexico City from January 2017 to December 2023. Clinical and electronic records of patients with histopathological diagnosis of pilomatricoma, both sexes, under 18 years old, with any type of present comorbidity were selected. Records of patients with diagnosis not confirmed by histopathology or incomplete records were not included in the study.* **Results:** *Fifty-two cases with pilomatrixoma were included in the study, showing a total of 74 lesions. About 23.1% of the cases had multiple pilomatrixomas. 40.4% of the cases experienced pain; this symptom was associated with lesions > 15 mm in diameter and with multiple pilomatrixomas. Risk factors for lesions > 15 mm included age under 8 years, positive tent sign, tumor evolution longer than a year, and a non-classical clinical variety. The head and neck were the most commonly affected areas. The left upper extremity presented larger pilomatrixomas (median 18.5 mm) and occurred more frequently in adolescent patients (mean age 12.1 years) compared to other body areas.* **Conclusions:** *Pilomatrixoma in children shows clinical diversity, with specific findings based on size, number, and anatomical location.*

Keywords: *Pilomatricoma. Pilomatrixoma. Multiple pilomatrixomas. Epithelioma of Malherbe. Pediatric pilomatrixoma.*

Características clínicas y epidemiológicas de los pilomatricomas en una población pediátrica mexicana

Resumen

Introducción: *El pilomatricoma es una neoplasia anexial benigna frecuente en la infancia. Hay muy pocos estudios epidemiológicos al respecto y la mayoría solo han utilizado estadística descriptiva.* **Métodos:** *Estudio transversal realizado en dos hospitales de concentración de la Ciudad de México de enero de 2017 a diciembre de 2023. Se seleccionaron expedientes clínicos y electrónicos de pacientes con diagnóstico histopatológico de pilomatricoma, ambos sexos, menores de 18 años, con cualquier tipo de comorbilidad presente. No se incluyeron los expedientes de pacientes con diagnóstico no confirmado por histopatología o expediente incompleto.* **Resultados:** *Se incluyeron 52 casos con diagnóstico de pilomatricoma que mostraron un total de 74 lesiones. El 23.1% de los pacientes tuvieron pilomatricomas múltiples. El 40.4% experimentaron dolor; este signo se asoció con lesiones de diámetro superior a 15 mm y pilomatricomas múltiples. La edad menor de 8 años,*

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el signo de la tienda de campaña positivo, un tiempo de evolución mayor de 1 año y una variedad clínica no clásica son factores de riesgo asociados con las lesiones mayores de 15 mm. La cabeza y el cuello fueron las áreas más comúnmente afectadas por estos tumores. La extremidad superior izquierda presento pilomatricomas de mayor tamaño (mediana 18.5 mm), y ocurrieron más en pacientes adolescentes (media 12.1 años), en comparación con otras áreas del cuerpo. **Conclusiones:** *El pilomatricoma en niños muestra diversidad clínica. Presenta hallazgos y asociaciones específicas según el tamaño, el número y la ubicación anatómica.*

Palabras clave: *Pilomatricoma. Pilomatrixoma. Pilomatricomas múltiples. Epitelioma de Malherbe. Pilomatricoma pediátrico.*

Introduction

Adnexal skin tumors are rare and usually benign neoplasms that originate from the epithelial adnexal of the skin, such as the pilosebaceous unit, and the eccrine or apocrine sweat glands. These tumors often have morphological similarities, making histopathological examination necessary for diagnostic confirmation[1].

Pilomatrixoma, also known as calcifying epithelioma of Malherbe, is a benign adnexal neoplasm that originates from the matrix cells of hair follicles. It accounts for 1-1.59% of benign skin tumors, and its incidence in dermato-histopathological materials ranges from 0.001% to 0.0031%. Pilomatrixomas are more frequent before the age of 20, with a mean age of 16 years and 7 months. Their size varies from 0.4 to 20 cm, with a mean of 0.8 cm[2-4].

