GYNECOLOGY

Uterine structural abnormality and intrauterine device malposition: analysis of ultrasonographic and demographic variables of 517 patients

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BACKGROUND: Intrauterine devices are currently one of the leading forms of reversible contraception in the world. However, in approximately 10−25% of women, intrauterine devices can become malpositioned, leading to consequences including pain, bleeding, as well as possible decreased contraceptive efficacy.

OBJECTIVE: We sought to determine whether certain reproductive and uterine characteristics are associated with an increased risk of intrauterine device malposition. We hypothesized that anatomical characteristics such as the presence of any uterine anomalies, particularly congenital anomalies and fibroids that may lead to cavitary distortion, would be associated with a higher incidence of intrauterine device malposition.

MATERIALS AND METHODS: We conducted a retrospective case-control study in an academic medical center. All patients presenting for scheduled ultrasound appointments for gynecologic indication between June 2004 and February 2016 were included (1,253 ultrasound reports identified). Of these, 236 demonstrated malpositioned intrauterine devices. With a control group of 281 patients with normal intrauterine device location, a total of 517 patients were included in the study. Transabdominal and transvaginal ultrasounds were performed followed by 3-dimensional rendering (as per our institution's protocol for patients with intrauterine devices) using Voluson 730 and Voluson E8 ultrasound machines. Demographic and reproductive characteristics, indication for ultrasound, intrauterine device, and uterine characteristics were all extrapolated from the electronic medical record. χ^2 Tests were performed for categorical variables. Generalized linear models for Poisson distributed variables, and multiple logistic regression were used to ascertain significant independent predictors of IUD malposition. Ninety-five percent confidence intervals and effect sizes were calculated, and $P < .05$ was considered statistically significant.

RESULTS: In this study, we found a cumulative IUD malposition rate of 19%. In patients with malpositioned intrauterine devices, there was increased incidence of retroflexed uterine positions (7.6% vs 1.8%, $P = .001$), and all uterine anomalies (this includes septate and bicornuate uteri and fibroids, 31.9% vs 23.5%, $P = .02$) compared with controls. The anterior midline uterine position was more commonly noted in controls (28.5% vs 11%, $P < .001$). A higher total number of fibroids was noted in the malpositioned group (3.7 vs 1.8, $P = .01$); however, fibroid size was not statistically significant. In particular, there was an increased incidence of submucosal fibroids in women with malpositioned intrauterine devices ($P = .01$). Multivariable logistic regression revealed that anterior midline position (odds ratio [OR], 0.33; 95% confidence interval [CI], 0.20−0.57) and absence of uterine anomalies (OR, 0.59; 95% CI, 0.38−0.93) were factors associated with a lower risk of IUD malposition; whereas vaginal bleeding (OR, 2.25; 95% CI, 1.38−3.67), pain (OR, 2.85; 95% CI, 1.84−4.44), or missing IUD strings at time of presentation (OR, 3.58; 95% CI, 1.88−6.82) were associated with an increased risk of malposition.

CONCLUSION: Retroflexed uterine positions and all uterine malformations are associated with higher incidence of malpositioned intrauterine devices. Presence of increased number of fibroids and specifically submucosal fibroids showed a positive association with intrauterine device malposition, as did symptoms of bleeding, pain, and missing IUD strings at time of presentation. These findings pertain to women presenting for gynecologic ultrasound evaluation and may not be generalizable to all women with IUDs.

Key words: fibroids, intrauterine device (IUD), long-acting reversible contraception, malpositioned IUD, uterine anomalies

Contraceptive prevalence and methods vary widely around the world. Female sterilization and intrauterine devices (IUDs) are currently the two most common forms of contraception used by married or in-union women worldwide.[1,2] The benefits of IUD use, which have likely contributed to its popularity, include high effectiveness, elimination of user error, and cost-effectiveness when considering the duration of contraception. A correctly positioned IUD is located at the fundus of the uterus, with the arms fully extended toward the uterine cornua. The vertical stem should extend straight down in the uterine cavity. In some reports, it is noted that the IUD should be located 3 mm or less from the fundus, with a distance >4 mm associated with symptoms such as bleeding and pain, as well as with a higher risk of expulsion or displacement.[3]

IUD malposition can occur in 10−25% of postpartum and non-postpartum women presenting for gynecologic evaluation. If so, it is most likely to take place within the first 6 weeks after placement, with the most common site being the lower uterine segment.[3−9] Malpositioned IUDs can have consequences, including possible decreased contraceptive efficacy, as suggested in studies involving copper IUDs.[4] Benacerraf et al found that whereas over half of the patients with malpositioned IUDs were asymptomatic at presentation, a higher proportion of patients with malpositioned IUDs

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AJOG at a Glance

Why was this study conducted?

