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RESEARCH ARTICLE

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Intrauterine adhesion is a more prevalent finding at hysteroscopy than submucous fibroid or polyps among infertile sub-Sahara African Women presenting for In-vitro Fertilization who have had previous uterine surgical procedures: A 15-year study

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ABSTRACT

Introduction: Hysteroscopy assists in detecting any intra-uterine anomaly among sub-fertile women who present for Assisted Reproductive Technology (ART). Previous uterine surgical procedures may have influence over these hysteroscopic findings.

Objective: To determine which specific previous uterine surgical procedure was likely to have deleterious hysteroscopic findings and how much more likely.

Methodology: This was a retrospective study in which case records of 1631 women who presented for ART from 2003 to 2018 were examined. Only Black African women with complete records and who presented solely for fertility management were included. Analysis was conducted with STATA 13 statistical software.

Results: The means of age (years) and BMI (Kg/m^2) were 38.7 (6.4) and 28.1 (5.3) respectively. Of the 1631 study subjects, 1574 (96.5%) were ever married, 690 (42.3%) were professionals and 462 (28.3%) were <35 years old while 1169 (71.7%) were ≥35 years. Those who never had uterine surgery (n=276, 16.9%) were significantly younger (t-test=5.10, P-value=0.0000001) than those who had had uterine surgery (n=1355, 83.1%). There was a significant variation (t=-4.32, P-value=0.0000001) in the mean duration of subfertility (years) among women who had no uterine surgery (5.9±5.0) and those who did (7.4±5.3). Depth of uterine cavity was significantly greater (t=-3.54, P-value=0.0002) among women who had undergone uterine surgery (n=1355, 83.1%) than among those who had never undergone uterine surgery (n=276, 16.9%). Sub-fertile women who had undergone various uterine surgeries (n=200, 14.8%) were 4.7 times more likely to present with intrauterine adhesions (IUA) (χ^2=51.6, P-value=0.0.0000001, OR=4.73, 95% CI: 2.99, 7.50), 1.89 times more likely to present with polyps at hysteroscopy compared with women who had not undergone surgeries (χ^2=14.55, P-value=0.0.001, OR=1.89, 95% CI: 1.36, 2.64). Intrauterine adhesion was most prevalent (41.8%) among women who had pre-hysteroscopic D&C and myomectomy (χ^2=82.84, P-value=0.0000001) and among those who had multiple pre-hysteroscopic surgical procedures such as D&C, C/S and Myomectomy.

Conclusion: Pre-hysteroscopy IUA was most prevalent among sub-fertile women presenting for management of infertility, especially among those who had undergone three previous uterine surgical procedures of D&C, C/S and myomectomy than those who had undergone D&C and Myomectomy and least among those who had had Myomectomy and C/S. IUA was least prevalent among those who had C/S alone. These findings underscore the importance of past history of uterine surgical procedures and of hysteroscopy among those presenting for fertility management.

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Abbreviations

ART: Assisted reproductive technology, BMI: Body Mass Index, CI: Confidence Interval, C/S: Caesarian section, D&C: Dilatation and Curettage, HIV: Human immunodeficiency virus, HSG: Hysterosalpingography, IUA: Intrauterine adhesion, IVF: In-vitro fertilization, NFC: Nordica Fertility Center, OR: Odds ratio, SSA: Sub-Sahara Africa, STIs: Sexually transmitted infections, WHO: World Health Organization, WRAG: Women in reproductive age group.

Introduction

Infertility and subfertility distress a substantial segment of people everywhere. The World Health Organization reckoned that more than 10% of women are afflicted, including those who have failed in attempts to reverse their infertility, and have maintained a steady relationship for five years or more [1]. Having one's own biological child is considered a major component of human life [2], a most universally desired goals in adulthood [3]. A 12-month prevalence rate of infertility ranged from 3.5% to 16.7% in more developed nations and from 6.9% to 9.3% in less-developed nations, with an estimated overall median prevalence of 9% [3]. A couple is generally considered clinically infertile when pregnancy has not occurred after a minimum of twelve months of regular unprotected sexual intercourse [4]. Estimates of the global, regional, and national prevalence of and trends in infertility shows that its occurrence was highest in South Asia, sub-Sahara African, North Africa/ Middle East and Central/Eastern Europe and Central Asia [5]. Infertility in resource-poor countries, especially in Africa, has long been an ignored reproductive health concerns, though it often has distressing costs for the couples involved. Abandoning infertility in recognized health schemes is often explained in terms of population control [6-9]. Infertility in females of reproductive age has many causes including polycystic ovarian syndrome (PCOS) [10], endometriosis [11-13], uterine fibroids [14], and intrauterine adhesions (IUA) [15] among others. Nigeria is included in the so-called infertility belt of Africa [16], with a notably high sub-Saharan African infertility prevalence ranging from 20-46% [17] attributable to high rate of sexually transmitted diseases, complications of unsafe abortion through dilatation and curettage and pelvic infection. Diagnosing infertility in females entails an appraisal of pattern of menstrual cycle bleeding to ascertain ovulation, and examining for presence or absence of extra- and intra-uterine defects such as submucous, intramural or subserous fibroid as well as polyps. Review of past surgical history on the uterus or cervix, such as dilation and curettage (D&C), myomectomy or Caesarian section (C/S) or even infections such as HIV, Tuberculosis or sexually transmitted infections (STIs) are essential for the diagnosis of infertility. According to Hourvitz et al., [18] the advantage of hysteroscopy over hysterosalpingography (HSG) in the accuracy of the diagnosis of uterine cavity abnormalities that may cause or contribute to infertility has been shown by numerous studies. For example, Acholonu et al. [19] reported higher sensitivity, specificity and accuracy of hysteroscopy over HSG, Vujovic et al. [20] concluded that hysteroscopy finding was crucial in final diagnosing of uterine pathologies in terms of safety (low complication rates) and reliability [21], minimal time requirement and a negligible effect on post-operative course [22]. Bosteels et al, suggested that hysteroscopy probably increases the likelihood of IVF success [23]. A previous study [24] however showed tubal pathologies as the most common abnormality using HSG. The prevalence of infertility in SSA may be under-estimated and the cause of infertility may be even more widespread than previously thought. Information on the most common hysteroscopic findings among infertile Black African women in SSA is limited. Even rarer is data on previous uterine surgical procedures that could negatively influence a conducive uterine cavity for an acceptable implantation in IVF treatment. The effect of prior surgical uterine evacuation on infertility has received relatively little attention, more so in sub-Saharan Africa [25]. The objective of this study was to investigate predominant uterine pathologies among infertile women who presented for IVF, relative to various previous uterine surgeries, especially dilatation and curettage, myomectomy, and Caesarian section, either in isolation or in combination.