At the clinical level, classic pilomatrixoma presents as a mobile, firm nodule with a hard or stony consistency when calcified, featuring irregular yet well-defined borders, and it is typically asymptomatic with slow growth. Variants include the perforating type, where the lesion is superficial and calcific material erodes the epidermis, forming a crust over a small ulcer; the anetodermic or pseudoampullar type, where the tumor skin may be thinned, atrophic, with telangiectasias, and herniation of the underlying mass; and the giant type, when the lesion measures over 4 cm[4]. Some patients may experience pain (50%), sensitivity, and itching at the site[3,5]. They are often misdiagnosed as other skin conditions, with only 16% of lesions correctly diagnosed on clinical examination[3].

Pilomatrixomas can occur throughout the body, with a predominance in the head and neck region among the Mexican population (39.6-55.2%). Other affected areas include the upper extremities (26.3-42.4%), trunk (15.7-16.4%), and lower extremities (51.3-2.6%)[5]. Laterality is reported in 15% of cases, with 72% occurring on the right side[3].

Diagnosis is confirmed through histological examination, revealing a neoplasm composed of three cellular populations: basaloid cells, transition cells with picnotic nuclei, and eosinophilic anucleate cells ("ghost cells"). Definitive treatment involves complete excision with clear margins, with recurrence rates ranging from 0.48% to 1.4%[3,5].

Epidemiological studies in pediatric populations are scarce, particularly among Latino children, and most research has been limited to descriptive analysis of findings. We sought to describe the clinical-epidemiological characteristics of pilomatricomas in a Mexican pediatric population and determine their potential clinical associations.

Methods

Study type and location

This is a cross-sectional, descriptive, retrospective, and observational study conducted at two tertiary hospitals in Mexico City (General Hospital "Dr. Gaudencio González Garza" CMN La Raza and General Hospital of Mexico "Dr. Eduardo Liceaga") from January 1, 2017, to December 31, 2023. This study adhered to the guidelines outlined in the Helsinki Declaration, the Belmont Report, and the General Health Law regarding health research, including information on internal ethics committees in healthcare institutions (articles 100, 103, and 105) and the Official Mexican Standard NOM012-SSA3-2012, with internal registration number R-2023-3502-107[6,7].

Protocol

Clinical and electronic records of patients with the histopathological diagnosis of pilomatricoma were selected for inclusion in the study. Both sexes under the age of 18 with any type of present comorbidity were included in the study. Records of patients with a diagnosis not confirmed by histopathology and incomplete clinical records were excluded from the study. Epidemiological and clinical information was collected from the records. The study variables analyzed were sex, age, nutritional status, underlying diseases or comorbidities, number of lesions, duration, size, signs and symptoms present,

diagnostic suspicion, variety, topography, and treatment. Data collection was performed by three pediatric dermatologists.

Statistical analysis

The sample size was calculated using the statistical software Open Epi version 3, based on a population proportion with a hypothetical disease frequency of 1.5%, derived from prevalence information described in the literature[2,3]. A sample of 52 cases was obtained. The sample was selected using a non-probabilistic and non-random method.

Kolmogorov-Smirnov tests were conducted to assess normality. Variables that met this criterion were summarized as means and standard deviations as a measure of dispersion. Variables with non-normal distribution were summarized as medians and interquartile range as a measure of dispersion. Nominal variables were summarized with frequencies and percentages. Inferential statistics were applied, and the Student's t-test was used to compare means, Mann–Whitney U test for medians, and Pearson's R2 test or Fisher's exact test to evaluate categorical variables. Multivariate logistic regression analyses were performed and stratified by lesion size and number. Variable selection was carried out using the backward regression method. The IBM SPSS version 26 software was used, and a bilateral $p < 0.05$ was considered statistically significant.

Table 1. Baseline demographic characteristics of pediatric patients with pilomatricomas

Variable	n = 52
Sex, No. (%)	
Male	29 (59.8)
Female	23 (44.2)
Age, mean (SD), years	
At diagnosis	9.8 (± 3.5)
Onset of dermatosis	8.3 (± 3.9)
Nutritional status, No. (%)	
Underweight	1 (1.9)
Normal	22 (42.3)
Overweight	16 (30.8)
Obesity	13 (25.0)
Comorbidity, No. (%)	
Absent	36 (69.2)
Present	16 (30.8)
Lesion, No. (%)	
Single	40 (76.9)
Multiple	12 (23.1)
Time of evolution, months, median (IQR)	10.0 (6.0, 24.0)
Clinical size in mm, median (IQR)	15.0 (10.0, 20.0)
Referral diagnostic suspicion, No. (%)	
Pilomatricoma	27 (51.9)
Lesion description	7 (13.5)
Tumor of cutaneous adnexa	11 (21.2)
Other cutaneous tumors	7 (13.5)
Pilomatricoma variety, No. (%)	
Classic	64 (86.5)
Perforating	2 (2.7)
Anetodermic	7 (9.5)
Giant	1 (1.4)

IQR: interquartile range; SD: standard deviation.

