REPORT

Prevalence and factors associated with hidradenitis suppurativa: Results from two case-control studies

Jean E. Revuz, MD, PhD,[a,b] Florence Canoui-Poitrine, MD,[b,c] Pierre Wolkenstein, MD, PhD,[a,b] Cedric Viallette, MSc,[d] Germaine Gabison, MD,[a] Florence Pouget, MD,[a] Florence Poli, MD,[a] Ousmane Faye, MD,[g] Jean Claude Roujeau, MD, PhD,[a,b] Genevieve Bonnelye, MSc,[e] Jean Jacques Grob, MD, PhD,[f] and Sylvie Bastuji Garin, MD, PhD[b,c]
Creteil, Montrouge, and Marseille, France; and Bamako, Mali

Background: Conflicting opinions have been reported regarding the epidemiology of hidradenitis suppurativa.

Objective: We sought to evaluate the prevalence of hidradenitis suppurativa and to identify associated factors.

Methodology: Prevalence was evaluated using a representative sample of the French population (n = 10,000). Associated risk factors were assessed using two case-control studies, one population-based with 67 self-reported patients and 200 control subjects, and the other clinic-based with 302 medically assessed patients and 906 control subjects.

Results: The prevalence was 1% of the French population. Multivariate analyses showed a strong association with current smoking in self-reported (odds ratio = 4.16, 95% confidence interval [2.99-8.69]) and in medically assessed (odds ratio = 12.55 [8.58-18.38]) populations. Association with body mass index was significant in medically assessed patients (odds ratio = 1.12 [1.08-1.15]) for each increase of 1 U of BMI.

Limitations: A causal relationship could not be established with such a cross-sectional study.

Conclusion: Hidradenitis suppurativa is a common disease, frequently associated with smoking and being overweight. (J Am Acad Dermatol 10.1016/j.jaad.2008.06.020.)

Hidradenitis suppurativa (HS) is an orphan disease whose definition relies on clinical criteria. Formerly defined as chronic suppuration of inverse areas, it is characterized clinically by recurrent, painful, deep-seated nodules and abscesses of apocrine gland-bearing skin.[1] Relapses and chronicity cause a significant impact on quality of life.

HS is usually considered to be a rare disease, but estimates of prevalence have ranged from 0.33 to 4 patients per 1000 inhabitants.[2] Only one epidemiologic study has been devoted to analyze its potential risk factors; smoking was the single factor significantly associated with HS.[3] The role of obesity has been considered repeatedly, but never conclusively demonstrated.[2]

The aim of this study was to estimate the prevalence of HS using a representative sample of the French population and to identify the factors potentially associated with HS.

Abbreviations used:

BMI: body mass index
HS: hidradenitis suppurativa
OR: odds ratio

From the AP-HP, Groupe Henri-Mondor Albert-Chenevier, Service de Dermatologie,[a] Service de Santé Publique,[c] and Unite de Recherche Clinique,[d] Creteil; Universite Paris 12, Faculte de Medecine, Creteil[b]; TNS Sofres Institute, Montrouge[e]; Dermatology Department, Hospital Sainte Marguerite, Marseille[f]; and Dermatology Department; CNAM-Ex Institut Marchoux, Bamako, Mali.[g]
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Reprint requests: Jean E. Revuz, MD, PhD, Dermatology Departement, Universite Paris XII, Hopital Henri Mondor, 51 avenue du Marechal DeLattre de Tassigny, 94010 Creteil, France.
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METHODS

A survey was conducted in March 2005 to evaluate the prevalence of major dermatologic disorders in the French population and any associated factors, including environmental and sociodemographic characteristics.

A panel of experts in the fields of dermatology, public health, and epidemiology (P. W., J. E. R., J. C. R., J. J. G., and S. B. G.) designed a questionnaire in collaboration with a polling expert (G. B.). This questionnaire was designed to be easily understood by the subjects surveyed. The questionnaire had 3 aims: (1) inquire into the management of the main skin diseases in France; (2) evaluate the incidence of major skin diseases in France; and (3) identify factors that may be associated with these dermatologic disorders.

We report herein the results on HS.

Survey sample

Cases of presumed HS were identified using the question: "During the last 12 months did you repeatedly have big painful nodules or boils located in the armpits or groin, a disease called hidradenitis?" Other questions concerned body size and weight; smoking and drinking habits; and treatment for hypertension, diabetes, and/or hypercholesterolemia. The questionnaire was mailed to 10,000 individuals aged 15 years or older. This sample was based on data extracted from the Enquête Emploi 2002, published by the Institut National de la Statistique et des Etudes Economiques,[4] and was drawn up after mailing, using proportional quota sampling to be representative of the general French population.[5,6] Institut National de la Statistique et des Etudes Economiques is the official French organization that carries out the census of the whole French population. The survey was of individuals and was based on the following characteristics: geographic area and urban/rural domicile, age, and socioprofessional category. This 10,000-individual sample is surveyed regularly by the TNS Sofres Institute, generally once a month; health status is a common subject (6-8 times a year). There is a 27% renewal of panelists each year. Participation in the TNS Sofres Institute sample is not paid for by the company. Nevertheless, the loyalty of panel members is ensured by a policy of regular contacts (eg, information magazine, games, lotteries, birthday card sent to each head of household, free telephone facilities). A gift is sent yearly to each good respondent. There was one form per individual.