Materials and Methods

The methodology used has already been described in a previous paper [26]. Briefly, data of 2857 (67.5%) out of 4233 women in reproductive age group (WRAG) who consulted at Nordica Fertility Center for either primary or secondary infertility from 2003 to 2018, were retrieved from archived medical records. Data from or previous study was extended backwards by 2 years, (June 2005 - July 2003) and forward by 4 years (November 2014: October 2018). Three newly recruited data recording officers were given a 2-day training solely to familiarize them with the volume of data to be extracted, excel spreadsheet to input the data, time allotted for data extraction, retrieving and recording the data in a laptop. Supervision of this part of the study, which lasted from June to December 2019, was by an experienced IVF specialist (VDA). Data extracted include anthropometric (age and body mass index) and socio-demographic (religious affiliation, marital status, occupation) information, parity, duration of infertility, and menstrual history. Also, past history of surgical procedures on the uterus and gynecological conditions presented at consultation prior to IVF treatment were recorded as well as pathologies of the cervix and the uterus observed at hysteroscopy. Inclusion criteria for this study were the same as for previous study, i.e. (i) Women with previous uterine surgeries (dilatation and curettage, myomectomy, caesarean section); (ii) Previous history of recurrent failed IVF treatment in the form of three or more cycles; (iii) After one or two attempt of IVF treatment at the infertility center; (iv) Poor/ non-distension of the endometrium at sonohysterogram; (v) Abnormal findings at Hysterosalpingogram (HSG) done within the previous one year. Those excluded had (i) history of pelvic inflammatory disease; (ii) pelvic cancer (iii) those whose infertility were mainly due to male factor infertility (iv) those with incomplete data. Of the 2857 eligible clients, 1631 (57.1%) met all the inclusion criteria. Before surgery, the operating surgeons gave detailed explanation of the procedure to all women presenting for infertility management. Hysteroscopy procedures at NFC have already been described and reported [26]. Briefly, hysteroscopy is a minimally invasive procedure that uses a thin, flexible telescope-like instrument, known as a hysteroscope, inserted in the vagina, to examine the uterine cavity under short general anesthesia for medical diagnosis and corrective procedure. Thus, hysteroscopy efficiently detects

cervical and uterine anomalies and can increase the possibility of IVF success.

Ethical approval:

Each study subject signed a consent form for her data to be used for research purposes and that the data will be discreet, coded, and unnamed. The benefits of using data for teaching and research purposes were explained to the study subjects. This retrospective study was approved by a local Ethics Committee.

Statistical Analysis:

The cleaned and coded data was transferred from Excel spreadsheet into STATA 13 software which was used for further analysis. Age (years) was categorized into < 35 and ≥35, BMI (Kg/m^2) was stratified into the classical groups of underweight (< 18.5), normal (18.5-24.9), overweight (25.0-29.9), obese (≥ 30.0). The level of significance was set at P-value<0.05. Chi-square analysis with odd ratio at 95% Confidence interval was used to test the significance of differences between two proportions. Student's t-test was used to evaluate significant differences in means between two continuous variables. Data were presented as numbers and percentages for qualitative data, mean with standard deviations and as Tables and Figures.

Results

The means (±) of age and of body mass index (BMI) of the 1631 subjects in this investigation were 38.7 (6.4) years and 28.1 (5.3) Kg/m^2 respectively. In all, 462 (28.3%) and 1169 (71.7%) of them were aged <35 years and ≥35 years correspondingly. Only 16 (1.0%) subjects were underweight (BMI<18.5Kg/m^2) but 401 (24.6%), 653 (40.0%), and 561 (34.4%) were normal, overweight, and obese. Overweight women aged ≥35 years were significantly heavier (t= -1.77, P-value=0.04) than overweight women aged <35. While women <35 years (n=5, 1.1%) were 1.1 times more likely to be underweight (χ^2=0.00, P-value=1.00, OR=1.05, 95% CI: 0.37, 3.01) compared to the older women (n=12, 1.0%), women aged ≥35 years (n=450, 38.5%) were 1.2 times more likely to be obese (χ^2=2.33, P-value=0.13, OR=1.20, 95% CI: 0.95, 1.53) than those aged <35 years (n=111, 24.0%) (Table 1).

Of the 1631 subjects, 1355 (83.1%) had previously undertaken uterine surgical procedures while 276 (16.9%) had never undergone any uterine surgical procedure (Table 2). Those who had previous uterine surgery were significantly older (t-test=5.10, P-value=0.0000001) and heavier (t-test = -1.91, -value = 0.03) than those who never had any previous uterine surgeries. The Table also illustrates the distribution of socio-demographic characteristics of the subjects and the type of uterine procedures that were performed on them. In some cases, only one surgical procedure was conducted and in other cases more than one uterine surgical procedure was conducted on subjects, leading to cumulative number of cases. Majority of the study subjects were Christians (1444, 88.5%), ever married (1574, 96.5%), professionals (690, 42.3%) and entrepreneurs (444, 27.2%). As illustrated in Figure 1, infertile women aged ≥35 years were 3.5 times more likely to have undergone previous uterine surgery compared to those aged <35 years (χ^2=98.7, P-value = 0..000003, OR=3.69, 95% CI: 2.83, 4.83).