Results

A total of 52 cases of pilomatricomas were included in the study, with 40 cases (76.9%) presenting a single lesion and 12 cases (23.1%) multiple lesions. Among cases with multiple lesions, six cases had two lesions, three cases had three lesions, two cases had four lesions, and one case had five lesions. In total, 74 pilomatricomas were documented. The baseline epidemiological characteristics of the studied population are summarized in table 1. Underlying medical conditions were found in 15 patients (28.8%): 6 with atopy, 3 with attention deficit hyperactivity disorder, and only one case each of alopecia areata, autism, Hodgkin lymphoma, Turner syndrome, hyperlaxity syndrome, metabolic syndrome, and short stature, respectively. The patient with Turner syndrome had multiple pilomatricomas (2 lesions).

Table 2 presents the results of pilomatricomas according to lesion size. It was observed that the presence of the tent sign (Fig. 1) and pain is associated with lesions > 15 mm in diameter, while the rest of the clinical variables showed no significant associations. Table 3 shows an unadjusted logistic regression model that also demonstrates the association of pain and the tent sign with larger lesions. Table 4 presents the adjusted logistic regression model, which found that age under 8 years, a positive tent sign, a tumor evolution time of more than one year, and the presence of another clinical variety of pilomatricoma (different from the classic type) are risk factors associated with lesions > 15 mm in diameter.

Table 5 summarizes the results of pilomatricoma cases according to the number of lesions. Multiple pilomatricomas were associated with the presence of pain and a longer duration of evolution, with single lesions having a median duration of 7 months compared to

Table 2. Baseline characteristics of pilomatrixomas stratified by lesion size

Variable	Less than 15 mm (n = 30)	Greater than 15 mm (n = 22)	p-value
Sex, No. (%)			
Male (n = 29)	16 (53.3)	13 (59.1)	0.78*
Female (n = 23)	14 (46.7)	9 (40.0)	
Age, mean (SD), years			
At diagnosis	10.3 (± 3.4)	9.3 (± 3.7)	0.34**
Onset of dermatosis	8.8 (± 4.0)	7.8 (± 3.0)	0.38**
Nutritional status, No. (%)			
Low/normal (n = 23)	11 (36.7)	12 (54.5)	0.26*
Overweight/obesity (n = 29)	19 (63.3)	10 (45.5)	
Comorbility, No. (%)			
Absent (n = 37)	20 (66.7)	17 (73.3)	0.76*
Present (n = 15)	10 (33.3)	6 (22.7)	
Lesion, No. (%)			
Single (n = 40)	24 (80.0)	16 (72.6)	0.53*
Multiple (n = 12)	6 (20.0)	6 (27.3)	
Time of evolution, months, median (IQR)	6.5 (3.7, 15.0)	12 (8.0, 24.0)	0.28***
Signs and symptoms, No. (%)			
Positive tent sign (n = 19)	6 (20.0)	13 (59.1)	< 0.01*
Pain present (n = 21)	8 (26.7)	13 (59.1)	0.02*
Calcification (n = 24)	11 (36.7)	13 (22.0)	0.16*
Pilomatricoma variety, No. (%)			
Classic (n = 42)	26 (86.7)	16 (72.7)	0.50****
Perforating (n = 2)	1 (3.3)	1 (4.5)	
Anetodermic (n = 7)	3 (10.0)	4 (18.2)	
Giant (n = 1)	0	1 (4.5)	
Referral diagnosis suspicion, No. (%)			
Pilomatricoma (n = 27)	17 (56.7)	10 (45.5)	0.57*
Other tumors (n = 25)	13 (43.3)	12 (54.5)	

*Pearson's R2.
**Student's t-test.
***Mann-Whitney U test.
****Fisher's X2.
IQR: interquartile range; SD: standard deviation.

