GYNECOLOGY

Sexual response in women with Mayer-Rokitansky-Küster-Hauser syndrome with a nonsurgical neovagina

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BACKGROUND: Sexual dysfunction is prevalent in women with Mayer-Rokitansky-Küster-Hauser syndrome after the creation of a neovagina. Insight into the physiologic response of the neovagina during sexual arousal is lacking, although this would help in the understanding of sexual function of these patients. The physiologic sexual response of the vagina can be measured objectively by vaginal photoplethysmography to assess vaginal blood flow.

OBJECTIVE: Testing whether the physiologic and subjective sexual response in women with Mayer-Rokitansky-Küster-Hauser syndrome with a neovagina differs from the response in women with a natal vagina.

STUDY DESIGN: Vaginal blood flow (vaginal pulse amplitude) and subjective sexual responses during neutral and erotic film viewing were assessed in premenopausal women with Mayer-Rokitansky-Küster-Hauser syndrome with a nonsurgically created neovagina (n=15) and were compared with responses of an age-matched control group (n=21).

RESULTS: All women with Mayer-Rokitansky-Küster-Hauser syndrome had created their neovagina themselves by dilation. Women with Mayer-Rokitansky-Küster-Hauser syndrome showed a significantly smaller vaginal pulse amplitude compared with control subjects during neutral film viewing ($P=.002$). In both groups, vaginal pulse amplitude increased significantly during erotic film viewing, but this increase was significantly smaller in the Mayer-Rokitansky-Küster-Hauser syndrome group ($P<.005$). Levels of subjective sexual arousal did not significantly differ between the 2 groups ($P>.2$).

CONCLUSION: Women with Mayer-Rokitansky-Küster-Hauser syndrome with a nonsurgically created neovagina showed a weaker vaginal blood flow response during visual sexual stimulation and poorer basal blood flow compared with control subjects. The differences in vaginal blood flow may be related to less vascularization and innervation of the neovagina compared with the natal vagina. The weaker vaginal sexual response can play a role in sexual dysfunction; however, despite the weaker vaginal response, women with Mayer-Rokitansky-Küster-Hauser syndrome did not differ in their level of subjective sexual arousal. Future studies may compare vaginal blood flow and subjective sexual response of women with Mayer-Rokitansky-Küster-Hauser syndrome with nonsurgically and surgically created vaginas.

Keywords: Mayer-Rokitansky-Küster-Hauser syndrome, sexual dysfunction, sexual response, vaginal blood flow, vaginal pulse amplitude

Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome, also known as Müllerian Agenesis syndrome, is an uncommon congenital condition (incidence of 1 per 4500–5000 women), characterized by an agenesis or hypoplasia of vagina and uterus.[1] The cause is not fully understood, but a failure in the canalization of the Müllerian ducts in the embryologic phase of the development of the female fetus is thought to be the main mechanism.[2] Usually, patients with the syndrome are identified when they are evaluated for primary amenorrhea with otherwise typical growth and pubertal development. Most women with MRKH syndrome decide to create or have created a vagina to allow penile-vaginal intercourse. According to the American College of Obstetricians and Gynecologists, nonsurgical vaginal elongation by dilation, as described by Frank,[3] is the first-line approach to create a vagina, with success rates of 90–96%.[4] If dilation therapy is unsuccessful, surgical procedures can be used such as the Vechietti's procedure that involves a traction device attached to the abdomen, sutures placed subperitoneally via laparoscopy, and a plastic "olive" placed on the vaginal dimple.[5] Other surgical techniques involve the creation of a canal that is covered not only by skin grafts,[6] peritoneum,[7] or amnion[8] but also by segments of ileum, caecum or sigmoid colon.[9,10]

Many publications on vaginal agenesis have documented medical treatment procedures and their anatomic and functional results. Published outcomes usually comprised the vaginal length measured at follow-up evaluation and the report of "being able to have intercourse satisfactorily." In the last decade, however, validated questionnaires have been used to assess sexual functioning in women with MRKH syndrome after treatment. Studies that have used sexual function questionnaires show a higher prevalence of sexual dysfunction (such as low sexual desire, arousal lubrication, problems reaching orgasm, and problems of pain during sexual intercourse) in women with MRKH syndrome after both vaginal dilation and surgical construction compared with healthy control subjects.[11] More specifically, insufficient vasocongestion and lubrication of the created vagina may play a role. This raised the question of whether the neovaginas of women with MRKH syndrome show similar sexual function as natal vaginas. There are indications of vaginal lubrication during sexual activity in women with MRKH syndrome;[12,13] however, this is based on patient self-report in questionnaires. In addition, Masters and Johnson[14] reported normal

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AJOG at a Glance

Why was this study conducted?

