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Screening of Nephropathy in Pregnant Diabetic Women

Ahmed Nagy Afifi* **and Hend Salah**

Obstetrics and Gynecology Department, faculty of medicine, Kasr El-Ainy Hospital, Cairo University, Cairo, Egypt

***Corresponding author:** Ahmed Nagy Afifi, Obstetrics and Gynecology Department, faculty of medicine, Kasr El-Ainy Hospital, Cairo University, Cairo, Egypt, Tel: +201098670624, Postal code: 11744, Email: dr_nagy.ahmed@yahoo.com

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Abstract

Background: Diabetes mellitus is the most common medical complication of pregnancy. Gestational diabetes mellitus (GDM) represents approximately 90% of these cases and affects 2–5% of all pregnancies, while pre-existing diabetes mellitus complicates 0.2% to 0.3% of pregnancies.

Objectives: To determine the prevalence of Microalbuminuria and diabetic Nephropathy in pregnant diabetic women.

Patients and Methods: the study is an observational cross-sectional study carried out at Al Zahraa University Hospital in the inpatient department of OB/GYN. One hundred pregnant women were enrolled in the study. They all had diabetes mellitus (pre-or gestational DM) at any gestational age.

Results: We found in our study that the prevalence of Microalbuminuria (incipient Nephropathy) was 26 %, and Macroalbuminuria (overt Nephropathy) was 2 % among 100 diabetic pregnant women.

Conclusion: This study concluded a high prevalence of Microalbuminuria in pregnant diabetic women. So, early screening and the active management of modifiable risk factors, particularly hyperglycemia, hypertension, and weight reduction, were needed to reduce the burden of future end-stage renal disease.

Keywords: Nephropathy, Pregnant Diabetic Women, Microalbuminuria.

Introduction

Diabetic Nephropathy was defined as the occurrence of Persistent Albuminuria (>300 mg/dl) that is confirmed on at least two occasions, Progressive decline in the glomerular filtration rate and Elevation of arterial blood pressure [1]. Diabetic Nephropathy is the chief cause of end-stage kidney disease around the world. Despite significant advancements in diabetic treatment, its overall prevalence remains large, and it is growing in type 2 diabetes due, among other causes, to life span lengthening in diabetic patients [2]. The prevalence of type 1 diabetes during pregnancy is variable worldwide, and there are differences in the definition of diabetic Nephropathy, which makes it challenging to combine epidemiological data. When diabetic Nephropathy is broadly defined as any sign of renal disease, including Microalbuminuria, its prevalence ranges from 5% to over 25% in type 1 diabetic pregnant women [3]. Women with diabetic Nephropathy have pregnancies with more challenges, with pregnancy outcomes far worse than expected for the stage of chronic kidney disease. The causative mechanisms that lead to the adverse events remain poorly understood, but it is a widely held belief that substantial endothelial injury in these women likely contributes [4]. Literature concerning kidney involvement in pregnant women with diabetes is scarce. Up to date knowledge, no studies using strict diagnostic criteria have described the prevalence of diabetic Nephropathy and Microalbuminuria in early pregnancy in women with type 2 diabetes [5]. In pregnant women with diabetes, Nephropathy is associated with poor pregnancy outcomes in increased rates of gestational hypertension, preeclampsia, and preterm delivery. In these women, intrauterine growth restriction occurs almost twice as often as in general [5]. In early pregnancy, the percentage of diabetic Nephropathy and Microalbuminuria was similar in type two and type one diabetes, as the prevalence of diabetic Nephropathy was 2.3% in women with type 2 diabetes and 2.5% in women with type 1 diabetes [5]. According to **Klemetti et al.** and other literature, it appears to be advisable to perform baseline assessments of proteinuria and kidney function before or in early pregnancy in women with diabetes to identify those in need of strict antihypertensive control [6].

