Radiologic Pattern of Uterine Leiomyoma among Rural Women Undergoing Routine Pelvic Ultrasonography in South-South Nigeria

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Summary

INTRODUCTION

Uterine leiomyomas are benign tumours of myometrial origin and are the most common solid uterine neoplasms in women and more prevalent among African women. The study was aimed at evaluating the radiologic pattern of uterine leiomyoma among rural women in South-South Nigeria.

MATERIALS AND METHODS

A descriptive study design was adopted with 1460 women in June 2017 and June 2018 in Degema and Bakana towns in Nigeria during a free medical care programme organised by the Kalabari National Association–USA. Real time grey scale ultrasonography using Sonolite Edge Portable Ultrasound machine fitted with 3.5MHz curvilinear transducer was used after obtaining informed consent. The collated results were analyzed using SPSS statistical software version 21.0 and presenting all in charts, tables, and figures. Eta correlation was used to evaluate association between variables.

RESULTS

The overall mean age (±standard deviation) of participants was 33.44±5.39years with a range of 18-56years and majority of participants were overweight 38.49% while 31.30% were obese. Majority of the leiomyomas were intramural constituting 47.60% followed by subserosal and submucosal constituting 28.63% and 23.77% respectively. Multiple leiomyomas were more common with majority of the masses found in the anterior wall of the uterus. Ovarian cyst was the most common co-existing pelvic lesion with leiomyoma.

CONCLUSION

The radiologic pattern of uterine leiomyoma shows that intramural leiomyomas are commoner in all age groups and multiple leiomyomas more than solitary lesions. An uncommon teenage leiomyoma was seen in a 19-year-old.

Keyword: *Uterine leiomyomas, fibroid, Degema, Bakana, Kalabari National Association –USA, Pelvic Ultrasonography*

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Introduction

Uterine leiomyomas, also referred to as uterine fibroids, are benign tumours of myometrial origin and are the most common solid benign uterine neoplasms in women[1,2,3,4]. The lesion is commonly found in women incidentally[1] who present in the radiology department for fertility related investigations or menstrual irregularities. They could also present with abdominal pain, abnormal vaginal bleeding, and palpable abdominal mass[1]. However, it has variable clinical presentations which depend on the size, location, and multiplicity of the mass[2].

Uterine leiomyoma is common among African women of reproductive age with a prevalence of about 25% [1]. The lesion has a strong racial correlation because it is 3 to 9 times commoner in African women than in Caucasians[2], with a genetic predisposition[5]. The disease is also more common among nulliparous women and women with infertility[2,6]. The exact prevalence of uterine leiomyoma in Nigeria is not known because available data were hospital based studies however studies have shown that the prevalence in some States in the North-central and South-west Nigeria were 9.8% in Lokoja, 8.3% in Zaria and 6.58% in Ile-Ife[2,7, 8,9,10,11,12]. The estimated incidence of uterine leiomyoma is over 70% by the age of 50 years [5, 13,14]. There is paucity of data on the prevalence of the lesion in South-South Nigeria.

It is rarely seen before puberty but is stimulated by hormones such as oestrogen[1], which increases in size during conception (to up to 30%) and involutes during menopause[1]. They are commonly multiple in numbers and vary in size[1]. The masses can outgrow the vascular supply leading to degenerative changes such as hyaline (in 60% of cases), myxoid (50%), cystic (5%), red/carneous degeneration or calcification [1,15,16].

The mass can be found within (Intra-uterine) or outside the uterus (extra uterine). The Intra-uterine locations include intramural leiomyoma (most common location), subserosal leiomyoma and submucosal leiomyoma being the least common accounting for about 10-15% of leiomyoma locations[1]. The extra-uterine leiomyomas include broad ligament leiomyoma, cervical leiomyoma, and parasitic leiomyoma as well as diffuse uterine leiomyomatosis[1].

Radiologically uterine leiomyomas can be evaluated using ultrasonography, plain radiography, computed tomography, and magnetic resonance imaging. However, ultrasonography is the commonest imaging modality used to evaluate leiomyomas because it is cheaper, more readily available and does not use ionizing radiation when compared to other imaging modalities, although ultrasonography is encumbered with the drawback of being operator and expertise dependent, it has still been the most common imaging modality used.

With plain radiography, there is poor uterine soft tissue evaluation, however degenerating leiomyoma changes can be seen as calcification in the pelvic cavity giving the popcorn calcification pattern[1]. The draw back with the use of plain radiography is poor visibility of the uterine soft tissue as a result the mass is often poorly outlined or marginated, followed by the untoward effect of ionizing radiation. Computed tomography scan, an axial imaging modality, gives a better tissue contrast when compared to plain radiography. In

computed tomography the lesion appears as a soft tissue density which may show coarse peripheral or central calcification with variable morphology and contrast agent uptake[1,2]. Computed tomography scan is relatively expensive with a higher radiation dose to the patient when compared to plain radiography[17].

