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Risk Factors for Intrauterine Adhesions in a Black African Population - Nigerians

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Abstract

Background: Intrauterine adhesions are associated with certain uterine procedures such as dilatation and curettage, open myomectomy and Cesarean section as well as some infections.

Objectives: To determine the most important risk factors for intrauterine adhesions among Black Africans

Study design, setting and subjects: This was a retrospective study conducted at Nordica Fertility Center (NFC). A total of 905 patients from three cities - Lagos, Abuja and Asaba, who consulted for infertility related problems and on whom hysteroscopy was performed between January 2005 and November 2014, were studied.

Main outcome measures: Performance of different uterine surgeries, type and number of different uterine surgeries performed, and presence or absence of intrauterine adhesions.

Results: A total of 905 women on whom hysteroscopy was performed were included in the study among whom 264 (29.2%) were positive for intrauterine adhesions. Women with IUA were significantly older (t=5.34, P-value=0.00001) than those without IUA. IUA was common among women who were Chief Executives (21/52, 40.4%). The overall mean [± sd] number of myomectomy (0.58 [0.66]) and of D&C (1.68 [1.82]) were significantly higher in IUA-positive women than in IUA-negative women (t=10.66, P-value=0.000001; t=4.52, P-value=0.00001). The ratio of D&C per woman was 1.70 per woman in IUA-positive women compared to 1.1 per woman in IUA negative women. Women with IUA were about 2½ times more likely to have had open myomectomy than those without IUA (Crude odds ratio=2.36, 95% CI:1.75, 3.16) and were just about twice as likely to have had D&C compared to those without IUA (Crude odds ratio=1.92, 95% CI:1.42, 2.60). Correlation coefficient study indicates that IUA was significantly (P-value<0.05) associated with performing all uterine and adnexal operations especially D&C (r=0.023, t=4.42), open myomectomy (r=0.017, t=3.45), Cesarean section (r=0.037, t=4.39), ovarian cystectomy (r=0.06, t=4.86) and salpingectomy (r=0.111, t=6.37). When the number of uterine surgeries performed was considered, IUA significantly (P-value<0.05) correlated with age (r=0.097, t=12.42), Body Mass Index (r=0.162, t=15.45), and with the number of D&C performed (r=0.014, t=2.16).

Conclusion: Uterine procedures like open myomectomy, Dilatation and Curettage and Caesarean section as well as adnexeal surgeries and the number of times these procedures are carried out are important risk factors for uterine adhesions in infertile black African women. Mitigating these risk factors can help reduce the incidence of intrauterine adhesions in these women and improve their fertility.

Keywords: Intrauterine adhesions; Dilatation and curettage; Open myomectomy; Cesarean section; Laparoscopy myomectomy; Salpingectomy

Abbreviations: BMI: Body mass index; CI: Confidence interval; C/S: Cesarean section; D&C: Dilatation and curettage; HEENDEF: Health, environment and development foundation; HS: Hysteroscopy; HSG: Hystero salpingo gram; IUA: Intrauterine adhesions; IUD: Intrauterine device; IVF: In-vitro fertilization; NFC: Nordica fertility Center; OM: Open myomectomy; OR: Odds ratio; WHO: World health organization.

Introduction

In general, adhesions are fibrous strands/bands of tissue that occur as a result of healing process of wounds or injuries. Adhesions bind together adjacent organs and tissues that, normally, are separate [1]. Intrauterine adhesions (IUA), also known as intrauterine synechiae, Fritsch syndrome (after Heinrich Fritsch who first describe the condition in 1894) [2] or Asherman's syndrome, (after Joseph Asherman who first described this condition in 1948, especially when it is associated with symptoms such as infertility and amenorrhea) [3], are a conceivable complication of uterine surgeries which, though frequently quiet, can inhibit fertility [4]. Women, on whom uterine surgery is performed, are at high risk of developing intrauterine adhesions of some extent postoperatively [5]. Epidemiologically, intrauterine adhesion distresses women globally across different ages, signifying no fundamental genetic predilection in its development [6]. Earlier studies indicate a 25% incidence of IUA among women on whom post-partum dilatation and curettage (D&C) has been performed [7-9]; approximately 30.9% incidence among those who had D&C performed for missed miscarriages; and 6.4% incidence among women who had D&C performed for incomplete miscarriages [10]. High prevalence (40%) of IUA has been observed among patients on who D&C were performed for retained products of conception after missed miscarriage or retained placenta [11]. Physical and

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bacteriological trauma to the uterus as a whole or to the endometrium and its basalis layer or stroma have also been linked to Asherman's syndrome [12]. For example, physical trauma could be inflicted in form of overzealous curettage of a pregnant or recently pregnant uterus in a resource-poor part of the world [13] or as a result of pelvic surgeries such as Caesarean sections [6,14], myomectomy, inserted intrauterine devices (IUDs) and pelvic irradiation. Infections such as schistosomiasis [15], pelvic inflammatory diseases [16] and genital tuberculosis [17].

The risk of intrauterine adhesion rises with the number of D&C performed, ranging from 16% after a single termination to 32% after a third or more D&C [18]. A study observed open myomectomy (OM) as a significant but unappreciated etiological factor in the formation of Asherman's syndrome [19] while another stated that recurrent miscarriages and D&C are risk factors for intrauterine adhesions [20]. It has been known for a while that women with intrauterine adhesions often present with certain menstrual irregularities such as reduced quantity of menstrual flow, decrease in duration of bleeding and/or irregular menstrual.