Patients and Methods

A cross-sectional study to estimate the prevalence of Microalbuminuria and Nephropathy in pregnant diabetic women by measuring creatinine clearance and microalbumin in the urine was conducted at El-Zahraa University hospital in Egypt. From January to December 2021. The Ethical Research Committee approved the study protocol. One hundred women were checked to guarantee that they fulfilled the study's inclusion criteria. Inclusion criteria involved (1) Age (20:40 years old). (2) Pregnancy at any gestational age. (3) Diabetic patients of any type (GDM, T1DM, and T2DM). Exclusion criteria included (1) Suspected or diagnosed preeclampsia. (2) Some renal diseases as nephritic syndromes or urinary tract infections & patients with collagen diseases. One hundred women were included in the observational study, and a detailed history was taken from all patients. The participants gave written informed consent. The participants were told to begin the collection of urine at a fixed time (8 am), usually to start in the morning by voiding into the toilet and then keeping all of the urine they do, after that, including urine collected 24 hours later at the same time. Microalbumin and creatinine clearance were measured in a 24-hour collection of urine to detect the incidence of Microalbuminuria and diabetic Nephropathy in pregnancy. The following formula measured creatinine clearance:

Creatinine Clearance = Urine Creat × Urine Volume (24/hr.) / Serum Creat × 1440

Microalbuminuria is defined as the persistence of 30–300 mg of albumin per 24 hours (or 20–200 mcg/min or 30–300 mcg/mg creatinine) on 2 of 3 urine collections [7]. Positive Microalbuminric and Macroalbuminuric patients were classified according to (Priscilla white, 1978) classification of DM during pregnancy [8] as follows:

- Class A1: gestational diabetes; diet controlled
- Class A2: gestational diabetes; medication controlled
- Class B: onset at age 20 or older or with the duration of fewer than 10 years
- Class C: onset at age 10-19 or duration of 10–19 years
- Class D: onset before age 10 or duration greater than 20 years
- Class E: overt diabetes mellitus with calcified pelvic vessels
- Class F: diabetic Nephropathy
- Class R: proliferative retinopathy
- Class RF: Retinopathy and Nephropathy
- Class H: ischemic heart disease
- Class T: prior kidney transplant

Sample Size Calculation:

Sample size calculation was done using MedCalc® Statistical Software version 19.5.3 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2020). The sample size was done using the incidence of Microalbuminuria and Nephropathy in diabetic pregnant women with proteinuria. As reported in a previous publication by Ekbom et al.**(9)**, the incidence of Microalbuminuria in diabetic pregnant women with proteinuria was 23%, while the incidence of Nephropathy in diabetic pregnant women with proteinuria was 55%. We were considering a 10 % rate of follow-up loss. Accordingly, we calculated that the minimum proper sample size was 80 minimum samples needed to reject the null hypothesis with 80% power at $\alpha = 0.05$ level using the Chi-square test for independent samples.

Statistical Analysis

Statistical analysis was performed using SPSS version 26 (SPSS, Chicago, IL, USA). Categorical data were presented as numbers and percentages. Kolmogorov-Smirnov tests were used to determine if data were normally distributed or not. Continuous numerical variables were presented as a range, median, and mean ± SD to describe the population regarding age, gestational age, parity, BMI, and duration of DM. The differences between the two groups were compared using the unpaired t-test. If data was parametric customarily distributed or were presented as median and range, the differences between two groups will be compared using the Mann-Whitney test if data are skewed or non-parametric. P-value is statistically significant if less than .05. Spearman rank correlation coefficient values (rs) were used to compare 24-hour Urinary albumin and the general demographic data of included women and between 24- hour Albuminuria and HbA1C and between 24- hour Albuminuria and administration of low dose aspirin and Antihypertensive medications. $P < 0.05$ was considered significant. A correlation coefficient test was used to rank different variables against each other.

