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Sexuality after Laparoscopic Peritoneal Vaginoplasty in Women with Mayer-Rokitansky-Kuster-Hauser Syndrome

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ABSTRACT **Objective:** To evaluate anatomic and sexual outcomes in women with Mayer-Rokitansky-Kuster-Hauser (MRKH) syndrome after laparoscopic Davydov (laparoscopic peritoneal vaginoplasty).

Design: Prospective follow-up study of patients with MRKH syndrome after vaginoplasty (Design classification: II-2).

Setting: Academic hospital.

Patients: Patients with MRKH syndrome and frequency-matched age-comparable healthy controls.

Intervention: Thirty-one patients with MRKH syndrome underwent surgery with the procedure, and their clinical, surgical, and follow-up data were recorded. A Female Sexual Function Index (FSFI) questionnaire was administrated to evaluate sexual functions of patients who became sexually active and compared them with 50 randomly selected, age-matched healthy women.

Measurements: FSFI scores in women with MRKH syndrome and in control subjects. Clinical and anatomic measurements of neovagina.

Main Results: The laparoscopic Davydov was successfully completed in all 31 cases, with 24 patients monitored. The mean length of the neovagina was 6.27±1.25 cm. There was no statistical difference in the total FSFI score between the case and control groups. There is indication that shorter neovaginal length, especially of<7 cm, appears to be associated with lower total FSFI scores.

Conclusion: Laparoscopic Davydov is a safe, effective treatment of Mayer-Rokitansky-Kuster-Hauser syndrome with minimal invasion and a relatively low complication rate. Journal of Minimally Invasive Gynecology (2009) 16, 720–729 © 2009 AAGL. All rights reserved.

Keywords: Evaluation; Davydov; Laparoscopic peritoneal vaginoplasty; MRKH syndrome; Sexual function

Mayer-Rokitansky-Kuster-Hauser syndrome (MRKHS) is an uncommon, but not rare, congenital anomaly manifesting mainly as primary amenorrhea because of uterovaginal agenesis. Patients with MRKHS have a normal karyotype, a normal external genitalia, functional ovaries, and normal female secondary sex characteristics [1]. When diagnosed in adolescence, the patients often suffer from a profound identity crisis, resulting in a low self-esteem and distorted body image [2]. When mature, they can experience enormous psychological and emotional anguish.

The treatment of MRKHS thus poses a technical challenge because its outcome may affect the patient's physical health, as well as her psychological and emotional well-being [3]. The treatment is often delayed until the patient is ready to start sexual activity and may be either surgical or nonsurgical, the choice of which depends on the needs and motivation of the patient [1]. The goal is to reconstruct a canal of appropriate axial direction and adequate size situated between the bladder and rectum, preferably also with normal lubrication when sexually aroused, to permit sexual intercourse. Ideally, a successful treatment, usually through vaginoplasty, should construct a neovagina that requires minimal, if any, dilation, free from scars, stenosis, or contracture and provides a satisfactory cosmetic appearance with intact external genitalia [4]. Above all, it should allow the patient to perform sexual activity satisfactorily.

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The most common nonsurgical vaginoplasty is Frank's method, which requires long-term catheterization [5]. Depending on the materials used to cover the wall of the canal, or whether the canal can be made from a "natural" tube or formed by a passive traction process, there are different methods of surgical vaginoplasty and their variations: skin or mucosal tissue graft [6,7], amnion grafts [8], peritoneum [9,10], artificial dermis [11], intestines [12-14], and a traction wire or device (Vecchietti's technique) [15-17]. Because almost all methods require certain postoperative maintenance to keep the neovagina in proper shape and size, their success hinges on the motivation and cooperation of the patient, although perhaps to a varying degree.

Although each surgical vaginoplasty method has its own advantages and disadvantages, methods with skin or amnion grafts appear to lose their favor mainly because of unsightly scarring and the risk of viral infection. Laparoscopic peritoneal vaginoplasty (the Davydov technique), laparoscopic sigmoid vaginoplasty, and a modified laparoscopic Vecchietti technique now seem to compete for popularity [18].

Regardless of which vaginoplastic procedure, it can be argued that vaginoplasty, in and of itself, offers no survival or reproductive advantage to the patient. It does not relieve any preexisting physical pain or suffering as in a corrective surgery, nor does it offer any cosmetic benefit as with other plastic surgeries. It does, however, serve one and only one purpose: to permit satisfactory intercourse. Therefore postsurgical functional evaluation, along with anatomic evaluation, is indispensable for a full assessment of treatment efficacy.

However, most published reports focus on the preoperative characteristics, perioperative complications, and anatomic outcomes of vaginoplasty. Although these outcomes are certainly important in deciding which surgical method should be used, the most important outcome, that is, functional outcome, is often measured only as "satisfying" or not until fairly recently.

