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RESEARCH ARTICLE

ULTRASONOGRAPHY EVALUATION OF THE IMPACT OF EARLY GESTATIONAL MISCARRIAGE IN A RESOURCE CONSTRAINED COMMUNITY OF WEST AFRICAN SUBREGION

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Abstract

Sonographic evaluation plays a great role in determining the findings in early gestational miscarriage. The aim of this study was to access the occurrence of early gestational miscarriage, the sonographic findings and relationship between age and the sonographic findings in the study group. This is a quantitative retrospective cross-sectional study. A total of 285 ultrasound reports of female patients were certified to have early gestational miscarriage for a period of three years in Nnamdi Azikiwe Teaching Hospital, Wave Radio-Diagnostic Center and Life Specialist Hospital in Nnewi Urban, Anambra State, Nigeria were studied. The data were analyzed using statistical package for social science (SPSS) version 21.0. Statistical significance was considered at <0.05. The result showed that early gestational miscarriage was (15.01%). The sonographic findings were a significant factor of early gestational miscarriage (p = 0.001). Early miscarriage was common among age group 26-30 years (33.7%). The maternal age was not significantly associated with the sonographic findings (P = 0.512). Crown rump length were more common in the ultrasound findings of women who were diagnosed with early gestational miscarriage. The prevailing age group was 26 – 30 years being the prevailing age group. Therefore, ultrasound should always be seen as the first line when it comes to uterine pregnancy, because it is cheap, does not use radiation and has high sensitivity in detecting early miscarriage.

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Introduction:-

Early gestational miscarriage or pregnancy loss is the loss of pregnancy before twenty (20) weeks. Usually in the first trimester, embryonic causes of spontaneous abortion are the predominant etiology and account for 80% to 90% of miscarriages [1]. Approximately 20% to 25% of all pregnancies experience a threatened miscarriage [1]. The rate of fetal loss is significantly lower in pregnancy which did not threaten to miscarry (only 2% to 7%) [2]. A miscarriage often occurs very early in the pregnancy, often without any alteration of the menstrual cycle and they are not perceived by the woman .A note should be taken that if a woman has had three or more miscarriages, the term habitual miscarriage is used [3]. It is estimated that as many as 26% of all pregnancies end in miscarriages and up to 10% of clinically recognized pregnancies [4]. The risk of a miscarriage decreases after 12 weeks gestation [5].

Usually, the term is miscarriage and abortion are used interchangeably. The term abortion refers to a termination of pregnancy either natural or induced. There are several terms that describe different stages of pregnancy loss. These terms include: threatened, inevitable, complete and missed abortion [6].Threatened abortion is the presence of vaginal bleeding in early pregnancy, but on pelvic exam, the cervical OS is closed and the trans vaginal scan shows a viablefetus [7].In an inevitable abortion there is a vaginal bleeding and on the pelvic exam the cervical OS is open meaning that the features of products of conception are expected to pass through the cervix in the near future [8].

In a complete abortion, there is initially vaginal bleeding and passing of products of conception through the cervix [9]. On transvaginal scan there would be no remaining products of conception in the uterus. A missed abortion refers to when there was a vaginal bleeding and perhaps some passage of conception [10]. On pelvic exam, the cervical OS would be closed. On transvaginal scan there would be retained products of conception and there will not be a viable fetus.

Research in the past 2 to 3 years has shown that previously accepted criteria for ruling out a viable pregnancy, which were based on small numbers of patients, are not stringent enough to avoid false positive test results. Dissemination of this information to practitioners and the achievement of standardized practice protocol are challenging, because the diagnosis and management of early pregnancy complications involve physicians from multiple specialties, including Radiology, obstetrics and gynecology, emergency medicine, and family medicine. As a result, there is a patchwork of sometimes conflicting, often outdated published recommendations and guidelines from professional societies.