Sexual dysfunction is prevalent in women with Mayer-Rokitansky-Küster-Hauser syndrome after creation of a neovagina. However, insight in the physiologic response of the neovagina during sexual arousal is lacking. Therefore, vaginal blood flow was measured during visual erotic stimulation with the use of vaginal photoplethysmography that assesses vaginal pulse amplitude.

Key Findings

Women with Mayer-Rokitansky-Küster-Hauser syndrome, all of whom had a nonsurgically created neovagina, showed a significantly lower basal blood flow and a smaller increase in vaginal pulse amplitude compared with control subjects.

What does this add to what is known?

The data provide the first evidence of physiologic sexual responsiveness of the nonsurgically created neovagina and indicate that physiologic response is weaker than in the natal vagina.

vaginal changes (such as lengthening, widening, and vasocongestion) in response to sexual stimulation in 2 women with MRKH syndrome after a McIndoe vaginoplasty, but they did not describe how exactly these vaginal changes were assessed and compared with a control group.

Today, vaginal photoplethysmography, which assesses vaginal pulse amplitude (VPA), offers a validated measure to assess sexual stimulation−induced vaginal vasocongestion.[15] Vaginal photoplethysmography has been used to study vaginal response in male-to-female transsexuals after penile inversion vaginoplasty and has shown lower basal vaginal blood flow and smaller increases in vaginal blood flow during erotic stimulation in the transsexual participants, compared with natal female participants.[16] So far, assessment of sexual response with the use of vaginal photoplethysmography has not been performed in women with MRKH syndrome with a neovagina. Because sexual dysfunction is prevalent in women with MRKH syndrome after creation of a neovagina, insight into the physiologic response of the neovagina and the association with the subjective experience of sexual arousal is important. The primary aim of the present study was to assess VPA and subjective sexual arousal in response to erotic video stimulation in women with MRKH syndrome with a neovagina and to compare them with the responses of healthy control subjects. Our hypothesis was that women in the MRKH group would have lower basal VPA, smaller increases in VPA, and weaker subjective sexual arousal measures in response to erotic stimulation compared with healthy control subjects.

Methods

Women with MRKH syndrome for this prospective cohort study were recruited by sending an information letter to all current or former patients who had been diagnosed with MRKH syndrome of the Departments of Gynecology of 3 university medical centers in The Netherlands (n=350) and to members of the Dutch MRKH support group (n=338). The control group was recruited through advertisements. The following inclusion criteria where used for both groups: a heterosexual orientation, age 18−45 years, and being in a stable relationship. Women with MRKH syndrome had to have a surgically or nonsurgically obtained vagina with a sufficient length to allow insertion of the photoplethysmograph (ie, approximately 5 cm). The following exclusion criteria were used: a disease or medical history known to affect genital response (such as diabetes mellitus, multiple sclerosis, hysterectomy for control subjects),[17] current or recent use of medication known to affect sexual responding (such as selective serotonin reuptake inhibitors, antipsychotics),[18] and current pregnancy or lactation (for control subjects). Participants received financial compensation of 60 Euro (approximately $70). The Human Subjects Ethical Review Boards of the 3 hospitals approved the study; oral and written informed consents were obtained from each woman. Recruitment and data collection took place from November 2015 to May 2017.

Following the same procedure as in previous sexual response studies in our laboratory,[19−21] women were exposed to 2 5-minute erotic film clips, each showing heterosexual scenes including sexual intercourse. The film clips are known to elicit comparable levels of sexual arousal.[19−21] Each erotic film was preceded by a 5-minute neutral nature film. Vaginal blood flow during the first neutral film clip was used to test differences in basal blood flow between groups.