Because female sexual activity, guided by sexual desire, is characterized by sexual arousal, vaginal lubrication, and orgasm, female sexual dysfunction or dissatisfaction can manifest in different aspects and would require different interventions [19]. Hence, a mere yes or no answer may not completely capture the degree of dissatisfaction or in what aspect and may also make comparative studies difficult.

Currently, there are several well-validated indexes or instruments, such as Female Sexual Function Index (FSFI) [20], that can be used to evaluate sexual function and have been extensively used in epidemiologic studies of sexual dysfunction [21]. For laparoscopic Davydov procedure, the use of FSFI as an instrument to evaluate the functional outcome was carried out by Giannesi et al. [18]. For laparoscopic sigmoid vaginoplasty, it was done by Communal et al. [22]. Fedele et al [17] recently reported functional outcome for Vecchiett's modified technique with the same index. Hensle et al [23] used Female Sexual Dysfunction Questionnaire (FSDQ) to evaluate bowel vaginoplasty.

In this study, we evaluated anatomic and functional outcomes in 31 women with MRKHS after laparoscopic peritoneal vaginoplasty (laparoscopic Davydov procedure) on the basis of follow-up data and self-reported FSFI questionnaire. We also examined the relationship between FSFI scores and neovaginal length and possible factors associated with the neovaginal length. Finally, a comparison with 3 published studies on anatomic and functional outcomes of vaginoplasty on women with MRKHS was made.

Materials and Methods

Patients

From January 2005 through February 2008, 31 patients with MRKHS, aged 19 to 35 years (mean age 24 years), underwent laparoscopic peritoneal vaginoplasty at Shanghai Obstetrics and Gynecology Hospital, Fudan University. All diagnoses were made by a battery of ultrasonographic, laparoscopic, and gynecologic examinations. Before surgery, all had undergone transabdominal ultrasonography, intravenous pyelography, and genetic evaluation. All patients had a normal female karyotype of 46, XX, and complained of primary amenorrhea or difficulty in sexual intercourse. The ultrasonographic examination indicated either a primordial uterus or the absence of the uterus, all with normal bilateral ovaries. No urinary tract malformation was found in intravenous pyelography.

For all 31 patients, clinical and surgical data were retrieved from their medical charts, and follow-up and gynecologic examination (monthly in the first 3 months after surgery, then trimonthly in the first year and, thereafter, biannually), along with an administration of FSFI questionnaire, were attempted after informed consent from the patients. The quality and structure of the neovaginal epithelium were evaluated by visual inspection, without biopsy, during gynecologic examinations.

For comparison, we randomly recruited 50 normal women from female outpatients attending the Dermatology Department in Shanghai Huashang Hospital, Fudan University. The inclusion criteria for the control group were as follows: (1) age 18 to 40 years; (2) had sexual intercourse at least in the last 4 weeks; and (3) no history/complaint of gynecologic diseases.

All data were entered into a Microsoft Excel database, and their quality and integrity were rigorously checked. This study was approved by the Ethics Committee of the Shanghai OB/GYN Hospital.

Surgical procedures

The surgical procedure was a modification of the peritoneal vaginoplasty procedure as described by Rangaswamy et al [24]. All 31 vaginoplastic surgeries were performed by senior gynecological surgeons (K.Q.H., B.L., and X.S.L.) with extensive experience in gynecologic surgery.

After general anesthesia, the patient was placed in a lithotomy position. Pneumoperitoneum was established after the insertion of a trocar through the umbilicus with 15 mm Hg of CO_2. A 10-mm cannula was inserted and through which the laparoscope was inserted. After that, a 10-mm and a 5-mm cannula were both inserted through incisions that were made bilaterally 5 cm from the right and left anterosuperior iliac spine at the level of the umbilicus.

A 10-cm–long needle was inserted at the center of the vestibule, followed by an infusion of diluted adrenaline in saline solution (1:200 000) into the rectovesical space [24]. Additional isotonic saline solution 100 mL was injected when the needle was near the bottom of the pelvic peritoneum. Under laparoscopy, the peritoneum floor could be seen bulging gradually and eventually separating pelvic peritoneum from the wall. A transverse perineal incision was made at the center of the vestibular mucosa between labia minora and beneath the urethral orifice. A stainless steel urethral catheter was inserted into the urethra and the bladder, serving as a palpable demarcation to avoid any injury to the bladder and the urethra during the vaginal dissection. Then, a 10-cm–long neovaginal vault of about 3 cm in diameter was created in the rectovesical-urethral space by blunt vaginal dissection and care was taken to stay inside the levator muscle [24].

