

Prevalence of Piedra infection in patients with brittle scalp hair

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ABSTRACT

Background: Brittle hair has many causes including several diseases and conditions ranging from poor diet, exposure to heat and chemicals, systemic illnesses and hair infections.

Objective: The aim of this study was to find out the prevalence of piedra infection among females complaining of brittling of scalp hair

Patients and Methods: The present study was conducted in the Department of Dermatology at Al-Hussein University Hospital, Cairo, Egypt from January 2014 to March 2015. Hundred female patients complaining of brittling of hair were included. All patients were subjected to: 1) Full history taking with emphasis on hair care practice; 2) Naked eye examination of hair; 3) Examination with a magnifying lens; 4) Examination of suspected and involved hairs with 10% potassium hydroxide; 5) Photography of affected sites and positive KOH results.

Results: The patient's age ranged from 7- 56 years (mean \pm SD; 27.780 \pm 11.905). Microscopic examination of hair samples showed that 14 (14%) were infected with white piedra and 3 (3%) were infected with black piedra. Forty eight patients (48%) showed pediculosis capitis nits while two patients (2%) showed hair cast. On the other hand, 33 patients (33%) showed no apparent findings.

Conclusion: Infection of the hair with white and black piedra is more common than we thought, and might be a contributive factor leading to affection of hair shaft integrity, and eventually lead to brittling and hair breakage. We recommend the importance of always keeping in mind white and black piedra, while examining any case of brittling of hair.

KEYWORDS: White piedra, black piedra, brittle hair

INTRODUCTION

Piedra is a fungal infection of the hair characterized by the presence of nodules of different hardness on the surface of hair shafts. Two types of piedra have been described: white piedra caused by the basidiomycetous yeasts "*Trichosporon species*", and black piedra produced by the ascomycete "*Piedraia hortae*".¹ White piedra results from fungal infection by one of the species of the genus *Trichosporon* (T). Molecular studies have shown that the taxon *Trichosporon beigelli* was replaced by the following six human pathogens: *T. cutaneum*,

T. asahii, *T. asteroides*, *T. mucoides*, *T. inkin* and *T. ovoides*.² The two types of piedra occur in different climatic conditions, and both are common in tropical regions of the world. Black piedra is most common in the tropical regions of the world that have high temperatures and humidity. White piedra is also endemic in temperate and semitropical climates. The source of infection is mostly the soil.³

Both types of piedra can affect the hair in different body locations. White piedra affects any hair-bearing site, mostly pubic hair, axillary

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hair, beard, moustache, and eyebrows and/or eyelashes. It is characterized by loosely attached white to light brown soft creamy gelatinous nodules that may surround the entire hair shaft. The soft nodules (fungal mass) can easily be detached from the hair.⁴ Black piedra mostly affects scalp hair. It is characterized by black, firmly adhered nodules that may or may not surround the entire hair and are harder and normally larger than those of white piedra.⁵

Direct microscopic examination of infected hair in 10% potassium hydroxide (KOH) will enable a clear differential diagnosis of the two types of piedra, and also from eggs of pediculosis and trichomycosis axillaris (trichobacteriosis) with which it is sometimes confused.⁶ Both types of piedra invade the hair shaft which is weakened by cuticular penetration. This ultimately may lead to hair breakage posing considerable cosmetic morbidity.⁴ This study aimed to evaluate the prevalence of piedra infection among females complaining of brittling of the hair to find out possible association.

PATIENTS AND METHODS

The present study was conducted during the period from January 2014 to March 2015 in the Department of Dermatology at Al-Hussein University Hospital, Cairo, Egypt after obtaining the required permissions. 100 female patients complaining of brittling of hair who fulfilled inclusion criteria were included. Exclusion criteria were: 1) Patients with tinea capitis and other scalp disorders. 2) Patients with brittle hair following obvious hair care practice. 3) Patients who have used topical scalp antifungal medications and/or systemic antifungals in the

last two weeks. All patients were subjected to: 1) Full history taking with emphasis on hair care practice; 2) Naked eye examination of hair; 3) Examination with a magnifying lens; 4) Examination of suspected and involved hairs with 10% KOH; 5) Photography of affected sites and positive KOH results.