Gynecological conditions presented by patients at consultation prior to IVF relative to previous uterine surgeries are as shown in Table 3. There was a significant variation (t=-4.32, P-value=0.0000001) in the mean duration of subfertility (years) among women who had no uterine surgery (5.9±5.0) and those who did (7.4±5.3). Sub-fertile women who had never undergone uterine surgery were 2.3 times more likely to be nulliparous (χ^2=19.9, P-value=0.000008, OR=2.3, 95% CI: 1.58, 3.36) compared to those who had undergone previous uterine surgeries. However, those who had had uterine surgeries were 2.4 times more likely to have had 1-2 children (χ^2=20.23, P-value=0.000007, OR=2.3, 95% CI: 1.58, 3.36) and were 1.2 times as likely to have had more than 2 children (χ^2=0.04, P-value=0.85, OR=1.23, 95% CI: 0.47, 3.19) than those who never had uterine surgery. Duration of infertility (years) was significantly longer (t= -4.32, P-value= 0.0000001) among women who had undergone uterine surgical procedures

Table 1: Anthropometric features of study participants.

Variable		Category		Freq.	%	Mean	±sd	Min.	Max
Age (years)		All		1631	100.0	38.7	6.4	20	61
		<35		462	28.3	31.1	2.6	20	34
		≥35		1169	71.7	41.6	4.8	35	61
BMI (Kg/m^2)	All			1631	100.0	28.1	5.3	17	59
	<18.5			16	1.0	17.4	0.5	17	18
	18.5-24.9			401	24.6	22.4	1.5	19	24
	25.0-29.9			653	40.0	27.0	1.4	25	29
	≥30.0			561	34.4	33.8	4.1	30	59
	If Age (years)	All		462		26.9	4.8	17	55
		<35	<18.5	5	1.1	17.2	0.5	17	18
			18.5-24.9	146	31.6	22.3	1.5	19	24
			25.0-29.9*	200	43.3	26.8	1.3	25	39
			≥30.0	111	24.0	33.5	3.7	30	55
	If Age (years)	All		1169		28.6	5.4	17	59
		≥35	<18.5	11	1.0	17.5	0.5	17	18
			18.5-24.9	255	21.8	22.5	1.5	19	24
			25.0-29.9*	453	38.7	27.0	1.4	25	29
			≥30.0	450	38.5	33.9	4.2	30	59

*(t= -1.77, P-value=0.04)

Table 2: Socio-demographic characteristics of study subjects relative to previous uterine surgery done.

Variable		Statistics	Previous uterine surgery										
				Yes (n=1,355)									
			No	D&C alone	D&C + C/S	D&C + Myomectomy.	Myomectomy alone	Myomectomy + C/S	C/S alone	D&C + C/S + Myomectomy	Cumulative figure	Non-cumulative figure	All
Age (years)		Freq.	276	753	89	239	588	31	206	11	1917	1355	1631
		%	16.9	39.3	4.6	12.5	30.7	1.6	10.7	0.6	117.5	83.1	100.0
		Mean	35.4*	39.6	39.9	41.8	40.7	41.6	39.3	43.5	-	39.3*	38.7
		±sd	6.5*	6.1	5.3	5.3	5.9	6.2	5.9	5.6	-	6.2*	6.4
BMI (Kg/m²)		Freq.	276	753	89	239	588	31	206	11	1917	1355	1631
		%	16.9	39.3	5.5	12.5	30.7	1.6	10.7	0.6	117.5	83.1	100.0
		Mean	27.5!	28.5	30.8	27.8	27.8	28.2	29.8	30.8	-	28.2!	28.1
		±sd	5.6!	5.6	7.9	4.7	5.0	5.1	6.5	4.4	-	5.2!	5.5
Religion	Christianity	Freq.	233	667	79	212	526	29	186	10	1709	1211	1444
		%	84.6	88.6	88.8	88.7	89.5	93.6	90.3	90.9	89.1	89.4	88.5
	Islam	Freq.	43	86	10	27	62	2	20	1	251	144	187
		%	15.6	11.4	11.2	11.3	10.5	6.4	9.7	9.1	10.9	10.6	11.5
Marital status	Single	Freq.	7	30	3	11	25	2	4	1	76	50	57
		%	2.5	4.0	3.4	4.6	4.3	6.5	1.9	9.1	4.0	3.7	3.5
	Ever Married	Freq.	269	723	86	228	563	29	202	10	1841	1305	1574
		%	97.5	96.0	96.6	95.4	95.7	93.5	98.1	90.9	96.0	96.3	96.5
Occupation [Freq. (%)]	Professionals		116 (42.0)	311 (41.3)	36 (40.5)	96 (40.2)	254 (43.2)	13 (41.9)	76 (36.9)	4 (36.4)	785 (39.5)	574	690 (42.3)
	Employment		61 (22.1)	184 (24.4)	19 (21.4)	65 (27.2)	155 (26.4)	7 (22.6)	45 (21.8)	1 (9.1)	473 (24.7)	323	384 (23.5)
	Business		69 (25.0)	217 (28.8)	31 (34.8)	68 (28.5)	149 (25.3)	7 (22.6)	69 (33.5)	5 (45.4)	536 (28.0)	375	444 (27.2)
	Housewife		13 (4.7)	21 (2.8)	2 (2.2)	8 (3.3)	21 (3.6)	3 (9.7)	12 (5.8)	1 (9.1)	67 (3.5)	47	60 (3.7)
	Student		12 (4.4)	9 (1.2)	0 (0.0)	1 (0.4)	5 (0.8)	1 (3.2)	2 (1.0)	0 (0.0)	18 (0.9)	19	31 (1.9)
	Unemployed		2 (0.7)	3 (0.4)	1 (1.1)	1 (0.4)	3 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	7 (0.4)	7	9 (0.6)
	Not stated		3 (1.1)	8 (1.1)	0 (0.0)	0 (0.0)	1 (0.2)	0 (0.0)	1 (0.5)	0 (0.0)	10 (0.5)	10	13 (0.8)

*Those who never had uterine surgery (n=276, 16.9%) were significantly younger (t-test=5.10, P-value=0.0000001) and !significantly lighter in weight (t-test= -1.92, P-value=0.03) than those who had had uterine surgery (n=1,355, 83.1%)

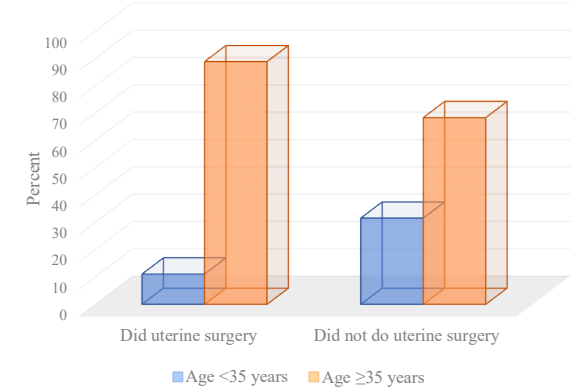
Table 3: Gynecological conditions presented by patients at consultation prior to IVF relative to previous uterine surgeries.