The umbilical incision was widened to about 2 cm to permit insertion of a peritoneum pusher, and subsequently the bulging pelvic peritoneum was moved downward towards the vestibular incision until it could be seen at the perineum and then was opened up at the bottom transversely. Then the peritoneum was sutured to the vaginal opening. A 10-cm–long and 3-cm–wide soft vaginal mould made from gauze, wrapped in a condom, was then placed into the neovagina. Then we performed a purse-string stitch to create the top of the neovagina by taking peritoneum of the bladder, the round ligament, the "uteroovarian" ligament, the pelvic peritoneum between the ovary and rectum and the surface of the rectum. A urethral catheter was inserted and remained for 5 days after the operation.

Postoperative care

The vaginal mould stayed in the neovagina for 48 hours and was then replaced by a wooden mould. The length of the mould was 7 to 10 cm, with the precise length dependent on the length of the neovagina. The perineum was kept cleaned, and daily vaginal douching was performed. The patient was instructed to insert the mould into the neovagina for 30 minutes daily until she had sexual activity at least once a week. The neovagina would be dilated if she was sexually inactive. Follow-up testing was carried out every 3 to 6 months after the surgery.

Statistical analysis

The comparison of distributions of continuous variables between or among 2 or more groups was made by and remained use of the Wilcoxon rank-sum test and Kruskal-Wallis test, respectively. Spearman's correlation coefficient was used when evaluating correlations between 2 variables. Fisher's exact test was used when comparing the count data between 2 groups. A linear regression analysis was carried out to evaluate whether duration of wearing moulds, age at surgery, body weight, and time to sexual activity after surgery had any effect on log-transformed neovaginal length.

The p values $<.05$ were considered statistically significant, yet no adjustment was made for multiple testing. All computations were made with the software R 2.7.0 [25] (see also: http://www.r-project.org).

Results

Clinicopathologic data

The mean interval between the diagnosis of malformation and surgical treatment was 3.73±3.45 years, with a range of 0 to 12 years. In all cases, normal external genitalia, normal female secondary sexual characteristics, and the absence of a vagina were observed by gynecologic examinations. At admission, only 3 (9.7%) patients were married. Among the 31 patients, 24 (77.4%) patients were successfully followed up, and the remaining 7 patients were lost to follow-up exclusively because of incorrect contact information provided by the patients. The median length of follow-up was 25 months and a range from 4 to 40 months.

The age of the normal control group ranged from 18 to 37 years, with a median of 26 years, which was statistically no different from the case group (p=.55, Wilcoxon's rank-sum test). There was no notable difference between this group and the women of comparable age in the general population.

Surgical results

The mean (±standard deviation, or SD) of preoperative vaginal length was 0.89±1.23 cm (n=28) (95% CI 0.0, 3.3), with a median of 0 cm (25% and 75% quantile=0 and 2 cm respectively) and a range of 0 to 3 cm. Surgical vaginoplasty was successfully completed in all 31 cases. The mean±SD duration of operation was 134.0±44.4 minutes, comparable with the 125±38 minutes as reported by Soong et al. [26] for 18 cases and 119±39.4 minutes as reported by Giannesi et al. [18] for 28 cases. The mean (SD) intraoperative hemorrhage volume was 90.0±56.8 mL. The mean (SD) hemoglobin reduction was 1.07±1.24 g/dL. No intraoperative complication was observed in any of the 31 cases, nor was rectal or bladder injury. Flatulence was recovered in 2 to 3 days after the surgery. The mean (±SD) length of the neovagina length during the surgery was 8.86±1.67 cm (n=14). The mean (±SD) hospital stay was 12.9±5.5 days, with a median of 12 days and a range of 5 to 26 days. The incidence of postoperative morbidity, defined to be the body temperature of the patient exceeding 38°C on

2 consecutive occasions, taken 4 hours apart, 24 hours after the surgery, was 19.4%.

Anatomic and clinical outcomes

At the time of follow-up, the mean (±SD) length of the neovagina was 6.27±1.25 cm (95% CI 3.82, 8.72), with a median of 6.75 cm (25% and 75% quantile = 5 and 7 cm, respectively) and a range of 4 to 8 cm. The width of the vagina was more than 3 cm in all cases, all of whom used moulds after surgery. Normal external genitalia, along with a smooth, moist, soft, and elastic vaginal wall with normal vaginal mucosa were found, as judged by look and feel, in gynecologic examinations. In all cases, the pH value of the vaginal discharge was less than 5.5, and no yeast or trichomonas infection was found in vaginal secretion inspection. No complications were observed.

Functional outcomes

In the vaginoplasty group, 20 (83.3%) of the 24 cases subsequently had a sexual partner and became sexually active (i.e., had vaginal intercourse) within 1 to 12 months (mean 4.2±3.1 months) after surgery. Their mean age was 26.5±4.2 years, which was statistically no different (p=.72 and 0.61, respectively) from that of the control group or the 4 women in the same group who did not have any sexual partner (mean age=25.0±3.3 years). There was no significant difference in the frequency of sexual intercourse between the control group and the 20 cases who were sexually active (p=.50), but the latter group had slightly higher education level (p=.073) and income level (p=.007) than the former.

