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Abstract: Porokeratosis is an uncommon disorder of keratinization that presents with keratotic papules or annular plaques that expand centrifugally with a thread-like elevated border. A distinctive histologic structure, the cornoid lamella, is diagnostic of this disorder and consists of a column of parakeratosis with the absence of the granular layer and dyskeratotic cells in the upper spinous zone. Porokeratosis confined to the genitogluteal region is rare and may be subclassified into three types, namely, classical porokeratosis on the genital region, ptychotropic porokeratosis most often seen in the natal cleft and buttocks and penoscrotal porokeratosis that is seen on the penis and adjacent scrotal skin in young men in their third decade of life. Genitogluteal porokeratosis is usually pruritic and may be undiagnosed for several years as it does not resemble classical porokeratosis in many cases; however, a biopsy is diagnostic. In general, response of genital porokeratosis to any modality of treatment is disappointing. No malignant changes have hereto been reported in porokeratosis restricted to the genitogluteal region.

Keywords: genital porokeratosis, ptychotropic porokeratosis, penoscrotal porokeratosis

Introduction

Porokeratosis was first described by Isidor Neuman in 1875¹ but has been eponymically linked with Vittorio Mibelli, an Italian dermatologist, who, in 1893, named it porokeratosis because of the involvement of eccrine ostia in his case.² It is an uncommon disorder of keratinization of unknown etiology and unpredictable course and presents itself as a keratotic papule or annular plaque with a thread-like elevated border that expands centrifugally³ and has been likened to the Great Wall of China with a ridge and moat on its summit.

Since the description of the classical plaque type of porokeratosis of Mibelli, several other clinical forms of porokeratosis have been described, namely, disseminated actinic and non-actinic superficial porokeratosis, porokeratosis in linear arrangement, palmoplantar porokeratosis and punctate porokeratosis. Other less common forms described in literature are facial porokeratosis, giant porokeratosis, reticulate porokeratosis, eruptive pruritic papular porokeratosis and so on.

It is extremely rare for different clinical variants to occur in the same individual, but cases have been described where typical porokeratosis of Mibelli may coexist with the disseminated superficial form, linear and hypertrophic verrucous forms.⁴

Histologically, the hallmark of all porokeratoses is the cornoid lamella, which is a column of parakeratosis that is often seen to bend inward toward the center of the lesion with the absence of the granular layer at its base. Of great significance diagnostically are few dyskeratotic keratinocytes just beneath in the upper spinous zone. The cornoid lamellae may be few in number as in porokeratosis of Mibelli where they are seen typically one on either side of the lesion or multiple as seen in penoscrotal

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porokeratosis and porokeratosis ptychotropica. They also arise from adnexal structures, both follicular infundibula and eccrine ostia as in porokeratotic adnexal ostial nevi.⁵

Presence of cornoid lamellae without typical clinical appearance of annular papules or plaques has been suggested to be an epidermal reaction pattern that may be steroid responsive⁶ or long-standing.⁷

Involvement of the genital region and adjacent areas (buttocks, perineum, groin and proximal thighs) may occur as part of generalized porokeratosis occurring elsewhere on the body;^{8–12} however, porokeratosis localized to the genitogluteal region is rare and very few cases have been described in literature.

The following is a clinical review of genitogluteal porokeratosis, where lesions occur only in the genitalia and/ or anal and gluteal region. A MEDLINE database search using the keywords genital, scrotal, anal, gluteal and vulval porokeratosis was done and the data collected were reviewed.

Genitogluteal porokeratosis

The first case of porokeratosis localized to the genital areas was probably described by Helfman and Poulos in 1985. ¹³ They described a young man with chronic persistent reticulated dermatosis involving the groin, genitals and thighs that was refractory to therapy. Biopsy revealed multiple cornoid lamellae consistent with porokeratosis.

Since then, there have been no more than 50 reports in the literature. Porokeratosis restricted to male and female genitalia have been described as scrotal, penoscrotal, penile, vulval and genito-cruro-anal and those restricted to buttocks as gluteal according to the site of involvement encompassing the term "genitogluteal porokeratosis."