RESULTS

In this study, 100 female patients with brittle hair were enrolled. Their ages ranged from 7-56 years (mean \pm SD; 27.780 \pm 11.905). Microscopic examination of hair samples showed that 14 (14%) were infected with white piedra, 3 (3%) were infected with black piedra, 48 (48%) showed pediculosis capitis nits while 2 patients (2%) showed hair cast. On the other hand, 33 patients (33%) showed no apparent findings.

White piedra presented clinically as white to cream-colored, easily detachable nodules along and completely encircling the hair shaft. Microscopically, these appeared as yellowish-white mycotic nodules encircling the hair shafts without altering them. They are formed by masses of arthroconidia completely involving the whole circumference of the hair shaft (Fig. 1). In black piedra, hard black nodules with gritty feeling were noticed on the hair shaft. On microscopy, pigmented brown mycotic nodules were observed. They are formed by degenerated fungal element that is made up of asci and ascospores completely involving the whole circumference of the hair shaft (Fig. 2).

Clinically, hair casts were presented as white, elongated, cylindrical structures that encircle the hair shaft and can be easily dislodged. Microscopically, cases of hair cast revealed a



Fig. 1 White piedra (10% KOH mount - x200).

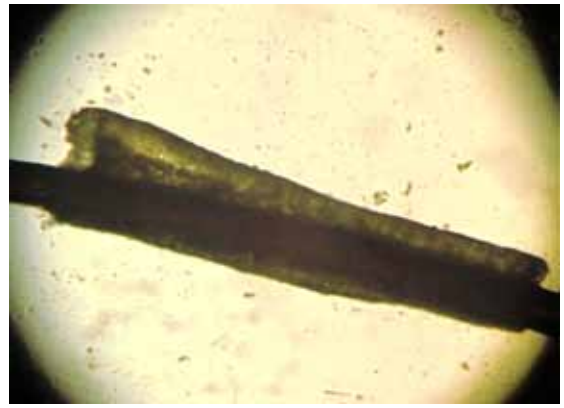


Fig. 3 Hair cast (10% KOH mount - x200).

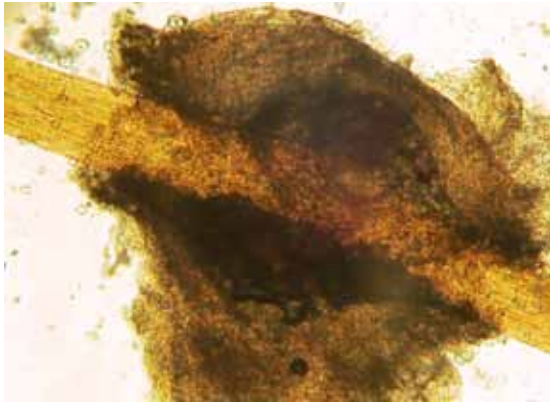


Fig. 2 Black piedra (10% KOH mount - x200).



Fig. 4 Pediculosis nit (10% KOH mount - x200).

cylindrical and hyaline mass involving the hair shaft with no evidence of fungal elements (Fig. 3). Pediculosis nits appeared as white nodules, and are firmly attached to the hair very close to the scalp. They were most often found in the hair behind the ears and at the back of the head and neck. Microscopically, nits were attached to

the hair shaft at one pole and loose at the other. Viable eggs were brownish yellow in color. Often one or two prominent eye spots were visible and the nit has a rounded distal end (the operculum). Empty egg cases or non-viable nits were clear, opaque, almost see transparent (Fig. 4).