The histograms of the total FSFI scores in control subjects and cases are shown in Fig. 1, from which it can be seen that the distribution of the scores was similar in the 2 groups, except that 2 cases reported fairly low scores. There was no statistical difference in scores of all 6 domains of FSFI between the cases and the control subjects, even though the pain score was marginally lower in the cases (Table 1). No statistically significant difference in the total FSFI score was found between the sexually active patients and the control subjects (26.09±4.82 vs. 26.26±4.04, p=.84, Table 1). We note that we did not administrate the FSFI questionnaire to the patients before the surgery because all these patients who came to seek medical help were either grossly unsatisfied with their sexual function or were ready to start sexual activity (and had had no sexual activity—thus no FSFI score would be available). By default, patients grossly unsatisfied with their sexual function would have a low FSFI score.

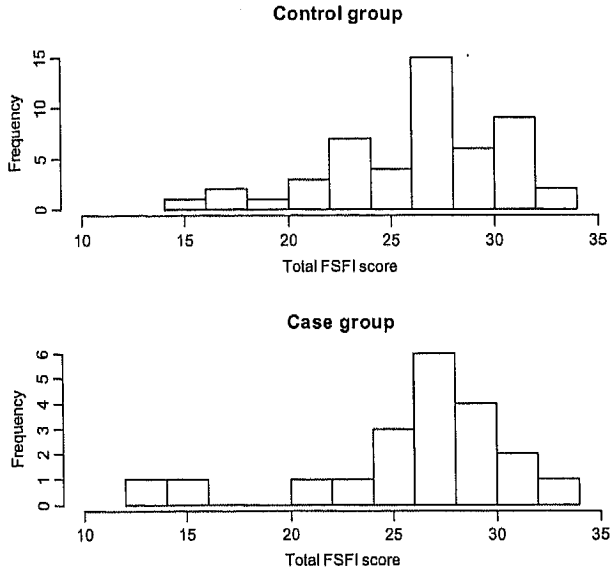

Fig. 1. Histograms of total FSFI scores in the control and case groups. There was no statistical significant difference in age between the two groups (p=.55).

Table 1
Characteristics and results of sexual function as evaluated by the total FSFI and individual scores in women with MRKHS who received laparoscopic peritoneal vaginoplasty as compared with a frequency-matched age-comparable control group

	Control subjects	Cases	p values
Sample size	50	24	—
No sexual activity	0	4	.009
Age (y)			.551
Mean	26.8	24.6	
SD	4.1	3.8	
Median	26	24.5	
Range	18-37	19-35	
Total FSFI score	26.26±4.04	26.09±4.82	.840
≥30	12	3	.60 (Fisher's exact test)
24-29	25	13	
≤23	13	4	
Desire score	3.48±0.87	3.78±0.85	.099
Arousal score	3.92±0.96	4.16±0.82	.336
Lubrication score	4.96±0.82	5.12±0.63	.632
Orgasm score	4.18±1.05	3.82±1.19	.312
Satisfaction score	4.55±0.84	4.52±1.10	.617
Comfort score	5.17±1.00	4.70±1.19	.066

Noticing that the 2 patients with the lowest total FSFI scores (12.7 and 15.9) (Fig. 1) had a length of the neovagina of 4.5 and 4.0 cm, respectively, we speculated that there might be an association between neovaginal length and the total FSFI score. We found that correlation coefficient of the neovaginal length and the total FSFI score, when both log-transformed, was 0.44 (p=.0499), seemingly in support of the association. A linear regression analysis involving duration of wearing moulds, age at surgery, body weight, time to sexual activity after surgery, and log-neovaginal length indicated that log-neovaginal length was the only variable that is related with the log-FSFI total score (p=.0499).

Because the length of neovagina ≤7 cm is judged to be unsatisfactory for vaginoplasty [18], we classified the patients into 2 groups, A and B, with A having a neovaginal length of <7 cm and B≥7 cm. Among the 20 patients, 11 (55%) fall into group A while the rest, group B. The difference in the total FSFI score was nearly statistically significant between the 2 groups (24.4±5.9 vs. 28.2±1.7, p=.053; Fig. 2, *A*). On the other hand, because the total FSFI score≤23 is deemed poor [18], we divided the patients into group 1 (≤ 23) and 2 (>23), and found that 3 (15%) of 20 patients fall into the former group. The former group had a shorter neovaginal length than the latter (5.0±1.3 cm vs. 6.3±1.2 cm), but the difference did not reach statistical significance (p=.085, Fig. 2, *B*). This gave some, but not a definitive, indication of a possible causal relationship between neovaginal length and the total FSFI score. It is interesting to note that group 1 consistently had significantly lower scores than group 2 across all 6 domains of FSFI, with the "orgasm" domain having the biggest difference (1.73±0.61 vs. 4.19±0.83).