Results

Table (1) showed that the incidence of diabetic Nephropathy was 2 % (2 of 100). The incidence of Microalbuminuria was 26 % (26 of 100); the rest of the patients, 72 (72%), had normal albumin excretion in urine. The patients were categorized into two groups according to the results of 24-hour Microalbuminuria (positive / Negative), and a comparison between them was made regarding different variables. **Table (2)** showed that the incidence of Microalbuminuria could occur early in pregnancy, as 57.14 % of the patients within the positive group were in class A of white classification of DM during pregnancy, 28.57 % were in class B, 7.14 % were in class C, and finally, 7.14 % were in class F. **Table (3)** showed a statistically significant difference between the two groups as regard to BMI. While no statistically significant difference regarding age, GA, Parity, and duration of DM. **Table (4)** showed no statistically significant difference between groups according to the type of DM (P=0.254). Among 44 patients with GDM, 16 had positive Albuminuria. While ten patients with type 1 DM, 2 showed positive Albuminuria, and 46 patients with type 2 DM, 10 showed positive Albuminuria. **Table (5)** showed no statistically significant difference between the two groups according to Trimester of pregnancy (P=0.343). That means the number of patients who had positive Albuminuria and normal albumin excretion in urine in each Trimester is similar. **Table (6)** showed no statistically significant difference between the two groups. Among 28 patients with Albuminuria, 20 were in the Third Trimester, while the remnant 8 was in the first and second trimesters. Among 28 patients in the positive group, three patients had Rheumatic heart disease, eight patients had hypertensive disorders, and two had thyroid problems. **Table (7)** shows a statistically significant difference between the two groups regarding HbA1C, serum creatinine, and ALT, while there is no statistically significant difference between the two groups regarding Hb, Creatinine clearance, AST, and serum urea, FBS, and PPBS. **Table (8)** shows a significant positive correlation between Albuminuria and age, parity, and BMI, which means an increasing age and BMI, is associated with an increase in the excretion of 24-hour albumin in urine and high parity related to the increased level of 24-hour Albuminuria. **Table (9)** demonstrates a significant positive correlation between 24- hour Albuminuria and glycosylated hemoglobin (HbA1C) (r=0,447, p=0.000), which means reasonable diabetic control reflects on the kidney function and the level of 24-hour albumin in the urine. **Table (10)** shows a significant negative relation between 24- hour albuminuria and administration of low-dose aspirin (p=0.017), which means the administration of low-dose aspirin reflects on the kidney function and decreases the level of 24-hour albumin in the urine.

Table 1: Distribution of patients as regard the 24-hour Micro-albuminuria*

24-hour Microalbuminuria		**Valid N ((100))**
Dimension	Positive Microalbuminuria (30-299 mg/day) Macroalbuminuria (>300 mg/day)	26 (26 %) 2 (2%)
	Negative (< 30 mg/day)	72 (72 %)
	Total	100

*Values (categorical data) are given numbers (percentage)

Table 2: Classification of positive patients according to Priscilla White classification of DM during pregnancy

Class of DM	n = 28(% within positive)
Class A: Gestional Diabetes	16 (57.14%)
Class B: onset at age 20 or older or with duration of less than 10 years	8(28.57%)
Class C: onset at age 10-19 or duration of 10–19 years	2(7.14%)
Class D: onset before age 10 or duration greater than 20 years	0
Class E: overt diabetes mellitus with calcified pelvic vessels	0
Class F: diabetic nephropathy	2 (7.14%)
Class R: proliferative retinopathy	0
Class RF: Retinopathy and nephropathy	0
Class H: ischemic heart disease	0
Class T: prior kidney transplant	0

*Values (categorical data) are given numbers (percentage)

Table 3: Comparison between two groups according to the demographic data

Demographic data	**Negative** **n= 72**	**Positive** **n = 28**	**p-value#**
Age (years)* Mean+SD Range	30.58 + 4.8 19- 39	31.86 + 5.11 19 -37	0.248 NS
Gestational age (weeks)* Mean±SD Range	30.33 ± 7.14 9-37	27.71 ± 10. 11 6-37	0.148 NS
Parity* Mean±SD Range	2.44 ± 1.71 0-6	3.21 ± 1.89 0-6	0.053 NS
BMI (kg/m2)* Mean±SD Range	26.75 ±3.25 17-30	30.85±2.52 26-35	0.00001 HS
Duration of DM (years)* Mean±SD Range	4.53 ± 4.97 0.2-20	3.21± 3.94 0.2-15	0.214 NS

*Values (continuous quantitative data) are given as mean±SD, Range
Kolmogorov–Smirnov test was used to examine the normal data distributional characteristics of age, BMI, GA, parity and duration of diabetes of all study cases
#Unpaired t student test for normally distributed data
P value ≤0.05 is significant, NS= non-significant, HS= highly significant

Table 4: Comparison between two groups according to different types of DM

DM type	Negative n= 72	Positive n = 28	Total n=100	P-value
GDM % within DM type	28 (38.9%) 63.6%	16 (57.14%) 36.4%	44	0.254[#] NS
T1DM % within DM type	8 (11.11%) 80.0%	2 (7.14%) 20.0%	10	
T2DM % within DM type	36(50%) 78.3%	10 (35.71%) 21.7%	46	

GDM =Gestational DM, T1DM = type 1 DM, T2DM = type 2 DM.
[*]Values (categorical data) are given numbers (percentage).
[#]the chi-square test was used
P value ≤0.05 is significant, NS= non-significant