Magnetic resonance imaging (MRI) is a multiplanar imaging modality that uses a radiofrequency wave. This modality does not use ionizing radiation and shows excellent soft tissue contrast. MRI is the preferred imaging modality of choice being that it can accurately detect, localise, and characterise leiomyomas with precision[15]. But MRI is very expensive and is not required for diagnostic purposes[1] except for complicated and complex cases. However, in MRI the mass appears as low to intermediate signal intensity in T1 weighted images when compared to the normal myometrial tissue in non-degenerated lesions[18]. If there are areas of degeneration, it will show characteristic increased signal intensity with T1 hyperintense rim round a centrally located myoma suggesting red degeneration. Whereas in T2 weighted images, the non-degenerated lesions and calcification will show as low signal intensity, and variable contrast enhancement is seen with the administration of Gadolinium[18]. Gadolinium administration during MRI is of value for intervention purposes, however; in routine evaluation gadolinium administration has not been shown to be of value towards the detection, localisation, or characterisation of the lesion[15]. It is worth noting that MRI is of significant value in differentiating a pedunculated leiomyoma from other masses especially adnexal masses[1,18,19].

Ultrasonography is the commonest modality used in the evaluation, screening, diagnosis, and monitoring of uterine leiomyomas[19]. It is relatively cheap and readily available. When uncomplicated, the masses appear as well marginated predominately hypoechoic or echo-complex masses (heterogeneous in echogenicity) when compared with normal myometrium (figure 1). However, when complicated with degenerative changes such as calcifications, they are seen as echogenic foci with posterior acoustic shadowing while cystic areas of necrosis will be hypoechoic.

They can be classified into intramural, subserosal and submucosal based on their location within the uterus as shown in figures 1, 2 and 3. The intramural types are the most common, followed by the subserosal type and the submucosal being the least common[15]. The intramural leiomyomas are the most common and may be associated with infertility following fallopian tubes compression and occlusion[15].

Subserosal types are second to intramural types. The Subserosal leiomyoma can be pedunculated (figure 2) with the ability to project into the abdomen or pelvis[15]. When pedunculated they could undergo torsion with resultant infarction[15]. The Submucosal leiomyoma accounts for about 5% of leiomyomas (least common) but more symptomatic and can be diagnosed during hysterosalpingography[15]. They have the tendency to be pedunculated and project into the endometrial cavity or prolapse into the cervix or vagina[15,20].

Uterine Leiomyomas can co-exist with pregnancy (figure 4 and 5), and other pelvic lesions such as ovarian cyst, endometriosis, and pelvic inflammatory disease.

The treatment options include myomectomy, focal endometrial curettage, hormone administration, hysterectomy, and uterine artery embolisation (UAE) depending on the age, fertility status and symptomatology of the lesion. With the paucity of data concerning the prevalence of the lesion in this environment,

it is imperative to evaluate the radiologic pattern of uterine leiomyoma among rural women undergoing routine pelvic ultrasonography in South-South Nigeria. The knowledge from the study will enable Gynaecologists and Interventional Radiologist in planning treatment modalities as well as instituting definitive interventions and follow-up.

Materials and Methods

A Prospective Study design was adopted with 1460 women in June 2017 and June 2018 in Degema and Bakana towns all in Degema local government area of Rivers State. Degema and Bakana towns are densely populated riverine communities in Degema Local Government Area of Rivers State in the oil rich Niger Delta region of South-South Nigeria. The Local government has an area of 1,011km² – Density 346.7/km² according to the National Population Commission of Nigeria and National Bureau of Statistics 21, 22. As at 2006 national census, females constituted 121,426 of the population. The study took place during a free medical care programme organised by the Kalabari National Association –USA in conjunction with O.B. Lulu Briggs foundation. During the free medical care programme 1460 women of child-bearing age participated in the free pelvic ultrasonography.

Real time grey scale ultrasonography using Sonolite Edge Portable Ultrasound machine fitted with 3.5MHz curvilinear transducer was used. After informed consent was obtained from the participants, the age, weight, height, and Last Menstrual Period (LMP) were obtained and documented prior to transabdominal ultrasound evaluation. A real time grey scale evaluation of the uterus was done with the prior intake of about 500mls of water 30 minutes to one hour before scan to ensure adequate bladder distension. This is imperative for the clear visualisation of the uterus and the adnexa. The examination was done with the patient in supine position on the examination couch. While lying supine on the couch, patients were requested to expose their lower abdomen/pelvis from the xiphisternum to the symphysis pubis. Acoustic gel was applied to the suprapubic area to obliterate air interface between the transducer and skin. The transducer was oriented to scan longitudinally and in transverse planes.