On the other hand, all patients with a neovagina <7 cm in length had lower scores across all 6 domains than those had a length of ≥7 cm, with the orgasm score having the largest difference (0.89, vs. 0.21-0.75 in other 5 domains). Even though none reached statistical significance (Table 2 and Fig. 3), the orgasm score contributed the least to the total FSFI score (14.0% vs. 14.6%-20.6% in other 5 domains). It is worth noting that the latter group consistently had a lower variation in the score than the former (Fig. 3).

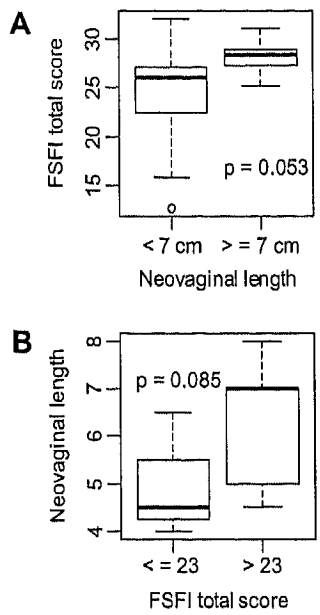

Fig. 2. (**A**) Boxplot of the total FSFI score distribution by the length of neovagina in women with MRKHS who received laparoscopic vaginoplasty and were sexually active after surgery. (**B**) Boxplot of the neovaginal length by the total FSFI score in women who received laparoscopic vaginoplasty and were sexually active after surgery. The number listed is the p-value of statistical significance.

Factors associated with neovaginal length

We next attempted to identify possible factors associated with neovaginal length. We found that the correlation coefficient between the duration of wearing vaginal moulds and the length of the neovagina was 0.36, but it did not reach statistical significance (p=.087). No significant correlation between the length and body weight, age, or coitus frequency was found (all p-values >.05).

Noticing that the neovaginal length decreased in almost all patients after the surgery (median decrease=2 cm, range=0-5.5), we then examined the correlation between the duration and the difference in neovaginal length measured between a week after surgery and at the time of

Table 2
Sexual function as evaluated by the FSFI in women with neovaginal length of <7 cm and of ≥7 cm

	Neovaginal length		
	<7 cm	≥7 cm	p value
N	11	9	—
Total FSFI score	24.35±5.86	28.22±1.70	.053
≥30	2	1	.26 (Fisher's exact test)
24-29	6	8	
≤23	3	0	
Desire score	3.55±1.02	4.07±0.50	.21
Arousal score	3.82±0.94	4.57±0.36	.06
Lubrication score	5.02±0.74	5.23±0.50	.42
Orgasm score	3.42±1.40	4.31±0.66	.19
Satisfaction score	4.18±1.32	4.93±0.60	.13
Comfort score	4.36±1.48	5.11±0.52	.17