Variable		Statistics	Previous uterine surgery										
				Yes									
			No	Dilatation & Curettage			Myomectomy		Caesarian Section	D&C + C/S+ Myomectomy	Cumulative	Non-cumulative	All
				Alone	+ C/S	+ Myomectomy	Alone	+ C/S	Alone				
		n	276	753	89	239	588	31	206	11	1917	1355	1631
		%	16.9	46.2	5.5	14.7	36.1	1.9	12.6	0.7			
Parity	0	Freq.	241*	555	14	206	514	7	39	1	1336	1015*	1256
		%	87.3	73.7	15.7	86.2	87.4	22.6	18.9	9.1	69.7	74.9	77.0
	1-2	Freq.	30	181	68	33	72	23	149	10	536	311	340
		%	10.9	24.0	76.4	13.8	12.3	74.2	72.3	90.9	28.0	22.9	20.8
	3-4	Freq.	5	17	7	0	2	1	18	0	45	30	35
		%	1.8	2.3	7.9	0.0	0.3	3.2	8.8	0.0	2.3	1.2	2.2
Duration of subfertility		Mean	5.9*	7.4	6.3	8.2	8.1	6.9	6.1	8.1	-	7.4*	7.1
		±sd	5.0	5.3	4.6	5.3	5.5	5.2	4.5	5.3	-	5.3	5.3
Cycle length (days)		Mean	29.5	29.0	29.9	28.7	28.6	29.1	29.6	29.9	-	28.9	29.0
		±sd	7.7	5.0	8.1	5.0	4.2	3.4	6.5	2.3	-	4.5	5.2
Duration of flow (days)		Mean	4.9	4.7	5.0	4.8	4.9	5.7	5.0	7.3	-	4.8	4.8
		±sd	2.3	1.6	3.0	2.0	2.0	4.5	3.3	7.8	-	1.9	2.0

*There was a significant variation (t=-4.32, P-value=0.0000001) in the mean duration of subfertility (years) among women who had no uterine surgery (5.9±5.0) and those who did (7.4±5.3).

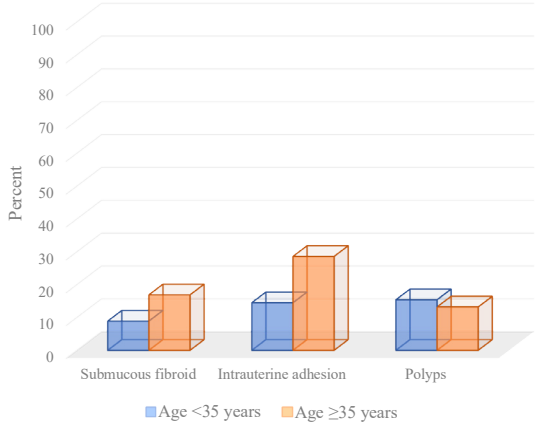
(7.4±5.3) than among those who had not undergone any uterine surgical procedure (5.9±5.0). There was no variation in the mean cycle length (days) and duration of flow (days) among the two groups of women.

Uterine size was approximately twice as likely to be normal among those who had not had uterine surgery (χ^2=25.71, P-value=0.00000004, OR=2.05, 95% CI: 1.55, 2.72) than among women who had undergone uterine surgery, approximately twice as likely to be bulkier (χ^2=19.71, P-value=0.000009, OR=1.88, 95% CI: 1.42, 2.50) than among those who had not undergone uterine surgical procedures (Table 4). While endocervical polyps were more prevalent (2.9% vs 1.5%) among



Women aged ≥35 years were 3.5 times more likely to have performed previous uterine surgery compared to those aged <35 years (χ^2=98.7, P-value = 0..000003, OR=3.69, 95% CI: 2.83, 4.83).

Figure 1. Previous uterine surgery relative to age group



Older women who had performed uterine surgery were 2.4 times more likely to present with IUA (χ^2=35.63, P-value=0..000003, OR=2.37, 95% CI: 1.77, 3.16) and 2.08 time more likely to have submucous fibroid (χ^2=16.903, P-value=0..00003, OR=2.08, 95% CI: 1.46, 2.97) at examination with hysteroscopy compared to younger women but less likely to present with polyps (χ^2=1.34.7, P-value=0..25, OR=0.84, 95% CI: 0.62, 1.13).

Figure 2. Findings at hysteroscopy relative to age group

Table 5: Depth of uterine cavity and pathologies of the ostia observed by hysteroscopy, relative to previous surgical procedures.

Variable		Statistics	Previous uterine surgery (uterine cavity and ostia)										
			No	Yes									All
				Dilatation & Curettage (D&C)			Myomectomy (Myo.)		Caesarian Section (C/S)	D&C + C/S+ Myo.	Cumulative figure	Non-cumulative figure	
				Alone	+ C/S	+ Myo.	Alone	+ C/S	Alone				
		n	276	753	89	239	588	31	206	11	1917	1355	1631
		%	16.9	46.2	5.5	14.7	36.1	1.9	12.6	0.7	117.5	83.1	100.0
Depth of uterine cavity		Mean	8.3	8.7	8.3	9.0	9.0	8.7	8.5	8.4	-	8.7	8.6
		±sd	1.2	4.0	1.6	5.2	3.6	1.4	1.7	1.3	-	3.2	3.0
Ostia right	Seen	Freq.	268	690	79	208	531	30	192	10	1740	1257	1525
		%	97.1	91.6	88.8	87.0	90.3	96.8	93.2	90.9	90.8	92.8	93.5
	Not seen	Freq.	8	63	10	31	57	1	14	1	177	98	106
		%	2.9	8.4	11.2	13.0	9.7	3.2	6.8	9.1	9.2	7.2	6.5
χ^2=7.08, P-value=0.008, OR=2.61, 95% CI: 1.26, 5.43													
Ostia left	Seen	Freq.	271	682	77	209	531	29	188	10	1726	1245	1516
		%	98.2	90.6	86.5	87.5	90.3	93.5	91.3	90.9	90.0	91.9	93.0
	Not seen	Freq.	5	71	12	30	57	2	18	1	191	110	115
		%	1.8	9.4	13.5	12.5	9.7	6.5	8.7	9.1	10.0	8.1	7.0
χ^2=12.97, P-value=0.0003, OR=4.79, 95% CI: 1.94, 11.85													

