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Sonographic Assessment of Pregnancy in Patients with Hypertension & Diabetes

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Abstract: ***Aim of study: This study was conducted to correlate between maternal age and incidence of fetal anomalies, as well as incidence of intrauterine fetal death, in diabetic (DM) and hypertensive (HT) pregnant women in Sudan in Khartoum City using ultrasonography. Method: Hundred pregnant women 50 diabetic, and 50 hypertensive were scanned by ultrasound to evaluate pregnancy status concerning the previous concerns. Ultrasound was used to scan pregnant diabetic or hypertensive women in the second and third trimester to see intrauterine fetal death, and fetal anomalies and malformations. The scan was done using tow dimensional Mindary machine, during the period from 2015 to 2018. Results: The study sample consists of 100 pregnant diabetic, and hypertensive pregnant female aged between 20 and 43 years old. 12 of 100 (12%) have a previous intrauterine fetal death, 88% of patient haven't undergoing intrauterine fetal death. 9 0f 100 (9%) of patient have fetus with anomalies. The anomalies were 1% microcephaly, 1% anencephaly, 1%fetal ascites, 3% spina bifida, 2% hydrocephalus, 1% undescended testes. Conclusion: Majority of women who have DM/HT undergo normal pregnancy and outcomes, but some of them might encounter complications with intrauterine fetal death, fetal congenital malformations and anomalies, and stillbirth. The incidence rate of these problems is increased with increasing maternal age.***

Keywords: Ultrasonography, Diabetes mellitus, Hypertension, IUFD, Anomalies

1. Introduction

Blood pressure is the force exerted by the blood against the walls of blood vessels, and the magnitude of this force depends on the cardiac output and the resistance of the blood vessels. Hypertension (HT), also known as high blood pressure (HBP), is a long term medical condition in which the blood pressure in the arteries is persistently elevated. [1]

High blood pressure usually does not cause symptoms. Long term high blood pressure, however, is a major risk factor for coronary artery disease, stroke, heart failure, peripheral vascular disease, vision loss, and chronic kidney disease.

Hypertension in pregnancy should be defined as a diastolic BP of ≥ 90 mmHg or systolic BP ≥ 140 mmHg, based on the average of at least 2 measurements, taken using the same arm. Mean arterial pressure (MAP) is no longer used as a criterion in the definition of hypertension as it is difficult to calculate. Pre-existing hypertension mean pre-dates pregnancy or appears before 20 weeks, and gestational hypertension appears at or after 20 wks.[1]

Severe hypertension should be defined as a systolic BP of ≥ 160 mmHg or a diastolic BP of ≥ 110 mmHg. A repeat measurement should be taken for confirmation in 15 minutes. [2] Mean arterial pressure (MAP) is no longer used as a criterion in the definition of hypertension as it is difficult to calculate. [2]

Preeclampsia in women with pre-existing hypertension is defined as resistant hypertension, new or worsening proteinuria, or one or more adverse conditions noted below. Resistant hypertension is elevation in blood pressure after 20 weeks gestation that requires three antihypertensive medications to control it. In women with gestational hypertension, preeclampsia is defined as new-onset proteinuria or one or more adverse conditions. Edema and weight gain have been excluded from the definition of preeclampsia. Hypertension can cause several complications during pregnancy for mother, or even to the fetus. [1]

1.1 Mother Complication

Vascular and Pulmonary complications, Hepatic complication: elevated AST, ALT, LDH, Severe nausea, Jaundice. Hematologic complications: platelets <100,000, Disseminated intravascular coagulopathy (DIC). CNS complications: persistent new or unusual headache, visual disturbances, hyper reflexia, seizures, stroke, and HELLP syndrome. [3]

1.2 Fetal complications include

- Intrauterine growth restriction (IUGR).
- Atypical / abnormal fetal heart rate.
- Intrauterine fetal death.
- Placental abruption.
- Oligo-hydramnios
- Prematurity. [3]

1.3 Diabetes Mellitus

Is the most common medical complication of pregnancy and it carries a significant risk to the fetus and the mother. [4]