IUDs play a very important role both for contraception and treatment of benign gynecologic conditions. IUD malposition, however, can have consequences including possible decreased IUD efficacy and discontinuation. We sought to determine whether certain reproductive and uterine characteristics are associated with an increased risk of IUD malposition in women undergoing ultrasound for a gynecologic indication.

Key findings

The presence of all uterine anomalies, multiple or submucosal fibroids, as well as uterine retroflexion are associated with a higher incidence of IUD malposition.

What does this add to what is known?

Our study has 1 of the largest numbers of patients with malpositioned IUDs in the literature, reviews 2- and 3-dimensional ultrasound data and a more comprehensive list of variables, and is the first to examine the influence of uterine flexion and cumulative effect of specific fibroid characteristics on malpositioned IUDs.

presented with complaints of bleeding (35.7% vs 15.1%, $P = .02$) or pain (39.3% vs 19.4%, $P = .03$) compared with those with normally positioned IUDs.[10] We sought to further evaluate whether certain characteristics in a patient's reproductive history or uterine anatomy may be related to, or have a predisposing role in, IUD malposition. We hypothesized that anatomical (as opposed to demographic) characteristics such as the presence of any uterine anomalies, particularly fibroids that may lead to cavitary distortion, would be associated with a higher incidence of IUD malposition.

Materials and Methods

We performed a retrospective case-control study of all patients who had an ultrasound performed at our institution for gynecologic indication (excluding ultrasounds performed through the emergency departments) with an IUD in place from June 2004 to February 2016. Ultrasounds were performed both transabdominally then transvaginally followed by 3D rendering (as per our institution's protocol for patients with IUDs) using Voluson 730 and Voluson E8 (GE Healthcare, Boston, MA) ultrasound machines. Standard measures were recorded including uterine position, uterine size, assessment of anomalies, total number of fibroids with size measurement(s), and IUD position. The reports were obtained by performing a query of the ultrasound referrals and orders placed through our computerized database of medical records with the search term "IUD" in the above-mentioned selected time frame. Reports were generated in numerical order based on patients' medical record number (MRN). A total of 1253 ultrasound reports were identified and reviewed. Of these, 236 individuals demonstrated malpositioned IUDs. The remaining pool of patients with normal IUD location were then listed in order of MRN; thus, characteristics such as year of ultrasound and all demographic characteristics were more likely to be distributed by chance. To reduce any selection bias, the first 300 patients were included for review. Nineteen patients were excluded due to missing information, and 281 patients comprised the control group for a total of 517 patients included in our study. Controls were not matched by any other parameters. As the query returned the patient list in order of MRN, only the first ultrasound per individual was included, and any subsequent or repeat ultrasounds were not.

We defined correctly positioned IUDs as located 3−4 mm from the uterine fundus with both arms fully extended and parallel to the axis of the uterine cornuas, with the vertical portion pointing directly and centrally into the uterine cavity. We defined "malpositioned" IUDs to include any deviation from the correct position. Embedment was defined as IUD penetration into the myometrium without extension through the serosa. Extrauterine IUDs were either partially or completely within the peritoneal cavity. In regard to uterine position, version referred to the anterior or posterior position of the uterus in relation to the axis of the vagina; anteriorly was considered anteverted, and posteriorly was considered retroverted. Flexion referred to any deviation of the long axis of the endometrial lumen (also uterine fundus) from the long axis of the cervix; anteriorly directed was considered anteflexion, and posteriorly directed was considered retroflexed. Anterior midline referred to when the axis of the uterus was in the same axis as the vagina.

We collected demographic and reproductive characteristics including age, parity, and previous number of cesarean deliveries through our electronic medical record (EMR). Indication for ultrasound, location and type of IUD, and whether or not it was embedded were abstracted from the ultrasound reports and images. Furthermore, we collected information regarding uterine position, presence of any uterine anomalies (Mullerian anomalies and fibroids), size, location, and the type of fibroid (submucosal, intramural, subserosal, or pedunculated). When fibroids were noted on ultrasound, the dimensions, type, and location of the two largest fibroids were recorded for our data analysis. These anatomic data were collected from documented findings on ultrasound examination report and were used in our analysis.