Depth of uterine cavity was significantly greater (t=-3.54, P-value=0.0002) among women who had undergone uterine surgery (n=1355, 83.1%) than among those who had never undergone uterine surgery (n=276, 16.9%). Ostia Right was 2.6 times more likely to be seen among those who did not undergo uterine surgery (n=268, 97.1%) than among those who underwent uterine surgery (n=1257, 92.8%) (); Ostia Left was 4.8 times more likely to be seen among those who did not undergo uterine surgery (n=271, 98.2%) than among those who underwent uterine surgery (n=1245, 91.9%) (). Thus, it was more likely to see Ostia Left than Ostia Right.

Table 6: Pathologies within corpus uteri seen at hysteroscopy relative to previous surgical procedures

-			Previous uterine surgery (Corpus uteri)																				
				Yes																			
				Dilatation & Curettage					Myomectomy				Caesarian Section										
		Statistics	No	Alone	+ C/S	+ Myomectomy	χ^2	P-value	Alone	+ C/S	χ^2	P-value	Alone	D&C + C/S+ Myomectomy	Cumulative figure	χ^2	P-value	Non-cumulative figure	χ^2	P-value	Odds ratio	95% CI	All (No+Yes)
		n	276	753	89	239	-	-	588	31	-	-	206	11	1917	-	-	1355	-	-	-	-	1631
		%	16.9	46.2	5.5	14.7	-	-	36.1	1.9	-	-	12.6	0.7	117.5	-	-	83.1	-	-	-	-	100.0
Submucous Fibroid	Present	Freq.	38	109	11	52			121	5			18	4	320			200					238
		%	13.8	14.5	12.4	21.8			20.6	16.1			8.7	36.4	16.7			14.8					14.6
	Absent	Freq.	238	644	78	187	8.1	0.02	467	26	0.14	0.71	188	7	1597	27.1	0.000001	1155	0.18	0.67	1.08	0.75, 1.58	1393
		%	86.2	85.5	87.6	78.2			79.4	83.9			91.3	63.6	83.3			85.2					85.4
IUA	Seen	Freq.	21	241	29	100			191	10			54	5	630			380					401
		%	7.6	32.0	32.6	41.8			32.5	32.3			26.2	45.5	32.9			28.0					24.6
	Not seen	Freq.	255	512	60	139	61.5	0.000001	397	21	0.00	1.00	152	6	1287	14.0	0.03	975	51.6	0.0000001	4.73	2.99, 7.50	1230
		%	92.4	68.0	67.4	58.2			67.5	67.7			73.8	55.5	67.1			72.0					75.4
Polyps	Seen	Freq.	58	76	9	16			66	3			24	1	195			167					225
		%	21.0	10.1	10.1	6.7			11.2	9.7			11.7	9.1	10.2			12.3					13.8
	Not seen	Freq.	218	677	80	223	2.54	0.28	522	28	0.00	1.00	182	10	1722	4.4	0.62	1188	14.55	0.0001	1.89	1.36, 2.64	1406
		%	79.0	89.9	89.9	93.3			88.8	90.3			88.3	90.9	89.8			87.7					86.2
χ^2				132.32	18.20	82.84	-		79.29	5.37	-		27.53	3.73	-			-	-				
P-value				0.000	0.000	0.000			0.000	0.10			0.000	0.16									

Sub-fertile women who had undergone various uterine surgeries (n=200, 14.8%) were 1.1 times more likely to present with fibroid at hysteroscopy compared with women who had not undergone surgeries (n=38, 13.8%) (χ^2=0.18, P-value=0.67, OR=1.08, 95% CI: 0.75, 1.58).

those who never had uterine surgery (χ^2=2.75, P-value=0.10, OR=1.99, 95% CI: 0.87, 4.57), endocervical adhesions were more prevalent (3.4% vs 1.1%) among those who had undergone uterine surgery (Fisher's χ^2=3.44, P-value=0.06, OR=3.20, 95% CI: 0.99, 10.36).

Mean depth (cm) of uterine cavity was significantly longer (t-test=-3.54, P-value=0.0002) among women who had undergone uterine surgery (8.7±3.2) compared to the other group of women (8.3±1.2). The probability of seeing ostia right was over 2½ times more likely among those who had not undergone uterine surgery (χ^2=7.08, P-value=0.008, OR=2.61, 95% CI: 1.26, 5.43) than among the other group of women. The probability of seeing ostia left was approximately 5 times more likely among those who had not undergone uterine surgery than among those who had (χ^2=12.97, P-value=0.0002, OR=4.80, 95% CI: 1.94, 11.83) (Table 5).

As shown in Figure 2, older infertile women who had performed uterine surgery were 2.4 times more likely to present with IUA (χ^2=35.63, P-value=0..000003, OR=2.37, 95% CI: 1.77, 3.16) and 2.08 time more likely to have submucous fibroid (χ^2=16.903, P-value=0..00003, OR=2.08, 95% CI: 1.46, 2.97) at examination with hysteroscopy compared to younger women but less likely to present with polyps (χ^2=1.34.7, P-value=0..25, OR=0.84, 95% CI: 0.62, 1.13).

Those who had pre-hysteroscopic uterine surgery were only about 1.08 times more likely to present with uterine fibroid at hysteroscopy (χ^2=0.18, P-value=0.67, OR=1.08, 95% CI: 0.75, 1.58) compared to the other group of women, 4.73 times as likely to present with IUA (χ^2=51.61, P-value=0.0000001, OR=4.73, 95% CI: 2.99, 7.50) and approximately twice as likely to present with intrauterine polyps (χ^2=14.55, P-value=0.0001, OR=1.89, 95% CI: 1.36, 2.64) compared to those who had not undergone previous uterine surgery (Table 6).