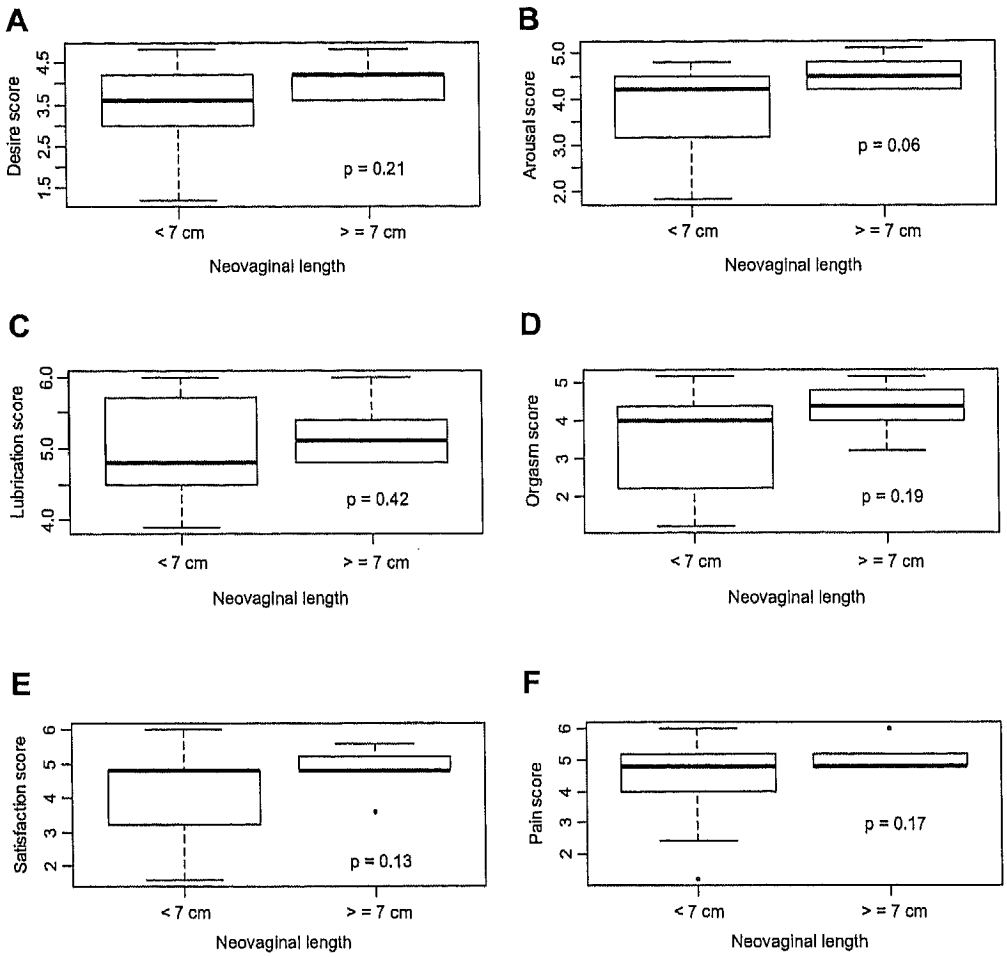

Fig. 3. Boxplot of the 6 FSFI individual domain scores by the length of neovagina in women who received laparoscopic vaginoplasty and were sexually active after surgery. The numbers listed are the p-values of statistical significance.

follow-up. We found that the decrease in neovaginal length appeared to drop precipitously with duration (Fig. 4, n=10 because of missing data in neovaginal length). The correlation coefficient between the duration and the log-transformed decrease (with 0.5 added to avoid 0) was −0.67 (n=10, p=.035), suggesting that greater neovaginal constriction appeared to happen in contractile phase of healing and the constriction quickly tapered off later on.

Comparison with 3 published studies

We compared the anatomic and functional outcomes of this study with 3 published ones that also used the FSFI questionnaire (Table 3). The total FSFI scores in our cases and controls were somewhat lower than those reported. However, classifying the patients into 3 groups of $\leq$23, 24-29, and $\geq$30, respectively, our results were statistically no different from the 2 French groups, although they were statistically different from the Italian group. The reason for the difference with the Italians is unclear, but we note that, race and culture aside, both cases and control subjects in our study were considerably older than those in the Italian series (mean age in cases 26.5 vs. 17 years) and also older than the 2 French series (Table 3).

Discussion

Although the Davydov procedure was proposed almost 40 years ago and the laparoscopic Davydov also has been around for more than a decade, so far there have been very few reports on its anatomic and, especially, sexual outcomes in patients with MRKHS, possibly because of the rarity of the abnormality. There are 2 published studies on this procedure [26,27] in the 1990s that reported the anatomic outcome without a formal and structured evaluation of the sexual outcome. A recent study involving 28 cases reported encouraging anatomic and sexual outcomes with the FSFI [18]. Another study reported 2 cases without a formal evaluation of its sexual outcome [28]. This study reviewed 31 cases with a mean age of 26.3 years, who were comparable with the reported 24 years from a case series of 28 from Shanghai [29] and 24.6 years from another case series of 18 from Taiwan [26] but were considerably older than cases previously reported. The older age, as compared with those studies

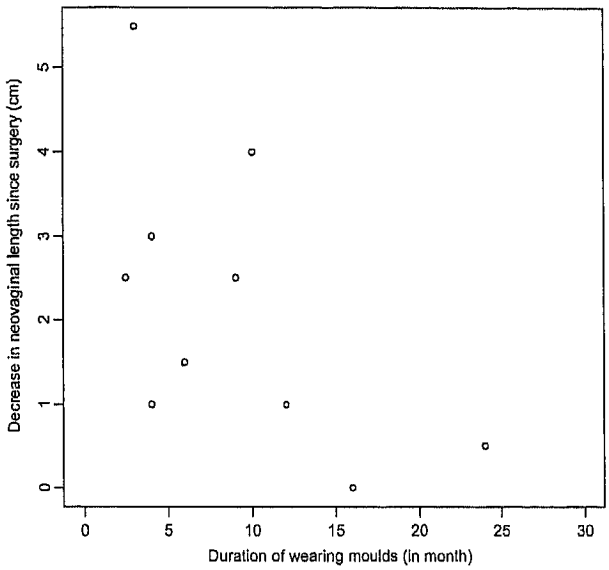

Fig. 4. Decrease in neovaginal length since surgery (in centimeters) and the duration of wearing moulds (in months).

conducted in developed countries, reflects the fact that a large proportion of women in China, where the average age at the first marriage in women in 2001 was 24.2 nationally and 25.3 in Shanghai [30], and begin their sexual intercourse shortly before and after marriage, at least in this cohort.