Table 5: Comparison between two groups according to Duration of DM

Duration of DM	**Negative n= 72**	**Positive n=28**	**Total n=100**	**P-value**
< 5 years % within DM duration	48 (66.7%) 68.6 %	22 (78.6%) 31.4 %	70	
5-10 years % within DM duration	16 (22.2%) 80%	4(14.3%) 20 %	20	0.506[#] NS
> 10 years % within DM duration	8 (11.1%) 80%	2 (7.1 %) 20%	10	

[*]Values (categorical data) are given numbers (percentage).
[#]the chi-square test was used
P value ≤0.05 is significant, NS= non-significant

Table 6: Comparison between two groups according to Associated medical diseases with pregnancy

Associated medical disease	**Negative n = 72**	**Positive n=28**	**P-value**
Cardiac dis.	1 (1.39%)	3(10.7%)	
HTN	10(13.9%)	8 (28.6%)	0.147 NS
Thyroid dis.	8 (11.1%)	2 (7.14%)	

[*]Values (categorical data) are given numbers (percentage).
[#]the chi-square test was used
P value ≤0.05 is significant, NS= non-significant

Table 7: Comparison between two groups according to Laboratory findings

Laboratory findings	Negative (n=72)	Positive (n=28)	p-value#
Hb (g/dl)		10.84±1	0.371
Mean±SD	10.65 ± 0.96	10-14	NS
Range	8-13		
Creat. Clearance (mlL/min)	133.88 ± 65.30	164±97.57	0.077
Mean±SD	41-347	40-345	NS
Range			
ALT(U/L)	18.28 ± 4.25	21.79±11.09	0.024*
Mean±SD	8-27	14-58	S
Range			
AST(U/L)	16.67±4.27	20.36±15.77	0.070
Mean±SD	11-26	11-74	NS
Range			
HbA1C (%)	7.011±0.658	8.20±0.931	**0.0001***
Mean±SD	5.7-9.2	7-9.7	**HS**
Range			
FBS (mg/dL)	177.5±41.49	167.14±46	0.278
Mean±SD	106-275	105-265	NS
Range			
PPBS (mg/dL)	275.75±51.41	257.71±45.18	0.107
Mean±SD	189-385	198-340	NS
Range			
S. Creatinine (mg/dl)	0.50±0.141	0.44±0.063	0.034*
Mean±SD	0.3-1	0.3-0.5	S
Range			
S, Urea(mg/dl)	15.56±5.63	14.93±4.90	0.606
Mean±SD	11-41	7-29	NS
Range			

*Values (continuous quantitative data) are given as mean±SD, Range.
Kolmogorov–Smirnov test was used to examine the normal data distributional characteristics
#Unpaired t student test for normally distributed data
P value ≤0.05 is significant, NS= non-significant, HS= highly significant, S=significant

Table 8: Correlation between 24-hour Urinary albumin and the general demographic data of included women

24-hour Microalbumin		Variables
P	**r***	
0.032	0.215	**Age**
0.000	0.617	**BMI**
0.030	0.218	**Parity**

*Spearman's non-parametric correlation coefficient

Table 9: Correlation between 24- hour Albuminuria and HbA1C

Variables	24-hour Albuminuria r*	P	Significance
HBA1C	0.447	0.000	Significant

*Spearman's non-parametric correlation coefficient

Table 10: Relation between 24- hour Albuminuria and administration of low dose aspirin and Antihypertensive medications

		24-hour Albuminuria		Test value	P-value#	Sig.
		Mean±SD	Range			
Antihypertensive Medications	No	59.4 ± 227.9	2.0 – 1480	0.109	0.914	NS
	Yes	56.1 ± 69.1	12.0 – 215			
Low dose aspirin	No	74.7 ± 236.8	4.3 – 1480	2.432	0.017	S
	Yes	8.4 ± 10.2	2– 31			

*Values (continuous quantitative data) are given as mean±SD, Range.
#Unpaired t student test was used
P value ≤0.05 is significant, NS= non-significant, S=significant