Vaginal blood flow was measured continuously as VPA that was assessed by photoplethysmography. VPA reflects the phasic changes in vaginal engorgement that accompany each heartbeat, with larger amplitudes reflecting higher levels of vaginal vasocongestion. VPA is a sensitive, specific, and reliable measure of increases in vaginal vasocongestion in response to sexual stimulation.[15] After the first neutral film and after each erotic film, subjective sexual responses were assessed with a questionnaire commonly used in sexual response studies that consisted of a sexual arousal, genital sensations, positive affect, and negative affect scale.[22] Each item was preceded by the sentence: "During the film, I felt…," after which a sexual or emotional experience was described (for instance "sexually aroused," "genital pulsing or throbbing," "joy," or "anger"). The items were measured on a Likert scale that ranged from 1 (not at all) to 7 (very intensely).

All women completed questionnaires on demographic characteristics and sexual function. Sexual functioning was assessed by the Female Sexual Function Index (FSFI), a 19-item self-report instrument that consists of 6 subscales: desire, arousal, lubrication, orgasm,

satisfaction, and pain.[23,24] Scores can range from 2−36; a higher scores indicates better sexual function, and a score <26.55 is indicative of sexual dysfunction. Sexual distress was assessed by the Female Sexual Distress Scale, a 12-item questionnaire, with a score range of 0−48, for which a score ≥15 is regarded as indicative of clinically significant sexual distress.[24,25] In addition, coital pain was assessed by the following question: "Do you experience pain during (attempted) sexual intercourse with your partner?" The item was scored as Yes or No. In case of pain, the location of the pain was asked, with the options of pain at the introitus, deep in the vagina, or both.

At least 1 hour before the sexual response test, the women with MRKH syndrome were subjected to a brief gynecologic evaluation that included assessment of vaginal length, which was defined as the distance from the posterior fourchette to the most proximal part of the blind-ending vagina (conducted by P.W.). During the sexual response test, which took place in a comfortable room, a female research assistant instructed all women individually. After an explanation of the procedure, the assistant left the room to allow the participant to insert the vaginal probe privately. During the procedure, communication was possible by intercom. Further instructions, the films, and the sexual response questionnaire were presented on a monitor in the participant's room. After the 5-minute baseline period watching the first neutral film, the first erotic film started. Then, the second neutral film followed for return-to-baseline and baseline measurement. Then, the second erotic film was shown.

Similar to previous sexual response studies,[19-21] mean VPA scores were calculated over 30-second periods that resulted in 10 periods for each neutral and erotic film fragment. Then, for each erotic film, 10 VPA change scores were calculated by subtraction of the mean baseline score from each VPA period score. Because preanalyses showed that the VPA scores during the second neutral film were significantly higher than the VPA scores during the first neutral film ($F(1,34)=33.51$; $P=.03$) that indicated that VPA did not return to baseline, mean VPA during the first neutral film was used as the reference baseline score.

Data analyses were performed with SPSS (version 23; SPSS Inc, Chicago, IL). Before analysis, all dependent variables were examined for fit between distributions and the assumptions of the analyses. The questionnaire data were analyzed with nonparametric Mann-Whitney *U* tests. To test differences between groups in basal VPA, the raw VPA scores during the first neutral film were analyzed by a 2 (group: MRKH, control)×10 (periods) mixed analysis of variance (ANOVA) with "group" as the between-subject factor and "periods" as the within-subject factor. VPA scores during erotic film viewing were analyzed for the 2 erotic films separately, with 2 (group: MRKH, control)×10 (periods) mixed ANOVAs with "group" as the between-subject factor and "periods" as the within-subject factor. To test differences between groups in change from baseline during erotic film viewing, VPA change scores were analyzed for the 2 erotic films separately, with 2 (group: MRKH, control)×10 (periods) mixed ANOVAs. Effect sizes are reported as η_p^2 with 0.01, 0.06, and 0.14 indicating respectively a small, medium, and large effect.[26]

We were interested in a difference between the MRKH group and the control subjects with a large effects size. With an alpha of .05, a power of 80%, and an effect size of d=.8 (large effect[26]), a minimum of 26 women for each group was needed.[26] We did not succeed in recruiting this number of women. With an alpha level of .05 and with the number of women that we recruited, the power was 54% to detect a difference with a large effect size between the 2 groups.