38 months for multiple lesions ($p \leq 0.01$). No other variables showed significant associations. Table 6 presents an unadjusted model confirming the association of multiple pilomatricomas with pain and a longer evolution time. These two variables were the only ones included in the adjusted logistic regression model (Table 7).

In addition, the only significant finding from comparing different clinical types of pilomatrixoma was age: (a) the classic type appeared at an average age of 7.9 ± 3.9 years, compared to other clinical varieties that emerged at 10.4 ± 3.5 years ($p = 0.05$), and (b) the anetodermic type appeared at 10.8 ± 1.4 years, significantly later than other varieties, which presented at 8.0 ± 4.1 years ($p < 0.01$).

Table 8 describes the global and specific topography of pilomatricomas. The tumors predominantly appeared on the right side of the body (51.4%). The most common location was the head and neck (36.5%), followed by the trunk (21.6%), with the fewest lesions appearing on the lower extremities (6.8%). Table 9 compares the variables of age and pilomatricoma size with respect to topography. The results show that the left upper extremity exhibited two distinct characteristics compared to other regions: (a) pilomatricomas had a larger diameter in this location compared to others (18.5 mm vs. 10.0 mm, $p = 0.01$, Mann–Whitney U test), and (b) the age of presentation in this site was during adolescence (12.1 ± 2.8 years), compared to other locations where it appeared in childhood (9.5 ± 3.2 years, $p < 0.01$, Student's t-test).

In 14 cases (26.9%), ultrasound was considered necessary to guide the clinical diagnosis. All lesions were surgically excised, and their diagnosis was confirmed by histopathology. No lesion showed signs of malignancy.

Table 3. Unadjusted model of clinical factors and dermatological findings of pilomatricomas associated with lesion size

Variable	OR	CI 95% inferior	CI 95% superior	p-value	R squared
Sex, male	1.26	0.41	3.84	0.68	<0.01
Age: < 8 years	2.27	0.68	7.54	0.17	0.04
Nutritional status, overweight/obesity	2.07	0.67	6.35	0.20	0.04
Comorbility, present	1.70	0.48	5.95	0.40	0.01
Multiple lesions	1.50	0.41	5.48	0.54	0.01
Time of evolution: > 1 year	2.27	0.68	7.54	0.17	0.04
Signs and symptoms, No. (%)					
Positive tent sign	5.77	1.68	19.84	< 0.01	0.20
Pain present	3.97	1.22	12.84	0.02	0.13
Calcification	2.49	0.80	7.71	0.11	0.06
Pilomatricoma variety, classic	2.43	0.59	9.98	0.21	0.04

CI: confidence interval; OR: odds ratio.

Table 4. Adjusted logistic regression model of clinical factors associated with pilomatricoma size >15 mm

Variable	OR	CI 95% inferior	CI 95% superior	p-value	R squared
Age: < 8 years	7.17	1.33	38.74	0.02	0.41
Positive tent sign	9.89	2.15	45.36	<0.01	
Time of evolution: > 1 year	5.73	1.12	29.22	0.03	
Other types of pilomatricoma (non-classic)	7.38	1.17	46.33	0.03	

CI: confidence interval; OR: odds ratio.

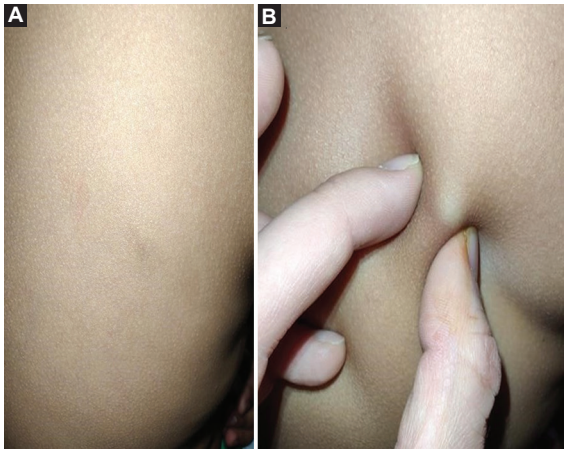

Figure 1. A: in the case of pilomatricoma, a blue grayish discoloration is observed on the skin surface. **B:** the tent sign facilitates a better appreciation of the lesion by stretching the overlying skin, allowing for a clearer definition of the tumor margins and its characteristic faceted nature.

