Attractiveness of women with rectovaginal endometriosis: a case-control study

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Objective: To evaluate physical attractiveness in women with and without endometriosis.
Design: Case-control study.
Setting: Academic hospital.
Patient(s): Three hundred nulliparous women.
Intervention(s): Assessment of attractiveness by four independent female and male observers.
Main Outcome Measure(s): A graded attractiveness rating scale.
Result(s): A total of 31 of 100 women in the rectovaginal endometriosis group (cases) were judged as attractive or very attractive, compared with 8 of 100 in the peritoneal and ovarian endometriosis group and 9 of 100 in the group of subjects without endometriosis. A higher proportion of cases first had intercourse before age 18 (53%, 39%, and 30%, respectively). The mean ± SD body mass index in women with rectovaginal endometriosis, in those with other disease forms, and in those without endometriosis was, respectively, 21.0 ± 2.5, 21.3 ± 3.3, and 22.1 ± 3.6. The median (interquartile range) waist-to-hip ratio and breast-to-underbreast ratio were, respectively, 0.75 (0.71–0.81), 0.76 (0.71–0.81), and 0.78 (0.73–0.83), and 1.15 (1.12–1.20), 1.14 (1.10–1.17), and 1.15 (1.11–1.18).
Conclusion(s): Women with rectovaginal endometriosis were judged to be more attractive than those in the two control groups. Moreover, they had a leaner silhouette, larger breasts, and an earlier coitarche. (Fertil Steril® 2013;99:212–8. ©2013 by American Society for Reproductive Medicine.)
Key Words: Endometriosis, attractiveness, body mass index, breast size, waist-to-hip ratio

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The observation that subjects with specific phenotypic traits are prone to the development of particular organic or psychiatric disorders is an old medical tenet. Nowadays, these relationships tend to be explained based on genotype-phenotype associations, which have been suggested for over one hundred disorders, including diabetes, obesity, Crohn's disease, and hypertension (1, 2). Along this line, some recent advances in endometriosis research fit this view, as multiple studies have contributed to the definition of a general phenotype associated with the disease (3–12). Intriguingly, such an emerging phenotype appears to be indirectly linked with attractiveness, because several of the physical characteristics studied, including body size, body mass index (BMI), and pigmentary traits (4, 5, 7, 8, 11–13), have an impact on perception of beauty (14, 15). A biological gradient between the degree of expression of these traits and the degree of severity of endometriosis has also emerged. As an example, with regard to body size and figure, an inverse relationship has been observed between BMI and severity of the disease in general (8), and in particular in patients with deep endometriosis (12). Despite this growing body of evidence, studies formally investigating attractiveness in women with endometriosis are lacking.

To verify the potential relationship between endometriosis and attractiveness, and to substantiate a possible biological gradient between aggressiveness of the disease and degree of attractiveness, we designed

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a case-control study recruiting three groups of subjects, that are, women with deep rectovaginal forms, women with peritoneal implants and/or ovarian cysts but without rectovaginal lesions, and women without endometriosis. The degree of physical attractiveness, the main study outcome, was assessed by independent female and male observers. Secondary outcomes were definition of selected morphological characteristics and sexual habits. Information on pain at intercourse and on sexual functioning in the three study groups is reported elsewhere.

MATERIALS AND METHODS

Women undergoing surgery for benign gynecological conditions at the "Luigi Mangiagalli" Department of Obstetrics and Gynecology, University of Milan, Italy, from January 2006 to March 2011, were consecutively evaluated for inclusion in the study. This large academic department is a tertiary-level referral center for the treatment of endometriosis from a nationwide catchment area. However, patients with other benign disorders are also referred. The local institutional review board approved the research protocol and all participants signed an informed consent.

Participants were informed that the study focused on several phenotypic variables and they knew that, in general, the overall physical appearance would be assessed. All the practical aspects relative to the planned evaluations were described in detail. However, in order to limit potential unintentional seductive behaviors that might have swayed the raters' judgment, information on the specific hypothesis of different degrees of attractiveness in the three study groups was not given in advance of the physical evaluation. Women were aware that the study focused also on patterns of sexual behavior associated with various benign gynecological conditions. All patients admitted for surgery to our unit routinely undergo a standardized diagnostic interview and examination, which include collection of general and gynecological data, physical examination, and transvaginal ultrasonography.

