Prevalence and Risk Factors for Xerosis in the Elderly: A Cross-Sectional Epidemiological Study in Primary Care

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Key Words

Xerosis · Atopic dermatitis · Elderly · Risk factors

Abstract

Background: Limited information is available concerning the prevalence and risk factors of xerosis in the elderly. **Objective:** To establish the prevalence of xerosis and associated factors in elderly patients. **Methods:** A national, multicenter, observational, cross-sectional study in patients aged 65 or older was performed. The data collected by general practitioners were demographics and medical history, including history of atopic disease. Xerosis was evaluated using the Overall Dry Skin score. **Results:** 756 patients were included. The prevalence of xerosis was 55.6%. Xerosis was significantly associated with older age (OR: 1.48, 95% CI: 1.16–1.89), female sex (OR: 1.80, 95% CI: 1.29–2.53), treatments that can potentially cause xerosis (OR: 2.21, 95% CI: 1.54–3.17), itching during sweating (OR: 7.11, 95% CI: 3.90–12.95), a history of dry skin (OR: 2.89, 95% CI: 1.65–5.08) and a history of atopic dermatitis (OR: 3.60, 95% CI: 1.99–6.52). **Conclusion:** Xerosis is highly prevalent in the elderly. A history of atopy, especially atopic dermatitis, is associated with an increased risk of xerosis in the elderly.

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Introduction

The skin hydration process is mostly regulated at the level of the stratum corneum which carries the skin barrier function. The stratum corneum controls transepidermal water loss from the body and is responsible for water capture from the environment. Skin barrier integrity depends on complex interactions between the corneocytes embedded in the cornified envelope consisting of cross-linked proteins, such as involucrin, loricrin and filaggrin, corneodesmosomes and lipid bilayers [1, 2]. Numerous factors may predispose to xerosis, including external aggressions, climate, medication, malignant diseases, endocrine disorders, infections and renal failure in dialyzed patients [3]. Aging is associated with modifications in skin hydration and barrier function properties accounting for an increased risk of xerosis [4].

Xerosis is a common skin manifestation in the elderly as assessed by epidemiological studies performed in secondary care [5, 6]. However, there is little information concerning its exact prevalence and severity in the community. Epidemiological studies, mostly conducted in nursing homes, have shown a prevalence of xerosis in the elderly ranging from 30 to 75% [7–12].

The objective of the present study was to evaluate the prevalence of xerosis in the elderly in a primary care setting and to establish associated risk factors with a focus on a history of atopic disease.

Patients and Methods

In this national, multicenter, cross-sectional, observational study, patients were recruited by a sample of general practitioners (GPs), randomly chosen from a comprehensive French database of GPs. The GPs were asked to recruit consecutively over 1 week the first 10 patients aged ≥ 65 years who presented in their office. All patients of both genders, aged ≥ 65 years and capable of answering questions related to their personal history since childhood could be included. The survey was conducted in accordance with French legal requirements. For observational studies performed in the context of normal clinical care, no ethical committee approval is required. The purpose of the study was explained to all patients and an information sheet was given.

The following information was collected: sociodemographic data (age, gender, socio-occupational category before retirement), concomitant diseases (renal failure and others) and treatments potentially related to xerosis including retinoids, lipid-lowering drugs and others.

Clinical assessment of xerosis was performed by visual examination using the Overall Dry Skin (ODS) score according to the guidelines of the European Group on Efficacy Measurement of Cosmetics and Other Topical Products [13].

Moreover, the GPs questioned the patients about their personal and family history regarding atopic diseases, such as asthma, hay fever, conjunctivitis, and atopic dermatitis, using the diagnosis criteria elaborated by the UK Working Party [14]. Finally, the patients were questioned about their environment and their life habits, including tobacco smoking, hydration, personal hygiene, living environment and climatic conditions.

In addition, patients presenting xerosis, defined by an ODS score of ≥ 1 , had the intensity of their skin dryness and pruritus evaluated using a five-point Likert scale.

Electronic data capture was performed during the visit through a secured and dedicated website.

