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Non-Melanocytic Benign Skin Tumors in Children

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Abstract

Background: Dermatologists often attend children with benign skin tumors and cysts. The decision to perform dermatologic surgery in children may be difficult to make, especially in cases of benign tumors.

Objective: The objective of this study was to determine the nature of non-melanocytic benign skin tumors amenable to dermatologic surgery in children.

Methods: Histopathologic studies of skin tumors in children treated by our department between January 2004 and December 2005 were studied. Malignant and melanocytic tumors were excluded. Age, sex, type of tumor, diagnostic category, site, size, reason for removal, type of anesthesia, and any other associated disorders were recorded.

Results: The records revealed that 121 patients presented 129 non-melanocytic benign skin tumors (73 in boys and 56 in girls). A total of 27 different anatomopathologic diagnoses were found. The most frequent was pilomatrixoma with 27 cases (20.9%), followed by infundibular cyst with 14 (10.9%), and molluscum contagiosum with 13 (10.1%). Tumors were located on the head and neck (45.7%), trunk (34.1%), and limbs (20.1%). The most frequently affected age group was children aged 11−14 years, which included 50 patients (38.8%). The main type of anesthesia used was local in 54.6% of the cases, sedation plus local anesthesia in 39.7%, and general anesthesia in 5.7%. The reasons that led to removal of the tumors were: increase in the size of the tumor (49%); various types of discomfort, such as severe itching or pain (30%); parental concern (4%); diagnostic uncertainty (16%); and esthetic reasons (1%).

Conclusion: There is a wide diversity of non-melanocytic benign skin tumors in children, some of which require surgical treatment. Pilomatrixomas appear to be the most frequent benign tumors; there are also high frequencies of infundibular cysts, pyogenic granulomas, and viral tumors. Most can be removed under local anesthesia, with or without sedation.

Background

A wide variety of benign tumors of the skin, including proliferative, pseudotumorous, or cystic lesions, can be the reason for dermatologic consultations in children.[1-5] Finding a tumorous lesion that increases in size in a child usually causes concern to parents, who subsequently generally visit a dermatologist. The most frequent tumorous lesions include hemangiomas, which are not usually removed surgically because of their self-resolving nature, and melanocytic nevi, which are often removed to prevent the possibility of them turning into a malignant melanoma. Other types of non-melanocytic skin lesions are also removed despite the fact that the decision to operate on a child is difficult to make, and particularly so when clinically the lesions have a benign appearance. In order to determine the nature of non-melanocytic benign tumors that are surgically treated in children, we retrospectively studied all lesions removed from children in our department (Department of Dermatology, Hospital General Universitario de Alicante, Alicante, Spain) in the period 2004–5.

Methods

The clinical histories of 121 children with 129 non-melanocytic benign skin tumors removed in the Department of Dermatology at our hospital between January 2004 and December 2005 were studied. The database of the Pathology Department was used to

identify the cases. The search was limited to tumors in patients <14 years of age (the upper limit of pediatric age in our country) referred by the Department of Dermatology for histopathologic study. Malignant lesions, melanocytic lesions, and inflammatory disorders were excluded from the study, as were lesions referred by other departments. From each clinical history the following variables were recorded: age, sex, type of tumor, diagnostic category, site, size, reason for removal, type of anesthesia, and any other associated disorders.

The patients were divided into four age groups (<1, 1–6, 7–10, and 11–14 years), with three main lesion sites (head/neck, trunk, and limbs). We classified the type of anesthesia in three groups: local anesthesia, sedation plus local anesthesia, and general anesthesia. The reasons for excision were defined as: increase in size of the tumor, various types of discomfort, parental concern, diagnostic uncertainty, and esthetic reasons. In order to make it easier to analyze the variables, the tumors were classified into 12 categories according to their histologic type: (i) epidermal; (ii) follicular; (iii) fibrous or fibrohistiocytic; (iv) histiocytic; (v) derived from sebaceous glands; (vi) derived from sweat glands; (vii) vascular; (viii) adipose; (ix) nervous; (x) muscular; (xi) bone and/or cartilage; and (xii) cysts.