There are few studies describing risk factors for intrauterine adhesions among indigenous black Africans. Two studies from Nigeria reported infertility to be associated with intrauterine adhesions in about 20% of patients consulting for subfertility but none clearly and cogently describes risk factors or frequency of uterine surgeries in association with intrauterine adhesions [21,22]. Further, there is scanty information on socio-demographic characteristics such as age, body mass index and occupation of women with IUA when compared with those without IUA. This study sought to document risk factors for intrauterine adhesions, examine the number of surgical procedures on the uterus and also report the biophysical profile of such indigenous Black African women with and without intrauterine adhesions.

Materials and Methods

This has been documented in our previous report [23] but briefly, this retrospective study took place at Nordica Fertility Centre (NFC), Lagos, Nigeria, a private health facility that attends to the health needs of males and females whose major complaint is infertility or subfertility. The facility is equipped for Assisted Reproductive Technology (ART) as well as world class endoscopy services. Located at three cities in Nigeria - Lagos, Abuja and Asaba - the facility caters for an overall population of about 12 million people in these cities. The locations of the facility are supplied with modern houses, well-tarred roads, electricity and excellent sewage disposal. Majority of men and women consulting for fertility assistance come from within these cities though few are referred from elsewhere in or outside the country.

Data from the medical record of 3138 patients who consulted between June 2005 and November 2014 were examined. Data of 1,115 (35.5%) of those who had performed hysteroscopy was extracted. After data cleaning, the record of 905 (81.2%) women who met the inclusion criteria were made available for analysis. Data of the remaining 210 patients were incomplete and there not included in further analysis.

Capacity of three data recording officers was enhanced for retrieving data from medical records of the study patients, coding, entering the data into a laptop and cleaning the data. These data recording officer were supported and administered by a seasoned obstetrician/gynecologist in the team (OB). Local Ethics Committee approved the study. All patients who satisfied the following inclusion criteria were sent for either diagnostic or therapeutic hysteroscopy at our theatre: (i) Women with previous uterine procedures (e.g. dilatation and curettage, myomectomy, caesarean section, metroplasty); (ii) Previous failed IVF treatment (iii) recurrent miscarriages before presentation (iv) abnormal sonohysterogram, history and or ultrasound scan features suggestive of uterine cavity abnormalities. Exclusion criteria were: (i) pelvic cancer and (ii) patients who declined or did not give consent. Hysteroscopy was performed to evaluate and treat the presence of intrauterine abnormalities. The operating surgeon gave detailed explanation of the procedure involved in hysteroscopy to each patient, and all women signed an informed consent before undergoing the procedure. Part of the informed consent concerns the use of data for teaching, training and research purposes. Step-by step discoveries at hysteroscopy were manually documented on the case note of each patient.

The patients were put under short general anesthesia (GA) before the hysteroscopy procedures were performed. The instrument used was a rigid 20-degree 5-mm hysteroscope consisting of an operative channel for the manipulation of grasping forceps, scissors, or bipolar electrode. A diagnostic hysteroscopic was first done in all cases then relevant instruments were placed via the operative channels to carry out surgical treatment on any identified pathology if indicated and where endometrial biopsies were necessary they were taken. Any specimens collected were sent for histological examination. Uterine cavity distension was achieved using normal saline. The procedure was adjudged complete only when the entire uterine cavity and both tubal ostia were visualized. A failed or abandoned procedure was when access into the uterine cavity was not possible. After completion of the diagnostic aspects, instruments were placed through the operative channel when needed for treatment of pathology. Distention of the uterine cavity was accomplished with normal saline solution. Only when the entire uterine cavity and both tubal ostia were visualized was the procedure considered complete otherwise it was regarded as a failed hysteroscopy when access into the uterine cavity was not possible. Throughout this procedure, the endocervical canal was cautiously examined for any pathology. The last part of the procedure was obtaining, under direct vision, endometrial biopsy sample and sending the sample for histologic examination when indicated. Data of women who consulted more than once were reviewed and only record of their latest consultation and procedure, which included record of all previous consultations and procedures, were included in analysis. This was done to ensure that there was no duplication or triplication of data.

Adhesiolysis

Adhesiolysis was done immediately in cases where adhesions were found and tissue specimens sent for histology for confirmation of adhesions. Surgeries mainly involved use of scissors for sharp dissection and sometimes blunt dissection or aquadissection was done as indicated depending on nature of adhesions and extent. In some cases, repeat or second look hysteroscopy was recommended. The cases analyzed in this study were doing their first hysteroscopies with Nordica Fertility Centre. Data or information for any hysteroscopies done elsewhere was either not available or not reliable.

Definitions and groupings

Age group was categorized by a five-year interval from 25 to 50 years. Ages below 25 and above 50 were not categorized by the 5-year interval. Body Mass Index group was categorized according to the WHO classification: <18.5=underweight; 18.5 to 24.99=normal, 25.0-29.99=overweight; ≥ 30=obese. Marital status was stratified as single if there has never been a conjugal matrimony and ever married if there has ever been such matrimony.

Statistical analysis

Analysis was done using STATA 13 and the level of significance

was set at P<0.05. Descriptive statistics were presented as numbers and percentages for qualitative data, mean and standard deviations for quantitative data. Data was presented as tables and graphs.

Results

Of the 905 women, whose data were analyzed, 264 (29.2%) were diagnosed by hysteroscopy to have intrauterine adhesions while 641 (72.8%) were free of the condition (Table 1). Figure 1 also shows the age-group distribution (1=<25, 2=25-30, 3=31-35, 4=36-40, 5=41-45, 6=46-50 and 7=>50 years) of IUA-positive women (1 below 1-7) compared to IUA-negative women 2 (2 below 1-7). The mean (± sd) age of women who were IUA positive (40.3 ± 5.8 years) was significantly different (t=5.34, 0.000011) from that of women who were IUA negative (38.0 ± 6.1 years). IUA was less likely to be found in younger women less than 35 years of age (25-30 years P=0.04 and 31-35 years P=0.0004). This may be because they were yet to become exposed or sufficiently exposed in terms of number to the risk factors like myomectomies and abortions or they have not attempted trying to have a baby and so fertility evaluation has not taken place and so diagnosis was yet to be made. Starting of families is being delayed these days.