Ultrasound is a gold standard widely used imaging modality for the diagnosis and staging of pregnancies and other diseases. In the past two decades, it has been beneficial from major advances in technology and has become an indispensable imaging modality, due to it's flexible, non-invasive and non-expensive [11]. It is the most useful method of imaging the female reproductive system. Ultrasound scanning is made possible with the use of a device called the transducer or a probe. The transducers are devices that actually converts one form of energy into another. Transducers use active elements, either natural or manufactured, to create the piezoelectric effect needed for sonography. Piezoelectric is the response of certain materials that, when deformed by pressure, a voltage is produced [12]. Early transducers that used the piezoelectric effect typically had some form of quartz as the active medium [13].

Found naturally in the environment, quartz is relatively plentiful and it's crystalline properties make it a very good choice [14]. Manufactured piezoelectric materials have included barium titanate, lead zirconatetitanate(commonly abbreviated PZT, the most popular choice and particularly used for Doppler transducers), barium lead zirconate, lead metaniobate, and polyvinylidene fluoride. The desirable attributes of these materials are a high coupling coefficient, a high frequency of natural resonance, and repeatable characteristics for stable design [15].

A pelvic ultrasound is a non-invasive diagnosis exam that produces images that are used to access organs and structures within the female pelvis. A pelvic ultrasound allows quick visualization of the female pelvic organs and structures including the uterus, cervix, vagina, fallopian tubes and ovaries.The transvaginal ultrasound scanning (TVS) is an established principal technique for imaging of the female pelvic organs and early pregnancy. The ability to utilize much higher transmission frequencies and the continuing development in terms of transducer design and performance have resulted in high image quality compound with the transabdominal ultrasound scanning [16]. Although most clinics and hospitals use the transabdominal ultrasound scanning method. The main reason why transvaginal sonography is considered as the first line technique, not only because of it's availability, low cost and patient acceptability, but because it is the most accurate diagnostic modality in the majority of cases including early miscarriage.Due to it's method of usage it is usually patient's discomfort especially if performed by a novice or even more by several operators [17].

Materials and Methods:-

Research design

The study was a retrospective cross-sectional study, and ultrasonography reports of female patients who had gone through pelvic ultrasound scan for early miscarriage were used for the study.

Study Area
The study was carried out at Nnamdi Azikiwe University Teaching Hospital, Waves Diagnostic Centre and Life Specialist Hospital in different locations in Nnewi urban, Anambra State, Nigeria.

Sample size estimation
The sample size was calculated using the Yaro Yamani formula [18]: $n= N/1+ N (e)^2$

Where n = desired minimum msample size, N = Population under study, e = acceptable limit of error (0.05), 1= a constant.
$N = 600+200+200/1+600+200+200(0.05)^2$
$= 1000/1+ 1000(0.0025) = 1000/1+2.5$
$= 1000/3.5 = 285$

Two hundred and eighty-five (285) ultrasound reports of adult female patients that had been certified to have early gestational miscarriage by a qualified sonographer or consultant radiologist for a period of three years in the study centers was used for the study. The age range of study was within child bearing age. The ages were arranged and categorized closely in order not to exclude any patient report that is expected to be included in the work. The age group was categorized into six groups, which include: 15 - 20, 21 – 25 years, 26 – 30 years, 31 - 35 years, 36 – 40 years, 41- 45 years old.

Method of Data Analysis:-
The data were analyzed using statistical package for social science (SPSS) version 21.0. Statistical significance was considered at <0.05. Descriptive statistics such as frequency distribution tables and simple percentages were used for the data presentation, interpretation and analysis.The level of statistical significance was at ($P < 0.05$).

Ethics approval:
By the principles of the Declaration of Helsinki, the study protocol was reviewed and approved by an independent ethics committee of the Faculty of Health Sciences and Technology, College of Health Sciences, Nnamdi Azikiwe University, Nigeria. Protocol number: NAU/FHST/2021/RAD22. Data were retrospectively collected and analyzed, ensuring the confidentiality and privacy of the patient's information.