The variables outlined above were statistically analyzed using χ^2 tests to determine significant differences between the groups for categorical variables. When there was a significant χ^2 for variables with more than 2 categories, χ^2 tests were made for each category vs all other categories combined. Generalized linear models for Poisson distributed variables were used to evaluate for any differences between the 2 groups for count-type variables such as age (count of years), gravida, and previous cesarean

TABLE 1
Patient reproductive and IUD characteristics

Parameter	Malpositioned n = 236	Controls n = 281	*P* value	Effect size
Age, year (SD)	36.2 (10.2)	38.8 (10.3)	.005	0.25
95% CI	34.98–37.54	37.58–40.05		
Gravida (SD)	2.4 (1.8)	2.3 (1.4)	.58	0.06
95% CI	2.14–2.60	2.06–2.50		
Number of previous cesarean deliveries			.93	0.01
n (%)	61 (26)	73 (26)		
Mean (95% CI)	0.51 (0.41–0.65)	0.52 (0.42–0.65)		
0	110 (47)	130 (46)		
1	39 (17)	43 (15)		
2	17 (7)	27 (10)		
3	5 (2)	3 (1)		
Not reported	65 (27)	78 (28)		
IUD years in situ (SD)	5.7 (1.6)	6.2 (7.7)[a]	.49	0.07
Range	<1–38[b]	<1–35[c]		
95% CI	4.68–6.85	5.16–7.50		
IUD type			<.001	0.18
ParaGard	57 (24.2)	12 (4.3)	<.001	0.30
Mirena	42 (17.8)	39 (13.9)	.14	0.07
Multiload	4 (1.7)	0 (0)	.04	0.10
Other	10 (4.2)	6 (2.1)	.15	0.06
Unsure	123 (52.1)	224 (79.7)	<.001	0.31
Malpositioned IUD			<.001	1.00
Location[d]			<.001	0.44
Low, not extending to the cervix	90 (38)	0 (0)	—	—
Low, extending into the cervix	51 (22)	0 (0)	—	—
Cervical	61 (26)	0 (0)	—	—
Other	28 (12)	0 (0)		
Axis deviated	14/28 (50)	0 (0)	—	—
Laterally displaced	6/28 (21)	0 (0)		
Inverted/transverse	3/28 (11)	0 (0)	—	—
Cornual	3/28 (11)	0 (0)		
At serosal edge	1/28 (3.5)	0 (0)	—	—
IUD arms folded	1/28 (3.5)	0 (0)	—	—
Unsure	3 (1)	0 (0)	—	—
Extrauterine	3 (1)	0 (0)	—	—
Total embedded	57 (24)	0 (0)	<.001	0.39

CI, confidence interval; *IUD,* intrauterine device; *SD,* standard deviation.

[a] Standard deviation greater than the mean, data skewed due to large range and missing data; [b] A total of 18 women had an IUD in situ for >15 years; 4 of these were in situ ≥25 years; [c] A total of 22 women had an IUD in situ for ≥15 years; 9 of these were in situ ≥25 years; [d] For variables with >2 categories that are significantly different between groups, each category is compared with all other categories combined.

Gerkowicz et al. Uterine structural abnormality and IUD malposition. Am J Obstet Gynecol 2019.

TABLE 2
Presenting symptoms for evaluation

Symptom(s) reported	Malpositioned n (%)[a]	Control n (%)[a]	*P* value	Effect size
Vaginal bleeding	68 (30)	53 (19)	.005	0.13
Pelvic pain	98 (43)	83 (30)	.002	0.08
Pregnancy	8 (4)	5 (2)	.22	0.05
Miscarriage	2 (0.9)	0 (0)	.20	0.07
Missing IUD string	37 (16)	27 (10)	.03	0.10
Retained IUD	26 (11)	66 (23)	<.001	0.16
IUD placement check[b]	46 (20)	20 (7)	<.01	0.19
Not documented	25 (11)	46 (16)	.07	0.08

IUD, intrauterine device.

[a] Of note, some patients had multiple symptoms on presentation; therefore the percentage reflects the frequency of that particular symptom based on reporting; [b] "IUD placement check" refers to ultrasonographic evaluation ordered by the clinician due to either difficult IUD insertion or concern for improper placement of the IUD. The patient may or may not have other associated symptoms with this presentation.