The Table also shows that between the ages of <25 and 35 years, the proportion of women who had IUA was lesser that those who did not have IUA. Age group 36-40 appears to be transition zone as the proportion of IUA-positive (27.3%) and IUA-negative (28.4%) women was insignificant. At age 40-45 years the proportion of women with IUA (34.5%) was significantly higher than that of women without IUA (22.2%) although the proportion of IUA-positive women was higher but not significant at older age groups, indicating that age could be a factor in the occurrence of intrauterine adhesions. Among overweight women, the proportion of women with IUA (47.0%) was also higher but insignificant than IUA-negative women (41.4%) indicating a possible influence of Body Mass Index on the development of synechae.

The proportion of women aged 41-45 years (91/263, 34.5%) with IUA was significantly higher (χ^2=14.84, P-value=0.0001) than that of their counterpart without IUA (142/641, 22.2%). Women in this age group were also about twice as likely to be IUA positive than those who were IUA negative (OR=1.85, 95% Confidence Interval: 1.35, 2.53). Intrauterine adhesions were observed to be more prevalent among women who are Chief Executives (21/52, 40.4%), those in the Banking

Variable	Sub-variable							ALL	IUA present (n=265; 27.2%)	IUA absent (n=641; 72.8%)	t	p-value
								(n=905)				
								Mean (± sd)	Mean (± sd)	Mean (± sd)		
Age	Years							38.7 (6.1)	40.3 (5.8)	38.0 (6.1)	5.34	0.00001
BMI	Kg/m^2							27.8 (5.2)	28.1 (4.7)	27.7 (5.4)	1.11	0.13
		Freq.	%	Freq.	%	Freq.	%					
Age group (years)	<25	3	0.3	0	0	3	0.5	0.23	0.63	0	undefined	
	25-30	83	9.2	16	6.1	67	10.5	4.33	0.04	0.55	0.31, 0.97	
	31-35	211	23.3	41	15.5	170	26.5	12.63	0.0004	0.51	0.35, 0.74	
	36-40	254	28.1	72	27.3	182	28.4	0.12	0.73	0.95	0.69, 1.30	
	41-45	233	25.8	91	34.5	142	22.2	14.84	0.0001	1.85	1.35, 2.53	
	46-50	98	10.8	36	13.6	62	9.7	3.04	0.08	1.47	0.95, 2.29	
	>50	23	2.5	8	3	15	2.3	0.36	0.55	1.3	0.54, 3.11	
BMI group	Underweight	7	0.8	3	1.1	4	0.6	0.15	0.42	1.83	0.41, 8.24	
(Kg/m^2)	Normal	246	27.2	56	21.2	190	29.6	6.71	0.01	0.64	0.45, 0.90	
	Overweight	389	43	124	47	265	41.4	2.42	0.12	1.26	0.94, 1.68	
	Obese	263	29.1	81	30.7	182	28.4	0.48	0.49	1.12	0.82, 1.53	
Nationality	Nigerian	899	99.3	262	29.1	637	70.9	0.05	0.82	0.82	0.15, 4.52	
	Non-Nigerian	6	0.7	2	33.3	4	66.7					
Marital status	Single	19	2.4	7	2.7	12	1.9	0.55	0.46	1.43	0.56, 3.67	
	Ever married	886	97.6	257	97.4	629	98.1					
Religion	Christianity	804	88.8	234	88.6	570	88.9	0.02	0.9	0.97	0.62, 1.53	
	Islam	101	11.2	30	11.4	71	11.1					
Occupation	Professional	375	41.4	95	25.3	280	74.7	4.56	0.03	0.72	0.54, 0.97	
	Student	185	20.4	60	32.4	125	67.6	1.2	0.27	1.21	0.86, 1.72	
	Trader/ Business	131	14.5	41	31.3	90	68.7	0.34	0.56	1.13	0.75, 1.68	
	Chief Executive	52	5.8	21	40.4	31	59.6	3.36	0.07	1.7	0.96, 3.02	
	Banking Industry	44	4.9	17	38.6	27	61.4	2.01	0.16	1.57	0.84, 2.92	
	Civil/Public Servant	35	3.9	8	22.9	27	77.1	0.7	0.4	0.71	0.32, 1.59	
	Farming	31	3.4	7	22.6	24	77.4	0.67	0.41	0.7	0.30, 1.65	
	Others	52	5.7	15	28.8	37	71.2	0.003	0.96	0.98	0.53, 1.82	

Table 1: Socio-demographic characteristics of women with and without intrauterine adhesions in the study.

and Finance sector (17/44, 38.6), Students (60/185, 32.4%) and Traders/ Business women (41/131, 31.3%).

As shown in Figure 2a, D&C was the most frequent uterine surgery performed, mostly between 1-6 times per woman, especially those aged 35-45 years and less frequently between 7-9 times per woman. Figure 2b shows that most women in the study had open myomectomy only once, fewer had it twice, and still fewer had had it more than twice. Figure 2c refers to the number of times patients had had C/S with most women having this surgical procedure performed on them once and still fewer had it performed twice. Figure 2d illustrates that relatively few women had laparoscopic myomectomy done once or twice probably because this is a relatively new technique.