Discussion

Micro-albuminuria is the earliest clinical manifestation of diabetic Nephropathy. It progresses to overt proteinuria in 20-40% of cases within ten years and further progresses to ESRD in 20% of cases [10]. Thus, Micro-albuminuria assessment is done for early diagnosis and screening of DN. Screening for diabetic Nephropathy must be started at the time of diagnosis in patients with type 2 diabetes since >7% of them already have microalbuminuria [11]. For patients with type 1 diabetes, the first screening has been recommended five years after diagnosis, but it might be performed one year after diabetes diagnosis, especially in patients with poor metabolic control and after the onset of puberty. If Microalbuminuria is not present, the screening must be repeated annually for type 1 and 2 diabetic patients. Microalbuminuria may be present before the diagnosis of DM (especially in Type 2 DM). At this juncture, it is a potentially reversible form of kidney injury. Therefore, effective screening measures are required for early diagnosis [12]. In our study, the incidence of overt Nephropathy was 2 % (2 of 100), the incidence of Microalbuminuria was 26 % (26 of 100), and the rest of the patients, 72 (72%), had normal albumin execration in the urine. The incidence of Microalbuminuria can occur early in pregnancy, as 57.14 % of the patients within a positive group were in class A of the white classification of DM during pregnancy, while 28.57 % were in class B, 7.14 % were in class C, and finally, 7.14 % were in class F. The studies performed to detect the incidence of Microalbuminuria and diabetic Nephropathy during pregnancy are scarce, but the subsequent studies have reported a similar incidence of Microalbuminuria in pregnant diabetic women. A study by ***Klemetti et al.*** [6] reported that the percentage of pregnant women with type 1 diabetes complicated by Nephropathy has more than halved (14.7% in 1988- 1999 to 6.5% in 2000-2011), likely related to the early use of angiotensin-converting enzyme (ACE) inhibitors, hypertension management, and aggressive glycemic control. ***Damm et al.*** [5] was a retrospective cohort study on 220 women with type 2 diabetes and 445 women with type 1 diabetes giving birth from 2007 to 2012, the prevalence of diabetic Nephropathy was 2.3% (5 of 220) in women with type 2 diabetes, and 2.5% (11 of 445) in women with type 1 diabetes (P = 1.00) and the prevalence of Microalbuminuria was 4.5 % (10 of 220) vs. 3.4% (15 of 445) (P = 0.39). In a study, 277 patients with type I Diabetes mellitus were followed for a median period of 18y (range 1-21.5y). They found that 33% of patients developed Microalbuminuria [13]. The DEMAND study found that the overall global prevalence of Microalbuminuria was 39% [14]. Microalbuminuria was prevalent in 32 % of Japanese type 2 diabetics [15]. The overall prevalence of Microalbuminuria was reported in type I and type II Diabetes mellitus as 49.3% [16]. In another study by ***AlFehaid*** [17], in which diabetic type 2 patients, 494 patients were studied, and the overall prevalence of MA found was 37.4%. In agreement with these results, ***Wisemen et al.*** [18], in a study involving 28 diabetic patients with Microalbuminuria, there was a positive correlation between glycosylated hemoglobin level and urinary albumin excretion rate (r=0.48, p<0.001). Another cross-sectional study was conducted from July to December 2007 in a Community Diabetic center. 100 known Type 2 diabetic patients (49 males