Case-control studies

Definition of patients. Two categories of patients were used in our study; self-reported patients from the TNS survey on the one hand and medically assessed patients on the other hand.

Population-based case-control study

Self-reported patients were those who stated that they had HS during the last 12 months (see identification question above) (n = 67). Data available were: sociodemographic characteristics, smoking and drinking habits, body mass index (BMI), and drug intake.

For each self-reported patient, 3 control subjects matched for age (±2 years) and sex were randomly selected among the individuals of the sample group who did not declare that they had HS (n = 200).

Clinic-based case-control study

Medically assessed patients were all consecutive patients with HS (N = 302) seen in our institution by the same investigator (J. E. R.) from 1998 to 2006. A standardized form was used to record prospectively socioprofessional data, lifestyle habits, disease history, and clinical characteristics. Inclusion (ie, diagnostic) criteria for HS, were:

- presence of typical lesions, ie, deep-seated nodules (blind boils), abscesses, and/or fibrosis.
- located in typical areas, ie, armpit and groin (and, secondarily, breast, buttocks, and perineum).
- evolving, with relapses and chronicity.[1]

For each medically assessed patient, 3 control subjects matched for age (±2 years) and sex were randomly selected among the individuals of the survey population who did not declare that they had HS (n = 906).

Statistical analysis

Prevalence estimate. The characteristics of the responding sample were compared with those of the general French population. As some social strata were underrepresented or overrepresented, prevalence estimates were adjusted[7] for sex, age, socioprofessional category, geographic area, and dwelling category, to conform to the profile of the French population. Prevalence rates were, therefore, extrapolated to the entire French population.

Case-control studies

For each study, patients and control subjects were compared for socioprofessional categories, smoking status, cigarette consumption (available for current smokers), alcohol consumption, BMI, category of towns where they lived (grouped as rural or semi-urban for people living in a town of <20,000 inhabitants; urbanized for towns of >20,000 population), and drug intake for hypertension, diabetes, and dyslipidemia.

Standard case-control methods were used to compare patients and control subjects. Categorical and continuous data were compared by using the

chi-square test and the Student *t* test, respectively. Crude odds ratio (OR) with 95% confidence interval was estimated separately for each variable using unconditional logistic regression models forcing the matching variable into all models. Variables with *P* less than .20 in univariate analysis were then considered for multivariate analysis. Two-by-two analyses were used to assess first-order interaction and confounding by fitting multiplicative models. A final model was then built with factors independently associated with HS.

Data are presented as mean (±1SD) or as number (percent) as appropriate.

All comparisons were two-sided and a *P* value less than .05 indicated a statistically significant difference.

Data were analyzed using statistical software (Stata, Release 8.2, StataCorp, College Station, TX). The study was approved by the local ethical committee (comité de protection des personnes d'Ile de France IX).

RESULTS

Prevalence rate

The questionnaire was filled in and returned by 6887 (68.9%) of the 10,000 subjects. A total of 3514 (51.0%) declared they had skin problems since birth, and 2200 (32%) reported having skin problems in the past 12 months. In all, 67 subjects (0.97%) stated that they had HS in the past 12 months. The standardized prevalence estimate led to an extrapolation of 447,215 French people (95% confidence interval = 362,242-576,904). The mean age was 39 years (±16.0). There was a substantial decrease of HS prevalence among people aged 55 years and older (1.4% vs 0.5%).

Nearly half of these people (N = 34; 47.2%) had sought help for their HS in the past 12 months: 9 (12.5%) had consulted a dermatologist, 25 (34.7%) a general practitioner, and 4 (5.6%) another specialist. Of the subjects with HS, 55% believed that their disease was "troublesome," 20.0% considered it "a real burden," and 19.5% "coped with it."

Factors associated with HS

Self-reported patients compared with control subjects. In univariate analysis, current smoking was more frequently reported in patients than in control subjects ($P = .001$) (Table I). No relationship was observed either with the number of cigarettes per day or with the age of starting smoking (Table I). There was no significant association with alcohol consumption, nor was any association noted with hypertension, diabetes, dyslipidemia, drugs, and socioprofessional categories (data not shown).

In multivariate analysis, current smoking remained significantly associated with HS (OR 4.16 [2.99-8.69]). Association with BMI was nearly significant (OR 1.05 for every increase of 1 U of BMI).