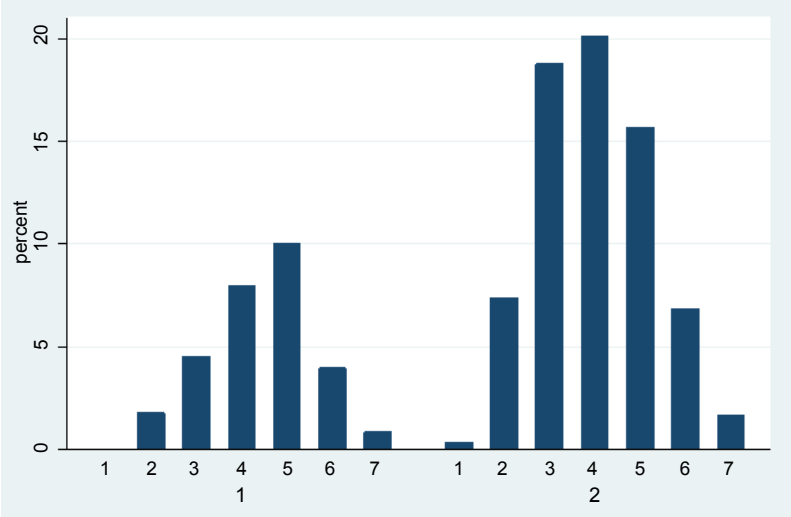

Figure 1: Percent distribution of age group of women with (1) and without (2) intrauterine adhesions by age group 1-7.

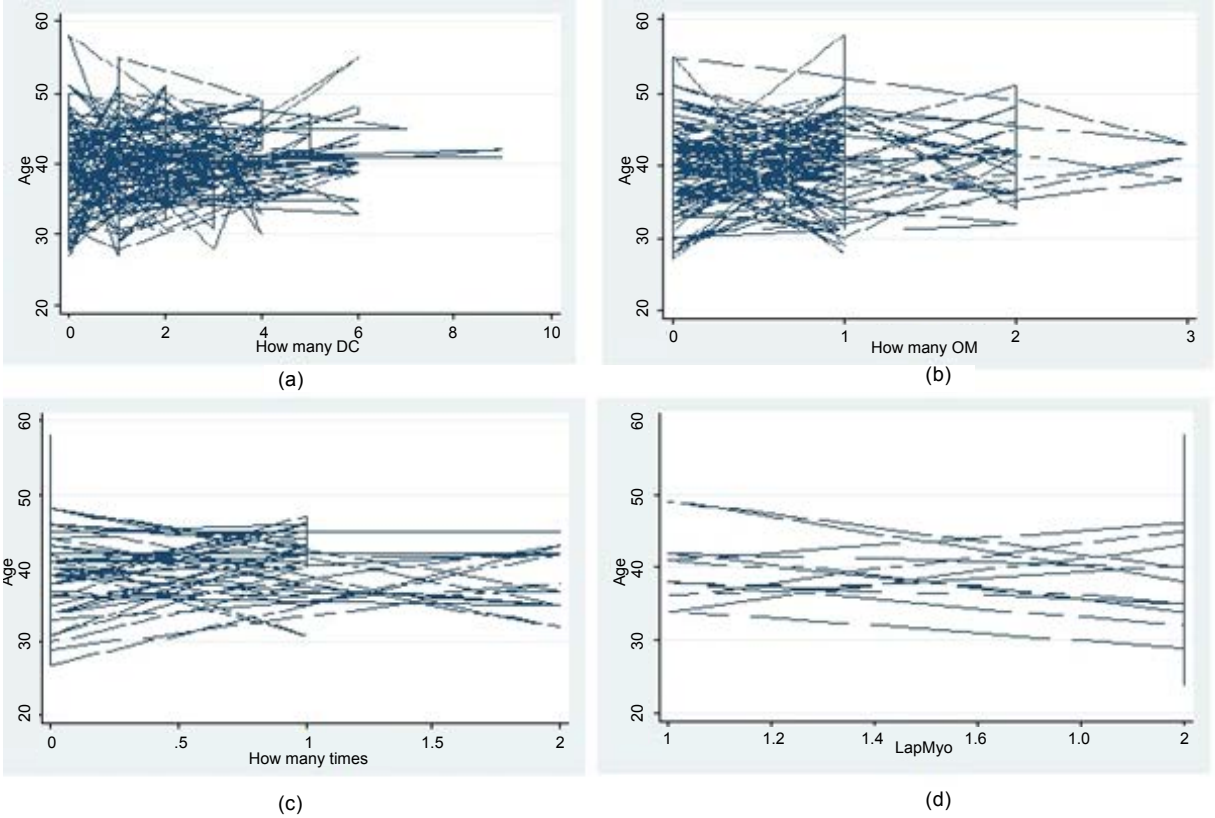

Figure 2: Frequency and density distribution of open myomectomy (OM), dilatation and curettage (DC), Caesarean section (How many times) and laparoscopic myomectomy.

The numbers dilatation and curettage (D&C), open myomectomy and Cesarean section were counted and the means (± sd) of these counts were compared among IUA-positive and IUA-negative women relative to their age group and body mass index group (Table 2). Overall, the mean [± sd] number of D&C performed among IUA-positive women (1.68 [± 1.82]) was significantly higher (t=4.52, P-value=0.00001) than among IUA-negative patients (1.11 [± 1.47]) regardless of age group or BMI group of the patient. This significant disparity in number of D&C performed in the two groups of women is graphically illustrated in (Figure 3).

The mean number of open myomectomy performed among IUA-positive women aged 41-45 (0.65 [0.69]) was significantly higher (t=2.84, P-value=0.003) than those performed among IUA-negative women in the same age-group (0.40 [0.60]), similar to what is observed in age groups 31-35, 36-40 and 46-50 years respectively (Figure 4). Significant differences were also observed in the mean number of open myomectomy performed among IUA-positive and IUA negative women relative to their body mass index, except among those who were underweight. This significant disparity in number of Open myomectomy (OM) performed in the two groups of women is graphically illustrated in (Figure 4).