The uterine leiomyomas were seen as well outlined predominately hypoechoic or echo-complex masses (heterogeneous in echogenicity) with some showing degenerative changes such as echogenic foci with posterior acoustic shadowing (due to calcification) while others show anechoic areas with posterior acoustic enhancement due to cystic areas of necrosis.

After the examination, the results were entered into a spread sheet, first by separating the normal pelvic scans from the abnormal ones. The findings were analysed using SPSS statistical software and Eta correlation to test association between variables. The analysis was later presented in charts, tables, and figures.

Result

The overall mean age (±standard deviation) of the participants was 33.44±5.39 years with a range of 18-56 years (table1). Table 1 also summarises that majority of the participants fall within the age group of 30-34 years constituting 39.3% of the total participants, with a mean age of 31.73+1.51 years. The BMI of participants revealed that 30.21% (441) had normal BMI, 38.49% (562) were overweight and 31.30% (457) were obese. Most of the obese participants were seen among age group 30-34 years; however, age group 40-

44 years had the highest proportion of obese participants as also shown in table 1.

The pattern of uterine leiomyomas showed that 47.60% (695) were intramural, 28.63% (418) subserosal and 23.77% (347) were submucosal (table 2 and figure 6) indicating that intramural leiomyomas were most common. Age classification in relation to the type of leiomyoma showed that all the subtypes were more in the age group 30-34 years whereas submucosal leiomyomas were more in age group 45-49 years (table 2). Table 3 and figure 7 shows that 38.0% (555) were solitary leiomyomas while 62.0% (905) were multiple leiomyomas, summarising that majority of patients with leiomyoma had multiple masses. Multiple leiomyomas were also more among all the age groups except those under 19 years and 50-55 years (table 3).

Concerning the location of leiomyomas, 488 (33%) were anterior, 467 (32.6%) were in the posterior aspect of the uterus while 478 (32.8%) and 27 (2%) were found in the fundal and cervical regions, respectively as shown in table 3 and figure 8. Majority of posteriorly located leiomyomas were found among the age group 30-34 years (table 3). Table 3 also shows that posterior leiomyomas were more common among age groups 45-49 and 50-55 years.

Table 4 and Figure 9 summaries that ovarian cysts were the most common co-existing lesion with leiomyoma constituting 9.11% (133), while adenomyosis were 3.7% (54), PID 7.47% (109). The table also shows that 78.56% (1147) of the respondent had no co-existing pelvic lesions whereas 1.16% (17) were pregnant in conjunction with the mass.

As stated in table 5, Eta Coefficient test showed a week statistically significant association between age and co-existing pelvic findings (where Eta Coefficient test statistic η = 0.124), whereas numerical occurrence, location of the mass and type of leiomyoma had no statistically significant association with age.

Discussion

Uterine leiomyomas are benign tumours of myometrial origin and are the most common solid uterine neoplasm in women which is more prevalent among African women. Ultrasonography is relatively cheap and readily available imaging modality used in the evaluation, screening, and diagnosis of uterine leiomyomas[19]. This modality was used in evaluating radiological patterns of uterine leiomyoma among rural women in South-South Nigeria was done using ultrasonography.

Most of the participants were young adults (30-34 years) with a mean age (±standard deviation) of 33.44±5.39 years and a range of 18-56 years. This age group was closely related to that obtained in the study by Olotu *et al*[23]. In their retrospective study to evaluate the age prevalence of uterine fibroids in South-South Nigeria; age group 26 – 35 years had the highest frequency of occurrence**.** The slight discrepancy observed may be due to the age group interval employed and methodology used. This result is also similar to the findings in other parts of Nigeria as documented in the study by Ndububa VI[24] with majority of the patients falling within the age groups 31–35years. The high prevalence of this age group can be attributed to the quest for early treatment infertility[25].

The BMI of participants revealed that 30.21% (441) had normal BMI, 38.49% (562) are overweight and 31.30% (457) obese. Most of the obese participants were seen among age group 30-34 years. However, most of the participants among age group 40-44 years were obese.

The pattern of uterine leiomyoma (based on the layer of the uterine wall affected) shows that majority of the leiomyomas were

intramural, in consonance with the finding by Victor Ukwenya *et al*[26]. However, the percentage was higher in their study (93.18%) against 47.60% in the index study. The variation in percentages may be due to study population, which was higher in the study by Victor Ukwenya *et al*[26], compared to the index study. Secondly the index study was a rural community-based study whereas the study by Victor Ukwenya *et al*[26] was a hospital-based study.