All cases described under the term genitogluteal porokeratosis may broadly be divided into three groups, namely:

- 1. classical porokeratosis restricted to the genital region,
- 2. ptychotropic porokeratosis and
- 3. penoscrotal porokeratosis

All these three groups have in common the presence of cornoid lamellae, which is a diagnostic and unifying factor to include them under the broader rubric of porokeratosis. They differ in morphologic appearance of the lesions, sites involved and age of presentation.

Classical porokeratosis restricted to the genital region

Table 1 presents a review of cases of genital porokeratosis.

Classical porokeratosis of Mibelli may be localized to the genital region and while it remains a rare entity, a possible increased incidence may occur in Asian and African-American populations. ^{14–16} The pathogenesis of this entity remains uncertain, and both genetic and environmental factors have been implicated. The majority of patients reported have been middle-aged males who have had the lesions for over a year before presenting to the dermatologist. The mean age at initial diagnosis is 39 years (range 22–61 years). The lesions most commonly affect the scrotum, penis and buttocks and adjacent thighs. Lesions on glans penis have been described, and Porter et al reported a case involving the external urethral meatus. ¹⁷

Most lesions are typical of porokeratosis of Mibelli with annular centrally atrophic plaques with raised margins showing the typical ridge (Figures 1 and 2). A few cases of linear arrangement of lesions have been reported. Kienast and Hoeger in 2009¹⁸ reported a 15-year-old male with a 2-year history of multiple erythematous linear atrophic lesions along the dorsum of the penis and prepuce with cornoid lamellae on biopsy. A similar case was reported in a 39-year-old male, which resolved by liquid nitrogen cryotherapy over a 6-month period and without recurrence at 2 years. ¹⁹

Follicular porokeratosis of Mibelli restricted to the genital region has been described. Gu et al,²⁰ in their large case series of porokeratosis, described a 35-year-old male with multiple 1–5 mm sized brownish papules along the gluteal folds sparing the anus. Histology showed cornoid lamellae arising from the hair follicles. The first report of follicular porokeratosis, however, was in a 42-year-old male who had follicular porokeratosis in the natal cleft.²¹

Genital porokeratosis is extremely rare in females and no significant familial association has been noted for genital porokeratosis, although familial cases of other types of porokeratosis have been described.

Repeated friction with clothes and scratching may be part of the pathogenesis of genital lesions. Pruritus is common in cases reported from Asia. Diagnosis is often delayed because of rarity of the condition and is often misdiagnosed as psoriasis, lichen simplex chronicus, hypertrophic lichen planus, tuberculosis of skin and Bowen's disease. Biopsy is diagnostic with the typical cornoid lamella and should be done in any long-standing plaque on the genital region, which does not respond to routine treatment. Like porokeratosis, elsewhere few cornoid lamellae are seen in this form of genital porokeratosis, unlike the multiple cornoid lamellae that have been described in the two other variants of porokeratosis on the genital area, that is, ptychotropic porokeratosis and penoscrotal porokeratosis.

Dermoscopy of lesions of genital porokeratosis shows features typical of porokeratosis, namely, central brown

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for five sessions over a 6-month period								and an atrophic, violaceous center		penis	nitrogen cryotherapy	recurrence at 24 months
a 6-month period											for five sessions over	
											a 6-month period	