Statistical Analysis

Statistical analyses were performed using SAS package program version 9.1 (SAS Institute, Cary, N.C., USA). With an estimation of 60% of elderly people suffering from xerosis and with the following hypotheses – prevalence of associated factors equal to 8% or more, odds ratio (OR) = 2, α -risk = 5%, and power $(1 - \beta)$ of 80% – a sample including at least 724 participants was required to evaluate the primary objective. Descriptive statistics were expressed as means $\pm$ standard deviations, and frequency (percentage of collected data). Group comparisons were conducted using Student's *t* test, ANOVA, the Kruskal-Wallis test, the χ^2 test and Fisher's exact test. The factors associated with xerosis in elderly patients were established through binary logistic regression analysis using stepwise selection with a 5% significance level on relevant variables that were significant at a 10% level in univariate analyses. The factors associated with xerosis severity were analyzed using ordinal logistic regression with manual backward se-

Fig. 1. Xerosis distribution in the study population according to ODS score (n = 756).

lection on relevant variables that were significant at a 10% level in univariate analyses. Odds ratios (ORs) and their 95% Wald confidence intervals (95% CIs), are presented for multivariate analyses. Statistical significance was accepted at the two-sided 0.05 level.

Results

Patients' Characteristics

Table 1 presents sociodemographic and clinical characteristics of patients according to their xerosis status. A total of 756 patients (43% men) with a mean age of 75.1 ± 6.9 years were recruited by 81 GPs from July 24 to December 1, 2008. The prevalence of any degree of xerosis was 55.6% in the population.

Figure 1 shows xerosis distribution in the study population according to the ODS score.

Patients' Personal Assessments of Skin Dryness and Pruritus

The perception of dry skin and pruritus in xerosis patients differed according to their ODS score ($p < 0.001$ for both assessments). There was a significant association between severity of xerosis as recorded by the ODS score and the patients' perception of skin dryness and pruritus (fig. 2).

Personal or Family History of Atopy

The current or previous history of atopic disease was recorded for all patients (table 2).

A history of asthma, hay fever and atopic dermatitis was more frequent in patients with xerosis ($p < 0.001$) as well as skin problems, dry skin, redness/red skin patches and pruritus during childhood or adolescence, and they were increased with the severity of xerosis.

Table 1. Patients' sociodemographic and clinical characteristics

	Without xerosis	With xerosis	p
Age, years	74.2 ± 6.7	75.9 ± 6.9	0.001
Gender			<0.001
Male	50	37.4	
Female	50	62.6	
Socio-occupational category (before retirement)			
Farmers	10.4	12.3	
Artisans, storekeepers, entrepreneurs	17.7	12.8	
Managers	12.9	12.8	
Intermediate jobs	12.0	13.8	
White-collar employees	28.4	30.3	
Blue-collar employees	17.7	16.9	
Students	0.95	1.03	
Projected longitude of patient's residence (French Department), radians	377 ± 105	339 ± 123	<0.001
Projected latitude of patient's residence (French Department), radians	398 ± 160	372 ± 157	0.017
Concomitant disease(s) that could be associated with xerosis	7.1	24.5	<0.001
Renal failure in dialyzed patients	16.7	15.5	n.s.
Renal failure in dialyzed patients and others	16.7	18.4	
Others	66.7	68.9	
Diabetes	1.2	2.6	n.s.
Renal failure	0	0.5	n.s.
Venous insufficiency	0	1.4	0.036
Cancer	0.6	1.9	n.s.
Other diseases	3.0	11.9	<0.001
Concomitant treatment(s) that could be responsible for xerosis	24.1	40.7	<0.001
Therapeutic classes of concomitant treatments potentially related to xerosis			n.s.
Retinoids	4.5	6.6	
Lipid-lowering drugs	74.6	68.9	
Other agents	20.9	25.5	
Concomitant treatment(s) that could reduce xerosis symptoms	3.9	10.5	0.001
Values denote percentages or means ± SD.			

Patients' Life Habits

Concerning patients' life habits related to xerosis, the quantity of absorbed water was less important in patients with xerosis than in patients without xerosis (1.3 ± 0.6 vs. 1.4 ± 0.5 liter, $p = 0.005$). Itching during sweating was more frequently observed in patients with xerosis than in patients without xerosis (27.9 vs. 4.5%, $p < 0.001$) as well as body wash frequency per week (6.5 ± 2.7 vs. 5.9 ± 2.6 , $p = 0.011$). In addition, the use of cosmetic agents containing soaps or detergents and perfumes was higher among patients with xerosis ($p < 0.001$ and $p = 0.033$, respectively) as well as the use of emollients and/or moisturizing and keratolytic agents ($p < 0.001$ and $p = 0.010$, respectively).