Gerkowicz et al. Uterine structural abnormality and IUD malposition. Am J Obstet Gynecol 2019.

deliveries. Multiple logistic regression was used to ascertain significant independent predictors of IUD malposition. Data are presented as mean and 95% confidence interval (CI) or as frequency and percentage. Effect sizes are Cohen's *d* for continuous variables and phi or Cramer's V for categorical variables. Statistical analyses were performed used SAS 9.3 (SAS Institute, Cary, NC). For all analyses, $P < .05$ was considered statistically significant. Institutional review board (IRB) approval was obtained with waiver of informed consent due to the retrospective nature and de-identification of the data (IRB: CR00000157 approved on January 22, 2014, project ID no. 20110627).

Results

The cumulative IUD malposition rate was 19% among patients with IUDs undergoing pelvic ultrasound for a gynecologic indication. Age and reproductive history are presented in Table 1. Mean age at time of presentation was 36.2 years in the malposition group vs 38.8 years in the control group ($P = .005$). There were no differences in total number of pregnancies, cesarean deliveries, or duration of IUD use between groups (Table 1). Type and prevalence of each IUD was statistically significant between groups ($P < .001$). Of the documented IUD types, ParaGard IUDs (Cooper Surgical, Trumbull, CT) were the most common malpositioned IUD (24.2%) but accounted for only 4.3% of the known IUDs in the controls ($P < .001$). Mirena IUDs (Bayer, Whippany, NJ) were the most common known IUD in the control group (13.9 %), and the

TABLE 3
Uterine anatomical characteristics

Uterine position/ characteristics	Malpositioned, n (%) n = 236	Controls n (%) n = 281	*P* value	Effect size
Position			<.001	0.13
Anteverted	155 (65.7)	152 (54.1)	.008	0.12
Retroverted	32 (13.6)	43 (15.3)	.59	0.02
Anteflexed	5 (2.1)	1 (0.3)	.10	0.08
Retroflexed	18 (7.6)	5 (1.8)	.001	0.14
Anterior-midline	26 (11)	80 (28.5)	<.001	0.21
Anomaly			.02	0.07
Septate	3 (1)	0 (0)	.09	0.08
Bicornuate	1 (0.4)	0 (0)	.46	0.05
Fibroids	72 (30.5)	66 (23.5)	.68	0.08
No anomaly	160 (68)	215 (76.5)	.03	0.09

Gerkowicz et al. Uterine structural abnormality and IUD malposition. Am J Obstet Gynecol 2019.

TABLE 4
Fibroid characteristics

Fibroid characteristics	Malpositioned n = 236		Control n = 281		*P* value	Effect size
Mean no. fibroids (SD)	3.7 (0.8)		1.8 (1.1)		.01	
	Fibroid 1 cm (SD)	Fibroid 2 cm (SD)	Fibroid 1 cm (SD)	Fibroid 2 cm (SD)		
Mean fibroid size	3.7 (0.9)	2.2 (0.4)	3.6 (2.4)	1.4 (1.6)	Fib1 .55 Fib2 .38	0.10 0.22
Fibroid location	Fibroid 1 n (%) n = 72	Fibroid 2 n (%) n = 35	Fibroid 1 n (%) n = 66	Fibroid 2 n (%) n = 30	Fib1 .21 Fib2 .46	0.10 0.12
Anterior	27 (37)	9 (26)	22 (33)	11 (36)	.72	
Posterior	26 (36)	15 (42)	24 (36)	12 (40)	.98	
Fundal	7 (10)	3 (8)	12 (18)	5 (16)	.10	
Lateral	9 (13)	9 (26)	8 (12)	4 (13)	.92	
Cervical	3 (4)	1 (2)	0 (0)	0 (0)	.24	
None	164 (69)		215 (76)			
Fibroid type	Fibroid 1 n (%) n = 72	Fibroid 2 n (%) n = 35	Fibroid 1 n (%) n = 66	Fibroid 2 n (%) n = 30	Fib1 .18 Fib2 .39	0.13 0.13
Intramural	48 (66)	18 (51)	42 (64)	20 (67)	0.75	
Subserosal	17 (24)	14 (40)	23 (35)	10 (33)	0.16	
Submucosal	7 (10)	3 (8)	0 (0)	0 (0)	0.01[a]	
Pedunculated	0 (0)	1 (1)	1 (1)	0 (0)	0.48	

Fib, fibroid.