The SPSS 12.0 software program (SPSS, Chicago, IL, USA) was used to analyze the data.

Results

During the period studied, the Pathology Department (Hospital General Universitario de Alicante, Alicante, Spain) received a total of 410 samples of skin lesions from children, of which 40% were melanocytic nevi and 13.9% corresponded to inflammatory disorders. Seven percent of the lesions had been referred by other departments. A total of 129 non-melanocytic benign tumors were found that fulfilled the requirements of our study, and these accounted for 39.1% of the total. During the period studied, 700 children were seen by the Department of Dermatology, of whom 121 children presented benign tumors (17.2% of pediatric dermatology consultations).

Of the 129 lesions, 73 occurred in boys (56.6%) and 56 (43.4%) in girls. Most patients had only one lesion; however, six had more than one lesion (one patient with four pilomatrixomas, three patients with two pilomatrixomas, one patient with one pilomatrixoma and one infundibular cyst, and one patient with two sebaceous hyperplasias). The patients' ages ranged between 6 months and 14 years. The most frequent age group was 11–14 years, which comprised 50 patients (38.8%). There were 37 children (28.7%) in the 7- to 10-year-old group, 31 (24%) in the 1- to 6-year-old group, and only 11 (8.5%) in the <1-year-old group.

A total of 27 different anatomopathologic diagnoses were identified (table I). The most frequent was pilomatrixoma with 27 cases (20.9%), followed by infundibular cyst with 14 cases (10.9%), molluscum contagiosum with 13 cases (10.1%), verruca vulgaris with 11 cases (8.5%), and pyogenic granuloma with 11 cases (8.5%).

Table I. Type of tumor expressed as absolute frequency and percentage

Type of tumor	Frequency	%
Pilomatrixoma	27	20.9
Infundibular cyst	14	10.9
Molluscum contagiosum	13	10.1
Pyogenic granuloma	11	8.5
Verruca vulgaris	11	8.5
Fibroepithelial polyp	8	6.2
Sebaceous nevus	6	4.7
Epidermal nevus	5	3.9
Infantile hemangioma	4	3.1
Condyloma	4	3.1
Sebaceous hyperplasia	3	2.3
Angiokeratoma	3	2.3
Accessory tragus	3	2.3
Trichoepithelioma	2	1.6
Keloid	2	1.6
Juvenile xanthogranuloma	2	1.6
Mucocele	1	0.8
Dermatofibroma	1	0.8
Neurofibroma	1	0.8
Venous malformation	1	0.8
Trichilemmal cyst	1	0.8
Osteoma	1	0.8
Pilar leiomyoma	1	0.8
Nevus lipomatosus	1	0.8
Neurothekeoma	1	0.8
Calcinosis cutis	1	0.8
Spindle-cell hemangioma	1	0.8
Total	**129**	**100.0**

By age groups, the type of tumor most frequently removed from children <1 year of age was molluscum contagiosum (six cases). In the 1- to 6-year-old group, the most frequent diagnosis was pilomatrixoma (7 of 33 cases), followed by verruca vulgaris (5 of 33). In 7- to 10-year-old children, the most frequent diagnosis was again pilomatrixoma (10 of 37) followed by infundibular cyst (4 of 37) and molluscum contagiosum (3 of 37). In the 11- to 14-year olds, the most frequent tumor was also pilomatrixoma (9 of 50), followed by pyogenic granuloma (7 of 50), and infundibular cyst (6 of 50) [table II].