There was no significant difference in the mean number of Caesarean section performed regardless of whether the patient was IUA-positive or IUA-negative relative to age or body mass index.

The ratio of the total number of D&C, open myomectomy and Caesarean section per woman was calculated for IUA-positive and IUA-negative women (Table 3). Overall, there were 1,152 D&C performed, 444 (38.5%) among IUA-positive women and 708 (61.5%) among IUA-negative women, giving a ratio of 1.7 D&C per IUA-positive woman in contrast to 1.1 D&C per IUA-negative woman. Similarly, of the total 358 open myomectomies (OM) performed, 151 (42.2%) were on IUA-positive women and 207 (57.8%) were on IUA-negative women, giving a ratio of 0.6 OM per IUA-positive woman versus 0.3 OM per IUA negative woman. The ratio of Caesarean section per woman was similar among the two groups of women.

Further analysis (Table 4) showed that IUA-positive women were about twice as likely to have had D&C (χ^2=18.40, P-value=0.00002,

Surgical uterine procedure	Variable	Item	ALL					Intrauterine adhesion											
								Present					Absent						
			Freq.	%	Mean	± sd	Max. No.	Freq.	%	Mean	± sd	Max. No.	Freq.	%	Mean	±sd	Max. No.	t	P-value
Dilatation and Curettage	Age group (years)	ALL	905	100.0	1.28	1.59	10	264	29.2	1.68	1.82	9	641	70.8	1.11	1.47	10	4.52	0.00001
		<25	3	0.3	0	0.0	0	0	0	0	0.0	0	3	050	0	0.0	0	-	-
		25-30	83	9.2	0.80	1.40	7	16	6.1	0.94	1.18	4	67	10.5	0.76	1.43	7	0.53	0.30
		31-35	211	23.3	1.13	1.62	10	41	15.5	1.24	1.51	6	170	26.5	1.11	1.65	10	0.49	0.31
		36-40	254	28.1	1.20	1.51	7	72	27.3	1.72	1.84	6	182	71.7	1.00	1.31	7	3.03	0.002
		41-45	233	25.8	1.57	1.71	9	91	34.5	1.89	2.02	9	142	60.9	1.36	1.44	7	2.17	0.02
		46-50	98	10.8	1.53	1.57	6	36	13.6	1.94	1.72	6	62	63.3	1.29	1.44	5	1.91	0.03
		>50	23	2.5	1.39	1.53	6	8	3.0	1.50	2.00	6	15	65.2	1.33	1.29	4	0.22	0.42
	BMI (Kg/m^2)	Underweight	7	0.8	1.00	1.15	3	2	0.8	0	0.0	0	5	71.4	1.40	1.14	3	-2.75	0.03
		Normal	246	27.2	1.38	1.74	10	69	26.1	1.87	1.95	7	177	72.0	1.19	1.62	10	2.57	0.006
		Overweight	389	43.0	1.28	1.54	9	103	39.0	1.69	1.81	9	286	73.5	1.13	1.40	7	2.85	0.003
		Obese	263	29.1	1.20	1.56	9	90	34.1	1.57	1.76	9	173	65.7	1.01	1.42	7	2.61	0.005
Open myomectomy	Age group (years)	ALL	905	100.0	0.41	0.61	3	264	29.2	0.58	0.66	3	641	70.8	0.12	0.37	3	10.66	0.00000
		<25	3	0.3	0.0	0.0	0	0	0.0	0.0	0.0	0	3	100.0	0.0	0.0	0	-	-
		25-30	83	9.2	0.20	0.46	2	16	19.3	0.19	0.40	1	67	80.7	0.21	0.48	2	-0.17	0.43
		31-35	211	23.3	0.30	0.54	2	41	19.4	0.46	0.60	2	170	80.6	0.26	0.52	2	1.96	0.03
		36-40	254	28.1	0.42	0.60	3	72	28.3	0.60	0.71	3	182	71.7	0.35	0.53	2	2.70	0.004
		41-45	233	25.8	0.50	0.64	3	91	39.1	0.65	0.69	3	142	60.9	0.40	0.60	3	2.84	0.003
		46-50	98	10.8	0.55	0.64	3	36	36.7	0.69	0.62	2	62	63.3	0.47	0.65	3	1.66	0.05
		>50	23	2.5	0.70	0.82	3	8	34.8	0.63	0.74	2	18	65.2	0.73	0.88	3	-0.30	0.38
	BMI (Kg/m^2)	Underweight	7	0.8	0.86	1.07	3	2	42.9	2.0	1.41	3	5	71.4	0.40	0.55	1	1.56	0.17
		Normal	246	27.2	0.40	0.61	3	69	22.8	0.52	0.63	3	177	72.0	0.35	0.59	3	1.94	0.03
		Overweight	389	43.0	0.40	0.56	2	103	31.9	0.58	0.63	2	286	73.5	0.33	0.52	2	3.61	0.0002
		Obese	263	29.1	0.43	0.64	3	90	30.8	0.60	0.68	3	173	65.7	0.35	0.61	3	2.93	0.002
Caesarian section	Age group (years)	ALL	905	100.0	0.12	0.39	3	264	29.2	0.13	0.42	2	641	70.8	0.12	0.37	3	0.34	0.39
		<25	3	0.3	0	0.0	0	0	0.0	0	0.0	0	3	100.0	0	0.0	0	-	-
		25-30	83	9.2	0.02	0.15	1	16	28.3	0	0.0	0	67	80.7	0.03	0.17	1	-1.44	0.08
		32-35	211	23.3	0.14	0.42	3	41	39.1	0.20	0.56	2	170	80.6	0.13	0.39	3	0.76	0.23
		36-40	254	28.1	0.11	0.40	2	72	36.7	0.11	0.40	2	182	71.7	0.12	0.40	2	-0.18	0.43
		41-45	233	25.8	0.15	0.43	2	91	34.8	0.18	0.49	2	142	60.9	0.14	0.39	2	0.66	0.26
		46-50	98	10.8	0.12	0.36	2	36	42.9	0.08	0.28	1	62	63.3	0.15	0.40	2	-1.01	0.16
		>50	23	2.5	0.04	0.21	1	8	22.8	0	0.0	0	15	65.2	0.07	0.26	1	-1.04	0.16
	BMI (Kg/m^2)	Underweight	7	0.8	0	0.0	0	2	31.9	0	0.0	0	5	71.4	0	0.0	0	-	-
		Normal	246	27.2	0.14	0.44	3	69	30.8	0.12	0.44	2	177	72.0	0.15	0.45	3	-0.48	0.32
		Overweight	389	43.0	0.09	0.31	2	103	28.3	0.08	0.30	2	286	73.5	0.10	0.31	2	-0.58	0.28
		Obese	263	29.1	0.15	0.44	2	90	39.1	0.21	0.53	2	173	65.7	0.12	0.39	2	1.42	0.08