Table I (Continued)	ز • •										
N _o	Year	Author	No. of	f Age	Sex	Duration	Description	No. of	Site	Treatment	Prognosis/
			cases	(years)		(months)		lesions			comments
15	2012	Kumar and Lee ⁴⁶	_	51	Σ	144	Erythematous, annular plaques with	٤	Buttocks, groin	Ϋ́Α	NA
							ridged borders and depressed centers		and scrotum		
13	2011	Garg et al ⁹	_	17	Σ	12 years	Asymptomatic widespread	٤	Trunk, extremity,	Acitretin	Excellent response in 5
							hyperpigmented papules and plaques		nail and genital		months
4	2009	Kienast and	_	15	Σ	24	Erythematous, linear atrophic lesions	٤	Dorsal penis and	ĄZ	Ϋ́
		Hoeger ¹⁸							prepuce		
12	2009	Liang et al ⁴⁷	_	22	Σ	∀ Z	Multiple, small, annular plaques with a	٤	Penis	Ą	CL with band-like
							thin, thread-like border				lymphohistiocytic
											infiltrate
91	2009	Yong et al ²¹	_	42	Σ	Ą	Multiple follicular papules	Ϋ́	Natal cleft	NA	Ϋ́Α
17	2009	Benmously et al ⁴⁸	_	20	ш	_	٧Z	Ϋ́	Ϋ́Α	Tretinoin	Associated with multiple
											myeloma
<u>8</u>	2009	Schiffman et al ⁴⁹	_	45	Σ	480	Pruritic recurrent annular papules and	٤	Scrotum and	Topical steroids,	Recurrence
							plaques		buttocks	retinoids, 5-FU	
61	2008	Sengupta et al ¹⁶	٣	34	Σ	3	1.5×1 cm ² depigmented annular keratotic	S	Scrotum	Surgery,	٩Z
							plague surrounded by a raised border			electrodessication	
							traversed by a groove				
				35	Σ	œ	Well-defined, hyperpigmented, annular	Ε	Penile shaft and	Electrodessication	Scar
				}		,	plaques of varying sizes		scrotum		
				76	ш	0	or chart was a second contained	8	Voctibulo	20111000	<u><</u>
				90	L	s o	Dry, itchy, hyperkeratotic verrucous	Ε	v estibule,	ourgical excision	<u> </u>
							plaque, 2×1.5 cm²		tourchette and		
									adjacent perineal		
									skin		
70	2008	Valdivielso- Ramos ⁵⁰	_	47	Σ	<u>8</u>	Solitary porokeratotic plaque	s	Scrotum	Surgical excision	٩
21	2006	Perlis et al ⁵¹	_	64	Σ	₹	Thick lichenified plaque	s	Ventral penis	Triamcinolone	ΑN
22	2006	Chen et al ¹⁴	9	8 months-15	Σ	¥	• V	s-m	YZ	Surgery, CO, lasers,	ΑN
										others	
23	2006	Huang et al ⁵²	9	29–66	Σ	12-108	٩Z	Ϋ́	ΝΑ	Y A	٩Z
				43	ш		٩Z	Ϋ́	ΝΑ	Ą	ΨN
24	2004	Laino et al ⁵³	_	36	Σ	36	٩Z	٤	Ϋ́	Ą	Ϋ́
25	2001	Porter et al ¹⁷	_	26	Σ	24	AZ	s	penis	5-FU	٧Z
76	1995	Neri et al ⁵⁴	2	40	Σ	09	٩Z	s	ΝΑ	No Rx	ΨN
				70	Σ	A/N	Asymptomatic annular lesion, 1 cm	s	Scrotum	No Rx	ΑΝ
27	1999	Stone et al ²⁵	_	27	Σ	2 years	٩Z	٤	Ϋ́Α	Cryotherapy	ΝΑ
Abbr	eviation	ıs: 5-FU, 5-fluorouraci	l; NA, not	: applicable; s, single	e; m, mul	ltiple; C/L, cont	Abbreviations: 5-FU, 5-fluorouracil; NA, not applicable; s, single; m, multiple; C/L, contra-lateral; B/L, bi-lateral; ILS, intra lesional steroid; Rx, treatment.	; Rx, treatme	ent.		

Dovepress Genitogluteal porokeratosis



 $\textbf{Figure I} \ \, \text{Classical genital porokeratos} \text{is of Mibelli showing multiple annular plaques} \\ \text{on the scrotum and penile shaft.} \\$

Note: Photo courtesy of K.J. Somaiya Hospital.

pigmentation with many blue-gray dots surrounded by a single hypopigmented band and the "white track" at the periphery.^{8,22}

Symptomatic relief from pruritus has been reported by the use of topical steroids and retinoids and 3% topical diclofenac cream. ²³ However, no therapy, including cryotherapy, CO₂ laser, oral retinoids, calcipotriol, 5-fluorouracil or imiquimod, has given lasting benefit.