Pooled analysis showed that, among those who had underdone uterine surgical operations, a significantly high proportion (χ^2=132.32, P-value=0.0000001) had D&C alone and lesser proportions had D&C and Myomectomy (χ^2=82.84, P-value<<0.001), Myomectomy alone (χ^2=79.29, P-value<<0.001), C/S alone (χ^2=27.53, P-value<<0.001) and D&C, Myomectomy and C/S collectively (χ^2=3.73, P-value<<0.16). Intra-uterine adhesion (IUA) was the most prevalent (32.0%, 41.8% and 45.5% respectively) pathology among those who had D&C alone, D&C and myomectomy and those who had D&C, C/S and Myomectomy (Table 6).

Discussion:

An accurate appraisal of the uterine cavity forms a critical part of the IVF process because an embryo of high-quality, a product of the best egg and sperm will not implant for pregnancy, should there be a defect or problems with the uterus. Hysteroscopic evaluation of the uterus can also identify whether a woman has an abnormally shaped uterus or a uterine septum which can prevent a woman from becoming pregnant or from carrying a pregnancy to term. Among sub-fertile women in Sub-Sahara Africa, intrauterine adhesions (IUA), uterine fibroids and polyps are common intrauterine findings. Polyps are abnormal tissue growths that occur in the inner lining of the uterus (endometrium) that can be diagnosed using hysteroscopy. Fibroids are noncancerous muscle growths within the walls of the uterus and can also be diagnosed with a hysteroscopy guided biopsy. This study

is among the few in sub-Saharan Africa that have evaluated findings at hysteroscopy to determine the most common intra-uterine pathology for rectification prior to IVF management of infertility. There were certain key findings in this study which need further discussion. Firstly, infertile or sub fertile women who never had uterine surgery (n=276, 16.9%) were significantly younger and significantly lighter in weight than those who had had uterine surgery. Possible reasons for this may be that, in sub-Saharan Africa, infertility is not reported in early to mid-reproductive age due probably to most women believing they can get pregnant, just like other women who get pregnant, until they realize that infertility has become a chronic physical and emotional health problem for them. Another reason is what Boivin et al. [27] described as "fear of infertility" that continues from teenage years to middle age and can have undesirable impacts on health [28-31]. In addition, most sub-Saharan women in early to mid-reproductive life are in general lean with few that are overweight and fewer still that are obese [32,33]. Duration of infertility was also significantly longer in women who had had uterine surgeries than among those who had not. This is in consonance with the observation of many studies that prior surgical uterine evacuation may increase the relative risk of infertility [34-36], though others [37-39] had a different opinion. The depth of uterine cavity was significantly greater among women who had undergone uterine surgery than among those who had never undergone any uterine surgery. This has not been reported before in sub-Saharan Africa or elsewhere. Thus, this study assumes that this phenomenon might be due to injuries to the uterus and attempts by that organ to heal the injury, though the pathophysiology is unclear. Further studies in this area are required. Another key finding was that the probability of seeing ostia right of the uterus was about seven time more likely among those who never had uterine surgery than among those who ever had uterine surgery. The justification behind this observation is not apparent and requires further study, though a study [40] observed that the proximity of the right uterotubal ostium to the post-caecum appendix predisposes it to abdominal debris. It is interesting to note that the proportion of women with fibroid was not significantly different among those who had never and those who had undergone uterine surgery prior to consulting for IVF. This agrees with the observation of Okogbo et al. [41] that fibroid is common in the Nigerian environment and is the most prevalent pelvic tumor in women [42, 43]. Intra-uterine adhesions were also observed in a significantly higher proportion of infertile women who had previous uterine surgery than among those who had never had uterine surgery, a finding that agrees with what other authors have reported [44-48]. Poole [49] observed that one of the common complications of uterine surgery, through the abdomen, is postoperative adhesions, a restorative process made up of fibrous scars tissues during which a fibrin clot is produced by accumulation of "*blood cells, platelets and clotting and growth factors"*. Intrauterine adhesions were also seen predominantly among infertile women who have had many uterine surgeries such as dilatation and curettage, Caesarian section and Myomectomy, a finding that resonates with what others have reported [50-54]. Lastly, a significantly higher proportion of infertile women who had undergone uterine surgeries also presented with intrauterine polyps before IVF, a finding that accords with what other studies reported [55,56].

Conclusion

To conclude, infertile women aged ≥35 years were 3.5 times more likely to have performed previous uterine surgery compared to those aged <35 years. Infertile women who never had uterine surgery were significantly younger and lighter in weight that those who had undergone such surgery. The mean duration of infertility was shorter among those who had never undergone uterine surgery compared to those who had. Older women who had performed uterine surgery were 2.4 times more likely to present with IUA and 2.08 time more likely to have submucous fibroid at examination with hysteroscopy compared to younger women but less likely to present with polyps. Intrauterine adhesions were the most prevalent pathology associated with past uterine surgeries among women presenting for IVF for the management of infertility. Depth of uterine cavity was significantly greater among women who had undergone uterine surgery than among those who had never undergone uterine surgery. Ostia Right was 2.6 times more likely to be seen among those who did not undergo uterine surgery than among those who underwent uterine surgery; Ostia Left was 4.8 times more likely to be seen among those who did not undergo uterine surgery than among those who underwent uterine surgery. Infertile women who had undergone three types of uterine surgical procedures such as dilatation and curettage, Caesarian section and myomectomy were most most likely to develop IUA than those who had undergone two types of uterine procedure and least among those who had undergone one type of uterine surgery such as Caesarian section.