Numerical distribution of leiomyoma showed that 38.0% were solitary leiomyomas while 62.0% were multiple leiomyomas, summarising that majority of patients with leiomyoma had multiple masses. This finding in the index study is also in accordance with the study by Victor Ukwenya *et al*[26], notwithstanding, the marginal variation in the percentages 59.09% (multiple) and 40.919 (solitary) as against 38.0% solitary and 62.0% multiple leiomyomas in the index study. It can be deduced that multiple leiomyomas were more common. Study population, duration and location may have contributed to the slight variation in percentages observed.

Concerning the location of leiomyomas, 33% (488) were anterior, 32.6% (467) were in the posterior aspect of the uterus while 32.8% (478) and 2% (27) were found in the fundal and cervical regions, respectively as shown in table 3 and figure 3. Majority of posteriorly located leiomyomas were found among the age group 30-34 years (table 3). Table 3 also shows that posterior leiomyomas were more common among age groups 45-49 and 50-55 years. Uterine leiomyomas can occur alone or in conjunction with other pelvic disorders. Ovarian cyst was observed to be the most co-existing condition, followed by pelvic inflammatory disease (PID) and ademomyosis. Some participants were pregnant at the time of the evaluation.

Conclusion

The pattern of uterine leiomyoma showed that intramural leiomyomas were more common in all age groups. Concerning the numerical occurrences there were more multiple occurring leiomyomas than solitary lesions. Majority of the masses were found in the anterior fundal and posterior uterine walls. Most of the participants did not have co-existing pelvic diseases, however, ovarian cysts were the most common co-morbidity followed by Pelvic Inflammatory Disease then ademomyosis.

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Author Contribution

This work was carried out in collaboration among all authors. All the Authors were involved in the design of the study, literature searches, the practical study, data collection, and the analyses of the data. All authors read and approved the final manuscript.

Conflict of Interest: None declared.

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Appendix

Table 1: Age and BMI Distributions of Participants

Age(Years)	Frequency N	Percentage (%)	Mean (±SD)	BMI		
				NORMAL	OVER WEIGHT	OBESE
UNDER 19	1	0.1	19.00±0.00	1	0	0
20-24	31	2.1	22.97±1.08	14	16	1
25-29	282	19.3	26.80±1.12	118	124	40
30-34	574	39.3	31.73±1.51	174	235	165
35-39	292	20.0	36.77±1.37	87	116	89
40-44	263	18.0	40.91±1.04	42	67	154
45-49	11	0.8	45.91±3.08	2	3	6
50-54	4	0.3	53.00±0.82	2	1	1
≥55	2	0.1	55.00±0.00	1	0	1
Total	1460	100.0	33.44±5.39	441(30.21%)	562(38.49%)	457(31.30%)

Table 2: Showing Age Classification with Types of Leiomyoma

AGE GROUPS	TYPE			Total
	INTRAMURAL	SUBSEROSAL	SUBMUCOSAL	
UNDER 19	0	1	0	1
20-24	20	7	4	31
25-29	130	80	72	282
30-34	271	170	133	574
35-39	131	85	76	292
40-44	138	70	55	263
45-49	3	2	6	11
50-54	1	2	1	4
55 AND OVER	1	1	0	2
Total	695	418	347	1460

Table 3: Showing Age Group Distribution with Location of Leiomyoma and Multiplicity of Masses

AGE GROUPS	LOCATION					Numerical Distribution of Leiomyoma		
	ANT	POST	FUND	CER	Total	SOLIT	MULTIPLE	Total
UNDER 19	0	0	1	0	1	1	0	1
20-24	8	11	11	1	31	9	22	31
25-29	92	93	90	7	282	113	169	282
30-34	209	189	166	10	574	215	359	574
35-39	88	76	123	5	292	126	166	292
40-44	85	95	79	4	263	85	178	263
45-49	3	2	6	0	11	4	7	11
50-54	1	1	2	0	4	0	4	4
55 OVER	2	0	0	0	2	2	0	2
Total	488	467	478	27	1460	555	905	1460

ANT (anterior), POST (posterior), FUND (fundal), and CER (cervical) , SOLIT (SOLITARY)

Table 4: Showing Age Classification with Co-Exiting Findings

AGE GROUPS	COEXISTING					Total
	OVARIAN CYST	ADENOMYOSIS	PID	NO OTHER LESION	PREGNANCY	
UNDER 19	0	0	0	1	0	1
20-24	3	1	1	20	6	31
25-29	25	10	26	215	6	282
30-34	40	20	52	459	3	574
35-39	39	10	10	233	0	292
40-44	25	13	20	203	2	263
45-49	0	0	0	11	0	11
50-54	0	0	0	4	0	4
55 AND OVER	1	0	0	1	0	2
Total	133	54	109	1147	17	1460