Results

Demographics, MRKH characteristics, and sexual functioning

Sixteen women with MRKH syndrome showed interest in study participation; 1 woman was excluded because she was <18 years old. Twenty-five "control" women showed interest in participation; 4 of them were excluded (2 were >45 years old; 2 of them were using antidepressants). Fifteen women with MRKH syndrome and 21 control women were tested. Table 1 lists demographics, MRKH characteristics, and sexual functioning scores and test results for comparisons between groups. The 2 groups did not differ significantly in age (MRKH: median, 30 (interquartile range, 15) years; control subjects: median, 25 (interquartile range, 10) years; $P=.53$) or length of relationship (MRKH: median, 3 (interquartile range, 6) years; control subjects: median,3.5 (interquartile range,5.5) years; $P=.84$); however, women with MRKH syndrome had a significantly lower level of educational attainment ($P=.01$). No women with MRKH syndrome with surgically created vaginas signed up for participation; all participating women with MRKH syndrome created their neovagina themselves by dilation.

There were no significant differences in the median FSFI total, sexual desire, arousal, lubrication, satisfaction, or pain scores between the 2 groups. However, the difference in orgasm score approached significance, which indicated more difficulty reaching orgasm in women with MRKH syndrome. There was no significant difference between the groups in reported sexual distress or in the number of women who reported coital pain. In case of coital pain, women with MRKH syndrome reported relatively more often deep pain than control subjects. In women with MRKH syndrome, there was a significant positive correlation between vaginal length and FSFI pain score ($r=0.53$; $P<.05$; Figure 1A), which showed that more vaginal length was related to less sexual pain and that there was a significant negative correlation between vaginal length and Female Sexual Distress Scale score ($r=-0.77$; $P<.01$; Figure 1B), which showed that more vaginal length was related to less sexual distress.

Genital response

Figure 2 shows raw VPA scores in response to neutral and erotic film in women with MRKH syndrome and control subjects. The 2 (group)×10

TABLE 1
Demographics, Mayer-Rokitansky-Küster-Hauser syndrome characteristics, and sexual function scores

Demographics	Scores, median (interquartile range)		Sexual function score test statistic (Mann-Whitney *U*/chi square)	*P* value
	Mayer-Rokitansky-Küster-Hauser syndrome group (n=15)	Control group (n=21)		
Age, y	30 (15)	25 (10)	−0.64	.53
Length of relationship, y	3.0 (6)	3.5 (5.5)	−0.21	.84
Educational attainment			6.30	.01
High, n (%)[a]	9 (60.0)	18 (85.7)		
Low, n (%)[b]	6 (40.0)	3 (14.3)		
Vaginal length, cm[c]	5.1 (1.6)			
Method of neovagina				
Dilation (Frank[3]), n (%)	8 (53.3)			
Coital dilation, n (%)	5 (33.3)			
Unknown, n (%)	2 (13.3)			
Time since creation of vagina, n (%)				
6–12 mo	1 (6.7)			
1–5 y	5 (33,3)			
5–10 y	3 (26.7)			
>10 y	4 (26.7)			
Unknown	2 (13.3)			
Female Sexual Function Index, total[d]	28.0 (5.3)	31.3 (13.3)	−1.4	.16
Desire	3.6 (1.8)	4.2 (1.5)	−1.12	.27
Arousal	5.1 (0.9)	5.4 (1.2)	−1.1	.28
Lubrication	5.7 (0.9)	6.0 (1.2)	−0.65	.52
Orgasm	4.8 (2.0)	5.6 (1.2)	−1.9	.05
Satisfaction	5.6 (0.8)	5.2 (2.0)	1.27	.21
Pain	4.4 (2.4)	6.0 (1.6)	−1.56	.12
Female Sexual Distress Scale[e]	4.0 (17.0)	6.0 (9.0)	−0.27	.79
Coital pain, n (%)[f]	7 (58.3)	8 (38.1)	1.3	3.0
Location of coital pain, n			8.8	.01
Superficial	0	6		
Deep	4	1		
Superficial and deep	3	1		

[a] Preparatory higher vocational, pre–university education, higher vocational, university; [b] Elementary school, lower vocational education, senior secondary vocational education; [c] Vaginal length was assessed in women with Mayer-Rokitansky-Küster-Hauser syndrome only; [d] Higher scores indicate better sexual function; [e] Higher scores indicate more sexual distress; [f] Three women with Mayer-Rokitansky-Küster-Hauser syndrome did not answer this question.