The median time for surgery was 1 month (0, 2.0). In no case was recurrence of the lesion reported.

Discussion

There are few studies on pilomatricomas focused exclusively on the pediatric population, despite this being the age group where these adnexal tumors are most common. The reasons for their higher incidence in childhood and the main risk factors in children remain unknown. The mean age of lesion appearance in this study was 8.3 ± 3.9 years, similar to what has been reported in studies with Canadian (8.7 years), Turkish (9.5 years), Argentine (9.5 years), and Korean (7.7 years) children[8-11]. Regarding sex, our study observed a slight male predominance at a ratio of 1.2:1, contrasting with findings in American and Italian children where females predominated at ratios of 1.75:1 and 2:1, respectively[12,13]. However, other studies have reported similar

Table 5. Baseline characteristics of pilomatricomas contrasted by number of lesions

Variable/lesion	Single (n = 40)	Multiple (n = 12)	p-value
Sex, No. (%) Male (n = 29) Female (n = 23)	 21 (52.5) 19 (47.5)	 8 (66.7) 4 (33.3)	 0.51*
Age, mean (SD), years At diagnosis Onset of dermatosis	 9.8 (+ 3.8) 8.8 (+ 4.0)	 10.1 (+ 2.6) 7.0 (+ 3.7)	 0.82** 0.18**
Nutritional status, No. (%) Low/normal (n = 23) Overweight/obesity (n = 29)	 20 (50.0) 20 (50.0)	 3 (25.0) 9 (75.0)	 0.18*
Comorbility, No. (%) Absent (n = 37) Present (n = 15)	 28 (70.0) 12 (30.0)	 9 (75.0) 3 (25.0)	 0.99***
Size, No. (%)	15 (9.0, 20.0)	17.5 (10.0, 28.5)	0.24****
Time of evolution, months, median (IQR)	7.0 (5.0, 12.0)	38.5 (10.5, 57.0)	< 0.01****
Signs and symptoms, No. (%) Positive tent sign (n = 19) Pain present (n = 21) Calcification (n = 24)	 14 (35.0) 12 (30.0) 17 (42.5)	 5 (41.7) 9 (75.0) 7 (58.3)	 0.73*** < 0.01*** 0.51*
Pilomatricoma variety, No. (%) Classic (n = 42) Other varieties (n = 10)	 32 (80.0) 8 (20.0)	 10 (83.3) 2 (16.7)	 1.00***
Referral diagnosis suspicion, No. (%) Pilomatricoma (n = 27) Other tumors (n = 25)	 22 (55.0) 18 (45.5)	 5 (41.7) 7 (58.3)	 0.51*

*Pearson's R2.
**Student's t-test.
***Fisher's X2.
****Mann-Whitney U test.
IQR: interquartile range; SD: standard deviation.

Table 6. Unadjusted model of clinical factors and dermatological findings associated with multiple pilomatricomas

Variable	OR	CI 95% inferior	CI 95% superior	p-value	R squared
Sex, male	1.81	0.46	6.98	0.39	0.02
Age: < 8 years	1.44	0.33	6.24	0.62	< 0.01
Nutritional status, overweight/obesity	3.00	0.70	12.74	0.13	0.07
Comorbility, Present	1.28	0.29	5.59	0.73	< 0.01
Size > 15 mm	1.50	0.41	5.48	0.54	0.01
Time of evolution: > 1 year	4.82	1.22	18.91	0.02	0.14
Signs and symptoms, No. (%) Positive tent sign Pain present Calcification Pilomatricoma variety, classic	 1.37 7.00 1.89 1.25	 0.35 1.60 0.51 0.22	 4.96 30.4 7.00 6.87	 0.67 0.01 0.33 0.79	 < 0.01 0.21 0.02 < 0.01

CI: confidence interval; OR: odds ratio.

frequencies in both sexes[8,10,11,14]. To date, no significant differences or associations have been identified when contrasting different clinical findings with sex.