Human rights statements and informed consent:
Introduction/informed consent letter was obtained from Radiography department which was issued to all participants before being included in the study.

Conflict of interest:
The author declared no conflict of interest.

Results and Discussions:-
A total of two hundred and eighty-five (285) reports were analyzed. All reports were certified to have early gestational miscarriage by a qualified sonographer or consultant radiologist.

Table 1:- Age distribution of the study population in relation with early gestational miscarriage.

	Age groups	Frequency	Percent	Range	Mean±STD
	15-20	18	6.3		
	21-25	43	15.1		
	26-30	96	33.7		
	31-35	58	20.4		
	36-40	55	19.3		
	41-45	15	5.3		
	Total	**285**	**100**		
				15-45	**30.44±6.57**

Table 1 above Shows the distribution of patient data by age range and average age with most of the patients within the age group 26-30 years (33.7%). The youngest age recorded was 15 years. The mean age of the study population is 30.44 years

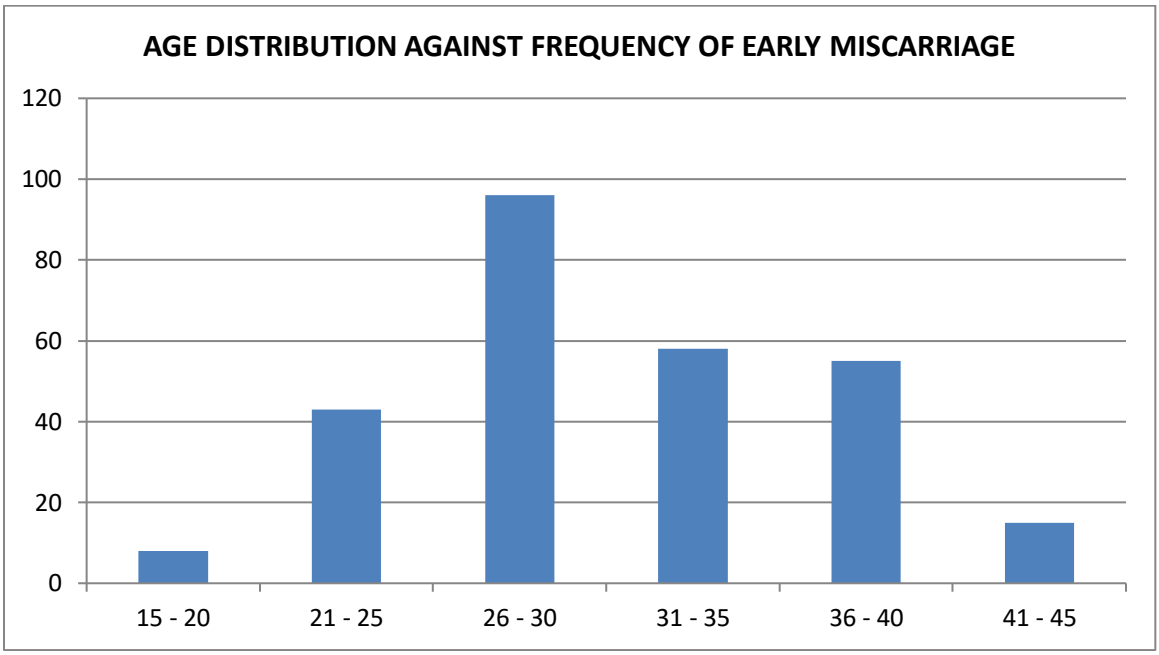

Figure 1:- Age distribution against Frequency of Early Gestational Miscarriage.

Table 2:- Classification of the type of miscarriage among the study population.

Groups	**Frequency**	**Percentage (%)**	
Complete Abortion	153	54.2	
Incomplete Abortion	104	36.7	
Inevitable Abortion	13	4.2	
Missed abortion	15	4.6	
TOTAL	**285**	**100**	

Table 2 above shows the classification of type of miscarriage in relation to the frequency of early Gestational Miscarriage, and are categorized into four groups. Complete abortion has a higher rate 153 (54.2%).