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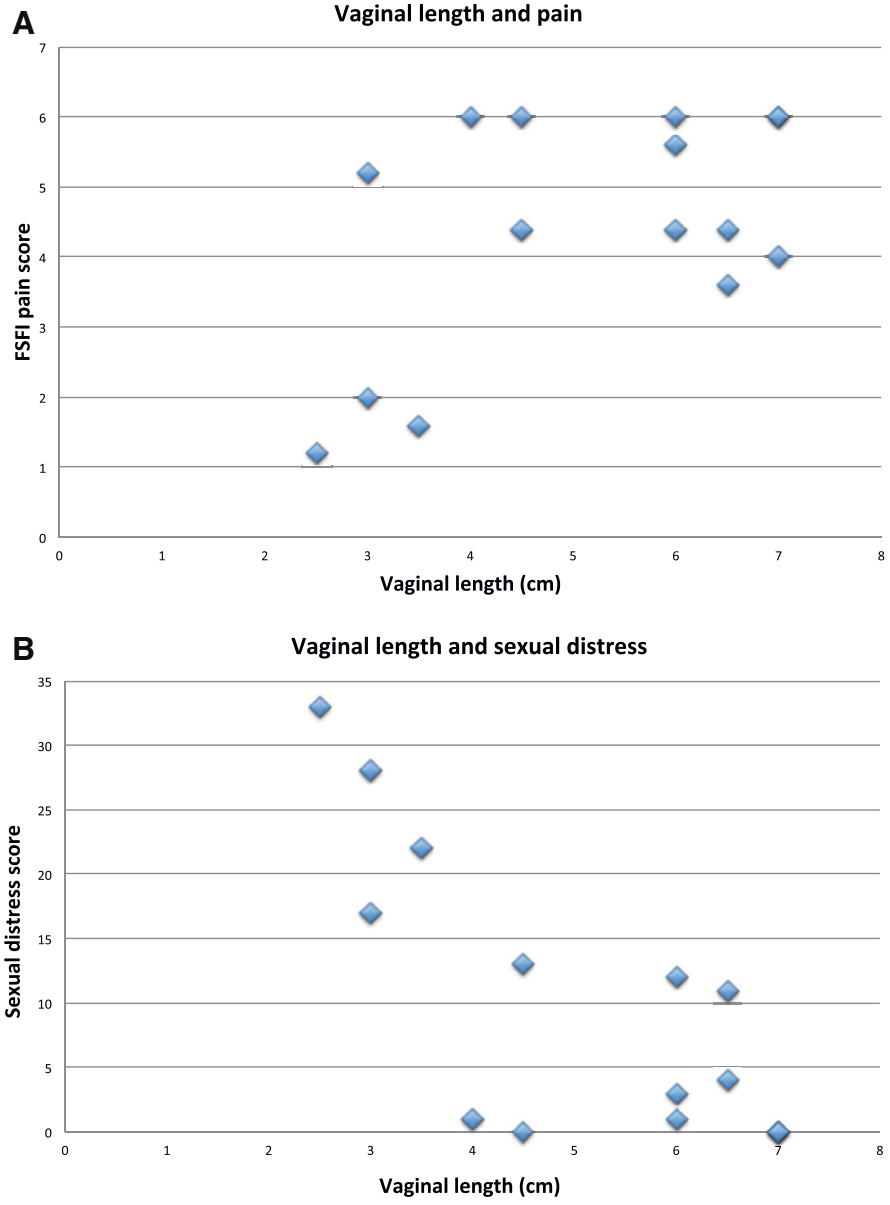
(periods) mixed ANOVA showed lower VPA in women with MRKH syndrome compared with control subjects during the first neutral film ($F[1,34]=11.32$; $P=.002$; $\eta^2=0.25$). The 2 (group)×10 (periods) mixed ANOVA of the responses during the first erotic film showed a main effect of group ($F[1,34]=17.1$; $P<.001$; $\eta^2=.33$), a main effect of period ($F[9,306]=27.1$; $P<.001$; $\eta^2=.44$), and a significant group×period interaction ($F[1,34]=4.1$; $P<.05$; $\eta^2=0.11$), which indicated that VPA increased significantly during erotic film viewing and that this increase was significantly smaller in the MRKH group. The 2 (group)×10 (periods) mixed ANOVA of the responses during the second erotic film showed a significant main effect of group ($F[1,34]=19.1$; $P<.001$; $\eta^2=.36$) and a significant main