Table 2: Mean count of Dilatation and Curettage, Open Myomectomy and Caesarian Section among IUA-positive and IUA-negative women.

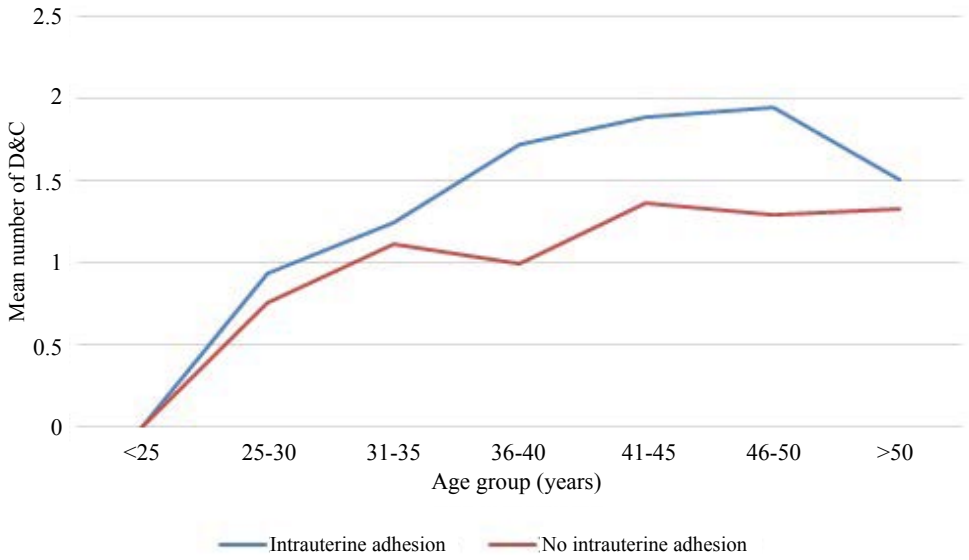

Figure 3: Disparity in mean numbers of dilatation and curettage (D&C) performed among women with and without intrauterine adhesions relative to age group.

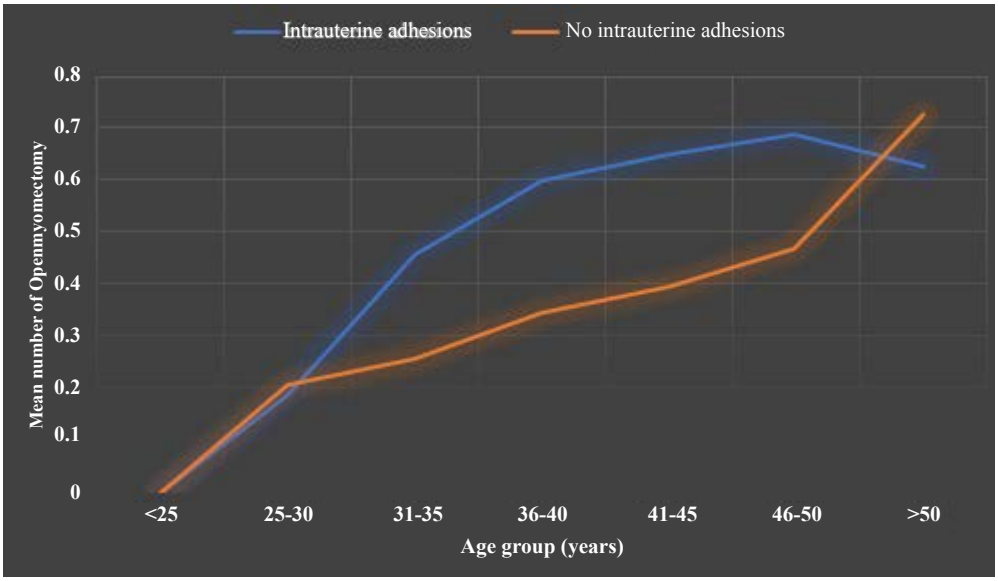

Figure 4: Disparity in mean number of Open myomectomy among women with and without intrauterine adhesions relative to age group.

Odds ratio=1.92, 95% confidence Interval: 1.42, 2.60), were about 2½ times as likely to have had open myomectomy (OM) (χ^2=33.09, P-value=0.0000001, Odds ratio=2.36, 95% confidence Interval: 1.75, 3.16), close to three times as likely to have had both D&C and OM (χ^2=34.39, P-value=0.0000001, Odds ratio=2.72, 95% confidence Interval: 3.15, 7.88), and also about 2½ times to have had laparoscopic myomectomy (χ^2=0.46, P-value=0.50, Odds ratio=2.44, 95% confidence Interval: 0.49, 12.19) compared to those who were IUA-negative.