Table 3:- Gestational week/age (of miscarriage) distribution of the study population.

GESTATIONAL WEEK(age)	FREQUENCY	PERCENTAGE (%)	
<6	97	34.0	
6 - 12	152	53.3	
12 - 18	35	12.6	
TOTAL	285	100	

Table 3. above shows the gestational week in relation to the frequency of Early Gestational Miscarriage, and are categorized into three groups. Group (6-12 weeks) has a higher rate 0f 152 (53.3%).

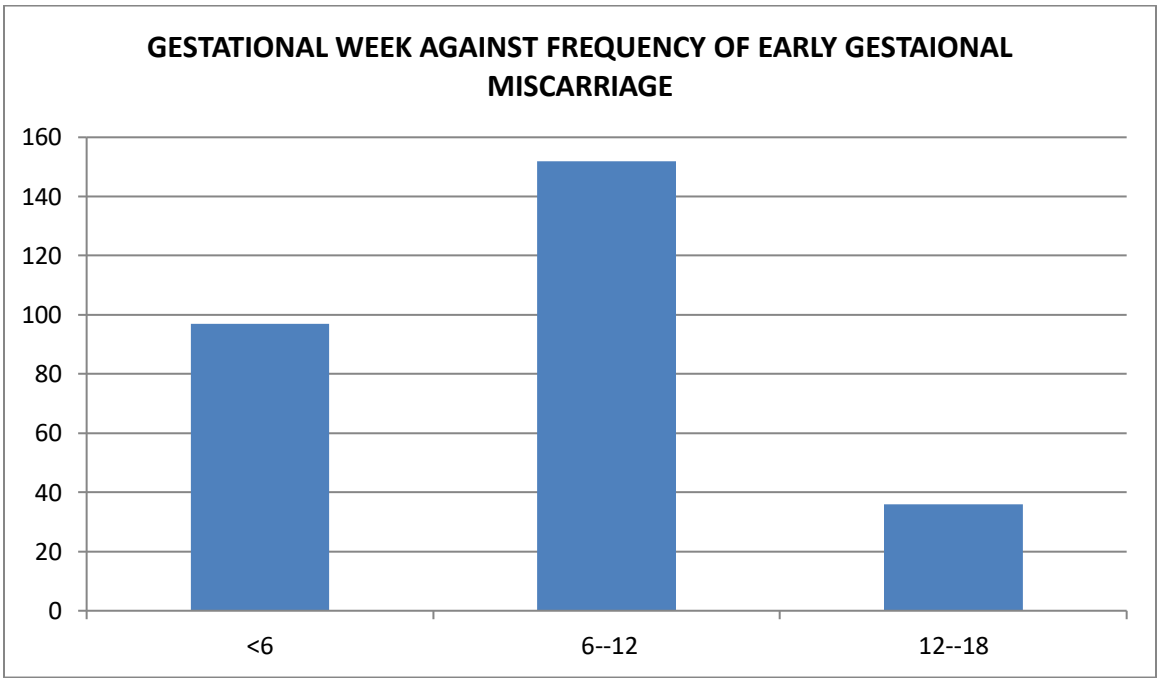

Figure 2:- Gestational week against frequency of early gestational miscarriage.

Table 4:- Distribution of Sonographic findings.

		Frequency	Percent	X^2	p-value
Sonographic findings	Crown rump length (> or =7mm, no heartbeat)	114	40	0.24	<0.001
	Gestational Sac Diameter (>20mm with no embryo)	51	17.9		
	Absence of Yolk sac (MSD >13mm)	26	9.1		
	Subchorionic Hematoma	20	7		
	Incompetent cervix	17	6		
	Ectopic Pregnancy	26	9.1		
	Underlying health conditions	31	10.9		
	Total	285	100		

Table 4, above shows that Data was analyzed using One Sample Non-parametric test. Resultis significant at $p \leq 0.05$.