Ptychotropic porokeratosis

Table 2 presents a review of cases of ptychotropic porokeratosis.

Lucker et al²⁴ in 1995 were the first to use the term "porokeratosis ptychotropica" derived from Greek ptyche (fold) and trope (turning) to describe the flexural location of this condition. Their patient was a 34-year-old man who had a 9-year history of a pruritic plaque localized to the natal cleft. A similar case was described by Stone et al in 1999²⁵ in a 32-year-old man with a 13-year history of pruritic lesions confined to the natal cleft. They named it "perianal inflammatory verrucous porokeratosis."



Figure 2 Porokeratosis of Mibelli on the scrotum showing the peripheral ridge that appears hypopigmented and completely surrounds the pigmented annular plaques.

Note: Photo courtesy of K.J. Somaiya Hospital.

Ptychotropic porokeratosis (Figure 3) represents a distinct clinical presentation of porokeratosis that presents with slowly enlarging pruritic thick verrucous plaques that involve mainly the natal cleft and the buttocks in a butterfly pattern but have also been described to affect the penis,²⁶ scrotum^{27,28} and vulva. In a review of 22 patients, the main regions affected were the buttocks (36.36%), genitogluteal region (31.82%) and buttocks with involvement of the extremities (22.7%).²⁸

This condition is usually not diagnosed as porokeratosis for several years or even decades because it lacks the classical peripheral ridge and moat appearance, but instead presents as long-standing pruritic verrucous plaques that are misdiagnosed as psoriasis, chronic eczema, lichen simplex chronicus, dermatophytosis or candidiasis. It has also been described as verrucous and hypertrophic porokeratosis. While it is mostly restricted to the genitogluteal region, ptychotropic porokeratosis has been described with lesions elsewhere on the body. Histologically, most case reports have mentioned the presence of multiple cornoid lamellae that differentiate it from the classical porokeratosis of Mibelli. Few cases have been reported to show amyloid deposits in the upper dermis.²⁷

Tab	e 2 Rev	Table 2 Review of cases of ptychotropic porokeratosis	tychotro	pic porok	eratosis						
o N	Year	Author	No. of cases	Age (years)	Sex	Duration (months)	Description	Number	Site	Treatment	Prognosis/comments
_	2016	Tebet et al ⁵⁵	_	23	Σ	801	7×4 cm², erythematous oval verrucous plaque, slightly hypochromic, with well-defined thread-like borders	v	Right gluteal	Tretinoin 0.05%	No improvement in I week
7	2016	Kogut et al²6	_			Ϋ́	٩Z	₹	Penis	Ϋ́Z	٩Z
33	2016	Veasey et al ⁵⁶	_	4	Σ	264	Extensive erythematous to	٤	Gluteal	Ϋ́	Dermoscopy: prominent
							wine color plaques, with hyperkeratotic surface, precise edges and irregular contours				hyperkeratosis thoroughly, with well-defined borders and no evidence of other structures
4	2015	Cabete et al ²⁹	_	34	Σ	24	Mildly pruritic single, annular, 1.5	s	Right scrotum	Surgical excision as	No recurrence; dermoscopy:
							cm diameter plaque with a raised			it is non-responsive	sharply demarcated annular
							hyperkeratotic, ridge-like border			to cryotherapy and	lesion with a thick, peripheral
										5% imiquimod cream	light brown rim, limiting an
										(three times a week	erythematous non-atrophic
										for 16 weeks)	center with regular dotted
											vessels
2	2015	Pitney et al ⁵⁷	_	₹	∀ Z	Υ V	₹Z	¥	Ϋ́Α	ΑN	٧Z
9	2014	D'Souza et al ^{s8}	_	37	Σ	300	Well-defined, butterfly-shaped, 15×10 cm², verrucous, grayish	v	Perianal	Isotretinoin 30 mg, 5-FU 1% a/d	Flattened in 1 month
							black plaque				
7	2013	Park et al ^{s9}	_	62	ட	36	Brownish hyperkeratotic	٤	B/L buttocks	Ϋ́	Psoriasiform epidermal
							verrucous plaque with well-				hyperplasia with multiple CL
							demarcated satellite papules				
	2013	Broussard et al''	_	26	Σ	5 years	Pruritic hyperkeratotic plaques	٤	Intergluteal cleft, buttocks, B/L	Ψ V	∀ Z
									diikles		
ω	2012	Wanat et al ⁶⁰	_	28	Σ	2	Burning and itchy thin red plaques with distinct elevated borders	Ε	Gluteal cleft	∀ Z	∀ Z
							and a pebbled appearance				
6	2011	Corradin et al ⁶¹	_	Ϋ́	∀ Z	Ϋ́Z	٧Z	₹	ĄZ	A A	٩Z
Abbre	eviations:	Abbreviations: 5-FU, 5-fluorouracil; NA, not applicable.	NA, not ap	plicable.							