We found that, overall, the laparoscopic Davydov is safe and effective, and in most cases yields satisfactory anatomic and sexual outcomes. The surgery enables women with MRKHS to have a more or less normal sex life that is comparable with a sample of healthy, age-matched women. We also found that the decrease in neovaginal length after surgery appeared to drop roughly exponentially with the duration of wearing moulds. There is indication that shorter neovaginal length, especially of <7 cm, appears to be associated with lower total FSFI scores, as well as in all 6 individual domains, especially the orgasm domain. Although the association did not reach statistical significance, it is likely that the failure to reach statistical significance may be due to the lack of adequate statistical power. Further research is warranted to illuminate this relationship, if any.

Of course, vaginal length is not the sole determinant of women's overall sexual satisfaction [31]. In fact, 1 woman in our series who reported the highest total FSFI score (32.1) had a neovaginal length of only 4.5 cm. This patient, aged 30, married and monogamous, had a vaginal length of 3 cm and 10 cm, respectively, before and 1 week after the surgery. She also reported having sexual intercourse 1 to 2 times a week despite her relatively shorter neovagina. This patient may epitomize a subset of patients who are highly motivated and fully committed to their intimate relationship and thus accept more positively whatever improvements the surgery brought them. Alternatively, better communication between spouses [32] and less conflict in the relationship [33] may also contribute to the overall sexual satisfaction despite the neovaginal length.

Vagina, in Latin, literally means sheath, which quite fittingly depicts its physiological role besides being a birth canal and a passage for menstrual debris. A successful copulation naturally would require a vagina of adequate length. The average length of penis, passively erected by negative pressure, in Chinese males of marrying age is reported to be 11.6±1.7 cm [34]. In normal Chinese women, in contrast, the length of an unaroused vagina ranges from 6 to 8 cm across the anterior wall and 7 to 10 cm long across the posterior wall. A natural vagina presumably has greater elasticity than a reconstructed one through vaginoplasty. Therefore, although satisfactory and gratifying sexual activities certainly involve many factors besides anthropologic parameters, a neovagina of adequate length, likely to be no less than 7 cm, should provide adequate hardware for a successful and satisfying sexual activity.

The significant negative correlation between the duration of wearing moulds and the log-transformed decrease in neovaginal length because surgery appears to suggest that greater neovaginal constriction appeared to happen in contractile phase of healing. As the women continue to wear the mould, the constriction quickly tapered off later on. This may indicate the benefit of long-term wearing of moulds if the patient is highly motivated and sexually inactive.

Unfortunately, the moderate sample size, along with missing information in our follow-up data, precluded a more thorough analysis of the relationship between sexual satisfaction and factors such as neovaginal length and copulation frequency. Not all patients were forthright—a few patients did not even provide their true contact information, which is the sole reason for the loss to follow-up in this study. Although in China the societal attitude toward sex has changed greatly in the last 20 years, sex is still a taboo to many people. It is perhaps no coincidence that the education level of all patients who were included in our study was slightly higher than the control group.

In addition, although sexual satisfaction would also involve male performance and their satisfaction, a full evaluation may require certain comparison among different partners and is also subject to some inherent and perhaps incorrigible biases to please partners. For ethical, as well as cultural, reasons, we did not venture into this territory.

The total FSFI scores in both our control subects and cases are comparable with those reported by the 2 French groups [18,22], even though the ages of their subjects were younger. However, the scores appeared to be significantly lower than the Italian counterparts as reported by Fedele et al. [17]. Difference in race and culture may account for the difference, but age difference also could be responsible because increasing age has been identified to be risk factor for sexual dysfunction and low sexual function in women [35,36]. The exact cause for the difference is beyond the scope of this study.

Different vaginoplastic procedures have different advantages and disadvantages. Intestinal vaginoplasty uses the patient's own intestinal segments and is thus a major operation that poses a considerable risk to her [37]. Foul-smelling

Table 3
Comparison with three published studies on anatomic and functional evaluation of vaginoplasty in women with MRKHS