Table 1 Distribution of white and black piedra cases among age groups

Type		Age groups (years)									
		<20		20-30		30-40		>40		Total	
		N	%	N	%	N	%	N	%	N	%
White piedra	+ve	5	16.13	5	18.52	2	7.69	2	12.50	14	14.00
	-ve	26	83.87	22	81.48	24	92.31	14	87.50	86	86.00
	Total	31	100	27	100	26	100	16	100	100	100
Black piedra	+ve	2	6.45	1	3.70	0	0.00	0	0.00	3	3.00
	-ve	29	93.55	26	96.30	26	100.00	16	100.00	97	97.00
	Total	31	100	27	100	26	100	16	100	100	100

The 100 patients were divided into 4 groups according to their ages: 31 patients less than 20 years, 27 between 20-30 years, 26 between 30-40 years and 16 more than 40 years old. White piedra involved 5 cases in age group less than 20 years, 5 cases in age 20-30 years, 2 cases in age 30-40 years, and 2 cases in age group more than 40 years. Black piedra involved 2 cases in age group less than 20 years and 1 case in age group 20-30 years (Table 1).

DISCUSSION

The role of piedra in brittle hair is not fully investigated; this cross sectional study aimed to investigate the possible association between brittle hair and piedra infection. We investigated the presence of piedra in cases of brittle hair in 100 female patients. All females were submitted to full history taking with emphasis on hair care practices, naked eye (aided with a magnifying lens) examination of scalp hair, and microscopic examination of hair shaft nodules with 10% KOH.

White piedra is a rare fungal infection. Clinical cases have been reported in South America, North America, Southern Asia, The Middle East, Europe, Japan, Australia and some reports from Brazil.⁷ In Egypt, neither case series nor case reports have been published on piedra infection. In this study, there were 17 patients infected with piedra, 14 of them were infected with white piedra and 3 were infected with black piedra. This gives us an idea about how piedra infection in this part of the world is not as rare as it is thought to be especially white piedra. This opinion coincides with Kiken *et al*⁸ who suggested that this clinical entity has been underestimated.

In a retrospective study based on data obtained from medical records of patients that had undergone exams for fungal infections, Diniz and Filho⁷ were able to register the presence of 15 cases of white piedra in Espírito Santo, Brazil during the five years of the study (1998 to 2002). Agreeing with the latter study, however in only few months, we were able to diagnose 17 cases of piedra (14 white piedra and 3 black piedra). This reflects an underestimated occurrence of this type of infection in our population. In both studies, all patients were females with nodules in the scalp hair but not in other hairy regions. In Diniz and Filho⁷ study, all females - as in majority of our cases - had woolly hair, of medium to long length, which suggests the habit of using greater amounts of conditioning creams and oils, causing retention of humidity in the hair strands. This could contribute to the infection and persistence of the fungi especially in hot humid climates like in Egypt and Brazil. Also, Kiken *et al*⁸ suggested that the rainy season, humidity, heat and use of hair conditioners as predisposing factors to infection. Most of our adult patients used prolonged hair covering (scarf), which maintained higher local humidity, a factor that may have contributed to the occurrence of the infection.

In this study, the distribution of positive white piedra cases indicates that most of our patients were in the young adult and middle age groups with the least prevalence among children and older age. This can be explained by increased use of certain hair care practices, seeking medical advice and increased outdoor activities in these age groups. Agreeing with this result, Khandpur and Reddy⁹ reported that piedra occurs in all age

groups with a higher incidence in young women. In an African study done by Thérizol-Ferly et al¹⁰ the prevalence of white piedra was most typical in women aged 15-44 years. Contrary to that, in studies done by Diniz and Filho,⁷ Pontes et al,¹¹ and Roselino et al,¹² the age group most affected was the preschool phase from 2 to 9 years of age (66.6%, 74% and 90% respectively). This can be due to lack of interest in seeking medical hair care advice for Egyptian children in certain localities. In the previous studies, most childhood cases were correlated with informed behavior of routinely using emollient creams on hair.