Linear regression analysis indicated that age group (years), body mass index (kg/m^2), D&C, OM, salpingectomy, appendicectomy, ovarian cystectomy Caesarean section and laparoscopic myomectomy provided a significant 99.85% of the occurrence of IUA (n=264, Prob>F=0.0000, r^2=0.9985 (Table 5) and only body mass index did not have a significant correlation with intrauterine adhesions. Surprisingly, salpingectomy (r=0.111, t=6.37, P-value=0.000, 95% Confidence interval: 0.07, 0.15) and ovarian cystectomy (r=0.062, t=4.86, P-value=0.000, 95% Confidence interval: 0.04, 0.09) were positively correlated with IUA (Table 6).

Unexpected finding of correlation between pelvic extrauterine surgery and IUA may be due to the proximity of the uterus and its connection via the fallopian tubes to other pelvic organs such as the ovaries, the pelvic cavity and peritoneal space where the appendix lies. Hence, the chance that appendix abscesses, hydrosalpinges and ovarian cysts and their surgical management may lead to spread of infective agents or inflammatory substances to the uterine cavity may be responsible for intrauterine adhesion.

Dilatation and Curettage					Open myomectomy					Caesarian section				
Number of women	Freq.	Total count (women x freq.)	Total count		Number of women	Freq.	Total count (women x freq.)	Total count		Number of women	Freq.	Total count (women x freq.)	Total count	
			IUA +ve (n=264)	IUA -ve (n=641)				IUA +ve (n=264)	IUA -ve (n=641)				IUA +ve (n=264)	IUA -ve (n=641)
391	0	0	0	0	590	0	0	0	0	810	0	0	0	0
214	1	214	74	140	278	1	278	110	168	73	1	73	17	56
138	2	276	62	214	31	2	62	32	30	17	2	34	18	16
75	3	225	96	129	6	3	18	9	9	1	3	3	0	3
44	4	176	80	96	-	-	-	-	-	-	-	-	-	-
14	5	70	35	35	-	-	-	-	-	-	-	-	-	-
19	6	114	72	42	-	-	-	-	-	-	-	-	-	-
7	7	49	7	42	-	-	-	-	-	-	-	-	-	-
0	8	0	0	0	-	-	-	-	-	-	-	-	-	-
2	9	18	18	0	-	-	-	-	-	-	-	-	-	-
1	10	10	0	10	-	-	-	-	-	-	-	-	-	-
	Total	1,152	444	708	905	-	358	151	207	-	-	110	35	75
Ratio /woman			1.7:1	1.1:1	Ratio /woman			0.6:1	0.3:1	Ratio /woman			0.1:1	0.1:1

Table 3: Ratio of number of Dilatation and Curettage, Open Myomectomy and Caesarian Section per woman.

Variable	Item	IUA present		IUA absent		χ^2	P-value	Odds ratio	95% CI
		Freq.	%	Freq.	%				
Dilatation and curettage	Yes	179	67.8	335	52.3	18.40	0.00002	1.92	1.42, 2.60
	No	85	32.2	306	47.4				
Open myomectomy	Yes	130	49.2	187	29.2	33.09	0.0000001	2.36	1.75, 3.16
	No	134	50.8	454	70.8				
Caesarian section	Yes	25	9.5	65	10.1	0.09	0.76	0.93	0.57, 1.51
	No	239	90.5	576	89.8				
Dilatation and curettage + Caesarian section	Yes	15	17.1	35	11.4	1.94	0.16	1.59	0.82, 3.07
	No	73	82.9	271	88.6				
Dilatation and curettage +Open myomectomy	Yes	82	31.1	91	14.2	34.39	0.0000001	2.72	3.15, 7.88
	No	182	68.9	550	85.8				
Laparoscopic myomectomy	Yes	3	1.1	3	0.5	0.46*	0.50	2.44	0.49, 12.19
	No	261	98.9	638	99.5				
Salpingectomy	Yes	5	1.9	29	4.5	3.58	0.05	0.41	0.16, 1.06
	No	259	98.1	612	95.5				
Appendectomy	Yes	35	13.3	75	11.7	0.42	0.51	1.15	0.75, 1.77
	No	229	86.7	566	88.3				
Ovarian cystectomy	Yes	10	3.8	33	5.2	0.76	0.38	0.73	0.35, 1.49
	No	254	96.2	608	94.8				
*Fisher's Exact Test									

Table 4: Proportional distribution of various uterine, adnexal and abdominal surgeries among women with and without intrauterine adhesions.

Performance of uterine surgery					Number of uterine surgeries performed				
Source	SS	Df	MS	Number of observations=264	Source	SS	df	MS	Number of observations=264
Model	263.59	9	29.29	F (9, 255)=18307.74	Model	255.32	6	42.55	F (6, 258)=1265.43
Residual	0.41	255	0.002	Prob>F=0.0000	Residual	8.68	258	0.034	Prob>F=0.0000
Total	264	264	1	R-squared=0.9984	Total	264	264	1	R-squared=0.9671
				Adjusted R-squared=0.9984					Adjusted R-squared=0.9664
				Root MSE=0.04					Root MSE=0.18

Table 5: Linear regression analysis on association between Intrauterine adhesion (IUA) as dependent variable and performance D&C, open myomectomy and laparoscopic myomectomy as first independent variables among women with IUA and number of various uterine surgeries performed as second independent variables.

Discussion

The non-gravid uterus is a muscular central organ to the reproductive system in the female, located in the pelvis and suspended by ligaments. It is amply supplied by blood and covered by a network of nerve fibers. The outside surface is covered by à thin membrane while the inner lining, the endometrium is made up of glandular Cells. The endometrium is the innermost glandular layer and functions as a lining for the uterus, preventing adhesions between the opposed walls of the myometrium, thereby maintaining the patency of the uterine cavity.