After completion of the baseline screening, women were considered for recruitment in the study. Inclusion criteria were age between 20 and 40 years, nulliparity, Caucasian origin, no previous pelvic procedures before the index surgery, and a regular menstrual cycle. Exclusion criteria were malignancy, ongoing pregnancy, congenital anomalies, acquired physical defects (e.g., following an accident of any type or a medical/surgical disease with physical consequences), previous esthetic and plastic surgery procedures, presence of visible tattoos or piercing, fixed orthodontic appliances, colored contact lenses, and completely dyed hair.

Before surgery, eligible subjects were asked to complete a standardized questionnaire. The women were left alone in a quiet room for as long as they needed. If a companion was present, he or she was requested to leave the room. Trained physicians were available to clarify any aspect of the questionnaire. Initially investigated items included general demographic and anthropometric variables, personal habits, and obstetric and gynecological information. The second part aimed at investigating sexual history and sexual habits. Most items were evaluated using a 5-point rating scale. Thereafter, women underwent a physical examination by the two trained physicians, including weight and height assessment, measurement of hip, waist, breast and underbreast circumferences. Once this overall evaluation was completed, other four different physicians (two females and two males), blinded to the women's preoperative diagnosis but not to the study hypothesis, independently gave a judgment, based on direct evaluation, on patient attractiveness on a 5-point rating scale (5 = very attractive; 4 = rather attractive; 3 = averagely attractive; 2 = little attractive; 1 = not at all attractive). The mean of the scores expressed by the four independent evaluators defined three separate categories (>3.5 = very attractive or rather attractive; 2.5–3.5 = averagely attractive; <2.5 = little or not at all attractive) that were used for data analysis. Two male and one female evaluator remained the same throughout the study period, whereas the fourth female evaluator changed twice.

Surgery was performed between 3 and 4 weeks after the preoperative evaluation. Cases and controls were selected postoperatively, excluding women with both endometriosis and additional coexisting gynecological anomalies.

Cases were women with a diagnosis of rectovaginal endometriosis based on vaginal and rectal examination and visible endometriotic lesions at speculum inspection, transvaginal and transrectal ultrasonography, intraoperative findings, and histological demonstration of endometriosis in the posterior fornix. Although the diagnosis of rectovaginal endometriosis was generally clinically obvious preoperatively, cases were finally selected only after pelvic visualization at surgery in order to rule out the presence of concomitant genital disorders.

Controls were the first age-matched women who underwent surgery after a case and with [1] a diagnosis of peritoneal endometriosis and/or ovarian endometriomas without rectovaginal lesions or [2] a diagnosis of other benign conditions without visual or histological demonstration of any form of endometriosis. Because rectovaginal lesions are almost invariably associated with superficial peritoneal implants or ovarian endometriomas (16), women were categorized based on the worst lesion present (12, 17, 18). Therefore, for any index case, two age-matched controls were selected to form three different study groups, that are, rectovaginal endometriosis, peritoneal and/or ovarian endometriosis, and other benign conditions without endometriosis.

Rectovaginal lesions were excised at laparoscopy in 63 patients, and at laparotomy in 37. The accessible portion of the pouch of Douglas was explored, the ureters were bilaterally identified, pararectal spaces were developed, and the anterior rectal wall was detached from the posterior fornix. After excision of the vaginal plaque, the anterior rectal wall was treated according to the shaving technique, unless a low anterior rectal resection was deemed necessary.