Congenital malformations and perinatal morbidity remain common compared with the offspring of non-diabetic pregnancies. Diabetic mothers are at risk of progression of micro vascular diabetic complications as well as early pregnancy loss, pre-eclampsia, poly-hydramnios and

premature labour. Glycemic control before and during pregnancy is critical and the benefit may result in a viable, healthy off spring. Gestational diabetes mellitus (GDM) which manifests for the first time during pregnancy is common and on the increase, its proper management will reduce the risk of neonatal macrosomia and hypoglycemia. Post-partum evaluation of glucose tolerance and appropriate counseling in women with GDM may help decrease the high risk of subsequent type 2 diabetes in the long term. [4]

1.4 Fetal complications include:

- Congenital anomalies: cardio-vascular central nervous system, skeletal (sacral agenesis), and genito-urinary.
- Fetal growth retardation (in diabetic pregnancy complicated by nephropathy(IUGR)
- Excessive fetal growth (macrosomia).[4]

Diabetic keto-acidosis, hypo-glycaemia, visual deterioration/retinopathy, deterioration of nephropathy, vomiting (gastric neuropathy), miscarriages, pre-eclampsia, poly-hydramnios, premature delivery are considered as maternal complications in diabetic pregnancy.[4]

2. Materials & Methods

This was an experimental clinical study carried out in Khartoum city, the capital of Sudan at Medical Corp Hospital. The study conducted from May 2015 till March 2019, in which a group of (100) diabetic and hypertensive pregnant women underwent U/S examination for antennal care. Another group of (20) healthy volunteers were selected as a control group and gray scale procedure was done for them in order to establish some preliminary data of the population.

2D Mindary ultrasound machine with Doppler facilities was used to scan the patients. The examination began with subject supine. First fast scan was done to survey all uterus and its content. Then a scan with details is done to evaluate and asses the heartbeat, gestational age, placenta site, amniotic fluid volume, presentation and asses fetal weight and finally if there is any fetal anomalies is detected.

In this study a complete scan was done for the pregnant women to detect intrauterine fetal death, placenta site, amniotic fluid volume, and fetal anomalies. Variables used for data collection are mother age, history of diabetes or hypertension, gestational age, placenta site, IUFD, previous abortions due to DM or HT, amniotic fluid volume, and fetal anomalies.

Data analyzed using SPSS to find the significant difference between the variables and the results presented in tables and graphs, significant correlation between the variables was represented in value(p=0.005).

3. Results

100 diabetic and hypertensive, pregnant women in Khartoum city, the capital of Sudan were referred to ultrasound department for ultrasound scan , they were selected randomly to participate in this study ; the obtained results were analyzed and presented in tables , graphs and figures. Significant correlations between the variables were obtained.

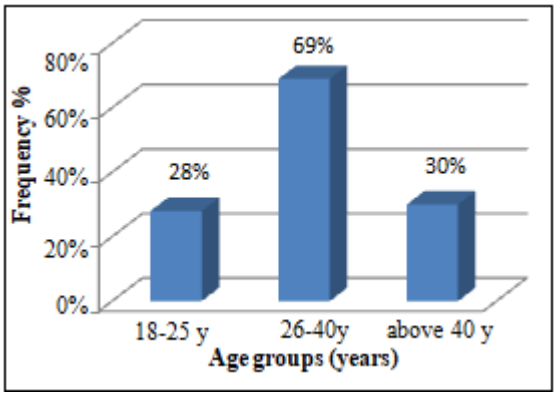

Figure 1: Shows the percentage distribution of age among study sample. (N=100)

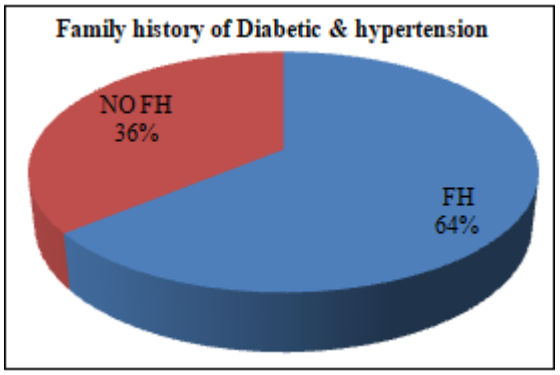

Figure 2: Shows the percentage distribution of the study sample have had family history of both hypertension and/or diabetes.