Although Schwartz¹³ mentioned that both sexes are equally affected. In our culture, it is uncommon for males to complain of brittle hair, so all our patients were females. Agreeing with this finding, Roselino et al¹² have reported that all scalp white piedra cases in an outbreak were females. In a study from Brazil, Pontes et al¹¹ found that most of the 23 patients with scalp white piedra were females (87%). Schwartz¹³ stated that both types of piedra affect the hair in different body locations. However, all our cases presented with scalp affection, as this study focused only on scalp hair infection with piedra to correlate this with the hair shaft integrity. More in line with this result, Diniz and Filho⁷ reported that most cases of white piedra affect the scalp hair of female children, mainly the occipital region. Also, Pontes et al¹¹ mentioned that, in Brazil, white piedra generally affects scalp hair. On the contrary, Coutinho et al¹⁴ noticed that other areas affected include the genitals, beard, moustache, eyelashes, eyebrows and armpits. Kiken et al⁸ believed that the white piedra predominantly affects scalp hair in tropical countries and pubic

hair in temperate countries.

In this study, it was noticed that many patients had poor hygiene and belonged to low socioeconomic states, as they lived in lower-quality housing conditions. Humidity, hyperhidrosis, and poor personal hygiene have been mentioned by Bonifaz¹⁵ as the most important predisposing factors. According to Guého et al,¹⁶ the white piedra was very common in the beginning of the 20th century in Europe and South America. However, in the present years, due to improvements in personal hygiene, it has become rarer in those countries. On the contrary, Kiken et al⁸ indicated that there was no evidence to suggest that the infection was associated with poor hygiene, socioeconomic status or sexual contact. However, the authors correlated long scalp hair with an increased risk of acquiring white piedra.

Clinically it is sometimes difficult to differentiate the nodules of white piedra from pediculosis nits and even from hair cast, so microscopic observation of the affected hair after treatment with 10% KOH is important to confirm the diagnosis. Fischman et al¹⁷ reported that 2 out of 4 Brazilian female children were treated for pediculosis in a Pediatric Service without efficacy. They were diagnosed afterwards by microscopy and culture as scalp white piedra. They recommended that microscopic examination of the hairs should always be considered. With which the correct diagnosis can be easily made, and it avoids unnecessary and sometimes toxic treatments.

Regarding the destructive effect of piedra on hair shaft, some authors¹⁸⁻²⁰ have concluded that

Piedraia hortae is unable to penetrate the cortex of the hair shaft. Although, others^{1,21} consider that it may be able to do so, but without extensive proliferation. Figueras *et al*^{22,23} proved that this fungus cause lifting and disruption of the cuticular layers. Kwon-Chung and Bennet²⁴ have reported that white piedra only produce lifting of the cuticular scales without cortex invasion. Ellner *et al*⁶ had identified this feature in some cases, and had suggested that the synergistic action between *T. beigellii* and specific coryneform bacteria produces the hair cortex invasion. Thérizol-Ferly *et al*¹⁰ has described an association between white piedra and bacteria in 11.8% in a study carried out in Gabon. Figueras and Guarro²⁵ observed white piedra nodules infected with bacteria. The bacteria were always observed at the periphery of the nodules, suggesting that they are not primary invaders. Further ultrastructural studies are needed to clarify the disruptive effect of piedra on hair.

CONCLUSION

The current study demonstrates that infection of the hair with piedra (especially white) is not rare and might be a contributive factor leading to affection of hair shaft integrity, and eventually lead to brittling and hair breakage. It should be considered in the differential diagnosis while diagnosing and treating cases with brittling of hair. Also, as it is usually misdiagnosed and mistreated as pediculosis capitis, it is important to differentiate nits of pediculosis from nodules of white piedra. Further ultrastructural studies are recommended to visualize the exact level of fungal penetration/perforation; whether it can only cause lifting of the hair cuticle, or cause invasion of the cortex, with or without synergistic action of coryneform bacteria.