Dovepress Genitogluteal porokeratosis



Figure 3 Ptychotropic porokeratosis showing a keratotic plaque on the medial right buttock close to the natal cleft.

Dermoscopic findings have been described as sharply demarcated annular lesions with a thick peripheral brown rim limiting an erythematous non-atrophic center with regular dotted vessels, which differentiates it from other inflammatory conditions such as psoriasis, dermatophytosis and lichen simplex chronicus.²⁹

This condition appears to be common in men and of 22 cases reviewed by Takiguchi et al,²⁸ 90% were males aged between 27 and 84 years. Its etiology is not established, but friction with clothing may be an aggravating factor. Treatment of this condition is disappointing, and response to various treatments is rather poor. The various therapies offered include cryotherapy with liquid nitrogen, 5-fluorouracil, imiquimod, calcipotriol, topical steroids and antifungals, and lasers. The only report of initial successful treatment was in a 25-year-old man who had a pruritic plaque on the buttock of 8 years duration diagnosed as porokeratosis on histology, which was treated using a dermatome to slice away the superficial tissue; however, there was a subsequent relapse.³⁰

Penoscrotal porokeratosis

Table 3 presents review of cases of penoscrotal porokeratosis.

Penoscrotal porokeratosis appears to be a distinct entity in the family of porokeratotic diseases, described only in young

able 3 Review of cases of penoscrotal porokeratosis

æ	Die 5 Kevi	ew of (lable 3 Review of cases of penoscrotal porokeratosis	noscrota	al porc	okeratosi	S									
å	Ref. no/	Year	Author	No. of	Age (Gender	Duration	No Ref. no/ Year Author No. of Age Gender Duration Description Number Site	Number		Dermoscopy HPE		Diagnosis	Treatment	Follow- Prognosis	Prognosis
	initials		_	cases											dn	
_	31	2015	2015 Joshi and	-	26	Σ	5 single	Persistent,	Multiple	Ventral	1	Multiple	Penoscrotal	White soft	4 months Cleared	Cleared
			Jadhav ³¹					itchy and		part of the	-	cornoid	porokeratosis paraffin	paraffin		
								burning skin		penile shaft	_	lamellae				
								lesions with		and anterior		located				
								raised, thread-		scrotal skin		adjacent to				
								like border			-	one another				
7	7	2014	2014 Joshi and 10		22 /	AIIM	٩	Pruritic	Single <<	Single << Penoscrotal	ı	CL in	Porokeratotic Topical	Topical		Partial to no
			$Mehta^7$	'	-30			plaques	multiple		-	epidermis (7), epidermal		steroids,		response
											-	eccrine ostia reactional		antifungals,		
												(I), combined pattern		antihistaminics,		
											_	(I), follicular		isotretinoin		
												infundibulum				
		L														

males in their third decade with involvement of the penile shaft and anterior scrotum with severe burning and itching and histologically demonstrating multiple cornoid lamellae.³¹

Repeated minor frictional trauma due to tight-fitting underclothes or a contact reaction to some agent may be the factors in the pathogenesis of these lesions. Joshi and Mehta⁷ described 10 young males who presented with pruritic plaques on the penoscrotal region of several months duration with a clinical appearance not being typical of porokeratosis of Mibelli. They had partly well defined to poorly defined plaques on the ventral surfaces of the penile shaft and the anterior scrotum (Figures 4 and 5).