FIGURE 1
Bivariate scatterplot



A, Vaginal length and Female Sexual Function Index pain score; the *diamonds* indicate measurements in a specific MRKH woman. B, Vaginal length and sexual distress score in women with Mayer-Rokitansky-Küster-Hauser syndrome; the *diamonds* indicate measurements in a specific MRKH woman. Note: lower Female Sexual Function Index pain scores indicate more intercourse-related pain.
FSFI, Female Sexual Function Index.

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effect of period (F[9,306]=14.9; P<.001; η^2=0.30), which again indicated that VPA increased significantly during erotic film viewing and that this increase was significantly smaller in the MRKH group. The 2 (group)×10 (periods) repeated measures ANOVA of the VPA change scores in response to the first erotic film revealed a significant effect of period (F[9,306]=27.09; P<.001; η^2=0.44) and a significant effect of group (F[1,34]=10.66; P=.003; η^2=0.24), which indicated an increase in VPA during erotic film viewing in both groups, but a smaller increase in the MRKH group compared with control subjects. For VPA changes scores in response to the second erotic film, there was a significant effect of period (F[9,306]=14.86; P<.001; η^2=0.30) and a significant effect of group (F[1,34]=12.46; P =.001; η^2=0.27), which again showed an increase in VPA in response to erotic film viewing in both groups, but a significantly smaller increase in women with MRKH syndrome compared with control subjects.

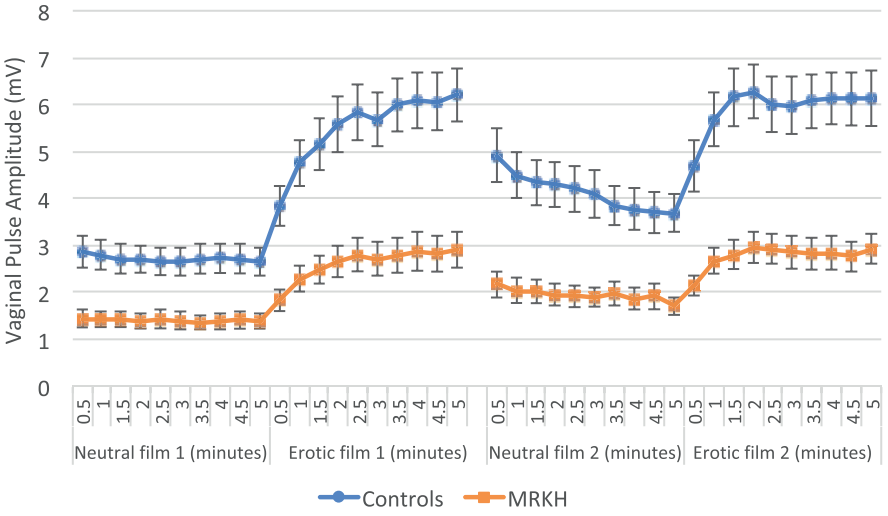
Subjective sexual arousal and affect

The subjective sexual response ratings are shown in Table 2. Both groups reported feelings of sexual arousal, genital sensations, and positive affect and hardly any negative affect in response to the erotic films. There were no significant differences between women with MRKH syndrome and control subjects in the sexual arousal, genital sensation, positive affect, or negative affect scores. However, there was a trend for ratings of genital sensations and positive affect during the first neutral film to be lower in women with MRKH syndrome and for ratings of negative affect during the second erotic film to be higher in control subjects.

Comment

In this study, for the first time, physiologic and subjective sexual responses of women with MRKH syndrome with a neovagina were assessed with the use of validated measurements, which contributed novel data in the area of sexual outcomes after the creation of a neovagina in this group. The VPA data showed that, similar to women with a natal vagina, women with MRKH syndrome with a nonsurgical neovagina respond to visual erotic stimulation with an increase in vaginal blood flow. However, the basal blood flow in the neovagina was lower, and the absolute increase in blood flow during erotic stimulation was less than in the natal vagina. Levels of subjective sexual arousal did not significantly differ between the women with MRKH syndrome and control subjects, which indicated that the smaller increase in

FIGURE 2
Mean vaginal pulse amplitude



Mean vaginal pulse amplitude in women with Mayer-Rokitansky-Küster-Hauser and the control group during the first 5 minutes of a neutral film presentation and the first 5 minutes of an erotic film presentation and during the second 5 minutes of a neutral presentation and the second 5 minutes of an erotic film presentation. *Error bars* represent standard error of the mean.