REFERENCES

1. Taplin D and Rebell G. Piedra. In: Demis J, McGuire J (Eds.) Clinical Dermatology. New York, Harper & Row Publishers, 1984:1-4, 1-7.
2. Chagas-Neto TC, Chaves GM and Colombo AL. Update on the Genus Trichosporon. Mycopathologia 2008; 166 (3):121-32.
3. Schwartz RA. Superficial fungal infections. Lancet 2004; 364:1173-82.
4. Sentamilselvi G, Janaki C and Murugusundram S. Trichomycosis. Int J Trichology 2009; 1 (2):100-107.
5. de Hoog GS and Guarro J (Eds.) Atlas of Clinical Fungi. Baarn, Holland, Centraalbureau voor Schimmelcultures, 1995.
6. Ellner KM, McBride ME, Kalter DC, Tschen JA and Wolf JE. White piedra: evidence for a synergistic infection. Br J Dermatol 1990; 123:355-63.
7. Diniz LM and Filho JBS. Study on 15 cases of White Piedra in Grande Vitória (Espírito Santo - Brazil) over a five-year period. An Bras Dermatol 2005; 80 (1):49-52.
8. Kiken DA, Sekaran A, Antaya RJ, Davis A, Imaeda S and Silverberg NB. White piedra in children. J Am Acad Dermatol 2006; 55 (6):956-61.
9. Khandpur S and Reddy BS. Itraconazole therapy for white piedra affecting scalp hair. J Am Acad Dermatol 2002; 47 (3):415-18.
10. Thérizol-Ferly M, Kombila M, Gomez de Diaz M, Duong TH and Richard-Lenoble D. White piedra and Trichosporon species in equatorial Africa, I: history and clinical aspects—an analysis of 449 superficial inguinal specimens. Mycoses 1994; 37:249-53.
11. Pontes ZB, Ramos AL, Lima Ede O, Guerra Mde F, Oliveira NM and Santos JP. Clinical and mycological study of scalp white piedra in the State of Paraíba, Brazil. Mem Inst Oswaldo Cruz 2002; 97 (5):747-50.
12. Roselino AM, Seixas AB, Thomazini JA and Maffei CML. An outbreak of scalp white piedra in a Brazilian children day care. Rev Inst Med Trop S Paulo 2008; 50 (5):307-309.
13. Schwartz RA. Piedra Clinical Presentation. Retrieved from <http://emedicine.medscape.com/article/1092330-clinical> Schwartz. Updated: May 05, 2015, Accessed 20 Jan. 2016.
14. Coutinho ASL, de Moraes OO, Gomes CM, Bruno

- CB and Reis CM. Scalp white Piedra: case report of a pediatric patient. *Egypt Dermatol Online J* 2011; 7(1):8.
15. Bonifaz A. *micologia medica basica*. 3rd ed. Mexico, DF: McGrawhill; 2009. P. 100-32.
 16. Guého E, Improvisi L, de Hoog GS and Dupont B. Trichosporon on humans: a practical account. *Mycoses* 1994; 37:3-10.
 17. Fischman O, Bezerra FC, Francisco EC, da Silva FC, Nishikaku AS, Cavalcanti SD, de Azevedo Melo AS, Bentubo HD and Petri V. Trichosporon inkin: An Uncommon Agent of Scalp White Piedra. Report of Four Cases in Brazilian Children. *Mycopathologia* 2014; 178 (1-2):85-89.
 18. Chung KC, Adam BA and Soo-Hoo TS. Morphology of Piedraia hortae. *Sabouraudia* 1975; 13:157-60.
 19. Adam BA, Soo-Hoo TS and Chong KC. Black piedra in West Malasia. *Aust J Dermatol* 1997; 18:45-47.
 20. Cortes A and Orfanos CE. Piedra. In: Orfanos CE, Happle R (Eds.) *Hair and hair disease*. Berlin, Springer, 1990. P. 745-51.
 21. Whiting DA. Structural abnormalities of the hair shaft. *J Am Acad Dermatol* 1987; 16:1-25.
 22. Figueras MJ, Guarro J and Zaror L. New findings in black piedra infection. *Brit J Dermatol* 1996; 135: 157-158
 23. Figueras MJ, Guarro J and Zaror L. Ultrastructural aspects of hair digestion in black piedra infection. *J Med Vet Mycol* 1997; 35:1-6.
 24. Kwon-Chung KJ and Bennet JE. *Medical Mycology*. Philadelphia, Lea & Febiger, 1992. p. 183-90.
 25. Figueras MJ and Guarro J. Ultrastructural aspect of the keratinolytic activity of piedra. *Rev Iberoam Micol* 2000; 17:136-41.