PID: Pelvic Inflammatory Disease

Table 5: Showing Eta Correlation Test between Age and Nominal Variables

Nominal by Interval (Eta)	Nominal variables	Eta Coefficient (η)	Association
AGE		**.015**	
	Occurrence	**.156**	**No association**
		.030	**No association**
	Location of the mass	**.183**	
		.012	**No association**
	Type of Leiomyoma	**.167**	
		.124	**Weak association**
	Co-existing findings	**.151**	

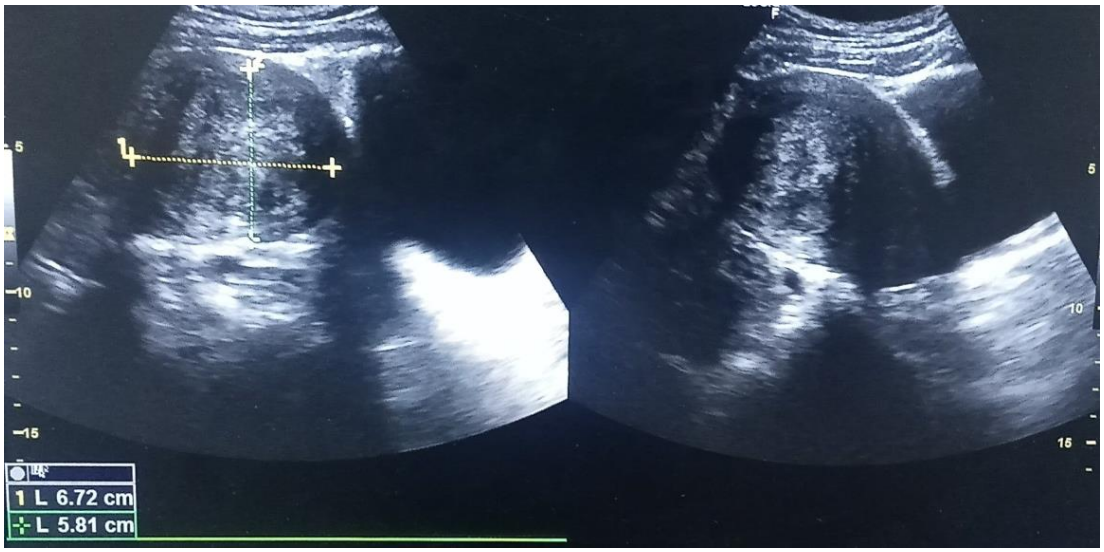

Figure 1: Gray Scale Longitudinal Images of the Uterus Showing A Well-Defined Echo-Complex Intramural Solid Mass in the Uterine Wall Measuring 6.72cmx5.81cm.

