

# Sexual and Reproductive Health Outcomes in Females With Cloacal Malformations and Other Anorectal Malformations



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## ABSTRACT

**Study Objective:** To improve our understanding of reproductive health and sexual function in women with cloacal malformations and other anorectal malformations (ARMs)

**Methods:** An observational cross-sectional survey was administered to individuals assigned female at birth aged 12 to 55 with ARMs and cloacal malformations cared for at our institution. Data included age of thelarche/menarche and questions on body image, gynecologic anatomy, sexual function, and pregnancy.

**Results:** Twenty-one patients responded in the ARM group and 30 in the cloacal malformation group. There were no differences in median age of thelarche/menarche in patients with ARMs (11/12.5 years) compared with patients with cloacal malformation (11/12 years). Patients with ARMs were more likely to have native vaginal tissue than those with cloacal malformations ( $n = 18, 82\%$  vs  $n = 12, 40\%$ ;  $P = .03$ ). There were no differences between groups regarding concerns about dyspareunia and functionality of their vagina ( $P > .05$ ). Forty-two percent of patients with cloacal malformations and 30% of patients with ARMs reported having been sexually active. Two patients with cloacal malformations and 2 with ARMs reported having been pregnant. Patients with cloacal malformations reported a lower quality of life score (80.4) compared with those with ARMs (87.0) (difference  $> 4.5$ ).

**Conclusions:** Patients with a cloacal malformation were less likely to have native vaginal tissue and reported a lower quality of life than those with ARMs. Despite this, patients with a cloacal malformation had similar reproductive health and sexual function compared with patients with ARMs. Our results reinforce the need for comprehensive sexual and reproductive health care for all women with ARMs.

**Key Words:** Cloaca, Anorectal malformation, Vaginal graft, Dyspareunia, Sexual function, Pregnancy

## Introduction

Anorectal malformations (ARMs) are rare congenital defects that affect 1 in 5000 infants.<sup>1</sup> A cloacal malformation, the most complex type of ARM, results from the persistence of a transient structure during fetal development that normally separates into a female's urogenital, gynecologic, and colorectal systems before birth. In 1 out of 50,000 births, the cloaca does not regress during development, forming a common channel (a single perineal orifice).<sup>2</sup> Other, less severe ARM subtypes in females include rectoperineal fistulas, rectovestibular fistulas, and rectovaginal fistulas. These subtypes can be associated with distal vaginal atresia and could potentially require vaginal decision-making at the time of the anorectal repair. Females born with a persistent cloaca require reconstructive surgery to separate their urogenital and colorectal systems to gain maximum functional-

ity and to reduce complications.<sup>3</sup> Some patients might have the potential for a myriad of gynecologic problems that result from maldevelopment of the Mullerian tubercle, sino-vaginal bulbs, vaginal plate, and urogenital sinus.<sup>4</sup>

Although there has been well-published research on women with ARMs grouped in 1 class with cloacal malformations, there has been little research on sexual and reproductive health outcomes specifically studying women with cloacal malformations.<sup>5</sup> Women born with cloacal malformations are sexually active, but their sexual activity could differ from that of women with other types of ARM.<sup>6,7</sup> Given the gynecological involvement of a cloaca, women with these malformations require more complex reconstructive pelvic surgery, which could involve creation of a neovagina. Depending on the type of surgical intervention, if any, penetrative sex, either vaginal or anal, might not be comfortable for patients, and nonpenetrative sex might be more frequently explored.<sup>8</sup> Additionally, women with a cloacal malformation are able to achieve pregnancy and live births, but research in this area is lacking.<sup>7</sup> The questions remain of whether these women are satisfied with their sexual activity, if they experience sexual desire at the same level as women with other ARMs, and if they report having

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a similar quality of life compared with women with other ARM subtypes.

The objective of this study was to improve our understanding of the reproductive health, sexual function, and quality of life in women born with cloacal malformations as a subset of the general ARM population, using a combination of validated and non-validated survey questions. We aimed to compare quality of life, collected via traditional screening measures, along with questions about body image and sexual well-being. We expected to gain insight into reproductive outcomes in this population as well. As patients with cloacal malformations have more physical challenges compared with the non-cloacae ARM population, such as incontinence, concern for dyspareunia, and more complicated surgical reconstructions with non-native vaginal tissue, we anticipated that body image, sexual experience, and sexual pleasure might be reported as inferior compared with the ARM group.