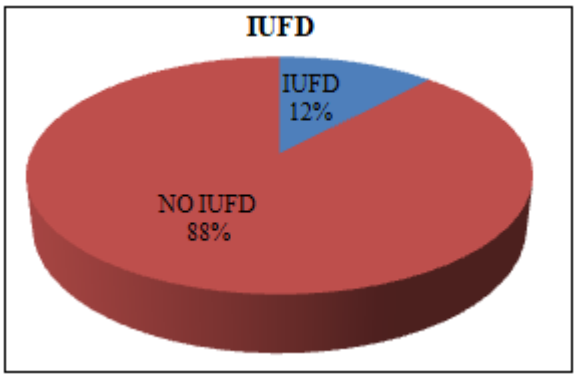

Figure 3: Shows the precentage of of intrauterine fetal death(IUFD) incedence

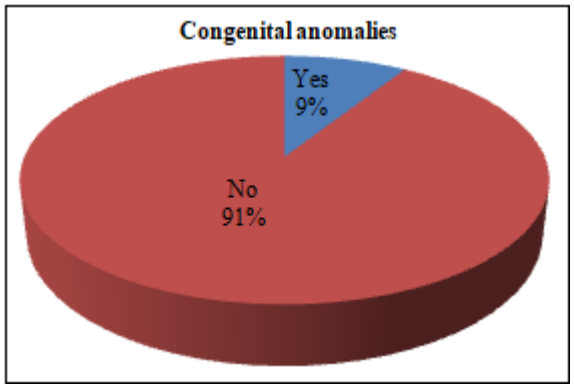

Figure 4: Show the percentage distribution of anomalies incidence

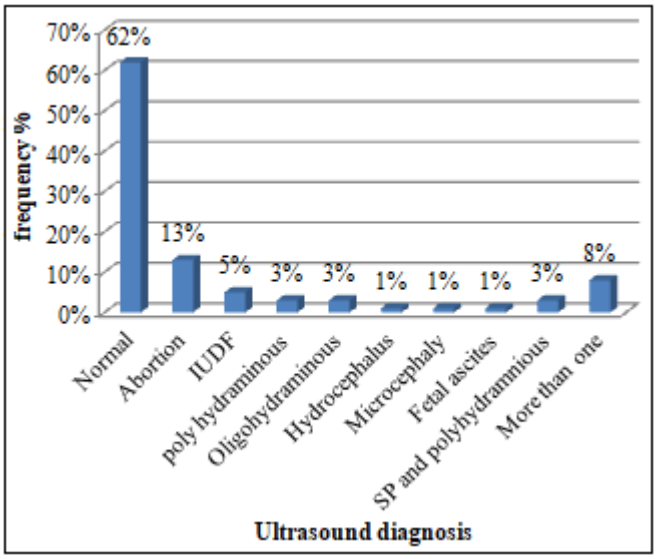

Figure 5: Shows the final ultrasound diagnosis

Table 1: The relation between study sample age groups and DM & HT incidence. (n=100)
*cross tab

Age groups			DMHT				Total	Asymp. Sig. (2-sided)
			GDM	HT	DM,HT	PDM		
	18 – 25y	Count	9_a	14_a	0_a	5_a	28	0.000
		% within age	32.1%	50.0%	.0%	17.9%	100.0%	
		% within DM/HT	32.1%	28.0%	.0%	23.8%	28.0%	
		% of Total	9.0%	14.0%	.0%	5.0%	28.0%	
	26 – 40y	Count	19_a	34_a	0_a	16_a	69	
		% within age	27.5%	49.3%	.0%	23.2%	100.0%	
		% within DMHT	67.9%	68.0%	.0%	76.2%	69.0%	
		% of Total	19.0%	34.0%	.0%	16.0%	69.0%	
	Above 40y	Count	0_a	2_a	1_b	0_a	3	
		% within age	.0%	66.7%	33.3%	.0%	100.0%	
		% within DMHT	.0%	4.0%	100.0%	.0%	3.0%	
		% of Total	.0%	2.0%	1.0%	.0%	3.0%	
	Total	Count	28	50	1	21	100	
		% within age	28.0%	50.0%	1.0%	21.0%	100.0%	
		% within DMHT	100.0%	100.0%	100.0%	100.0%	100.0%	
		% of Total	28.0%	50.0%	1.0%	21.0%	100.0%	
*Each subscript letter denotes a subset of DMHT categories whose column proportions do not differ significantly from each other at the .05 level.								