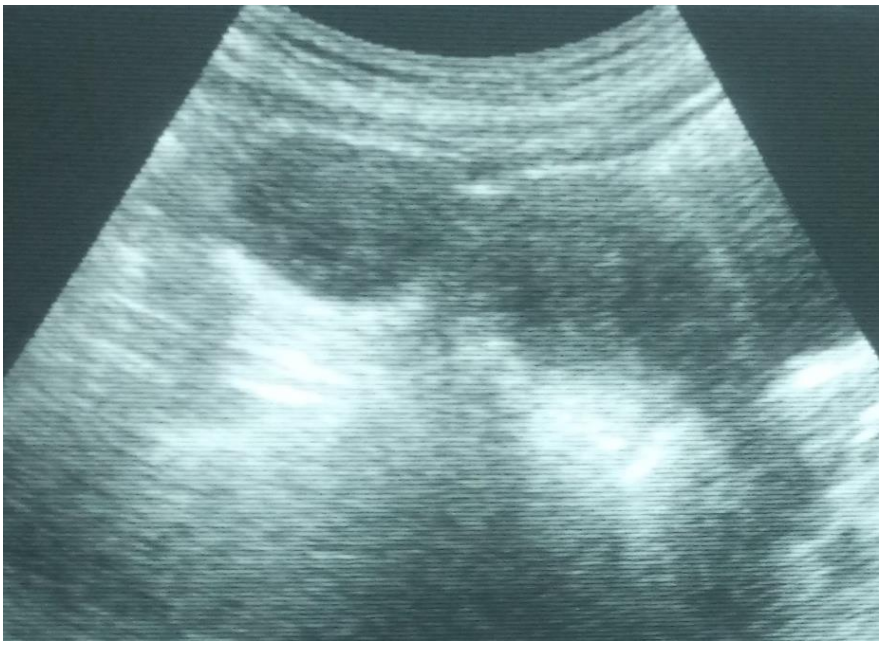

Figure 2: Gray Scale Image of Subserosal Leiomyoma

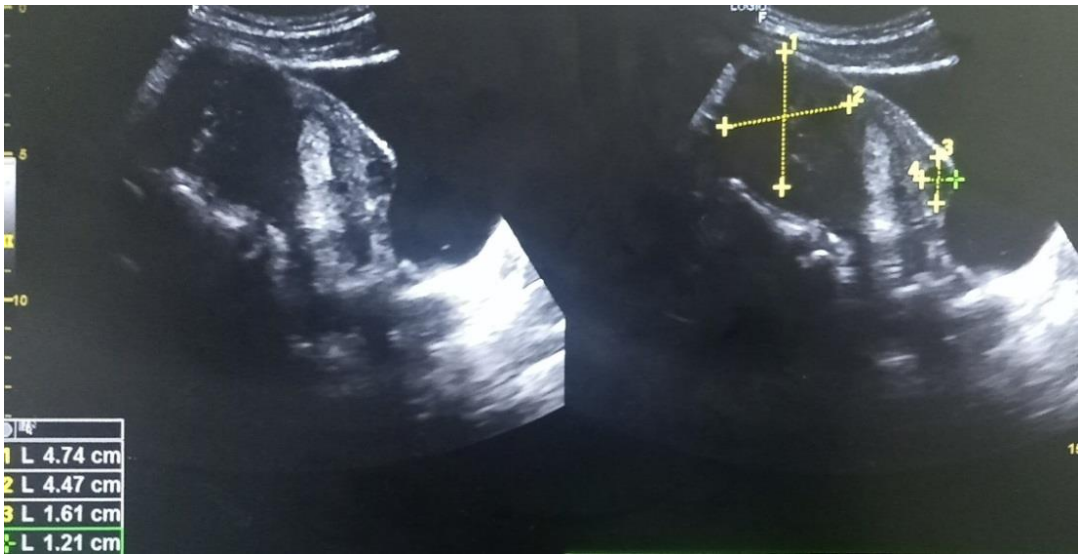

Figure 3: Gray Scale Longitudinal Images of the Uterus Showing Multiple Well-Defined Echo-Complex Subserosal Solid Masses in the Fundal and Anterior Uterine Walls Measuring 4.74cmx4.47cm And 1.61cmx1.21cm Respectively

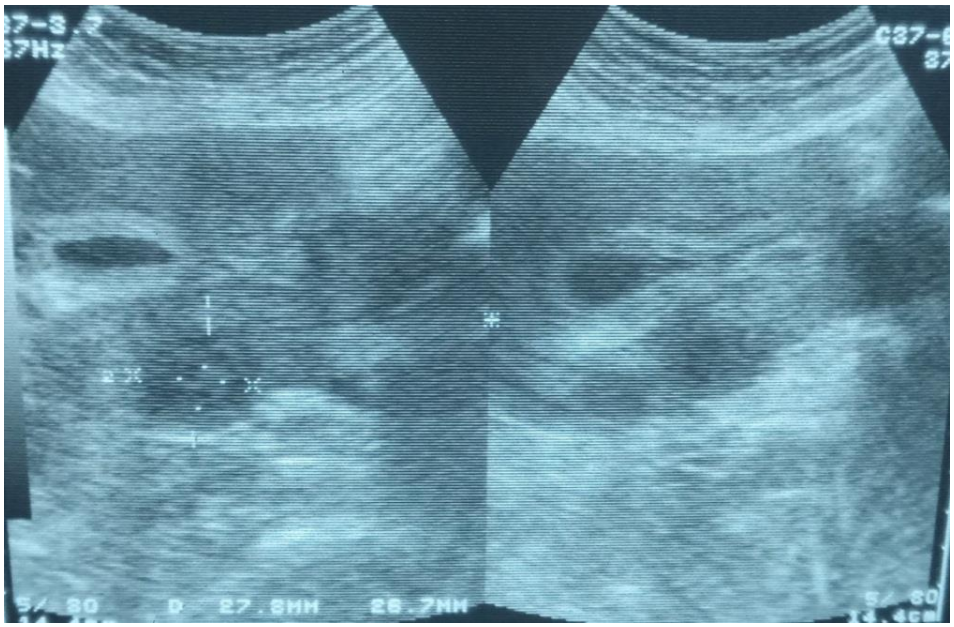

Figure 4: Gray Scale Image of Intramural Leiomyoma in the Posterior Uterine Wall Measuring 2.8cmx2.1cm Co-Existing with Gestational Sac (Early Pregnancy)