and 51 females) were included in the study. Microalbuminuria in type 2 diabetic patients has shown a significant correlation with HbA1C, (r= 0.352, p<0.05) [19]. In contrast, ***Afkhami-Ardekani et al.*** [20] Showed no correlation between Microalbuminuria and age (p=0.6) and BMI (p=0.272) in a diabetic patient. Our study showed a positive correlation between Albuminuria and increasing parity (r=0.218, p=0.030). ***Kajaa et al.*** [21], study suggest that pregnancy does not affect the development or progression of diabetic Nephropathy. Pregnancy has no adverse long-term impact on kidney function and survival in Type I diabetic patients with well-preserved kidney function (normal serum creatinine) suffering from diabetic nephropathy [22]. Our study showed no correlation between Albuminuria and the duration of DM (r=-0.053, p=0.599). In agreement with our study, ***Al-Maskari et al.*** [23] study included 513 diabetic patients, in which the prevalence of Microalbuminuria (MA) was found in 61% and showed that the duration of DM was DM was not significantly associated with MA. There are not enough studies linking the correlation between MA and increasing parity; hence more studies are needed to determine if Pregnancy or increasing parity increases the risk for MA and DN. In addition, ***Ghosh et al.*** [24], Study on 149 type two diabetic patients showed no significant correlation between MA and duration of diabetes (P= 0.14). It was noticed that out of 135 patients with long-standing type I Diabetes mellitus (> 30 years duration), 24.4% of patients developed Microalbuminuria during a 7y follow-up period [25]. In another study by ***Varghese et al.*** [26], on the 1425 diabetic patients, 518 had Microalbuminuria (36.3%, 95% CI, and 33.8 to 38.9). There was a positive correlation between the duration of DM and the prevalence of Microalbuminuria as the P-value of patients who had DM for < 5 years was (0.02), 6-10 years (<0.00001), and 16-20 years (0.0005) [27]. ***Al-Fehaid et al.*** [17] also showed a significant correlation was found between the prevalence of MA and diabetes of 15 years or more (66.2%) (***P*** < 0.000). ***Afkhami et al.*** [20] was a cross-sectional study on 288 type two diabetic patients that showed that the duration of diabetes directly correlates with Microalbuminuria (***P***=0.001) and increases the risk of Microalbuminuria. Our study showed no relation between Albuminuria and antihypertensive medications during pregnancy (p=0.914). Women who want to get pregnant should be switched to calcium channel blockers (such as nifedipine or diltiazem), methyldopa, hydralazine, or selected b-adrenergic blockers labetalol [28]. There are no prospective observational studies or randomized trials evaluating the benefits of various antihypertensive drugs in diabetic pregnant women with Microalbuminuria or diabetic Nephropathy. Nevertheless, several trials have compared the effects of ACE - Is with calcium channel blockers in non-pregnant diabetic patients. These studies suggest similar efficacy in preserving renal function in diabetic nephropathy [29]. Our study showed a negative relation between Albuminuria and administration of low dose aspirin (p=0.017), which means the administration of low dose aspirin reflects on the kidney function and decreases the level of 24-hour albumin in the urine. In individuals with diabetes, low-dose aspirin has been suggested for primary and secondary cardiovascular events prevention [30]. This treatment had no adverse effects on renal function (UAE or GFR) in type 1 and type 2 diabetic individuals with micro- or Macroalbuminuria [30]. Patients who received intensive therapy had a significantly lower risk of Nephropathy (hazard ratio, 0.39; 95 % CI, 0.17 to 0.87) [30]. The British NICE guidelines recommend 75 mg of aspirin daily from 12 gestational weeks for all pregnant women with diabetes and kidney disease [31]. Also, ***Watala et al.*** [32], showed that 150 mg of aspirin daily for one week substantially reduced platelet adhesiveness and reactivity (by 14.1 percent in diabetes vs. 78.6 percent in control, p=0.0035) in 48 healthy adults and 31 type 2 DM patients. A greater level of HbA1C, a lower concentration of HDL-cholesterol, and a higher total cholesterol concentration were related to diminished responsiveness of diabetic platelets to aspirin. Poor metabolic management may play a role in DM patients' lower platelet sensitivity to aspirin [32]. For quantification of Albuminuria and proteinuria, 24 hours urine sample (timed collection) is considered a gold standard. However, it has significant limitations of time consumption, sample collection errors, poor patient compliance, and is expensive. The study's weakness was poor compliance of the patients and consumption of a long time regarding the need for a 24-hour collection of the urine, so some studies recommended random urine samples to quantify Albuminuria and proteinuria. The random urine sample can quantify Albuminuria and proteinuria to avoid a time-consuming and cumbersome procedure. Patient compliance is better with the random urine sample. Variables were attributable to circadian rhythm, variation in hydration status, diuresis, exercise, and diet [33].

Limitation of study

This study has not determined the role of antihypertensive drugs in the treatment of women with diabetic nephropathy; this is because of the exclusion of all patients with hypertension and preeclampsia from the study due to we can't determine the duration of hypertension in most patients, and most of them were not compliant or regular on antihypertensive drugs before pregnancy.

Conclusion

This study concluded a high prevalence of Microalbuminuria in pregnant diabetic women. This study showed that pregnancy alone could produce renal affection in pregnant diabetic women even without progression to DN. So, early screening and the active management of modifiable risk factors, particularly hyperglycemia, hypertension, and weight reduction, were needed to reduce the burden of future end-stage renal disease.

Author Contributions

AN helped design the study, develop the article, gather data, and revise the manuscript. HS was involved in the analysis, assisted in analyzing the data, and changed the essay. The final version of the paper was reviewed and approved for publication by all authors.

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Conflict of Interest

The authors have no conflicts of interest

Ethical Approval

This study was done after approval of the ethical committee of the department of obstetrics and gynecology, faculty of medicine, Al-Azhar University. Informed consent was taken from all participants before recruitment in the study and after explaining the purpose and procedures of the study.

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