The most frequent diagnostic group was made up of tumors of epidermal origin, which comprised 34 cases (26.3%). This group included tumors of viral origin (verruca vulgaris, condyloma, and

molluscum contagiosum) and five epidermal nevi. The second most frequent diagnostic category, accounting for 29 cases (22.5%), consisted of tumors derived from hair follicles. The most frequent of these was pilomatrixoma (27 of 29). Although four children presented multiple pilomatrixoma lesions, none of these patients gave a history of familial disease or other associations. The second most common tumor from hair follicles was trichoepithelioma, which accounted for two cases (1.6%); these were also isolated. Of tumors derived from sebaceous glands, the most frequent was Jadassohn's sebaceous nevus (six cases), followed by hyperplasia of the sebaceous glands (two cases). Of tumors of the fibrous tissue, two cases of keloid (1.6%), one on the cheek and the other on the arm after vaccination, eight cases (6.2%) of fibroepithelial polyps, and one dermatofibroma were found. Only two cases of juvenile xanthogranuloma were found as examples of histiocytic tumors. Of the vascular tumors removed, the most frequent were pyogenic granulomas with 11 cases (8.5%), followed by infantile hemangiomas with four cases (3.1%), three angiokeratomas (2.3%), one venous malformation (0.8%), and one spindle-cell hemangioma (0.8%). In the group of neural tumors, one case of neurofibroma as an isolated lesion on the neck and one case of neurothekeoma were identified. Of the muscular tumors, only one case of pilar leiomyoma was found. One case of nevus lipomatosus in the group of adipose type tumors was identified. Of bone and/or cartilage tumors, we observed a case of osteochondroma on the foot of a 7-year-old boy and a case of idiopathic calcinosis cutis (calcified epidermal nodule) on a 4-year-old boy's cheek. In this category, we also included three cases of accessory tragus.

Table II. Type of tumor by age

Type of tumor	Age (y)				
	≤1	1–6	7–10	11–14	total
Pilomatrixoma	1	7	10	9	27
Infundibular cyst	1	3	4	6	14
Molluscum contagiosum	6	3	3	1	13
Pyogenic granuloma	0	2	2	7	11
Verruca vulgaris	0	5	2	4	11
Fibroepithelial polyp	0	1	3	4	8
Sebaceous nevus	1	0	1	4	6
Epidermal nevus	0	0	1	4	5
Infantile hemangioma	0	0	2	2	4
Condyloma	0	3	0	1	4
Sebaceous hyperplasia	0	0	1	2	3
Angiokeratoma	0	0	3	0	3
Accessory tragus	1	1	0	1	3
Trichoepithelioma	0	1	0	1	2
Keloid	0	1	1	0	2
Juvenile xanthogranuloma	0	1	1	0	2
Mucocele	1	0	0	0	1
Dermatofibroma	0	0	0	1	1
Neurofibroma	0	0	0	1	1
Venous malformation	0	0	1	0	1
Trichilemmal cyst	0	0	0	1	1
Osteoma	0	0	1	0	1
Pilar leiomyoma	0	1	0	0	1
Nevus lipomatosus	0	0	0	1	1
Neurothekeoma	0	1	0	0	1
Calcinosis cutis	0	1	0	0	1
Spindle-cell hemangioma	0	0	1	0	1
Total	**11**	**31**	**37**	**50**	**129**

The most common cyst was infundibular cyst, which accounted for 80% of the total number of cysts. Fourteen cases (10.9%) were observed, eight of which were found on the face and neck. We found only one case of trichilemmal cyst, which was located on the cheek.

The most frequent site of tumors was the head and neck with 59 cases (45.7%), followed by the trunk with 44 (34.1%), and limbs with 26 (20.1%). The size of the lesions varied between 1mm and 35mm, with a mean size of 9.8mm.

The reasons that led to removal of the tumors were: increase in the size of the tumor (49%), various types of discomfort such as severe itching or pain (30%), parental concern (4%), diagnostic uncertainty (16%), and esthetic reasons (1%).