Table 5:- Incidence of miscarriage in the centers during the studied period.

Number of miscarriages	Number of pregnancy	Incidence
285	1899	15.01%

Table 5. Shows that in every 10 pregnancies 1.5 pregnancy ended up in a miscarriage

Table 6:- Analysis of relationship between age (years) and sonographic findings.

	15-20 years	21-25years	26-30years	31-35years	36-40years	41-45years
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Crown rump length (> or =7mm, no heartbeat)	5(4.4)	12(10.5)	40(35.1)	27(23.7)	25(21.9)	5(4.4)
Gestational Sac Diameter (>20mm with no embryo)	5(9.8)	9(17.6)	15(29.4)	10(19.6)	10(19.6)	2(3.9)
Absence of Yolk sac (MSD >13mm)	2(7.7)	3(11.5)	8(30.8)	5(19.2)	5(19.2)	3(11.5)
Subchorionic Hematoma	2(10)	4(20)	9(45)	4(20)	1(5)	0(0)
Incompetent cervix	3(17.6)	4(23.5)	5(29.4)	0(0)	3(17.6)	2(11.8)
Ectopic Pregnancy	0(0)	4(15.4)	7(26.9)	8(30.8)	6(23.1)	1(3.8)
Underlying health conditions	1(3.2)	7(22.6)	12(38.7)	4(12.9)	5(16.1)	2(6.5)
			X^2 =5.25; p = 0.512			

Table 6: Cross-tabulation between sonographic findings and maternal age of the patients shows there is no significant association between the sonographic findings and maternal age, meaning it is not age dependent 0.512 (5.12%)

Data was analysed using Chi-square test for association. X^2 means Chi-square value. Result is significant at $p \leq 0.05$.

Discussion:-

In this research the study was made possible using ultrasound reports to assess early gestational miscarriages and classifying them relying on the sonographic appearance. The result of this study showed the mean maternal age at 30.44±6.57 almost correlating with the result from [19] who studied a five-year review of cases of miscarriages in a tertiary hospital in Abakiliki, South East, Nigeria. They reported the mean age to be 28.4 ±6.4. This present study also shows the age group (26-30) had the highest frequency of miscarriage. This also correlates with [19] who found the highest frequency to be between the age group (20-29). This present study showed that complete miscarriage was the most common with the frequency of 152 (53.3%). Although according to [20] there was no correlation. They had a major occurrence of incomplete miscarriage with a frequency of 254 (42.1%). Also in this present study, the frequency of the gestational week of miscarriage were analysed. It was noted that gestational week between 6-12 had the major frequency of miscarriages. In the literature and previous studies, researchers found no explanation demonstrating these findings. According to the research crown rump length (= or >7mm no heartbeat) had the highest frequency with regards to the 7 sonographic findings relating to evaluation of early gestational miscarriage. These sonographic findings were based on the already set parameters during the study of tested the reliability of established ultrasound parameters in predicting the outcome of first-trimester pregnancy by S E Rowling et al., 1997. There was a correlation study between maternal age and the sonographic findings with P value of 0.512(5.12%). This indicated that the maternal age had no significant association on the sonographic findings. In this result, there was no previous study that was found to demonstrate this finding. From the study, the occurrence of early gestational miscarriage in Nnewi urban was 15.01%.

Conclusion:-

Crown rump length (> or =7mm, no heartbeat) were more common in the ultrasound findings of women who were diagnosed with early gestational miscarriage with age group 26 – 30 years being the prevailing age group both in number of early gestational miscarriage cases and also in the number of occurrences of Crown rump length (> or =7mm, no heartbeat). Ultrasound should always be seen as the first line when it comes to uterine pregnancy, because it is cheap, does not use radiation and has moderate sensitivity.

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