MRKH, Mayer-Rokitansky-Küster-Hauser

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vaginal blood flow during erotic stimulation in women with MRKH syndrome did not impede feelings of sexual arousal, which corroborated the general observation that, in women, genital and mental sexual arousal are loosely coupled.[17]

What may cause the lower blood flow of the nonsurgical neovagina? Possible factors may be differences in tissue, vascularization, and innervation of the neovagina vs the natal vagina. The natal vaginal walls consist of the stratified squamous nonkeratinized epithelium and an underlying lamina propria of connective tissue, the smooth muscular layer, and the adventitia, which is a dense connective tissue that blends with the surrounding fascia.[17] The lamina propria and connective tissue layers contain a rich supply of vascular channels. In women with MRKH syndrome, through a failure in the canalization of the Müllerian ducts, the uterus is not developed, and at the location of the vagina, a small depression or dimple or a partially developed vagina can be observed. This partially developed vagina probably originates from the sinus urogenitalis from which the outer third of the vagina normally develops. Dilation of the dimple or partially developed vagina to create a neovagina results in a cavity, and through the influence of body temperature, the stretched tissue develops into nonkeratinized epithelium. The tissue that forms the neovagina is likely to be of similar nature to the outer third of the natal vagina, which is supported by observations from vaginoscopy that the neovaginal epithelium appears to be largely similar to normal vaginal mucosa.[13,27] However, scanning electron microscopy showed flatter neovaginal mucosa in women with MRKH syndrome, lacking the transverse folds that characterize the normal vagina, as determined by a paucity of smooth muscle cells and venous plexus under the mucosa of the neovagina.[28] The blood supply of the natal vagina derives from the *vaginalis* and from branches of the *A uterina*, the *A pudenda interna*, and the *A rectalis media* and because the uterus and vagina are not developed in women with MRKH, the network of arterial branches will be less extensive. In addition, in the natal vagina, vasocongestion is activated through parasympathetic nerve fibers that originate in the sacral parasympathetic nucleus and travel via the pelvic nerves to the vagina,[29] with nerves that contain vasoactive intestinal polypeptide and nitric oxide synthetase innervating capillaries and deep and superficial arteries and veins.[30] The arteries and veins of the neovagina in women with MRKH syndrome are probably less extensively innervated than in the natal vagina.

Although the women with MRKH syndrome showed lower increases in vaginal blood flow in response to erotic stimulation, they did not report significantly more lubrication problems in the sexual function questionnaire. Vaginal lubrication in response to sexual stimulation is thought to be mediated by arterial dilation and a reduction in vasomotion with its opening of the capillaries.[17] Increased capillary surface area and vasocongestion enhance the production of plasma transudate that percolates through the vaginal epithelium, increasing lubrication. It can be expected that because of less vasocongestion, the neovaginal lubrication response will be weaker compared with the natal vagina. However, our study group was small, and lubrication problems, as assessed by the FSFI, concern the subjective experience of a lack of vaginal lubrication and not an objective index. Unfortunately, currently there are no validated methods to assess vaginal lubrication; however, if there were, it would be interesting to compare erotic stimulation—induced lubrication of the neovagina and the natal vagina. The questionnaire data on sexual functioning did show a trend for more orgasmic problems and indicated more deep pain during sexual intercourse in the MRKH group. Orgasmic problems may be related to lower vaginal blood flow; pelvic engorgement is thought to activate firing of stretch receptors in the pelvic striated muscles, initiating the orgasmic reflex.[31] With regard to pain, significant associations between the assessed length of the neovagina and FSFI pain and sexual distress scores were observed, which shows that,

TABLE 2
Subjective sexual arousal, genitals sensation, and positive and negative affect scores