*There is strong correlation between the variables as (p=0.000)

Table 2: Shows Ultrasound results * Age (cross tab). (n=100)

Ultrasound diagnosis			Age			Total	Asymp. Sig. (2-sided)
			18 – 25 y	26 – 40 y	above 40 y		
	Normal	Count	22_a	40_a	0_b	62	0.000
		% within final diagnosis	35.5%	64.5%	.0%	100.0%	
		% within age	78.6%	58.0%	.0%	62.0%	
		% of Total	22.0%	40.0%	.0%	62.0%	
	Abortion	Count	2_a	10_a	1_a	13	
		% within final diagnosis	15.4%	76.9%	7.7%	100.0%	
		% within age	7.1%	14.5%	33.3%	13.0%	
		% of Total	2.0%	10.0%	1.0%	13.0%	
	IUDF	Count	2_a	3_a	0_a	5	
		% within final diagnosis	40.0%	60.0%	.0%	100.0%	
		% within age	7.1%	4.3%	.0%	5.0%	
		% of Total	2.0%	3.0%	.0%	5.0%	
	Poly hydramnios	Count	1_a	2_a	0_a	3	
		% within final diagnosis	33.3%	66.7%	.0%	100.0%	
		% within age	3.6%	2.9%	.0%	3.0%	
		% of Total	1.0%	2.0%	.0%	3.0%	
	Oligo-hydramenios	Count	0_a	2_a	1_b	3	
		% within final diagnosis	.0%	66.7%	33.3%	100.0%	

		% within age	.0%	2.9%	33.3%	3.0%	
		% of Total	.0%	2.0%	1.0%	3.0%	
	Hydrocephaly	Count	0_a	1_a	0_a	1	
		% within final diagnosis	.0%	100.0%	.0%	100.0%	
		% within age	.0%	1.4%	.0%	1.0%	
		% of Total	.0%	1.0%	.0%	1.0%	
	Microcephaly	Count	0_a	1_a	0_a	1	
		% within final diagnosis	.0%	100.0%	.0%	100.0%	
		% within age	.0%	1.4%	.0%	1.0%	
		% of Total	.0%	1.0%	.0%	1.0%	
	Fetal ascites	Count	0_a	0_a	1_b	1	
		% within final diagnosis	.0%	.0%	100.0%	100.0%	
		% within age	.0%	.0%	33.3%	1.0%	
		% of Total	.0%	.0%	1.0%	1.0%	
	Spina bifida and poly-hydramnios	Count	0_a	3_a	0_a	3	
		% within final diagnosis	.0%	100.0%	.0%	100.0%	
		% within age	.0%	4.3%	.0%	3.0%	
		% of Total	.0%	3.0%	.0%	3.0%	
	More than one	Count	1_a	7_a	0_a	8	
		% within final diagnosis	12.5%	87.5%	.0%	100.0%	
		% within age	3.6%	10.1%	.0%	8.0%	
		% of Total	1.0%	7.0%	.0%	8.0%	
Total		Count	28	69	3	100	
		% within final diagnosis	28.0%	69.0%	3.0%	100.0%	
		% within age	100.0%	100.0%	100.0%	100.0%	
		% of Total	28.0%	69.0%	3.0%	100.0%	
*There is strong correlation between the variables represented as (p=0.000).							

Table 3: Shows maternal family history (FH) of DM/HT and IUFD (cross tab) (n=100)

FH		IUFD		Total	Exact Sig. (1-sided)
		Yes	No		
	Yes	12	52	64	.003
	No	0	36	36	
Total		12	88	100	

Table 4: Shows maternal FH of DM/HT and anomalies (cross tab). (n=100)

FH		Anomalies		Total	Exact Sig. (1-sided)
		Yes	No		
	Yes	9	55	64	.01
	No	0	36	36	
Total		9	91	100	

Table 5: Ultrasound diagnosis * Fetal anomalies (cross tab). (n=100)