## Materials and Methods

### Patient Population

We performed a single-institution cross-sectional study of individuals assigned female at birth and continuing to identify as female with ARMs who underwent medical or surgical treatment between February 2014 and December 2020 at the Center for Colorectal and Pelvic Reconstruction, a multidisciplinary clinic involving colorectal surgery, gynecology, urology, and gastroenterology, at our institution, a major tertiary referral center for patients with complex ARMs. Patients aged 12 years and older who were born with a cloacal malformation and patients aged 12 years and older born with an ARM other than a cloaca (rectoperineal fistula, rectovestibular fistula, or rectovaginal fistula only) were included, the latter forming a control group. This study was approved by the Institutional Review Board at our institution. Eligible patients were identified through our clinic's research electronic data capture (REDCap) database and the electronic medical record.

### Survey Administration

The Female Reproductive Health survey was created by gynecologists with extensive experience working with patients with ARMs across their life span and colorectal and pelvic floor reconstructive surgeons with experience working with both pediatric and adult patients with ARMs (Appendix A). This survey was created and distributed through the REDCap database between June 2019 and August 2020. There is no validated survey to assess sexual function in the ARM population; this survey is based on the Female Sexual Function Index, which is a validated metric for assessing sexual function in patients without an ARM.<sup>9</sup> Eligible patients were contacted first through email to identify if they were interested in participating and to obtain consent. If a patient was under the age of 18, their legal guardian was contacted to obtain consent. Once consent was obtained, patients under the age of 18 were contacted and asked to provide assent to participate. Patients who participated had

3 options to complete their surveys: electronically via a secure link, on paper (at the time of their clinic visit), or over the phone.

The survey included questions about demographic characteristics, body image, gynecologic anatomy, sexual orientation, sexual desire, sexual activity, sexual satisfaction, and pregnancy outcomes. The survey was the same for both the cloacal malformation cohort and the ARM cohort. Patients were informed that all questions in the survey were optional; therefore, they could choose to skip over any questions they did not wish to answer. Participants also took a validated, age-adjusted quality-of-life survey known as the Pediatric Quality of Life Inventory (PedsQL).<sup>10–12</sup> This survey was only available to take online through REDCap.

### Statistical Analysis

All data were summarized using descriptive statistics. Categorical variables were compared using  $\chi^2$  or Fisher's exact tests, and Wilcoxon rank-sum tests were used for quantitative variables. A significance threshold of  $P < .05$  was utilized for all tests. A clinically significant difference between 2 PedsQL scores is defined as a difference of 4.5 or more points—it is not measured by statistical significance.<sup>10–12</sup> Missing data were simply treated as missing (ie, complete-case analyses were performed for variables in which missing data were present). All statistical analyses for this study were performed using SAS software, version 9.4 (SAS Institute, Cary, NC).

## Results

### Cohort Demographic Characteristics

Forty-two females with an ARM (not cloacal malformation) and 44 patients with a cloacal malformation were eligible for this study. Twenty-one (50%) patients responded to the reproductive survey in the ARM group, and 30 (68%) responded in the cloacal malformation group. The results of the demographic characteristics, gynecologic anatomy, and body image questions within the Female Reproductive Health survey are shown in Table 1. The median age of participating patients with cloacal malformations and ARMs was 17.5 years (with a range of 12–41) and 15 years (with a range of 12–55), respectively ( $P = .14$ ). Thelarche was reached in all ARM patients and nearly all cloacal malformation patients (93%). Menarche was reached in 67% of patients in both the ARM and cloacal malformation groups. The median age of thelarche and menarche in patients with a cloacal malformation was 11 (range: 8–14) and 12 (range: 8–16) years, respectively. Similarly, the median age of thelarche and menarche of patients with an ARM was 11 (range: 8–13) and 12.5 (range: 9–14) years, respectively ( $P = .85$  and  $P = .72$ ). The median age of menarche for patients with cloacal malformations with both native vaginas and neovaginas was 12 years. Within the cloaca malformation population, 61% ( $n = 27$ ) were incontinent of urine and 57% ( $n = 25$ ) were incontinent of stool. In the non-cloacal ARM population, 21% ( $n = 9$ ) were incontinent of urine and 50% ( $n = 21$ ) were incontinent of stool.