Medically assessed patients did not differ from self-reported patients with respect to BMI and sex ratio. Nonetheless, they were younger (43.2 ± 17.0 vs 32 ± 9.5; $P < .0001$), more frequently current smokers (75.8% vs 40.0%; $P < .0001$), and had started to smoke earlier ($P = .06$).

Medically assessed patients compared with control subjects

In univariate analysis, current smoking status and BMI were significantly associated with HS (Table II). These associations remained significant in multivariate analyses with high risk estimates for current smokers (OR = 12.55, 95% confidence interval [8.58-18.38]) and for each increase of 1 U of BMI (OR = 1.12 [1.08-1.15]). The multivariate OR for being overweight was 2.08 (1.40-3.08) and was 4.42 (2.82-6.93) for obesity. Smoking status and BMI were significantly associated, but no significant interaction was observed among current smokers; patients reported a higher number of cigarettes consumed than control subjects. This was also observed in the multivariate model (OR = 1.05 [1.02-1.08]).

DISCUSSION

This study estimated the prevalence rate of HS in a representative sample of the French population, and reported results of two case-control studies, one a population-based and the second a clinic-based study. Based on the data of the population survey, we observed a 1% prevalence of HS in the French population. We identified two factors significantly associated with the disease: current smoking and being overweight or obese. There was no association with any of the other parameters examined.

The result of 1% prevalence is supported strongly by the fact that we used a large population sample that was representative of the French population. Furthermore, the quota sampling method ensures that the sample is representative of the population for specified sociodemographic characteristics such as age, sex, geographic area, category of towns, and socioprofessional category. However, some limitations may weaken the results. First, self-reported patients were established by interview and were not confirmed by clinical examination. The diagnosis of HS was made through a single question that has not been validated, thereby possibly underestimating or overestimating the prevalence. Second, discrepancies between prevalence figures

Table I. Factors associated with hidradenitis suppurativa: Self-reported case-control study

	Patients N = 67	Control subjects N = 200	P*	Univariate OR (CI 95%)†	Multivariate OR (CI 95%)‡
Sex					
Male	18 (26.7)	53 (26.5)	—	—	—
Female	49 (73.1)	147 (73.5)		—	—
Age, y	43.2 (17.0)	43.0 (18.1)	—	—	—
Town category (No. inhabitants)					
<20,000	24 (35.8)	93 (46.5)		1.00	1.00
≥20,000	43 (64.2)	107 (53.5)	.13	1.56 (0.88-2.76)	1.59 (0.87-2.90)
Socioprofessional status					
Active	41 (61.2)	134 (67.0)		1.00	—
Inactive	13 (19.4)	29 (14.5)	.59	1.48 (0.70-3.12)	—
Retired	13 (19.4)	37 (18.5)		1.19 (0.40-3.56)	—
Smoking status					
Nonsmoker	21 (31.3)	103 (52.0)		1.00	1.00
Current smoker	27 (40.3)	38 (19.2)	.001	3.76 (1.86-7.59)	3.79 (1.86-7.74)
Ex-smoker	19 (28.4)	57 (28.8)		1.64 (0.80-3.34)	1.55 (0.74-3.22)
Cigarette consumption, n/d§	13.9 (9.2)	11.2 (8.3)	.25	1.04 (0.98-1.10)	—
Age of starting smoking, y§	18.9 (7.2)	19.6 (9.5)	.77	0.98 (0.91-1.06)	—
Alcohol intake					
Never	27 (40.9)	86 (43.2)		1.00	—
1-2 times/wk	28 (42.3)	83 (41.7)	.93	1.20 (0.52-2.80)	—
≥1 d	11 (16.7)	30 (15.1)		1.09 (0.59-2.01)	—
Body mass index, kg/m^2‖	25.6 (6.2)	24.3 (5.0)	.11	1.04 (0.99-1.10)	1.05 (0.99-1.10)
Body mass index, kg/m^2					
≤24	38 (56.7)	130 (66.3)		1.00	1.00
25-29	18 (26.9)	40 (20.4)	.36	1.58 (0.79-3.14)	1.76 (0.85-3.66)
≥30	11 (16.4)	26 (13.3)		1.48 (0.66-3.31)	1.43 (0.62-3.31)
Treated hypertension					
No	53 (79.1)	166 (83.0)	.47	1.00	—
Yes	14 (20.9)	34 (17.0)		1.39 (0.61-3.19)	—
Treated diabetes					
No	64 (95.5)	194 (97.0)	.56	1.00	
Yes	3 (4.5)	6 (3.0)		1.53 (0.36-6.55)	—
Treated dyslipidemia					
No	60 (89.6)	172 (86.0)	.46	1.00	—
Yes	7 (10.5)	26 (14.0)		0.65 (0.25-1.71)	—