Data analysis was carried out with the Statistics Package for Social Sciences (SPSS 18.0). Statistically significant differences were determined using χ^2 or Fisher's exact test, or ANOVA and Fisher's least significant difference post hoc test, or unpaired Wilcoxon test, as appropriate. For categorical variables, within-group comparisons were performed only if a statistically significant difference emerged for the

whole comparison. A probability value $<.05$ was considered statistically significant. In order to assess the extent of inter-rater agreement with regard to attractiveness, the unweighted *k*-index was calculated. We considered a value >0.60 as "good agreement", and a value >0.80 as "very good agreement" (19). The required sample size (about 100 women per group) was calculated using a type I and II error of 0.05 and 0.20, respectively, and stating as clinically relevant a twofold increase in the proportion of rather attractive to very attractive women among cases. Recruitment continued until completion of the preplanned sample size in the rectovaginal endometriosis group.

RESULTS

Four hundred eighty-eight women were deemed eligible for the study, but 62 refused to participate (unwilling to compile the sexual part of the questionnaire, n = 29; unwilling to undergo physical assessment, n = 21; personal or other reasons, n = 12), and 126 were excluded because mixed endometriotic and nonendometriotic lesions were observed (n = 95) or owing to unclear or missing surgical data (n = 31). Three hundred women were finally recruited, one hundred per study group. The mean ± SD sonographic volume of rectovaginal lesions was 2.9 ± 1.4 mL. The group without endometriosis included 57 women with uterine leiomyomas, 26 with non-endometriotic ovarian cysts, and 17 with unexplained infertility. Baseline characteristics of the subjects are shown in Table 1. No statistically significant difference emerged, also when analyzing data on current employment (data not shown).

Sexual history is summarized in Table 2. Reservations about providing complete information on this point were similar in the study groups (9% of the overall population). The proportion of women denying previous sexual intercourse was significantly higher among subjects without endometriosis ($P=.007$ versus rectovaginal endometriosis, and $P=.014$ versus other forms of endometriosis). The mean ± SD age at first sexual intercourse in women with rectovaginal endometriosis, in those with other disease forms, and in the group without endometriosis was 18.3 ± 2.8, 18.8 ± 2.3 and 19.5 ± 3.9 years, respectively ($P=.042$). A statistically significant difference emerged between women with rectovaginal endometriosis and those without endometriosis ($P=.012$). This translates into a higher proportion of women first having intercourse before age 18 in the group of women with rectovaginal endometriosis ($P=.002$ vs. women without endometriosis and $P=.06$ vs. other forms of endometriosis). The median (interquartile range [IQR]) number of sexual partners did not differ, being 3 (IQR = 2–5) in all the groups ($P=.80$). No differences emerged even after categorization. Most women avoided intercourse during menstruation, both during their early years of sexual activity (two in three women) and currently (three in four women), with no between-group differences.

Morphological characteristics of the study population are shown in Table 3. We failed to identify any statistically significant relationship between endometriosis and pigmentary traits. Hair and eye color did not differ significantly ($P=.98$ and $P=.09$, respectively). The mean (±SD) body mass index in women with rectovaginal endometriosis, in those with other disease forms, and in those without endometriosis was 21.0 ± 2.5, 21.3 ± 3.3 and 22.1 ± 3.6, respectively ($P=.045$). A statistically significant difference was observed between rectovaginal endometriosis and those without the disease ($P=.016$). This difference did not emerge when data were divided into three categories. The median (IQR) of the waist-to-hip ratio in women with rectovaginal endometriosis, in those with other disease forms, and in those without endometriosis was, respectively, 0.75 (0.71–0.81), 0.76 (0.71–0.81), and 0.78 (0.73–0.83); $P=.08$. The median (IQR) of the breast-to-underbreast ratio in the three study groups was 1.15 (1.12–1.20), 1.14 (1.10–1.17), and 1.15 (1.11–1.18), respectively ($P=.044$). When data were categorized, women with rectovaginal endometriosis were found to have a significantly higher breast-to-underbreast ratio ($P=.023$ versus other

TABLE 1

Baseline characteristics of participants according to study group.