**Table 1**  
Gynecologic History and Body Image Responses.

Survey question		CM patients	ARM patients	P value
Number of eligible patients		44	42	
Completed surveys		30 (68)	21 (50)	
Median age of participants (years)		17.5 (12–41)	15 (12–55)	0.14
Number of patients with a uterus		24 (80)	19 (90)	0.44
Thelarche	Number of participants	27 (93)	20 (100)	0.51
	Median age (years)	11 (8–14)	11 (8–13)	0.85
Menarche	Number of participants	20 (67)	14 (67)	0.99
	Median age (years)	12 (8–16)	12.5 (9–14)	0.72
Menstrual cycle	Regular	11 (55)	7 (54)	0.95
	Irregular	9 (45)	6 (46)	
Menstrual flow	Light	10 (53)	6 (50)	0.62
	Normal	4 (21)	1 (8)	
	Heavy	5 (26)	5 (42)	
Dysmenorrhea	None	6 (30)	3 (23)	0.71
	Mild	6 (30)	2 (15)	
	Moderate	5 (25)	5 (38)	
	Severe	3 (15)	3 (23)	
Vaginal tissue	Native	12 (40)	18 (86)	0.03
	Native with tissue graft	5 (17)	1 (5)	
	Bowel tissue	4 (13)	1 (5)	
	Other tissue	4 (13)	0 (-)	
	None	5 (17)	1 (5)	
In general, I feel my health is:	Very good	10 (33)	8 (38)	0.39
	Fairly good	13 (43)	8 (38)	
	Fair	7 (23)	3 (14)	
	Rather bad	0 (-)	2 (10)	
Have you felt less physically attractive because of your diagnosis/condition?	Not at all	14 (47)	13 (62)	0.79
	A little	8 (27)	4 (19)	
	Quite a bit	6 (20)	3 (14)	
	Very much	2 (7)	1 (5)	
Do you feel less feminine as a result of your diagnosis/condition?	Not at all	18 (60)	16 (76)	0.35
	A little	10 (33)	3 (14)	
	Quite a bit	2 (7)	2 (10)	
	Very much	0 (-)	0 (-)	
If you have scars from medical treatment related to your diagnosis, do they make you feel self-conscious or awkward?	Not at all	10 (36)	8 (47)	0.86
	A little	12 (43)	5 (29)	
	Quite a bit	3 (11)	3 (18)	
	Very much	2 (7)	1 (6)	
	I don't have scars	1 (4)	0 (-)	
On the whole, I feel good about my body.	Strongly Agree	9 (30)	3 (14)	0.55
	Agree	10 (33)	9 (43)	
	Neutral	7 (23)	6 (29)	
	Disagree	4 (13)	2 (10)	
	Strongly Disagree	0 (-)	1 (5)	

ARM, anorectal malformation; CM, cloacal malformation.

Data are presented as *N* (%) or median (range). Percentages might not sum to 100% due to rounding. *Ns* might not sum to total sample size due to missing data for some questions. *P* values result from  $\chi^2$  or Fisher's exact tests for qualitative variables and Wilcoxon rank-sum tests for quantitative variables.

### Gynecologic Anatomy

There was a significant association between diagnosis and vaginal tissue type, with patients in the ARM group more likely to have native vaginal tissue compared with the cloacal malformation group ( $n = 18, 86\%$  vs  $n = 12, 40\%$ ;  $P = .03$ ). Five patients with a cloacal malformation had native vaginal tissue that was elongated with a bowel graft; 4 had neovaginas made entirely of bowel; 4 had neovaginas made of grafts other than bowel, such as buccal tissue; and 5 did not have any vaginal tissue at the time of the survey. All but 3 ARM patients had a native vagina. One had native vaginal tissue that was elongated with a bowel graft; 1 had a neovagina made entirely of bowel; and 1 did not know what type of vaginal replacement they had.