Ultrasound diagnosis			Fetal anomalies		Total	Asymp. Sig. (2-sided)
			Yes	No		
	Normal	Count	0_a	62_b	62	0.000
		% within final diagnosis	.0%	100.0%	100.0%	
		% within Anomalies	.0%	68.1%	62.0%	0.000
		% of Total	.0%	62.0%	62.0%	
	Abortion	Count	0_a	13_a	13	0.000
		% within final diagnosis	.0%	100.0%	100.0%	
		% within Anomalies	.0%	14.3%	13.0%	
		% of Total	.0%	13.0%	13.0%	
	IUDF	Count	0_a	5_a	5	
		% within final diagnosis	.0%	100.0%	100.0%	
		% within Anomalies	.0%	5.5%	5.0%	
		% of Total	.0%	5.0%	5.0%	
	Poly-hydramnios	Count	0_a	3_a	3	
		% within final diagnosis	.0%	100.0%	100.0%	
		% within Anomalies	.0%	3.3%	3.0%	
		% of Total	.0%	3.0%	3.0%	
	Oligo-hydramnios	Count	0_a	3_a	3	
		% within final diagnosis	.0%	100.0%	100.0%	
		% within Anomalies	.0%	3.3%	3.0%	
		% of Total	.0%	3.0%	3.0%	
	Hydrocephaly	Count	1_a	0_b	1	

		% within final diagnosis	100.0%	.0%	100.0%	
		% within Anomalies	11.1%	.0%	1.0%	
		% of Total	1.0%	.0%	1.0%	
	microcephaly	Count	1_a	0_b	1	
		% within final diagnosis	100.0%	.0%	100.0%	
		% within Anomalies	11.1%	.0%	1.0%	
		% of Total	1.0%	.0%	1.0%	
	fetal ascites	Count	1_a	0_b	1	
		% within final diagnosis	100.0%	.0%	100.0%	
		% within Anomalies	11.1%	.0%	1.0%	
		% of Total	1.0%	.0%	1.0%	
	SP and poly-hydramnios	Count	3_a	0_b	3	
		% within final diagnosis	100.0%	.0%	100.0%	
		% within Anomalies	33.3%	.0%	3.0%	
		% of Total	3.0%	.0%	3.0%	
	more than one	Count	3_a	5_b	8	
		% within final diagnosis	37.5%	62.5%	100.0%	
		% within Anomalies	33.3%	5.5%	8.0%	
		% of Total	3.0%	5.0%	8.0%	
Total		Count	9	91	100	
		% within final diagnosis	9.0%	91.0%	100.0%	
		% within Anomalies	100.0%	100.0%	100.0%	
		% of Total	9.0%	91.0%	100.0%	
*Each subscript letter denotes a subset of Anomalies categories whose column proportions do not differ significantly from each other at the .05 level.						

4. Discussion

This study was conducted to evaluate pregnancy in diabetic and hypertensive women by detecting the prevalence of fetal anomalies and related risk factors (maternal age, presence of family history and amniotic fluid problems) among hypertensive and diabetic women in Sudan in Khartoum city using ultrasonography.

100 pregnant women 50 diabetic, and 50 hypertensive were scanned by gray scale and color Doppler ultrasound to assess pregnancy status concerning the previous concerns.

In this study the patients was distributed in three age groups, as in fig (1) the first age group from (18-25) years old represented (28%) , (26 – 40) years old represented (69%) and the third groups above forty represented (3%) of the study sample. This distribution reveals that the bearing age in Sudanese women mostly around the second age group (26 – 40) years. The study showed that, increasing age increased the incidence of DM and HT, and consistently increased the risks associated with pregnancy, in diabetic and hypertensive women as well represented as (p=0.00), as in table (1), and this agree with M. Jolly et al 2000 [5] ; who reported in their study 'the risks associated with pregnancy in women aged 35 years or older they found that, risk of stillbirth was significantly higher in the older women. The risks of fetal congenital anomalies and malformations, and aneuploidy increase with maternal age and, despite antenatal screening, they are likely contributed to the increased rate of stillbirth'.