Characteristic	Rectovaginal endometriosis (n = 100), n (%)	Peritoneal and/or ovarian endometriosis (n = 100), n (%)	No endometriosis (n = 100), n (%)	*P* value
Age, y (mean ± SD)	32.1 ± 4.0	32.1 ± 3.8	32.2 ± 3.9	.98
Education, y				.09
≤13	46 (46)	32 (32)	34 (34)	
>13	54 (54)	68 (68)	66 (66)	
Marital status				.90
Not married/divorced	71 (71)	69 (69)	68 (68)	
Married	29 (29)	31 (31)	32 (32)	
Smoking				.64
Never smokers	66 (66)	60 (60)	65 (65)	
Current or ex-smokers	34 (34)	40 (40)	35 (35)	
Age at menarche, y				.24
<12	30 (30)	26 (26)	37 (37)	
≥12	70 (70)	74 (74)	63 (63)	
Cycle length, d				.61
<28	15 (15)	20 (20)	16 (16)	
≥28	85 (85)	80 (80)	84 (84)	

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TABLE 2

Sexual history of participants according to study group.

Characteristic	Rectovaginal endometriosis (n = 100), n (%)	Peritoneal and/or ovarian endometriosis (n = 100), n (%)	No endometriosis (n = 100), n (%)	*P* value
Reservations in providing information[a]				.61
No	93 (93)	91 (91)	89 (89)	
Yes	7 (7)	9 (9)	11 (11)	
Sexual intercourse				.001[c]
Never	0 (0)	0 (0)	7 (7)	
Ever	100 (100)	98 (100)	91 (93)	
Age at first intercourse, y[b]				.006[d]
<18	52 (53)	37 (39)	27 (30)	
≥18	47 (47)	58 (61)	63 (70)	
Number of sexual partners[b]				.72
≤4	68 (72)	63 (68)	67 (74)	
>5	26 (28)	29 (32)	24 (26)	
Sexual intercourse during menses currently				.96
Never	75 (75)	70 (74)	69 (76)	
Ever	25 (25)	25 (26)	22 (24)	
Sexual intercourses during menses initially[e]				.91
Never	69 (69)	64 (66)	60 (66)	
Ever	31 (31)	33 (34)	31 (34)	

Note: The sum may not add up to the total because of missing information (some patients refused to provide information on some points).
[a] Women who did not fill in all the items included in the table.
[b] Women who did not have sexual intercourse were included in the groups "Age at first intercourse ≥18 years" and "Number of sexual partners ≤4."
[c] Rectovaginal endometriosis versus no endometriosis, *P*= .007. Peritoneal and/or ovarian endometriosis versus no endometriosis, *P*= .014. Rectovaginal endometriosis versus peritoneal and/or ovarian endometriosis, *P*=1.00.
[d] Rectovaginal endometriosis versus no endometriosis, *P*= .002. Peritoneal and/or ovarian endometriosis versus no endometriosis, *P*= .22. Rectovaginal endometriosis versus peritoneal and/or ovarian endometriosis, *P*= .06.
[e] Initially = first 2 years of sexual activity.

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forms of endometriosis; *P*=.008 versus no endometriosis; Table 3). In particular, almost one woman in four (24%) in the rectovaginal endometriosis group had a breast-to-under breast ratio >1.2, compared with 10% in the nonrectovaginal endometriosis group, and 8% in the group with other gynecological conditions.

Results regarding attractiveness are shown in Table 4. The proportion of women who were judged to be rather attractive or very attractive was significantly higher in women with rectovaginal endometriosis than in those with other disease forms and those without endometriosis (*P*<.001). Overall, almost one woman in three in the rectovaginal endometriosis

TABLE 3

Morphological variables of participants according to study group.