Study limitations and strengths

This study has certain limitations that need mentioning. Because the study design was retrospective, there could have been some, albeit negligible, intra-person errors which could have occurred in data documentation. However, desk-nurses at the first point-of-contact and the clinicians whom the clients consulted are experts in their fields. Intrauterine pathologies observed in this study were not reported as having been sent for histological examination. This would have added more robustness to the data analysis. The outcome of IVF was also not presented. It would have been pertinent to document the result of pregnancy test and if the patients carried their pregnancy to term or not and if it were singleton or multiple pregnancy that each patient delivered. The strength intrinsic in this study was that the attending clinicians, nurses, embryologists, and other hospital personnel had a minimum of 20 years of professional service in their respective fields. Nordica Fertility Center has most modern IVF/ART equipment, favorable environment, and motivated staff.

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References

[1] World Health Organization. Sexual and reproductive health https://www.who.int/reproductivehealth/topics/infertility/

perspective/en/

[2] Jin X, Wang G, Liu S, Zhang J, Zeng F, Qui Y, et al. Survey of the situation of infertile women seeking In-vitro fertilization treatment in China.

[3] Boivin J, Bunting L, Collins JA, Nygren KG. International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care. Human Reproduction. 2007; 22(6): 1506–1512.

[4] Zeger-Hochschild F, Adamson GD, de Mouzon J, Ishihara O, Mansour R et al. The International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary on ART terminology, 2009. Hum Reprod. 2009; 24: 2683-87

[5] Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, Regional, and Global trends in infertility prevalence since 1990: A systematic analysis of 277 Health surveys. PLoS Med. 2012; 9(12): e1001356.

[6] Inhorn MC, Birenbau-Carmeli D. Assisted reproductive technologies and culture change. Annual Review of Anthro. 2008; 37: 177-196.

[7] Okonofua FE. The case against new reproductive technologies in developing countries, Br J Obstet Gynaecol. 1996: 957-962.

[8] Ombelet W. Reproductive healthcare systems should include accessible infertility diagnosis and treatment: An important challenge for resource-poor countries. Int J Gynaecol Obstet. 2009; 106: 168-171.

[9] Van Balen and Gerrits, Quality of infertility care in poor-resource areas and the introduction of nes reproductive technologies. Hum Reprod. 2001; 16: 215-219.

[10] Legro RS, Kunselman AR, Brzyski RG, Casson PR, Diamond MP, Schlaff WD, et al. The Pregnancy in Polycystic Ovary Syndrome II (PPCOS II) trial: rationale and design of a double-blind randomized trial of clomiphene citrate and letrozole for the treatment of infertility in women with polycystic ovary syndrome. Contemp Clin Trial. 2012; 33(3): 470-481.

[11] A quantitative overview of controlled trials in endometriosis-associated infertility. Hughes EG, Fedorkow DM, Collins JA, Fertil Steril. 1993; 59(5): 963-970.

[12] Ajayi AB, Ajayi VD, Biobaku O, Oyetunji I, Aikhuele H, Atiba A, et al. A 10-year study of endometriosis in an indigenous black African population. Journal of Endometriosis and Pelvic Pain Disorders. 2016; 8(4): 157-166.

[13] Prescott J, Farland LV, Tobias DK, Gaskins AJ, Spiegelman D, Chavarro JE et al. A prospective cohort study of endometriosis and subsequent risk of infertility. Hum Reprod. 2016; 31(7): 1475–1482.

[14] Okogbo FO, Ezechi OC Loto OM, Ezeobi PM. Uterine Leiomyomata in South Western Nigeria: a clinical study of presentations and management outcome. Afr Health Sci. 2011; 11(2): 271–278.

[15] Ugboaja JO, Oguejiofor CB, Igwegbe AO. Clinico-hysteroscopic analysis of severe intrauterine adhesions among Nigerian infertile women. Pan Afr Med J. 2017; 28: 226.

[16] Okonofua FE. Infertility in Sub-Saharan Africa. In: Okonofua FE, Odunsi K, eds. Contemporary Obstetrics and Gynecology for Developing Countries. Publishers Women's Health and Action Research Center. Benin City: 2003; 128-156.

[17] Panti AA, Sununu Y. the profile of infertility in a teaching hospital in North West Nigeria. Sahel Med J. 2014; 17: 7-11.

[18] Hourvitz A, Lédée N, Gervaise A, Fernandez H, Frydman R, Olivennes F. Should hysteroscopy be a routine procedure during diagnostic laparoscopy in women with normal hysterosalpingography? Reproductive Biomedicine Online. 2002; 4(2): 256-260.

[19] Acholonu UC, Silberzweig J, Stein DE, Keltz M. Hysterosalpingography versus sonohysterography for intrauterine abnormalities. Journal of the Society of Laparo-endoscopic Surgeons. 2011; 15(4): 471-474.

[20] Vujovic M, Garalejic E, Arsic B, Zamurovic M, Perovic M. Hysterosalpingography versus hysterscopy in intrauterine pathology research of infertile patients. Clin Exp Obstet Gynecol. 2015; 42(2): 141-145.

[21] Gordts S, Campo R, Puttemans P, verhoeven H, Brosens J, et al. Investigation of the infertile couple. Hum Reprod. 2002; 17: 1684-1687.

[22] Carneiro MM (2014) What Is the Role of Hysteroscopic Surgery in the Management of Female Infertility? A Review of the Literature. Surgery Research and Practice 2014: 1-6.

[23] Bosteels J, Kasius J, Weyers S, Broekmans FJ, Mol BWJ, et al. Hysteroscopy for treating subfertility associated with suspected major uterine cavity abnormalities. Cochrane Database of Systematic Reviews. 2013.

[24] Omodiji ATO, Toyobo OO, Adegbola O, Fatade A, Olowoyeye O. Hysterosalpigographic fingings in infertility: what has changed over the years? Afr Health Sci. 2019; 19(2): 1866-187.

[25] Tu P, Pei K. Prior surgical uterine evacuation of pregnancy and infertility: protocol for systematic review and meta-analysis. BMJ Open. 2020; 10: e034837.

[26] Ajayi AB, Biobaku O, Ajayi VD, Oyetunji IO, Aikhuele H, Afolabi BM. Detection of Intrauterine Lesions by Hysteroscopy among Women with Fertility Challenges in an In-Vitro Fertilization Center in Lagos, Nigeria. Critical Care Obstetrics and Gynecology. 2015; 1(1): 8.

[27] Boivin J, Carrier J, Zulu JM, Edwards D. A rapid scoping review of fear of infertility in Africa. Reprod Health. 2020; 17: 142.