[a] $P = .01$, therefore reflecting a statistically significant difference between the two groups in regard to presence of submucosal in malpositioned group only vs none in control group.

Gerkowicz et al. Uterine structural abnormality and IUD malposition. Am J Obstet Gynecol 2019.

second most common in the malpositioned group (17.8%, $P = .14$). Of 236 malpositioned IUDs, 57 (24%, $P < .001$) were embedded, and all embedded IUDs were by definition malpositioned. The location of the malpositioned IUDs, as determined by 2-dimensional (2D) and 3-dimensional (3D) ultrasound, are also outlined in Table 1, with the most common malposition presentation being low but not extending to the cervix (38%), followed by cervical (26%), low and extending into the cervix (22%), other (12%), unsure (1%), and extrauterine (1%).

Presenting symptoms are outlined in Table 2. Vaginal bleeding and pelvic pain were more common in patients with malpositioned IUDs compared with controls (30% vs 19%, $P = .005$ and 43% vs 30%, $P = .002$). Patients with malpositioned IUDs were also noted to have "missing" IUD strings at the time of IUD check more often than controls (16% vs 10%, $P = .03$). Six percent of patients were found to have malpositioned IUDs when ultrasound was performed for pregnancy or miscarriage. The incidence of malpositioned IUDs was not statistically significant when ultrasound was performed for pregnancy or miscarriage.

Incidence and frequency of uterine positions are outlined in Table 3. Anterior midline position was significantly more common in control patients (28.5% vs 11%, $P < .001$). There was an increased incidence of retroflexed uterine positions in patients with malpositioned IUDs in comparison to controls (7.6% vs 1.8%; $P = .001$). Patients with malpositioned IUDs had a higher incidence of all uterine anomalies (31.9% vs 23.5%, $P = .02$), such as septate uteri, bicornuate uteri, and fibroids. Detailed characteristics regarding the fibroids analyzed are listed in Table 4. The average total number of fibroids was higher in the group with malpositioned IUDs compared with controls, which was statistically significant (3.7 vs 1.8, $P = .01$). Fibroids were not significantly larger in patients with malpositioned IUDs compared with the controls averaging 3.7 cm with a standard deviation (SD) of 0.9 cm vs 3.6 cm (SD, 2.4 cm) ($P = .55$). When comparing the two largest fibroids in both patient groups, the most common type was intramural, followed by subserosal and submucosal. There was a statistically significant increased incidence of submucosal fibroids in the malpositioned vs controls ($P = .01$), with none present in the control group.

Finally, we ran a multiple logistic regression model with items that had significant *P* values for group differences in the above bivariate analyses as outlined in Table 5. We used a backward

TABLE 5
Variables predicting malpositioned IUD: multivariable logistic regression

Variable	Odds ratio	95% CI	*P* value
Anterior midline position	0.33	0.20-0.57	<.001
No uterine anomaly	0.59	0.38-0.93	.023
Vaginal bleeding	2.25	1.38-3.67	.001
Pain	2.85	1.84-4.44	<.001
Missing IUD string	3.58	1.88-6.82	<.001
IUD placement check[a]	3.94	2.05-7.59	<.001

CI, confidence interval; *IUD*, intrauterine device.

[a] "IUD placement check" refers to ultrasonographic evaluation ordered by the clinician due to either difficult IUD insertion or concern for improper placement of the IUD. The patient may or may not have other associated symptoms with this presentation.

Gerkowicz et al. Uterine structural abnormality and IUD malposition. Am J Obstet Gynecol 2019.

elimination process to delete variables that were not significant at the $P < .05$ level. Variables were removed one variable at a time, eliminating that with the lowest Wald χ^2 value. Anterior midline position (OR, 0.33; 95% CI, 0.20−0.57) and no uterine anomaly (OR, 0.59; 95% CI, 0.38−0.93) were factors associated with a lower risk of IUD malposition, whereas vaginal bleeding, pain, and missing IUD strings as indications for ultrasound were associated with an increased risk of malposition.