### Body Image

When comparing body image, 54% of patients in the cloacal malformation group reported that they felt “a lit-

tle,” “quite a bit,” or “very much” less physically attractive due to their diagnosis, compared with 38% of the patients in the ARM group, although this difference was not statistically significant ( $P = .79$ ). Overall, there were no differences between the ARM and cloacal malformation group in terms of each patient's perception of their general health, their femininity, thoughts on their scars, or how they feel about their bodies.

### Sexual Health and Activity

A detailed comparison of the Female Reproductive Health survey sexual health responses of the ARM and cloacal malformation groups is shown in Table 2. No patients in the ARM group expressed concerns regarding dyspareunia or the functionality of their vagina. Some patients in the cloacal malformation group responded “very much” to being concerned about dyspareunia ( $n = 4, 17\%$  for cloacal malformation vs  $n = 0, 0\%$  for ARM;  $P = .39$ ) and functionality of their vagina ( $n = 7, 29\%$  for cloacal malformation vs

**Table 2**  
Sexual Health Responses.

Survey question	Answer choices	CM patients	ARM patients	P value
Continue with sexual health survey	Yes, continue	24 (80)	10 (48)	0.02
	No, skip this section	6 (20)	11 (52)	
Describe your sexual orientation	Heterosexual	19 (79)	8 (80)	0.86
	Homosexual	0 (-)	0 (-)	
	Bisexual	1 (4)	0 (-)	
	Asexual	3 (13)	1 (10)	
	Other	1 (4)	1 (10)	
In the past week, how often have you had sexual feelings or thoughts about sex?	Almost never or never	11 (48)	6 (60)	0.29
	A few times	5 (22)	3 (30)	
Have you ever worried that sex would be painful?	Sometimes	6 (26)	0 (-)	0.39
	Most of the time	0 (-)	0 (-)	
	Always or almost always	1 (4)	1 (10)	
	Not at all	10 (43)	4 (40)	
	A little	6 (26)	5 (50)	
	Quite a bit	3 (13)	1 (10)	
	Very much	4 (17)	0 (-)	
Have you ever worried if your vagina is going to work for sex?	Not at all	11 (46)	5 (50)	0.18
	A little	4 (17)	3 (30)	
	Quite a bit	2 (8)	2 (20)	
	Very much	7 (29)	0 (-)	
In your lifetime, which of the following have you done?	Kissing	12 (50)	5 (50)	0.99
	Someone touching my breasts	10 (42)	3 (30)	0.70
	Touching my own sexual organs	9 (38)	2 (20)	0.44
	Touching other people's sexual organs	8 (33)	3 (30)	0.99
	Having someone touch my sexual organs	8 (33)	2 (20)	0.68
	Giving oral sex	9 (38)	2 (20)	0.44
	Receiving oral sex	9 (38)	2 (20)	0.44
	Penetrating vaginal sex	9 (38)	3 (30)	0.99
	Penetrating anal sex	3 (13)	0 (0)	0.54
	Withdrawal/pull-out	2 (8)	3 (30)	0.14
	Fertility awareness/counting days	1 (4)	1 (10)	0.51
	Condoms	6 (25)	3 (30)	0.99
	Pills	10 (42)	4 (40)	0.99
Birth control use	Shot	2 (8)	0 (-)	0.99
	Implant	1 (4)	0 (-)	0.99
	Intrauterine device	0 (-)	1 (10)	0.29

ARM, anorectal malformation; CM, cloacal malformation.

Data are presented as N (%). Percentages might not sum to 100% due to rounding. P values result from  $\chi^2$  or Fisher's exact tests.

$n = 0$ , 0% for ARM;  $P = .18$ ), but these comparisons were not statistically significant. Additionally, although again unable to be analyzed statistically, a roughly similar percentage of responding groups reported ability to reach orgasm from sexual activity within the groups ( $n = 6$ , 60% for cloacal malformation vs  $n = 2$ , 67% for ARM).