Characteristic	Rectovaginal endometriosis (n = 100), n (%)	Peritoneal and/or ovarian endometriosis (n = 100), n (%)	No endometriosis (n = 100), n (%)	*P* value
Hair color				.98
Black/brown	77 (77)	77 (77)	76 (76)	
Blonde/red	23 (23)	23 (23)	24 (24)	
Eye color				.09
Brown/black	89 (89)	94 (94)	97 (97)	
Green/blue	11 (11)	6 (6)	3 (3)	
BMI				.30
<20	40 (40)	35 (35)	27 (27)	
20–22	26 (26)	34 (34)	34 (34)	
>22	34 (34)	31 (31)	39 (39)	
Waist-to-hip ratio				.47
<0.7	19 (19)	16 (16)	12 (12)	
0.7–0.8	53 (53)	56 (56)	51 (51)	
>0.8	28 (28)	28 (28)	37 (37)	
Breast-to-underbreast ratio				.01[a]
<1.1	16 (16)	24 (24)	21 (21)	
1.1–1.2	60 (60)	66 (66)	71 (71)	
>1.2	24 (24)	10 (10)	8 (8)	

[a] Rectovaginal endometriosis versus no endometriosis, *P*= .008. Peritoneal and/or ovarian endometriosis versus no endometriosis, *P*= .78. Rectovaginal endometriosis versus peritoneal and/or ovarian endometriosis, *P*= .023.

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TABLE 4

Physical attractiveness of participants according to study group.[a]

Characteristic[b]	Rectovaginal endometriosis (n = 100), n (%)	Peritoneal and/or ovarian endometriosis (n = 100), n (%)	No endometriosis (n = 100), n (%)
Very attractive or rather attractive	31 (31)	8 (8)	9 (9)
Averagely attractive	55 (55)	51 (51)	47 (47)
Not very attractive or not at all attractive	14 (14)	41 (41)	44 (44)

[a] Rectovaginal endometriosis versus no endometriosis, $P<.001$. Rectovaginal endometriosis versus peritoneal and/or ovarian endometriosis, $P<.001$. Peritoneal and/or ovarian endometriosis versus no endometriosis, $P=.87$.
[b] A score was calculated as the mean of the judgments of four independent observers (two females and two males), who independently gave a score of 5 (very attractive), 4 (rather attractive), 3 (averagely attractive), 2 (not very attractive), and 1 (not at all attractive).

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group was classified as rather attractive or very attractive compared with less than one in ten in both control groups. The statistical significance of the observed differences was confirmed also when comparing the five categories separately in the three study groups at post hoc analysis ($P<.001$). Results were similar when evaluating the judgments according to the sex of the observers separately (data not shown). Kappa-indexes of agreement among the four different observers varied from 0.62 to 0.86 ($P<.001$ for all one-to-one comparisons). The *k*-index between the judgment of males and females was 0.68 ($P<.001$). Mean attractiveness scores did not vary significantly during the years of the study period (data not shown).

DISCUSSION

Women with rectovaginal endometriosis appeared more attractive to external observers than those with peritoneal and/or ovarian endometriosis, as well as those without endometriosis. Moreover, compared with controls, women with rectovaginal endometriosis had a leaner silhouette, larger breasts, and an earlier coitarche. The results substantiate the validity of the preplanned power calculation, as the proportion of women with rectovaginal endometriosis deemed rather attractive or very attractive was much more than double that observed in the other two study groups.

The selection criteria adopted were strict and should have prevented major sources of confounding. The four raters were aware of the study objective but were blind with respect to the women's preoperative diagnosis. For this reason, observers were specifically instructed to refrain from asking questions about symptoms and the reason for the consultation. In addition, the physicians conducting the physical examination were not part of the four physicians assessing physical attractiveness. This should have avoided undue influence on judgment.

Breast size, waist-to-hip ratio, and BMI are deemed the three major physical determinants of attractiveness (14, 20–23). Theoretically, assessment by female observers could have been based on different variables with respect to male counterparts. As an example, a higher breast-to-underbreast ratio (large breasts) might have been more attractive to male than female raters (23). However, agreement between female and male observers was good, and lack of bias due to rater's sex when assessing female attractiveness has been already demonstrated (24). Moreover, in modern Western society, physical characteristics such as large breasts and slender figure are considered to have an impact on current perception of female beauty in both females and males (15, 20, 25, 26). In this regard, women with rectovaginal endometriosis had a significantly lower body mass index than women without the disease, confirming literature findings (4, 5, 7, 8, 11, 12). Only the waist-to-hip ratio was similar in cases and controls.