Comment

In this study, we found a cumulative IUD malposition rate of 19% among patients with IUDs undergoing pelvic ultrasound. No patients with correctly positioned IUDs had congenital uterine anomalies, whereas 4 patients with malpositioned IUDs did. Although the incidence of fibroids was comparable in both groups, patients with malpositioned IUDs had a higher number of fibroids and were the only patients to have submucosal fibroids. Furthermore, there was a statistically significant increase in the presenting symptom of bleeding in patients with malpositioned IUDs vs controls.

We reviewed 2D and 3D ultrasound data and a comprehensive list of variables in an effort to identify ultrasonographic and reproductive characteristics that may predispose or increase the risk of IUD malposition. Previous studies have examined the effect of postabortion or postpartum IUD insertion (6−9 weeks), breastfeeding, pregnancy history, adenomyosis, indication for placement, age, presence of fibroids, and total uterine volume as a surrogate for fibroid size on IUD malposition.[4,7,11] However, most studies have focused on the incidence, on only 1 variable, or have been inadequately powered.

As per protocol at our institution, all patients with IUDs having a gynecological ultrasound undergo 3D imaging. Benacerraf et al reported that 3D ultrasound is superior in identifying IUD malposition.[10] Similarly, Chen et al found 64.8% vs 83.6% sensitivity with 2D vs 3D ultrasound in the identification of IUD malposition.[12,13] We found a cumulative IUD malposition rate of 19% among patients with IUDs undergoing pelvic ultrasound, compared with 10.4% reported by Braaten et al.[4] However, it is not clear as to whether 3D ultrasonography was used in their study. In contrast, Moschos and Twickler found that 25% of patients (with IUDs) presenting with symptoms necessitating gynecologic ultrasound evaluation had malpositioned IUDs.[9] Our findings are consistent with the range reported in the literature and may be enhanced by adjunct use of 3D imaging.

When considering demographic and reproductive characteristics, we found no significant difference in gravidity, number of previous cesarean deliveries, and years IUD in situ when comparing the 2 groups. These findings are similar to those of Braaten et al. and Liang et al.[4,14] We found the most common malposition to be in the lower uterine segment or to be "low lying," similar to findings by Anteby et al and Merki-Feld et al, followed by cervical.[7,8] Similar to Merki-Feld et al, we observed a higher incidence of ParaGard IUDs in women with known IUD types in the malpositioned group.[8] In contrast, Mirena IUDs were the most common known IUD type in patients with correctly positioned IUDs.[8] This may reflect the fact that ParaGard or copper IUDs have been in use since the 1970s and thus have a higher incidence in the population using long-acting reversible contraception as opposed to an inherent property of the ParaGard that lends to higher risk of malposition. In more recent years, however, increased use of hormonal IUDs has been noted, and the distribution of use between copper and hormonal IUDs certainly varies from country to country.[15]

Average presentation with symptoms warranting pelvic ultrasound, and subsequent IUD malposition diagnosis, was 5.7 years vs 6.2 years after IUD placement in women with malpositioned IUDs vs controls ($P = .49$, $d = 0.07$). This finding is somewhat unexpected, as it is suggested that women are more likely to experience IUD malposition within the first 6 weeks after IUD placement.[3−8] Merki-Feld et al followed up patients for 60 months after IUD insertion, and found that 33% of all IUD "dislocations" occurred by 6 weeks after IUD insertion and that 80% occurred during the first year.[8] Although our findings were not statistically significant, they indicate that women with malpositioned IUDs tend to have their IUDs in place for a shorter period of time at time of malposition diagnosis. Furthermore, the risk of IUD malposition always remains a possibility while the IUD is in situ, even beyond the immediate post-IUD placement window. This is especially relevant, because the time at which IUD malposition occurs is difficult to ascertain at the time of diagnosis, as the clinical symptom and time of IUD malposition may not truly coincide.