Of the 24 patients with a cloacal malformation who participated in the sexual history survey, 10 (42%) reported having either penetrative vaginal or anal intercourse (Table 3). Of the 10 patients with an ARM who participated in the sexual history survey, 3 (30%) reported ever being sexually active. Only 2 of the ARM patients responded to the rest of the questions, so no statistical analysis was able to be performed to determine differences between the 2 groups for this portion. Seven of the 10 (70%) patients with a cloacal malformation reported having a current sexual partner, compared with 0 (0%) of the patients with an ARM. The median age of initiating penetrative vaginal or anal sexual activity among sexually active women with cloacal malformations was 17 years (range: 13–26), compared with 16.5 years (range: 15–18) in women with an ARM. Women in the cloacal malformation group had a median of 4 sexual partners (range: 1–15), and women in the ARM group had a median of 8 (range: 1–15). One patient (10%) in the

cloacal malformation group reported being diagnosed with a sexually transmitted infection, compared with no patients (0%) in the ARM group. Four patients (40%) in the cloacal malformation group indicated that their vagina has felt “too small” during intercourse, whereas no patients (0%) in the ARM group felt their vagina was “too small.” Five patients (50%) in the cloaca group reported some degree of dyspareunia during sexual intercourse, and 2 patients (67%) with an ARM reported some degree of dyspareunia.

#### Pregnancy

Of the patients who responded to the Female Reproductive Health survey, 2 patients with a cloacal malformation and 2 patients with an ARM reported that they have been pregnant before. All pregnancies were singleton pregnancies and resulted in live births. All but 1 was conceived spontaneously—1 patient underwent assisted reproductive technology. Both patients with cloacal malformation had native vaginas and delivered via cesarean section. In both cases, patients were advised against vaginal delivery by their providers due to their diagnosis. One of the patients with a cloacal malformation reported trying to conceive for 10 years before becoming pregnant. One patient in the

**Table 3**  
Penetrative Sexual Activity Responses.

Survey question	CM patient responses	ARM patient responses*
Patients who have engaged in penetrative sex <sup>†</sup>	10/24 (42)	3/10 (30)
Patients who currently have a sexual partner	7 (70)	0/2 (0)
Median age at first penetrative sexual activity (years)	17 (13–26)	16.5 (15–18)
Median number of sexual partners	4 (1–15)	8 (1–15)
When you have had sex with a partner, how often did/do you orgasm (climax)?	Almost never or never	3 (30)
	A few times	2 (20)
	Sometimes	0 (-)
	Most of the time	3 (30)
	Almost always or always	1 (10)
	Unknown/not answered	1 (10)
		1 (33)
If you have fecal incontinence, do you feel it compromises your sexual activity?	Almost never or never	2 (40)
	A few times	1 (20)
	Sometimes	0 (-)
	Most of the time	1 (20)
	Almost always or always	1 (20)
	N/A—don't have	5
		0 (-)
If you have urinary incontinence, do you feel it compromises your sexual activity?	Almost never or never	0 (-)
	A few times	1 (33)
	Sometimes	0 (-)
	Most of the time	1 (33)
	Almost always or always	1 (33)
	N/A—don't have	7
		1
During sex, has your vagina felt too small?	Not at all	4 (40)
	A little	2 (20)
	Quite a bit	2 (20)
	Very much	2 (20)
		0 (-)
Have you experienced pain during sexual intercourse?	Not at all	5 (50)
	A little	2 (20)
	Quite a bit	2 (20)
	Very much	1 (10)
		0 (-)
Is sexual activity enjoyable for you?	Not at all	0 (-)
	A little	5 (50)
	Quite a bit	0 (-)
	Very much	2 (20)
	Unknown/not answered	3 (30)
		1 (33)
		1 (33)

ARM, anorectal malformation; CM, cloacal malformation.

Data are presented as N (%) or median (range). Percentages might not sum to 100% due to rounding.

\* Statistical comparison was unable to be performed due to low sample sizes.

<sup>†</sup> Vaginal or anal.

ARM group delivered vaginally twice (both deliveries were vacuum-assisted, and 1 was with an episiotomy), and the other delivered via cesarean section per provider recommendation due to their diagnosis. A patient with a cloacal malformation who had a partial vaginal replacement with a colonic tissue graft reported previous attempts at obtaining a pregnancy, but she was unable to conceive despite assistive reproductive technology.

#### Quality of Life Scores

Sixteen patients with a cloacal malformation and 23 patients with an ARM completed the PedsQL. The median PedsQL score reported by patients with cloacal malformations was 80.4 (range: 42.4–97.8) out of a maximum score of 100, with higher scores indicating a higher quality of life. The ARM group had a median PedsQL of 87.0 (range: 52.2–100) (clinically significant difference of 6.6).