Previous study[6], reported that 'pregnancy outcomes according to increasing maternal age reported that 29,760 singleton pregnancies delivered between 2005 and 2008 was extracted from our database. Patients were distributed into 4 groups according to age: (20–29) years, (30–34) years, (35–39) years, and ≥40 years. Multivariable logistic regression analysis was used to evaluate the adjusted odd ratios (AORs) of adverse outcomes of pregnancy according to mother age after adjusting for parity, body mass index, medical history and use of in vitro fertilization. The result was that majority of adverse perinatal outcomes were associated with a maternal age ≥35 years as follows: low birth weight (AOR 1.2 and 1.6 for women aged 35–39 years and ≥40 years, respectively); Apgar score < 7 at 1 minute (AOR: 1.7 and 1.8); and chromosomal anomaly (AOR: 2.7 and 12.3). However, women aged ≥30 years also had greater risks for adverse maternal outcomes such as: gestational diabetes (AOR: 2.0, 3.6 and 5.1 for women aged 30–34 years, 35–39 years and ≥40 years, respectively); placenta previa (AOR: 1.6, 2.1 and 3.6); and cesarean delivery (AOR: 1.5, 2.3, and 4.1), as well as adverse fetal outcomes such as: preterm delivery (AOR: 1.2, 1.4 and 1.8) and neonatal intensive care unit transfer (AOR: 1.1, 1.2, and1.6). However Increasing maternal age is an independent and substantial risk factor for adverse perinatal and obstetric outcomes. These adverse outcomes become more common as increasing maternal age without a clear cutoff age.

Regarding family history in this study (64%) of the study sample have had positive family history for hypertension or and DM, as in fig (2).Controlled cohort studies [7,8,9] showed that the risk of pre-eclampsia is increased in women with a previous history of hypertension (relative risk 7.19, 95% confidence interval 5.85 to 8.83) , pre-existing diabetes (3.56, 2.54 to 4.99), family history (2.90, 1.70

to 4.93), raised blood pressure (diastolic ≥ 80 mm Hg) at booking (1.38, 1.01 to 1.87), raised body mass index before pregnancy (2.47, 1.66 to 3.67) or at booking (1.55, 1.28 to 1.88), or maternal age ≥ 40 (1.96, 1.34 to 2.87, for multiparous women). A family history of pre-eclampsia nearly triples the risk of pre-eclampsia (2.90, 1.70 to 4.93) (two cohort studies.

(12%) from the study sample have previous intrauterine fetal death, while (88%) of patient haven't undergoing intrauterine fetal death, as in fig (3). This mean that DM even pregestational or gestational, and or hypertension can cause intrauterine fetal death as reported in previous study by Günter HH., et al [10]; Intrauterine fetal death in pregnancies of women with preconceptional and gestational diabetes mellitus and of women without glucose tolerance disorders. Results of the perinatal registry of Lower Saxony, Germany. The prevalence of intrauterine fetal death as well as the relevant risk factors in pregnancies of women with preconceptional and gestational diabetes mellitus.

Ahmad A, et al, [11] ,they reported in their study 'Hypertensive disorders in pregnancy and fetal death at different gestational lengths: a population study of 2,121 and 371 pregnancies , reported that the prevalence of hypertensive disorders in pregnancy was 4.7%. In total, 17 933 fetal deaths occurred and 9.2% of these were in hypertensive pregnancies. In normotensive pregnancies, 0.8% (16 290/2 022 400) experienced fetal death. This was true for 1.9% (1170/62 261) of the pregnancies with pre-eclampsia, 1.2% (390/32 068) with gestational hypertension and 1.8% (83/4642) with chronic hypertension. There was a 44% overall reduction in fetal death rate from 1967–1986 to 1987–2006. The largest decline was in women with pre-eclampsia (80% reduction). In women with gestational hypertension and chronic hypertension, the overall reductions in fetal death rates were 49% and 57%, respectively, comparable with the 41% decline in normotensive pregnancies'.

In this study and regarding congenital anomalies , there were (9%) of the study sample have had fetuses with intra-uterine congenital anomalies, as in fig (4),table (2) fetal anomalies were found to be (1%) microcephaly, (1%) anencephaly, (1%) fetal ascites, (3%) with spina bifida, (2%) hydrocephalus, (1%) undescended testes. These results agree with study by Victoria M. Allen et al, [12] , they found that teratogenicity associated with pre-existing and gestational diabetes, which mentioned that the majority of pregnancies complicated by pre-existing and gestational diabetes are not associated with congenital abnormalities and result in the birth of healthy newborns. However, the evidence consistently confirms that pregnancies complicated by diabetes are associated with an increased risk of congenital malformations that varies with the degree of pre-conception glycemic control and other mitigating factors such as folic acid supplementation.