Factors Associated with Xerosis in the Elderly: Multivariable Analysis

Table 3 presents the factors that remained significantly associated with xerosis: older age, female sex, concomitant treatments that could be responsible for xerosis, current or previous history of atopic dermatitis, dry skin during childhood or adolescence, and itching during sweating.

Factors Associated with the Severity of Xerosis in the Elderly: Multivariable Analysis

A higher severity of xerosis was associated with older age (OR = 1.69, 95% CI: 1.27–2.25, $p < 0.001$), concomitant treatments that could be responsible for xerosis (OR = 1.69, 95% CI: 1.15–2.48, $p = 0.008$), itching during sweating (OR = 1.60, 95% CI: 1.04–2.45, $p = 0.031$), increase in

Fig. 2. Patients' assessments of xerosis (a) and pruritus (b) (n = 420).

xerosis and pruritus in winter time (OR = 2.07, 95% CI: 1.35–3.16, $p < 0.001$) and a history of hay fever (OR = 1.89, 95% CI: 1.16–3.08, $p < 0.02$).

Discussion

This cross-sectional study in a primary care setting shows that xerosis is highly prevalent in patients ≥ 65 years, with 56% of patients experiencing at least some degree of xerosis and about 9% of the elderly population experiencing moderate and severe xerosis according to the ODS score. Of note, the presence of moderate and severe xerosis was associated with a significant burden to patients including pruritus and feelings of very dry or unbearably dry skin in a high proportion of sufferers. Pruritus is frequently associated with xerosis and is highly prevalent in elderly subjects. In a large cross-sectional study performed in Germany, the prevalence of chronic pruritus was 20.3% in people between 60 and 70 years [15].

The most significant risk factors associated with xerosis in the elderly were older age, female sex, dry skin or atopic dermatitis during childhood or adolescence, atopic dermatitis (current or previous), itching during sweating and concomitant treatment that may be associated with xerosis. Xerosis in the elderly appeared to be more severe in older patients, in patients receiving treatments that may be associated with xerosis and in patients with a history of hay fever or itching when sweating.

This study highlights the role of atopy as a risk factor for xerosis in the elderly. According to a recent epidemiological study in primary care in Germany using a questionnaire completed by patients aged 50–75 years, the lifetime prevalence of reported atopy is low, with about 4.3, 8 and 5.5% of patients, respectively, reporting a diagnosis of atopic dermatitis, hay fever or asthma established by a physician [16]. According to the current study, which was also performed in a primary care setting but in an older population of elderly subjects, the prevalence of atopy was higher with, respectively, 17.7, 15.1 and 10.2% of patients reporting a diagnosis of atopic dermatitis, hay fever or asthma.

Table 2. Patients' personal and family history of atopic disease (n = 756)

	Without xerosis (n = 336)	With xerosis (n = 420)	p
Asthma, %	7.4	12.4	0.026
Hay fever, %	11.3	18.1	0.010
Conjunctivitis, %	4.8	7.6	0.109
Atopic dermatitis, %	5.6	27.4	<0.001
Atopic diseases occurring in a patient			
Mean $\pm$ SD	0.29 $\pm$ 0.62	0.65 $\pm$ 0.95	<0.001
Number of atopic diseases occurring in a patient ^a			<0.001
0, %	78.3	59.3	
1, %	15.5	25.0	
2, %	5.1	9.1	
3, %	1.2	5.0	
4, %	0	1.7	
History of atopic diseases ^a			<0.001
0, %	88.4	72.6	
1, %	7.7	19.8	
2, %	3.9	4.8	
3, %	0	2.4	
4, %	0	0.5	
Patient's memory ^b			
Skin disorders, %	3.57	18.3	<0.001
Wool intolerance, %	20.8	23.3	0.080
Dry skin, %	6.25	27.9	<0.001
Red skin patches/redness, %	7.14	26.7	<0.001
Pruritus, %	4.17	14.8	<0.001
Family history of asthma/hay fever/atopic dermatitis			
Offspring suffering from atopy (currently or in the past)			
No offspring, %	31.3	22.1	0.003
No, %	52.4	53.6	
Yes, %	16.4	24.3	
Siblings suffering from atopy (currently or in the past)			
No siblings, %	28.6	29.8	0.045
No, %	61.6	54.8	
Yes, %	9.8	15.5	

^a Among the four types are: asthma, hay fever, conjunctivitis and atopic dermatitis. ^b Patient's memory regarding atopic dermatitis or a typical sign of atopic dermatitis during childhood or adolescence.