#### Discussion

The results of this study showed that both females with cloacal malformations and other ARM subtypes perceived their health as good. Both of these groups reached thelarche and menarche at an age comparable to the non-ARM population, despite the presence of a chronic illness and

severity of the malformation. Therefore, all patients with ARMs and cloacal malformations should be counseled similarly to their peers regarding pubertal timing/tempo, sexual health, and reproductive health. Patients with a cloacal malformation were less likely to have native vaginal tissue. There were no differences between the cloacal malformation and ARM groups regarding feeling less physically attractive or concerns about dyspareunia and vaginal function. A successful pregnancy was possible in both groups of patients, although fertility rates are unknown. The patients' quality of life was clinically significantly different between the 2 groups, with patients with a cloacal malformation reporting an overall lower health-related quality of life compared with patients with an ARM. The medical and surgical complexity of these patients did not appear to have a large impact on our population, illustrating that comprehensive sexual and reproductive health education and counseling should be performed for patients with ARMs and cloacal malformations at the same time as their age-matched peers.

A study from the Netherlands assessed psychosexual well-being and its relation to health-related quality of life in adults who underwent operations for ARM and Hirschsprung disease.<sup>13</sup> The authors reported that 50% of female patients with ARMs and Hirschsprung's disease had sexual dysfunction. Although that study suggested the de-



gree of ARM had no impact on sexual dysfunction, unlike our study, it did not include women with cloacal malformations. We found that women with cloacal malformations had a lower quality of life than women with another type of ARM. Another study examining sexual function in patients with ARMs was a qualitative study of 55 adult patients with ARMs (23 females, median age 23 years), which showed that these patients have delayed sexual intercourse that could be related to delayed psychosocial adaptation.<sup>6</sup> However, regardless of the severity of the malformation, and regardless of incontinence, many of these patients still expressed interest in sexual activity. In our patient population, a limited number of individuals engage in penetrative sexual intercourse, although the frequency of climax when having intercourse was similar. This suggests that sexual satisfaction might be related to non-penetrative forms of intercourse in this population. Further studies could provide more insight into understanding the relationship between sexual desire and specific types of sexual activity within this population. The current median coital debut age among the general population of both males and females is estimated to be 16 years, which is slightly younger compared with the patients with a cloacal malformation in our study (17.8 years).<sup>14</sup>

The importance of education and counseling on sexual and reproductive health cannot be understated. Our study affirms that patients with cloacal malformations and ARMs deserve the same comprehensive care, education, and anticipatory guidance that patients without these conditions receive, with a special emphasis on anatomy, body image, and vaginal function. Education and advocacy by parents, schools, and all medical providers regarding puberty, sex, preconception care, and pregnancy should be encouraged. Providers should prepare and educate patients and their families regarding thelarche and menarche, which, in our population of both those with cloacal malformations and ARMs, occurred around 11 and 12 years of age.

Counseling on sexual and reproductive health for individuals with a cloacal malformation or ARM should begin at the same time as their age-matched peers. Comprehensive reproductive health care for individuals with an ARM should include a combination of education specific to anatomical changes relevant to ARMs, as well as general education/screening applicable to all young women. Specifically, we recommend that comprehensive gynecologic and reproductive health care include (1) discussion of pubertal changes, (2) discussions of the potential for menarche and risk of menstrual outflow obstruction, (3) confirmation and education for patients about their Mullerian and vaginal anatomy, (4) assessment of the ability to accommodate and tolerate penetrative sex, (5) offering sexually transmitted infection screening and contraception, (6) provision of the human papilloma virus (HPV) vaccine, (7) assessment of family building potential and desire, (8) preconception care, (9) assessment of the need for specialized obstetric care, (10) screening for safety or dating violence in relationships or partnerships, (11) screening for body image and offering counseling if needed, (12) referral to patient support groups, (13) evaluation of quality of life, (14) consideration of treatment for sexual dysfunction as needed (vaginal di-

lation, pelvic floor physiotherapy, counseling, surgery), and (15) assistance with the transition of care from pediatric to adult providers as the patient ages.<sup>12,15</sup>