Variable[a]	Scores, median (interquartile range)[b] Mayer-Rokitansky-Küster-Hauser syndrome group (n=15)	Control group (n=21)	Mann-Whitney *U* test, *z* score	*P* value
Neutral film 1				
Sexual arousal	1.0 (0.3)	1.0 (0.2)	−0.19	.90
Genital sensations	1.2 (0.3)	1.5 (0.3)	−1.98	.05
Positive affect	1.8 (1.2)	2.4 (1.1)	−1.92	.06
Negative affect	1.0 (0.3)	1.2 (0.4)	−0.94	.36
Erotic film 1				
Sexual arousal	4.0 (1.6)	4.7 (1.8)	−1.3	.21
Genital sensations	4.5 (2.2)	5.0 (2.3)	−0.76	.46
Positive affect	3.4 (1.6)	4.6 (2.5)	−0.76	.46
Negative affect	1.5 (0.5)	1.3 (0.7)	−0.52	.61
Erotic film 2				
Sexual arousal	3.7 (2.3)	4.7 (2.3)	−1.53	.13
Genital sensations	4.2 (1.8)	4.3 (2.4)	−0.84	.41
Positive affect	3.4 (2.6)	3.6 (2.8)	−0.93	.36
Negative affect	1.0 (0.5)	1.3 (0.9)	−1.72	.09

[a] Independent of group ratings of sexual arousal, genital sensations, positive affect, and negative affect in response to erotic film 1 were significantly higher compared with neutral film (all $P<.01$) but did not differ significantly from ratings in response to erotic film 2 (all $P>.05$); [b] A score of 1=not at all; a score of 7=very intensely.

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explicably, less length of the neovagina was related to more pain at intercourse and more sexual distress.

Obviously, 1 limitation of the present study is the small number of participants with MRKH syndrome. Despite extensive recruitment, only 15 women with MRKH syndrome participated. Unfortunately, we have no information on how women who were not willing to participate differ from our study population. It might be the case that, especially in women with MRKH syndrome, assessment of genital responses is a sensitive topic. Possibly, the MRKH participants in the present study are a sexually relatively self-confident and well-functioning group; therefore, we should be careful with generalization of our observations. Also, the negative results for group differences in sexual function scores and subjective sexual response to erotic film viewing could be due to the small sample size that resulted in limited statistical power. Another limitation is that only the women with MRKH syndrome were subjected to the gynecologic evaluation before sexual response testing. Although this evaluation was performed at least 1 hour before the sexual response assessment and took place in a different room, the evaluation may have provoked anxiety, and we cannot exclude that the difference in procedure for the 2 groups may have influenced the outcomes. The negative affect ratings in response to the first neutral film were very low and not significantly different between groups; however, there was a trend for lower genital sensations and positive affect in women with MRKH syndrome. Additionally, regarding the associations between vaginal length and sexual pain and distress, it would have been interesting to assess coital frequency. Possibly, the experience of sexual pain and distress is related to less frequent coital activity and, consequently, in less opportunity to maintain an appropriate vaginal length by self-dilation through coitus. Furthermore, we intended to include women with MRKH syndrome with surgically and nonsurgically created vaginas, but, unexpectedly, only women with a nonsurgically created neovagina participated, which restricts our conclusions to vaginal blood flow responses to the nonsurgically created neovagina. Further research that will include women with MRKH syndrome with a surgically created vagina is needed to examine possible differences in blood flow responses of the nonsurgically vs surgically created neovagina.

Our conclusion is that women with MRKH syndrome with a nonsurgically created neovagina show an increase in vaginal blood flow in response to erotic stimulation. This provides clear evidence for the sexual responsiveness of the self-created neovagina. Basal blood flow in the neovagina and increases in blood flow in response to sexual stimulation are, however, lower than in the natal vagina, which may be a factor in the sexual dysfunction reported by women with MRKH syndrome. Nonetheless,

women with MRKH syndrome do not show weaker feelings of sexual arousal or weaker genital sensations, which indicates that the smaller increase in vaginal blood flow does not impede their subjective sexual arousal response. For women with MRKH syndrome, our findings may decrease feelings of insecurity regarding sexual contact. Women with MRKH syndrome report less sexual self-esteem and more psychologic distress compared with women without the condition,[32,33] and they may feel empowered by the results of the present study that show the sexual responsiveness of the self-dilated neovagina. Healthcare professionals can inform young women with MRKH syndrome about the study results, which may help them to adjust to the diagnosis. ■

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