The main type of anesthesia used was local anesthetic in 54.6% of the cases, followed by sedation plus local anesthesia in 39.7%; only seven children (5.7%) were operated on under general anesthetic. Local anesthetic was normally used in older patients (85% of the 11- to 14-year olds), whereas sedation plus local anesthesia was preferred in younger children (90% of children aged <1 year and 40% of children aged 1–6 years).

No association was found between skin tumors and other disorders in our patients.

Discussion

The skin tumors giving rise to the greatest number of consultations in children are melanocytic nevi and hemangiomas.[6-8] However, dermatologists frequently see children with other types of tumors,[1-5,9] which are often treated surgically. There are reviews in the literature on the characteristics of benign skin tumors, but only in the adult population.[9,10] In children, on the other hand, only a few epidemiologic studies have been conducted on these type of tumors, and reports on isolated cases or series relating to a specific type of tumor, such as pilomatrixoma,[11-13] are all that can be found.

The true frequency of benign skin tumors in children is difficult to assess because such tumors encompass a group of pathologies which are evaluated by multiple disciplines such as pediatrics or surgery, not just dermatology. Our study is not intended to be a reflection of the exact frequency of these lesions, since skin tumors removed from children by other hospital departments (such as pediatric surgery or plastic surgery) were excluded. Furthermore, only lesions undergoing anatomopathologic examination were evaluated; cases in which the lesion was not removed and therefore not examined histologically were not counted. In addition, when the clinical diagnosis is very evident, tumors are not submitted for biopsy or surgical excision, and this explains the low reported frequency in this study of some of the typical tumors in children (e.g. xanthogranuloma, mastocytoma). This study simply shows the type of lesions removed in our Department of Dermatology over a period of 2 years. The greatest number of tumors were removed from children between the age of 11 and 14 years (38.8%), which could be related to the fact that on the one hand it is possible to treat older children using a local anesthetic and on the other that we have included tumors of viral and traumatic origin (e.g. pyogenic granuloma), which are more frequent in this age group.

Lesions were removed for different reasons; in some cases due to an obvious, progressive increase in size, and in others to reduce discomfort (pain, itching, or bleeding). The fact that there were no statistically significant differences in the number of tumors removed between boys and girls indicated that esthetic reasons, which might result in more removals from girls, did not predominate. Some lesions were removed because of diagnostic uncertainty and others because, despite their benign appearance, it was necessary to obtain the confirmation from a pathologist to alleviate parental anxiety. The majority of lesions were not biopsied because of their small size. Therefore, we performed only one surgical procedure, which had both diagnostic and therapeutic value, to minimize distress in the children.

Local anesthetic was normally used in older patients, whereas sedation plus local anesthesia was preferred in younger children, because both patients and doctors are more comfortable with this type of anesthesia and it is a safe technique.[14,15]

A high prevalence of viral tumors amongst tumors of epidermal origin was found. Treatment of these lesions was not usually surgical, but they were removed if they had an unusual clinical presentation or size. Both verrucae and molluscum contagiosum are very common in children and adolescents, but they are usually easily recognized by the clinician and treated with other procedures such as cryotherapy (and so are not usually removed surgically). Condyloma acuminatum is rare in children; however, in our series we found four cases, an unusual finding that we considered circumstantial.

Epidermal nevi appear in the first year of life. Surgical treatment is not always possible in such cases, depending on the extension of the lesion; furthermore, in some cases, there is systemic involvement. In all our five cases, a clinical examination was conducted to rule out any associated skeletal, ophthalmologic, or neurologic alterations; no associations with clinical syndromes were found.