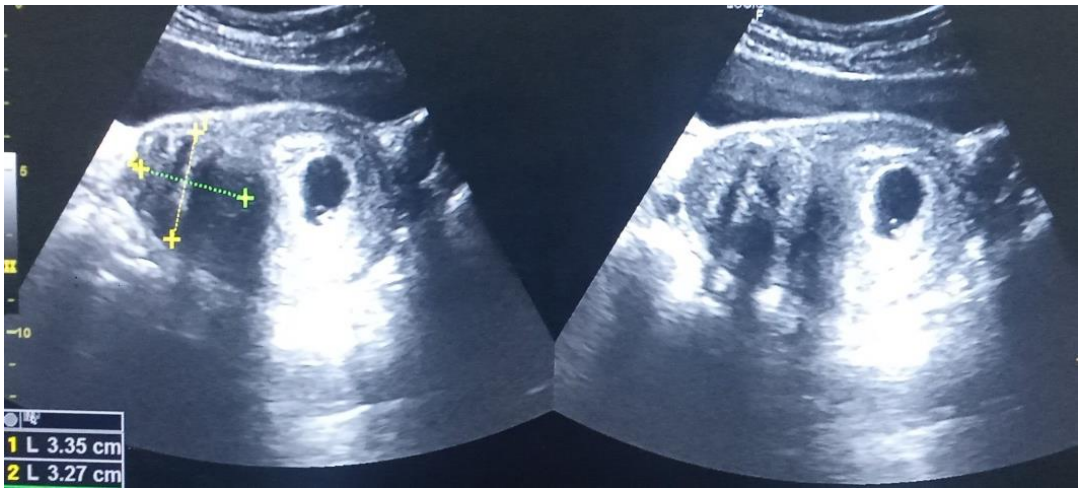

Figure 5: Gray Scale Transvers Images of the Uterus Showing A Gestational Sac Harbouring A Foetal Pole in Its Endometriun with A Co-Existing Subserosal Leiomyoma in the Fundal Region of the Uterus Measuring 3.35cmx3.27cm.