[28] Daniele M, Cleland J, Benova L, Moazzam A. Provider and lay perspectives on intra-uterine contraception: a global review. Reprod Health. 2017; 14.

[29] Koster W. Linking two opposites of pregnancy loss: induced abortion and infertility in Yoruba society, Nigeria. Soc Sci Med. 2010;71:1788-1795.

[30] Otoide VO, Oronsaye F, Okonofua FE. Why Nigerian adolescents seek abortion rather than contraception: evidence from focus-group discussions. Int Fam Plan Perspect. 2001; 27: 77–81.

[31] Schuster S. Abortion in the moral world of the Cameroon Grassfields. Reprod Health Matters. 2005; 13: 130-138.

[32] Bakari AG, Onyemelukwe GC, Xani BG, Aliyu IS, Hassan SS, Aliyu TM. Obesity, overweight and underweight in sub-urban Nigeria. Int J Metab. 2007; 15: 68-69.

[33] Osuji CU, Nzerem BA, Meludu S, Dioka CE, Nwobodo E, AMilo CI. The prevalence of overweight/obesity and dyslipidemia among a group of women attending "August" meeting. Niger Med J. 2010; 51: 153-159.

[34] Trichopoulos D, Handanos N, Danezis J, et al. Induced abortion and secondary infertility. Br J Obstet Gynaecol. 1976; 83: 645–50.

[35] Tzonou A, Hsieh CC, Trichopoulos D, et al. Induced abortions, miscarriages, and tobacco smoking as risk factors for secondary infertility. J Epidemiol Community Health. 1993; 47: 36-39.

[36] Hamy A-S, Mayenga J-M, Grefenstette I, et al. A study comparing previous induced abortion rates in populations of newly delivered women and infertile women. Gynecol Obstet Fertil. 2008; 36: 395-399.

[37] Lin T-B, Hsieh M-F, Hou Y-C, et al. Long-Term physical health consequences of abortion in Taiwan, 2000 to 2013: a nationwide retrospective cohort study. Medicine. 2018; 97: e11785.

[38] Torres-Sánchez L, López-Carrillo L, Espinoza H, et al. Is induced abortion a contributing factor to tubal infertility in Mexico? Evidence from a case-control study. BJOG. 2004; 111: 1254-1260.

[39] Minh PN, Vinh NQ, Tuong HM, et al. A case-control study on the relationship between induced abortion and secondary tubal infertility in Vietnam. Fukushima. J Med Sci. 2002; 48: 15–25.

[40] https://www.indiraivf.com/blocked-fallopian-tubes-causes-symptoms-treatment/

[41] Okogbo FO, Ezechi OC, Loto OM, Ezeobi PM. Uterine Leiomyomata in South Western Nigeria: a clinical study of presentations and management outcome. Afr Health Sci. 2011; 11(2): 271–278.

[42] Buttran VCJR, Reiter RC. Uterine fibromyomata- etiology, symptomatology and management. Fertility and Sterility. 1981; 4: 36-41.

[43] Walker CL, Stewart EA. Uterine fibroids: the elephant in the room. Science. 2005; 308: 1589–1592.

[44] Papoulis D, Georgantzis D, Dacco MD, Halmos G, Moustafa M, Mesquita-Pinto AR et al. A rare case of Asherman's syndrome after open myomectomy: Sonographic investigations and possible underlying mechanisms. Gynecol Obstet Invest. 2014; 77: 194-200.

[45] Lev-Toaff AS, Karasick S, Toaff ME. Hysterosalpingography before and after myomectomy: Clinical value and imaging findings. AJR Am J Roentgenol. 1993; 160: 803-807.

[46] Nakhuda GS, Douglas NC, Sauer MV. Clinically significant uterine synechiae caused by transmural uterine incisions. J Gynecol Surg. 2005; 21: 95-98.

[47] Gambadauro P, Gudmundsson J, Torrejón R. Intrauterine adhesions following conservative treatment of uterine fibroids. Obstet Gynecol Int. 2012; 2012: 853269.

[48] Asgari Z, Hafizi L, Hosseini R, Javaheri A, Rastad H. Intrauterine synechiae after myomectomy; laparotomy versus laparoscopy: Non-randomized interventional trial. Iran J Reprod Med. 2015; 13: 161-168.

[49] Poole JH. Adhesions following cesarean delivery: a review of their occurrence, consequences and preventative management using adhesion barrier. Women's Health, 2013; 9(5): 467–477.

[50] Shilpa B, Ishita G, Pallavi A, Aparna S, Nitika G. Effect of myomectomy on endometrial cavity: A prospective study of 51 cases. Journal of Human Reproductive Sciences 2016; 9(2):107-111.

[51] Conforti A, Krishnamurthy GB, Dragamestianos C, Kouvelas S, Micallef Fava A, Tsimpanakos I, et al. Intrauterine adhesions after open myomectomy: An audit. Eur J Obstet Gynecol Reprod Biol. 2014; 179: 42-45.

[52] Nakhuda GS, Douglas NC, Sauer MV. Clinically significant uterine synechiae caused by transmural uterine incisions. J Gynecol Surg. 2005; 21: 95-98.

[53] Hooker AB, de Leeuw R, van de Ven P, Bakkum EA, Thurkow AL, Vogel NEA et al. Prevalence of intrauterine adhesions after application of hyaluronic acid gel after dilatation and curettage in women with at least one previous curettage: short-term outcomes of a multicenter, prospective randomized controlled trial. Fertility and Sterility. 2017; 107(5): P1223-1232.E3

[54] Deans R, Abbott J. Review of intrauterine adhesions. J Minim Invasive Gynecol. 2010; 17: 555-569.

[55] Yang JH, Chen CD, Chen SU, Yang YS, Chen MJ. Factors Influencing the Recurrence Potential of Benign Endometrial Polyps after Hysteroscopic Polypectomy. PLoS One. 2015; 10(12): e0144857.

[56] Paradisi R, Rossi S, Scifo MC, Dall'O' F, Battaglia C, Venturoli S. Recurrence of endometrial polyps. Gynecol Obstet Invest. 2014; 78(1): 26-32.