Pilomatrixoma or Malherbe's calcified epithelioma, a neoplasm derived from epithelial germ tissue, is the most frequently diagnosed tumor derived from appendages.[11] It is the most frequently occurring benign skin tumor in individuals <20 years of age and is removed at a mean age of 8 years. It is usually isolated but may also be multiple. Pilomatrixoma appears on the face, neck, and upper limbs in children and young adults as a hard papulo-nodular lesion, 0.5–5cm in diameter, and covered by asymptomatic skin with a pigmented, rosy, or normal appearance. Multiple forms have been described in association with myotonic dystrophy, Rubinstein-Taybi syndrome, and Gardner or Rombo syndrome.[11-13] In our 27 cases, the lesions were clinically typical in terms of their appearance, size, and site except for one case in which the tumor on the leg was larger (35mm). There were no recurrences or association with the above syndromes in any of our cases. Trichoepithelioma, another tumor derived from hair follicles, tends to appear in the first few decades of life as a rosy papule measuring approximately 2–8mm and most often found on the face. Our patients had single lesions on the forehead or nose.

Jadassohn's sebaceous nevus is the most frequent hamartoma in children derived from sebaceous glands.[16] Since various types of tumors may develop in it, it is advisable to remove these lesions before puberty. In our series, four of the five cases were removed from patients in the 11- to 14-year-old age group. Hyperplasia of sebaceous glands usually appears on the face in adults. Two brothers were reported to have lesions on the penis, which is a rare occurrence.[17]

Tumors derived from the sweat glands are extremely rare in childhood and no case was found in our series. However, syringoma was found to be the third most frequent adnexal tumor in children in the study by Marrogi et al.[18]

Dermatofibromas are the most frequent tumors on the lower limbs in middle-aged women.[19] However, they may also affect people of any age, either sex, and appear at any site, although they are rarer in children. Our only case was that of a 12-year-old boy who had a dermatofibroma on his arm, with no known history of trauma or stings. During the study period, no other tumors of fibrous tissue typical of childhood, such as desmoid fibromatosis or myofibroma, were found.

Juvenile xanthogranuloma, the most frequent type of histiocytic tumor in children, is characterized by a yellow papulo-nodular lesion measuring 1–10mm.[20] These lesions do not require surgical treatment because they usually disappear gradually on their

own, although large or ulcerated lesions may be removed. Our patient with juvenile xanthogranuloma was a 3-year-old boy with a lesion on the thigh; the tumor was removed because it was progressively increasing in size.

The vascular tumors in our series were removed because of bleeding or rapid increase in size in the case of the pyogenic granuloma and parental concern in the case of the hemangiomas. Maffucci syndrome was ruled out in the child with spindle-cell hemangioma.

The most frequently diagnosed neural tumor in adults is neurofibroma on its own or associated with neurofibromatosis.[21] In children, it is more rare: we found only one boy with an isolated lesion on his neck. Even rarer is neurothekeoma, also called nerve sheath myxoma. This lesion may appear on the head, neck, and upper limbs in middle-aged adults, usually women. Our case was a 2-year-old girl with a painful lesion on her arm.

Of the muscular group, we found one case of a pilar leiomyoma on the thorax of a 3-year-old girl. This had the typical smooth, rounded appearance, was painful, and was therefore removed. One case of nevus lipomatosus in the buttock of a 13-year-old girl, characterized by its yellowy appearance and soft consistency, was found. No case of lipoma, the most frequent adipose type tumor in adults, was observed. In the group of bone and/or cartilage tumors, no cases were found with pathologic associations or alterations of phospho-calcium metabolism.

The most frequent cyst identified was infundibular cyst. One case of mucocele in the mucosa of the upper lip was found; this was produced by repeated trauma.

It is important to point out that some tumors that appear in children may be markers of other disorders. For example, pilomatrixoma may be a marker of myotonic dystrophy; trichoepithelioma of Brooke-Spiegler syndrome; desmoid fibromatosis or multiple epidermal cysts of Gardner syndrome; spindle-cell hemangioma of Maffucci syndrome; connective hamartoma of tuberous sclerosis; and neurofibromas of neurofibromatosis. No association was found between skin tumors and other disorders in our patients.

Of the tumors considered rare in the literature, the existence in our series of two cases of sebaceous hyperplasia, one neurothekeoma, one spindle-cell hemangioma, one localized skin calcinosis, one isolated pilar leiomyoma, and one osteoma are worthy of special mention.