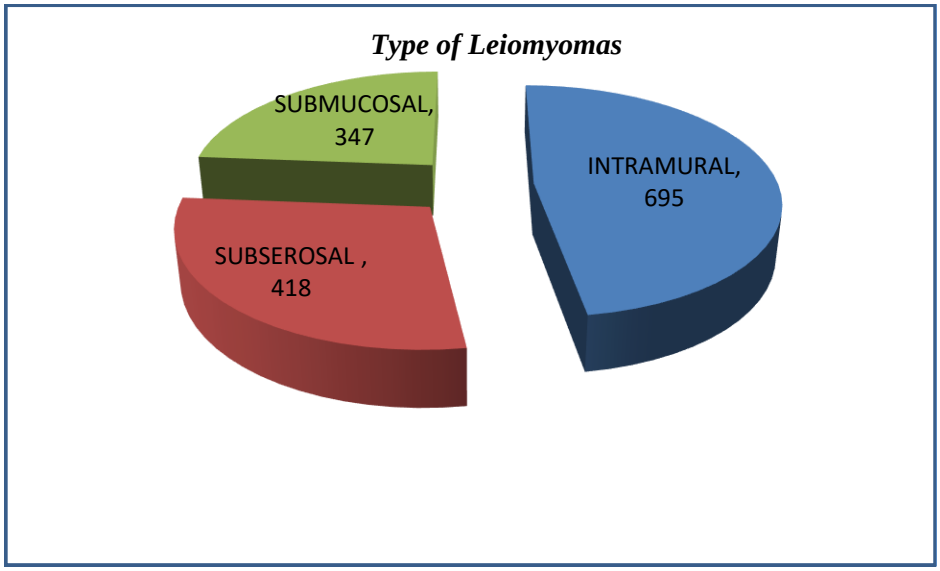

Figure 6: Showing Type of Leiomyomas

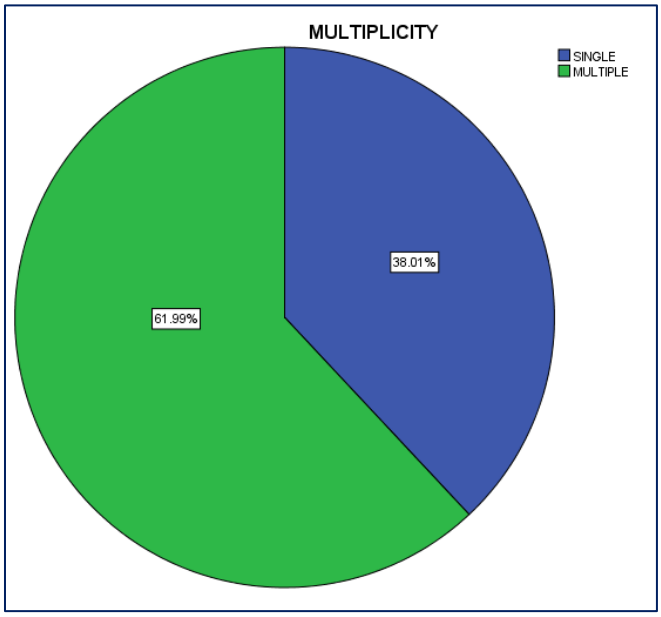

Figure 7: Numerical Distribution of Leomyomas

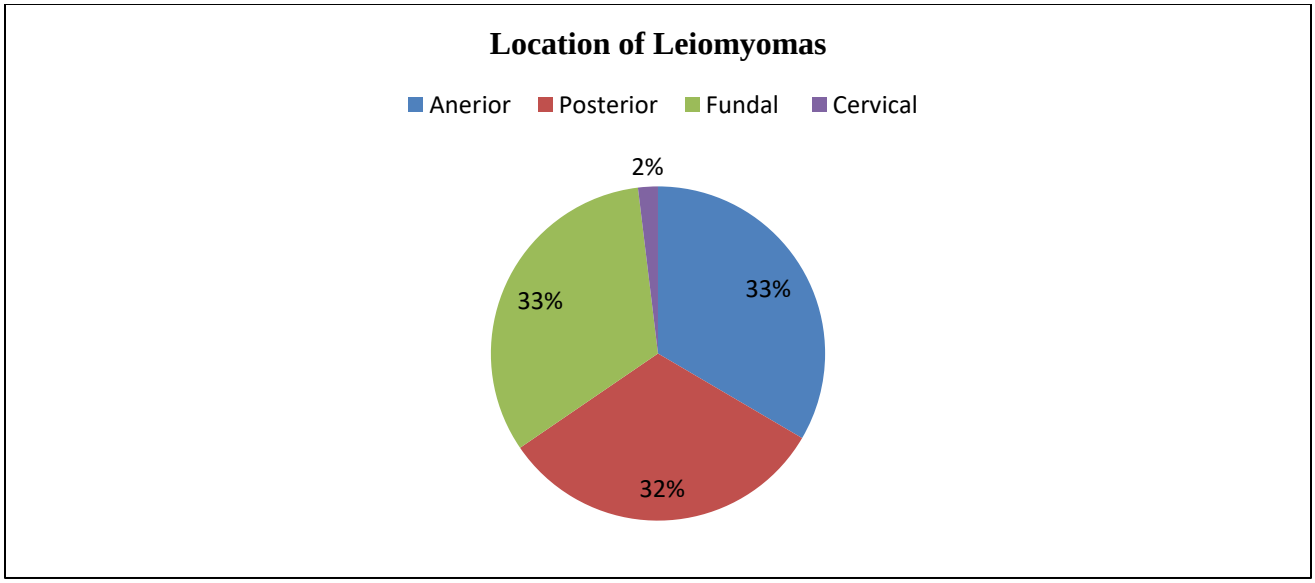

Figure 8: Location of the Leiomyomas

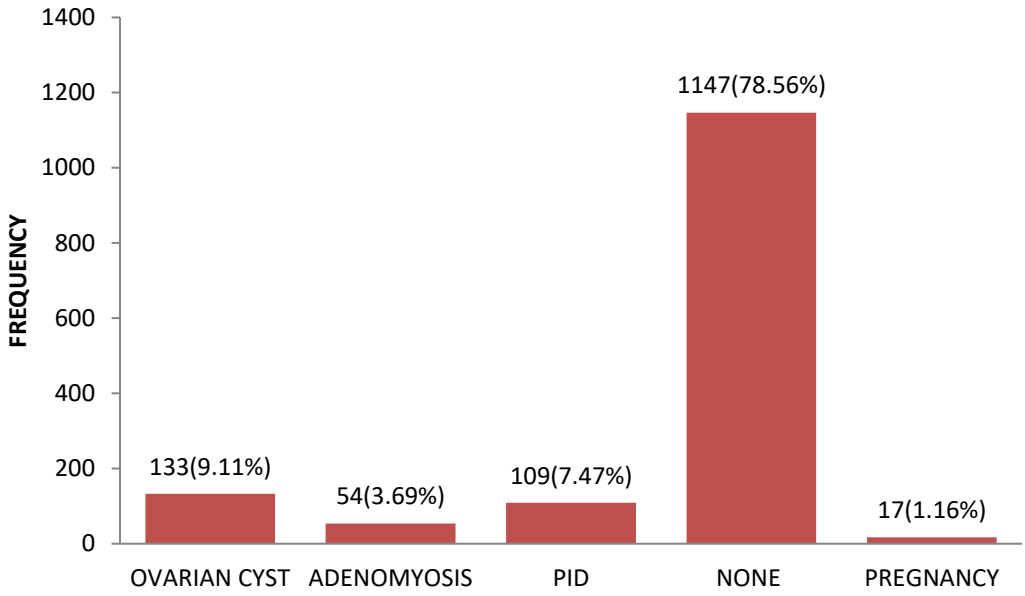

Figure 9: Leiomyoma with Co-Existing Conditions