Biopsy showed multiple cornoid lamellae in nine patients (Figures 6 and 7), which in three cases were seen to arise from eccrine and follicular structures. Clinicopathologically, these cases do not correspond to typical plaque porokeratosis, and they postulated that these cases represent an unusual, hitherto undescribed porokeratotic epidermal reaction pattern with multiple cornoid lamellae.



Figure 4 Penoscrotal porokeratosis, annular plaque and small papules on the ventral shaft of penis.



Figure 5 Penoscrotal porokeratosis, hypertrophic verrucous plaques on the anterior scrotum.

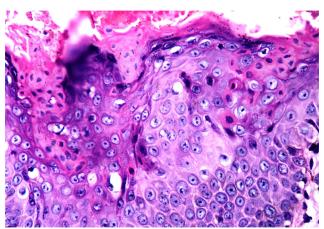


Figure 6 Multiple contiguous cornoid lamellae in penoscrotal porokeratosis. H&E, 400×.

Treatment with topical steroids and/or antifungals and oral antihistaminics is only partially helpful without any resolution of the condition. Oral isotretinoin showed flattening of the lesions with a decrease in pruritus, but recurrence of symptoms on discontinuation of the medication after 2 months was observed.

The following criteria have been suggested for the diagnosis of penoscrotal porokeratosis.³¹

Dovepress Genitogluteal porokeratosis

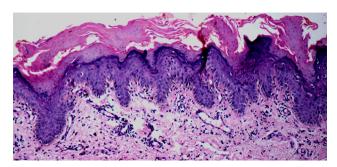


Figure 7 Multiple contiguous cornoid lamellae in penoscrotal porokeratosis. H&E, $100\times$.

- 1. young men in their third decade of life;
- plaques and diffuse patches with a rough granular surface associated with severe pruritus and burning sensation restricted to the penile shaft and scrotum;
- histologic findings of multiple contiguous cornoid lamellae, some of which arise from follicular and eccrine structures and
- 4. a poor response to topical and systemic treatment.

Penoscrotal porokeratosis appears to have a very restricted age involvement with all cases described in males in their 20s.

Comments

The etiology and pathogenesis of porokeratosis is not well understood even today, more than a century after its description. Certain mutations have been identified with porokeratosis in some pedigrees, ^{32,33} and familial cases have also been reported. ³⁴ Porokeratosis has been considered to be a premalignant condition, ^{35,36} and malignancy had been described in long-standing, large and ulcerative lesions of porokeratosis; ³⁷ however, to date, there has been no report of malignancy developing in genital porokeratosis. A case of 70-year-old male with genito-ano-crural porokeratosis following chronic exposure to benzene, a known carcinogen, has been described. ³⁸

Unlike porokeratosis elsewhere on the body, genital porokeratosis has been reported to be associated with severe pruritus. Most cases have been described from Asia and the Indian subcontinent, where the hot and humid ambience may be a factor along with friction with tight synthetic clothing.

While all three forms of genital porokeratosis have in common the presence of cornoid lamellae, multiple contiguous cornoid lamellae are seen in both ptychotropic and penoscrotal porokeratosis.

A uniformly poor response to various treatments, topical, systemic and surgical, is seen in all forms of genital porokeratosis, and a reliable modality of therapy for this often distressing condition still awaits elucidation.

In summary, the following can be mentioned:

- Porokeratosis restricted to the genitogluteal region is an uncommon entity.
- Clinically, three distinct presentations are seen and may be classified as classical porokeratosis, porokeratosis ptychotropica and penoscrotal porokeratosis.
- Genitogluteal porokeratosis of all varieties has been described mainly in men with a very restricted age occurrence in penoscrotal porokeratosis.
- 4. Pruritus that may often be distressing is a common presenting feature as is the chronicity of the disease.
- The "cornoid lamella" is the common unifying histologic finding in all cases, and multiple cornoid lamellae is the rule in both ptychotropic and penoscrotal porokeratosis.
- 6. No malignancy has yet been reported in genitogluteal porokeratosis.
- No satisfactory modality of treatment has yet been described.

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Disclosure

The authors report no conflicts of interest in this work.

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