Conclusion

A wide diversity of skin tumors affect children. Pilomatrixomas were the most frequent benign tumors in our series, as reported in the literature. High frequencies of infundibular cysts, pyogenic granulomas and viral tumors were also noted. Some of these benign skin tumors in children will require surgical treatment.

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References

1. Abensour M, Grosshans E. Cutaneous tumors and adnexal cyst in children. Ann Dermatol Venereol 1989; 116: 333-9
2. Barranger C, Morel P, Civatte J. Cutaneous tumors in children. Rev Prat 1977; 27: 3321-30
3. Putnam TC. Lumps and bumps in children. Pediatr Rev 1992; 13: 371-8
4. Filston HC. Common lumps and bumps of the head and neck in infants and children. Pediatr Ann 1989; 18: 180-2, 184, 186
5. Knight PJ, Reiner CB. Superficial lumps in children: what, when, and why? Pediatrics 1983; 72: 147-53
6. Bruckner AL, Frieden IJ. Hemangiomas of infancy. J Am Acad Dermatol 2003; 48: 477-93
7. Fraitag S. Melanocytic nevi in children. Ann Pathol 2004; 24: 587-604
8. Lyon VB. Lumps and bumps in children – when to worry: recent trends in recognition and pathology of hemangiomas of infancy and Spitz nevi. Curr Opin Pediatr 2004; 16: 392-5
9. Pariser RJ. Benign neoplasms of the skin. Med Clin North Am 1998; 82: 1285-307
10. Barro-Traore F, Traore A, Konate I, et al. Epidemiological features of tumors of the skin and mucosal membranes in the department of dermatology at the Yalgado Ouedraogo National Hospital, Ouagadougou, Burkina Faso. Sante 2003; 13: 101-4
11. Pirouzmanesh A, Reinisch JF, Gonzalez-Gomez I, et al. Pilomatrixoma: a review of 346 cases. Plast Reconstr Surg 2003; 112: 1784-9
12. Darwish AH, Al-Jalahema EK, Dhiman AK, et al. Clinicopathological study of pilomatricoma. Saudi Med J 2001; 22: 268-71
13. Cigliano B, Baltogiannis N, De Marco M, et al. Pilomatricoma in childhood: a retrospective study from three European paediatric centres. Eur J Pediatr 2005; 164: 673-7
14. Vergara G, Betlloch I, Galiana I, et al. Tratamiento quirúrgico de lesiones dermatológicas en pacientes pediátricos. Actas Dermosifiliogr 2004; 95: 362-9
15. Cunningham BB, Gigler V, Wang K, et al. General anesthesia for pediatric dermatologic procedures: risks and complications. Arch Dermatol 2005; 141: 573-6
16. Muñoz-Pérez MA, Garcîa-Hernandez MJ, Ríos JJ, et al. Sebaceus naevi: a clinicopathologic study. J Eur Acad Dermatol Venereol 2002; 16 (4): 319-24
17. Mataix J, Betlloch I, Bañuls J, et al. Umbilicated papules on genitals in two siblings. Actas Dermosifilogr 2006; 97: 609-10
18. Marrogi AJ, Wick MR, Dehner LP. Benign cutaneous adnexal tumors in childhood and young adults, excluding pilomatrixoma: review of 28 cases and literature. J Cutan Pathol 1991; 18: 20-7
19. Gonzalez S, Duarte I. Benign fibrous histiocytoma of the skin: a morphologic study of 290 cases. Pathol Res Pract 1982; 174 (4): 379-91
20. Hernandez-Martin A, Baselga E, Drolet BA, et al. Juvenile xanthogranuloma. J Am Acad Dermatol 1997; 36 (3 Pt 1): 355-67
21. Requena L, Sangüeza OP. Benign neoplasms with neural differentiation: a review. Am J Dermatopathol 1995; 17 (1): 75-96

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