Clinically, several studies have reported that pilomatricomas are usually asymptomatic and slow-growing tumors[8,13,15]. However, Figueroa-Basurto et al., in a study

Table 7. Adjusted model of clinical factors associated with multiple pilomatricomas

Variable	OR	CI 95% inferior	CI 95% superior	p-value	R squared
Pain present	5.00	1.06	23.63	0.04	0.25
Time of evolution: > 1 year	2.86	0.64	12.67	0.16	

CI: confidence interval; OR: odds ratio.

Table 8. Topography of pilomatricomas

Hemibody side	No. (%)	General topography	No. (%)	Specific topography	No. (%)
Right	38 (51.4)	Head		Scalp	
Left	27 (36.5)	Scalp	4 (5.4)	Temporal	4 (5.4)
Near the midline	9 (12.2)	Face	16 (21.6)	Face	
Total	74 (100)	Neck	7 (9.5)	Forehead	2 (2.7)
		Trunk	16 (21.6)	Eyebrow	2 (2.7)
		Right upper extremity	14 (18.9)	Eyelid	1 (1.4)
		Left upper extremity	12 (16.2)	Preauricular	3 (4.1)
		Right lower extremity	3 (4.1)	Ear	1 (1.4)
		Left lower extremity	2 (2.7)	Cheek	6 (8.1)
		Total	74 (100)	Jaw	1 (1.4)
				Neck	
				Anterior	2 (2.7)
				Posterior	4 (5.4)
				Lateral	1 (1.4)
				Trunk	
				Posterior thorax	7 (9.5)
				Scapula	7 (9.5)
				Clavicle	1 (1.4)
				Armpit	1 (1.4)
				Upper extremity	
				Shoulder	5 (6.8)
				Arm	11 (14.9)
				Elbow	3 (4.1)
				Forearm	6 (8.1)
				Wrist	1 (1.4)
				Lower extremity	
				Thigh	2 (2.7)
				Leg	3 (4.1)
				Total	74 (100)

on a Mexican population, described that 49% of patients with pilomatricomas presented with pain, a finding similar to our results[5]. In our study, the presence of pain was significantly higher in lesions with a diameter > 15 mm and in patients with multiple pilomatricomas, an association not previously reported in other studies.

Another distinctive sign of the disease is the "tent sign," (Fig. 1) first described in 1978 by Graham and Merwin. This sign allows visualization of the lesion's margins and the faceted nature of the tumor by stretching the overlying skin[4,16]. Few studies describe the frequency of this sign and its association with clinical presentation. In our study, the "tent sign" was present in 19 patients (36.5%) and was associated with larger lesions. This clinical sign can assist physicians in identifying the tumor.

Through this study, we have identified several risk factors associated with the presence of larger pilomatricomas (> 15 mm). These factors include early onset of lesions (< 8 years), the presence of the tent sign, a tumor evolution time of over 1 year, and the presence of clinical variants different from the classical form. These findings have not been previously described in the literature due to the descriptive nature of earlier studies. We consider this information relevant as it enables physicians to identify these risk factors early, which could facilitate the timely removal of tumors and thus prevent the formation of larger residual scars.

Regarding the location of lesions, our study identified the head and neck as the most common areas for pilomatricomas, consistent with other studies[11-13,17]. Descriptive

Table 9. Comparison of age and size of pilomatricomas according to their topography

Variable/topography	Age, mean (SD), years	p-value	Clinical size in mm, median (IQR)	p-value
Topography 1 Head and neck (n = 27) Other locations (n = 47)	 9.2 ± 3.2 10.4 ± 3.3	0.12*	 13.0 (9.0, 20.0) 12.0 (6.0, 20.0)	0.96**
Topography 2 Trunk (n = 16) Other locations (n = 58)	 9.3 ± 2.6 10.1 ± 3.5	0.35*	 10.0 (5.0, 15.0) 13.5 (8.5, 20.0)	0.19**
Topography 3 Right upper limb (n = 14) Other locations (n = 60)	 10.6 ± 3.7 9.8 ± 3.2	0.41*	 11.0 (6.0, 18.5) 12.5 (7.5, 20.0)	0.82**
Topography 4 Left upper limb (n = 12) Other locations (n = 62)	 12.1 ± 2.8 9.5 ± 3.2	0.01*	 18.5 (10.0, 49.5) 10.0 (5.7, 18.5)	0.01**
Topography 5 Lower extremities (n = 5) Other locations (n = 69)	 9.4 ± 4.1 10.0 ± 3.3	0.69*	 5.0 (3.0, 25.0) 12.0 (8.0, 20.0)	0.36**
Total number of pilomatricomas	74			