Out of the 7 risk factors significantly associated with the occurrence and severity of xerosis in the multivariate analysis, 4 are related to atopy, namely: dry skin or atopic dermatitis during childhood, itching when sweating and a history of hay fever. The role of itching during sweating is difficult to interpret. Itching during sweating may be related to atopy, but in part it may also be a consequence of xerosis. The fact that itching during sweating was significantly associated with the severity of xerosis corroborates this hypothesis.

Table 3. Factors associated with xerosis in elderly patients (n = 756)

Covariates	OR	95% CI	p value
Age ¹	1.48	1.16–1.89	0.002
Gender, female vs. male	1.80	1.29–2.53	<0.001
Projected longitude ²	0.75	0.65–0.87	<0.001
Projected latitude ²	0.87	0.78–0.96	0.008
Concomitant treatments that could be responsible for xerosis			
yes vs. no	2.21	1.54–3.17	<0.001
Atopic dermatitis (current or previous), yes vs. no	3.60	1.99–6.52	<0.001
Dry skin during childhood/adolescence, yes vs. no	2.89	1.65–5.08	<0.001
Itching during sweating, yes vs. no	7.11	3.90–12.95	<0.001

¹ Age was divided into 10-year classes. ² Projected longitude and latitude were divided into 100-radian classes.

It has recently been shown that adult patients recruited from a dermatology department in Scotland had a higher risk of dry skin if they were carriers of one of the filaggrin null mutations associated with atopic dermatitis and ichthyosis vulgaris [17]. In that study, 50% of young adults and 100% of elderly patients who were heterozygotes for one of the filaggrin null mutations had some degree of xerosis as assessed clinically. Genetic studies have shown that the prevalence of filaggrin null mutations in continental Europe are lower as compared to the United Kingdom, where between 17.5–23% of atopic patients carry a filaggrin null mutation compared to 3.5–8% of controls in studies from France and Germany [17, 18]. The predisposition to xerosis may also include other skin barrier-related genes such as Spink5, kallikrein 7 or hornerin [19–21]. It has been shown that atopic dermatitis may be associated with subclinical inflammation which could contribute to pruritus in elderly patients with xerosis and a history of atopic dermatitis [22].

The potential limitations of the present study are the retrospective nature of risk factors assessment which may be subjected to recall bias in patients with xerosis and the fact that the study population consisted of subjects who visited a doctor for any cause. These subjects may not be exactly representative of the general population. In addition, information bias, for example a more thorough investigation of a history of atopy in patients with xerosis by physicians, cannot be ruled out. However, patient questionnaires were administered by GPs who had no interest in the study and limited knowledge of the patho-

physiology of xerosis. The strengths of the study are the primary care setting, which is closer to population-based epidemiology, and the consecutive inclusion of all elderly patients seen by the GPs, thus limiting selection bias.

In summary, to our knowledge, this is the first study exploring the incidence and risk factors for xerosis in the elderly in a primary care setting. It provides information regarding the high prevalence of xerosis in the elderly. Moderate and severe forms of xerosis are associated with clinical symptoms which can be troublesome. Xerosis in this population was more frequent in women, and the most important risk factors appear to be related to atopy.