Open discussion with the patient regarding their personal preferences and desire for pregnancy is critical, in addition to discussing their ability to achieve pregnancy and the risk of pregnancy given their congenital condition. Documentation of the Mullerian anatomy from previous surgical reports or by imaging is pertinent to discuss future fertility potential and potential obstetric risks.<sup>2,16</sup> In those with associated vertebral defects, anal atresia, cardiac defects, trachea-esophageal fistula, renal abnormalities, and limb defects (known as VACTERL syndrome), the risks of anesthesia-related perioperative morbidity in high-risk pregnant patients should be discussed, and coordination of care with anesthesia should be initiated.<sup>17</sup> Anesthesia is complicated by these associated abnormalities, which could lead to difficulties with intubation due to tracheal abnormalities or difficulties with adequate pain control given limitations of epidural placement with spinal abnormalities. Our study identified 4 patients in the cohort who had live births; 3 underwent cesarean section, and 1 underwent vaginal delivery twice. Additionally, of these patients, 3 were able to conceive naturally, and 1 required assisted reproductive technology. Only 1 patient with a cloacal malformation in our cohort experienced infertility. Nonetheless, our study identified that pregnancy is attainable in women with a cloacal malformation, which has been illustrated in other small studies as well.<sup>6,7</sup>

Our study found that patients with a cloacal malformation were more likely to have a lower quality of life than those with another type of ARM. Another difference between the 2 groups on the reproductive health survey was that patients with cloacal malformations were less likely to have a native vagina, and although not statistically significant, they had concerns related to dyspareunia. Studies have demonstrated that colonic vaginas can have increased rates of mucous production, introital stenosis, and malodorous discharge, despite the advantageous self-lubrication and similarities in texture.<sup>18</sup> Although the impact of colonic vaginas on fertility is unknown, these factors could impact patient quality of life. However, further studies should be conducted examining additional reasons for a lower quality of life in patients with a cloacal malformation. Patients within the survey described both penetrative and non-penetrative forms of sexual intercourse at roughly similar rates between groups.

There are several limitations to this study. First, given the rarity of ARMs, our analyses run the risk of sampling error and bias. Additionally, because of the low sample size of control respondents for the sexual activity portion of the survey, we were unable to analyze differences between the cloacal malformation group and the ARM group. It is unclear why our respondents declined to answer this portion of the survey. The survey itself is not validated, as there currently is no validated survey to assess sexual function in the ARM population. Our data support the need for development of such an evaluation tool. This study also highlights patients being referred to our large, quaternary colorectal center and therefore impacts generalizability. Our

multidisciplinary clinic is a referral center for patients with complex anorectal malformations and pelvic anomalies and often cares for patients who require repeat reconstructive surgeries, which could explain why a large percentage of patients with cloacal malformations in our cohort did not have their native vaginal tissue. Finally, the goal of this study was to compare women with cloacal malformations with their non-cloacal anorectal malformation peers. We did not explicitly study the comparison between women with cloacal malformations or ARMs and the general population. This represents a future area of research for us in understanding how women with cloacal malformations experience, enjoy, and are potentially limited in sexual expression compared with patients without these malformations.

### Conclusions

Before the initiation of this study, we hypothesized that women with cloacal malformations would have higher rates of dyspareunia and non-native vaginal tissue due to their complicated reconstructions. We believed that this would correlate with lower rates of enjoyment of sexual intercourse and lower rates of quality of life. However, our research demonstrates no differences between age at the-lar-che and menar-che, body image, concerns for dyspareunia or vaginal function, and sexual health/activity between the 2 populations. Overall, it appears that women with cloacal malformations have similar reproductive health and sexual function compared with patients with an ARM. Patients with a cloacal malformation were less likely to have native vaginal tissue compared with those with other ARM types. Patients with a cloacal malformation also reported a lower overall health-related quality of life. Given the similarity in populations, all providers who care for these patients should educate and advocate for both patient populations and provide the same comprehensive sexual and reproductive health care at the same time as their age-matched peers, with individualized information based on their diagnosis, medical history, and presence of VACTERL anomalies. Future research involves comparing both populations with age-matched controls without cloacae or anorectal malformations, as well as larger studies to acquire an adequate power for true statistical analysis. Development of a multi-

institutional study can help to achieve adequate power for true statistical analysis.

### Disclosures/conflict of interest statement

Nothing to disclose.

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