In this study and, as in table (1) shows that there is strong relationship between the age and incidence of DM/HT that mean when age is increase the percentage of incidence of DM/HT is increased represented in (p=0.000).In this study demonstrated a significant relationship between the age and incidence of anomalies, abnormalities represented in (p=0.000) , as in table (2). Ketut S et al, [13] found that ; age is an important risk factor for type 2 Diabetes Mellitus and cardiovascular disease. Central obesity and insulin resistance as the initial preconditions and its consequences related to metabolic diseases and cardiovascular diseases are frequently found among the elderly. Thomas W, et al.,[14] in his study about hypertension and aging reported that; 'hypertension is a highly prevalent condition with numerous health risks, and the incidence of hypertension is greatest among older adults'.

This study reported strong co- relation between maternal family history of IUFD and presence of fetal anomalies as reported in the sonographic imaging results among positive cases of the study sample with (p=0.003,0.01&0.00) respectively , as in tables (3,4&5) and fig (5). Study by Simerpal K. Gill et all, [15] found that, there is A strong association between Maternal Age and birth defects of unknown etiology, for maternal age <20 years, associations with total anomalous pulmonary venous return mention that (a OR, 2.3; 95% CI, 1.3–4.0), and gastroschisis (a OR, 6.1; 95% CI, 4.8–8.0) were observed. For the ≥40 year age group, associations with several cardiac defects, esophageal atresia (a OR, 2.9; 95% CI, 1.7–4.9), hypospadias (a OR, 2.0; 95% CI, 1.4–3.0), and craniosynostosis (a OR, 1.6; 95% CI, 1.1–2.4) were observed. Results using maternal age as a continuous variable were consistent with those that used categorized maternal age.

Pre-eclampsia was seldom divided into early and late onset, nor were results presented for onset of pre-eclampsia or delivery in relation to gestational age. We may therefore have underestimated the importance of risk factors for early onset pre-eclampsia, a type with considerable maternal and perinatal morbidity and mortality. [16,17]

K Cambra[18] reported that; trends in the prevalence of congenital anomalies and age at motherhood in a southern European region: a population-based study mentioned that in the Basque Country, rates of chromosomal anomalies are higher than the overall estimated prevalence in European countries, and continue to increase slightly, which may be related to the rise in maternal age. Rates of non-chromosomal anomalies are within the European frequent range of values, and the increases observed need to be checked in the following years.

5. Conclusion

This study concluded that Age is a risk factor for incidence of DM/HT during pregnancy, and is also a

risk factor of abortions, IUFD, and fetal anomalies. Age is a risk factor for incidence of DM/HT during pregnancy, and is also consistently risk factor of DM, HT complications such as abortions, placenta site abnormalities, polyhydramnios, oligohydramnios, IUFD, and fetal anomalies. Diabetes mellitus and hypertension are the most common and hence worse disorders occur during pregnancy, leading to many complications for mother, fetus or both. Mother complications; like women with induced diabetes mellitus or hypertension during pregnancy may undergo later DM or HT, and with increased rate of mortality and morbidity. Complications to Fetus might be developed like anomalies and congenital malformations, also may be loosed due to miscarriage in early pregnancy or through intrauterine fetal death in late pregnancy. Majority of women who have DM/HT undergo normal pregnancy and outcomes, but some of them might encounter complications with intrauterine fetal death, abortions, oligohydramnios or polyhydramnios as complications of DM.

6. Recommendations

- Primary health care should be available for every woman anywhere, anytime for good pregnancy outcome, and this will reduce the cost of adverse outcome of pregnancy with DM/HT or even other problems which leading to complications, such as mother mortality and morbidity, fetus anomalies, abortion, intrauterine fetal death, placenta abnormalities, amniotic fluid volume abnormalities, and stillbirth. And this is simple human rights of women, neonates, and children to have the primary health care. And this will be approached through existence of many primary health care centers, and antenatal care centers, that which are excellent equipped.
- Majority of women who have DM/HT undergo normal pregnancy and outcomes, but some of them might encounter complications with intrauterine fetal death, abortions, oligohydramnios or polyhydramnios, placenta abruption, placenta previa, fetal congenital malformations and anomalies, and stillbirth. Age is a risk factor for incidence of DM/HT during pregnancy, and is also a risk factor of abortions, IUFD, and fetal anomalies.
- Implementation of community education and awareness about diabetes, and hypertension especially between women in bearing age, about the complications of DM/HT for mothers and fetus is mandatory in Sudan.

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