*T student.
**Mann-Whitney U test.
IQR: interquartile range; SD: standard deviation.

studies have reported that 15% of pilomatricomas exhibit laterality, with 72% located on the right side[3]. Our inferential analysis revealed two significant findings in the left upper extremity compared to other locations: pilomatricomas were larger and more frequently appeared in adolescents. At present, there is no medical literature explaining the biological cause of this predominance, highlighting the need for further studies on this issue. Unfortunately, this study did not investigate the predominant laterality in each case.

Some studies in pediatric populations have indicated that multiple pilomatricomas occur in 7-14% of cases[9,11,15,17]. In our study, 23.1% of cases presented with multiple pilomatricomas, constituting the highest frequency reported in pediatric research. In addition, our results indicate that multiple pilomatricomas were associated with the presence of pain and a longer evolution time. The presence of multiple pilomatricomas can be sporadic, familial, or associated with other diseases[18,19]. The existence of six or more pilomatricomas is highly suggestive of an underlying syndrome (95.52% specificity and 80.65% positive predictive value)[18], warranting referral to genetics and pediatrics services for a multidisciplinary approach to identify more clinical indicators of syndromic pathology. When fewer than five tumors are present, they are considered sporadic and only require a thorough medical evaluation. Close follow-up is recommended, as in many associated syndromes, the lesions appear before the syndrome is detected[18]. The main syndromes associated with multiple pilomatricomas include myotonic dystrophy, syndromes related to Adenomatous Polyposis FAP (including Gardner syndrome), Turner syndrome, Kabuki syndrome, Rubenstein-Taybi syndrome, and Sotos syndrome[18,19]. In our study, only one patient with Turner syndrome was identified, presenting with two pilomatricomas.

The main strengths of this study were: (1) the use of both descriptive and inferential statistics for data analysis, (2) the inclusion of two referral hospitals in Mexico City, which increased the representativeness of the sample and the reliability of the results, (3) highlighting the high frequency of multiple pilomatricomas and their possible clinical associations, contributing to the existing knowledge about this pathology, (4) the study was conducted exclusively in a pediatric and Latin population, (5) some findings are consistent with previous studies in other populations, such as topography and clinical variation, and (6) this research provides a foundation for future prospective studies.

The main limitations of our study were: (1) as a cross-sectional and retrospective study, there is a possibility of selection and information biases, (2) although the sample size was determined, the number of cases analyzed may limit the applicability of the results to a broader population, (3) the lack of follow-up limits the ability to assess the recurrence of pilomatricomas,

and (4) although possible clinical associations are described, a cross-sectional study does not allow for definitive causal relationships to be established between the variables analyzed and pilomatricomas.

Conclusion

The main findings of our study are as follows: (a) 23.1% of the cases presented with multiple pilomatrixomas, the highest frequency reported in pediatric studies to date; (b) the presence of pain was associated with larger lesions and multiple pilomatrixomas; (c) age under 8 years, a positive tent sign, a tumor evolution time > 1 year, and the presence of a clinical variant different from the classic type are risk factors for lesions > 15 mm in diameter; (d) anetodermic pilomatrixomas appeared at the onset of adolescence (10.8 ± 1.4 years); (e) multiple pilomatrixomas had a longer evolution time; (f) the head and neck were the most commonly affected areas, confirming previous findings; and (g) the left upper extremity presented with larger pilomatrixomas (median 18.5 mm) and was more frequent in adolescents (mean 12.1 years) compared to other body areas.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript, nor for the creation of images, graphics, tables, or their corresponding captions.

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