CI, Confidence interval; *OR*, odds ratio.
*t Test and chi-square for univariate comparisons.
†Adjusted for sex and age.
‡Multivariate logistic regression adjusted for sex, age, smoking status or cigarette consumption in separate models, and body mass index (continuous or categorical in separate models).
§Data available for current smokers only.
‖OR expressed for an increase of 1 U of body mass index.

obtained by self-reporting and medical examination are well known.[8] In our study, self-reported patients were, for example, less frequently smokers than medically assessed ones. The smoking trend, however, was the same and, furthermore, the BMI was similar. The similarity of characteristics between patients of the two studies lowers the probability of an important bias. Third, there was a 69% return rate for the questionnaire, which can lead to a selection bias. However, this prevalence is entirely consistent with a study carried out in a population of 599 Danish adults.[9] A higher prevalence was found in selected series. Indeed, Jemec[10] gave a lifetime prevalence of 4 in 100 after interview of a population of 70 female hospital employees; the same author found a prevalence of 4 in 100, by clinical examination, in a population of 507 patients attending a sexually transmitted disease clinic; the young age of this biased population may explain this high figure.[11] Considering these results, if HS remains an orphan disease, it is no longer a rare disease.

Table II. Factors associated with hidradenitis suppurativa: Medically assessed case-control study

	Patients N = 302	Control subjects N = 906	P*	Univariate OR (CI 95%)†	Multivariate OR (CI 95%)‡
Sex					
Male	70 (23.2)	210 (23.2)	—	—	—
Female	232 (76.8)	696 (76.8)		—	—
Age, y	32.0 (9.5)	32.0 (9.5)	—	—	—
Smoking status					
Nonsmoker	45 (15.0)	484 (53.8)		1.00	1.00
Current smoker	228 (75.6)	222 (24.7)	<.001	11.20 (7.82-16.04)	12.55 (8.58-18.38)
Ex-smoker	28 (9.3)	194 (21.6)		1.56 (0.95-2.59)	1.46 (0.86-2.46)
Cigarette consumption, n/d§	16.1 (8.8)	13.0 (7.3)	.0001	1.06 (1.03-1.08)	1.05 (1.02-1.08)
Age of starting smoking, y§	17.4 (3.4)	17.6 (4.7)	.49	0.98 (0.93-1.03)	—
Body mass index, kg/m²‖	25.6 (6.0)	23.2 (4.4)	<.0001	1.10 (1.07-1.13)	1.12 (1.08-1.15)
Body mass index, kg/m²					
≤ 24	167 (56.8)	660 (74.4)	<.001	1.00	1.00
25-29	64 (21.8)	152 (17.1)		1.71 (1.22-2.41)	2.08 (1.40-3.08)
≥ 30	63 (21.4)	75 (8.5)		3.40 (2.32-4.97)	4.42 (2.82-6.93)

Data are expressed in mean (SD) and n (%) for continuous and categorical variables, respectively.
CI, Confidence interval; *OR*, odds ratio.
*t Test and chi-square for univariate comparisons.
†Adjusted for sex and age.
‡Multivariate logistic regression adjusted for sex, age, smoking status or cigarette consumption in separate models, and body mass index (continuous or categorical in separate models).
§Data available for current smokers only.
‖OR expressed for an increase of 1 U of body mass index.

Smoking was a factor strongly suspected of being associated with HS.[2] Such an association was found in a case-control study performed in Germany in 1999 and is in agreement with the opinion of experts in the field.[2,3] However, a causal relationship has never been demonstrated. A chronologic relationship between smoking and first attacks of HS was not demonstrated in our study. The strength of the association and the relationship with number of cigarettes per day observed in the medically assessed case-control study could suggest a causal relationship. Conversely, the significant association observed with current smoking, but not with being an ex-smoker, argues in favor of smoking being a consequence rather than a risk factor for HS.

An association with being overweight or obese was significant for medically assessed patients and tended to be significant for self-reported patients. Until this study, the association between BMI and HS has been considered repeatedly, but not demonstrated.[2] The significant association with BMI found in both studies is, thus, an important finding.

An important strength in the results on factors associated with HS is the concordance between the two studies, which have different methodologies in defining HS, lending credence to each.

Further studies should assess associations of HS with smoking and BMI to try to determine whether tobacco use and BMI are really risk factors or a consequence of the chronic disorder. The main difficulty is that most patients with this chronic disease do not seek advice until the disease has been present for several years, thus preventing any case-control study of early and developing cases. Other risk factors for HS have been suspected: heredity and androgenic effect, but we had no data in our studies to test the association of these factors with HS.

In conclusion, HS, commonly considered a rare disease, has a prevalence of 1 in 100 in the general population, which makes it a cutaneous disease deserving more attention from dermatologists. It is strongly associated with current smoking and an increase of BMI.

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