Disturbances or trauma to the inner lining or the entire body of the uterus (corpus uteri) would most likely cause Intrauterine adhesions. These traumas are usually associated with recent pregnancy, although any instrumentation of the uterine cavity may predispose to the condition [23].

Performance of uterine surgery						Number of uterine surgeries performed					
Parameter	**Coefficient (r)**	**Standard error**	**t**	**P-value**	**95% Confidence Interval**	**Parameter**	**Coefficient (r)**	**Standard error**	**t**	**P-value**	**95% Confidence Interval**
Age group (years)	0.009	0.002	4.04	0.00	0.00, 0.01	Age group (years)	0.097	0.008	12.42	0.000	0.08, 0.11
BMI (Kg/m^2)	0.005	0.003	1.55	0.12	-0.00, 0.01	BMI (Kg/m^2)	0.162	0.010	15.45	0.000	0.14, 0.18
Performed D&C	0.023	0.005	4.42	0.000	0.13, 0.03	Number of D&C performed	0.014	0.006	2.16	0.031	0.00, 0.03
Performed OM	0.017	0.005	3.45	0.001	0.01, 0.03	Number of OM performed	0.022	0.018	1.23	0.219	-0.01, 0.06
Performed Salpingectomy	0.111	0.017	6.37	0.000	0.08, 0.15	Number of C/S performed	0.005	0.027	0.20	0.840	-0.05, 0.06
Performed Appendicectomy	0.027	0.007	3.73	0.000	0.01, 0.04	Number of LM performed	0.248	0.132	1.88	0.062	-0.01, 0.51
Performed Ovarian cystectomy	0.062	0.013	4.86	0.000	0.04, 0.09						
Performed Caesarian section	0.037	0.008	4.39	0.000	0.20, 0.05						
Performed Laparoscopic myomectomy	0.215	0.021	10.21	0.000	0.17, 0.26						

Table 6: Correlation coefficient outcomes between Intrauterine adhesions as dependent variable and other independent variables among women with IUA.

The first major finding in this study was that the proportion of women with intrauterine adhesion was lower in the younger age-group and as age increases this proportion also increases. Nevertheless, the mean number of surgical uterine procedure such as D&C increased with increasing age group. Though, as with other reproductive aspects of a woman, age appears to be directly associated with the occurrence of intrauterine adhesions, the number of D&C performed also seemed to be a factor related to the occurrence of intrauterine adhesions. Most studies on Asherman's syndrome describe age of women who were IUA-positive only, omitting age of those who were IUA-negative [16,24,25]. Also, data from this study spanned a period of about 10 years including over 900 women in child-bearing age unlike most other studies, especially in Africa. Therefore, in general, this study postulates a direct relationship between age and number of uterine surgeries performed and the occurrence of intrauterine adhesions. In addition, when the number of surgical interventions was considered in the regression analysis, a positive correlation was observed between IUA and body mass index, stressing the importance of the number of procedures as a risk factor for intrauterine adhesions.

The second major finding was that intrauterine adhesions were commoner in certain occupational groups than others. Data on the relationship between intrauterine adhesions and occupational status of indigenous Black Africa women is very rare in the literature and this study appears to be the first to report such association. This study observed that the proportion of Asherman's syndrome was high among Chief Executives, those in Financial sector, professionals such as Medical Doctors, Lawyers and Engineers. This probably so because they are more likely to afford these procedures. Also such top educated executives could be more likely to delay starting their families/child bearing and these may increase the likelihood of having such conditions as fibroids and myomectomy to treat this.

Another key finding was the observation of a stronger positive correlation between performance of D&C and IUA (r=0.023, t=4.42, P-value=0.0000, 95% CI: 0.13, 0.03) on one hand and performance of Open myomectomy and IUA (r=0.017, t=3.45, P-value=0.001, 95% CI: 0.01, 0.03) on the other. There was also a positive correlation between number of D&C performed and intrauterine adhesions (r=0.14, t=2.16, P-value=0.031, 95% CI: 0.00, 0.03) indicating that D&C and the number of D&C performed are stronger risk factors for IUA than open myomectomy and the number of open myomectomy performed. This is similar to the findings of Hooker et al., [26] whose systematic review suggests a link between D&C for termination of pregnancy (TOP) and adhesion formation and to the conclusion of the works of Conforti et al. [19] that Open myomectomy represents an important but currently underappreciated aetiological factor in the formation of intrauterine adhesions. Of the two procedures, our study postulated the combination of performing D&C and quantity of D&C performed to be a stronger risk factor for IUA than the combination of performing Open myomectomy and the quantity of Open myomectomy performed. This supposition is further buttressed by the ratio of D&C per woman among IUA-positive women (1.7:1) in comparison to the ratio of Open myomectomy per woman among IUA-positive women (0.6:1). Caesarean section appears to be a low risk factor in the occurrence of IUA. Tissue hypoxia may be a potentiating factor for the primary tissue injury and the activator of a series of responses leading to adhesions formation [27-29]. Studies have shown that hypoxia is damaging to fibrinolysis and it also is a catalyst for irreversible phenotypic changes in fibroblasts [30,31].

Conclusion

Age, type and number of procedures and occupational group are major risk factors for the occurrence of intrauterine adhesions in this group of women. Older professional women who had multiple procedures particularly dilatation and curettage are more at risk of IUA, however Caesarean section presents a low risk of IUA. Among infertile black African women in our environment clinicians should consider a strong possibility of intrauterine adhesions in women who present with these characteristics.

Limitations

This was a facility based study in a select group of women (mainly infertile women) hence generalization of the findings from this study is limited. Nature, number and other details of procedures carried out may be subject to recall bias and thus may not be completely accurate. Infections were not considered because of inconsistency and unreliability of the history from the clients.

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