	Communal et al.[22]	Giannesi et al. [18]	Fedele et al. [17]	This study
Year of publication	2003	2005	2008	—
Time interval in which the patients underwent operation	1992–2002	1996–2003	1993–2004	2005–2008
Vaginoplasty Procedure	Sigmoid vaginoplasty	Laparoscopic Davydov	Laparoscopic Vecchietti	Laparoscopic Davydov
Sample size				
Cases	16, but only 11 were evaluated by FSFI	28, but only 25 were evaluated by FSFI	110, but only 27 were evaluated by FSFI	31, but only 20 were evaluated by FSFI
Control subjects	Published data (131 normal pts)	25	27	50
Age				
Cases	Mean=20.2 (17-38 years) at surgery (24.3 yrs at time of evaluation)	Mean=21.6±6.2 years at surgery	Mean=17 years at surgery (21.5±1.8 at time of evaluation)	Mean=24 years (19-35 years) at surgery Mean=26.5±4.2 years at evaluation
Control subjects	NR	NR (only age-matched)	NR	26.8±4.1
Mean duration of follow-up	39.6 months (6 mos-108 mos)	42.8 mos (15-100 m)	NR	24.3±11.2 mos (4-40 mos)
Operating time (mean±SD)	NR	119±39.4 min	NR	134±44.4 min
Mean hospital stay	NR	8.1±2.0 d	NR	12.9±5.5 d
Neovaginal length at follow-up	NR	7.2±1.5 cm	NR	6.27±1.25 cm
Mean time between surgery and the start of sexual activity	NR	7 (1-9) months	NR	4.2±3.1 (1-12) months
FSFI				
Cases				
Total score	28±5	26.5±5.6	29.0±3.2	26.1±4.8
≥30	5	7	12	3
24-29	3	12	14	13
≤23	3	6	1	4
Comparison w/this study	p=.11	p=.52	p=.038	—
Control subjects				
Total score	30±5	27.9±4.5	31.0±2.4	26.3±4.0
≥30	NR	9	18	12
24-29		13	9	25
≤23		3	0	13
Comparison w/this study	NA	p=34	p=.0001	

vaginal discharge can also occur. Vaginoplasty with either amnion grafts or skin or mucosal tissues may result in relatively poor sexual function after surgery [28]. One disadvantage of using skin graft is the formation of unsightly scars at the harvest site; hence, it is cosmetically less appealing. The Vecchietti procedure requires compatible anatomic structure, namely, normal-appearing outer genitalia and proper urethra opening. As such, it is not suitable for all patients [38].

For traditional sigmoid vaginoplasty surgery, the operating time ranged from 130 to 300 minutes; the intraoperative hemorrhage volume, 100 to 300 mL; and the hospital stay, 6 to 30 days [13,39-44]. Reported complications include intestinal fistula, intestinal obstruction, peritonitis at the intestinal anastomotic stoma, incision infection, neovaginal stenosis, and malodorous vaginal discharge. Some of them could be fairly serious. The reported complication rate ranged from 10% to 50% [13,39-44].

For laparoscopic Davydov, in contrast, the reported operating time ranged from 60 to 150 minutes; the intraoperative hemorrhage volume, 50 to 100 mL; and the hospital stay, 6 to 20 days. The reported complication rate was about 5% to 20% [18,26-28,45]. Our results are quite comparable with the previously published ones. Thus laparoscopic Davydov has some advantages as compared with the traditional sigmoid vaginoplasty. However, the procedure is not without any downside. Injuries to the bladder or rectum, bladder-vaginal fistula, mould displacement, and vaginal dryness have been reported. In our study, no bladder or rectum injuries or other complications occurred.

Given the nature of the disorder and the procedure, our follow-up rate of 77.4% (24 of 31) is by no means low. Because the false contact information, likely intended to avoid perceived embarrassment, was provided by the patient before, not after, the surgery without knowing any surgical outcome, the possibility that the loss to follow-up occurred more likely in patients with a worse outcome can be ruled out. In other words, the loss to follow-up in our case series can be assumed, reasonably, to be random with regard to the functional results.

Although the normal control subjects may be ideally selected at random from the age-comparable general female population, our choice of outpatients in the dermatology department can be justified on the ground that it affords an economical way of having a reference from a sample of age-comparable women apparently no different from the general population. We note that the use of hospital control subjects is a well-accepted practice in epidemiology and such use is abound in human reproductive research [46], as long as subjects are selected so that, except for the exposure variable of interest (MRKHS and vaginoplasty in our case), everything else is similar to the cases as in the general population. The use of self-reported information also is well accepted in epidemiology [47].

Aside from the strength of an attempt to evaluate the functional outcome of the Davydov procedure and to explore as whether neovaginal length would influence sexual satisfaction, our study has a few limitations. Ideally, a baseline FSFI measurement should be done to allow for before/after comparison. However, by the very definition of MRKH syndrome, these women sought medical attention precisely because they could not perform sexually. In fact, given a median preoperative vaginal length of 0 cm, their FSFI scores would have been well below the normal range in all likelihood. Therefore it would be more meaningful to do a comparative study with apparently normal women of similar age, as other studies did [17,18,22].

We also did not, as in other 3 published studies [17,18,22] measure the baseline psychological state of all subjects. It is possible that the difference in baseline depression and anxiety levels among patients might have contributed to any change in sexual function and satisfaction after vaginoplasty. Future studies that have the baseline measure should be able to illuminate this issue.

In conclusion, we found that the laparoscopic Davydov is safe and effective, and in most cases yields satisfactory anatomical and sexual outcomes. There is some indication that longer neovaginal length, especially of $\geq$7 cm, appears to be associated with more satisfaction with the sexual outcomes of the surgery. In addition, less decrease in neovaginal length appears to be associated with longer use of the moulds. Further research is warranted to clarify these relationships, if any.

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