The distribution of baseline characteristics including education, marital status, smoking, and menstrual pattern was similar across the groups, and thus should have not interfered with the study outcome. Interestingly, compared with subjects in both control groups, women with rectovaginal lesions referred a significantly lower age at first intercourse, although the difference was limited. This finding could be explained by higher attractiveness and, hence, higher male sexual demand, even in the adolescent phase. Alternatively, as rectovaginal endometriosis usually causes deep dyspareunia (27, 28), an exaggerated sexual activity aimed at hiding problems at intercourse cannot be excluded.

We cannot confirm previous findings on specific pigmentary traits in women with endometriosis (6, 9, 10). Indeed, the Mediterranean origin of the women enrolled implies an overwhelming prevalence of dark hair and eye color. Nonetheless, the proportion of subjects with green or blue eyes was 11% in the rectovaginal endometriosis group and 3% in the nonendometriosis group.

The lack of a "hard" main outcome may be considered a limitation of our study. In this regard, we cannot exclude that the hospital environment and the unusual situation in which the women were evaluated might have influenced participants' behavior and spontaneity. Even if this were true, no particular study group should have been selectively disadvantaged. Moreover, the difference in proportion of women judged as rather attractive or very attractive was so largely in favor of women with rectovaginal endometriosis as to render confounding an unlikely sole explanation of the results. In addition, the reduction of the attraction categories from five to three in the final analysis should have limited the effect of interrater variability.

The experience of chronic pelvic pain may induce anxiety and depression, thus hypothetically indirectly influencing physical attractiveness. However, this potential interaction should have reduced, not enhanced, the observed between-

group difference in favor of women with rectovaginal endometriosis, as deep lesions are those most strongly associated with severe pain (17, 27, 28).

In theory, human beauty standards may vary across different countries, cultural backgrounds, and ethnic groups, thus limiting the generalizability of our findings. However, it has recently been demonstrated that standards for evaluating attractiveness are shared across cultures as different as Caucasian, Chinese, and Japanese (29, 30).

The biological significance of beauty has generally been interpreted in terms of sexual selection associated with presumed health advantages (29, 31, 32). Attractive subjects have more chances of being selected by potential mates because they are subliminally identified as carriers of the best gene pool. In the case of females, attractiveness can also act as a cue for fertility and reproductive potential (21, 33). In fact, esthetic perception is influenced by sexual hormones (29). Women with higher estrogen levels have more feminine, attractive, and healthy looking faces than those with lower levels (24, 29). Because female attractiveness could be the expression of higher estrogen levels (24, 28, 33), it cannot be excluded that a stimulating endocrine environment might favor the development of aggressive and infiltrating endometriotic lesions, particularly in the most feminine subjects. Unfortunately, we did not measure serum estradiol levels in our study subjects.

Alternatively, phenotypic characteristics of women with rectovaginal endometriosis might constitute indicators of specific gene polymorphism associated with severe disease development (3). A genetic link in the pathogenesis of deeply infiltrating endometriotic forms has been recently confirmed by Chapron et al. (34), who observed that patients with this lesion type had a threefold likelihood of a positive family history compared with those with superficial peritoneal lesions and/or ovarian endometriomas. Indeed, endometriosis is significantly associated with genetic variants on chromosome 1, 7 and 9, and a higher genetic loading has been shown specifically among women with advanced disease (35, 36).

According to the principles of *phenomics*, phenotypic information could be used in conjunction with genetic and environmental data to help uncover the pathogenesis of several disorders (1–3). In this regard, we not only confirmed previous findings on the association between some phenotypic characteristics and endometriosis (4, 5, 7, 8, 11, 12) but also observed that physical attractiveness is higher in women with the most severe disease form. Genetic and endocrine factors may underlie the expression of a particularly feminine phenotype and predisposition to the development of deep endometriosis. However, further studies are warranted to exclude a spurious relation between attractiveness and rectovaginal endometriosis, and to rule out the potentially confounding effect of deep dyspareunia on some aspects of sexual behavior.

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