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Disclosure Statement

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References

- 1 Elias PM: The skin barrier as an innate immune element. *Semin Immunopathol* 2007; 29:3–14.
- 2 Cork MJ, Danby SG, Vasilopoulos Y, Hadgraft J, Lane ME, Moustafa M, et al: Epidermal barrier dysfunction in atopic dermatitis. *J Invest Dermatol* 2009;129:1892–1908.
- 3 Mazereeuw J, Bonafé J-L: Xerosis (in French). *Ann Dermatol Venereol* 2002;129:137–142.
- 4 Farage MA, Miller KW, Berardesca E, Maibach HI: Clinical implications of aging skin: cutaneous disorders in the elderly. *Am J Clin Dermatol* 2009;10:73–86.
- 5 Grover S, Narasimhalu CRV: A clinical study of skin changes in geriatric population. *Indian J Dermatol Venereol Leprol* 2009;75:305–306.
- 6 Smith DR, Atkinson R, Tang S, Yamagata Z: A survey of skin disease among patients in an Australian nursing home. *J Epidemiol* 2002; 12:336–340.
- 7 Beauregard S, Gilchrist BA: A survey of skin problems and skin care regimens in the elderly. *Arch Dermatol* 1987;123:1638–1643.
- 8 Polat M, Yalçın B, Calışkan D, Alli N: Complete dermatological examination in the elderly: an exploratory study from an outpatient clinic in Turkey. *Gerontology* 2009;55: 58–63.
- 9 Seyfarth F, Schliemann S, Antonov D, Elsner P: Dry skin, barrier function, and irritant contact dermatitis in the elderly. *Clin Dermatol* 2011;29:31–36.
- 10 Smith DR, Sheu H-M, Hsieh F-S, Lee Y-L, Chang S-J, Guo YL: Prevalence of skin disease among nursing home patients in southern Taiwan. *Int J Dermatol* 2002;41:754–759.
- 11 Tianco EA, Buendia-Teodosio G, Alberto NL: Survey of skin lesions in the Filipino elderly. *Int J Dermatol* 1992;31:196–198.
- 12 Yalçın B, Tamer E, Toy GG, Öztaş P, Hayran M, Alli N: The prevalence of skin diseases in the elderly: analysis of 4099 geriatric patients. *Int J Dermatol* 2006;45:672–676.
- 13 Serup J: EEMCO guidance for the assessment of dry skin (xerosis) and ichthyosis: clinical scoring systems. *Skin Res Technol* 1995;1:109–114.
- 14 Williams HC, Burney PG, Pembroke AC, Hay RJ: Validation of the UK diagnostic criteria for atopic dermatitis in a population setting. UK Diagnostic Criteria for Atopic Dermatitis Working Party. *Br J Dermatol* 1996;135:12–17.
- 15 Ständer S, Schäfer I, Phan NQ, Blome C, Herberger K, Heigel H, Augustin M: prevalence of chronic pruritus in Germany: results of a cross-sectional study in a sample working population of 11,730. *Dermatology* 2010;221: 229–235.
- 16 Wolkewitz M, Rothenbacher D, Löw M, Stegmaier C, Ziegler H, Radulescu M, et al: Lifetime prevalence of self-reported atopic diseases in a population-based sample of elderly subjects: results of the ESTHER study. *Br J Dermatol* 2007;156:693–697.
- 17 Sergeant A, Campbell LE, Hull PR, Porter M, Palmer CNA, Smith FJD, et al: Heterozygous null alleles in filaggrin contribute to clinical dry skin in young adults and the elderly. *J Invest Dermatol* 2009;129:1042–1045.
- 18 Hubiche T, Ged C, Benard A, Léauté-Labrèze C, McElreavey K, de Verneuil H, et al: Analysis of SPINK 5, KLK 7 and FLG genotypes in a French atopic dermatitis cohort. *Acta Derm Venereol* 2007;87:499–505.
- 19 Walley AJ, Chavanas S, Moffatt MF, Esnouf RM, Ubhi B, Lawrence R, et al: Gene polymorphism in Netherton and common atopic disease. *Nat Genet* 2001;29:175–178.
- 20 Vasilopoulos Y, Cork MJ, Murphy R, Williams HC, Robinson DA, Duff GW, et al: Genetic association between an AACC insertion in the 3'UTR of the stratum corneum chymotryptic enzyme gene and atopic dermatitis. *J Invest Dermatol* 2004;123:62–66.
- 21 Henry J, Hsu C-Y, Haftek M, Nachat R, de Koning HD, Gardinal-Galera I, et al: Hornylin is a component of the epidermal cornified cell envelopes. *FASEB J* 2011;25:1567–1576.
- 22 Bangert C, Strober BE, Cork M, Ortonne JP, Luger T, Bieber T, et al: Clinical and cytological effects of pimecrolimus cream 1% after resolution of active atopic dermatitis lesions by topical corticosteroids: a randomized controlled trial. *Dermatology* 2011;222: 36–48.