In our series, approximately 6% of patients presented with viable intrauterine pregnancies. These findings may

align with the theory of possible decreased efficacy of malpositioned IUDs; however, the interpretation of this information is limited due to the small sample size and uncertainty as to whether the malpositioned IUD was there before pregnancy (thus decreased contraceptive efficacy) or whether it was caused by the growing intrauterine pregnancy.[4,7] Our findings of abnormal bleeding, pelvic pain, and "missing strings" as the leading presenting symptoms in patients found to have malpositioned IUDs are consistent with the literature.[9,10,12] Beyond assessing incidence alone, we performed a multivariable logistic regression, which revealed an increased risk of IUD malposition in conjunction with the presentation for pelvic ultrasound for symptoms of abnormal vaginal bleeding (OR, 2.25; 95% CI, 1.38−3.67), pelvic pain (OR, 2.85; 95% CI, 1.84−4.44), missing IUD strings (OR, 3.58; 95% CI, 1.88−6.82), or for an IUD placement check (OR, 3.94; 95% CI, 2.05−7.59). Other possible risk factors addressed in the literature include uterine position. Similar to Chi et al, our findings suggest no difference in incidence of IUD complications with retroverted uterine positions.[16] We did, however, find significantly more retroflexed uterine positions in patients with malpositioned IUDs vs controls, which to our knowledges has not been noted in previous studies. The anterior-midline uterine position was associated with both lower incidence and a reduced risk of IUD malposition as compared with all other uterine positions (OR, 0.33; 95% CI, 0.20−0.57).

None of the patients with correctly positioned IUDs had congenital uterine anomalies, whereas 4 patients with malpositioned IUDs did. This finding was not statistically significant, likely because of the small sample size. Although the incidence of fibroids was comparable in both groups, we did find that women with malpositioned IUDs had more fibroids than controls. However, we were not able to calculate a fibroid number threshold after which one is definitively at greater risk for IUD malposition. As various types of fibroids can lead to cavity distortion, including intramural fibroids that may abut the cavity, we deemed it important to further explore each type of fibroid and its subsequent effect on malposition. Interestingly, submucosal fibroids were found only in women with malpositioned IUDs. Cumulatively, increased frequency of all uterine pathology (anomalies and fibroids) was noted in patients with malpositioned IUDs as compared with the control group; however, the effect size was not significant ($V = 0.07$). In contrast, multivariable logistic regression demonstrated that the absence of uterine anomalies was in fact associated with a lower risk of IUD malposition (OR, 0.59; 95% CI, 0.38−0.93) which may be a valuable factor for patient counseling when discussing risks before IUD insertion.

There are scant published data on the clinical relevance and management of malpositioned IUDs.[17,18] Furthermore, having a malpositioned IUD removed or expelled is not a contraindication to reinsertion of a new device. The risk of repeat expulsion is higher in these women; however, the risk of repeat malposition is unknown.[19] Although our data did not clarify the rate of IUD expulsion or the direct management of IUD malposition, with better understanding of incidence and risk factors, providers can more thoroughly counsel their patients. In addition, in patients with prior malpositioned IUDs or other suspected risk factors, pre- and post-insertion ultrasound may be beneficial.[20] Whether IUD placement under ultrasound guidance might decrease the incidence of future malposition remains unexplored.

To our knowledge, our study has 1 of the largest numbers of patients with malpositioned IUDs in the literature, and is the first to examine the influence of uterine flexion and cumulative effect of specific fibroid characteristics on malpositioned IUDs. Other strengths include our comparison of multiple ultrasonographic and demographic variables as well as single-institution review of imaging. Our study was limited by its retrospective nature. Case-control studies are also subject to observation and selection bias; however, by choosing the control group purely by MRN and normal IUD location, this did allow for a control group with distribution by chance in regard to demographic and anatomical features. Our ultrasonographers and physician reading the images also knew the indication for the sonogram, which may have introduced some bias. This study was also performed among a population of women undergoing ultrasound for a gynecologic indication, and may not be generalized to the larger population of women using IUDs. Another limitation was the small sample size of uterine anomalies and missing data from the patients' medical records such as IUD type, knowledge of whether IUD placement was immediately postpartum, and so forth.

In summary, our study reveals that the presence of congenital uterine anomalies, presence of multiple fibroids and submucosal fibroids, and retroflexed uterine position are associated with a higher incidence of IUD malposition among women who underwent ultrasound for a gynecologic indication. We also noted that patients with malpositioned IUDs presented more commonly for evaluation due to symptoms of abnormal uterine bleeding or pelvic pain. Clinicians should have a higher suspicion for IUD malposition when any of these factors are present, and can provide more targeted pre-placement counseling, ideally resulting in more accurate expectations and higher patient satisfaction. In general, the benefit of IUD placement greatly outweighs the risk of possible malposition, but the patient should always be counseled regarding this possibility. Ultrasonographic evaluation before and during insertion of the device, and post-placement in cases in which any of these conditions are suspected, may be beneficial. ■

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